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SHEET CONVEYING DEVICE AND IMAGE FORMING APPARATUS

Abstract

A sheet conveying device includes a first roller, a second roller, and a pressing portion. The pressing portion includes a pressing member contacting the first roller from its side opposite from the second roller and a pressing urging member urging the pressing member toward the second roller. The first roller has a step portion formed in an outer circumferential part of it all over its circumference. The step portion has an outer diameter smaller than the outer diameter of a contact region with the second roller and is contacted by the pressing member.

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Background/Summary

INCORPORATION BY REFERENCE

[0001] This application is based on and claims the benefit of priority from Japanese Patent Application No. 2024-021007 filed on Feb. 15, 2024, the contents of which are hereby incorporated by reference.

BACKGROUND

[0002] The present disclosure relates to sheet conveying devices and image forming apparatuses.

[0003] Image forming apparatuses such as copiers and printers include a sheet conveying device. The sheet conveying device includes a pair of conveying rollers that conveys sheets. The sheet conveying device conveys sheets one by one from a sheet feeding portion, which stores a stack of sheets as a recording medium to be used for the printing (recording) of images, to an image forming portion (transfer portion), a fixing portion, and a sheet discharge portion.

SUMMARY

[0004] According to one aspect of the present disclosure, a sheet conveying device includes a first roller, a second roller, and a pressing portion. The first and second rollers constitute a pair of conveying rollers rotatably disposed opposite each to convey a sheet. The pressing portion, of which at least one is provided, presses the first roller toward the second roller at a position inward of opposite end parts of the rotation shaft of the pair of conveying rollers. The pressing portion has a pressing member that contacts the first roller from its side opposite from the second roller and a pressing urging member that urges the pressing member toward the second roller. The first roller has a step portion that is formed in an outer circumferential part of it all over its circumference. The step portion has an outer diameter smaller than the outer diameter of a contact region with the second roller, and is contacted by the pressing member.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. 1 is a schematic sectional front view of an image forming apparatus according to one embodiment of the present disclosure.

[0006] FIG. 2 is a perspective view of a sheet conveying device in the image forming apparatus in FIG. 1.

[0007] FIG. 3 is a perspective view around a pair of registration rollers in the sheet conveying device in FIG. 2.

[0008] FIG. 4 is a perspective part view around a support portion for the pair of registration rollers in FIG. 3.

[0009] FIG. 5 is a schematic top view around the pair of registration rollers in FIG. 3, in a middle part of it along the axial direction.

[0010] FIG. 6 is a sectional front view around the pair of registration rollers in FIG. 3, in a middle part of it along the axial direction.

[0011] FIG. 7 is a sectional perspective view around the pair of registration rollers in FIG. 3, in a middle part of it along the axial direction.

DETAILED DESCRIPTION

[0012] An embodiment of the present disclosure will be described below with reference to the

accompanying drawings. The following description, however, is not meant to limit the scope of the present disclosure.

[0013] FIG. 1 is a schematic sectional front view of an image forming apparatus 1 according to the embodiment. One example of the image forming apparatus 1 of the embodiment is a tandem-type color printer that transfers a toner image to a sheet S by use of an intermediate transfer belt 71. The image forming apparatus 1 can be what is called a multifunction peripheral that has functions of printing, scanning (image reading), facsimile transmission, and the like.

[0014] As shown in FIG. 1, the image forming apparatus 1 includes, inside its body 2, a sheet feeding portion 3, a sheet conveying device 4, an exposure portion 5, an image forming portion 6, a transfer portion 7, a fixing portion 8, a sheet discharge portion 9, and a control portion 10.

