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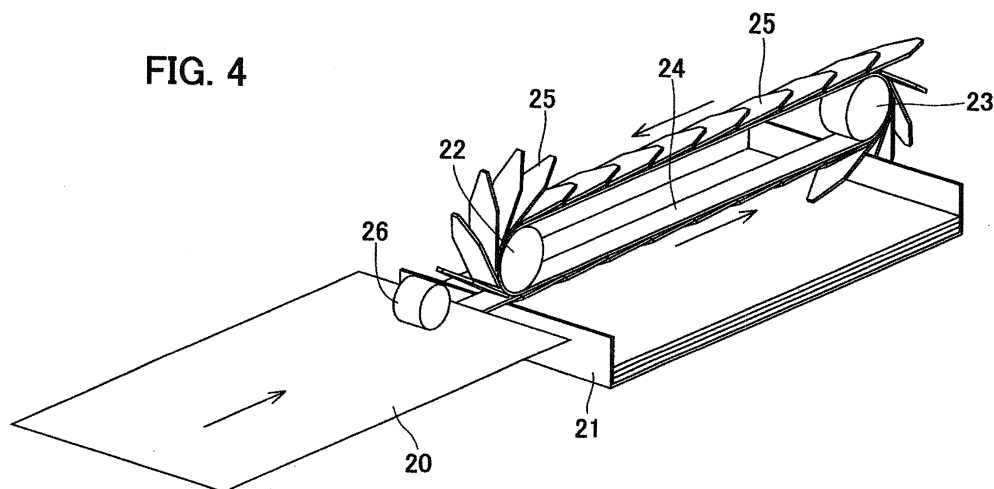
(54) **PAPER AGGREGATION DEVICE**

(57) There is provided a paper sheet stacking device which can stably store, even in the case of a top bill of stacked bills being in a state different from its original state, succeeding bills.

A conveyer belt (24) is looped on rollers placed over and at both ends of a paper sheet storage part and bill holding members (25) for holding bills (20) are fixed onto an outer surface of the conveyer belt (24) at determined interval. The bill holding members (25) themselves have grip force by which the conveyer belt (24) bends inward, and hold the bills (20) by the grip force. When the bill

holding members (25) pass over the roller on a reception side, their free ends (25c) get apart from the conveyer belt (24) and the bill holding members (25) receive the bills (20). When the bill holding members (25) pass between the rollers, the bill holding members (25) grip portions near ends of the bills (20). When the bill holding members (25) pass under the roller on a release side, their free ends (25c) get apart from the conveyer belt (24). The bill holding members (25) release the bills (20), make the bills (20) fall onto stacked bills, and stack and store the bills (20).

FIG. 4



Description

Technical Field

5 **[0001]** The embodiments discussed herein are related to a paper sheet stacking device and, more particularly, to a paper sheet stacking device which can stably perform stacking at the time of stacking paper media, such as bills, conveyed one by one into a bundle.

Background Art

10 **[0002]** ATMs (Automatic Teller Machines), automatic transaction apparatus, and the like installed in stores and the like of financial institutions include paper sheet stacking devices which stack and store bills conveyed one by one. A bill is conveyed in a direction parallel with faces of bills stacked in a storage part, and its end slides on a top bill of bills stacked in the storage part. As a result, the bill is introduced into the storage part. Bills are stacked in this way in these paper sheet stacking devices.

15 **[0003]** Usually bills conveyed to a storage part have gone into various states different from their original states while they are in circulation. For example, a bill folded is creased. A bill put into a wallet is curled. A bill put into a trouser pocket is crumpled. If a bill in a state different from its original state, such as a bill in a curled state, is at the top of stacked bills, an end of a bill conveyed strikes against a rear end of the bill in a curled state and bills are not arranged properly.

20 This interference between a bill conveyed and bills stacked is liable to occur especially in paper sheet stacking devices into which bills longitudinally conveyed are longitudinally introduced and stored.

[0004] Some proposals for avoiding the above interference between a bill conveyed and bills stacked are known. For example, portions near rear ends of bills stacked are pressed down by a hold-down lever to ensure a bill route in a direction from which bills are conveyed (see, for example, PTL1). In this case, the hold-down lever is placed on an upstream side of a conveying roller which feeds bills into a storage part. One end of the hold-down lever is supported so that it will freely pivot. A free end of the hold-down lever touches a top bill of bills stacked in the storage part. As a result, a bill conveyed is inserted between the free end of the hold-down lever and the top bill, slides on the top bill while lifting the free end of the hold-down lever, and is stacked on the top bill.

25 **[0005]** Furthermore, a rear end of a bill which has just been introduced into a storage part is pushed downward by a runner to ensure a bill route in a direction from which bills are conveyed (see, for example, PTL2). In this case, the runner is arranged coaxially with a conveying roller which feeds bills into the storage part. The runner pushes downward a rear end of a bill which has just been introduced into the storage part to prevent interference between the bill and an end of the following bill. Furthermore, even if a hold-down lever is also used, the runner can effectively prevent the flutter of a rear end of a bill which the hold-down lever cannot prevent.

Citation List

Patent Literature

40 **[0006]**

PTL1: Japanese Laid-open Patent Publication No. 2010-95365

PTL2: Japanese Laid-open Patent Publication No. 2003-16499

45 Summary of Invention

Technical Problem

50 **[0007]** However, even if a hold-down lever or a runner is used for pressing down or pushing downward a rear end of a bill introduced, there is a possibility that a portion on an end side of a bill to which the function of the hold-down lever or the runner does not extend is in a state different from its original state. In this case, interference may still occur between a top bill and the following bill.

[0008] The present invention was made in view of this problem. An object of the present invention is to provide a paper sheet stacking device which stably stores the following bills even in the case of a top bill of bills stacked being in a state different from its original state.

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Solution to Problem

[0009] In order to solve the above problem, there is provided a paper sheet stacking device which introduces paper sheets conveyed, which stores the paper sheets in a stacked state, and which includes a paper sheet storage part that receives and stores the paper sheets one by one, an endless conveyer belt looped on a first roller placed on a side over the paper sheet storage part on which the paper sheets are received and a second roller placed on a side over the paper sheet storage part on which the paper sheets are released, and paper sheet holding members each having one end fixed onto an outer surface of the conveyer belt and another end energized to a conveyer belt side on a downstream side in a conveyance direction of a position at which the one end is fixed.

[0010] When the paper sheet holding member on the conveyer belt included in the above paper sheet stacking device passes over the first roller, its end portion gets apart from the conveyer belt and the paper sheet holding member receives an end of a paper sheet. When the paper sheet holding member passes between the first roller and the second roller, the paper sheet holding member holds the paper sheet by grip force. When the paper sheet holding member passes under the second roller, its end portion gets apart from the conveyer belt. The paper sheet holding member releases the paper sheet, makes the paper sheet fall onto stacked paper sheets, and stacks and stores the paper sheet. That is to say, the paper sheet is not pushed from behind into the paper sheet storage part. An end of the paper sheet is drawn in for storage. Therefore, even if a top paper sheet of stacked paper sheets is in a state different from its original state, the paper sheet is stably stored.

Advantageous Effects of Invention

[0011] With the paper sheet stacking device having the above structure, an end of a paper sheet conveyed is held by grip force of the paper sheet holding member and is drawn in. The grip force is released on a side opposite the reception side. The paper sheet is made to fall onto stacked paper sheets. Therefore, the paper sheet stacking device has the advantage of being able to stably store a paper sheet.

[0012] In addition, with this paper sheet stacking device an end of a paper sheet is gripped and is drawn in. As a result, a paper sheet can be conveyed for a long distance, compared with a case where a paper sheet is pushed in by utilizing its rigidity. Therefore, this paper sheet stacking device is suitable for introducing and storing rectangular paper sheets longitudinally.

[0013] The above and other objects, features and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings which illustrate preferred embodiments of the present invention by way of example.

Brief Description of Drawings

[0014]

[FIG. 1] FIG. 1 is a perspective view which illustrates the appearance of an ATM to which a paper sheet stacking device according to an embodiment is applied.

[FIG. 2] FIG. 2 illustrates an example of the internal structure of a bill processing section of the ATM.

[FIG. 3] FIG. 3 is a side-view which illustrates the rough structure of a paper sheet stacking device according to a first embodiment.

[FIG. 4] FIG. 4 is a perspective view which illustrates the rough structure of the paper sheet stacking device according to the first embodiment.

[FIG. 5] FIG. 5 are views for describing a relationship between a conveyer belt and a bill holding member of the paper sheet stacking device according to the first embodiment, FIG. 5(A) being a view for describing the shape of the bill holding member which is not yet attached to the conveyer belt, FIG. 5(B) being a view which illustrates a state of the bill holding member at operation time.

[FIG. 6] FIG. 6 are views from a paper sheet storage part side which illustrate a state in which bill holding members are attached to the conveyer belt, FIG. 6 (A) being a view which illustrates an example of the shape of paper sheet holding members, FIG. 6(B) being a view which illustrates another example of the shape of paper sheet holding members.

