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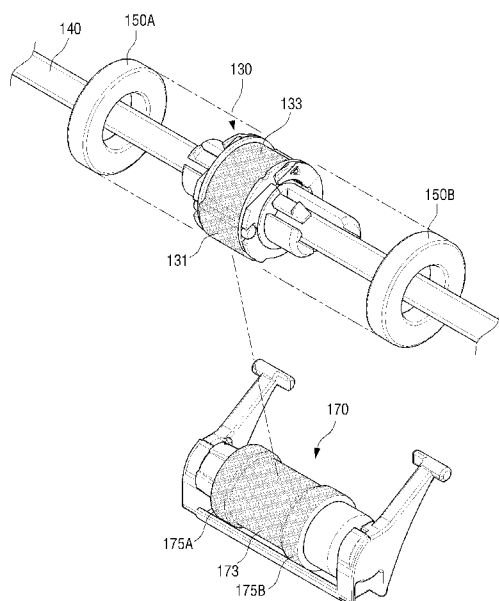
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(54) **Title:** PAPER FEEDING DEVICE FOR PREVENTING PAPER SLIP AND IMAGE FORMING APPARATUS HAVING THE SAME

FIG. 5



(57) **Abstract:** An image forming apparatus is provided. The image forming apparatus includes a pick-up roller including a paper contact area in contact with paper only in one part during rotation, an idle roller disposed on both sides of the pick-up roller, the idle roller to guide conveyance of the paper, and a retard roller including two end areas and a central area, the central area facing the pick-up roller and both end areas facing the idle roller, wherein both end areas protrude from the central area.

PAPER FEEDING DEVICE FOR PREVENTING PAPER SLIP AND IMAGE FORMING APPARATUS HAVING THE SAME

BACKGROUND

[0001] An image forming apparatus is an apparatus for generating, printing, receiving, and transmitting image data. Representative examples include a printer, a copier, a facsimile, a scanner, and a multi-function printer that integrally implements these functions.

[0002] An image forming apparatus includes a paper-feeding device which supplies paper to a printing device provided therein. Paper accommodated in the paper-feeding device may be picked up by a pick-up roller and conveyed to a print engine along a conveying path.

BRIEF DESCRIPTION OF DRAWINGS

[0003] The above and other aspects, features, and advantages of certain examples of the present disclosure will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:

[0004] FIG. 1 is a schematic view illustrating an image forming apparatus according to an example;

[0005] FIG. 2 is a perspective view illustrating a paper-feeding device according to an example;

[0006] FIG. 3 is a side view illustrating a paper-feeding device according to an example;

[0007] FIG. 4 is a cross-sectional view taken along line IV-IV shown in FIG. 2 according to an example;

[0008] FIG. 5 is an exploded perspective view illustrating a pick-up roller, an idle roller, and a retard roller according to an example;

[0009] FIG. 6A is a front view illustrating a pick-up roller and a retard roller during a pick-up operation of the paper-feeding device according to an example;

[0010] FIG. 6B is a front view illustrating a pick-up roller and a retard roller

during a pick-up standby operation of the paper-feeding device according to an example; and

[0011] FIG. 7 is a schematic view illustrating an image reading apparatus according to an example.

[0012] Throughout the drawings, it should be noted that like reference numbers are used to depict the same or similar elements, features, parts, components, and structures.

DESCRIPTION OF EXAMPLES

[0013] Hereinafter, various examples will be described with reference to the accompanying drawings. The examples to be described below may also be modified in various forms. In order to more clearly describe features of the examples, a detailed description of matters which are well known to those skilled in the art to which the examples pertain will be omitted.

[0014] In the present specification, a case in which any component is described as "connected" with another component includes a case in which any component is "directly connected" to another component and a case in which any component is "connected to another component while having the other component interposed therebetween." In addition, a case in which any component "comprises" another component means that any component may further comprise other components, and not exclude other components, unless explicitly described to the contrary.

[0015] The expression "image forming job" as used herein may refer to various jobs related with an image, such as, formation of an image or generation/storage/transmission of image files (e.g., printing, copying, scanning, or faxing), and the expression "job" as used herein may refer to not only the image forming job, but also a series of processes required for performance of the image forming job.

[0016] In addition, an "image forming apparatus" refers to a device for printing print data generated from a terminal such as a computer on a recoding paper. Examples of the image forming apparatus described above may include a

copier, a printer, a facsimile, a scanner, a multi-function printer (MFP) of complexly implementing functions thereof through a single device, and the like. The image forming apparatus may refer to any device capable of performing an image forming task, such as the copier, the printer, the scanner, the fax machine, the multi-function printer (MFP), or a display.

[0017] Further, the expression "hard copy" as used herein may refer to an operation of outputting an image on a recording medium such as paper, and the expression "soft copy" as used herein may refer to an operation of outputting an image to a display device such as a TV, a monitor, or the like, or to a memory.

[0018] The expression "content" as used herein may refer to any type of data as a subject of the image forming job, such as a picture, an image, a document file, or the like.

[0019] The expression "printing data" as used herein may refer to data converted into a format that can be printed at the printer. Meanwhile, when the printer supports direct printing, the file itself may be the printing data.

[0020] The expression "user" as used herein may refer to a person who performs a manipulation related with the image forming job using the image forming apparatus or a device connected to the image forming apparatus by a wired or wireless connection. Further, the expression "manager" as used herein may refer to a person who has an authority to access all the functions and systems of the image forming apparatus. The "manager" and the "user" may refer to the same person.

[0021] FIG. 1 is a schematic view illustrating an image forming apparatus according to an example.

[0022] Referring to FIG. 1, an image forming apparatus 1 may include a paper-feeding device 100, a print engine 10, and a discharging device 30.

[0023] The paper-feeding device 100 may accommodate paper P and supply the paper P to the print engine 10. The discharging device 30 may externally discharge the paper P which passes through the print engine 10. A description of the paper-feeding device 100 will be provided below.

[0024] The print engine 10 may form an image on the paper P supplied from the paper-feeding device 100. The print engine 10 may form an image on

the paper P using an electro-photographic method.

[0025] The print engine 10 may include a photoconductive drum 11, a charger 12, an exposure device 13, a developing device 14, a transfer device 15, and a fixing device 18. Although the print engine 10 and the paper-feeding device 100 are shown as being different in configuration, the paper-feeding device 100 may be a configuration in the print engine 10.

[0026] An electrostatic latent image may be formed on the photoconductive drum 11. In more detail, an electrostatic latent image may be formed on the photoconductive drum 11 by the operations of the charger 12 and the exposure device 13, which will be described below. The photoconductive drum 11 may be referred to as an image forming medium, a photoconductive belt, etc. depending on its form.

[0027] An example configuration of the print engine 10 corresponding to only one color will be described for convenience of explanation. However, the print engine 10 may include a plurality of photoconductive drums 11, a plurality of chargers 12, a plurality of exposure devices 13, a plurality of developing devices 14 and an intermediate transfer belt (not shown) corresponding to a plurality of colors.