[0015] The sheet feeding portion 3 is disposed in a bottom part of the body 2. The sheet feeding portion 3 stores a plurality of unprinted sheets S, and separates and feeds out one sheet S after another during printing. The sheet conveying portion 4 extends along a side wall of the body 2, along the top-bottom direction. The sheet conveying portion 4 conveys the sheet S fed out from the sheet feeding portion 3 to a secondary transfer portion 73 and then to the fixing portion 8, and then discharges the sheet S having undergone fixing through a sheet discharge port 4a to the sheet discharge portion 9. The exposure portion 5 is disposed above the sheet feeding portion 3. The exposure portion 5 shines laser light controlled based on image data to the image forming portion 6.

[0016] The image forming portion 6 is disposed above the exposure portion 5, below the intermediate transfer belt 71. The image forming portion 6 includes an image forming portion 6Y for yellow, an image forming portion 6C for cyan, an image forming portion 6M for magenta, and an image forming portion 6B for black. These four image forming portions 6 have basically the same configuration. Accordingly, in the following description, unless distinction is needed, the suffixes “Y,” “C,” “M,” and “B” that distinguish colors will sometimes be omitted.

[0017] The image forming portion 6 includes a photosensitive drum that is supported so as to be rotatable in a predetermined direction (clockwise in FIG. 1). The image forming portion 6 further includes, disposed around the photosensitive drum along its rotation direction, a charging portion, a developing portion, and a drum cleaning portion. Between the developing portion and the drum cleaning portion, a primary transfer portion 72 is disposed.

[0018] The photosensitive drum has a photosensitive layer formed on its outer circumferential surface. The charging portion electrostatically charges the outer circumferential surface of the photosensitive drum to a predetermined surface potential. The exposure portion 5 exposes to light the outer circumferential surface of the photosensitive drum electrostatically charged by the charging portion to form, with attenuated electrostatic charge, an electrostatic latent image of a document image on the outer circumferential surface of the photosensitive drum. The developing portion supplies toner to the electrostatic latent image on the outer circumferential surface of the photosensitive drum to develop it to form a toner image. The four image forming portions 6 form toner images of different colors respectively. The drum cleaning portion performs cleaning by removing the toner and the like that are left on the outer circumferential surface of the photosensitive drum after the primary transfer of the toner images to the outer circumferential surface of the intermediate transfer belt 71. In this way the image forming portion 6 forms the image (toner image) that will later be transferred to the sheet S.

[0019] The transfer portion 7 includes the intermediate transfer belt 71, primary transfer portions 72Y, 72C, 72M, and 72B, the secondary transfer portion 73, and a belt cleaning portion 74. The intermediate transfer belt 71 is disposed above the four image forming portions 6. The intermediate transfer belt 71 is an endless intermediate transfer member that is supported so as to be rotatable in a predetermined direction (counter-clockwise in FIG. 1) and to which the toner images formed by the four image forming portions 6 are primarily transferred sequentially so as to be overlaid on each other. The four image forming portions 6 are disposed in what is called a tandem arrangement

in which they are arrayed in a row from upstream to downstream in the rotation direction of the intermediate transfer belt **71**.

[0020] The primary transfer portions **72Y**, **72C**, **72M**, and **72B** are disposed, across the intermediate transfer belt **71**, above the image forming portions **6Y**, **6C**, **6M**, and **6B** of the corresponding colors. The secondary transfer portion **73** is disposed upstream of the fixing portion **8** with respect to the sheet conveyance direction of the sheet conveying portion **4**, downstream of the four image forming portions **6Y**, **6C**, **6M**, and **6B** with respect to the rotation direction of the intermediate transfer belt **71**. The belt cleaning portion **74** is disposed downstream of the secondary transfer portion **73** with respect to the rotation direction of the intermediate transfer belt **71**.

[0021] The primary transfer portion **72** transfers the toner image formed on the outer circumferential surface of the photosensitive drum to the intermediate transfer belt **71**. In other words, the toner images are, in the primary transfer portions **72Y**, **72C**, **72M**, and **72B** of the corresponding colors, primarily transferred to the outer circumferential surface of the intermediate transfer belt **71**. Then, as the intermediate transfer belt **71** rotates, the toner images from the four image forming portions **6** are transferred, with predetermined timing, to the intermediate transfer belt **71** sequentially so as to be overlaid on each other, so that a color toner image having the toner images of four colors, namely yellow, cyan, magenta, and black, overlaid on each other is formed on the outer circumferential surface of the intermediate transfer belt **71**.