[FIG. 7] FIG. 7 are views for describing another relationship between the conveyer belt and a bill holding member of the paper sheet stacking device according to the first embodiment, FIG. 7(A) being a view for describing the shape of the bill holding member which is not yet attached to the conveyer belt, FIG. 7(B) being a view which illustrates a state of the bill holding member at operation time.

[FIG. 8] FIG. 8 is a fragmentary sectional view which illustrates an example of the combination of the conveyer belt and the bill holding member.

[FIG. 9] FIG. 9 is a view for describing a state in which bills are arranged on a bill release side by the bill holding members.

[FIG. 10] FIG. 10 are views which illustrate bill holding members included in a paper sheet stacking device according to a second embodiment, FIG. 10(A) being a view which illustrates the bill holding members that are arranged on a conveyer belt so as not to overlap with one another, FIG. 10(B) being a view which illustrates the bill holding members that are arranged on the conveyer belt so as to overlap with one another.

[FIG. 11] FIG. 11 are views which illustrate a modification of the bill holding member included in the paper sheet stacking device according to the second embodiment, FIG. 11(A) being a view which illustrates bill holding members that are arranged on the conveyer belt so as not to overlap with one another, FIG. 11(B) being a view which illustrates the bill holding members that are arranged on the conveyer belt so as to overlap with one another.

[FIG. 12] FIG. 12 is a view which illustrates a bill holding member included in a paper sheet stacking device according to a third embodiment.

Description of Embodiments

[0015] Embodiments will now be described in detail with reference to the drawings with an ATM having a mechanism for conveying and storing bills longitudinally as an example.

[0016] FIG. 1 is a perspective view which illustrates the appearance of an ATM to which a paper sheet stacking device according to an embodiment is applied. FIG. 2 illustrates an example of the internal structure of a bill processing section of the ATM.

[0017] As illustrated in FIG. 1, an ATM includes in the front a customer operation part 1, a bill insertion and dispensing aperture 2, a coin insertion and dispensing aperture 3, a card insertion and ejection aperture 4, and a bankbook insertion and ejection aperture 5. The customer operation part 1 is used for operation by which input or instructions regarding a cash transaction are given. The customer operation part 1 includes a display portion, such as a liquid crystal panel, and a position input portion, such as a touch pad. Operation by which input is provided to the ATM is performed by touching a screen. The bill insertion and dispensing aperture 2 receives bills at the time of a transaction, such as receipt of money, and releases paid bills at the time of a transaction, such as payment of money. The coin insertion and dispensing aperture 3 receives coins at the time of a transaction, such as receipt of money, and releases coins paid as change at the time of a transaction, such as receipt of money or remittance. The card insertion and ejection aperture 4 handles a cash card used for identifying an individual at the time of the operation of the ATM, a transfer card used at the time of transfer operation, and the like. The bankbook insertion and ejection aperture 5 receives a bankbook and prints the contents of a transaction onto it.

[0018] As illustrated in FIG. 2, this ATM includes a bill processing parts. That is to say, the ATM includes the bill insertion and dispensing aperture 2 which receives and pays bills, a discrimination part 6 which determines the kind and genuineness of bills, and a temporary pool part 7 which pools received bills after determination, for example, until the conclusion of a transaction. In addition, the ATM includes a reject part 8 which stores, at the time of the determination that bills are inadequate for reuse being made, the bills as bad bills and storage parts 9, 10, 11, 12, and 13 which store bills. The storage parts 9, 10, and 11 are used mainly for storing bills handled at the time of receipt and payment of money. On the other hand, the storage parts 12 and 13 are used for storing bills to supplement lack of bills in the storage part 9, 10, or 11 and for storing received bills at the time of the storage parts 9, 10, and 11 being full.

[0019] A paper sheet stacking device according to the present invention can be applied to a part in which bills are stacked in a bundle. For example, a paper sheet stacking device according to the present invention is applied to a part which is placed adjacently to the bill insertion and dispensing aperture 2, which receives and stacks in order bills sent one by one from the storage part 9, 10, or 11 at the time of payment of money, and which passes the bills to the bill insertion and dispensing aperture 2 in a bundle. It is a matter of course that a paper sheet stacking device according to the present invention can also be applied to the temporary pool part 7, the reject part 8, and the storage parts 9, 10, 11, 12, and 13.

[0020] FIG. 3 is a side-view which illustrates the rough structure of a paper sheet stacking device according to a first embodiment. FIG. 4 is a perspective view which illustrates the rough structure of the paper sheet stacking device according to the first embodiment.

[0021] The paper sheet stacking device according to the first embodiment includes a paper sheet storage part 21 which stacks and stores bills 20 conveyed one by one. A roller 22 is placed on a side over the paper sheet storage part 21 on which the bills 20 are received and a roller 23 is placed on an opposite side over the paper sheet storage part 21 on which the bills 20 are released. An endless conveyer belt 24 is looped on the rollers 22 and 23 and bill holding members 25 which hold ends of the bills 20 conveyed are fixed onto an outer surface of the conveyer belt 24. In the examples of FIGS. 3 and 4, a plurality of bill holding members 25 are arranged at determined intervals in a conveyance direction on the outer surface of the conveyer belt 24 in a state in which they overlap with one another. However, the bill holding members 25 may be fixed onto the conveyer belt 24 in the conveyance direction in a state in which they do

not overlap with one another, that is to say, in a state in which they are apart from one another. If the bill holding members 25 do not overlap with one another, then FIGS. 3 and 4 indicate the movement of the bill holding members 25 at the time of the conveyer belt 24 operating.

[0022] Furthermore, a pair of conveying rollers 26 and 27 is placed adjacently to the paper sheet stacking device on the side on which the bills 20 are received, and fulfills the function of passing to the paper sheet stacking device bills 20 conveyed longitudinally one by one. The bills 20 passed to the paper sheet stacking device are conveyed in a state in which their ends are held by the bill holding members 25 of the paper sheet stacking device. Accordingly, a conveying speed of the conveyer belt 24 is equal to or slightly lower than a speed at which the bills 20 are conveyed by the conveying rollers 26 and 27.

[0023] The ends of the bills 20 supplied by the conveying rollers 26 and 27 are held on the roller 22 side by the conveyer belt 24 and the bill holding members 25. The bills 20 are conveyed to the opposite side of the paper sheet storage part 21 in a state in which their ends are held by the conveyer belt 24 and the bill holding members 25. The bill holding members 25 release the bills 20 on the roller 23 side. As a result, the bills 20 fall onto a top bill stored in the paper sheet storage part 21 and are stacked.

[0024] If a large number of bills 20 are stored, the paper sheet storage part 21 has at the bottom a stage which freely goes up and down. Accordingly, when the number of bills 20 stored in the paper sheet storage part 21 changes, control is exercised so that the stage will go up or down. As a result, the position of a top bill 20 does not change materially.

[0025] Furthermore, in the example of FIG. 4, one conveyer belt 24 onto which the bill holding members 25 are fixed is placed in order to store the bills 20 conveyed in the paper sheet storage part 21. However, a plurality of conveyer belts 24 may be arranged and used as needed.

[0026] FIG. 5 are views for describing a relationship between the conveyer belt and a bill holding member of the paper sheet stacking device according to the first embodiment. FIG. 5(A) is a view for describing the shape of the bill holding member which is not yet attached to the conveyer belt. FIG. 5(B) is a view which illustrates a state of the bill holding member at operation time.

[0027] The bill holding member 25 has a base 25a fixed onto the conveyer belt 24 and a bill pressing portion 25b which extends from the base 25a in a direction close to a direction of conveyance by the conveyer belt 24 and which presses a bill 20 against the conveyer belt 24. The base 25a and the bill pressing portion 25b are integrally formed from an elastic material.

[0028] As illustrated in FIG. 5(A), the bill holding member 25 is formed so that it will have the following shape. A free end 25c of the bill pressing portion 25b cuts into the conveyer belt 24 by distance a beyond a fitting face 25d of the base 25a. As a result, as illustrated in FIG. 5(B), if the bill holding member 25 is fixed onto the conveyer belt 24, the free end 25c of the bill pressing portion 25b functions so as to bend the conveyer belt 24 to a side opposite a side on which the bill holding member 25 is fixed. This flexion is grip force for holding the bill 20.

[0029] FIG. 6 are views from a paper sheet storage part side which illustrate a state in which bill holding members are attached to the conveyer belt. FIG. 6(A) is a view which illustrates an example of the shape of paper sheet holding members. FIG. 6(B) is a view which illustrates another example of the shape of paper sheet holding members.

