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Description

Technical Field

[0001] The present invention relates to a sheet processing apparatus.

Background Art

[0002] Patent Literature (hereinafter referred to as "PTL") 1 discloses a sheet storage mechanism for storing a sheet by winding a tape and the sheet around a drum. PTL 1 discloses a technique of controlling a drum driving source such that a tape speed detected by a tape speed detection unit is constant. PTL 1 also discloses a technique of controlling, based on the tape speed detected by the tape speed detection unit and a reel speed detected by a reel detection unit, a reel driving source such that the tape has a certain level of tension. PTL 2 discloses a method of controlling a banknote store comprising at least one winding means and at least one elongate support means, PTL 3 discloses a paper sheet feeding device wherein a pair of guide members are arranged separated from each other in a mounting part, and PTL 4 discloses a paper money temporary storage apparatus provided with one recycling roller assembly.

Citation List

Patent Literature

[0003]

PTL 1 WO2017/126129
PTL 2 EP 1772406 A1
PTL 3 WO 2016/140139 A1

Summary

[0004] Recently, a banknote with a security thread and a banknote with a seal have been used. Such banknotes are not uniform in thickness. In other words, a thick portion and a thin portion exist in one banknote. In addition to these banknotes, there are sheets not uniform in thickness. When such sheets are wound around a drum together with a tape, thick portions overlap each other, and the shape of a roll may be an inappropriate shape that is not a cylindrical shape; for example, the shape of the roll may be a truncated cone shape.

[0005] The sheet storage mechanism disclosed in PTL 1 is incapable of detecting that the shape of a roll formed from the tape and sheets wound around the drum is an inappropriate shape.

[0006] A sheet processing apparatus according to the present invention is a sheet processing apparatus comprising: a storage unit that stores a sheet and feeds the sheet stored; and a control unit that controls the storage unit, characterized in that the storage unit comprises: a first reel around which a first tape is wound; a second reel around which a second tape is wound; a drum that winds the sheet together with the first tape drawn from the first reel and the second tape drawn from the second reel to form a roll; a first sensor that detects movement of the first tape; and a second sensor that detects movement of the second tape, a position at which the first tape is wound around the drum and a position at which the second tape is wound around the drum are different from each other in an axial direction of the drum, and the control unit controls the storage unit based on a detection result of the first sensor and a detection result of the second sensor.

[0007] According to the sheet processing apparatus of the present invention, the control unit is capable of obtaining, based on the detection result of the first sensor, a size of the roll at the position at which the first tape is wound. Further, the control unit is capable of obtaining, based on the detection result of the second sensor, a size of the roll at the position at which the second tape is wound. Therefore, the control unit is capable of detecting that the shape of the roll is an inappropriate shape that is not a cylindrical shape being substantially uniform in diameter. In addition, when detecting that the shape of the roll is an inappropriate shape, the control unit is capable of controlling the storage unit suitably to that situation. It is thus possible, for example, to prevent deterioration of the situation or improve the situation.

[0008] The sheet includes a banknote, check, ticket, coupon, and voucher.

[0009] In the sheet processing apparatus, the first tape and the second tape may be wound around the drum while being in contact with the same surface of the sheet wound around the drum.

[0010] In the sheet processing apparatus the storage unit may comprise a third reel around which a third tape is wound, and a fourth reel around which a fourth tape is wound. In this case, the third tape is wound around the drum in such a manner as to overlap the first tape, and the fourth tape is wound around the drum in such a manner as to overlap the

second tape. Further, the third tape is wound around the drum in a state where the sheet is sandwiched between the third tape and the first tape, and the fourth tape is wound around the drum in a state where the sheet is sandwiched between the fourth tape and the second tape.

[0011] In the sheet processing apparatus, the first tape and the second tape may be wound around the drum while in contact with respective different surfaces of the sheet wound around the drum. In this case, the first tape and the second tape do not overlap each other, but sandwiches the sheet from above and below. Therefore, when the drum, the first reel, and the second reel rotate reversely to unwind the roll, and the sheet comes out of the roll, the sheet cannot remain attached to the roll. In other words, it is possible to smoothly discharge the sheet from the storage unit.

[0012] In this case, the storage unit may comprise a fifth reel around which a fifth tape is wound. The position at which the fifth tape is wound around the drum may be a position that is different in the axial direction of the drum from the position at which the first tape is wound and the position at which the second tape is wound. The position at which the fifth tape is wound may be on the opposite side of the position at which the first tape is wound, with the position at which the second tape is wound being interposed therebetween. Further, the storage unit may comprise a fifth sensor for detecting the movement of the fifth tape. By using three of the first sensor, the second sensor, and the fifth sensor, it is possible to detect the shape of the roll more accurately. It is possible to detect that the roll has a barrel shape, for example.

[0013] In the sheet processing apparatus according to the present invention, the storage unit may comprise at least one of a first roller and a second roller, the first roller being a roller which is in contact with the first tape stretched between the first reel and the drum and rotation of which is detected by the first sensor, the second roller being a roller which is in contact with the second tape stretched between the second reel and the drum and rotation of which is detected by the second sensor. The first roller may be disposed to be in contact with the first tape on a first tape path between the first reel and the drum along which the first tape is drawn from the first reel and reaches the drum. The second roller may be disposed to be in contact with the second tape on a second tape path between the second reel and the drum along which the second tape is drawn from the second reel and reaches the drum. Each of the rollers making contact with the tape rotates as the tape moves. Therefore, the roller rotates by an angle (number of rotations) corresponding to the amount of movement of the tape, and rotates at an angular speed corresponding to the moving speed of the tape. The storage unit comprises the first roller, and the first sensor detects the rotation of the first roller. Accordingly, the first sensor is capable of reliably detecting the movement of the first tape. The storage unit comprises the second roller, and the second sensor detects the rotation of the second roller. Accordingly, the second sensor is capable of reliably detecting the movement of the second tape.

[0014] At least one of the first tape and the second tape may be a tape that is given a repetitive mark throughout its length. The mark can be given by printing. The mark can also be given by forming the tape from a colored material. In this case, the first sensor may be a sensor that reads the mark given to the first tape. The second sensor may be a sensor that reads the mark given to the second tape. The amount of movement of the tape can be detected based on the number of passed marks. The moving speed of the tape can be detected based on the moving speed of the passed mark or the number of passed marks per unit time. In the case where the sensors are a sensor that reads the mark on the tape, the first sensor may be disposed at a position adjacent to the first tape stretched between the first reel and the drum, and the second sensor may be disposed at a position adjacent to the second tape stretched between the second reel and the drum. The first sensor may be disposed at a position adjacent to the first tape path and the second sensor may be disposed at a position adjacent to the second tape path. Such sensors are capable of detecting the movement of the tapes without making contact with the tapes.

[0015] At least one of the first sensor and the second sensor may be a sensor for detecting the amount of movement of the tape. In this case, the control unit may calculate the moving speed of the tape from the amount of movement of the tape per unit time. Further, at least one of the first sensor and the second sensor may be a sensor for directly detecting the moving speed of the tape.

[0016] The first reel may be driven by a first motor, and the second reel may be driven by a second motor. The second motor is a different motor from the first motor. That is, the first reel and the second reel may be driven by the separate motors. With this configuration, it is possible to drive the first reel and the second reel independently of each other. Driving the reels independently of each other makes it possible to make greater or smaller the tension applied to one of the first tape and the second tape than the tension applied to the other. By adjusting the tension applied to the tape, it is possible to adjust the degree to which the diameter of the roll at a portion where this tape is wound is increased. A case is considered where a sheet is to be wound further in a state in which the roll has the shape of a truncated cone, specifically, in a state in which the diameter of the roll at the position at which the first tape is wound (hereinafter, sometimes referred to as the first position) is larger than the diameter of the roll at the position at which the second tape is wound (hereinafter, sometimes referred to as the second position). In this case, by making greater the amount of increase in the diameter of the roll at the second position than the amount of increase in the diameter of the roll at the first position, it is possible to equalize the diameter of the roll between both of the positions. To achieve this, the first motor and the second motor are driven so that the tension applied to the first tape is greater than the tension applied to the second tape. By driving the motors in this way, the degree of increase in the diameter of the roll at the second position

can be greater than the degree of increase in the diameter of the roll at the first position. That is, it is possible to gradually change the truncated cone shape into the cylindrical shape.

[0017] The first reel and the second reel may be configured to be rotatable independently of each other by a single motor. That is, the motor may be configured such that the rotation of the single motor is transmitted via a transmission mechanism to the first reel and second reel at respective different transmission ratios. Examples of such a transmission mechanism may include a belt transmission mechanism using a pulley whose groove width is variable. With this configuration, it is possible to rotate the first reel and the second reel independently of each other using the single motor.

[0018] The first reel and the second reel may be coaxially arranged. With such an arrangement, it is possible to equalize the distance from the first reel to the drum and the distance from the second reel to the drum, and thus to adjust the tension of the first tape and the tension of the second tape in the same manner.

[0019] The first reel and the second reel may be arranged such that the axis of the first reel and the axis of the second reel are on respective different straight lines. With such an arrangement, it is possible to increase the degree of freedom in the layout of the first reel and the second reel, and thus to optimize the layout of elements constituting the storage unit.

[0020] The drum may be driven by a drum motor. The drum motor is a different motor from the first motor for driving the first reel and the second motor for driving the second reel. With this configuration, it is possible to drive the drum independently of the first reel and the second reel. Driving the drum independently of the driving of each of the reels makes it possible to finely adjust the tension applied to the first tape and the second tape.

[0021] The drum, the first reel, and the second reel may be configured to be rotatable independently of one another by a single motor. That is, the motor may be configured such that the rotation of the single motor is transmitted via a transmission mechanism to the drum, the first reel, and the second reel at respective different transmission ratios.

[0022] The first motor may be a stepper motor. Using the stepper motor allows accurate control on the rotational angle (number of rotations) of the first motor and thus the rotational angle (number of rotations) of the first reel. The second motor may be a stepper motor. Using the stepper motor allows accurate control on the rotational angle (number of rotations) of the second motor and thus the rotational angle (number of rotations) of the second reel. The drum motor may be a stepper motor. Using the stepper motor allows accurate control on the rotational angle (number of rotations) of the drum motor and thus the rotational angle (number of rotations) of the drum. A sensor for detecting the rotational angle (number of rotations) of the first motor or the first reel may be disposed. A sensor for detecting the rotational angle (number of rotations) of the second motor or the second reel may be disposed. A sensor for detecting the rotational angle (number of rotations) of the drum motor or the drum may be disposed.