[0022] The color toner image on the outer circumferential surface of the intermediate transfer belt **71** is transferred, at a secondary transfer nip formed in the secondary transfer portion **73**, to a sheet **S** conveyed by the sheet conveying portion **4** in synchronization. The belt cleaning portion **74** performs cleaning by removing the deposit such as toner that is left on the outer circumferential surface of the intermediate transfer belt **71** after secondary transfer. In this way the transfer portion **7** transfers (records) the toner image formed on the outer circumferential surface of the photosensitive drum to the sheet **S**.

[0023] The fixing portion **8** is disposed above the secondary transfer portion **73**. The fixing portion **8** heats and presses the sheet **S** having the toner image formed on it to fix the toner image to the sheet **S**.

[0024] The sheet discharge portion **9** is disposed above the transfer portion **7**. The sheet **S** having the toner image fixed to it and thus having undergone printing is conveyed to the sheet discharge portion **9**. The sheet discharge portion **9** permits the printed sheet (printed matter) to be retrieved upward.

[0025] The control portion **10** includes a CPU, an image processor, a storage, and other electronic circuits and electronic components (none is shown). Based on programs and data for control stored in the storage, the CPU controls the operation of the components of the image forming apparatus **1** to perform processes for carrying out the functions of the image forming apparatus **1**. The sheet feeding portion **3**, the sheet conveying portion **4**, the exposure portion **5**, the image forming portion **6**, the transfer portion **7**, and the fixing portion **8** individually receive instructions from the control portion **10** and cooperate to perform printing on the sheet **S**. The storage is composed of, for example, a combination of a non-volatile storage device (not shown), such as a program ROM (read-only memory) and a data ROM, and a volatile memory device (not shown), such as a RAM (random-access memory).

[0026] Next, the construction of the sheet conveying device **4** will be described with reference to FIG. **2** in addition to FIG. **1**. FIG. **2** is a perspective view of the sheet conveying device **4** in the image forming apparatus **1** in FIG. **1**. Note that FIG. **2** shows only those components that are relevant to the following description. The sheet conveying device **4** includes a sheet conveyance passage **41**, an openable/closable portion **42**, and a pair of registration rollers **43**.

[0027] The sheet conveyance passage **41** extends substantially along the top-bottom direction from downstream of the sheet feeding portion **3** in the sheet conveyance direction via the secondary transfer portion **73** and the fixing portion **8** to upstream of the sheet discharge portion **9** in the sheet

conveyance direction. The sheet conveyance passage **41** is provided with a plurality of pairs of conveying rollers including the pair of registration rollers **43**. The sheet conveyance passage **41**, with the plurality of pairs of conveying rollers, conveys the sheet S fed out from the sheet feeding portion **3** to the secondary transfer portion **73** and then to the fixing portion **8**, and then discharges the sheet S after fixing through a sheet discharge port **4a** to the sheet discharge portion **9**.

[0028] The openable/closable portion **42** extends along a side wall of the body **2**, along the top-bottom direction. The openable/closable portion **42** is supported on the body **2** so as to be swingable, with an upper end part of the openable/closable portion **42** as a free end, about a rotation axis disposed in a lower end part of the openable/closable portion **42** and extending in the front-rear direction of the body **2** (along the near-far direction across the plane of FIG. **1**). When the upper end part of the openable/closable portion **42** is slanted sideways (rightward in FIG. **1**) away from the body **2**, the sheet conveyance passage **41** is exposed along with a space around the pair of registration rollers **43**. That is, the openable/closable portion **42** is fitted to the body **2** so as to be openable and closable with respect to it.

