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SHEET CONVEYANCE APPARATUS, IMAGE READING APPARATUS, AND IMAGE FORMING APPARATUS

Abstract

A sheet conveyance apparatus includes a stacking tray having a sheet stacking surface, a feeding roller configured to feed the sheet in a feeding direction, and a first side regulating member disposed in the stacking tray to be movable in a width direction and configured to regulate a position of one end of the sheet in the width direction, the first side regulating member having a first regulating surface to contact with the one end of the sheet, and a first supporting surface configured to support the sheet, wherein the first side regulating member has, at a downstream side end of the first supporting surface in the feeding direction, a first scooping portion that is configured to scoop the sheet onto the first supporting surface when the first side regulating member moves and that extends from the first supporting surface to below the sheet stacking surface.

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Background/Summary

BACKGROUND

Field

[0001] The present disclosure relates to a sheet conveyance apparatus that conveys a sheet, an image reading apparatus including the sheet conveyance apparatus, and an image forming apparatus including the sheet conveyance apparatus.

Description of the Related Art

[0002] Some typically known image reading apparatuses to be mounted on image forming apparatuses, such as copy machines, include an auto document feeder (hereinafter referred to an ADF) that conveys a document placed on a document tray one sheet by one sheet. In such an image reading apparatus, a document to be conveyed by the ADF is discharged to a discharge tray after an image is read by a reading unit.

[0003] A document tray of the ADF and/or a manual feed tray of the image forming apparatus includes a pair of side regulating members for preventing a sheet from being skewed when the sheet is fed. When setting a sheet on the document tray or the manual feed tray, a user moves the pair of side regulating members to fit a width of the sheet. United States Patent Application Publication No. 2022/0089388 discusses a side regulating member provided with a scooping portion to prevent a sheet from entering below the side regulating member when the user moves the side regulating member.

[0004] There has been a growing demand for ADFs and image forming apparatuses to support various sheet sizes, particularly for feeding small-sized sheets, such as business cards and receipts. Such small-sized sheets have a short length in a feeding direction, so that the set sheet may be out of reach of a scooping portion of a side regulating member. In such a case, there is a possibility that the sheet enters below the side regulating member, which can damage the sheet.

SUMMARY

[0005] The present disclosure is directed to a technique of enabling a side regulating member to smoothly scoop a small-sized sheet.

[0006] According to some embodiments, a sheet conveyance apparatus includes a stacking tray having a sheet stacking surface on which a sheet is stacked, a feeding roller configured to feed the sheet stacked on the stacking tray in a feeding direction, and a first side regulating member disposed in the stacking tray to be movable in a width direction orthogonal to the feeding direction and configured to regulate a position of one end of the sheet stacked on the stacking tray in the width direction, the first side regulating member having a first regulating surface to be brought into contact with the one end of the sheet in the width direction, and a first supporting surface configured to, together with the sheet stacking surface, support the sheet, wherein the first side regulating member has, at a downstream side end of the first supporting surface in the feeding direction, a first scooping portion that is configured to scoop the sheet onto the first supporting surface when the first side regulating member moves and that extends from the first supporting surface to below the sheet stacking surface.

[0007] Further features of the present disclosure will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is a sectional view schematically illustrating an image forming apparatus.
[0009] FIG. **2** is a sectional view schematically illustrating an image reading apparatus.
[0010] FIG. **3** is a perspective view of an auto document feeder (ADF).
[0011] FIG. **4** is a perspective view of the ADF.
[0012] FIG. **5** is a view illustrating a configuration of a document tray.
[0013] FIG. **6** is a view illustrating a configuration of an upper cover member of the document tray.
[0014] FIG. **7** is a plan view illustrating an interlocking mechanism of a side regulating portion.
[0015] FIG. **8** is a top view of the document tray.
[0016] FIG. **9** is a front view of the document tray.
[0017] FIG. **10** is a top view of the document tray.
[0018] FIG. **11** is an enlarged front view of the document tray.
[0019] FIG. **12** is an enlarged front view of the document tray.
[0020] FIG. **13** is a perspective view of the ADF.
[0021] FIG. **14** is a perspective view of the ADF.
[0022] FIG. **15** is a view illustrating a configuration of a document tray.
[0023] FIG. **16** is a top view of the document tray.

DESCRIPTION OF THE EMBODIMENTS

[0024] Various exemplary embodiments, features, and aspects of a sheet feeding apparatus, an image reading apparatus, and an image forming apparatus according to the present disclosure will be described below with reference to the accompanying drawings. Dimensions, materials, shapes, and relative arrangement of the components and the like described in the following exemplary embodiments are not intended to limit a scope of application of the present technology unless specifically described.