[0023] The drum motor may be a DC motor.

[0024] The sheet processing apparatus may comprise an inlet unit that lets the sheet in the inside of the sheet processing apparatus.

[0025] The sheet processing apparatus may comprise a dispensing unit that dispenses the sheet to the outside of the sheet processing apparatus.

[0026] The sheet processing apparatus may comprise a transport unit. The transport unit may be configured to transport the sheet between the inlet unit and the storage unit. The transport unit may be configured to transport the sheet between the storage unit and the dispensing unit.

[0027] The sheet processing apparatus may comprise a recognition unit disposed to recognize the sheet being transported by the transport unit. The recognition unit may recognize the type or the transport orientation of the sheet. The transport orientation is a concept including the orientation of the face and the back of the sheet (for example, whether the face is oriented upward or downward) and the direction of the sheet. The transport orientation may be a concept including the position of the transported sheet in the width direction of the transport surface (in other words, in a direction orthogonal to the transport direction). The transport orientation may be a concept including an inclination of the sheet (whether or not the sheet is skewed) with respect to the transport direction. The transport orientation may be a concept including a relationship between the long edge and the short edge of a rectangular sheet and the transport direction (whether so-called short-edge leading transport or long-edge leading transport). The transport orientation relates to the position, in the axial direction of the drum, of a thick portion or a thin portion of a sheet not uniform in thickness during winding of the sheet around the drum. The recognition unit may recognize at least one of the denomination, fitness, authenticity, or degree of soiling of the banknotes.

[0028] The control unit may control at least one of the inlet unit, the dispensing unit, the transport unit, and the recognition unit.

[0029] The control unit may calculate, based on an output of the first sensor, a diameter or a radius of a portion of the roll at which the first tape is wound, and calculate, based on an output of the second sensor, a diameter or a radius of a portion of the roll at which the second tape is wound. In this case, the control unit controls the storage unit based on the calculated diameter or the calculated radius of the portion at which the first tape is wound and the calculated diameter or the calculated radius of the portion at which the second tape is wound. By obtaining the diameter or the radius of the roll at the first position and the diameter or the radius of the roll at the second position, it is possible to accurately determine whether or not the roll has an inappropriate shape such as a truncated cone shape; that is, it is possible to

accurately determine the appropriateness of the shape of the roll. Accordingly, it is possible to appropriately control the storage unit.

[0030] The control unit calculates the diameter or the radius of the portion of the roll at which the first tape is wound, based on the length of the first tape wound around the drum in a predetermined period and the rotational angle of the drum in this predetermined period. Further, the control unit calculates the diameter or the radius of the portion of the roll at which the second tape is wound, based on the length of second tape wound around the drum in a predetermined period and the rotational angle of the drum in this predetermined period.

[0031] The control unit calculates, based on a detection result of the first sensor, the length of the first tape wound around the drum in the predetermined period. The control unit calculates, based on a detection result of the second sensor, the length of the second tape wound around the drum in the predetermined period.

[0032] The control unit is capable of obtaining the rotational angle of the drum in the predetermined period based on the rotational angle of the motor driving the drum in the predetermined period. When the drum and the motor are directly connected (that is, the transmission ratio is 1), the rotational angle of the motor is the rotational angle of the drum. When a transmission mechanism is interposed, a value obtained by multiplying the rotational angle of the motor by the transmission ratio is the rotational angle of the drum. The control unit is capable of obtaining the rotational angle of the drum by performing this operation. The rotational angle of the motor is obtainable from the number of steps when the motor is a stepper motor, or is obtainable from a detected value of a sensor such as an encoder mounted on a drive shaft of the motor when the motor is a DC motor.

[0033] The control unit may control the storage unit based on a difference between the calculated diameter of the portion at which the first tape is wound and the calculated diameter of the portion at which the second tape is wound, or a difference between the calculated radius of the portion at which the first tape is wound and the calculated radius of the portion at which the second tape is wound. By calculation for obtaining the difference between the diameters or the difference between the radii, it is possible to accurately determine whether or not the roll has an inappropriate shape such as a truncated cone shape; that is, it is possible to determine the appropriateness of the shape of the roll. Accordingly, it is possible to appropriately control the storage unit.

[0034] The control unit may control the storage unit based on whether or not the difference between the diameters or the difference between the radii exceeds a predetermined threshold.

[0035] The control unit may control the storage unit based on a ratio between the calculated diameter of the portion at which the first tape is wound and the calculated diameter of the portion at which the second tape is wound, or a ratio between the calculated radius of the portion at which the first tape is wound and the calculated radius of the portion at which the second tape is wound. By calculation for obtaining the ratio between the diameters or the ratio between the radii, it is possible to accurately determine whether or not the roll has an inappropriate shape such as a truncated cone shape; that is, it is possible to determine the appropriateness of the shape of the roll. Accordingly, it is possible to appropriately control the storage unit.

[0036] The control unit may control the storage unit based on whether or not the ratio between the diameters or the ratio between the radii exceeds a predetermined threshold.

[0037] The predetermined threshold may be changed according to a change in size of the diameter or the radius of the roll. For example, the difference of 1 cm between the diameter at the first position and the diameter at the second position is assumed. With respect to this value of 1 cm, it is indicative that the truncated cone shape is more distinctive when the diameters of the roll are smaller than when the diameters of the roll are larger. That is, the difference or ratio between the diameter of the first position and the diameter of the second position which requires some countermeasures to be taken may be different depending on the sizes of the diameters of the roll. The same applies to the radius. Therefore, when it is to be determined whether or not the difference between the diameters or the difference between the radii exceeds a predetermined threshold, the predetermined threshold may be set small when the diameters or the radii of the roll are small, or may be set largely when the diameters or the radii of the roll are large. Further, when it is to be determined whether or not the ratio between the diameters or the ratio between the radii exceeds a predetermined threshold, the predetermined threshold may be set small when the diameters or the radii of the roll are small, or may be set largely when the diameters or the radii of the roll are large.

[0038] The control unit may calculate the moving speed of the first tape based on the output of the first sensor and calculate the moving speed of the second tape based on the output of the second sensor. In this case, the control unit controls the storage unit based on the calculated moving speed of the first tape and the calculated moving speed of the second tape. The moving speed of the first tape is proportional to the diameter of the roll at the first position. The moving speed of the second tape is proportional to the diameter of the roll at the second position. Thus, by calculation for obtaining the moving speed of the first tape and the moving speed of the second tape, it is possible to accurately determine whether or not the roll has an inappropriate shape such as a truncated cone shape; that is, it is possible to determine the appropriateness of the shape of the roll. Accordingly, it is possible to appropriately control the storage unit.

[0039] The control unit may calculate the moving speed of the first tape based on the length of the first tape wound by the drum in a unit time. The control unit may calculate the moving speed of the second tape based on the length of

the second tape wound by the drum in a unit time.

[0040] The control unit may control the storage unit based on a difference between the calculated moving speed of the first tape and the calculated moving speed of the second tape. The difference between the moving speeds of the tapes is proportional to the difference between the diameters or the radii of the roll at the positions at which the tapes are wound. Therefore, by controlling the storage unit based on the difference between the moving speeds, it is possible to obtain the same effect as in the case of controlling the storage unit based on the difference between the diameters or the radii of the roll.

[0041] The control unit may control the storage unit based on whether or not the difference between the moving speed of the first tape and the moving speed of the second tape exceeds a predetermined threshold.

[0042] The control unit may control the storage unit based on whether or not the ratio between the moving speed of the first tape and the moving speed of the second tape exceeds a predetermined threshold.

[0043] The control unit may control the storage unit based on whether or not the difference between the moving speeds or the ratio between the moving speeds exceeds a predetermined threshold.

[0044] The control unit may limit storage of sheets in the storage unit based on the output of the first sensor and the output of the second sensor. Limiting storage of sheets in the storage unit when the outputs of the sensors indicate that the shape of the roll is inappropriate makes it possible to prevent the shape of the roll from becoming more inappropriate. Accordingly, it is possible to prevent the inappropriate shape of the roll from causing a shift of the first tape or the second tape from an original position at which the first tape or the second tape is to be wound, resulting in impossibility of winding the sheet around the roll by the first tape or the second tape. It is also possible to prevent the first tape or the second tape from shifting inside the storage unit from the original position at which the first tape or the second tape is wound under tension, to come off the first reel or the second reel or to become entangled inside the storage unit. Further, it is possible to prevent skew from being caused when the roll is unwound to discharge the sheet to the outside of the storage unit, so as to prevent clogging of the sheet due to the skew from being caused.

[0045] A specific example of limitation of storage of sheets in the storage unit is prohibition of storage. The control unit may prohibit the storage of sheets in the storage unit not only when the outputs of the sensors indicate that the shape of the roll is an inappropriate shape, but also when such a shape is not indicated. For example, the control unit may prohibit the storage of sheets in the storage unit when the outputs of the sensors indicate that the amount of banknotes stored in the storage unit has reached a predetermined upper limit.

[0046] The control unit may limit storage of a predetermined type of sheet in the storage unit.

[0047] For example, the control unit may prohibit the storage of banknotes of a predetermined denomination. Specifically, the storage of banknotes of a denomination that are known in advance as the banknotes which are not uniform in thickness, such as those with a security thread or with a seal, may be prohibited. Prohibition of the storage of such banknotes makes it possible to prevent the shape of the roll from becoming an inappropriate shape such as a truncated cone shape, or to prevent an increase in the degree of such a shape. Determination of whether or not the denomination is a predetermined denomination can be made based on a recognition result of the recognition unit. In addition, in a case where a unit from which a banknote is transported is a storage unit that separately stores banknotes for each denomination, and a destination to which the banknote is transported is a storage unit that collectively stores the banknotes of a plurality of denominations, it is possible to determine whether or not a banknote is of the predetermined denomination based on information indicating from which part of the storage unit the banknote is discharged.