[0029] The pair of registration rollers **43** is disposed upstream of the secondary transfer portion **73** in the sheet conveyance direction. The sheet S fed out from the sheet feeding portion **3** passes through the sheet conveyance passage **41** to reach the pair of registration rollers **43**. With the pair of registration rollers **43** the control portion **10** corrects skewed conveyance of the sheet S and feeds out the sheet S toward the secondary nip portion in the secondary transfer portion **73** while adjusting the timing of the conveyance of the sheet S with toner image formation in the image forming portion **6** and primary transfer in the transfer portion **7**.

[0030] Next, the construction around the pair of registration rollers **43** will be described with reference to FIGS. **3** and **4**. FIG. **3** is a perspective view around the pair of registration rollers **43** in the sheet conveying device **4** in FIG. **2**. FIG. **4** is a perspective part view around a support portion for the pair of registration rollers **43** in FIG. **3**. Note that FIG. **4** depicts part of the pair of registration rollers **43** around one end part along its axial direction.

[0031] The pair of registration rollers **43** is composed of a first roller **43A** and a second roller **43B** that together constitute a pair of conveying rollers. The first and second rollers **43A** and **43B** are disposed opposite each other. The first roller **43A** is a driving roller that rotates by being fed with a driving force from a driving motor (not shown). The second roller **43B** is a driven roller that rotates by following the first roller **43A** by staying in contact with it.

[0032] The first roller **43A** is rotatably supported on a body frame **2F** of the body **2**. Specifically, the rotation shaft **43Ax** of the first roller **43A** is rotatably supported via a bearing (not shown) fitted to the body frame **2F**. At each end part of the pair of registration rollers **43** along its axial direction, a bush member **44** and a counter-urging member **45** are disposed.

[0033] The bush member **44** is disposed at each end part of the pair of registration rollers **43** along its axial direction. The bush member **44** is formed substantially in the shape of a rectangular parallelepiped extending along the direction along which the first and second rollers **43A** and **43B** face each other, and is supported on the body frame **2F** so as to be movable along the axial direction of the first roller **43A**. The bush member **44** has a hole **44a** and a bearing **44b**.

[0034] The hole **44a** is disposed at the position where the rotation shaft **43Ax** of the first roller **43A** is located, and penetrates the bush member **44** along the axial direction of the rotation shaft **43Ax**. The hole **44a** is formed substantially in a cylindrical shape, and is penetrated by the rotation shaft **43Ax**. Within the movement range of the bush member **44**, which is movable along the radial direction of the first roller **43A**, the rotation shaft **43Ax** does not contact an inner circumferential part of the hole **44a**.

[0035] The bearing **44b** is disposed at the position where the rotation shaft **43Bx** of the second roller **43B** is located. The bearing **44b** is fixed to the bush member **44**, and rotatably supports the rotation shaft **43Bx**. In other words, the bush member **44** rotatably supports the second roller **43B**. That is, the second roller **43B** is supported on the body **2** via the bush member **44**. As the bush

member **44**, which is movable along the radial direction of the first roller **43A**, moves, the second roller **43B** moves along the radial direction of the first roller **43A**.

[0036] The counter-urging member **45** is disposed adjacent to the bush member **44**, at the side opposite from the second roller **43B** across the first roller **43A**. The counter-urging member **45** is configured with, for example, a compression coil spring that is disposed so as to expand and compress along the radial direction of the first roller **43A**. The counter-urging member **45** is, at one end in its expansion-compression direction, supported on the body frame **2F** and, at the other end, supported on the bush member **44**.

[0037] The counter-urging member **45** urges the bush member **44**, which is movable along the radial direction of the first roller **43A**, relative to the body frame **2F**. Specifically, the counter-urging member **45** urges the bush member **44** in such a direction that the second roller **43B** comes closer to the first roller **43A**, that is, leftward in FIG. **4**.

