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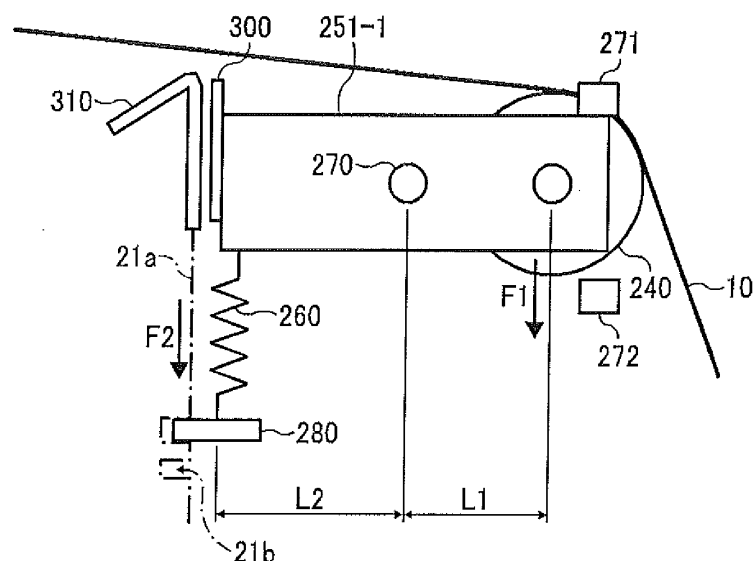
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(54) **Feed roller holder for image forming apparatus and dryer unit for continuous form**

(57) A feed roller holder (250) for μ m image forming apparatus includes a feed roller (240) to contact a continuous form (10) as a target for image formation, rotate from upstream to downstream in a conveyance direction of the continuous form (10), and provide the continuous form (10) with a conveyance path; a roller supporting member (256) that rotatably supports the feed roller

(240); and a holding member (270) that rotatably holds the roller supporting member (256). In the holder (250) as configured above, the holding member (270) encompasses a rotary axis of the roller supporting member (256), and the rotary axis of the roller supporting member (256) is offset from but disposed substantially parallel to a rotary shaft (241) of the feed roller (240).

FIG. 7



Description

BACKGROUND

Technical Field

[0001] The present invention relates to a feed roller holder for an image forming apparatus and a dryer for a continuous form, and in particular, to a technology for minimizing damage when the continuous form is not properly fed due to paper jam, for example.

Background Art

[0002] There are continuous feed printing systems for printing on a recording medium in the form of paper roll (hereinafter "continuous form").

[0003] In such printing systems, a sheet feed device or unwinder is disposed upstream in a sheet conveyance direction and a wind-up device or rewinder of the continuous form is disposed downstream. By winding up the wind-up device and applying tension to the continuous form, the continuous form moves smoothly along the sheet conveyance direction. Inside the printing system, conveying members such as a feed roller disposed along the conveyance path of the continuous form and a drive unit to rotatably drive the feed roller are disposed. Operation of the feed roller, drive unit, and wind-up device is such that there is no excessive load on the conveying members in the normal state.

[0004] However, if the actual conveyance speed of the continuous form and the programmed sheet feed speed of the sheet feed device (or the winding speed of the wind-up device) are not identical, the continuous form is subjected to an excessive or abnormal tension that can extensively damage the conveying members.

[0005] To cope with this problem, JP-H09-249341-A discloses an approach in which, when a trailing end of the continuous form is detected, if the continuous form is in a sheet cut mode and an abnormality of the drive unit of the sheet feed device is found, the drive unit is suspended and the driving of the drive unit is resumed only after the sheet cut has been completed. Damage to the drive unit is thus prevented.

[0006] However, even though the continuous form is not fed, because the sheet feed device is activated, excess electric current is generated. The disclosed approach can prevent the aforementioned problem, but, the abnormal tension may adversely affect not only the drive unit of the sheet feed device but any member contacting the continuous form such as the feed roller may be subjected to abnormal tension. In the above approach, the adverse effect on the feed roller is not considered and consequently the damage to the feed roller is still not prevented.

SUMMARY

[0007] Disclosed embodiments provide a novel holder for a feed roller to minimize damage to the feed roller even when excessive tension is applied to the continuous form, and a dryer for the continuous form.

[0008] The feed roller holder for an image forming apparatus includes a feed roller to contact a continuous form as a target for image formation, rotate from upstream to downstream in a conveyance direction of the continuous form, and provide the continuous form with a conveyance path; a roller supporting member that rotatably supports the feed roller; and a holding member that rotatably holds the roller supporting member. In the holder as configured above, the holding member encompasses a rotary axis of the roller supporting member, and the rotary axis of the roller supporting member is offset from but disposed substantially parallel to a rotary shaft of the feed roller.

[0009] Also provided is a dryer for a continuous form including the feed roller holder as described above; a liquid applicator to apply a preprocessing liquid to the continuous form; a dryer unit to dry the continuous form after the preprocessing liquid is applied; heat rollers to heat the continuous form and disposed inside the dryer unit and upstream in the conveyance direction of the continuous form in the dryer unit; and the feed roller disposed inside the dryer unit and downstream in the conveyance direction of the continuous form to form the conveyance path of the continuous form, in which the feed roller is rotatably held by the holder.

[0010] These and other objects, features, and advantages of the present invention will become apparent upon consideration of the following description of the preferred embodiments of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a schematic configuration of a printing system according to an embodiment of the present invention;

FIG. 2 is a block diagram illustrating a hardware structure of an image forming apparatus of FIG. 1; FIG. 3 is a block diagram illustrating a functional structure of the image forming apparatus;

FIG. 4 illustrates an internal structure of a pretreatment system as illustrated in FIG. 1;

FIG. 5 is a perspective view illustrating a holder of all idler roller disposed in the pretreatment system; FIG. 6 illustrates a cutter disposed on the holder of the idler roller;

FIG. 7 illustrates the holder of the idler roller in a state of normal conveyance;

FIG. 8 illustrates the holder of the idler roller when the abnormal conveyance occurs;

FIG. 9 illustrates a state in which a cutting blade contacts a continuous form over the whole width of the continuous form;

FIG. 10 illustrates a state in which the cutting blade contacts a left side of the continuous form in the width direction according to an example of cutting the continuous form;

FIG. 11 illustrates a state in which the cutting blade contacts a right side of the continuous form in the width direction according to an example of cutting the continuous form; and

FIG. 12 illustrates the holder of the idler roller according to another embodiment.

DETAILED DESCRIPTION

[0012] Referring to drawings, preferred embodiments of the present invention will be described in detail.

[0013] With reference to FIG. 1, a structure of a printing system including the continuous for dryer using a holder for the feed roller according to the present embodiment will now be described.

[0014] FIG. 1 is a general configuration of the printing system according to an embodiment of the present invention. As illustrated in FIG. 1, a printing system 100 includes a sheet feed device 1, a pretreatment system 2, an image forming apparatus 3, an aftertreatment device 4, and a wind-up device 5.