Image Forming Apparatus

[0025] Initially, a schematic configuration of an image forming apparatus **101** is described with reference to FIG. **1**. In the following description, a position at which a user performs an operation on an operation unit to perform various types of input/setting to the image forming apparatus **101** is referred to as a "front side" of the image forming apparatus **101**, and a back surface side of the image forming apparatus **101** is referred to as a "back side". Specifically, FIG. **1** illustrates an internal configuration of the image forming apparatus **101** when viewed from the front side. The image forming apparatus **101** includes a printer main body **101**A and an image reading apparatus **103**, as illustrated in FIG. **1**. The image reading apparatus **103** disposed above the printer main body **101**A includes a reader **30** and an auto document feeder (ADF) **1**, which will be described in detail below, and optically scans a document and reads image information. Examples of the document include paper, such as a paper sheet or an envelope, a plastic film such as a sheet for an overhead projector (OHP), and a cloth sheet. The image information converted into an electric signal by the image reading apparatus **103** is transferred to a control unit **132** included in the printer main body **101**A.
[0026] The printer main body **101**A includes an image forming unit **133** capable of forming an image on a sheet P serving as a recording medium, and a sheet feeding unit **140** that feeds the sheet P to the image forming unit **133**. The sheet feeding unit **140** includes sheet accommodation units **137***a*, **137***b*, **137***c*, and **137***d* that are capable of accommodating sheets in mutually different sizes. Sheets accommodated in each sheet accommodation unit are sent out by a pickup roller **141**, separated from the other sheets one sheet by one sheet by a feeding roller **142** and a retard roller **143**, and transferred to the corresponding conveyance roller pair **131**. A sheet P is sequentially transferred to a plurality of conveyance roller pairs **131** arranged along a sheet conveyance path, and so that the sheet P is conveyed to a registration roller pair **136**.
[0027] The sheet P placed on a manual feed tray **137***e* by a user is fed to the inside of the printer

main body **101**A by a feeding roller **138**, and conveyed to the registration roller pair **136**. The registration roller pair **136** stops a leading end of the sheet P to correct skew, and also resumes conveyance of the sheet P in step with the progress of an image formation operation, which is a toner image formation process to be performed by the image forming unit **133**.

[0028] The image forming unit **133** that forms an image on the sheet P is an electrophotographic image forming unit including a photosensitive drum **121** serving as a photosensitive body. The photosensitive drum **121** is rotatable along a conveyance direction of the sheet P. A charger **118**, an exposure device **123**, a developing device **124**, a transfer charger **125**, a separation charger **126**, and a cleaner **127** are disposed around the photosensitive drum **121**. The charger **118** uniformly charges the surface of the photosensitive drum **121**. The exposure device **123** exposes the photosensitive drum **121** based on image information input from the image reading apparatus **103** or the like, and forms an electrostatic latent image on the photosensitive drum **121**.

[0029] The developing device **124** contains a two-component developer including toner and carriers, and supplies charged toner to the photosensitive drum **121** to develop the electrostatic latent image into a toner image. The toner image borne by the photosensitive drum **121** is transferred onto the sheet P, which has been conveyed by the registration roller pair **136**, by a bias electric field formed by the transfer charger **125**. The sheet P serving as a recording medium onto which the toner image has been transferred is separated from the photosensitive drum **121** by a bias electric field formed by the separation charger **126**, and conveyed toward a fixing unit **129** by a pre-fixing conveyance unit **128**. A sticking substance, such as transfer residual toner, that has not been transferred to the sheet P and that has been left in the photosensitive drum **121** is removed by the cleaner **127**, and the photosensitive drum **121** prepares for a subsequent image formation operation.

[0030] The sheet P that has been conveyed to the fixing unit **129** is heated while being nipped and pressed by a roller pair, and subjected to fixing of an image by melting and solidification of toner. In a case where the output of the image is completed, the sheet P that has been subjected to the fixing of the image is discharged via a discharge roller pair **40** to a discharge tray **130** that protrudes toward the outside of the printer main body **101**A. In a case where an image is formed on a back surface of the sheet P in double-sided printing, the front surface and back surface of the sheet P that has passed through the fixing unit **129** are reversed by a reverse unit **139**, and the sheet P is conveyed to the registration roller pair **136** by a double-sided conveyance unit **150**. The sheet P on which the image is formed again by the image forming unit **133** is discharged to the discharge tray **130**. In this manner, the image forming unit **133** is capable of forming an image on a sheet P based on an image of a document D read by a first reading unit **151** and a second reading unit **201**, which will be described below. In addition to the above-mentioned electrophotographic method, the image forming unit **133** serving as an image forming means may employ other methods such as an inkjet method.

Image Reading Apparatus

[0031] Subsequently, a configuration of the image reading apparatus **103** is now described with reference to FIG. **2**. FIG. **2** is a sectional view schematically illustrating the image reading apparatus **103**. As illustrated in FIG. **2**, the image reading apparatus **103** includes the reader **30** as a reading unit that reads a document image, and the ADF **1** as a sheet conveyance apparatus. The ADF **1** includes a base unit **13**, an opening/closing cover **11** that is supported by the base unit **13** to be openable and closable, a document tray **2** on which the document D is to be stacked, and a discharge tray **3** disposed blow the document tray **2**. The image reading apparatus **103** includes the first reading unit **151** disposed in the reader **30** and the second reading unit **201** disposed in the ADF **1**. The first reading unit **151** and the second reading unit **201** are examples of a reading means in the present exemplary embodiment.

[0032] The first reading unit **151** reads an image on a first surface of the document D. The second reading unit **201** reads an image on a second surface of the document D. The second surface is on

the opposite side of the first surface. The first surface in the present exemplary embodiment is the bottom side surface of the document D in a double-sided reading unit DR, and the second surface is the top side surface of the document D in the double-sided reading unit DR. The first reading unit **151** and the second reading unit **201** constitute the double-sided reading unit DR capable of simultaneously reading both surfaces of the document D conveyed by the ADF **1**. However, the double-sided reading unit DR does not necessarily constantly execute simultaneous reading of both surfaces and is capable of reading only one surface.