[0038] Owing to the above-described supporting mechanism for the first and second rollers **43A** and **43B**, the pair of registration rollers **43** has its first and second rollers **43A** and **43B** both supported on the body **2**. This allows accurate positioning and stable pressing.

[0039] The construction around the pair of registration rollers **43** will now be described in more detail with reference to, in addition to FIG. **3**, FIGS. **5** to **7**. FIGS. **5**, **6**, and **7** are a schematic top view, a sectional front view, and a sectional perspective view, respectively, around the pair of registration rollers **43** in FIG. **3**, in a middle part of it in the axial direction. The sheet conveying device **4** further includes a pressing portion **46**.

[0040] The pressing portion **46** is disposed inward of the opposite ends of the pair of registration rollers **43** along the axial direction. Specifically, in the embodiment, the pressing portion **46** is disposed at one place at the middle of the pair of registration rollers **43** along the axial direction. One or more pressing portions **46** can be provided; that is, a plurality of them can be provided. The pressing portion **46** has a pressing member **461** and a pressing urging member **462**. The first roller **43A** has a step portion **431** disposed opposite the pressing portion **46**.

[0041] The pressing member **461** is disposed at the side opposite from the second roller **43B** across the first roller **43A**. The pressing member **461** contacts the first roller **43A** from the side opposite from the second roller **43B**. A tip end part of the pressing member **461**, which faces the first roller **43A**, is formed in the shape of a rectangular parallelepiped. The tip end face of the pressing member **461** contacting the first roller **43A** is a curved face that fits the circumferential face of the step portion **431** of the first roller **43A**.

[0042] The pressing urging member **462** is disposed adjacent to the pressing member **461**, at the side opposite from the second roller **43B** across the first roller **43A**. The pressing urging member **462** is configured with, for example, a compression coil spring that is disposed so as to expand and contract along the radial direction of the first roller **43A**. The pressing urging member **462** is, at one end along its expansion-compression direction, supported on the body frame **2F** and, at the other end, on the pressing member **461**.

[0043] The pressing urging member **462** urges the pressing member **461**, which is movable along the radial direction of the first roller **43A**, relative to the body frame **2F**. That is, the pressing urging member **462** urges the pressing member **461** toward the second roller **43B**. Specifically, the pressing urging member **462** urges the pressing member **461** in such a direction that the first roller **43A** comes closer to the second roller **43B**, that is, rightward in FIG. **6**.

[0044] The step portion **431** is disposed opposite the pressing member **461** such that the pressing member **461** contacts it. The outer diameter **D1** of the step portion **431** is smaller than the outer diameter **D2** of the contact region between the first and second rollers **43A** and **43B**. The step portion **431** is formed in an outer circumferential part of the first roller **43A**, all around its circumference. The step portion **431** is formed in the shape of a cylinder of which the center axis coincides with the contact region between the first and second rollers **43A** and **43B**.

[0045] The dimension **L1** of the step portion **431** along the axial direction is larger than the

dimension L2 of the pressing member **461** along the axial direction. The pressing member **461** contacts the first roller **43A** in an inward region of the step portion **431** along the axial direction.

[0046] With the above construction, at the place on the step portion **431** against which the pressing member **461** is pressed, the first roller **43A** does not contact the second roller **43B**. This helps suppress a rise in the pressure between the first and second rollers **43A** and **43B** at the place against which the pressing member **461** is pressed. It is thus possible to suppress misalignment and sagging of the pair of registration rollers **43** and to suppress creases in the sheet S conveyed.

[0047] The pressing portion **46** is disposed at one place at the middle along the axial direction of the pair of registration rollers **43**. This makes it possible to raise the pressure between the first and second rollers **43A** and **43B** uniformly from one to the other end of the pair of registration rollers **43** along the axial direction. This helps enhance the effect of suppressing misalignment and sagging of the pair of registration rollers **43**.