[0015] A roll or continuous form 10 is installed in the sheet feed device 1, and is discharged to the pretreatment system 2. The pretreatment system 2 serves to apply to and dry preprocessing liquid on the continuous form 10 to prevent ink to be applied to the continuous form 10 by the image forming apparatus 3 from running or offsetting. The image forming apparatus 3 forms images on the continuous form 10 after preprocessing and discharged the continuous form 10. Accordingly, the continuous form 10 serves as a recording medium of the image. The aftertreatment device 4 performs post-processing on the continuous form 10 and discharges the same from the image forming apparatus 3. The wind-up device 5 winds up the continuous form 10 after post-processing into a roll. When the wind-up device 5 winds up the continuous form 10 into a roll, tension is applied to the continuous form 10 and the continuous form 10 is conveyed from the sheet feed device 1 to the wind-up device 5. In the description below, a side nearer to the sheet feed device 1 is defined as upstream and a side nearer to the wind-up device 5 is defined as downstream in the conveyance direction of the continuous form 10.

[0016] In the printing system 100, each device of the sheet feed device 1, the pretreatment system 2, the image forming apparatus 3, the aftertreatment device 4, and the wind-up device 5 may be selected and positioned based on the actual printing process to be performed and the order of processes performed by each device can be changed. For example, if the aftertreatment device 4 performs binding, folding, or cutting, the wind-up device 5

can be connected downstream of the image forming apparatus 3 and the aftertreatment device 4 can be connected downstream of the wind-up device 5. In addition, when the preprocessing is not required for the continuous form 10 formed into a roll, or when a wind-up roll of the continuous form 10 after preprocessing is set to the sheet feed device 1, the image forming apparatus 3 (not the pretreatment system 2) can be connected downstream of the sheet feed device 1.

[0017] In the present embodiment, overall control of the whole printing system 100 can be performed by the controller of the image forming apparatus 3. Specifically, the image forming apparatus 3 recognized which is a directly or indirectly connected device among the sheet feed device 1, the pretreatment system 2, the aftertreatment device 4, and the wind-up device 5, (each of which is referred to as an "externally connected device," hereinafter) and, the image forming apparatus 3 causes all devices to stop at once if so required.

[0018] On the other hand, each of the sheet feed device 1, the pretreatment system 2, the image forming apparatus 3, the aftertreatment device 4, and the wind-up device 5 included in the printing system 100 includes an architecture similar to that of information processing terminals such as general servers or PCs, and an engine to perform functions particular to each apparatus. With this configuration, each device can execute commands from the image forming apparatus 3 and can execute operations particular to each device.

[0019] Herein, referring to FIG. 2, a hardware configuration of the image forming apparatus 3 that executes an overall control of the printing system 100 will be described. It is noted that the sheet feed device 1, the pretreatment system 2, the aftertreatment device 4, and the wind-up device 5 include a similar hardware configuration.

[0020] FIG. 2 is a block diagram illustrating a hardware structure of the image forming apparatus 3. As illustrated in FIG. 2, the image forming apparatus 3 according to the present embodiment includes an engine to perform image formation in addition to functional devices similar to those the information processing terminals such as general servers and PCs include. Specifically, the image forming apparatus 3 according to the present embodiment includes a central processing unit (CPU) 30, a random access memory (RAM) 31, a read-only memory (ROM) 32, an engine 33, a hard disk drive (HDD) 34, and an interface (I/F) 35, all of which are connected each other via a bus 38. In addition, a liquid crystal display (LCD) 36 and a control panel 37 are connected to the I/F 35. Signals from externally-connected devices connected via the I/F 35 to the image forming apparatus 3 are transmitted.

[0021] The CPU 30 is computing means and controls an overall operation of the image forming apparatus 3. The RAM 31 is a volatile storage medium that can read and write data at a high speed and is used as a work area when the CPU 30 performs information processing.

The ROM 32 is a non-volatile storage medium that can read only and stores programs such as firmware. The engine 33 functions to actually execute image formation in the image forming apparatus 3.

[0022] The HDD 34 is a non-volatile storage medium that can read and write information and stores operating systems, various control programs, application programs, and the like. The I/F 35 connects and controls various hardware and networks with the bus 38. The LCD 36 is a visual user interface for a user to verify a state of the printing system 100. The control panel 37 is a user interface such as a keyboard and a mouse for a user to input data into the printing system 100.

[0023] In the thus configured hardware structure, any program stored in the storage media such as the ROM 32, HDD 34, or an optical disc, not shown, is read out by the RAM 31, and is allowed to operate according to the control by the CPU 30, the software processor is implemented. Its combination of the thus configured software processor and hardware, a functional block to execute functions of the image forming apparatus 3 is constructed.

[0024] Next, with reference to FIG. 3, a functional construction of the image forming apparatus will be described.

[0025] FIG. 3 is a block diagram illustrating a functional structure of the image forming apparatus 3. As illustrated in FIG. 3, the image forming apparatus 3 included in the printing system 100 includes a controller section 140, a control panel 124, a sheet feed device 125, a print engine 126, a sheet discharge device 127, and an external device I/F 128.

[0026] In addition, the controller section 140 includes a main controller 130, an engine controller 131, an input/output controller 132, an image processor 133, and a control panel controller 134. Referring to FIG. 3, the electrical connection is depicted using solid line arrows. Conveyance of the sheet is depicted by broken line arrows as illustrated in FIG. 3.

[0027] The control panel 124 serves as an output interface to visually illustrate a status of the image forming apparatus 3 and an input interface as a touch panel for a user to directly operate the printing system 100 or input data to the image forming apparatus 3. The external device I/F 128 serves as an interface to communicate with other devices via the network or communication cables between devices and employs Ethernet (Trademark) or a universal serial bus (USB) interface.

[0028] The controller section 140 is configured with software and hardware in combination. Specifically, control programs such as the firmware stored in the ROM 32, nonvolatile memories, HDD 34, nonvolatile storage media such as optical discs are loaded in the volatile memory such as the RAM 31, so that the software controller implemented by the control by the CPU 30 and the hardware such as integrated circuits are configured to construct the controller section 140. The controller section 140 functions as a processor to control over the

whole printing system 100.

[0029] The main controller 130 controls each part included in the controller section 140 and issues commands to each part of the controller section 140. The engine controller 131 acts as a driver means to control or drive the print engine 126.

[0030] The input/output controller 132 sends signals and commands input via the external device I/F 128 to the main controller 130. The main controller 130 controls the input/output controller 132 and accesses other devices via the external device I/F 128.

[0031] The image processor 133 generates, under control of the main controller 130, image data based on printing information included in an input print job. The image data is information for the print engine 126 as the image forming section to draw an image to be formed in an image forming operation. In addition, the printing information included in the print job is image data converted to a format that the printing system 100 can recognize by a printer driver installed into the information processor such as a PC. The control panel controller 134 causes the control panel 124 to display information or notifies the data input through the control panel 124 to the main controller 130.

[0032] In the printing system 100, the input/output controller 132 first receives a print job via the external device I/F 128. The input/output controller 132 transfers the received print job to the main controller 130. Upon receipt of the print job, the main controller 130 controls the image processor 133 and allows the image processor 133 to generate image data based on the print data included in the print job.