[0033] The first reading unit **151** and the second reading unit **201** each include a contact image sensor (hereinafter referred to as a CIS), which is a scanning device of an equal-magnification optical system. The first reading unit **151** and the second reading unit **201** each include a light source including an array of light emitting diodes (LEDs) arrayed in a main scanning direction that is orthogonal to a conveyance direction of the document D, and a plurality of light receiving elements also arrayed in the main scanning direction. Light that has been emitted from the array of LEDs and reflected by the document D forms an image on each light receiving element via a lens, and is photoelectrically converted by the light receiving element.

[0034] The reader **30** is fixed to an upper surface of the printer main body **101**A (refer to FIG. **1**). A transparent document positioning plate **30***a* is disposed on the upper surface of the reader **30**. The first reading unit **151** is supported by a carriage (not illustrated) that is movable in a left-and-right direction in FIG. **2**, and is movable from a predetermined position in the double-sided reading unit DR for the entire length of the document positioning plate **30***a* along the document positioning plate **30***a*.

[0035] The ADF **1** is provided to be openable and closable in an up-and-down direction with respect to the reader **30** with a hinge mechanism (not illustrated) disposed on the rear side in FIG. **2**. The document tray **2** serving as a sheet stacking unit supports a document placed by the user. A document conveyance path T that curves in a substantially U-shape is formed in the ADF **1**. The ADF **1** conveys the document D placed on the document tray **2** to the double-sided reading unit DR via the document conveyance path T. The user opens the opening/closing cover **11** with respect to the base unit **13**, and can thereby expose part of the document conveyance path T.

[0036] Subsequently, a configuration of the ADF **1** for conveying the document D is described in detail. The ADF **1** includes a pickup roller **4**, a conveyance roller **5**, a separation roller **6**, a registration roller pair **7**, conveyance roller pairs **8** and **9**, and a discharge roller pair **10** in this order along a document conveyance direction (indicated by an arrow in FIG. **2**). The ADF **1** includes a shutter **29**, and the document D is set on the document tray **2** in a state of abutting against the shutter **29**. The shutter **29** serving as an abutting portion is configured to regulate the document D from moving in a feeding direction FD before the start of feeding, and permit the document D to move in the feeding direction FD after the start of feeding. The pickup roller **4** serving as a feeding means is movable in the up-and-down direction with respect to the upper surface of the document tray **2**, and comes into contact with the document D on the document tray **2** to feed the document D in the feeding direction FD. The conveyance roller **5** conveys the document D received from the pickup roller **4** toward a downstream side in the feeding direction FD. The separation roller **6** is brought into pressure contact with the conveyance roller **5** to form a separation nip N as a separation portion between the separation roller **6** and the conveyance roller **5**, and separates the document D conveyed by the conveyance roller **5** into individual sheets. In the present exemplary embodiment, the conveyance roller **5** and the separation roller **6** form the separation nip N, but a configuration is not limited thereto. For example, a retard roller to which driving for reverse rotation is input via a torque limiter, a separation pad, or the like may be applied instead of the separation roller **6**.

[0037] A feed shaft which is a rotary shaft of the conveyance roller **5** is rotatably supported by the opening/closing cover **11**, and the pickup roller **4** is supported by the opening/closing cover **11** to be pivotable with respect to the feed shaft via a pickup arm, which is not illustrated. One roller of

the registration roller pair **7** is also rotatably supported by the opening/closing cover **11**.
[0038] The registration roller pair **7**, in a rotation stopped state, receives a downstream side end of the document D, which is conveyed by the conveyance roller **5**, in the conveyance direction (hereinafter, such a downstream side end is referred to as a leading end), and flexes the document D to correct skew of the document D. The registration roller pair **7** conveys the document D having been subjected to the skew correction via a bend portion of the document conveyance path T, and transfers the document D to a conveyance roller pair **8**. The conveyance roller pair **8** sends the document D to the double-sided reading unit DR and transfers the document D to a conveyance roller pair **9** on the downstream side. At this time, an image on the document D is read by the first reading unit **151** and the second reading unit **201**.
[0039] The conveyance roller pair **9** transfers the document D that has passed the double-sided reading unit DR to the discharge roller pair **10**. The discharge roller pair **10** which is a discharge means discharges the document D in a discharge direction DD. The document D discharged by the discharge roller pair **10** is stacked on the discharge tray **3** as a discharge stacking unit.
[0040] The image reading apparatus **103** having such a configuration reads image information from the document D using a streaming reading mode or a fixed reading mode. In the streaming reading mode, the image reading apparatus **103** scans a document image while feeding the document D with the ADF **1**. In the fixed reading mode, the image reading apparatus **103** scans the document placed on the document positioning plate **30***a*. In a case where the document D placed on the document tray **2** is detected, or in a case where the user explicitly instructs execution of the streaming reading mode via an operation panel or the like on the printer main body **101**A, the streaming reading mode is selected. In this case, the ADF **1** feeds the document D toward the double-sided reading unit DR one sheet by one sheet in a state where the first reading unit **151** is at a predetermined position on the double-sided reading unit DR. In a case of the double-sided simultaneous reading, both the first reading unit **151** and the second reading unit **201** irradiate the document D with a scanning beam to scan the document D. In a case of the one-sided reading, either the first reading unit **151** or the second reading unit **201** irradiates the document D with a scanning beam to scan the document D. The image information converted into an electric signal by the light receiving elements is transferred to the control unit **132** in the printer main body **101**A.
[0041] In contrast, in a case where the document D placed on the document positioning plate **30***a* is detected by the image reading apparatus **103**, or in a case where the user explicitly instructs execution of the fixed reading mode via the operation panel or the like on the printer main body **101**A, the fixed reading mode is selected. In this case, the first reading unit **151** irradiates the document D placed on the document positioning plate **30***a* with light to scan the document D while moving along the document positioning plate **30***a*. The image information converted into an electric signal by the light receiving element in the first reading unit **151** is transferred to the control unit **132** in the printer main body **101**A.
Document Tray
[0042] Subsequently, the configuration of the document tray **2** is described with reference to FIGS. **3** to **7**. FIGS. **3** and **4** are perspective views of the ADF **1**. The document tray **2** includes a document stacking surface **211** as a sheet stacking surface for supporting the document, and a first side regulating member **22** and a second side regulating member **23** that regulate respective positions of the document in a width direction W. The first side regulating member **22** regulates a position of a front side end of the document (a position of one end). The second side regulating member **23** regulates a position of a back side end of the document (a position of the other end). The document stacking surface **211** is formed on an upper cover member **21** serving as a main body of the document tray **2** and is used for supporting the document. The upper cover member **21** will be described below. As illustrated in FIG. **2**, the document stacking surface **211** is slightly inclined so that the document stacking surface **211** lowers toward the downstream side in the feeding direction FD. The first side regulating member **22** and the second side regulating member **23** are