[0030] The bill holding members 25 are arranged at determined intervals in the direction of conveyance by the conveyer belt 24 so that they will not overlap with one another. In FIG. 6(A), the bill holding members 25 are arranged in a state in which a base 25a of a bill holding member 25 and a free end 25c of an adjacent bill holding member 25 are apart. In FIG. 6(B), on the other hand, a notch is cut in a central portion on a base 25a side of each bill holding member 25 and the bill holding members 25 are arranged in a state in which a free end 25c of a bill holding member 25 fits into a notch of an adjacent bill holding member 25. By shortening in this way intervals at which the bill holding members 25 are arranged in the direction of conveyance by the conveyer belt 24, the number of positions on the conveyer belt 24 at which the bill holding members 25 receive bills 20 from the conveying rollers 26 and 27 increases. This means that cooperation control of the conveying rollers 26 and 27 and the rollers 22 and 23 becomes easier.

[0031] FIG. 7 are views for describing another relationship between the conveyer belt and a bill holding member of the paper sheet stacking device according to the first embodiment. FIG. 7 (A) is a view for describing the shape of the bill holding member which is not yet attached to the conveyer belt. FIG. 7(B) is a view which illustrates a state of the bill holding member at operation time.

[0032] Unlike the case of FIG. 5, the bill holding members 25 are arranged on the conveyer belt 24 in a state in which they overlap with one another. A bill holding member 25 has a base 25a fixed onto the conveyer belt 24 and a bill pressing portion 25b which extends from the base 25a in the direction of conveyance by the conveyer belt 24 and which presses a bill 20 against the conveyer belt 24. In the example of FIG. 7(A), the bill holding member 25 has a pressing protrusion 25e near a free end 25c of the bill pressing portion 25b on a conveyer belt 24 side. The base 25a, the bill pressing portion 25b, and the pressing protrusion 25e are integrally formed from an elastic material.

[0033] As illustrated in FIG. 7(A), the bill holding member 25 is formed so that it will have the following shape. The pressing protrusion 25e protrudes by distance b from a face on a paper sheet storage part 21 side of the bill pressing portion 25b to the conveyer belt 24 side. As a result, if a bill holding member 25-1 and an adjacent bill holding member

25-2 behind are fixed onto the conveyer belt 24, a state illustrated in FIG. 7(B) arises. That is to say, a pressing protrusion 25e-1 of the bill holding member 25-1 is on a bill pressing portion 25b-2 of the adjacent bill holding member 25-2 behind and a bill pressing portion 25b-1 bends to the paper sheet storage part 21 side. At this time the pressing protrusion 25e-1 of the bill holding member 25-1 touches an area c on an outer surface of the bill pressing portion 25b-2 of the adjacent bill holding member 25-2 behind by a reaction caused by the flexion of the bill pressing portion 25b-1. As a result, grip force for holding the bill 20 is obtained. In addition, an inner surface of the bill pressing portion 25b-1 of the bill holding member 25-1 touches an end portion d of a base 25a-2 of the adjacent bill holding member 25-2 behind. By doing so, the bill 20 is held. Therefore, the bill 20 is fixed more firmly.

[0034] FIG. 8 is a fragmentary sectional view which illustrates an example of the combination of the conveyer belt and the bill holding member.

[0035] A rib 24a protruding from a surface of the conveyer belt 24 onto which the bill holding member 25 is fixed is formed. This rib 24a has a head portion at its end and extends in a crosswise direction of the conveyer belt 24 so as to cross the conveyer belt 24. A section of the rib 24a has the shape of a mushroom. A more detailed description of the rib 24a is as follows. A base 24b of the rib 24a (at which the rib 24a is joined to the conveyer belt 24) is narrow in the direction of conveyance by the conveyer belt 24 and an opposite end portion 24c of the rib 24a is wider in the direction of conveyance by the conveyer belt 24 than the base 24b of the rib 24a. On the other hand, a fitting groove 25f whose section has the same shape that a section of the rib 24a has is formed in the base 25a of the bill holding member 25 so that it will extend in the crosswise direction of the conveyer belt 24.

[0036] The bill holding member 25 is fixed onto the conveyer belt 24 by fitting the rib 24a of the conveyer belt 24 into the fitting groove 25f and sliding the bill holding member 25 in the crosswise direction of the conveyer belt 24. A portion in which the rib 24a is fitted into the fitting groove 25f is fixed more firmly, for example, by injecting an adhesive into clearance. Furthermore, the size of the fitting groove 25f is made approximately equal to or slightly smaller than that of the rib 24a. By doing so, the bill holding member 25 is fixed firmly when the rib 24a is fitted into the fitting groove 25f. In addition, a part of bill holding members 25 which are significantly expendable can be replaced.

[0037] FIG. 9 is a view for describing a state in which bills are arranged on a bill release side by the bill holding members.

[0038] The paper sheet storage part 21 has, on a side on which bills 20 held and conveyed by the conveyer belt 24 and the bill holding members 25 are released, a guide 21a for catching and properly arranging the released bills 20. A base 25a of a bill holding member 25 reaches an area in which the direction of conveyance by the conveyer belt 24 is changed by the roller. 23, and a bill pressing portion 25b of the bill holding member 25 gets apart from the conveyer belt 24. At this time a bill 20 is released. At this point of time the force of conveyance by the conveying rollers 26 and 27 has already been lost, so the released bill 20 falls at that position onto a stacked top bill 20 stored in the paper sheet storage part 21. After that, a bill holding member 25 on a downstream side in the direction of conveyance of the bill holding member 25 which has held and conveyed the bill 20 rises from the conveyer belt 24 and moves to the guide 21a while pressing a portion near an end of the stored bill 20 with an outer surface 25k of its bill pressing portion 25b. As the bill pressing portion 25b moves, the top bill 20 slides on a second stored bill 20 from the top. A front edge of the top bill 20 touches the guide 21a and stops. As a result, bills 20 are stacked and stored in the paper sheet storage part 21 in an arranged state in which their front edges are touching the guide 21a.

[0039] FIG. 10 are views which illustrate bill holding members included in a paper sheet stacking device according to a second embodiment. FIG. 10(A) is a view which illustrates the bill holding members that are arranged on a conveyer belt so as not to overlap with one another. FIG. 10 (B) is a view which illustrates the bill holding members that are arranged on the conveyer belt so as to overlap with one another. Components in FIG. 10 which are identical or equivalent to those illustrated in FIGS. 5 and 7 are marked with the same numerals and detailed descriptions of them will be omitted.

[0040] A bill holding member 25 used in a paper sheet stacking device according to a second embodiment realizes grip force for holding a bill 20 by the elastic force of an elastic body. That is to say, the bill holding member 25 has a base 25a whose one end is fixed onto a conveyer belt 24 and which is made from a hard material, a bill pressing portion 25b attached to the other end of the base 25a, and an elastic body which makes the bill pressing portion 25b tilt to a conveyer belt 24 side. The bill pressing portion 25b preferably is attached to the base 25a so that the bill pressing portion 25b can pivot. A coiled spring 25g is placed on an axis and makes the bill pressing portion 25b tilt to the conveyer belt 24 side.

[0041] A range in which the bill pressing portion 25b tilts is limited so that when the bill holding member 25 receives a bill 20 from conveying rollers 26 and 27, interference will not occur between the conveying rollers 26 and 27 and the bill pressing portion 25b. In the case of FIG. 10(A) in which the bill holding members 25 are arranged on the conveyer belt 24 so as not to overlap with one another, the bill pressing portion 25b can tilt only to a position in the conveyer belt 24 indicated by a dashed line in a state in which the bill holding member 25 is not fixed onto the conveyer belt 24. This is realized, for example, by attaching a stopper portion by which a part of the bill pressing portion 25b touches the base 25a and by which the bill pressing portion 25b cannot pivot any further. Furthermore, in the case of FIG. 10(B) in which the bill holding members 25 are arranged on the conveyer belt 24 so as to overlap with one another, the bill pressing portion 25b can tilt only to a position in a base 25a of an adjacent bill holding member 25 indicated by a dashed line.

[0042] FIG. 11 are views which illustrate a modification of the bill holding member included in the paper sheet stacking device according to the second embodiment. FIG. 11(A) is a view which illustrates bill holding members that are arranged on the conveyer belt so as not to overlap with one another. FIG. 11 (B) is a view which illustrates the bill holding members that are arranged on the conveyer belt so as to overlap with one another.

[0043] A bill holding member 25 used in the paper sheet stacking device according to the second embodiment realizes grip force for holding a bill 20 by the elastic force of a plate spring 25h. That is to say, the bill holding member 25 has a base 25a whose one end is fixed onto a conveyer belt 24 and which is made from a hard material, a bill pressing portion 25b attached to the other end of the base 25a, and the plate spring 25h which is an elastic body and which makes the bill pressing portion 25b tilt to a conveyer belt 24 side. The bill holding member 25 is formed by fixing both ends of the plate spring 25h, which is resin or metal, to the base 25a and the bill pressing portion 25b. For example, the plate spring 25h is an insert and the bill holding member 25 is formed by insert molding. In this case, resin is poured around the plate spring 25h and is hardened. By doing so, the base 25a and the bill pressing portion 25b are formed.