[0028] The charger 12 may charge the surface of the photoconductive drum 11 to a uniform potential. The charger 12 may be implemented in the form of a corona charger, a charging roller, a charging brush, or the like.

[0029] The exposure device 13 may form an electrostatic latent image on the surface of the photoconductive drum 11 by changing a surface potential of the photoconductive drum 11 according to image information to be printed. For example, the exposure device 13 may form an electrostatic latent image by irradiating light modulated according to the image information to be printed to the photosensitive drum 11. The exposure device 13 of this type may be referred to as a light scanning device or the like, and a light emitting diode (LED) may be used as a light source.

[0030] The developing device 14 may include a developer therein and supply the developer (e.g., toner) to the electrostatic latent image to develop the electrostatic latent image into a visible image. The developing device 14 may

include a developing roller 17 which supplies the developer to the electrostatic latent image. For example, the developer may be supplied from the developing roller 17 to the electrostatic latent image formed on the photoconductive drum 11 by a developing electric field formed between the developing roller 17 and the photoconductive drum 11.

[0031] The visible image formed on the photosensitive drum 11 may be transferred to a printing paper by the transfer device 15 or the intermediate transfer belt (not shown). The transfer device 15 may transfer the visible image to the printing paper by using, for example, an electrostatic transfer method. The visible image may be attached to the printing paper by electrostatic attraction.

[0032] The fixing device 18 may fix the visible image on the printing paper by applying heat or pressure to the visible image on the printing paper. A printing job may be completed by a series of processes.

[0033] The paper-feeding device 100 may accommodate the paper P, and include a tray 110, a pick-up roller 130, a retard roller 170, and a conveying roller 117 to provide the paper P to the print engine 10.

[0034] The tray 110 may accommodate at least one piece of paper P, and the tray 110 may accommodate a predetermined number of pieces of paper P.

[0035] The tray 110 may be elastically pressed in a direction of the pick-up roller 130 so as to bring the loaded paper P into contact with the pick-up roller 130. A pressing member 111 may be connected to the tray 110 so as to press the tray 110 in the direction of the pick-up roller 130. As an example, one end of the pressing member 111 may be connected to the tray 110 to press the tray 110 in the direction of the pick-up roller 130.

[0036] The pressing member 111 may be, for example, a compression coil spring, but is not limited thereto. The pressing member 111 could be any type as long as it can bring the tray 110 toward the pick-up roller 130.

[0037] The pick-up roller 130 may pick up the paper P loaded in the tray 110. The retard roller 170 may be disposed in engagement with the pick-up roller 130 to prevent or retard conveyance of the paper P picked up from the tray 110.

[0038] The retard roller 170 may allow only one piece of the paper P to be conveyed to the print engine 10 by separating paper when two or more of pieces

of paper are conveyed while the pick-up roller 130 is pressed.

[0039] The retard roller 170 may apply a frictional force to a rear surface of the paper P conveyed between the retard roller 170 and the pick-up roller 130 in a direction opposite to a paper-feeding direction in order to prevent or retard conveyance.

[0040] The retard roller 170 may be elastically pressed in the direction of the pick-up roller 130 by an elastic member 171 so that the paper P conveyed between the retard roller 170 and the pick-up roller 130 is in contact with the pick-up roller 130.

[0041] The paper P picked up by the pick-up roller 130 and the retard roller 170 may be conveyed to a conveying roller 117. The conveying roller 117 may be formed of a pair of rollers facing each other and rotating at the same time, and may convey the paper P picked up by the pick-up roller 130 to the print engine 10.

[0042] The paper-feeding device 100 may prevent slippage of the paper P passing through the pick-up roller 130 and the retard roller 170, and minimize partial abrasion of the retard roller 170. An example configuration of the paper-feeding device 100 to achieve this purpose will be described below.

[0043] FIG. 2 is a perspective view illustrating a paper-feeding device according to an example.

[0044] Referring to FIG. 2, a paper-feeding device 100 may include a pick-up roller 130, idle rollers 150A and 150B, and a retard roller 170.

[0045] The pick-up roller 130 may be rotatably mounted on the tray 110. The pick-up roller 130 may be mounted on a shaft 140 that rotates by receiving power from a driving motor (not shown). The pick-up roller 130 may rotate by the driving motor (not shown), and separate and convey paper at the top of the paper P loaded in the tray 110.

[0046] The pick-up roller 130 may be coupled to the central area of the shaft 140 to rotate together. The shaft 140 may be bent to have a [shape, that is, the shape of a U or a square with an open side.

[0047] The pick-up roller 130 may pick up paper loaded in the tray 110, and include a pair of idle rollers 150A and 150B mounted on either side of the pick-up

roller 130 to freely rotate.

[0048] As will be described in more detail with reference to FIGS. 4 and 5, the pick-up roller 130 may include a paper contact area 131 which contacts paper in one part during rotation. The paper contact area 131 may protrude outwardly from a radial direction of the idle rollers 150A and 150B. In other words, an external diameter of the paper contact area 131 may be greater than external diameters of the idle rollers 150A and 150B.

[0049] Accordingly, when the paper contact area 131 is in contact with the paper P, the idle rollers 150A and 150B may be spaced apart from the paper P, but when the paper contact area 131 is not in contact with the paper P, the idle rollers 150A and 150B may be in contact with the paper P. An example structure and operation of the pick-up roller 130 will be described below.

[0050] The idle rollers 150A and 150B may press the retard roller 170 with a predetermined pressure when the paper P passes on the retard roller 170. Accordingly, only the paper P at the top of the paper loaded in the tray 110 may be picked up and conveyed.

[0051] A pair of the idle rollers 150A and 150B may be coupled to the shaft 140 to be idly rotated. The idle rollers 150A and 150B may rotate independently of the rotation of the shaft 140. The idle rollers 150A and 150B may idly rotate with respect to the shaft 140 to be in contact with the paper P to thereby guide conveyance of the paper P toward the conveying roller 117.

[0052] The idle rollers 150A and 150B may have a smaller diameter than that of the pick-up roller 130 by a predetermined amount so that a feeding force applied onto the paper P could be more intense when the pick-up roller 130 picks up paper.

[0053] The idle rollers 150A and 150B may have a circular shape. A power transmission member 190 may be coupled to one side of the shaft 140 to rotate the shaft 140. The power transmission member 190 will be described in more detail with reference to FIG. 3 below.

[0054] The paper-feeding device 100 may accommodate the paper P, and include the tray 110 rotatable in upward and downward directions with respect to the pick-up roller 130. The paper-feeding device 100 may include a pair of cams

143 coupled to both sides of the shaft 140 by having the pick-up roller 130 therebetween and rotating together with the pick-up roller 130.

[0055] The pair of cams 143 may downwardly rotate the tray 110 by pressing both side walls of the tray 110 in a specific part during the rotation of the shaft 140. When the pair of cams 143 is rotated and spaced apart from the tray 110, the tray 110 may be upwardly rotated by the pressing member 111 (see FIG. 1).

[0056] FIG. 3 is a side view illustrating a paper-feeding device according to an example.