disposed to be movable in the width direction W that is perpendicular to the feeding direction FD. The first side regulating member **22** and the second side regulating member **23** are configured to be movable in mutually opposite directions in coordination with each other via an interlocking mechanism, which will be described below. For example, when the first side regulating member **22** moves to the back side of the image reading apparatus **103**, the second side regulating member **23** moves to the front side of the image reading apparatus **103** in conjunction with the movement of the first side regulating member **22**.

[0043] The first side regulating member **22** includes a first supporting surface **221** formed along the document stacking surface **211** and a first regulating surface **222** formed to be substantially perpendicular to the document stacking surface **211** and the first supporting surface **221**. The first supporting surface **221** is a surface that, together with the document stacking surface **211**, supports the document, and slides on the document stacking surface **211**. The first supporting surface **221** is a surface that extends in the feeding direction FD and the width direction W. The first regulating surface **222** is integrally formed to stand up from an outermost side of the first supporting surface **221** in the width direction W, and is a surface against which the front side end (edge) of the document is abutted. Similarly, the second side regulating member **23** includes a second supporting surface **231** formed along the document stacking surface **211** and a second regulating surface **232** formed to be substantially perpendicular to the document stacking surface **211** and the second supporting surface **231**. The second supporting surface **231** is a surface that, together with the document stacking surface **211**, supports the document, and slides on the document stacking surface **211**. The second regulating surface **232** is integrally formed to stand up from an outermost side of the second supporting surface **231** in the width direction W, and is a surface against which the back side end (edge) of the document is abutted.

[0044] FIG. **5** is an exploded perspective view of the document tray **2**. FIG. **6** is a perspective view of the upper cover member **21** serving as the main body of the document tray **2** when viewed from below. FIG. **7** is a plan view of the upper cover member **21** when viewed from the back side (below) and is a view illustrating the interlocking mechanism. The document tray **2** includes the upper cover member **21** and a lower cover member **24**. The upper cover member **21** includes the above-mentioned document stacking surface **211**. The lower cover member **24** covers the upper cover member **21** from below. The lower cover member **24** is fixed to the upper cover member **21** with a plurality of screws **300**. The lower cover member **24** faces the discharge tray **3**, and includes a discharge guide surface **241** that guides the document discharged by the discharge roller pair **10**. On the discharge guide surface **241**, a plurality of ribs extending along the discharge direction DD is formed.

[0045] As the interlocking mechanism for moving the first side regulating member **22** and the second side regulating member **23** in conjunction with each other, a first rack portion **25**, a second rack portion **26**, and a pinion gear **27** are attached to the upper cover member **21**. A plurality of teeth is formed in a straight line on each of the first rack portion **25** and the second rack portion **26**. Two slits **212** extending in the width direction W are formed in the upper cover member **21**. The first rack portion **25** is fixed to the first side regulating member **22** with a screw **300** via the slit **212**, and the first side regulating member **22** and the first rack portion **25** are disposed to sandwich the upper cover member **21** (document stacking surface **211**). Similarly, the second rack portion **26** is fixed to the second side regulating member **23** with a screw **300** via the slit **212**, and the second side regulating member **23** and the second rack portion **26** are disposed to sandwich the upper cover member **21** (document stacking surface **211**). A pinion gear supporting portion **28** is formed in the upper cover member **21**, and the pinion gear **27** is engaged with the pinion gear supporting portion **28** in a rotatable manner. As illustrated in FIG. **7**, the pinion gear **27** is provided to be engaged with both the first rack portion **25** and the second rack portion **26**. With this configuration, the rotation of the pinion gear **27** at the time of movement of one of the first side regulating member **22** or the second side regulating member **23** enables the other one of the first side

regulating member **22** and the second side regulating member **23** to move in the opposite direction in conjunction with the rotation.

[0046] Pivot shafts **213** are formed at the downstream side end of the upper cover member **21** in the feeding direction FD to protrude in the width direction W. Meanwhile, the base unit **13** has bearings (not illustrated) to which the pivot shafts **213** are fitted. The pivot shafts **213** being fitted to the respective bearings in the base unit **13** enables the upper cover member **21** to pivot about the pivot shafts **213** with respect to the base unit **13**.