[0033] When the image data is generated by the image processor 133, the engine controller 131 executes image formation to the sheet conveyed from the sheet feed device 125 based on the generated image data. To be more specific, the print engine 126 functions as the image forming unit. The sheet or document on which the image is formed by the print engine 126 is discharged outside the apparatus by the sheet discharge device 127.

[0034] In the printing system 100, the continuous form 10 discharged from the sheet feed device 1 is sequentially conveyed to the pretreatment system 2, the image forming apparatus 3, the aftertreatment device 4, and to the wind-up device 5. Each device includes feed rollers internally disposed along the conveyance path that contact the continuous form 10 as a target for image formation, rotate from upstream to downstream in the conveyance direction of the continuous form 10, and provide the continuous form 10 with the conveyance path. The feed rollers include both a drive roller driving to rotate connected to the drive unit and a driven or idler roller to rotate with the movement of the continuous form 10. The continuous form 10 is subjected to a tensile force directing from upstream to downstream in the conveyance direction due to the winding operation of the wind-up device 5. The feed roller serving as an idler roller rotates because the continuous form 10 contacts a surface of the

feed roller and, from the contact portion, a tensile force acts on the feed roller.

[0035] When the conveyance operation is normally done, the continuous form 10 moves from upstream to downstream in the conveyance direction due to the tensile force applied by the winding operation of the wind-up device 5, and the feed roller also rotates with the movement of the continuous form 10.

[0036] However, when a paper jam occurs in the upstream of the feed roller, although the movement of the continuous form stops at the position of the paper jam, the winding operation of the wind-up device 5 continues as if during normal conveyance. As a result, the continuous form is subjected to a greater tension (to be referred to as an "abnormal tension," hereinafter) than during normal conveyance.

[0037] The present invention aims to prevent a damage to the idler roller due to the abnormal tension that pushes the idler roller from the contact portion with the continuous form and to move the idler roller according to the tension applied to the continuous form.

[0038] Hereinafter, the present embodiment is described concerning the idler roller disposed inside the pretreatment system 2; however, the present invention may be applied to any feed roller including the drive roller disposed on the conveyance path of the continuous form 10 and contacting the continuous form 10, without limitation to the idler roller.

[0039] Hereinafter, the contacting and detaching structure will be described.

[0040] FIG. 4 illustrates an internal structure of the pretreatment system 2 as illustrated in FIG. 1. As illustrated in FIG. 4, the pretreatment system 2 includes a liquid applicator 20 in which the preprocessing liquid is applied to the continuous form 10, a dryer unit 21 to dry the continuous form 10 after applying the preprocessing liquid, and a feed roller 25 located between the liquid applicator 20 and the dryer unit 21 to feed the continuous form 10 from the liquid applicator 20 to the dryer unit 21. The pretreatment system 2 according to the present embodiment is a dryer for the continuous form including the liquid applicator 20 and the dryer unit 21. The continuous form 10 is conveyed in the direction indicated by arrow A via the feed roller 25 from the liquid applicator 20 to the dryer unit 21. In the present embodiment, the continuous form 10 in FIG. 4 is a continuous form with a predetermined length wound into a roll; however, alternatively the continuous form 10 may be a relatively long cut sheet. In addition to paper, plastic, and the like, the continuous form 10 may be made of other materials that may be damaged, deformed, or wrinkled by heat. Specifically, in the present embodiment, the continuous form is not limited to paper, but may include all relatively long recording media regardless of material.

[0041] The dryer unit 21 includes a first heat roller set 210, a second heat roller set 220, and a third heat roller set 230, disposed serially within the dryer unit 21. The first heat roller set 210 includes a first rear heat roller

210a and a first front heat roller 210b; the second heat roller set 220 includes a second rear heat roller 220a and a second front heat roller 220b; and the third heat roller set 230 includes a third rear heat roller 230a and a third front heat roller 230b. The dryer unit 21 further includes a discharge idler roller (which will be abbreviated to simply as an idler roller) 240, and a controller 290.

[0042] Each heat roller 210a, 210b, 220a, 220b, 230a, and 230b has a cylindrical shape with the axis thereof as the axis of rotation, and is disposed such that the axial direction of the cylindrical shape is orthogonal to the conveyance direction of the continuous form 10. Each heat roller 210a, 210b, 220a, 220b, 230a, and 230b is rotatably mounted onto a solid member, in this case a housing 21a of the dryer unit 21, so as to be rotatable by bearings positioned at both lateral ends of the axis of rotation. The first heat roller set 210, the second heat roller set 220, and the third heat roller set 230 are disposed from upstream to downstream along the conveyance direction on the conveyance path of the continuous form 10 inside the dryer unit 21.

[0043] The first rear heat roller 210a is separated from the first front heat roller 210b; the second rear heat roller 220a is separated from the second front heat roller 220b; and the third rear heat roller 230a is separated from the third front heat roller 230b, respectively. In addition, a first height of each of the rear heat rollers 210a, 220a, and 230a from a reference position and a second height of each of the front heat rollers 210b, 220b, and 230b from the reference position are different. Herein, the reference position is an interior bottom surface of the housing 21a of the dryer unit 21. In FIG. 4, each rotary axis of the first rear heat roller 210a, the second rear heat roller 220a, and the third rear heat roller 230a is disposed at a position having the first height H1 from the bottom face of the housing 21a. By contrast, each rotary shaft of the first front heat roller 210b, the second front heat roller 220b, and the third front heat roller 230b is disposed at a position having the second height H2 from the bottom face of the housing 21a.

[0044] Put differently, a virtual plane including all rotary axes of the first rear heat roller 210a, the second rear heat roller 220a, and the third rear heat roller 230a and a surface including all rotary axes of the first front heat roller 210b, the second front heat roller 220b, and the third front heat roller 230b are parallel to each other and are separated in the height direction from the reference position.

[0045] Each of the heat rollers 210a, 210b, 220a, 220b, 230a, and 230b includes a heater 211a, 211b, 221a, 221b, 231a, and 232b, respectively. The heater such as a halogen lamp is disposed in an interior center of each heat roller. With this structure, a surface of each heat roller 210a, 210b, 220a, 220b, 230a, and 230b is heated, so that the continuous form can be subjected to a heating process. Each heat roller 210a, 210b, 220a, 220b, 230a, and 230b is provided with a temperature sensor such as a thermistor, thermopile, or the like, to detect a surface

temperature of the heat roller.

[0046] The continuous foam 10 is conveyed from upstream to downstream in the conveyance direction, sequentially winding around the first rear heat roller 210a, the first front heat roller 210b, the second rear heat roller 220a, the second front heat roller 220b, the third rear heat roller 230a, and the third front heat roller 230b, and passes through respective heat rollers 210a, 210b, 220a, 220b, 230a, and 230b, in this order.

[0047] A holder 250 including the idler roller 240, a roller supporting member 256 (see FIG. 5) to support the idler roller 240, and a holding member or a shaft 270 (see FIG. 5) to rotatably hold the roller supporting member 256 is disposed downstream in the conveyance path inside the dryer unit 21. The holder 250 further includes a helical extension spring 260 as a biasing member, and a plate 280 to have the helical extension spring 260 engaged with the housing 21a, and is disposed on the housing 21a via these parts.