[0057] Referring to FIG. 3, a power transmission member 190 may include a solenoid 191, a pick-up gear 195 and a driving gear 197.

[0058] The pick-up gear 195 for rotating the shaft 140 may be coupled to one end of the shaft 140. The pick-up gear 195 may be engaged with the driving gear 197 connected to a driving motor (not shown).

[0059] The pick-up gear 195 may consist of a tooth portion 195B engaged with the driving gear 197 and a cutting portion 195A which releases the engagement with the driving gear 197.

[0060] The pick-up roller 130 needs to stop for a predetermined time after rotating by a predetermined amount until the next paper is supplied for feeding the paper P one by one. Therefore, to control the pick-up roller 130, the paper-feeding device 100 may include the solenoid 191 for controlling the rotation of the pick-up gear 193 coupled to the pick-up roller 130 based on an axis.

[0061] The solenoid 191 may be coupled to one side of the pick-up gear 195. The solenoid 191 may consist of an electromagnet 192, a movable body 193, and a spring 194.

[0062] When power is not supplied to the solenoid 191, the movable body 193 may be swung by the spring 194, and may protrude outwardly from the electromagnet 192, and a front end portion of the protruding movable body 193 may be locked by the rotating pick-up gear 195. The cutting portion 195A of the pick-up gear 195 may be adjacent to the driving gear 197, and the engagement of the pick-up gear 195 and the driving gear 197 may be released by the cutting portion 195A, so that the rotation of the pick-up gear 195 and the shaft 140 may

be stopped.

[0063] The paper contact area 131 of the pick-up roller 130 may stop at a position before it contacts the paper P.

[0064] When power is applied to the solenoid 191 again, the movable body 193 may be pulled toward the electromagnet 192 by a force of the electromagnet 192, so that the movable body 193 may be deviated from the pick-up gear 195. The tooth portion 195B of the pick-up gear 195 may rotate by being engaged with the driving gear 197. Accordingly, the pick-up gear 195 and the shaft 140 may rotate.

[0065] In this case, the paper contact area 131 of the pick-up roller 130 may rotate in contact with the paper P, and pick up the paper P while being in contact with the paper P during the rotation.

[0066] FIG. 4 is a cross-sectional view taken along line IV-IV shown in FIG. 2 according to an example, and FIG. 5 is an exploded perspective view illustrating a pick-up roller, an idle roller, and a retard roller according to an example.

[0067] Referring to FIGS. 4 and 5, the pick-up roller 130 may rotate by a predetermined amount in order to feed the paper P one by one and may not pick-up the paper P for a predetermined time until the next paper is fed. Therefore, the pick-up roller 130 may include the paper contact area 131 in contact with the paper P only in one part during the rotation thereof.

[0068] The pick-up roller 130 may include the paper contact area 131 and a non-contact area 133. The remaining area outside the paper contact area 131 may be the non-contact area 133 which is not in contact with the paper P during the rotation of the pick-up roller 130. The pick-up roller 130 may be formed so that the non-contact area 133 may be recessed toward the shaft 140.

[0069] The paper contact area 131 may protrude outwardly from a radial direction of the idle rollers 150A and 150B, and the non-contact area 133 may be recessed inwardly from the radial direction of the idle rollers 150A and 150B. An external diameter of the paper contact area 131 may be greater than external diameters of the idle rollers 150A and 150B, and an external diameter of the non-contact area 133 may be smaller than the external diameters of the idle rollers 150A and 150B.

[0070] During the rotation of the pick-up roller 130, a frictional force may occur since the paper contact area 131 is in contact with the paper P, and thus the paper P may be conveyed toward the conveying roller 117. The external diameter of the paper contact area 131 may be greater than the external diameters of the idle rollers 150A and 150B. Thus, when the paper P is picked up in the paper contact area 131, the idle rollers 150A and 150B may be spaced apart from the paper P during the rotation.

[0071] The pick-up roller 130 may be separated from the paper P in the non-contact area 133, and the idle rollers 150A and 150B may be in contact with the paper P. The paper P separated from the pick-up roller 130 may be continuously conveyed by the conveying roller 117, so that the idle rollers 150A and 150B may idle due to a frictional force with paper.

[0072] At the time of paper pick-up, the paper P may contact the pick-up roller 130 and pass through between the rotating retard roller 170 and the pick-up roller 130.

[0073] The retard roller 170 may press the paper P picked up by the force centrally applied to the pick-up roller 130 by the elastic member 171 in a normal direction of a surface of the pick-up roller 130. By doing so, the paper P passing through the pick-up roller 130 and the retard roller 170 may be in close contact with the surface of the pick-up roller 130 and stably conveyed in a direction of the conveying roller 117 without slippage with the pick-up roller 130.

[0074] At the time of paper pick-up standby, the paper P may be separated from the pick-up roller 130. The paper P may be in contact with the idle rollers 150A and 150B and may pass through the rotating retard roller 170 and the idle rollers 150A and 150B.

[0075] However, since the paper P is separated from the pick-up roller 130 and only in contact with the idle rollers 150A and 150B, a close contact area of the paper P (a frictional force) may be reduced, so that the paper P may slide. A frictional force between the paper P and the idle rollers 150A and 150B may be smaller than a frictional force of the paper P and the retard roller 170, so that paper slippage may occur between the paper P and the pick-up roller 130.

[0076] Due to slippage of the paper P, the retard roller 170 may be worn

due to the frictional force with the paper P.

[0077] The retard roller 170 may include end areas 175A and 175B protruding from a central area 173 to prevent slippage of the paper P, and partial abrasion of the retard roller 170.

[0078] The central area 173 of the retard roller 170 may be concavely formed with respect to both end areas 175A and 175B. In other words, an external diameter of the central area 173 of the retard roller 170 may be smaller than external diameters of both end areas 175A and 175B.

[0079] Since the external diameters of both end areas 175A and 175B of the retard roller 170 are greater than the external diameter of the central area 173, a pressing force by which the retard roller 170 presses the pick-up roller 130 may be increased. As the external diameter of the retard roller 170 is increased, the pressing force of the retard roller 170 may be increased.

[0080] The slippage of the paper P may be affected by a magnitude of the pressing force applied to the paper P. Therefore, the retard roller 170 may press the pick-up roller 130 by a greater pressing force to prevent slippage of the paper P passing through the retard roller 170 and the pick-up roller 130. In addition, by reducing the chances of slippage of the paper P, the retard roller 170 may be less worn by paper slippage.

[0081] The central area 173 of the retard roller 170 may have a width corresponding to that of the pick-up roller 130 and may have a greater width than the pick-up roller 130. Accordingly, the central area 173 of the retard roller 170, which is concavely formed, may partly accommodate the paper contact area 131 of the pick-up roller 130.

[0082] Both end areas 175A and 175B of the retard roller 170 may have widths respectively corresponding to the idle rollers 150A and 150B and may have a width greater than the idle rollers 150A and 150B. Both end areas 175A and 175B may have a width outwardly extending from the idle rollers 150A and 150B.