[0047] The document tray **2** is configured to be pivotable with respect to the base unit **13**. This enables the user to retrieve the document discharged to the discharge tray **3** in a state where the document tray **2** is lifted upward.

Document Scooping Shape

[0048] FIG. **8** is a top view of the document tray **2**. FIG. **9** is a front view of the document tray **2** when viewed from the downstream side in the feeding direction FD. In the following description, the "inside (or inner, inward)" in the width direction W means the side closer to the center of conveyance C (refer to FIG. **8**). The center of conveyance C mentioned here is a middle of the pickup roller **4**, and is a middle position between the first regulating surface **222** and the second regulating surface **232**. The first supporting surface **221** of the first side regulating member **22** includes a first scooping portion **223** at the downstream side end of the first supporting surface **221** in the feeding direction FD and at the inner end of the first supporting surface **221** in the width direction W. The second supporting surface **231** of the second side regulating member **23** includes a second scooping portion **233** at the downstream side end of the second supporting surface **231** in the feeding direction FD and at the inner end of the second supporting surface **231** in the width direction W. The first scooping portion **223** and the second scooping portion **233** are respectively formed at the most downstream side position (downstream side end) of the first supporting surface **221** and the most downstream side position (downstream side end) of the second supporting surface **231**. The first scooping portion **223** and the second scooping portion **233** are inclined downward toward the inside in the width direction W, and are formed to extend below the document stacking surface **211**. The first scooping portion **223** and the second scooping portion **233** are disposed to slide to the downstream side end of the document stacking surface **211** (upper cover member **21**).

[0049] The first supporting surface **221** of the first side regulating member **22** includes a third scooping portion **224** upstream of the first scooping portion **223** in the feeding direction FD. The second supporting surface **231** of the second side regulating member **23** includes a fourth scooping portion **234** upstream the second scooping portion **233** in the feeding direction FD. The third scooping portion **224** is formed upstream the fourth scooping portion **234**. The third scooping portion **224** and the fourth scooping portion **234** are inclined downward toward the inside in the width direction W, and are formed to extend below the document stacking surface **211**, as in the first scooping portion **223** and the second scooping portion **233**. The third scooping portion **224** and the fourth scooping portion **234** are fitted to the respective slits **212** formed in the document stacking surface **211** to be slidable inside the respective slits **212**.

[0050] An end (outer edge) in the width direction W of the first supporting surface **221** of the first side regulating member **22** serves as a first inclined portion **225** (first inclined surface) having a shape that approaches the first regulating surface **222** as it extends upstream from the first scooping portion **223** in the feeding direction FD. An end (outer edge) in the width direction W of the second supporting surface **231** of the second side regulating member **23** serves as a second inclined portion **235** (second inclined surface) having a shape that approaches the second regulating surface **232** as it extends upstream from the second scooping portion **233** in the feeding direction FD. The first inclined portion **225** and the second inclined portion **235** are inclined downward toward the inside in the width direction W. Each of the first inclined portion **225** and the second inclined portion **235** has a shape that is inclined outward in the width direction W as it extends upstream in the feeding

direction FD and is inclined downward to the inside in the width direction W. In other words, each of the first supporting surface **221** and the second supporting surface **231** has a shape with a length in the width direction W that becomes shorter as it extends upstream in the feeding direction FD. The first scooping portion **223** is formed at the most inner position of the first supporting surface **221** in the width direction W. The second scooping portion **233** is formed at the most inner position of the second supporting surface **231** in the width direction W.

[0051] FIG. **10** is a top view of the document tray **2** in a state where the document D of a business card size is placed. The document D illustrated in FIG. **10** has a Japanese standard business card size (55 mm×91 mm), and is the smallest-sized document among documents conveyable by the ADF **1** according to the present exemplary embodiment. Here, the smallest-sized document conveyable by the ADF **1** refers to, for example, the smallest-sized document among supported sheets described in product specifications and the like. FIG. **11** is a front view of the document tray **2** in a state where the first side regulating member **22** and the second side regulating member **23** are moved to the inside in the width direction W, and the first scooping portion **223** and the second scooping portion **233** come into contact with the document D. FIG. **12** is a front view of the document tray **2** in a state where the first regulating surface **222** and the second regulating surface **232** come into contact with both ends of the document D in the width direction W.

[0052] As described above, the document D is set in the document tray **2** in a state where the document D abuts against the shutter **29**. When the user moves the first regulating surface **222** and the second regulating surface **232** to the inside to fit the width of the document D, the first scooping portion **223** and the second scooping portion **233** first come into contact with the corresponding ends of the document D as illustrated in FIG. **11**. At this time, since the first scooping portion **223** and the second scooping portion **233** extend to the lower side of the document stacking surface **211**, the respective ends of the document D are scooped by the first scooping portion **223** and the second scooping portion **233** from below. Hence, the document D is guided onto the first supporting surface **221** and the second supporting surface **231** without the ends of the document D getting caught. Furthermore, when the first side regulating member **22** and the second side regulating member **23** are brought close to each other, the document D is scooped onto the first supporting surface **221** and the second supporting surface **231** by the first inclined portion **225** and the second inclined portion **235** continuously from the leading end to the trailing end of the document D. As illustrated in FIG. **12**, the first regulating surface **222** and the second regulating surface **232** abut against the respective ends of the document D in the width direction W, so that the position of the document D is regulated.