[0048] In addition, the control unit may prohibit the storage of sheets soiled to a degree equal to or greater than a predetermined threshold. For example, as the degree of soiling increases, the surface of the sheets may become slippery. The slippery surface brings about a lower friction coefficient of the sheet. The sheet having a low friction coefficient is likely to slip with respect to the tape and other sheets with which the sheet having a low friction coefficient is in contact in the roll. Therefore, when a sheet soiled to a great degree is wound in the case where the roll has a truncated cone shape, the inner side and the outer side of the roll with respect to the sheet soiled to a great degree serving as a border are displaced from each other in the axial direction of the roll, and in some cases, the roll may collapse. Such a situation can be prevented from being caused by prohibiting the storage of sheets soiled to a degree equal to or greater than a predetermined threshold. The degree of soiling can be obtained from the recognition result of the recognition unit. In addition, in a case where a unit from which a sheet is transported is a storage unit that separately stores sheets for each degree of soiling, and a destination to which the sheet is transported is a storage unit that collectively stores the sheets regardless of the degree of soiling, it is possible to obtain the degree of soiling based on information indicating from which part of the storage unit the sheet is discharged.

[0049] In addition, the control unit may limit the storage of sheets having a predetermined transport orientation into the storage unit. When sheets not uniform in thickness are wound while having the same orientation or orientations in which the faces and backs are reversed between the sheets but the positions of the thick portions are the same between the sheets, the thick portions overlap one another and the thin portions overlap one another. When such overlaps are repeated, the diameter of the portion of the roll where the thick portions overlap one another increases more than the diameter of the portion of the roll where the thin portions overlap one another. In other words, the shape of the roll

becomes an inappropriate shape. Limitation of winding the sheets being not uniform in thickness that are wound while having the same orientation or orientations in which the faces and backs are reversed between the sheets but the positions of the thick portions are the same between the sheets makes it possible to prevent the aforementioned state from being caused or from proceeding, and further, to eliminate such a state.

[0050] The predetermined transport orientation requiring limitation of storage in the storage unit is an orientation that increases a difference between the diameter of the roll at the position at which the first tape is wound and the diameter of the roll at the position at which the second tape is wound. Specifically, the predetermined transport orientation is an orientation causing a thick portion of a sheet not uniform in thickness, such as a banknote with a security thread and a banknote with a seal, to be wound around at a portion of the roll greater in diameter.

[0051] The sheet processing apparatus may comprise two or more storage units for storing sheets of the same type. When the sheet processing apparatus comprises two or more storage units, that is, a first storage unit and a second storage unit, the control unit may determine to which storage unit a sheet is stored, based on a detection result of a first sensor and a detection result of a second sensor of the first storage unit and a detection result of a first sensor and a detection result of a second sensor of the second storage unit. The control unit may further determine to which storage unit the sheet is stored, based on the transport orientation of the sheet. For example, the control unit is capable of controlling the transport unit such that a sheet, storage of which in the first storage unit is limited because the transport orientation is a predetermined transport orientation, is transported to the second storage unit. Storing the sheets in the storage units and discharging the sheets from the storage units that accompany processing of the sheets are performed using the two or more storage units for storing the same type of sheets. Thus, the shapes of rolls of the two or more storage units can be levelled. In other words, it is possible to prevent the shape of a single roll from becoming an inappropriate shape. For example, in a case where the shape of the roll of the first storage unit would be impaired when a sheet having a certain transport orientation is stored in the first storage unit, whereas the shape of the roll of the second storage unit would not be affected when such a sheet is stored in the second storage unit, the control unit is capable of causing this banknote to be stored in the second storage unit, while limiting storage of the banknote in the first storage unit. In addition, when it is found that the shape of the roll in the first storage unit is an inappropriate shape, the control unit may limit storage of a sheet having the predetermined transport orientation in the storage unit afterwards. In this case, the control unit is capable of controlling the first storage unit, the transport unit, and the second storage unit, to discharge, from the first storage unit, a sheet affecting the inappropriate shape of the roll in the first storage unit and store the sheet again in the second storage unit. As a result of storing the sheet again, the shape of the roll in the first storage unit can be an appropriate shape.

[0052] The control unit may determine whether or not the storage amount of the storage unit has reached the upper limit, based on a larger one of the values of the diameter of the roll at the position at which the first tape is wound and the diameter of the roll at the position at which the second tape is wound, or a larger one of the values of the radius of the roll at the position at which the first tape is wound and the radius of the roll at the position at which the second tape is wound. By determining, based on the larger value of the diameters or radii, whether or not the upper limit has been reached, it is possible to prevent the diameter of the roll from increasing excessively at a part other than a target part for determination in a case where the roll has an inappropriate shape such as a truncated cone shape.

[0053] The control unit may determine whether or not the storage amount of the storage unit has reached the lower limit, based on a smaller one of the values of the diameter of the roll at the position at which the first tape is wound and the diameter of the roll at the position at which the second tape is wound, or a smaller one of the values of the radius of the roll at the position at which the first tape is wound and the radius of the roll at the position at which the second tape is wound. By determining, based on the smaller value of the diameters or radii, whether or not the lower limit has been reached, it is possible to prevent a problem from being caused at a part other than a target part for determination in a case where the roll has an inappropriate shape such as a truncated cone shape. Specifically, it is possible to prevent the first tape or the second tape from being excessively tensioned to be cut or stretched when although all banknotes are discharged actually, the first reel, the second reel, and the drum are rotated to further discharge a banknote.

[0054] When a sheet is to be stored in the storage unit after it is detected that all the sheets were discharged from the storage unit, the control unit recording the number of rotations that is the number of rotations of the drum for storing the sheets may determine that the storage unit is empty when the number of reverse rotations that is the number of rotations of the drum for discharging the stored sheets reaches the same number of rotations as the recorded number of rotations. Such determination makes it unnecessary to feed tape excessively in order to determine that the storage unit is empty, and it is thus possible to quickly proceed to the next winding operation.

[0055] The control unit may adjust the rotational speed of the drum based on the detection result of the first sensor and the detection result of the second sensor.

[0056] For example, when the detection results of the sensors indicate that the shape of the roll is a truncated cone shape, the control unit may reduce the rotational speed of the drum. When the rotational speed of the drum is reduced, the sheet and the tapes are slowly wound on the outside of the roll. That is, the sheet and the tapes are more carefully wound around the roll. Therefore, even when the shape of the roll is a truncated cone shape, it is possible to prevent

the roll from collapsing. Conversely, when the detection results of the sensors indicate return to the cylindrical shape from the state of being the truncated cone shape, the control unit may increase the rotational speed of the drum.

[0057] The control unit is capable of obtaining, based on the detection result of the first sensor and the detection result of the detection result of the second sensor, the diameter or the radius of the roll at the position at which the first tape is wound and the diameter or the radius of the roll at the position at which the second tape is wound. When the difference between these diameters or the difference between these radii is equal to or greater than a predetermined value, the control unit may reduce the rotational speed of the drum.

[0058] The control unit is capable of obtaining, based on the detection result of the first sensor and the detection result of the second sensor, the moving speed of the first tape and the moving speed of the second tape. When the difference between these moving speeds is equal to or greater than a predetermined value, the control unit may reduce the rotational speed of the drum.

[0059] The control unit adjusts at least one of the tension of the first tape and the tension of the second tape based on the detection result of the first sensor and the detection result of the second sensor. The tension of the first tape can be adjusted by adjusting the number of rotations of the drum and the number of rotations of the first reel. The tension of the second tape can be adjusted by adjusting the number of rotations of the drum and the number of rotations of the second reel. An increased tension of the tape results in stronger tightening by this tape during winding of this tape. Accordingly, the diameter of the roll at the position at which this tape is wound is unlikely to increase. Conversely, a reduced tension of the tape results in weaker tightening by this tape during winding of this tape. Accordingly, the diameter of the roll at the position at which the tape is wound is likely to increase.

[0060] The control unit is capable of obtaining, based on the detection result of the first sensor and the detection result of the second sensor, the diameter or the radius of the roll at the position at which the first tape is wound and the diameter or the radius of the roll at the position at which the second tape is wound. When the difference between these diameters or the difference between these radii is equal to or greater than a predetermined value, the control unit is capable of controlling the drum, the first reel, and the second reel such that the tension of the first tape or the second tape wound at the position at which the diameter or the radius is large is increased.

[0061] The control unit is capable of obtaining, based on the detection result of the first sensor and the detection result of the second sensor, the diameter or the radius of the roll at the position at which the first tape is wound and the diameter or the radius of the roll at the position at which the second tape is wound. When the difference between these diameters or the difference between these radii is equal to or greater than a predetermined value, the control unit is capable of controlling the drum, the first reel, and the second reel such that the tension of the first tape or the second tape wound at the position at which the diameter or the radius is small is reduced.

[0062] When adjusting at least one of the tension of the first tape and the tension of the second tape based on the detection result of the first sensor and the detection result of the second sensor, the control unit may adjust the moving speeds of the first tape and the second tape, that is, the supply amounts of the first tape and the second tape to the drum by adjusting the number of rotations of at least one of the first reel and the second reel. For example, when the radius at the position at which the first tape is wound is greater than the radius at the position at which the second tape is wound, the length of the first tape wound during one rotation of the drum is longer than the length of the second tape wound. Therefore, the control unit is capable of controlling the storage unit such that the tension of the first tape is greater than the tension of the second tape for tightening, and the first tape is supplied more than the second tape. It is thus possible to prevent application of excessive tension to the first tape and to wind the sheet smoothly while eliminating the inappropriate shape of the roll.

[0063] The full length of the first tape and the full length of the second tape may be different from each other. The full lengths may be different from the beginning, or may be made different because one or both of the tapes is cut and joined together during maintenance. The remaining amount of the first tape wound around the first reel and the remaining amount of the second tape wound around the second reel can be individually calculated. That is, the remaining amount of the first tape can be calculated from the amount of movement or the moving speed of the first tape and the rotational angle of the first reel, and the remaining amount of the second tape can be calculated from the amount of movement or the moving speed of the second tape and the rotational angle of the second reel.

Brief Description of Drawings

[0064]

FIG. 1 is a block diagram of a sheet processing apparatus according to the present invention;
FIG. 2 schematically illustrates a storage unit that the sheet processing apparatus according to the present invention comprises;
FIG. 3 is an explanatory view for explaining a calculation method for calculating the radius of a roll;
FIG. 4 schematically illustrates another example of the storage unit that the sheet processing apparatus according

to the present invention comprises; and
FIG. 5 schematically illustrates still another example of the storage unit that the sheet processing apparatus according to the present invention comprises.