[0083] At the time of paper pick-up, a difference d_1 (see FIG. 6B) in external diameters of the central area 173 of the retard roller 170 and both end areas 175A and 175B may be equal to or smaller than a difference d_2 in external diameters of the paper contact area 131 of the pick-up roller 130 and the idle

rollers 150A and 150B.

[0084] An outer circumferential surface of the central area 173 of the retard roller 170 may be tapered by a predetermined angle by allowing boundaries between both end areas 175A and 175B to have an increasing external diameter. The boundaries between the central area 173 and both end areas 175A and 175B may be formed to be symmetrical to each other at the same angle and height.

[0085] The central area 173 of the retard roller 170 may have boundaries between both end areas 175A and 175B at a right angle.

[0086] The paper contact area 131, which is one part of the pick-up roller 130 that picks up paper, may be disposed to be accommodated in the central area 173 of the retard roller 170, and another part of the pick-up roller 130 may be disposed to be spaced apart from the retard roller 170.

[0087] The paper contact area 131 may be disposed in the central area 173 at the time of paper pick-up, and disposed on the opposite side to the retard roller 170 at the time of pick-up standby. In this case, the non-contact area 133 may be disposed to face the retard roller 170.

[0088] Example operations of the paper feeding device 100 at a time of paper pick-up and at a time of pick-up standby will be described below with reference to FIGS. 6A and 6B.

[0089] FIG. 6A is a front view illustrating a pick-up roller and a retard roller during a pick-up operation of the paper-feeding device according to an example.

[0090] Referring to FIG. 6A, at the time of paper pick-up, the pick-up roller 130 may be disposed so that the paper contact area 131 may face the retard roller 170. At the time of paper pick-up, the paper contact area 131 of the pick-up roller 130 may rotate to be accommodated in the central area 173 of the retard roller 170. The paper contact area 131 may be disposed to be accommodated in the central area 173 of the retard roller 170. The pick-up roller 130 and the retard roller 170 may contact the paper contact area 131 and the central area 173 of the retard roller 170 by having the paper P there-between.

[0091] The paper contact area 131 protruding from the external diameters of the idle rollers 150A and 150B may be pressed by the central area 173 of the retard roller 170. The paper P between the paper contact area 131 and the central

area 173 of the retard roller 170 may be conveyed toward the conveying roller 117 due to a frictional force generated by the contact between the paper contact area 131 and the central area 173 of the retard roller 170 during the rotation of the pick-up roller 130.

[0092] The retard roller 170 may contact the pick-up roller 130 by having the paper P therebetween, so that the retard roller 170 may rotate in a paper conveying direction by the rotation of the paper contact area 131.

[0093] The external diameter of the paper contact area 131 may be greater than the external diameters of the idle rollers 150A and 150B. Therefore, when paper is picked-up while the paper contact area 131 is in contact with the central area 173 of the retard roller 170, the idle rollers 150A and 150B may be spaced apart from the paper P during the rotation.

[0094] FIG. 6B is a front view illustrating a pick-up roller and a retard roller during a pick-up standby operation of the paper-feeding device according to an example.

[0095] Referring to FIG. 6B, at the time of pick-up standby, both end areas 175A and 175B of the retard roller 170 may be in contact with the idle rollers 150A and 150B by having the paper between the retard roller 170 and the idle rollers 150A and 150B. In more detail, a left side area 175A of the retard roller 170 may be in contact with the idle roller 150A on the left side, and a right side area 175B of the retard roller 170 may be in contact with the idle roller 150B on the right side.

[0096] At the time of pick-up standby, the paper contact area 131 may be disposed on the opposite side to the retard roller 170, so that the non-contact area 133 may be disposed to face the retard roller 170. There could be a space between the pick-up roller 130 and the retard roller 170, which is surrounded by the central area 173 of the retard roller 170 and the non-contact area 133 of the pick-up roller 130.

[0097] At the time of pick-up standby, the paper P passing through the pick-up roller 130 and the retard roller 170 may be spaced apart from the central area 173 of the retard roller 170. In this case, there could be a space between the paper P and the retard roller 170 by the central area 173 of the retard roller 170, which is concavely formed. In other words, at the time of pick-up standby, since

the paper P contacts only both end areas 175A and 175B of the retard roller 170 and the idle rollers 150A and 150B, the abrasion of the retard roller 170 may be minimized even if paper slippage occurs.

[0098] Further, since both end areas 175A and 175B of the retard roller 170 have a greater external diameter than the central area 173, a pressing force applied to the pick-up roller 130 by the retard roller 170 may be increased, thereby preventing the slippage of the paper P.

[0099] FIG. 7 is a schematic view illustrating an image reading apparatus according to an example.

[00100] The retard roller 170 of the paper-feeding device 100 as described in FIGS. 1 to 6 may be applied to an image reading apparatus 1000.

[00101] Referring to FIG. 7, the image reading apparatus 1000 may include an image sensor 1010, a document conveying device 1100, and a processor (not shown).

[00102] The image sensor 1010 may read a document. In more detail, the image sensor 1010 may read image information of a document from light reflected from the document.

[00103] The document conveying device 1100 may automatically provide a plurality of pieces of document to the image sensor 1010.

[00104] The processor may control each constituent element in the image reading apparatus 1000. In various examples, the processor may be embodied as a central processing unit (CPU), an application specific integrated circuit (ASIC), of the like and may detect whether a scan command is received from a user.

[00105] The document conveying device 1100 may convey a document S loaded in a tray 1110 along a document conveying path. The document conveying device 1100 may include a pick-up roller 1130, a retard roller 1170, and a plurality of conveying rollers 1117.

[00106] The pick-up roller 1130 and the retard roller 1170 may have substantially the same structure as the pick-up roller 130 and the retard roller 170 of the image forming apparatus 1 according to an example.

[00107] A pair of idle rollers may be mounted on both sides of the pick-up

roller 1130 to freely rotate. The pick-up roller 1130 may have a document contact area contacting the document S in one part during the rotation. The document contact area may protrude outwardly from a radial direction of the idle rollers.

[00108] At the time of document S pick-up, the pick-up roller 1130 may contact the central area of the retard roller 1170 by having the document S there-between. The document contact area of the pick-up roller 1130 may contact the central area of the retard roller 1170, and the idle roller may be spaced apart from both end areas of the retard roller 1170.

[00109] At the time of document S pick-up standby, only the idle roller may contact both end areas of the retard roller 1170 with the document S there-between. The non-contact area of the pick-up roller 1130 may be spaced apart from the central area of the retard roller 1170.

[00110] At the time of pick-up standby, since the document S contacts only both end areas of the retard roller and the idle rollers, the abrasion of the retard roller 1170 may be minimized even if document slippage occurs.

[00111] In addition, since both end areas of the retard roller have a greater external diameter than a central area, a pressing force of the retard roller 1170 applied to the pick-up roller 1130 may be increased, thereby preventing slippage of the document S.