[0044] In the case of FIG. 11 (A) in which bill holding members 25 are arranged on the conveyer belt 24 so as not to overlap with one another, the grip force of the plate spring 25h is used for holding a bill 20 by the bill pressing portion 25b and the conveyer belt 24. Furthermore, in the case of FIG. 11(B) in which the bill holding members 25 are arranged on the conveyer belt 24 so as to overlap with one another, the grip force of the plate spring 25h is used for holding a bill 20 by the bill pressing portion 25b and a base 25a of an adjacent bill holding member 25.

[0045] FIG. 12 is a view which illustrate a bill holding member included in a paper sheet stacking device according to a third embodiment.

[0046] A bill holding member 25 used in a paper sheet stacking device according to a third embodiment realizes grip force for holding a bill 20 by the magnetic attraction force between magnetic attraction portions. That is to say, the bill holding member 25 has a base 25a fixed onto a conveyer belt 24, a bill pressing portion 25b which extends from the base 25a approximately parallel with the face of the conveyer belt 24 and which can swing with the base 25a as a supporting point, and a magnet 25i fixed to an end of the bill pressing portion 25b. In addition, in order to give grip force to the bill holding member 25, a magnetic substance 25j is placed on a side of the conveyer belt 24 opposite a side on which the bill holding member 25 is fixed. An end of the magnetic substance 25j on a side on which a bill 20 is released extends to a position at which the bill 20 is released. As a result, when the magnet 25i of the bill holding member 25 moves in an area in which the magnetic substance 25j is placed, the magnet 25i is attracted by the magnetic substance 25j and grip force is produced. The bill 20 is held by this grip force. The bill 20 is released at a position at which the magnetic substance 25j ends.

[0047] In the example of FIG. 12, the moving magnetic attraction portion placed in the bill holding member 25 is the magnet 25i and the fixed magnetic attraction portion placed inside the conveyer belt 24 is the magnetic substance 25j. However, the moving magnetic attraction portion and the fixed magnetic attraction portion may be a magnetic substance and a magnet, respectively, or both of the moving magnetic attraction portion and the fixed magnetic attraction portion may be magnets. If a magnet is placed inside the conveyer belt 24, the magnets are magnetized so that their faces opposite the conveyer belt 24 will have different magnetic polarities.

[0048] In the above embodiments many bill holding members 25 are arranged on the conveyer belt 24. However, if circumstances require, only one bill holding member 25 may be used. In this case, it is desirable to drive the rollers 22 and 23 in synchronization with the conveying rollers 26 and 27 or drive the conveying rollers 26 and 27 in synchronization with the rollers 22 and 23, according to a state in which a bill 20 is conveyed.

[0049] The foregoing is considered as illustrative only of the principles of the present invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and applications shown and described, and accordingly, all suitable modifications and equivalents may be regarded as falling within the scope of the invention in the appended claims and their equivalents.

Reference Signs List

[0050]

1	customer operation part
2	bill insertion and dispensing aperture
3	coin insertion and dispensing aperture
4	card insertion and ejection aperture
5	bankbook insertion and ejection aperture
6	discrimination part
7	temporary pool part
8	reject part
9, 10, 11, 12, and 13	storage part

20	bill
21	paper sheet storage part
21a	guide
22 and 23	roller
5 24	conveyer belt
24a	rib
25, 25-1, and 25-2	bill holding member
25a and 25a-2	base
25b, 25b-1, and 25b-2	bill pressing portion
10 25c	free end
25d	fitting face
25e and 25e-1	pressing protrusion
25f	fitting groove
25g	coiled spring
15 25h	plate spring
25i	magnet
25j	magnetic substance
25k	outer surface
26 and 27	conveying roller
20	

Claims

- 25 1. A paper sheet stacking device which introduces paper sheets conveyed and which stores the paper sheets in a stacked state, the device comprising:
 - a paper sheet storage part which receives and stores the paper sheets one by one;
 - an endless conveyer belt looped on a first roller placed on a side over the paper sheet storage part on which the paper sheets are received and a second roller placed on a side over the paper sheet storage part on which
 - 30 the paper sheets are released; and
 - paper sheet holding members each having one end fixed onto an outer surface of the conveyer belt and another end energized to a conveyer belt side on a downstream side in a conveyance direction of a position at which the one end is fixed.
- 35 2. The paper sheet stacking device according to claim 1, wherein:
 - the paper sheet holding members are arranged at determined intervals in the conveyance direction of the conveyer belt so as not to overlap with one another; and
 - 40 the paper sheet is held by the another end and the conveyer belt.
3. The paper sheet stacking device according to claim 2, wherein:
 - each of the paper sheet holding members is an elastic body having a shape by which the another end is, at the time of the one end being fixed onto the conveyer belt like a plane, at a position beyond the plane of the conveyer
 - 45 belt; and
 - the elastic body is bent by the conveyer belt and therefore the paper sheet is held.
4. The paper sheet stacking device according to claim 2, wherein:
 - 50 each of the paper sheet holding members has a first portion having one end which is fixed onto the conveyer belt and which is formed from a hard material, a second portion attached to a free end of the first portion, and an elastic body which energizes the second portion so as to make the second portion tilt to the conveyer belt side; and
 - the second portion holds the paper sheet by energizing force of the elastic body.
 - 55
5. The paper sheet stacking device according to claim 4, wherein the elastic body is a coiled spring placed on an axis at which the second portion is attached to the first portion so as to freely pivot.

6. The paper sheet stacking device according to claim 4, wherein the elastic body is a plate spring whose both ends are fixed to the first portion and the second portion.

7. The paper sheet stacking device according to claim 2, wherein:

each of the paper sheet holding members has a swinging portion which extends approximately parallel with a face of the conveyer belt and which can swing with the one end fixed onto the conveyer belt as a supporting point and a first magnetic attraction portion attached to a free end of the swinging portion; and the paper sheet is held by attraction force produced between the first magnetic attraction portion and a second magnetic attraction portion placed in a lower conveyance area inside the conveyer belt.

8. The paper sheet stacking device according to claim 7, wherein one of the first magnetic attraction portion and the second magnetic attraction portion is a magnet and another is a magnet or a magnetic substance.

9. The paper sheet stacking device according to claim 1, wherein:

the paper sheet holding members are arranged at determined intervals in the conveyance direction of the conveyer belt so as to overlap with one another; and the paper sheet is held by the another end and an adjacent paper sheet holding member on an upstream side in the conveyance direction.

10. The paper sheet stacking device according to claim 9, wherein:

each of the paper sheet holding members is an elastic body having a shape by which the another end is, at the time of the one end being fixed onto the conveyer belt like a plane, at a position on the conveyer belt side beyond a face on the paper sheet storage part side of the adjacent paper sheet holding member on a downstream side in the conveyance direction; and the another end is on the adjacent paper sheet holding member, the elastic body bends, and therefore the paper sheet is held.

11. The paper sheet stacking device according to claim 9, wherein:

each of the paper sheet holding members has a first portion having one end which is fixed onto the conveyer belt and which is formed from a hard material, a second portion attached to a free end of the first portion, and an elastic body which energizes the second portion so as to make the second portion tilt to the conveyer belt side; and the second portion which is on the first portion of an adjacent paper sheet holding member on a downstream side in the conveyance direction holds the paper sheet by energizing force of the elastic body.

12. The paper sheet stacking device according to claim 11, wherein the elastic body is a coiled spring placed on an axis at which the second portion is attached to the first portion so as to freely pivot.

13. The paper sheet stacking device according to claim 11, wherein the elastic body is a plate spring whose both ends are fixed to the first portion and the second portion.

14. The paper sheet stacking device according to claim 2 or 9, wherein each of the paper sheet holding members is fixed onto the conveyer belt by fitting a rib protruding from a face of the conveyer belt onto which each of the paper sheet holding members is fixed into a fitting groove which is formed on one end side of each of the paper sheet holding members and whose section is equal in shape to a section of the rib.

15. The paper sheet stacking device according to claim 1, wherein:

the paper sheet holding members are arranged at determined intervals in the conveyance direction of the conveyer belt so as to overlap with one another; a notch is cut in the one end of each of the paper sheet holding members fixed onto the outer surface of the conveyer belt; and the paper sheet holding members are arranged in a state in which the another end of each adjacent paper sheet holding member on an upstream side in the conveyance direction fits into the notch.