Description of Embodiments

[0065] FIG. 1 is a block diagram illustrating a configuration of a banknote processing apparatus 1 that is an example of a sheet processing apparatus according to the present invention. The banknote processing apparatus 1 comprises an inlet unit 2, a transport unit 3, a recognition unit 4, a storage unit 5, and a control unit 6.

[0066] The inlet unit 2 feeds banknotes put in or placed on the inlet unit 2 one by one to the transport unit 3.

[0067] The transport unit 3 transports the banknotes fed from the inlet unit 2.

[0068] The recognition unit 4 recognizes the banknotes being transported by the transport unit 3. Specifically, the recognition unit 4 recognizes the denomination, fitness, transport orientation, authenticity, and the like of each of the banknotes.

[0069] The storage unit 5 takes and stores therein the banknotes transported by the transport unit 3. An example of the storage unit 5 is a recycle storage unit. The banknote processing apparatus 1 may comprise a temporary storage unit as another example of the storage unit 5. The recycle storage unit is a storage unit in which banknotes are finally stored in a deposit process, and from which the banknotes are fed in a withdrawal process. The temporary storage unit is a storage unit that temporarily stores banknotes at the time of, for example, the deposit process or withdrawal process.

[0070] The inlet unit 2, the transport unit 3, the recognition unit 4, and the storage unit 5 are controlled by the control unit 6.

[0071] Note that, the banknote processing apparatus 1 may comprise a dispensing unit controlled by the control unit 6. In this case, the transport unit 3 can transport, to the dispensing unit, a banknote fed from the inlet unit 2 or a banknote fed from the storage unit 5. In addition, the banknote processing apparatus 1 may comprise a plurality of storage units 5 that are the recycle storage unit.

[0072] FIG. 2 schematically illustrates the storage unit 5.

[0073] The storage unit 5 comprises a first reel 11. A base end portion of a first tape 12 is wound around the first reel 11. A first motor 13 is attached to the first reel 11. The first motor 13 is rotatable in both forward and reverse directions. The first reel 11 rotates forward by forward rotation of the first motor 13, and the first tape 12 is fed from the first reel 11 accordingly. The first reel rotates reversely by reverse rotation of the first motor 13, and the first tape 12 is wound around the first reel 11 accordingly. The first motor 13 may be directly connected to the first reel 11 or may be connected via a transmission mechanism. FIG. 2 illustrates the state of direct connection.

[0074] The storage unit 5 comprises a second reel 21. A base end portion of a second tape 22 is wound around the second reel 21. A second motor 23 is attached to the second reel 21. The second motor 23 is rotatable in both forward and reverse directions. The second reel 21 rotates forward by forward rotation of the second motor 23, and the second tape 22 is fed from the second reel 21 accordingly. The second reel rotates reversely by reverse rotation of the second motor 23, and the second tape 22 is wound around the second reel 21 accordingly. The second motor 23 may be directly connected to the second reel 21 may be connected via a transmission mechanism. FIG. 2 illustrates the state of direct connection.

[0075] The storage unit 5 comprises a drum 61. The leading end portion of the first tape 12, the leading end portion of the second tape 22, and a banknote S is wound around the drum 61. The banknote S is a banknote received by the storage unit 5 from the transport unit 3. The first tape 12, the second tape 22, and the banknote S wound around the drum forms a roll 62 around the drum 61. The drum motor 63 is attached to the drum 61. The drum motor 63 is rotatable in both forward and reverse directions. The drum 61 rotates forward by forward rotation of the drum motor 63, and the first tape 12, the second tape 22, and the banknote S are wound around the drum accordingly to increase the diameter and the radius of the roll 62. The drum 61 rotates reversely by reverse rotation of the drum motor 63 to feed the first tape 12, the second tape 22, and the banknote S accordingly to reduce the diameter and the radius of the roll 62. The drum motor 63 may be directly connected to the drum 61 or may be connected via a transmission mechanism. FIG. 2 illustrates the state of direct connection.

[0076] The drum motor 63 is a stepper motor or a DC motor. The control unit 6 controls the drum motor 63 such that the drum motor 63 rotates by a predetermined rotational angle (number of rotations). Alternatively, the control unit 6 receives a rotational angle (number of rotations) of the drum motor 63 from a sensor that detects the rotation of the drum motor 63.

[0077] When the first reel 11 and the drum 61 rotate forward, the first tape 12 is fed from the first reel 11 to move so as to be wound around the drum 61. Hereinafter, such a movement is referred to as a forward movement. The same applies to the second tape 22. Further, when the first reel 11 and the drum 61 rotate reversely, the first tape 12 is fed from the drum 61 to move so as to be wound around the first reel 11. Hereinafter, such a movement is referred to as a reverse movement. The same applies to the second tape 22. A path along which the first tape 12 moves between the first reel 11 and the drum 61 may be referred to as a first tape path. A path along which the second tape 22 moves

between the second reel 21 and the drum 61 may be referred to as a second tape path.

[0078] The storage unit 5 comprises a first roller 14. The first roller 14 is disposed to make non-slipping contact with the first tape 12 stretched between the first reel 11 and the drum 61. The first roller 14 is disposed in the vicinity of the first tape path. When the first tape 12 moves forward, the first roller 14 rotates forward, and when the first tape 12 moves reversely, the first roller 14 rotates reversely.

[0079] The storage unit 5 comprises a first sensor 15. The first sensor 15 is a sensor for detecting the rotation of the first roller 14, that is, the movement of the first tape 12. The first sensor 15 is, for example, a rotary encoder. The control unit 6 receives a detection result of the first sensor 15.

[0080] The storage unit 5 comprises a second roller 24. The second roller 24 is disposed to make non-slipping contact with the second tape 22 stretched between the second reel 21 and the drum 61. The second roller 24 is disposed in the vicinity of the second tape path. When the second tape 22 moves forward, the second roller 24 rotates forward, and when the second tape 22 moves reversely, the second roller 24 rotates reversely.

[0081] The storage unit 5 comprises a second sensor 25. The second sensor 25 is a sensor for detecting the rotation of the second roller 24, that is, the movement of the second tape 22. The second sensor 25 is, for example, a rotary encoder. The control unit 6 receives a detection result of the second sensor 25.

[0082] The transport unit 3 sequentially transports a plurality of banknotes S at predetermined intervals, and passes the banknotes S to the storage unit 5. The storage unit 5 winds and stores the banknotes S received from the transport unit 3 together with the tapes such that the banknotes S are sandwiched between the roll 62 and the tapes.

[0083] The control unit 6 calculates, based on the amount of movement or the moving speed of the first tape 12 and the rotational angle of the drum 61, the diameter or the radius of the roll 62 at a position at which the first tape 12 is wound. The control unit 6 also calculates, based on the amount of movement or the moving speed of the second tape 22 and the rotational angle of the drum 61, the diameter or the radius of the roll 62 at a position at which the second tape 22 is wound. The control unit 6 compares the calculated diameters or radii. When the difference or ratio exceeds a predetermined threshold, the control unit 6 determines that the shape of the roll 62 is an inappropriate shape, for example, a truncated cone shape, and controls the storage unit 5 to eliminate this state.

[0084] Note that, the control unit 6 is capable of adjusting, during storage of the banknotes S, the interval between the banknotes S in the roll 62 by increasing or reducing the moving speeds of the first tape 12 and the second tape 22 with respect to the transporting speed at which the banknotes S are transported by the transport unit 3. That is, the control unit 6 is capable of controlling the banknote interval at the time of winding the banknote S.

[0085] The control unit 6 is capable of increasing the storage amount by reducing the interval between the banknotes S in the roll 62 when a fit note, that is, a banknote in a good state is stored. On the other hand, when an unfit note, that is, a banknote in a bad state is stored, it is possible to prevent, by increasing the interval between the banknotes S in the roll 62, a trouble (for example, clogging at the time of feeding) that might be caused by the banknotes being too close to one another.

[0086] In addition, the control unit 6 is capable of adjusting, during feeding of the banknotes S from the storage unit 5, the interval between the banknotes S in the transport unit 3 by increasing or reducing the moving speeds of the first tape 12 and the second tape 22 with respect to the transporting speed at which the banknotes S are transported by the transport unit 3. That is, the control unit 6 is capable of controlling the interval between the banknotes S fed from the storage unit 5 and transported by the transport unit 3.

[0087] The control unit 6 is capable of increasing the transport amount by reducing the transport interval between the banknotes S when the fit notes are fed. On the other hand, when the unfit notes are fed, it is possible to prevent, by increasing the transport interval between the banknotes S, a trouble that might be caused by the banknotes being too close to one another (for example, clogging in the transport unit 3 or clogging in a connection unit where the transport unit 3 passes the banknotes S to another element). The transport interval between the banknotes S may be adjusted according to a transport destination to which the banknotes S are transported by the transport unit 3.

[0088] FIG. 3 is an explanatory view for explaining a calculation method for calculating the radius of the roll. The radius of the roll 62 at the position at which the first tape 12 is wound can be calculated as follows. Note that, FIG. 3 illustrates a state in which the first motor 13 is connected to the first reel 11 via a transmission mechanism, and the drum motor 63 is connected to the drum 61 via a transmission mechanism.

[0089] In a certain period, the amount of movement of the first tape 12 on the circumference of the roll 62 is equal to the amount of movement of the first tape on the circumference of the first roller 14. Therefore, letting the radius of the roll 62 at the position at which the first tape 12 is wound be r_{62}, the transmission ratio between the drum 61 and the drum motor 63 (the number of rotations of the drum motor 61 when the drum motor 63 rotates once) be Z_{61}, the radius of the first roller 14 be r_{14}, the number of steps counted by the first sensor 15 when the drum motor 63 rotates once be PLS_{15}, and the resolution (the number of steps per rotation) of the first sensor 15 be ais, following Equation 1 holds, and Equation 2 is obtained from Equation 1.

$$2 \cdot \pi \cdot r_{62} \cdot Z_{61} = 2 \cdot \pi \cdot r_{14} \cdot PLS_{15}/a_{15} \quad \text{... (Equation 1)}$$

$$r_{62} = (r_{14} \cdot PLS_{15}/a_{15})/Z_{61} \quad \text{... (Equation 2)}$$

[0090] Based on these equations, the radius of the roll 62 at the position at which the first tape 12 is wound can be calculated. The diameter can similarly be calculated. The diameter of the roll 62 at the position at which the second tape 22 is wound can also be calculated based on the same equations.