[00112] In FIG. 7, a document conveying path is illustrated as a single path. However, the present disclosure is not limited thereto. Rather, the document conveying device 1100 may have two or more document conveying paths. As an example, the document conveying device 1100 may include a document conveying path for single-side scan and a document conveying path for double-side scan.

[00113] Although examples have been shown and described, it will be appreciated by those skilled in the art that changes may be made to these examples without departing from the principles and spirit of the present disclosure. Accordingly, the scope of the present disclosure is not construed as being limited to the described examples, but is defined by the appended claims as well as equivalents thereto.

WHAT IS CLAIMED IS:

1. A paper-feeding device, comprising:
a pick-up roller including a paper contact area in contact with paper in one part during rotation;
an idle roller disposed on both sides of the pick-up roller, the idle roller to guide conveyance of the paper; and
a retard roller including two end areas and a central area, the central area facing the pick-up roller and both end areas facing the idle roller, wherein both end areas protrude from the central area.
2. The paper-feeding device as claimed in claim 1,
wherein the central area has a width corresponding to a width of the pick-up roller, and
wherein each end area has a width corresponding to a width of the idle roller.
3. The paper-feeding device as claimed in claim 1, wherein an external diameter of the central area is less than an external diameter of both end areas.
4. The paper-feeding device as claimed in claim 1, wherein an external diameter of the paper contact area is greater than an external diameter of the idle roller.
5. The paper-feeding device as claimed in claim 1, wherein the paper contact area is disposed to be accommodated in the central area of the retard roller, and another part of the pick-up roller is disposed to be spaced apart from the retard roller.
6. The paper-feeding device as claimed in claim 1, wherein the paper contact area has the one part disposed in the central area at a time of paper pick-up, and disposed on an opposite side to the retard roller at a time of pick-up standby.

7. The paper-feeding device as claimed in claim 1, wherein a difference between an external diameter of the central area of the retard roller and an external diameter of both end areas is less than or equal to a difference between an external diameter of the paper contact area and an external diameter of the idle roller.

8. The paper-feeding device as claimed in claim 1, further comprising:
a shaft to which the pick-up roller is fixed; and
a solenoid to selectively rotate the shaft.

9. The paper-feeding device as claimed in claim 8, wherein the idle roller is supported by the shaft, and idly rotates independently of rotation of the shaft.

10. The paper-feeding device as claimed in claim 8, wherein the shaft has a U-shaped cross-section, and is connected to a driver to rotate in one direction.

11. The paper-feeding device as claimed in claim 1, wherein the paper contact area is formed of a rubber material for applying a frictional force to paper.

12. The paper-feeding device as claimed in claim 1, wherein the pick-up roller is disposed upstream of the retard roller.

13. The paper-feeding device as claimed in claim 1, wherein the retard roller faces the paper conveyed between the pick-up roller and the retard roller and retards conveyance of the paper.

14. An image forming apparatus comprising:
a paper-feeding device to accommodate paper;
a print engine to form an image on paper provided from the paper-feeding

device; and

a discharging device to discharge paper on which an image is formed by the print engine,

wherein the paper-feeding device comprises:

a pick-up roller including a paper contact area in contact with paper in one part during rotation;

an idle roller disposed on both sides of the pick-up roller, the idle roller to guide conveyance of the paper; and

a retard roller including two end areas and a central area, the central area facing the pick-up roller and both end areas facing the idle roller, both end areas protruding from the central area.

15. An image reading apparatus comprising:

a document conveying device to convey a document to a document conveying path;

an image sensor to scan the document; and

a processor to control the document conveying device and the image sensor to scan the document,

wherein the document conveying device comprises:

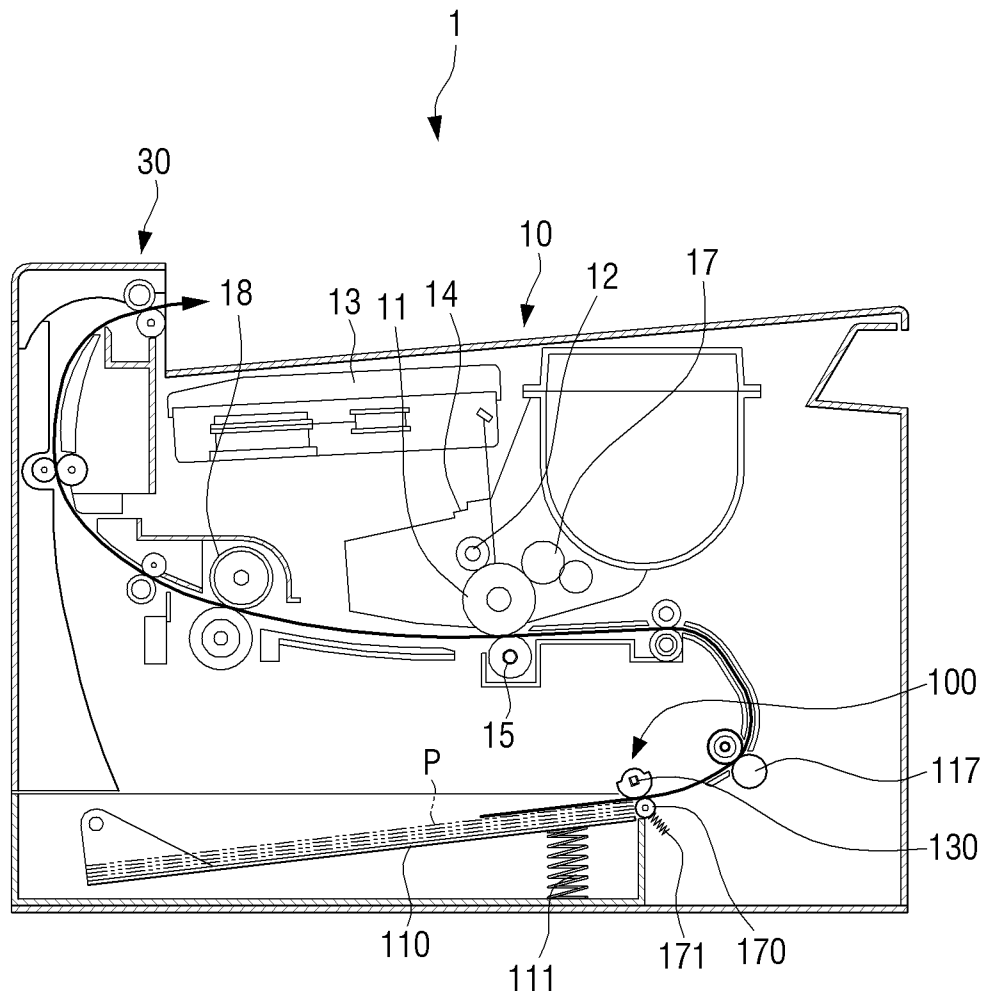
a pick-up roller including a document contact area in contact with document in one part during rotation;

an idle roller disposed on both sides of the pick-up roller, the idle roller to guide conveyance of the document; and

a retard roller including two end areas and a central area, the central area facing the pick-up roller and both end areas facing the idle roller, both end areas protruding from the central area.