[0048] A cutter 300 is disposed above the holder 250. The housing 21a includes a cover 310 to provide protection from a cutting blade 301 (see FIG. 6) of the cutter 300.

[0049] Next, referring to FIG. 5, a holder for the idler roller will be described.

[0050] FIG. 5 is a perspective view illustrating the holder of the idler roller disposed in the pretreatment system 2. As illustrated in FIG. 5, the idler roller 240 is formed in a cylindrical shape, with the axial direction of the cylindrical shape as the axis of rotation, and is disposed such that the axial direction of the cylindrical shape is orthogonal to the conveyance direction of the continuous form 10.

[0051] The idler roller 240 has a rotary shaft 241, which has lateral ends. The roller supporting member 256 includes two supporting portions, 251-1 and 251-2, each supporting one end of the rotary shaft 241, and a center connecting portion 252 that connects two supporting portions 251-1, and 251-2. In the following description, when referring to the roller supporting member 256, the two supporting portions 251-1 and 251-2 and the center connecting portion 252 are included.

[0052] The two supporting portions 251-1, and 251-2 are dimensioned to accommodate the width of the idler roller 240 along the rotary shaft of the idler roller 240. The center connecting portion 252 connects each of the supporting portions 251-1, and 251-2 downstream from the idler roller 240 in the sheet conveyance direction. Specifically, the holder 250 includes the center connecting portion 252 as a reference, and the supporting portions 251-1, and 251-2 protruding from downstream to upstream in the sheet conveyance direction and disposed opposite with the space corresponding to the width of the idler roller 240 along the rotary shaft 241 of the idler roller 240. The idler roller 240 is disposed in the above space between the two supporting portions 251-1, and 251-2.

[0053] More specifically, the supporting portions 251-1, and 251-2 include roller bearings 253-1, and

253-2, respectively, that rotatably support the idler roller 240. The roller bearings 253-1, and 253-2 support the rotary shaft 241 of the idler roller 240 at lateral ends thereof. The idler roller 240 rotates around the rotary shaft 241 from upstream to downstream in the sheet conveyance direction by tension from the continuous form 10 that contacts the idler roller 240.

[0054] Each upstream end of the supporting portions 251-1, and 251-2 in the sheet conveyance direction is formed as an open end not connected to any solid member, for example the housing 21a. Through-holes 254-1, and 254-2 are disposed downstream in the sheet conveyance direction of the roller bearings 253-1, and 253-2.

[0055] The shaft 270 is disposed substantially parallel to the rotary shaft 241 of the idler roller 240 but at a position different from the rotary shaft 241 of the idler roller 240. Specifically, the shaft 270 is mounted to the housing 21a at a position different from but parallel to the axis of rotation of the rotary shaft 241 of the idler roller 240.

[0056] The shaft 270 passes through the through-holes 254-1 and 254-2 and both lateral ends of the shaft 270 are fixed to the housing 21a of the dryer unit 21. With this structure, the supporting portions 251-1, and 251-2 are movably and rotatably connected to the housing 21a via the shaft 270. In other words, the shaft 270 supports the supporting portions 251-1, and 251-2 by the through-holes 254-1, and 254-2, so that the roller supporting member 256 is supported pivotally about the shaft 270. With this structure, the idler roller 240 and the roller supporting member 256 pivot together about the shaft 270.

[0057] A bottom end of the center connecting portion 252 is connected to the housing 21a of the dryer unit 21 via the two helical extension springs 260-1, and 260-2, each serving as an biasing member. In the present embodiment, each upper end of the helical extension springs 260-1, and 260-2 is connected at two positions of the bottom end of the center connecting portion 252 spaced each other along the roller width direction of the idler roller 240.

[0058] Each bottom end of the helical extension springs 260-1, and 260-2 is connected to the plate 280 (see FIG. 4). The plate 280 is engaged with a groove 21b (see FIG. 7) disposed on the housing 21a and is secured to the housing 21a. Plural grooves 21b are disposed in the height of the housing 21a. If the position of the groove 21b to engage with the plate 280 is changed, an extension amount of the helical extension springs 260-1, and 260-2 can be changed.

[0059] Specifically, the roller supporting member 256 is held to the housing 21a via the biasing force of the helical extension springs 260-1, and 260-2 and is supported pivotally about the shaft 270. The biasing force of the helical extension springs 260-1, and 260-2 functions to pull the supporting portions 251-1, and 251-2 toward the plate 280 because the plate 280 is secured to the housing 21a. At this time, the roller supporting member 256 is subjected to a moment with the shaft 270 set as the center of rotation. A moment constantly directed in

the direction indicated by arrow B works on the roller supporting member 256 at the upstream end in the sheet conveyance direction.

[0060] One stopper 271 is disposed to prevent the upstream end the roller supporting member 256 in the sheet conveyance direction from jumping. A second stopper 272 (shown in FIG. 7) is disposed to prevent the roller supporting member 256 from rotating and contacting other parts due to abnormal tension. The stoppers 271 and 272 are secured to the housing 21a. Of the parts of the roller supporting member 256, the roller supporting member 256 takes a predetermined position when the upper ends of the supporting portions 251-1, and 251-2 contact the stopper 271. As a result, the idler roller 240 positions at a predetermined position and the continuous form 10 winds around the idler roller 240 at a predetermined winding angle.

[0061] The cutter 300 to cut the continuous form 10 when the sheet is not conveyed normally, and the cover 310 to cover the cutting blade 301 of the cutter 300 during normal conveyance, are both disposed downstream of the holder 250 in the sheet conveyance direction. The cover 310 is separate from the holder 250 and is configured to protrude toward the continuous form 10 beyond the cutting blade 301 when the holder 250 does not rotate. Specifically, the cover 310 functions as a protective member against the cutter 300.

[0062] Next, referring to FIG. 6, mounting of the cutter will be described.

[0063] FIG. 6 illustrates a cutter disposed on the holder of the idler roller. Positioning projections 255-1, and 255-2 are disposed at both lateral ends of the center connecting portion 252, respectively, along the axis of the roller. In addition, the cutter 300 includes two holes into which the positioning projections 255-1, and 255-2 are inserted. One of the holes is a slot 302 having a width corresponding to a diameter of the positioning projection 255-1 with an allowance to a positional error when the cutter 300 is mounted along the roller axial direction, and the other is a hole 303 having a width corresponding to a diameter of the positioning projection 255-2. In the replacement of the cutter 300, the positioning projections 255-1, and 255-2 are passed through the slot 302 and the hole 303, respectively, so that the cutter 300 can be mounted at the same position constantly.

[0064] The housing 21a is provided with the cover 310 that protrudes from the cutting blade 301 of the cutter 300. The cutting blade 301 of the cutter 300 is disposed usually on an interior of the cover 310 and does not contact the continuous form 10. In addition, the cover 310 is secured at a position not contacting the continuous form 10 wound around the idler roller 240 and does not adversely affect the conveyance of the continuous form 10.

[0065] Next, referring to FIGS. 7 and 8, movement of the idler roller for sheet conveyance and the holder in the normal and abnormal conveyance will be described.

[0066] FIG. 7 illustrates the holder of the idler roller in the normal conveyance. FIG. 8 illustrates the holder of

the idler roller when the abnormal conveyance occurs.