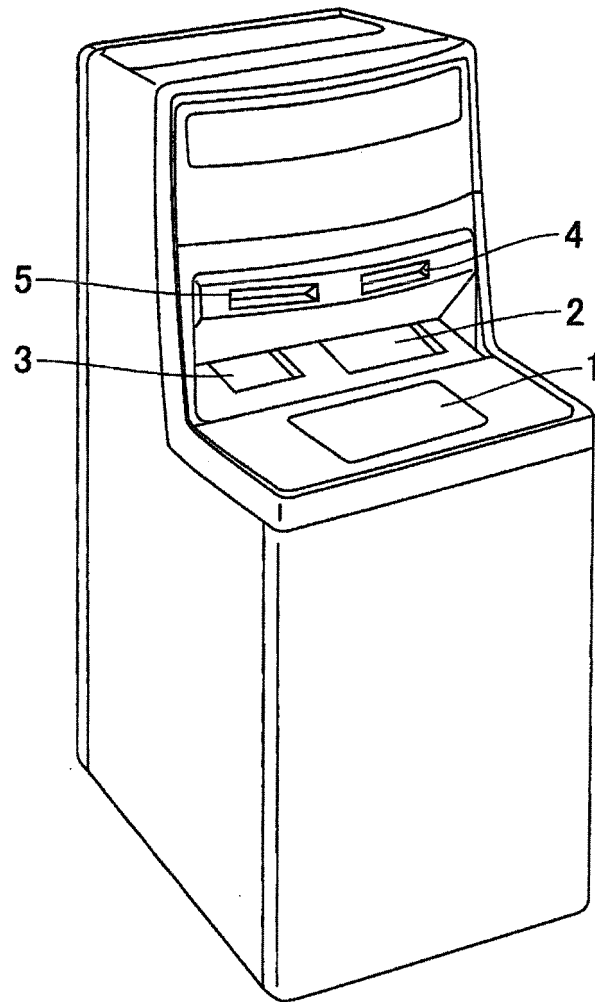


FIG. 1

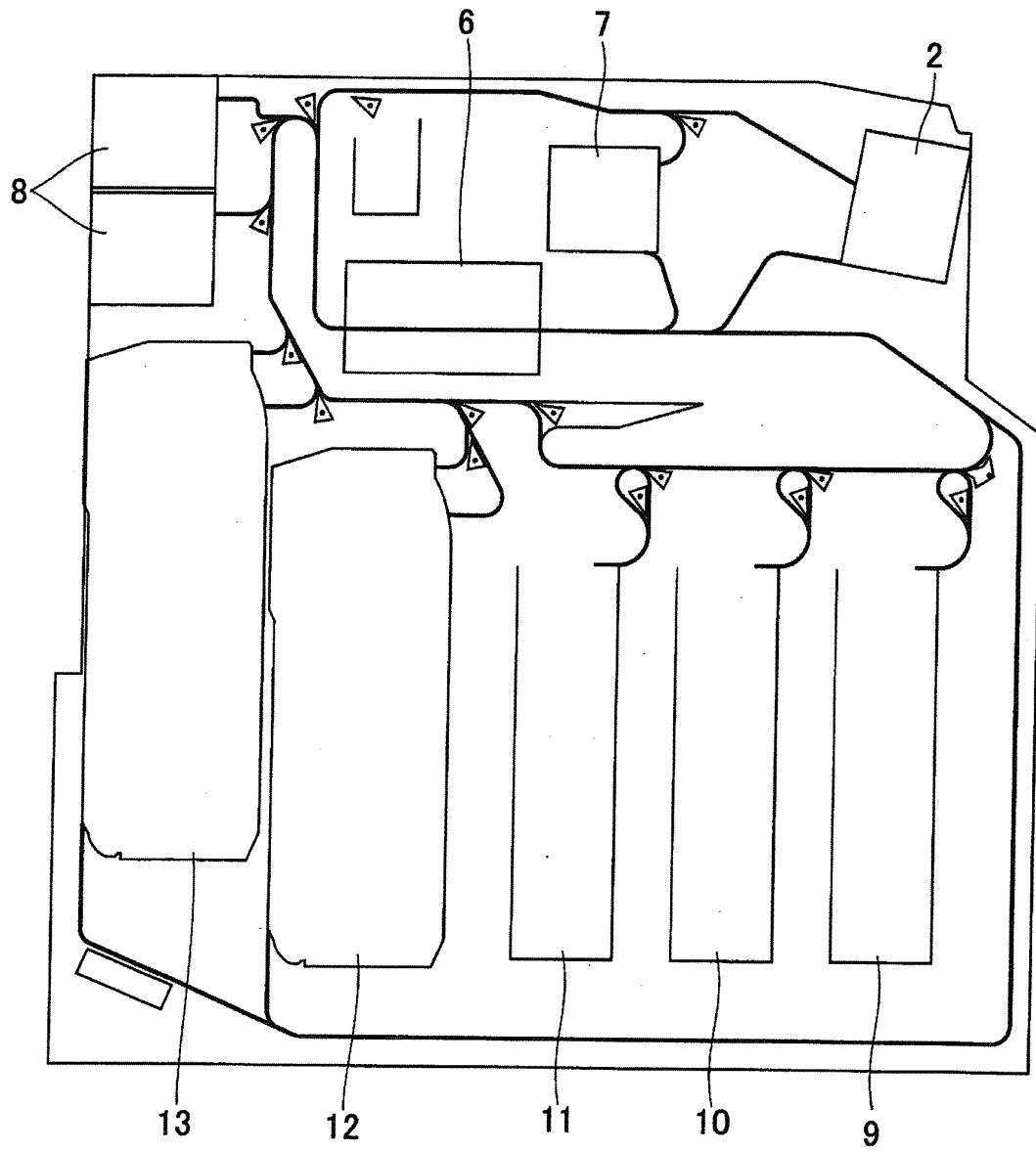


FIG. 2

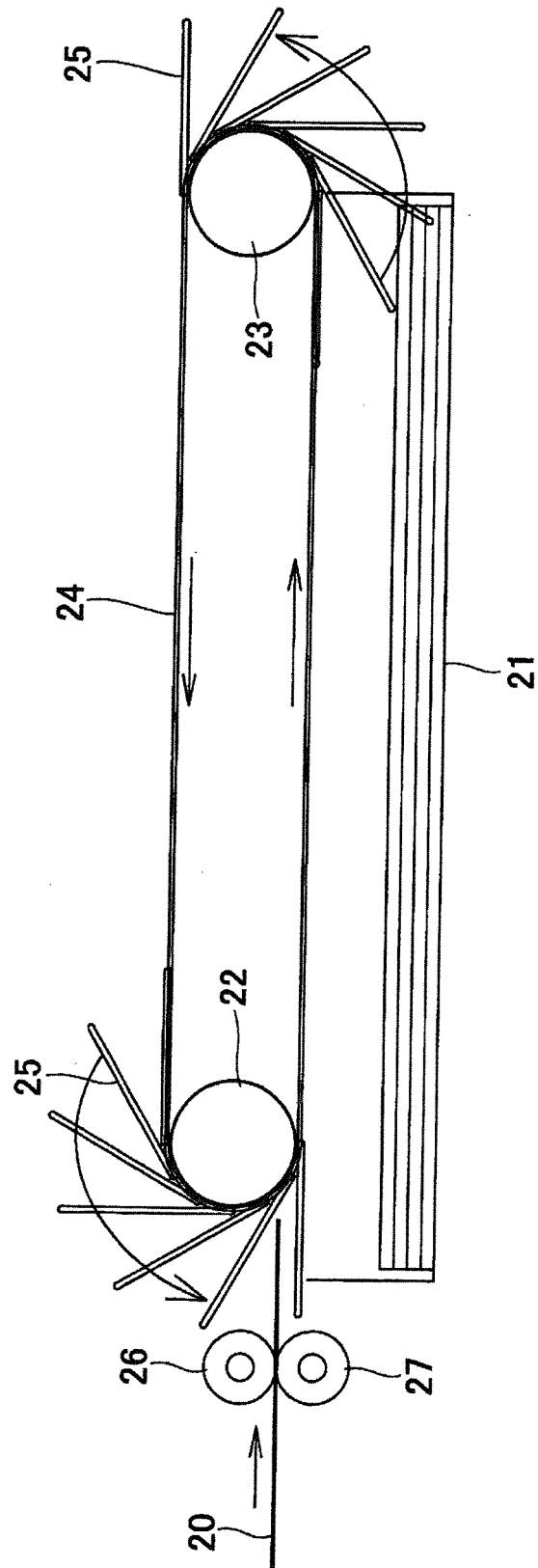


FIG. 3

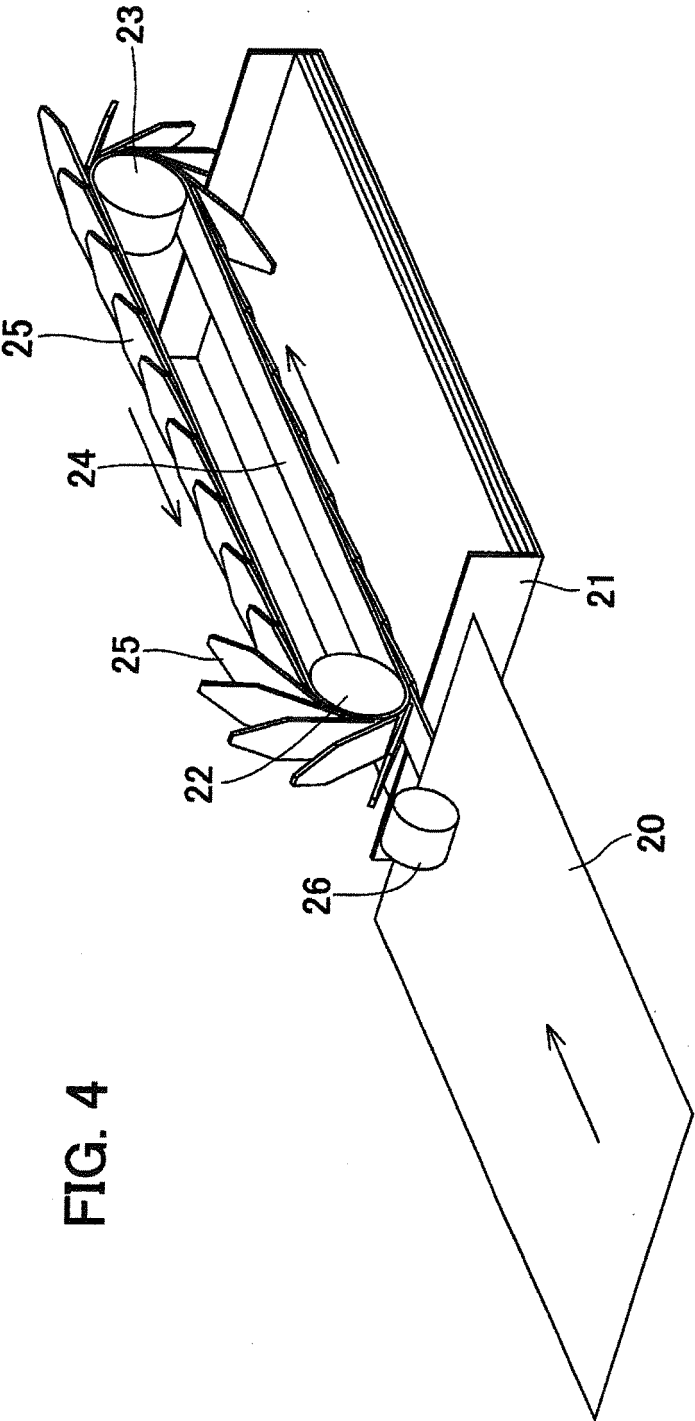


FIG. 4

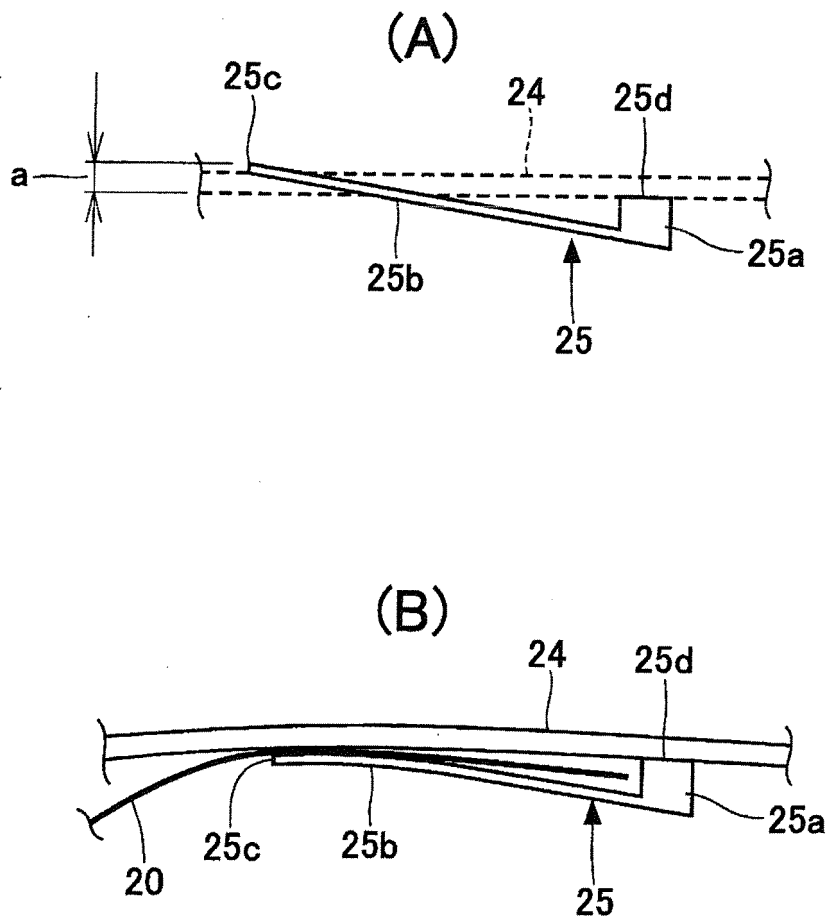


FIG. 5

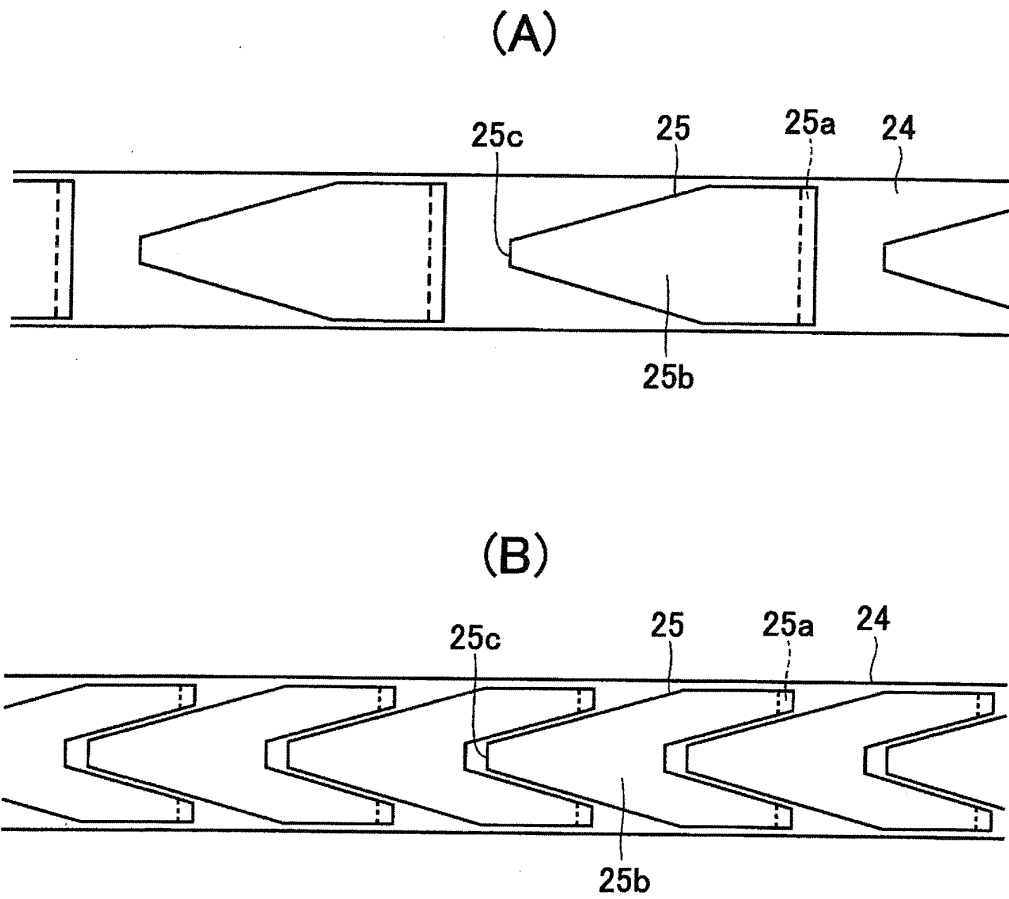


FIG. 6

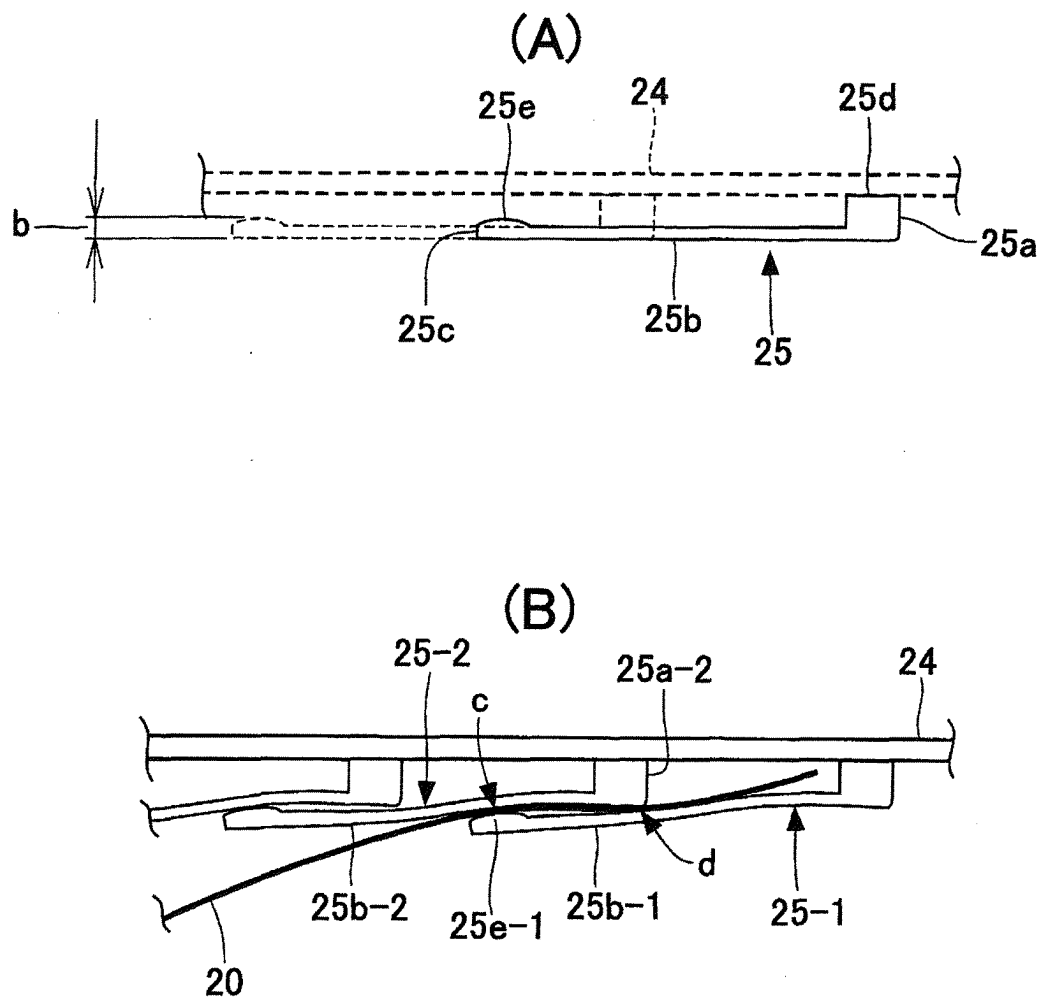


FIG. 7

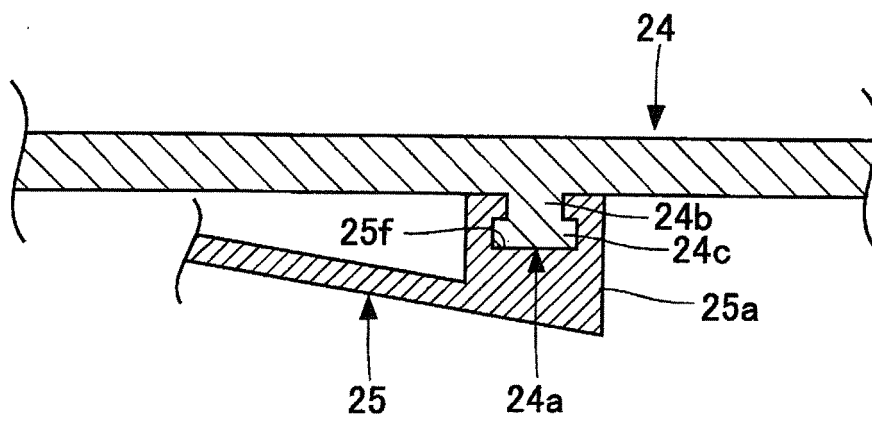


FIG. 8

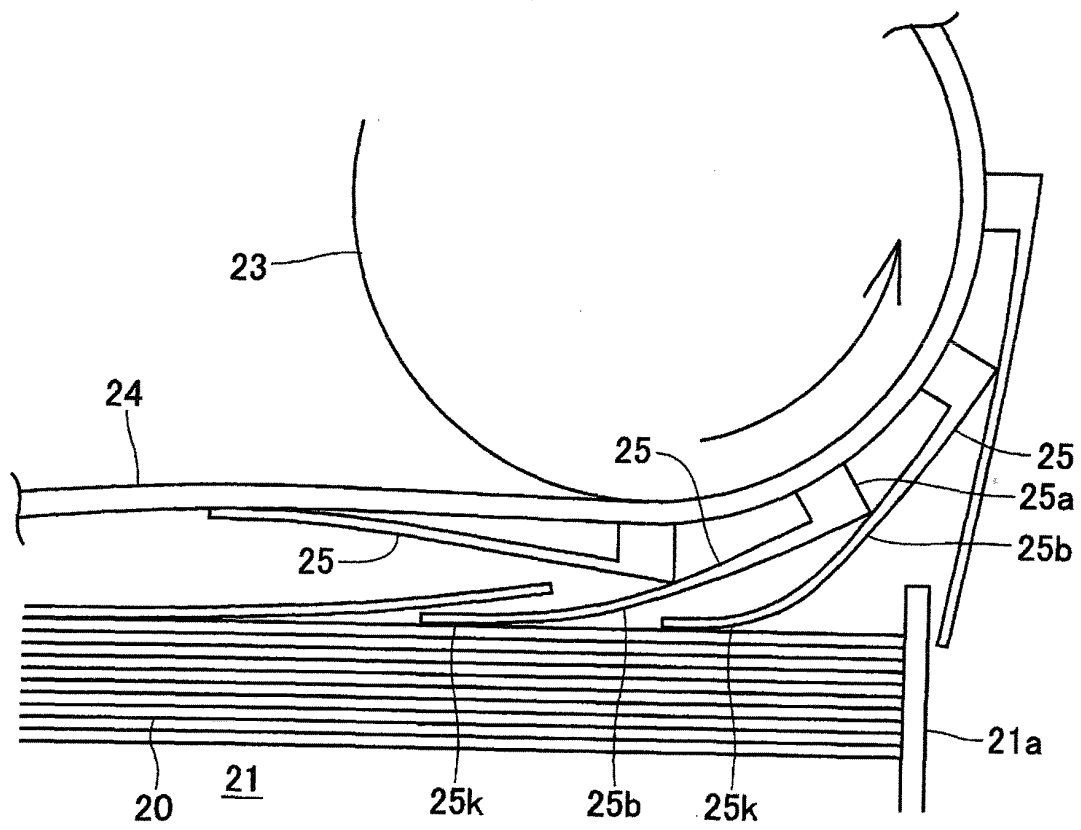


FIG. 9

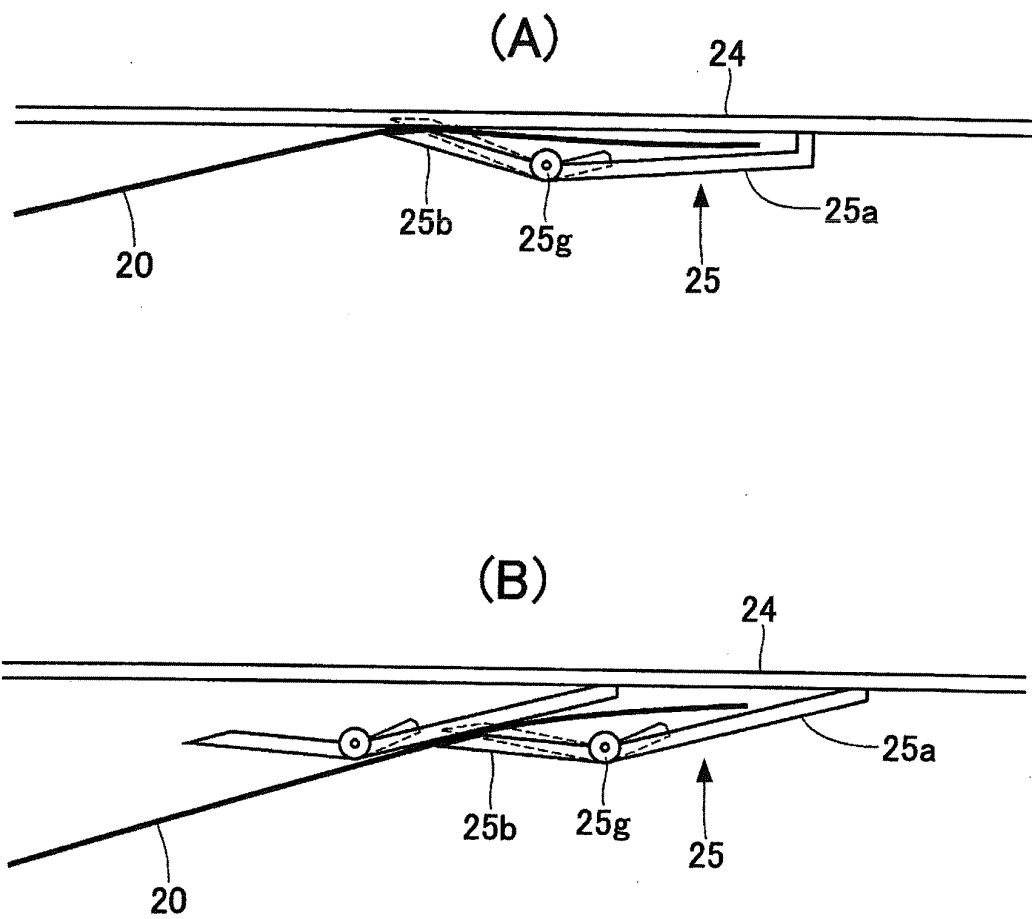


FIG. 10

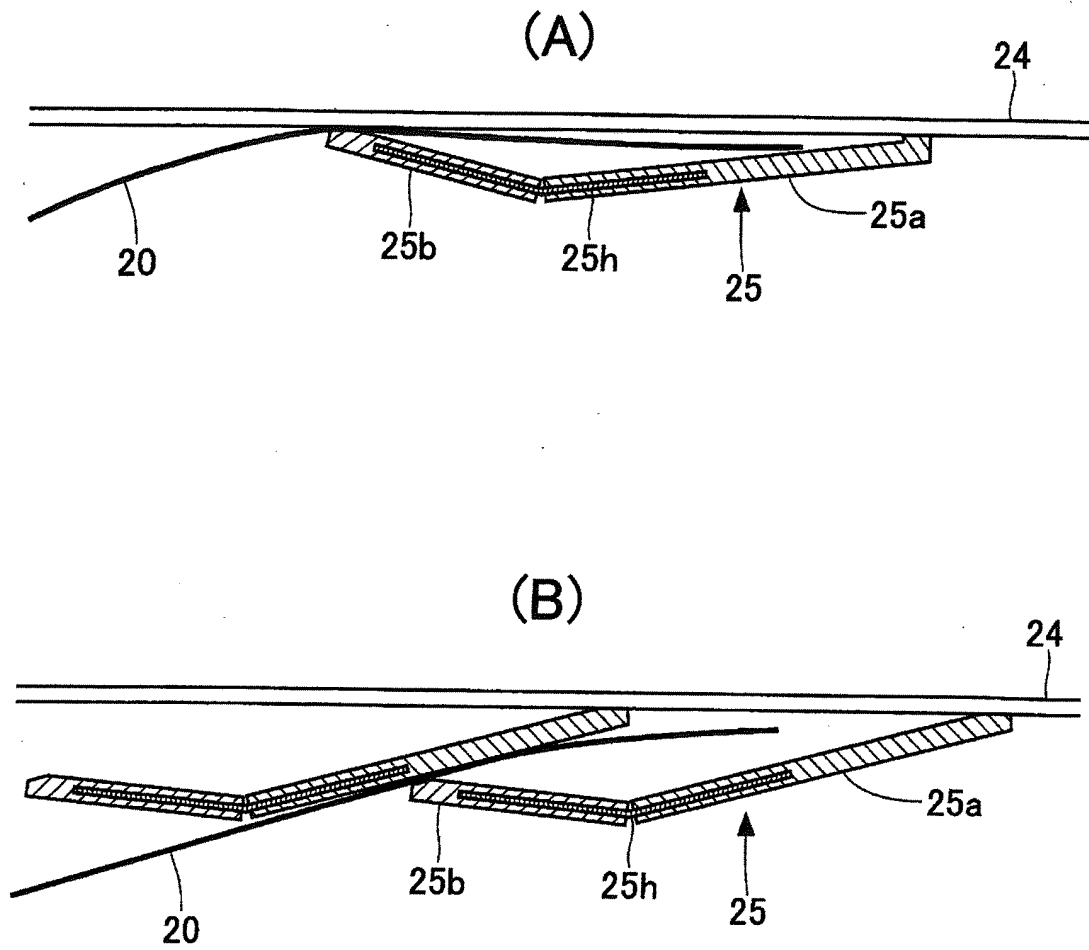


FIG. 11

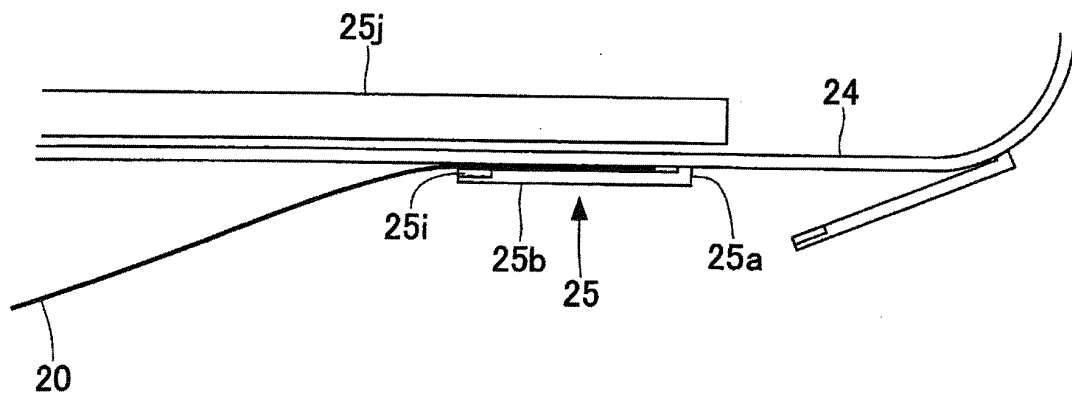


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/076786

A. CLASSIFICATION OF SUBJECT MATTER

B65H29/04 (2006.01) i, B65H29/38 (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)

B65H29/04, B65H29/38

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	1996-2011
Kokai Jitsuyo Shinan Koho	1971-2011	Toroku Jitsuyo Shinan Koho	1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 130174/1985 (Laid-open No. 38257/1987) (Toyo Communication Equipment Co., Ltd.), 06 March 1987 (06.03.1987), page 5, line 3 to page 6, line 12; fig. 1 to 2 (Family: none)	1-6
Y		7-8