[0053] The smallest-sized document conveyable by the ADF **1** according to the present exemplary embodiment is the Japanese standard business card size (55 mm×91 mm). Here, a distance L**1** from the shutter **29** to the trailing end of the document is 91 millimeters (mm). In order to cause the first scooping portion **223** and the second scooping portion **233** to scoop a document, a distance L**2** from the shutter **29** to each of the first scooping portion **223** and the second scooping portion **233** desirably satisfies L**2**<L**1** (91 mm in the present exemplary embodiment). That is, the distance L**2** from the shutter **29** to each of the first scooping portion **223** and the second scooping portion **233** is desirably shorter than a length of the smallest-sized sheet conveyable by the image reading apparatus **103**.

[0054] As described above, the first scooping portion **223** is formed on the first supporting surface **221** of the first side regulating member **22** at the downstream side end of the first supporting surface **221** in the feeding direction FD. The second scooping portion **233** is formed on the second supporting surface **231** of the second side regulating member **23** at the downstream side end of the second supporting surface **231** in the feeding direction FD. The first scooping portion **223** and the second scooping portion **233** are inclined downward toward the inside in the width direction W, and are formed to extend below the document stacking surface **211**. Such a first scooping portion **223** and a second scooping portion **233** enable even the small-sized sheet such as a business card to

be scooped onto the first supporting surface **221** and the second supporting surface **231** without getting caught. This configuration can prevent the document from entering under the first supporting surface **221** and the second supporting surface **231** and being damaged.

[0055] Each of the first supporting surface **221** and the second supporting surface **231** has a shape with the length in the width direction W that becomes shorter as it extends upstream in the feeding direction FD. Hence, the document D is scooped onto the first supporting surface **221** and the second supporting surface **231** continuously from the leading end to the trailing end of the document D by the first inclined portion **225** and the second inclined portion **235**. This configuration can further prevent the document from getting caught on the first side regulating member **22** and the second side regulating member **23**.

[0056] The third scooping portion **224** is formed on the first supporting surface **221** on the upstream side of the first scooping portion **223** in the feeding direction FD. The fourth scooping portion **234** is formed on the second supporting surface **231** on the upstream side of the second scooping portion **233** in the feeding direction FD. This enables the third scooping portion **224** and the fourth scooping portion **234** to scoop even a document that is long in the feeding direction onto the first supporting surface **221** and the second supporting surface **231**. This configuration can further prevent the document that is long in the conveyance direction from getting caught on the first side regulating member **22** and the second side regulating member **23**.

[0057] Subsequently, a second exemplary embodiment is described. The second exemplary embodiment is different from the first exemplary embodiment only in a configuration of the first side regulating member **22** and a configuration of the document stacking surface **211**. Thus, since a configuration other than the document tray **2** in the second exemplary embodiment is similar to that in the first exemplary embodiment, a description thereof is omitted.

Document Tray

[0058] FIGS. **13** and **14** are perspective views of the ADF **1** according to the second exemplary embodiment. FIG. **15** is a perspective view of an upper cover member **21** in the document tray **2** according to the second exemplary embodiment when viewed from below. FIG. **16** is a top view of the document tray **2** according to the second exemplary embodiment. The document tray **2** includes the document stacking surface **211** for supporting the document, and the first side regulating member **22** and the second side regulating member **23** that regulate the respective positions of the document in the width direction W. The document tray **2** includes a movable stacking surface **251**. The movable stacking surface **251** is a stacking surface that is movable in the width direction W integrally with the first side regulating member **22**, and supports, together with the document stacking surface **211**, the document when the first side regulating member **22** is located on the outside as illustrated in FIG. **13**. As illustrated in FIG. **16**, when the first side regulating member **22** moves inward, the movable stacking surface **251** retracts to enter under the document stacking surface **211**. In other words, for a large size document, the movable stacking surface **251** is located at a supporting position at which the movable stacking surface **251**, together with the document stacking surface **211**, supports the document. For a small-sized document, the movable stacking surface **251** is located at a retracted position at which the movable stacking surface **251** is retracted below the document stacking surface **211**. With this configuration, for a small-sized document, the movable stacking surface **251** is retracted and a space is formed above the discharge tray **3**. This makes it easier for the user to visually recognize the small-sized document discharged to the discharge tray **3** and retrieve it.

[0059] As an interlocking mechanism for moving the first side regulating member **22** and the second side regulating member **23** in conjunction with each other, the upper cover member **21** includes the first rack portion **25**, the second rack portion **26**, and the pinion gear **27**. An upper surface of the first rack portion **25** serves as the movable stacking surface **251**, and is fixed to the first side regulating member **22** with screws **300**. The second rack portion **26** is fixed to the second side regulating member **23** with a screw **300** via the slits **212**, and the second side regulating

member **23** and the second rack portion **26** are disposed to sandwich the upper cover member **21**. The pinion gear supporting portion **28** is formed in the upper cover member **21**, and the pinion gear **27** is rotatably engaged with the pinion gear supporting portion **28**. The pinion gear **27** is provided to be engaged with the first rack portion **25** and the second rack portion **26**. With this configuration, the rotation of the pinion gear **27** at the time of movement of one of the first side regulating member **22** or the second side regulating member **23** allows the other of the first side regulating member **22** and the second side regulating member **23** to move in the opposite direction in conjunction with the rotation.