[0067] The continuous form 10 dried by the heat rollers 210a, 210b, 220a, 220b, 230a, and 230b disposed upstream in the sheet conveyance direction is sent to the image forming apparatus 3 while being wound around the idler roller 240 at a predetermined angle. The continuous form 10 is subjected to substantially constant tension. When a force applied to the idler roller 240 is F1, a force applied to the helical extension springs 260-1, and 260-2 is F2, and distances from a work point of each force to a center of the shaft 270 are L1 and L2, the following relation stands:

$$F1 \times L1 < F2 \times L2 \dots (1).$$

[0068] Even though the condition of the tension is changed due to a change in the thickness of the continuous form 10, the force F2 to be applied to the helical extension springs 260-1, and 260-2 is so adjusted to satisfy the above formula (1). As a result, in the normal conveyance state, the supporting portions 251-1, and 251-2 always contact the stopper 271. Therefore, the idler roller 240 does not move from a home position in which the supporting portions 251-1, and 251-2 contact the stopper 271. Further, even though an operator erroneously pushes the idler roller 240, the force F2 is designed such that the cutting blade 301 of the cutter 300 does not jump out, and so, the cutting blade 301 of the cutter 300 does not jump out inadvertently. Further, because the cutting blade 301 of the cutter 300 is behind the interior of the cover 310, the operator is not injured by the cutting blade 301 of the cutter 300.

[0069] Herein, when the printing system 100 operates normally and the continuous form 10 is pulled toward upstream, if the movement of the sheet conveyance stops due to the paper jam that occurs in the sheet feed device 1, or the heat rollers 210a, 210b, 220a, 220b, 230a, and 230b disposed downstream in the sheet conveyance direction, the continuous form 10 in the upstream side alone is pulled. In the dryer unit 21, because the continuous form 10 is wound around the heat rollers 210a, 210b, 220a, 220b, 230a, and 230b, enormous tension is applied to the dryer unit 21, resulting in damage to the apparatus.

[0070] In this case, an excess tension is applied to the idler roller 240 and the force F1 becomes larger, so that the relation in the above formula (1) changes to a relation expressed by the following formula (2):

$$F1 \times L1 > F2 \times L2 \dots (2)$$

[0071] As a result, a contact surface of the continuous form 10 with the idler roller 240 is pushed vertically down. Because the idler roller 240 is pushed down, the support-

ing portions 251-1, and 251-2 rotate about the shaft 270 from a state as illustrated in FIG. 7 to a state as illustrated in FIG. 8, so that the cutting blade 301 of the cutter 300 disposed downstream of the supporting portions 251-1, and 251-2 in the sheet conveyance direction is pushed up. Accordingly, the cutting blade 301 of the cutter 300 contacts the continuous form 10 to cut the continuous form 10.

[0072] Referring to FIGS. 9 through 11, a state in which the cutting blade 301 of the cutter 300 contacts the continuous form 10 in a cutting process of the continuous form will be described. FIG. 9 illustrates a state in which the cutting blade contacts the continuous form over the whole width of the sheet according to an example of cutting the continuous form. FIG. 10 illustrates a state in which the cutting blade contacts a left side of the continuous form in the width direction according to an example of cutting the continuous form. FIG. 11 illustrates a state in which the cutting blade contacts a right side of the continuous form in the width direction according to an example of cutting the continuous form.

[0073] In FIG. 9, because the cutting blade 301 of the cutter 300 contacts the whole width of the continuous form 10, the continuous form 10 can be easily cut. However, the cutting blade 301 does not always contact the whole width of the continuous form 10, and there are occasions in which the continuous form 10 contacts the cutting blade 301 of the cutter 300 with an inclination as illustrated in FIGS. 10 and 11. Even in this case, because the cutting edge of the cutting blade 301 of the cutter 300 is saw-toothed, pressure applied to a contact surface with the continuous form 10 increases, so that the continuous form 10 can be reliably cut without exceptions. When the continuous form 10 is cut, no abnormal tension is applied to the continuous form 10, and the idler roller 240 is not pushed down. As a result, the state returns to FIG. 7 from FIG. 8, and the idler roller 240 is not pushed down anymore due to an abnormal tension.

[0074] Even though the cutting blade 301 of the cutter 300 is damaged due to excessive force due to cutting of the continuous form 10, the cutting blade 301 can easily be replaced with a new one. When the idler roller 240 is pushed down by the continuous form 10, because the stopper 272 is disposed at a pushed down direction, the idler roller 240 is not pushed down exceeding a predetermined distance as illustrated in FIG. 8. The idler roller 240 stops upon abutting the stopper 272, and the movement of the idler roller 240 along the rotary direction is stopped by the stopper 272. The stopper 272 is disposed at a distance that secures the position where the cutting blade 301 of the cutter 300 satisfactorily protrudes. Because a rotation angle of the roller supporting member 256 is restricted by the stoppers 271 and 272 disposed above and below the roller supporting member 256, any excessive force is not applied to the helical extension springs 260-1, and 260-2, thereby preventing any damage.

[0075] Further, to cope with any stronger force or

weaker force applied due to specifications of the continuous form 10, the helical extension springs 260-1, and 260-2 are mounted and the position of the groove 21b disposed on the housing 21a to engage with the plate 280 is changed so as to optimize the cutting operation of the cutting blade 301 of the cutter 300. With this configuration, the extension amount of the helical extension springs 260-1, and 260-2 can be adjusted. Specifically, the groove 21b serves as a biasing member retainer to hold the biasing member by changing the extension amount thereof. Specifically, the upper ends of the helical extension springs 260-1, and 260-2 are connected to the through-holes 254-1, and 254-2, respectively. The helical extension springs 260-1, and 260-2 are connected to the housing 21a at a side opposite a contact portion between the idler roller 240 and the continuous form 10 with the bottom end of the center connecting portion 252, the center axis of the shaft 270, and the center axis of the rotary shaft 241 of the idler roller 240 sandwiched in between.

[0076] According to the structure as above, even when an abnormal tension is applied to the continuous form of the recording medium, the damage to be applied to the feed roller can be reduced, and a failure of the apparatus can be prevented. More specifically, the idler roller is rotatably mounted to the solid member (i.e., the frame of the dryer according to the present embodiment) via the shaft, so that the idler roller rotates about the shaft. With this structure, when an abnormal tension exceeding a predetermined value is applied to the idler roller, the tension received from the continuous form can be freed by the rotation of the idler roller, thereby preventing a breakage of the idler roller.

[0077] Further, the roller supporting member of the idler roller is fixed to the solid member (i.e., the frame of the drying device according to the present embodiment) at an opposite side of the idler roller via the shaft, a force reverse to the direction in which the idler roller is pushed down is applied to the idler roller. With this structure, in an occurrence of the abnormal tension, the idler roller 240 and the roller supporting member 256 pivot together about the shaft 270. Further, when the biasing member easily extends or is easily replaceable, the amount of pushing down of the idler roller can be adjusted in accordance with properties of the recording medium, such as a type of the material, level of the tension to be applied to such a material, and the like.