[0091] FIG. 4 schematically illustrates another example of the storage unit 5. In the example illustrated in FIG. 4, the storage unit 5 winds the banknote S around the drum 61 using four tapes.

[0092] The storage unit 5 comprises a first reel 11. A base end portion of the first tape 12 is wound around the first reel 11. A first motor 13 is attached to the first reel 11. The first motor 13 is rotatable in both forward and reverse directions. The first reel 11 rotates forward by forward rotation of the first motor 13, and the first tape 12 is fed from the first reel 11 accordingly. The first reel 11 rotates reversely by reverse rotation of the first motor 13, and the first tape 12 is wound around the first reel 11 accordingly. A first direction conversion roller 16 is disposed on a tape path between the first reel 11 and the drum 61. The traveling direction of the first tape 12 is converted by the first direction conversion roller 16.

[0093] The storage unit 5 comprises a second reel 21. A base end portion of the second tape 22 is wound around the second reel 21. A second motor 23 is attached to the second reel 21. The second motor 23 is rotatable in both forward and reverse directions. The second reel 21 rotates forward by forward rotation of the second motor 23, and the second tape 22 is fed from the second reel 21 accordingly. The second reel 21 rotates reversely by reverse rotation of the second motor 23, and the second tape 22 is wound around the second reel 21 accordingly. A second direction conversion roller 26 is disposed on a tape path between the second reel 21 and the drum 61. The traveling direction of the second tape 22 is converted by the second direction conversion roller 26.

[0094] The storage unit 5 comprises a third reel 31. A base end portion of a third tape 32 is wound around the third reel 31. A third motor 33 is attached to the third reel 31. The third motor 33 is rotatable in both forward and reverse directions. The third reel 31 rotates forward by forward rotation of the third motor 33, and the third tape 32 is fed from the third reel 31 accordingly. The third reel 31 rotates reversely by reverse rotation of the third motor 33, and the third tape 32 is wound around the third reel 31 accordingly. A third direction conversion roller 36 is disposed on a tape path between the third reel 31 and the drum 61. The traveling direction of the third tape 32 is converted by the third direction conversion roller 36.

[0095] The storage unit 5 comprises a fourth reel 41. A base end portion of a fourth tape 42 is wound around the fourth reel 41. A fourth motor 43 is attached to the fourth reel 41. The fourth motor 43 is rotatable in both forward and reverse directions. The fourth reel 41 rotates forward by forward rotation of the fourth motor 43, and the fourth tape 42 is fed from the fourth reel 41 accordingly. The fourth reel 41 rotates reversely by reverse rotation of the fourth motor 43, and the fourth tape 42 is wound around the fourth reel 41 accordingly. A fourth direction conversion roller 46 is disposed on a tape path between the fourth reel 41 and the drum 61. The traveling direction of the fourth tape 42 is converted by the fourth direction conversion roller 46.

[0096] The first tape 12 and the third tape 32 overlap each other between the first direction conversion roller 16 and the third direction conversion roller 36, and are wound around the drum 61 while overlapping each other. The second tape 22 and the fourth tape 42 overlap each other between the second direction conversion roller 26 and the fourth direction conversion roller 46, and are wound around the drum 61 while overlapping each other. The banknote S is wound around the drum 61 while being sandwiched between the first tape 12 and the third tape 32 and between the second tape 22 and the fourth tape 42.

[0097] Although not illustrated in FIG. 4, the storage unit 5 comprises at least one of a sensor for detecting movement of the first tape 12 and a sensor for detecting movement of the third tape 32. The storage unit 5 comprises at least one of a sensor for detecting movement of the second tape 22 and a sensor for detecting movement of the fourth tape 42.

[0098] FIG. 5 schematically illustrates still another example of the storage unit 5. In the example illustrated in FIG. 5, the storage unit 5 winds the banknote S around the drum 61 using three tapes.

[0099] The storage unit 5 comprises a first reel 11 (not illustrated). A base end portion of the first tape 12 is wound around the first reel 11. A first motor 13 (not illustrated) is attached to the first reel 11. The first motor 13 is rotatable in both forward and reverse directions. The first reel 11 rotates forward by forward rotation of the first motor 13, and the first tape 12 is fed from the first reel 11 accordingly. The first reel 11 rotates reversely by reverse rotation of the first motor 13, and the first tape 12 is wound around the first reel 11 accordingly. A first direction conversion roller 16 is disposed on a tape path between the first reel 11 and the drum 61. The traveling direction of the first tape 12 is converted by the first direction conversion roller 16.

[0100] The storage unit 5 comprises a second reel 21 (not illustrated). A base end portion of the second tape 22 is wound around the second reel 21. A second motor 23 (not illustrated) is attached to the second reel 21. The second

motor 23 is rotatable in both forward and reverse directions. The second reel 21 rotates forward by forward rotation of the second motor 23, and the second tape 22 is fed from the second reel 21 accordingly. The second reel 21 rotates reversely by reverse rotation of the second motor 23, and the second tape 22 is wound around the second reel 21 accordingly. A second direction conversion roller 26 is disposed on a tape path between the second reel 21 and the drum 61. The traveling direction of the second tape 22 is converted by the second direction conversion roller 26.

[0101] The second tape 22 is in contact with a surface of the banknote S opposite to the surface with which the first tape 12 is in contact. That is, the first tape 21 and the second tape 22 sandwich the banknote S.

[0102] The storage unit 5 comprises a fifth reel 51 (not illustrated). A base end portion of a fifth tape 52 is wound around the fifth reel 51. A fifth motor 53 (not illustrated) is attached to the fifth reel 51. The fifth motor 53 is rotatable in both forward and reverse directions. The fifth reel 51 rotates forward by forward rotation of the fifth motor 53, and the fifth tape 52 is fed from the fifth reel 51 accordingly. The fifth reel 51 rotates reversely by reverse rotation of the fifth motor 53, and the fifth tape 52 is wound around the fifth reel 51 accordingly. A fifth direction conversion roller 56 is disposed along a tape path between the fifth reel 51 and the drum 61. The traveling direction of the fifth tape 52 is converted by the fifth direction conversion roller 56.

[0103] The fifth tape 52 is in contact with the same surface of the banknote S with which the first tape 12 is in contact. A position at which the fifth tape is wound around the drum 61 is a position that is different in the axial direction of the drum 61 from the position at which the first tape 12 is wound and the position at which the second tape 22 is wound. The position at which the fifth tape 52 is wound is set on the opposite side of the position at which the first tape 12 is wound, with the position at which the second tape 22 is wound being interposed therebetween.

[0104] The first tape 12 and the fifth tape 52 are in contact with one side (e.g., the face) of the banknote S, and the second tape 22 is in contact with the other side (e.g., the back) of the banknote S. That is, the banknote S is sandwiched by three tapes. The tapes and the banknote S in this state are wound around the drum 61 to form the roll 62.

[0105] Although not illustrated in FIG. 5, the storage unit 5 comprises a sensor for detecting the movement of the first tape 12, a sensor for detecting the movement of the second tape 22, and a sensor for detecting the movement of the fifth tape 52. The control unit 6 is capable of determining, from the detection results of these three sensors, whether or not the shape of the roll 62 is inappropriate. For example, when it is found, from the detection results of the sensors, that the radius of the roll 62, at the position at which the first tape 12 is wound, is larger than the radius of the roll 62, at the position at which the second tape 16 is wound, and that the radius of the roll 62, at the position at which the second tape is wound, is larger than the radius of the roll 62, at the position at which the fifth tape 52 is wound, it can be determined that the shape of the roll 62 is a truncated cone shape. In addition, when it is found that the radii of the roll, at the position at which the first tape 12 is wound and at the position at which the fifth tape 52 is wound, are smaller than the radius of the roll, at the position at which the second tape 16 is wound, it can be determined that the shape of the roll 62 is a barrel shape. When determining that the shape of the roll 62 is in an inappropriate shape, the control unit 6 is capable of controlling the storage unit 5 according to the situation.

Claims

1. A sheet processing apparatus (1), comprising:

a storage unit (5) that stores a sheet (S) and feeds the sheet stored; and
a control unit (6) that controls the storage unit (5), wherein
the storage unit (5) comprises:

a first reel (11) around which a first tape (12) is wound;
a second reel (21) around which a second tape (22) is wound;
a drum (61) that winds the sheet (S) together with the first tape (12) drawn from the first reel (11) and the second tape (22) drawn from the second reel (21) to form a roll (62);
a first sensor (15) that detects movement of the first tape (12); and
a second sensor (25) that detects movement of the second tape (22),

a position at which the first tape (12) is wound around the drum (61) and a position at which the second tape (22) is wound around the drum (61) are different from each other in an axial direction of the drum (61), and
the control unit (6) controls the storage unit (5) based on a detection result of the first sensor (15) and a detection result of the second sensor (25),
characterized in that
the control unit (6) adjusts at least one of a tension of the first tape (12) and a tension of the second tape (22) based on the detection result of the first sensor (15) and the detection result of the second sensor (25).

2. The sheet processing apparatus (1) according to claim 1, wherein
the storage unit (5) further comprises at least one of a first roller (14) and a second roller (24), the first roller (14) being a roller which is in contact with the first tape (12) stretched between the first reel (11) and the drum (61) and rotation of which is detected by the first sensor (15), the second roller (24) being a roller which is in contact with the second tape (22) stretched between the second reel (21) and the drum (61) and rotation of which is detected by the second sensor (25).

3. The sheet processing apparatus (1) according to claim 1 or 2, wherein

the first reel (11) is driven by a first motor (13), and
the second reel (21) is driven by a second motor (23).