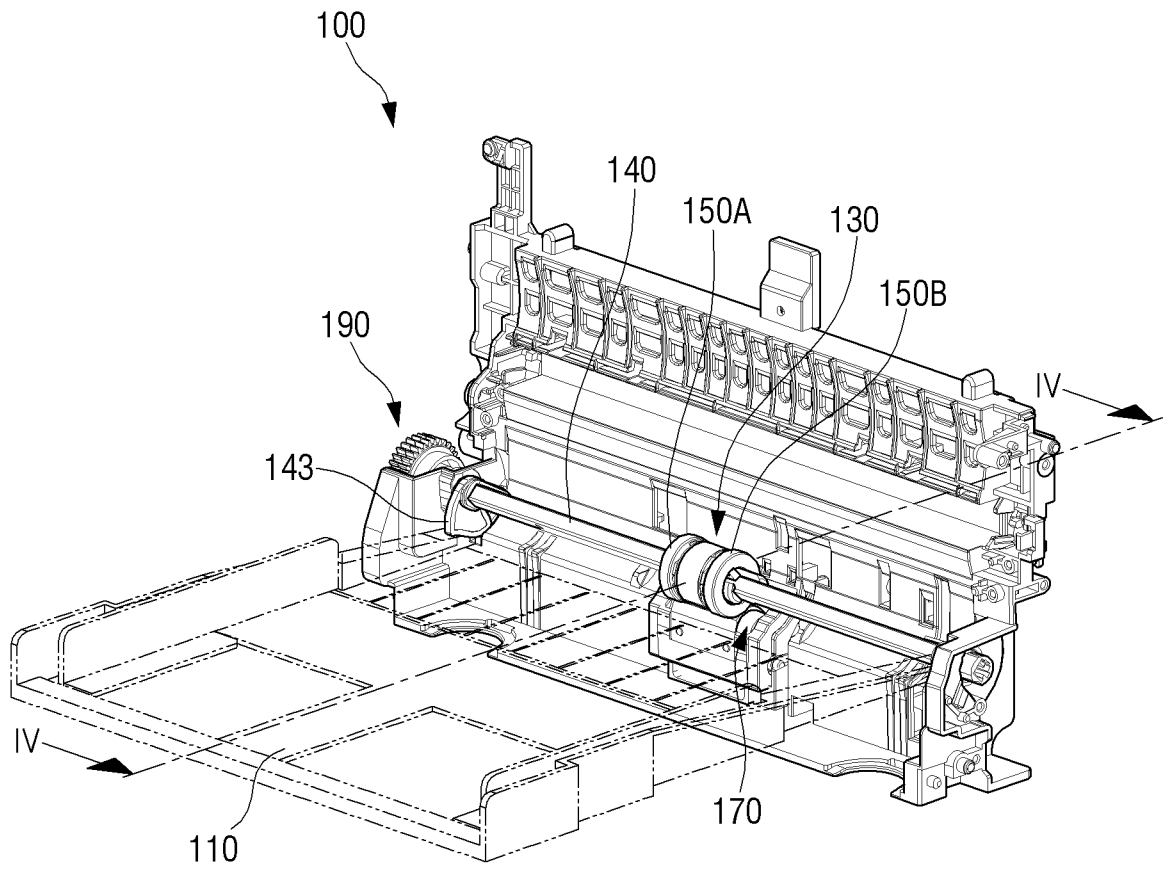
1/8

FIG. 1



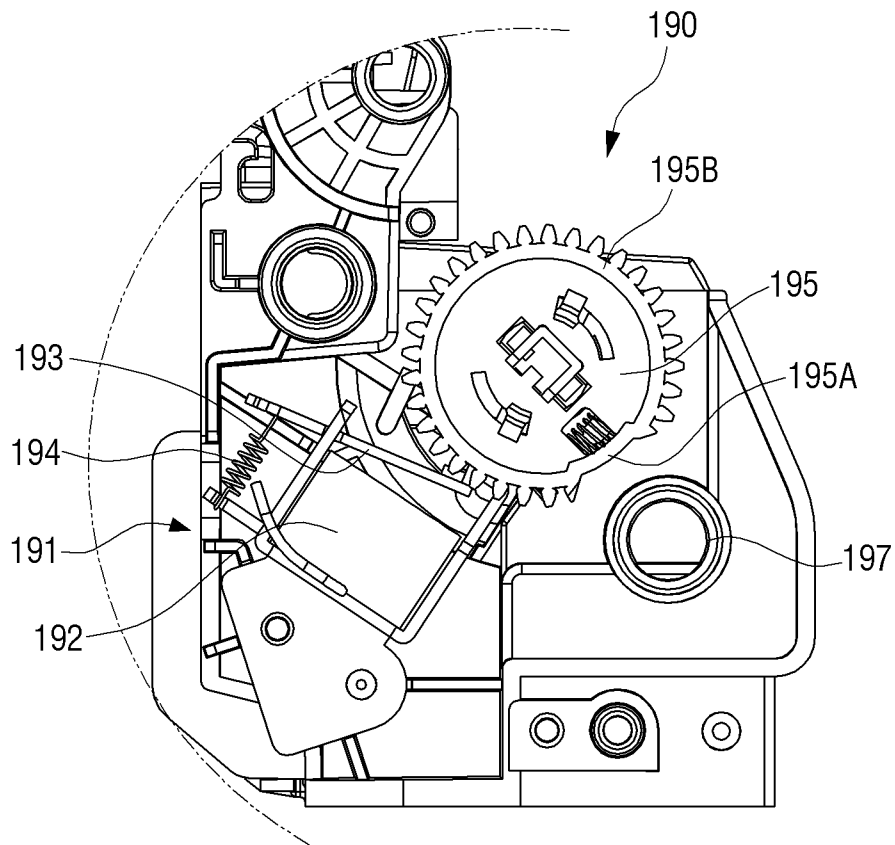
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FIG. 2