[0078] Further, according to the embodiment, a cutting blade is disposed at a side opposite the idler roller with the rotary shaft of the roller supporting member and the shaft 270 sandwiched in between, and the continuous form is cut when the roller supporting member rotates about the shaft 270, thereby preventing an abnormal tension from being applied continuously to the continuous form. Furthermore, because the cutting blade is detachably fastened with screws to the solid member, replacement thereof is easy. The cutting blade is wavy shaped, so that the continuous form can be cut no matter how the continuous form contacts the cutting blade.

[0079] The aforementioned embodiments are simply examples of the present disclosure, and are not limited thereto alone. Various embodiments are possible without departing from the scope of the invention. For example, in one embodiment, first ends of the helical extension springs 260-1, and 260-2 are connected to the center connecting portion 252 at downstream in the sheet conveyance direction with the through-holes 254-1, and 254-2 of the supporting portions 251-1, and 251-2 set as reference positions, and second ends of the helical extension springs 260-1, and 260-2 are connected to the housing 21a below the supporting portions 251-1, and 251-2. With this structure, a moment in the direction reverse to that shown by Arrow F1 in FIG. 7 acts on the roller bearings 253-1, and 253-2 of the supporting portions 251-1, and 251-2. When the above moment and the force from the continuous form applied to the idler roller are well balanced, the position of the idler roller is kept to be constant in the normal conveyance.

[0080] Specifically, it is preferred that the helical extension springs 260-1, and 260-2 be connected to the supporting portions 251-1, and 251-2 or the center connecting portion 252 such that the biasing force of the springs 260-1, and 260-2 acts in a direction against the pushing force in the direction orthogonal to a sheet surface of the continuous form 10 when contacting the idler roller 240.

[0081] With reference to FIG. 12, another embodiment of the supporting member for the idler roller will be described.

[0082] FIG. 12 illustrates the supporting member of the idler roller according to another embodiment. For example, in one embodiment, one ends of the helical extension springs 260-1, and 260-2 are connected to the roller supporting member 256 at upstream in the sheet conveyance direction with the through-holes 254-1, and 254-2 of the supporting portions 251-1, and 251-2 set as reference positions, the other ends of the helical extension springs 260-1, and 260-2 are connected to the housing 21a above the supporting portions 251-1, and 251-2 in FIG. 11, and upstream sides of the supporting portions 251-1, and 251-2 in the sheet conveyance direction are lifted up. With this structure, if the lifting-up force and the force shown by Arrow F1 in FIG. 12 are balanced, the idler roller 240 can be kept at a constant position in the normal conveyance. However, when an abnormal conveyance occurs, the helical extension springs 260-1, and 260-2 extend, so that the idler roller 240 and the roller supporting member 256 pivot together. In the present embodiment, a structure in which the roller supporting member is connected to the housing via the biasing member so that the biasing force of the springs 260-1, and 260-2 acts in the direction against the pushing force in the direction orthogonal to a sheet surface of the continuous form 10 when contacting the idler roller 240, is implemented. The biasing force of the biasing members acts not only in the direction opposite the directly pushed-down orthogonal direction, but acts in directions including

various vector components against the directly pushed-down orthogonal direction.

[0083] In the embodiments described above, the shaft and the through-holes are used in combination, but alternatively a bearing may be used as a unit to rotatably support the roller supporting member to the housing.

Claims

1. A feed roller holder (250) for an image forming apparatus comprising:

a feed roller (240) to contact a continuous form (10) as a target for image formation, rotate from upstream to downstream in a conveyance direction of the continuous form (10) and provide the continuous form (10) with a conveyance path; a roller supporting member (256) that rotatably supports the feed roller (240); and a holding member (270) that rotatably holds the roller supporting members (256), wherein the holding member (270) encompasses a rotary axis of the roller supporting member (256), and the rotary axis of the roller supporting member (256) is offset from but disposed substantially parallel to a rotary shaft (241) of the feed roller (240).

2. The feed roller holder (250) as claimed in claim 1, further comprising a housing (21a) to house the holder (250), wherein:

the holding member is a shaft (270) secured to the housing (21a); the roller supporting member (256) includes roller bearings (253-1, 253-2) to rotatably support the feed roller (240), and through-holes (254-1, 254-2) into which ends of the shaft (270) are inserted; the feed roller (240) is supported by the roller supporting member (256) via the roller bearings (253-1, 253-2); and the shaft (270) rotatably supports the roller supporting member (256) by the through-holes (254-1, 254-2), and the roller supporting member (256) is supported pivotally about the shaft (270).

3. The feed roller holder (250) as claimed in claim 2, wherein, when the feed roller (240) is pushed down in a direction orthogonal to a sheet surface of the continuous form (10) from a contact portion between the feed roller (240) and the continuous form (10) in response to a tension applied to the continuous form (10), the feed roller (240) and the roller supporting member (256) pivot together about the shaft (270).

4. The feed roller holder (250) as claimed in claim 3, further comprising biasing members (260-1, 260-2) connected to the roller supporting member (256), the roller supporting member (256) being connected to the housing (21a) via the biasing members (260-1, 60-2),
wherein the biasing members (260-1, 260-2) are connected to the roller supporting member (256) such that biasing force of the biasing members (260-1, 260-2) acts in a direction against a pushing force applied to the contact portion between the feed roller (240) and the continuous form (10) in the direction orthogonal to the sheet surface of the continuous form (10). 5
5. The feed roller holder (250) as claimed in claim 4, further comprising a retainer (21b) to retain the biasing member (260), wherein an extension amount of the biasing members (260) is changed via the retainer (21b). 10
6. The feed roller holder (250) as claimed in claim 4 or 5, wherein the biasing members (260-1, 260-2) each include first ends and second ends, the first ends of the biasing members (260-1, 260-2) connected farther downstream in the conveyance direction of the continuous form (10) than the through-holes (254-1, 254-2) of the shaft (270), and the second ends of the biasing members (260-1, 260-2) are connected to the housing (21a) at a side opposite the contact portion between the feed roller (240) and the continuous form (10) with a center axis of the shaft (270) and a rotary axis of the feed roller (240) located therebetween. 15
7. The feed roller holder (250) as claimed in any one of claims 1 through 5, further comprising a cutter (300) including a cutting blade (301) to contact and cut the continuous form (10), the cutting blade (301) being disposed downstream, in the conveyance direction of the continuous form (10), from a rotary axis of the holding member (270). 20
8. The feed roller holder (250) as claimed in claim 7, further comprising a cover (310) separate from the holder (250) and protruding toward the continuous form (10) beyond the cutting blade (301) when the holder (250) does not rotate, wherein the cutting blade (301) comes out of the cover (310) and contacts the continuous form (10) when the holder (250) and the cutter (300) rotate upon rotation of the holder (250). 25
9. The feed roller holder (250) as claimed in claim 7 or 8, wherein the cutter (300) is detachably attachable to/from the holder (250). 30
10. The feed roller holder (250) as claimed in any one 35

of claims 7 through 9,
wherein the cutting blade (301) is saw-toothed and extends in a direction orthogonal to the conveyance direction of the continuous form (10).