[0048] Specifically, with the pressing urging member **462** the pressing portion **46** urges the pressing member **461** upstream in the sheet conveyance direction with respect to the center axis **43By** of the second roller **43B**, that is, downward relative to the center axis **43By** in FIG. 6. In other words, with the pressing urging member **462** the pressing portion **46** urges the pressing member **461** upstream of the nip portion N in the pair of registration rollers **43** in the sheet conveyance direction, that is, downward relative to the nip portion N in FIG. 6.

[0049] With the above construction, the urging force of the pressing urging member **462** acts on the first roller **43A** as the driving roller in a part of it upstream of the nip portion N in the rotation direction. This helps increase the gripping force on the sheet S entering the nip portion N and hence enhance the capability of the first roller **43A** to convey the sheet S. It is thus possible to enhance the conveying performance of the pair of registration rollers **43** with the sheet S.

[0050] Urging the pressing member **461** upstream in the sheet conveyance direction with respect to the center axis **43By** of the second roller **43B** as the driven roller as described above is considered to make it easy for the second roller **43B** to move downstream in the sheet conveyance direction. However, the movement of the second roller **43B** downward in the sheet conveyance direction can be prevented by the above-described supporting mechanism at the opposite end parts of each of the first and second rollers **43A** and **43B** along the axial direction.

[0051] In the above construction, the pressing portion **46** is provided opposite the first roller **43A** as the driving roller with respect to the second roller **43B** as the driven roller. It is thus possible to suppress misalignment and sagging of the first and second rollers **43A** and **43B** and creases in the sheet S conveyed and meanwhile enhance the conveying performance of the pair of registration rollers **43** with the sheet S.

[0052] In addition, in the above construction, the pair of registration rollers **43** is provided with the pressing portion **46**. It is thus possible to suppress, for the pair of registration rollers **43**, misalignment and sagging of the pairs of rollers and creases in the sheet S conveyed, and furthermore to correct skewed conveyance of the sheet S and enhance the performance related to adjustment of the timing of conveyance of the sheet S.

[0053] The embodiment of the present disclosure described above is not meant to limit the scope of the present disclosure, which can thus be implemented with any modifications made without departure from the spirit of the present disclosure.

Claims

1. A sheet conveying device comprising: a first roller and a second roller that constitute a pair of conveying rollers rotatably disposed opposite each to convey a sheet; and at least one pressing portion that presses the first roller toward the second roller at a position inward of opposite end parts of the pair of conveying rollers along an axial direction, wherein the pressing portion includes: a pressing member that contacts the first roller from a side thereof opposite from the

second roller; and a pressing urging member that urges the pressing member toward the second roller, and the first roller has a step portion that is formed in an outer circumferential part of the first roller all over a circumference thereof, the step portion having an outer diameter smaller than an outer diameter of a contact region with the second roller, the step portion being contacted by the pressing member.

2. The sheet conveying device according to claim 1, wherein the pressing portion is disposed at a middle of the pair of conveying rollers along the axial direction.

3. The sheet conveying device according to claim 1, wherein with the pressing urging member the pressing portion urges the pressing member upstream of a center axis of the second roller in a sheet conveyance direction.

4. The sheet conveying device according to claim 1, wherein the first roller is a driving roller that rotates by being fed with a driving force, and the second roller is a driven roller that rotates by following the first roller by staying in contact with the first roller.

5. The sheet conveying device according to claim 1, wherein the first roller is rotatably supported on a body frame of an apparatus body, and the sheet conveying device further comprises: a bush member that is supported on the body frame so as to be movable along a radial direction of the first roller, the bush member rotatably supporting the second roller; and a counter-urging member that urges the bush member in such a direction that the second roller comes closer to the first roller.

6. An image forming apparatus comprising the sheet conveying device according to claim 1.

7. The image forming apparatus according to claim 6, wherein the pair of conveying rollers is a pair of registration rollers that conveys the sheet while correcting skewed conveyance of the sheet.