Y	JP 55-61553 A (Ricoh Co., Ltd.), 09 May 1980 (09.05.1980), page 2, lower left column, line 17 to lower right column, line 1 (Family: none)	7-8

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
14 December, 2011 (14.12.11)Date of mailing of the international search report
27 December, 2011 (27.12.11)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/076786

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 63695/1989 (Laid-open No. 4158/1991)	9-13
Y	(Laurel Bank Machine Co., Ltd.), 16 January 1991 (16.01.1991), page 12, line 13 to page 15, line 6; fig. 3 to 4 (Family: none)	14-15
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 38400/1989 (Laid-open No. 129356/1990)	14
	(Nippon Mektron, Ltd.), 25 October 1990 (25.10.1990), page 7, lines 14 to 20 (Family: none)	
Y	JP 2006-206266 A (Oki Electric Industry Co., Ltd.), 10 August 2006 (10.08.2006), paragraph [0016]; fig. 3 & CN 1810616 A	15
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 135357/1985 (Laid-open No. 44852/1987)	3-6, 11-13
	(NEC Corp.), 18 March 1987 (18.03.1987), page 3, lines 3 to 20; fig. 2 to 3 (Family: none)	

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/076786

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Although the inventions of claims 1-15 are common to one another since the inventions have the configuration according to the invention of claim 1, the inventions of claims 1-2 and the inventions of claims 9-10 are disclosed in the documents cited in this international search report, and therefore cannot be considered to have a special technical feature.

Therefore, there is no special technical feature common to all of the inventions in claims 1-15, and it is obvious that the inventions in claims 1-15 do not comply with the requirement of unity of invention.

(continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/076786

Continuation of Box No.III of continuation of first sheet (2)

The inventions of claims 1-3 relate to a paper sheet stacking device in which paper sheet holding members are an elastic body formed into such a shape as to be located above the plane of a conveyor belt.

The inventions of claims 4-6, 11-13 relate to a paper sheet stacking device which is configured in such a manner that paper sheet holding members each comprise a first member which is formed of a rigid material and is fixed to a belt and a second member which is attached to the free end of the first member, and that the second member is urged by an elastic body.

The inventions of claims 7-8 relate to a paper sheet stacking device which is configured in such a manner that paper sheet holding members hold a paper sheet with a magnetic attachment member.

The inventions of claims 9-10 relate to a paper sheet stacking device which is configured in such a manner that paper sheet holding members partially overlap one another.

The invention of claim 14 relates to a paper sheet stacking device which is configured in such a manner that an engaging groove which is formed on the side of one ends of paper sheet holding members and a rib which is formed on a conveyor belt are fitted to each other.

The invention of claim 15 relates to a paper sheet stacking device which is configured in such a manner that notch sections are formed at one ends of paper sheet holding members which are fixed to the outer peripheral surface of a conveyor belt, and the other ends of the paper sheet holding members are fitted into the notch sections.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2010095365 A [0006]
- JP 2003016499 A [0006]