4. The sheet processing apparatus (1) according to any one of claims 1 to 3, wherein
the control unit (6)

calculates, based on an output of the first sensor (15), a diameter or a radius of a portion of the roll (62) at which the first tape (12) is wound,
calculates, based on an output of the second sensor (25), a diameter or a radius of a portion of the roll (62) at which the second tape (22) is wound, and
controls the storage unit (5) based on the calculated diameter or the calculated radius of the portion at which the first tape (12) is wound and the calculated diameter or the calculated radius of the portion at which the second tape (22) is wound.

5. The sheet processing apparatus (1) according to claim 4, wherein
the control unit (6) controls the storage unit (5) based on a difference between the calculated diameter of the portion at which the first tape (12) is wound and the calculated diameter of the portion at which the second tape (22) is wound, or a difference between the calculated radius of the portion at which the first tape (12) is wound and the calculated radius of the portion at which the second tape (22) is wound.

6. The sheet processing apparatus (1) according to any one of claims 1 to 3, wherein
the control unit (6)

calculates a moving speed of the first tape (12) based on an output of the first sensor (15),
calculates a moving speed of the second tape (22) based on an output of the second sensor (25), and
controls the storage unit (5) based on the calculated moving speed of the first tape (12) and the calculated moving speed of the second tape (22).

7. The sheet processing apparatus (1) according to claim 6, wherein
the control unit (6) controls the storage unit (5) based on a difference between the calculated moving speed of the first tape (12) and the calculated moving speed of the second tape (22).

8. The sheet processing apparatus (1) according to any one of claims 1 to 7, wherein
the control unit (6) limits storage of the sheet (S) in the storage unit (5) based on an output of the first sensor (15) and an output of the second sensor (25).

9. The sheet processing apparatus (1) according to any one of claims 1 to 8, wherein
the control unit (6) limits storage of a predetermined type of sheet (S) in the storage unit (5).

10. The sheet processing apparatus (1) according to any one of claims 1 to 9, wherein
the control unit (6) limits storage of the sheet (S) having a predetermined transport orientation in the storage unit (5).

11. The sheet processing apparatus (1) according to any one of claims 1 to 10, wherein
the control unit (6) adjusts a rotational speed of the drum (61) based on the detection result of the first sensor (15) and the detection result of the second sensor (25).

Patentansprüche

1. Bogenverarbeitungsvorrichtung (1), umfassend:

   eine Lagereinheit (5), die einen Bogen (S) lagert und den gelagerten Bogen zuführt; und
   eine Steuereinheit (6), die die Lagereinheit (5) steuert, wobei die Lagereinheit (5) umfasst:

      eine erste Rolle (11), um die herum ein erstes Band (12) gewickelt ist;
      eine zweite Rolle (21), um die herum ein zweites Band (22) gewickelt ist;
      eine Trommel (61), die den Bogen (S) zusammen mit dem ersten Band (12), das von der ersten Rolle (11) abgezogen wird, und dem zweiten Band (22), das von der zweiten Rolle (21) abgezogen wird, aufwickelt, um eine Rolle (62) zu bilden;
      einen ersten Sensor (15), der eine Bewegung des ersten Bandes (12) detektiert; und
      einen zweiten Sensor (25), der eine Bewegung des zweiten Bandes (22) detektiert, und
      eine Position, an der das erste Band (12) um die Trommel (61) herum gewickelt ist, und eine Position, an der das zweite Band (22) um die Trommel (61) herum gewickelt ist, sind in einer Axialrichtung der Trommel (61) voneinander verschieden, und

   die Steuereinheit (6) die Lagereinheit (5) basierend auf einem Detektionsergebnis des ersten Sensors (15) und einem Detektionsergebnis des zweiten Sensors (25) steuert,
   dadurch gekennzeichnet, dass
   die Steuereinheit (6) mindestens eine von einer Spannung des ersten Bandes (12) und einer Spannung des zweiten Bandes (22) basierend auf dem Detektionsergebnis des ersten Sensors (15) und dem Detektionsergebnis des zweiten Sensors (25) einstellt.

2. Bogenverarbeitungsvorrichtung (1) nach Anspruch 1, wobei
   die Lagereinheit (5) ferner mindestens eine von einer ersten Walze (14) und einer zweiten Walze (24) umfasst, wobei die erste Walze (14) eine Walze ist, die mit dem zwischen der ersten Rolle (11) und der Trommel (61) gespannten ersten Band (12) in Kontakt steht und deren Drehung vom ersten Sensor (15) detektiert wird, wobei die zweite Walze (24) eine Walze ist, die mit dem zwischen der zweiten Rolle (21) und der Trommel (61) gespannten zweiten Band (22) in Kontakt steht und deren Drehung vom zweiten Sensor (25) detektiert wird.

3. Bogenverarbeitungsvorrichtung (1) nach Anspruch 1 oder 2, wobei
   die erste Rolle (11) durch einen ersten Motor (13) angetrieben wird, und die zweite Rolle (21) durch einen zweiten Motor (23) angetrieben wird.

4. Bogenverarbeitungsvorrichtung (1) nach einem der Ansprüche 1 bis 3,
   wobei
   die Steuereinheit (6)

      basierend auf einer Ausgabe des ersten Sensors (15) einen Durchmesser oder einen Radius eines Abschnitts der Rolle (62), auf den das erste Band (12) gewickelt ist, berechnet, und
      basierend auf einer Ausgabe des zweiten Sensors (25) einen Durchmesser oder einen Radius eines Abschnitts der Rolle (62), auf den das zweite Band (22) gewickelt ist, berechnet, und
      die Lagereinheit (5) basierend auf dem berechneten Durchmesser oder dem berechneten Radius des Abschnitts, auf den das erste Band (12) gewickelt ist, und dem berechneten Durchmesser oder dem berechneten Radius des Abschnitts, auf den das zweite Band (22) gewickelt ist, steuert.

5. Bogenverarbeitungsvorrichtung (1) nach Anspruch 4, wobei
   die Steuereinheit (6) die Lagereinheit (5) basierend auf einer Differenz zwischen dem berechneten Durchmesser des Abschnitts, auf den das erste Band (12) gewickelt ist, und dem berechneten Durchmesser des Abschnitts, auf den das zweite Band (22) gewickelt ist, oder einer Differenz zwischen dem berechneten Radius des Abschnitts, auf den das erste Band (12) gewickelt ist, und dem berechneten Radius des Abschnitts, auf den das zweite Band (22) gewickelt ist, steuert.

6. Bogenverarbeitungsvorrichtung (1) nach einem der Ansprüche 1 bis 3,
   wobei
   die Steuereinheit (6)

eine Bewegungsgeschwindigkeit des ersten Bandes (12) basierend auf einer Ausgabe des ersten Sensors (15) berechnet,
eine Bewegungsgeschwindigkeit des zweiten Bandes (22) basierend auf einer Ausgabe des zweiten Sensors (25) berechnet,
die Lagereinheit (5) basierend auf der berechneten Bewegungsgeschwindigkeit des ersten Bandes (12) und der berechneten Bewegungsgeschwindigkeit des zweiten Bandes (22) steuert.

7. Bogenverarbeitungsvorrichtung (1) nach Anspruch 6, wobei
die Steuereinheit (6) die Lagereinheit (5) basierend auf einer Differenz zwischen der berechneten Bewegungsgeschwindigkeit des ersten Bandes (12) und der berechneten Bewegungsgeschwindigkeit des zweiten Bandes (22) steuert.

8. Bogenverarbeitungsvorrichtung (1) nach einem der Ansprüche 1 bis 7,
wobei
die Steuereinheit (6) die Lagerung des Bogens (S) in der Lagereinheit (5) basierend auf einer Ausgabe des ersten Sensors (15) und einer Ausgabe des zweiten Sensors (25) begrenzt.

9. Bogenverarbeitungsvorrichtung (1) nach einem der Ansprüche 1 bis 8,
wobei
die Steuereinheit (6) die Lagerung eines vorbestimmten Typs von Bogen (S) in der Lagereinheit (5) begrenzt.

10. Bogenverarbeitungsvorrichtung (1) nach einem der Ansprüche 1 bis 9,
wobei
die Steuereinheit (6) die Lagerung des Bogens (S), der eine vorbestimmte Transportausrichtung aufweist, in der Lagereinheit (5) begrenzt.

11. Bogenverarbeitungsvorrichtung (1) nach einem der Ansprüche 1 bis 10,
wobei
die Steuereinheit (6) eine Drehzahl der Trommel (61) basierend auf dem Detektionsergebnis des ersten Sensors (15) und dem Detektionsergebnis des zweiten Sensors (25) einstellt.

Revendications

1. Appareil de traitement de feuilles (1), comprenant :

une unité de stockage (5) qui stocke une feuille (S) et alimente la feuille stockée ; et
une unité de commande (6) qui commande l'unité de stockage (5), dans lequel l'unité de stockage (5) comprend :

une première bobine (11) autour de laquelle est enroulée une première bande (12) ;
une deuxième bobine (21) autour de laquelle est enroulée une deuxième bande (22) ;
un tambour (61) qui enroule la feuille (S) conjointement à la première bande (12) tirée de la première bobine (11) et à la deuxième bande (22) tirée de la deuxième bobine (21) pour former un enroulement (62) ;
un premier capteur (15) qui détecte le mouvement de la première bande (12) ; et
un deuxième capteur (25) qui détecte le mouvement de la deuxième bande (22),

une position à laquelle la première bande (12) est enroulée autour du tambour (61) et une position à laquelle la deuxième bande (22) est enroulée autour du tambour (61) sont différentes l'une de l'autre dans une direction axiale du tambour (61), et
l'unité de commande (6) commande l'unité de stockage (5) sur la base d'un résultat de détection du premier capteur (15) et d'un résultat de détection du deuxième capteur (25),
caractérisé en ce que
l'unité de commande (6) ajuste au moins une tension parmi la tension de la première bande (12) et une tension de la deuxième bande (22) sur la base du résultat de détection du premier capteur (15) et du résultat de détection du deuxième capteur (25).

2. Appareil de traitement de feuilles (1) selon la revendication 1, dans lequel
l'unité de stockage (5) comprend en outre au moins un premier rouleau (14) et un deuxième rouleau (24), le premier

rouleau (14) étant un rouleau qui est en contact avec la première bande (12) tendue entre la première bobine (11) et le tambour (61) et dont la rotation est détectée par le premier capteur (15), le deuxième rouleau (24) étant un rouleau qui est en contact avec la deuxième bande (22) tendue entre la deuxième bobine (21) et le tambour (61) et dont la rotation est détectée par le deuxième capteur (25).