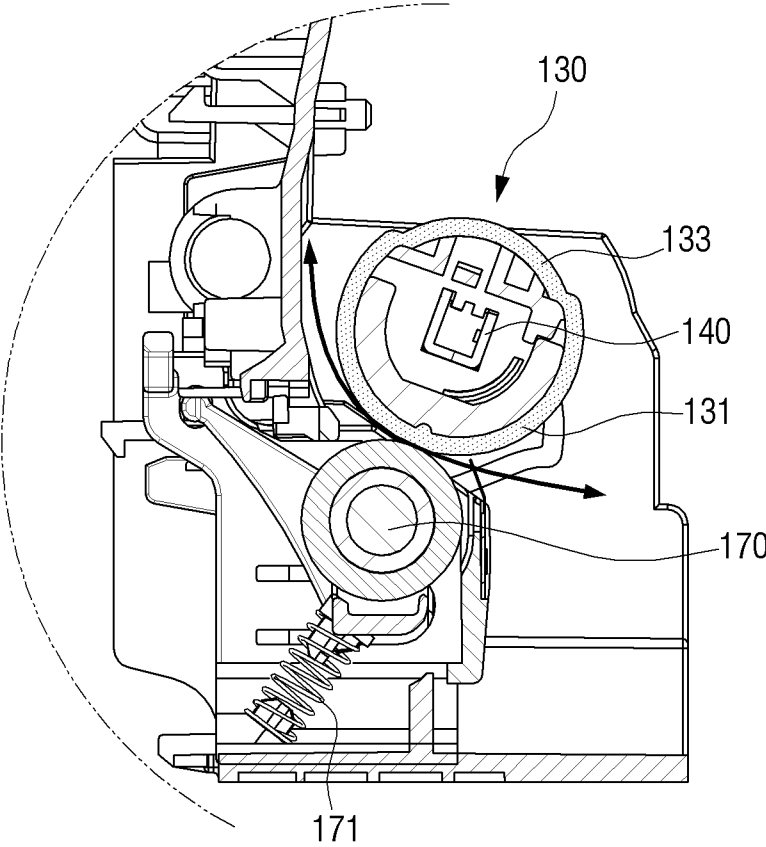
3/8

FIG. 3



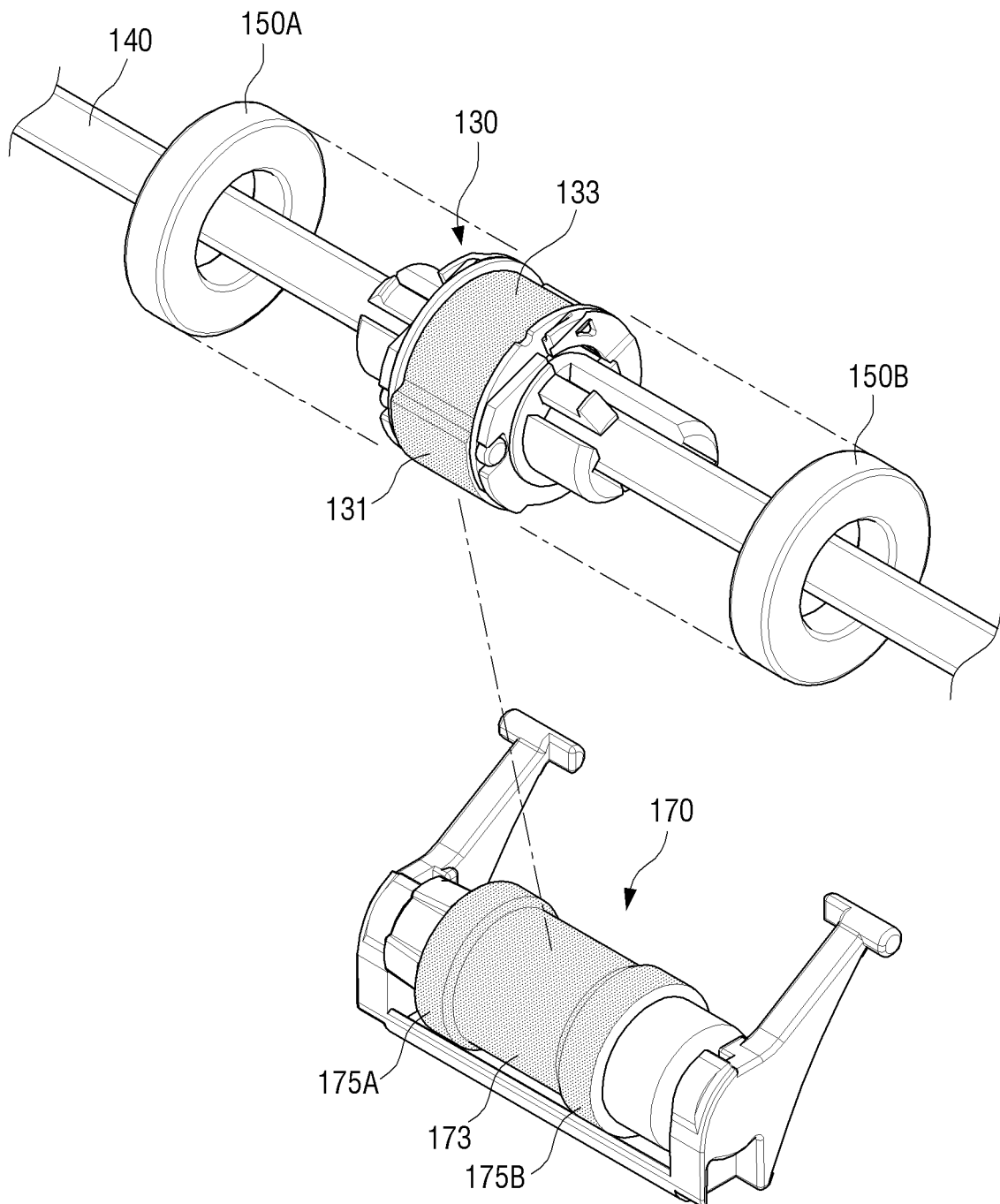
4/8

FIG. 4



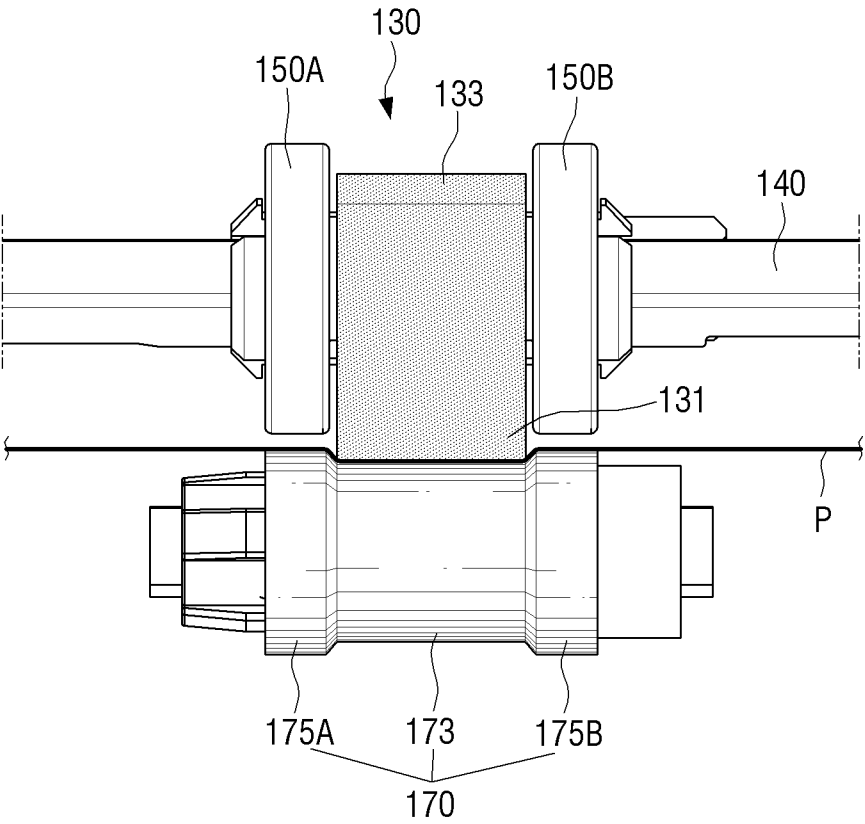
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FIG. 5