Document Scooping Shape

[0060] Subsequently, a document scooping shape according to the second exemplary embodiment is described. Since the configuration of the second supporting surface **231** is similar to that in the first exemplary embodiment, only the configuration of the first supporting surface **221** will be described below. Also in the second exemplary embodiment, the first supporting surface **221** of the first side regulating member **22** includes the first scooping portion **223** at the downstream side end of the first supporting surface **221** in the feeding direction FD and at the inner end of the first supporting surface **221** in the width direction W. The first scooping portion **223** is formed to extend to the lower side of the document stacking surface **211**. The inside of the first supporting surface **221** in the width direction W serves as the first inclined portion **225** having a shape that approaches the first regulating surface **222** from the first scooping portion **223** as it extends upstream in the feeding direction FD. The first supporting surface **221** on the upstream side of the first inclined portion **225** serves as a third inclined portion **226** is shaped to extend away from the second regulating surface **232** toward the upstream side in the feeding direction FD. In other words, the inner side of the first supporting surface **221** in the width direction W has a V-shape when viewed from above. A boundary between the first inclined portion **225** and the third inclined portion **226** is located at a position that matches a boundary between the document stacking surface **211** and the movable stacking surface **251**. The third scooping portion **224** is formed at a position at the downstream side end of the movable stacking surface **251** of the third inclined portion **226** (the boundary between the first inclined portion **225** and the third inclined portion **226**).

[0061] The first scooping portion **223** is formed on the first supporting surface **221** of the first side regulating member **22** at the downstream side end of the first supporting surface **221** in the feeding direction FD also in the present exemplary embodiment. The second scooping portion **233** is formed on the second supporting surface **231** of the second side regulating member **23** at the downstream side end of the second supporting surface **231** in the feeding direction FD. This configuration can prevent the document from entering under the first supporting surface **221** and the second supporting surface **231** and being damaged.

[0062] In a case where the document tray **2** includes the movable stacking surface **251** that is movable in the width direction W, there is a possibility that the end of the document gets caught on the boundary between the document stacking surface **211** and the movable stacking surface **251** when the user sets the document. To address this, in the present exemplary embodiment, the third scooping portion **224** is formed at the downstream side end of the third inclined portion **226**. This configuration can prevent a document from getting caught on the boundary between the document stacking surface **211** and the movable stacking surface **251** and being damaged while increasing visibility of a small-sized document and easiness to retrieve the small-sized document.

[0063] The above-mentioned characteristic configuration of the document tray **2** can be applied also to the manual feed tray **137***e*. Providing the first scooping portion **223** and the second scooping portion **233** described above in the pair of side regulating members provided in the manual feed tray **137***e* can prevent a recording medium from entering under the first supporting surface **221** and the second supporting surface **231** and being damaged.

[0064] In the above-mentioned first and second exemplary embodiments, both the first scooping portion **223** and the second scooping portion **233** are respectively disposed at the downstream side

end of the first supporting surface **221** and the downstream side end of the second supporting surface **231**. Alternatively, only the first scooping portion **223** may be disposed at the downstream side end of the first supporting surface **221**, and the second scooping portion **233** may be disposed on the upstream side of the downstream side end of the second supporting surface **231**. Only the first side regulating member **22** may be movable in the width direction, and the second side regulating member **23** may be fixed to be immovable with respect to the document tray **2**.

[0065] According to the present disclosure, it is possible to prevent a small-sized sheet from entering under the side regulating member and being damaged when the side regulating member moves.

[0066] While the present disclosure has been described with reference to exemplary embodiments, it is to be understood that the disclosure is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

[0067] This application claims the benefit of priority from Japanese Patent Application No. 2024-022450, filed Feb. 16, 2024, which is hereby incorporated by reference herein in its entirety.

Claims

1. A sheet conveyance apparatus comprising: a stacking tray having a sheet stacking surface on which a sheet is stacked; a feeding roller configured to feed the sheet stacked on the stacking tray in a feeding direction; and a first side regulating member disposed in the stacking tray to be movable in a width direction orthogonal to the feeding direction and configured to regulate a position of one end of the sheet stacked on the stacking tray in the width direction, the first side regulating member having a first regulating surface to be brought into contact with the one end of the sheet in the width direction, and a first supporting surface configured to, together with the sheet stacking surface, support the sheet, wherein the first side regulating member has, at a downstream side end of the first supporting surface in the feeding direction, a first scooping portion that is configured to scoop the sheet onto the first supporting surface when the first side regulating member moves and that extends from the first supporting surface to below the sheet stacking surface.

2. The sheet conveyance apparatus according to claim 1, wherein an outer edge of the first supporting surface has a first inclined portion that is inclined with respect to the feeding direction so as to approach the first regulating surface as the first inclined portion extends upstream from the first scooping portion in the feeding direction.

3. The sheet conveyance apparatus according to claim 1, wherein the first scooping portion extends from the first supporting surface in the width direction, and is inclined downward as the first scooping portion extends away from the first regulating surface.

4. The sheet conveyance apparatus according to claim 1, further comprising an abutting portion configured to come into contact with a leading end of the sheet stacked on the stacking tray and regulate a movement of the sheet in the feeding direction, wherein a distance from the abutting portion to the first scooping portion in the feeding direction is shorter than a length of a smallest-sized sheet that is conveyable by the sheet conveyance apparatus.

5. The sheet conveyance apparatus according to claim 1, further comprising an abutting portion configured to come into contact with a leading end of the sheet stacked on the stacking tray and regulate a movement of the sheet in the feeding direction, wherein a distance from the abutting portion to the first scooping portion in the feeding direction is shorter than 91 millimeters (mm).