3. Appareil de traitement de feuilles (1) selon la revendication 1 ou 2, dans lequel

la première bobine (11) est entraînée par un premier moteur (13), et
la deuxième bobine (21) est entraînée par un deuxième moteur (23).

4. Appareil de traitement de feuilles (1) selon l'une quelconque des

revendications 1 à 3, dans lequel
l'unité de commande (6)

calcule, sur la base d'une sortie du premier capteur (15), un diamètre ou un rayon d'une portion de l'enroulement (62) sur laquelle la première bande (12) est enroulée,
calcule, sur la base d'une sortie du deuxième capteur (25), un diamètre ou un rayon d'une portion de l'enroulement (62) sur laquelle la deuxième bande (22) est enroulée, et
commande l'unité de stockage (5) sur la base du diamètre calculé ou du rayon calculé de la portion sur laquelle la première bande (12) est enroulée et du diamètre calculé ou du rayon calculé de la portion sur laquelle la deuxième bande (22) est enroulée.

5. Appareil de traitement de feuilles (1) selon la revendication 4, dans lequel
l'unité de commande (6) commande l'unité de stockage (5) sur la base d'une différence entre le diamètre calculé de la portion sur laquelle la première bande (12) est enroulée et le diamètre calculé de la portion sur laquelle la deuxième bande (22) est enroulée, ou une différence entre le rayon calculé de la portion sur laquelle la première bande (12) est enroulée et le rayon calculé de la portion sur laquelle la deuxième bande (22) est enroulée.

6. Appareil de traitement de feuilles (1) selon l'une quelconque des

revendications 1 à 3, dans lequel
l'unité de commande (6)

calcule une vitesse de déplacement de la première bande (12) sur la base d'une sortie du premier capteur (15),
calcule une vitesse de déplacement de la deuxième bande (22) sur la base d'une sortie du deuxième capteur (25), et

commande l'unité de stockage (5) sur la base de la vitesse de déplacement calculée de la première bande (12) et de la vitesse de déplacement calculée de la deuxième bande (22).

7. Appareil de traitement de feuilles (1) selon la revendication 6, dans lequel
l'unité de commande (6) commande l'unité de stockage (5) sur la base d'une différence entre la vitesse de déplacement calculée de la première bande (12) et la vitesse de déplacement calculée de la deuxième bande (22).

8. Appareil de traitement de feuilles (1) selon l'une quelconque des

revendications 1 à 7, dans lequel
l'unité de commande (6) limite le stockage de la feuille (S) dans l'unité de stockage (5) sur la base d'une sortie du premier capteur (15) et d'une sortie du deuxième capteur (25).

9. Appareil de traitement de feuilles (1) selon l'une quelconque des

revendications 1 à 8, dans lequel

l'unité de commande (6) limite le stockage d'un type prédéterminé de feuilles (S) dans l'unité de stockage (5).

10. Appareil de traitement de feuilles (1) selon l'une quelconque des

revendications 1 à 9, dans lequel
l'unité de commande (6) limite le stockage de la feuille (S) ayant une orientation de transport prédéterminée dans l'unité de stockage (5).

11. Appareil de traitement de feuilles (1) selon l'une quelconque des

revendications 1 à 10, dans lequel
l'unité de commande (6) ajuste la vitesse de rotation du tambour (61) sur la base du résultat de détection du premier capteur (15) et du résultat de détection du deuxième capteur (25).

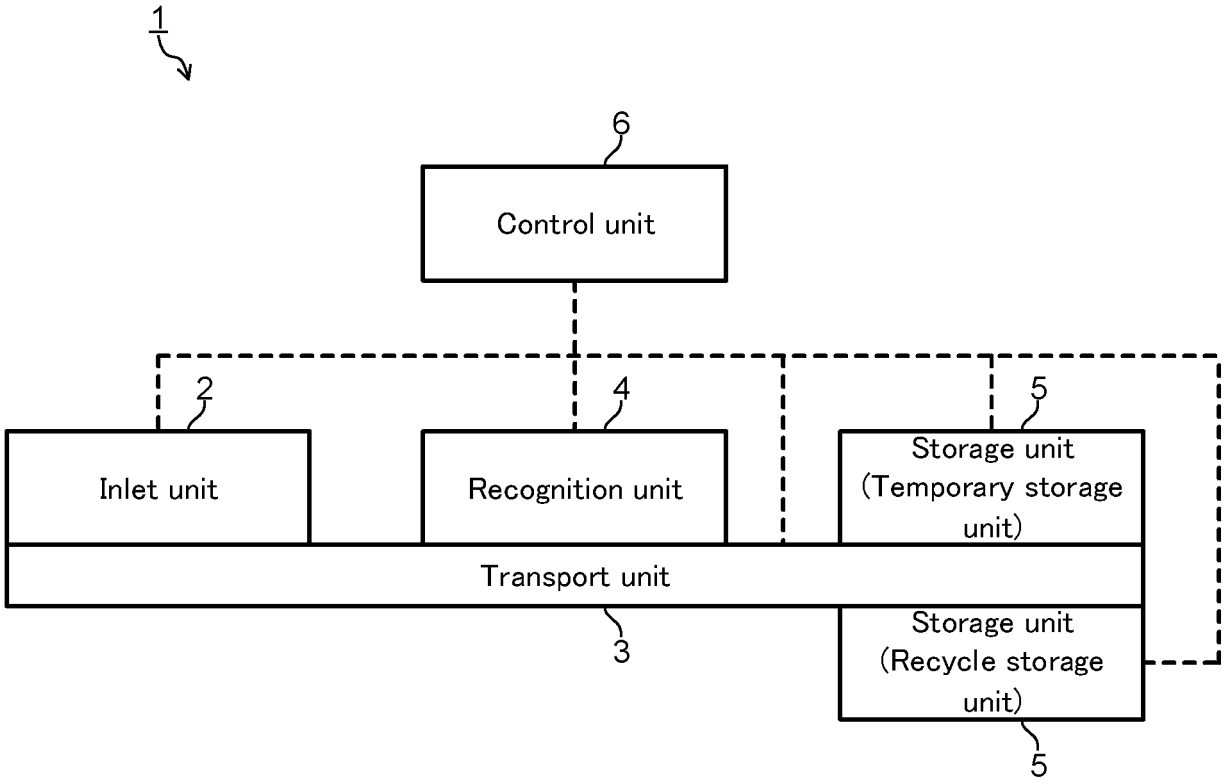
1
6
Control unit
2
4
5
Inlet unit
Recognition unit
Storage unit
(Temporary storage
unit)
Transport unit
3
Storage unit
(Recycle storage
unit)
5