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FIG. 6A



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FIG. 6B

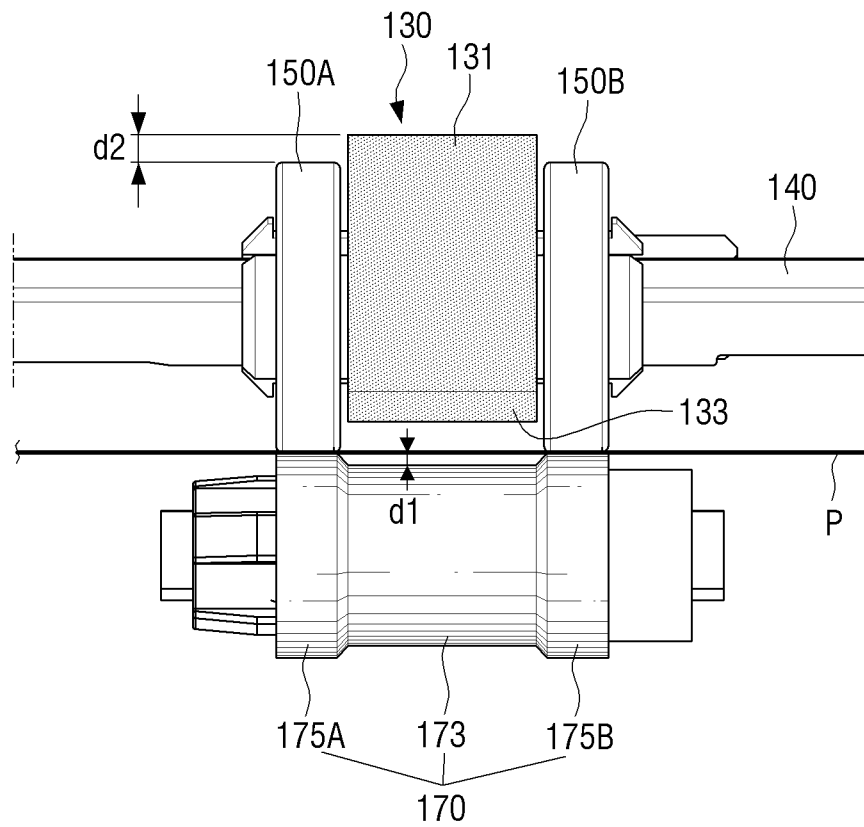
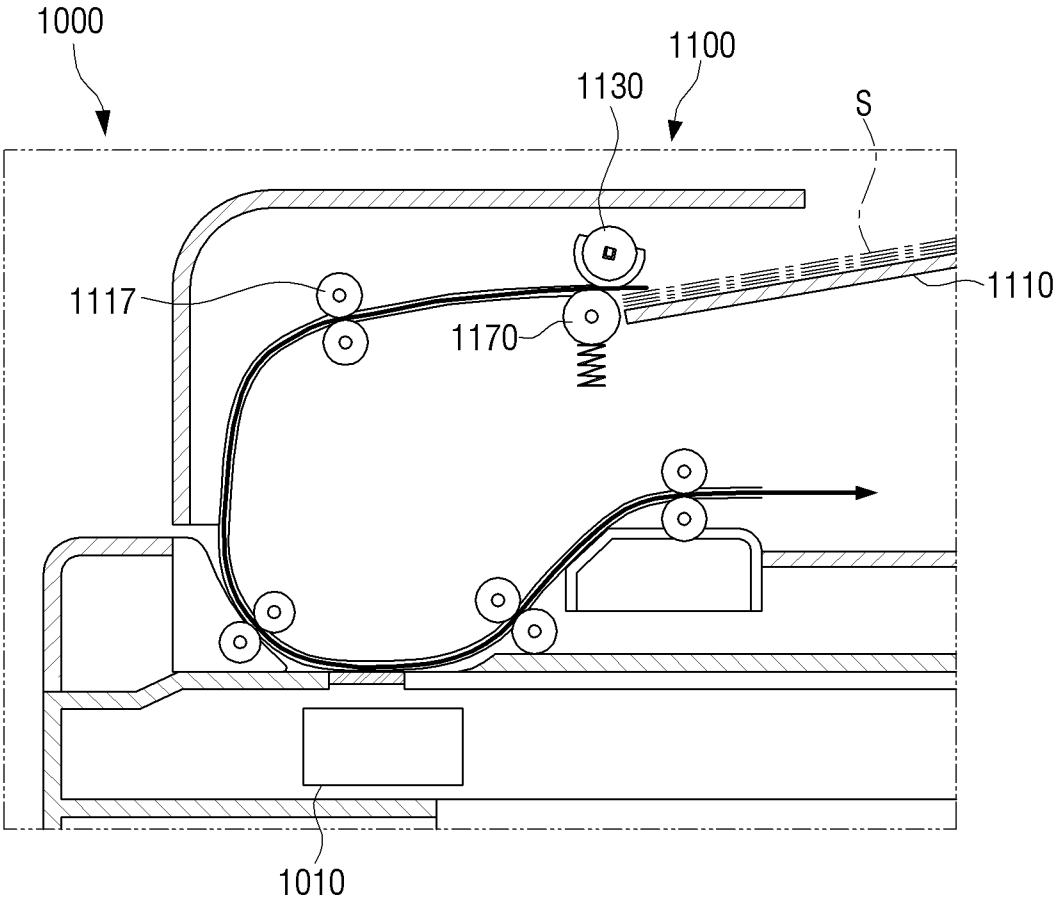


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2019/030551

A. CLASSIFICATION OF SUBJECT MATTER		
B65H 5/06 (2006.01) B41J 13/02 (2006.01) According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
B41J 11/00-11/70, 13/00-13/32, 23/00-23/38, B65H 1/00-1/30, 31/00-31/41, 5/06, G03G 15/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
PatSearch (RUPTO Internal), USPTO, PAJ, Espacenet, Information Retrieval System of FIPS		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6305682 B1 (CANON KABUSHIKI KAISHA) 23.10.2001	1-15
A	US 4100411 A (XEROX CORPORATION) 11.07.1978	1-15
A	US 5370380 A (CANON KABUSHIKI KAISHA) 06.12.1994	1-15
A	EP 0464785 A2 (CANON KABUSHIKI KAISHA) 08.01.1992	1-15
A	RU 2256560 C2 (CANON KABUSHIKI KAISHA) 20.07.2005	1-15
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “E” earlier document but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “O” document referring to an oral disclosure, use, exhibition or other means “P” document published prior to the international filing date but later than the priority date claimed “T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art “&” document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
15 July 2019 (15.07.2019)		15 August 2019 (15.08.2019)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37		Authorized officer A. Nikitin Telephone No. 8(495) 531-65-15