6. The sheet conveyance apparatus according to claim 1, further comprising a second side regulating member disposed in the stacking tray to be movable in the width direction and configured to regulate a position of another end of the sheet stacked on the stacking tray in the width direction, the second side regulating member having a second regulating surface to be

brought into contact with the other end of the sheet in the width direction, and a second supporting surface configured to, together with the sheet stacking surface, support the sheet, wherein the second side regulating member has, on a downstream side end of the second supporting surface in the feeding direction, a second scooping portion that is configured to scoop the sheet onto the second supporting surface when the second side regulating member moves and that extends from the second supporting surface to below the sheet stacking surface.

7. The sheet conveyance apparatus according to claim 6, wherein an outer edge of the first supporting surface has a first inclined portion that is inclined with respect to the feeding direction so as to approach the first regulating surface as the first inclined portion extends upstream from the first scooping portion in the feeding direction, and wherein an outer edge of the second supporting surface has a second inclined portion that is inclined with respect to the feeding direction so as to approach the second regulating surface as the second inclined portion extends upstream from the second scooping portion in the feeding direction.

8. The sheet conveyance apparatus according to claim 6, wherein the first scooping portion extends from the first supporting surface in the width direction, and is inclined downward as the first supporting surface extends away from the first regulating surface, and wherein the second scooping portion extends from the second supporting surface in the width direction, and is inclined downward as the second scooping portion extends away from the second regulating surface.

9. The sheet conveyance apparatus according to claim 6, wherein the first supporting surface has, at a position upstream of the first scooping portion in the feeding direction, a third scooping portion extending below the sheet stacking surface, and wherein the second supporting surface has, at a position upstream of the second scooping portion in the feeding direction, a fourth scooping portion extending below the sheet stacking surface.

10. The sheet conveyance apparatus according to claim 9, wherein the sheet stacking surface has a slit into which the third scooping portion and the fourth scooping portion are fitted so that the third scooping portion and the fourth scooping portion are slidable.

11. The sheet conveyance apparatus according to claim 6, further comprising an abutting portion that is configured to come into contact with a leading end of the sheet stacked on the stacking tray and regulate a movement of the sheet in the feeding direction, wherein a distance from the abutting portion to each of the first scooping portion and the second scooping portion in the feeding direction is shorter than a length of a smallest-sized sheet that is conveyable by the sheet conveyance apparatus.

12. The sheet conveyance apparatus according to claim 6, further comprising an abutting portion that is configured to come into contact with a leading end of the sheet stacked on the stacking tray and regulate a movement of the sheet in the feeding direction, wherein a distance from the abutting portion to each of the first scooping portion and the second scooping portion in the feeding direction is shorter than 91 mm.

13. The sheet conveyance apparatus according to claim 6, further comprising an interlocking mechanism configured to move the first side regulating member and the second side regulating member in conjunction with each other, the interlocking mechanism having a first rack portion in the first side regulating member, a second rack portion in the second side regulating member, and a gear configured to be engaged with the first rack portion and the second rack portion.

14. The sheet conveyance apparatus according to claim 1, further comprising a movable stacking surface configured to be movable in the width direction together with the first side regulating member, and be movable to a supporting position at which the movable stacking surface, together with the sheet stacking surface, supports the sheet and to a retracted position, below the lower side of the sheet stacking surface, at which the movable stacking surface is retracted.

15. The sheet conveyance apparatus according to claim 14, wherein the first supporting surface has, at a position at a downstream side end of the movable stacking surface in the feeding direction, a third scooping portion extending below the sheet stacking surface.

16. The sheet conveyance apparatus according to claim 1, wherein the stacking tray is configured to be pivotable with respect to a main body of the sheet conveyance apparatus, and wherein the first scooping portion is configured to slide to a downstream side end of the stacking tray in the feeding direction.

17. An image reading apparatus, comprising: a stacking tray having a sheet stacking surface on which a sheet is stacked; a feeding roller configured to feed the sheet stacked on the stacking tray in a feeding direction; and a first side regulating member disposed in the stacking tray to be movable in a width direction orthogonal to the feeding direction and configured to regulate a position of one end of the sheet stacked on the stacking tray in the width direction, the first side regulating member having a first regulating surface to be brought into contact with the one end of the sheet in the width direction, and a first supporting surface configured to, together with the sheet stacking surface, support the sheet; and an image reading unit configured to read an image of the sheet fed from the stacking tray, wherein the first side regulating member has, at a downstream side end of the first supporting surface in the feeding direction, a first scooping portion that is configured to scoop the sheet onto the first supporting surface when the first side regulating member moves and that extends from the first supporting surface to below the sheet stacking surface.

18. An image forming apparatus, comprising: a stacking tray having a sheet stacking surface on which a sheet is stacked; a feeding roller configured to feed the sheet stacked on the stacking tray in a feeding direction; and a first side regulating member disposed in the stacking tray to be movable in a width direction orthogonal to the feeding direction and configured to regulate a position of one end of the sheet stacked on the stacking tray in the width direction, the first side regulating member having a first regulating surface to be brought into contact with the one end of the sheet in the width direction, and a first supporting surface configured to, together with the sheet stacking surface, support the sheet; and an image reading unit configured to read an image of the sheet fed from the stacking tray; and an image forming unit configured to form an image on a recording medium based on the image of the sheet read by the image reading unit, wherein the first side regulating member has, at a downstream side end of the first supporting surface in the feeding direction, a first scooping portion that is configured to scoop the sheet onto the first supporting surface when the first side regulating member moves and that extends from the first supporting surface to below the sheet stacking surface.