FIG. 1

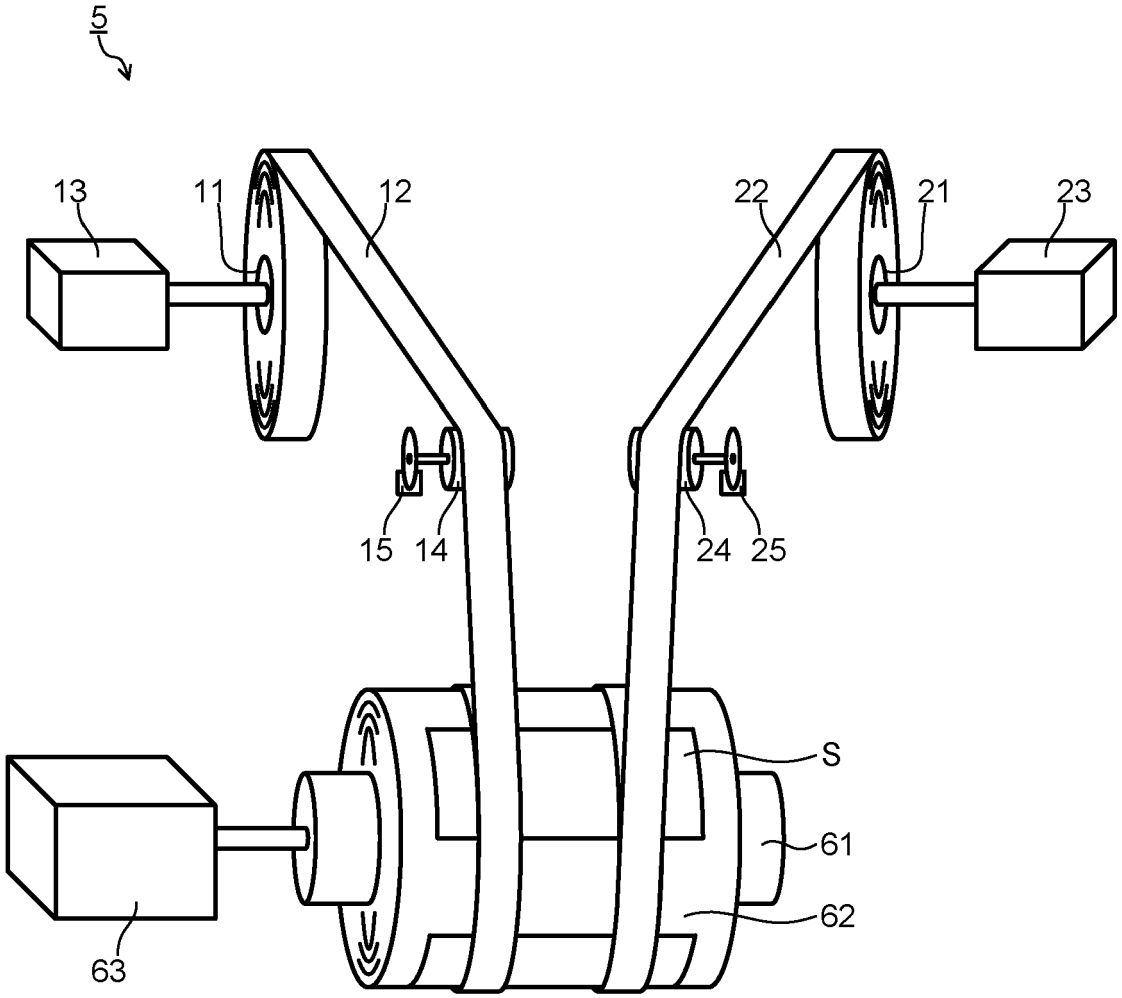

FIG. 2

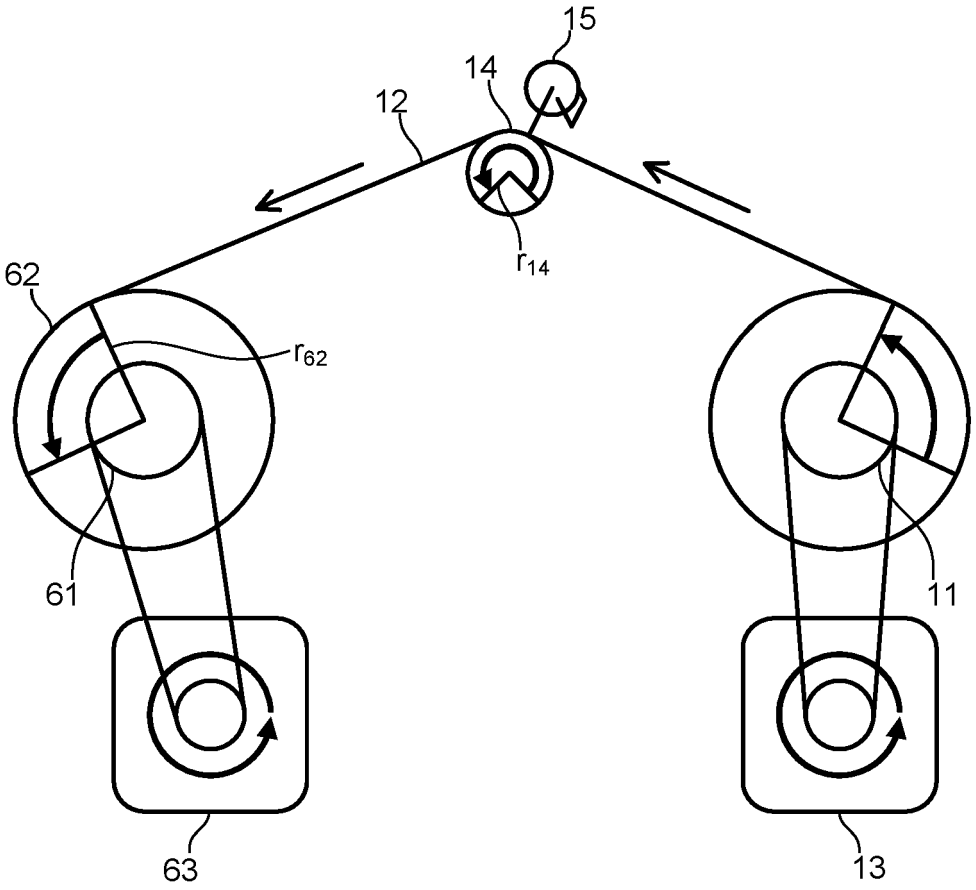

FIG. 3

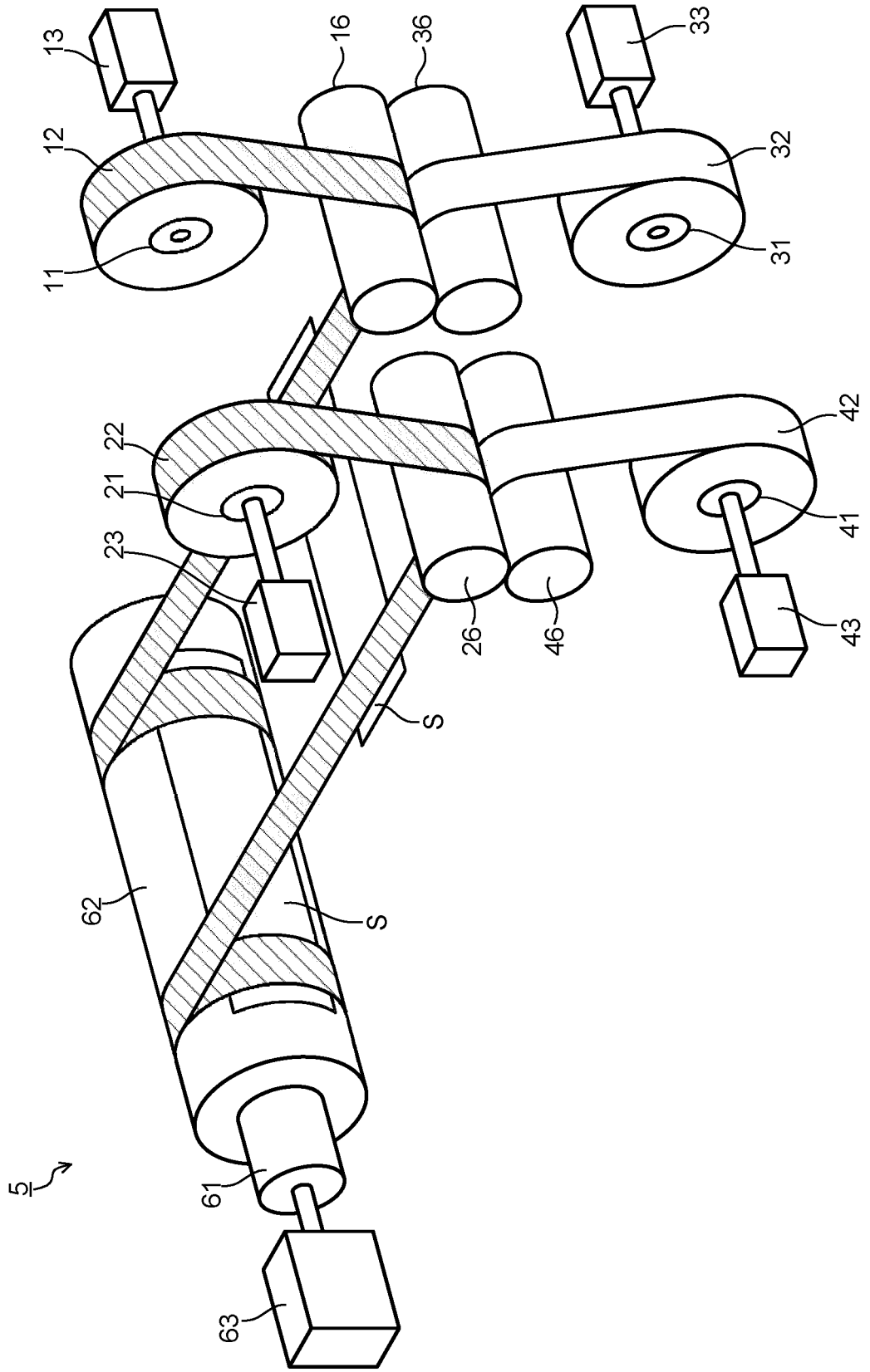

FIG. 4

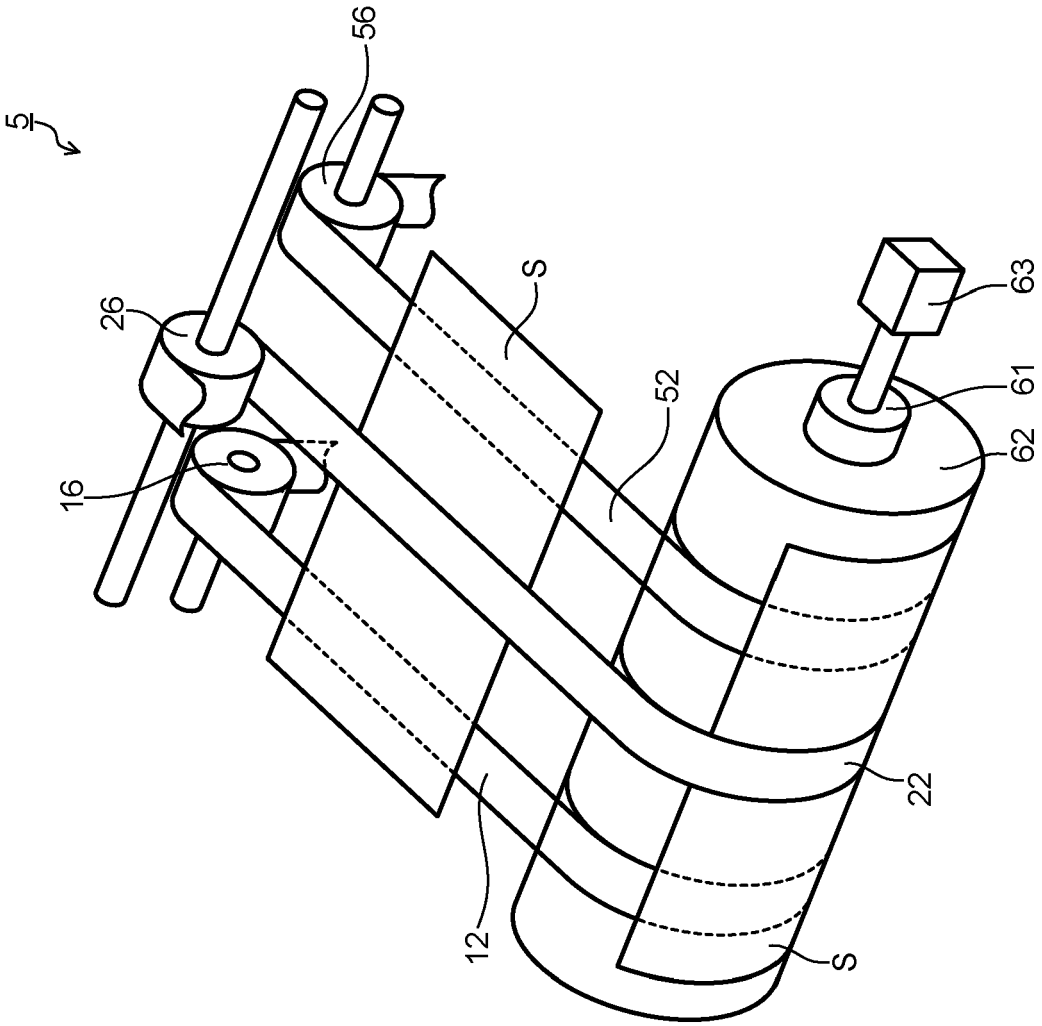

FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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