11. A dryer (2) for a continuous form (10), comprising:

the feed roller holder (250) as claimed in any one of claims 1 through 10,
a liquid applicator (20) to apply a preprocessing liquid to the continuous form (10);
a dryer unit (21) to dry the continuous form (10) after the preprocessing liquid is applied;
heat rollers (210a, 210b, 220a, 220b, 230a, and 230b) to heat the continuous form (10), disposed inside the dryer unit (21) and upstream in the conveyance direction of the continuous form (10) in the dryer unit (21); and
the feed roller (240) disposed inside the dryer unit (21) and downstream in the conveyance direction of the continuous form (10) to form the conveyance path of the continuous form (10), wherein the feed roller (240) is rotatably held by the holder (250). 40

FIG. 1

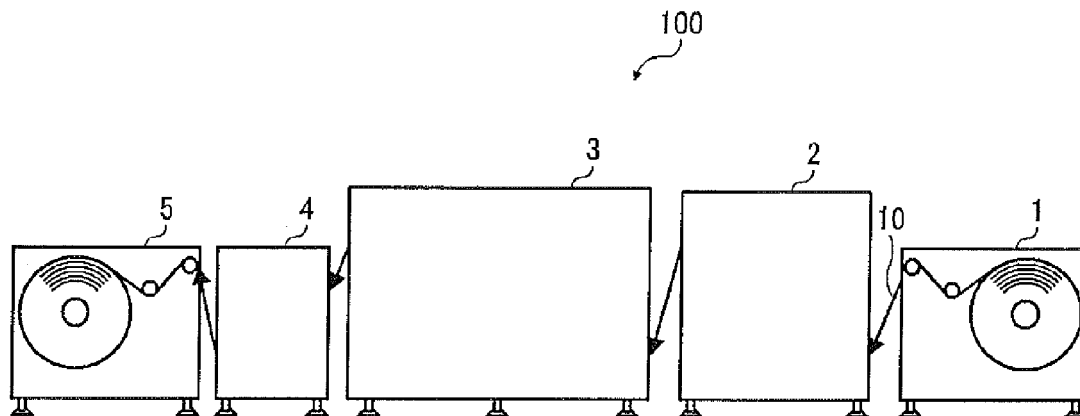


FIG. 2

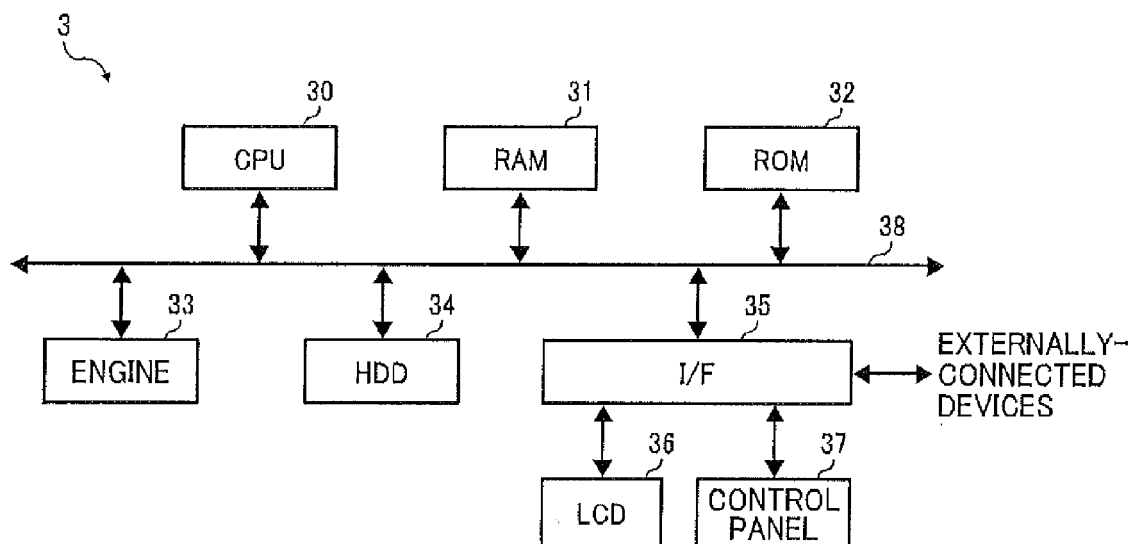


FIG. 3

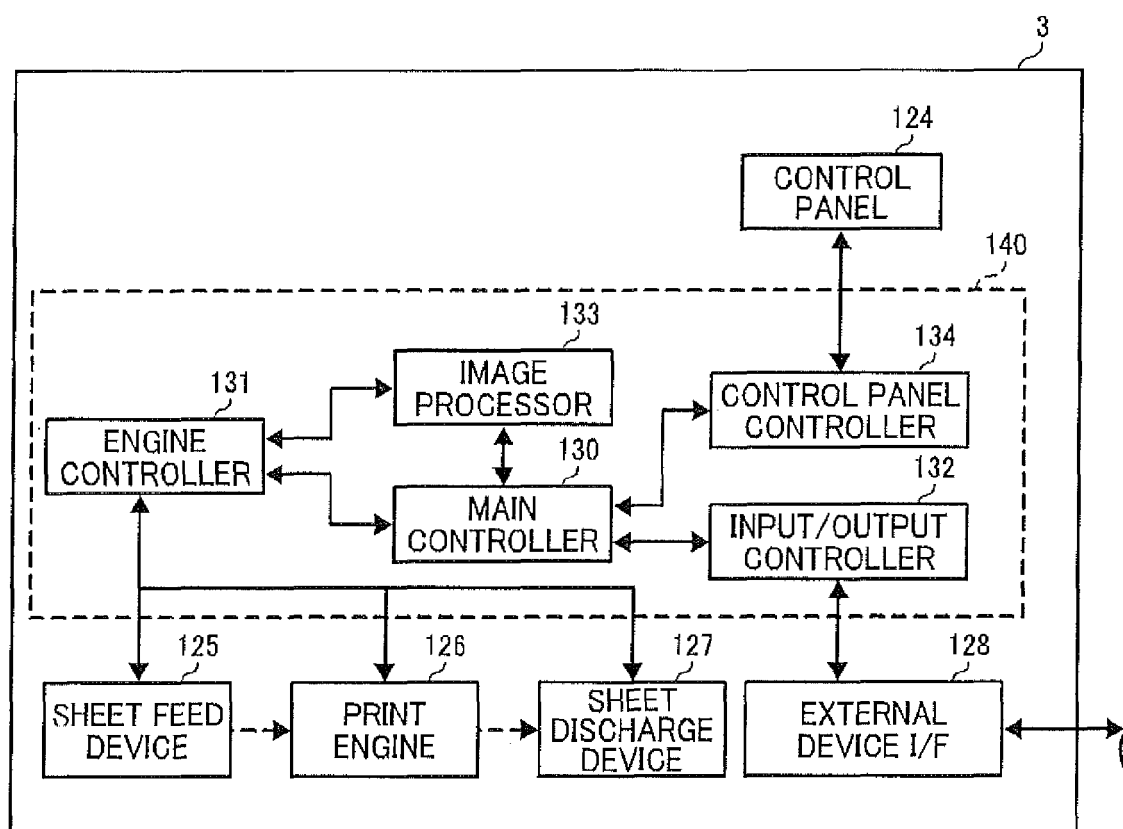


FIG. 4

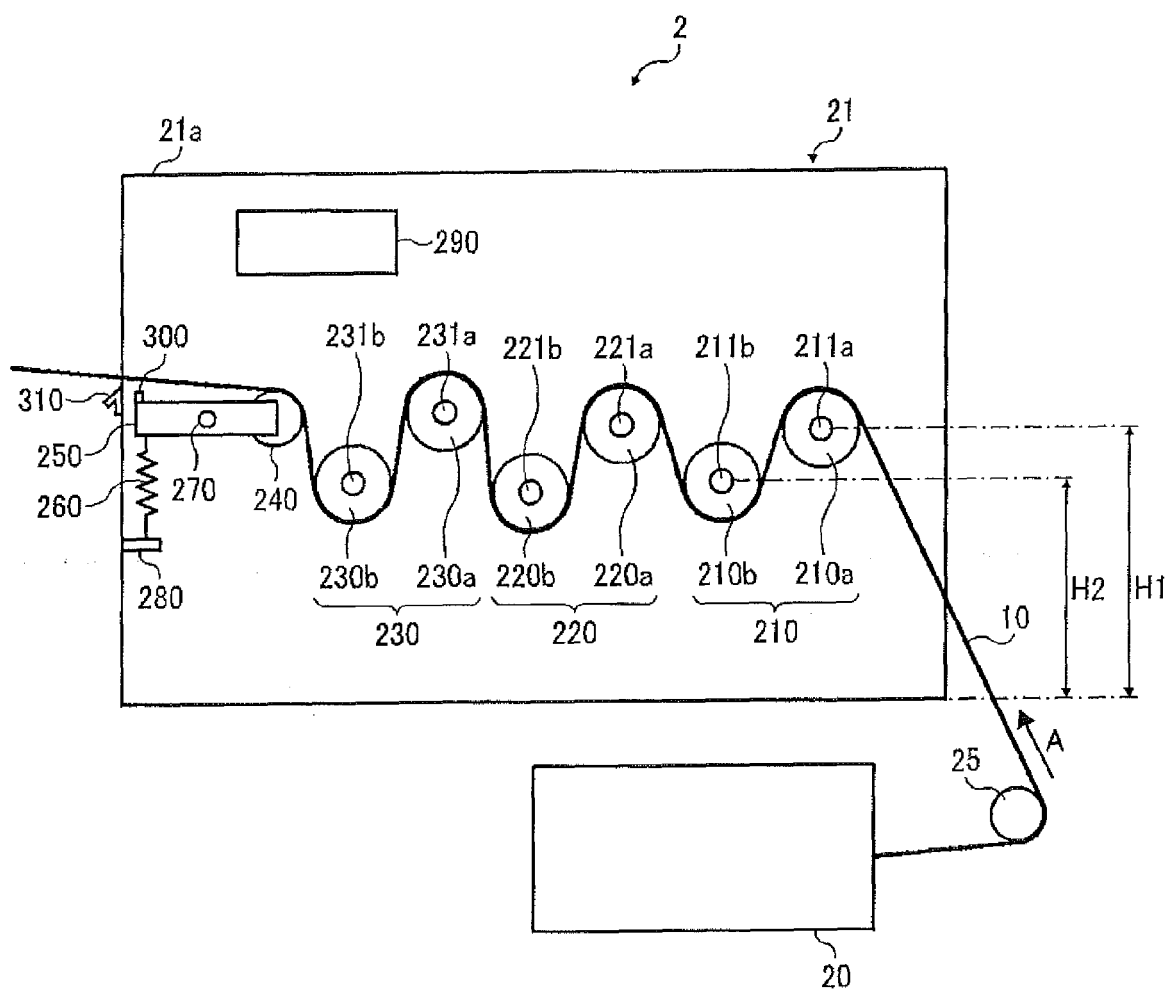


FIG. 5

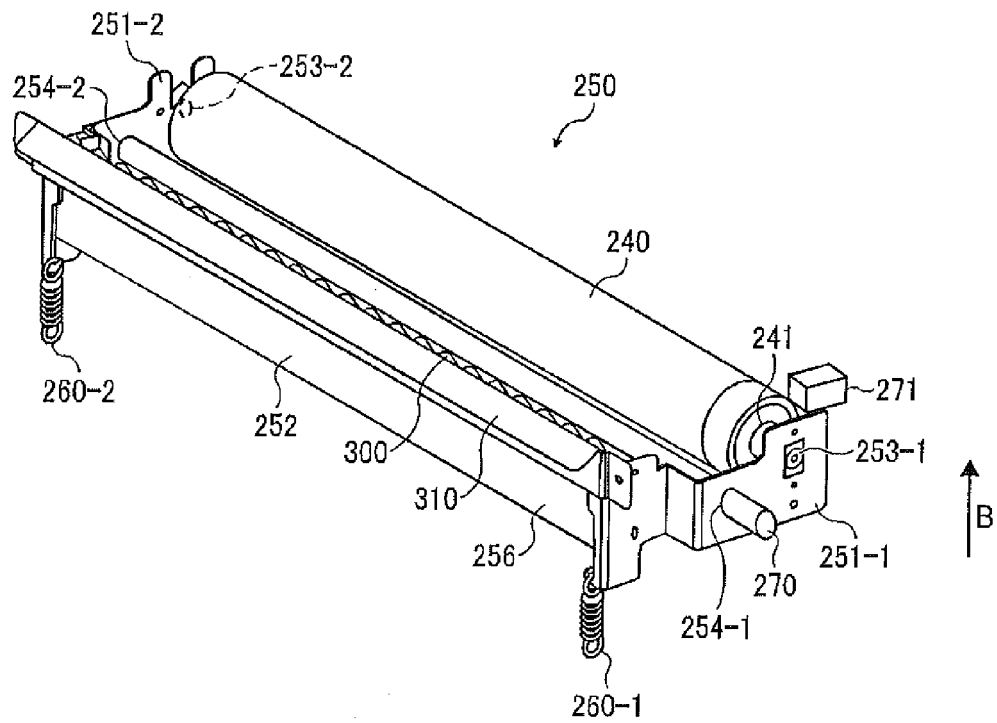


FIG. 6

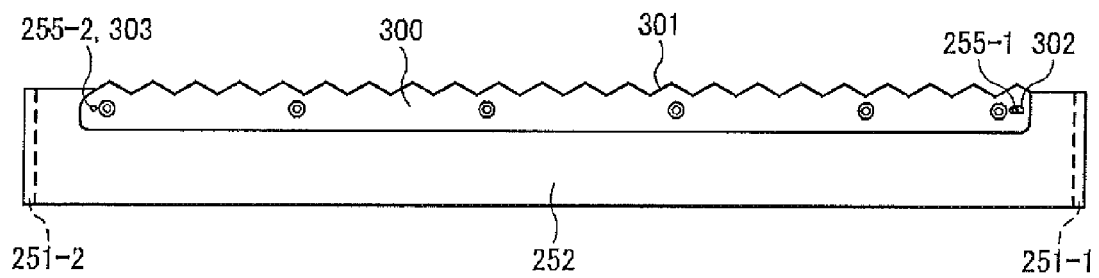


FIG. 7

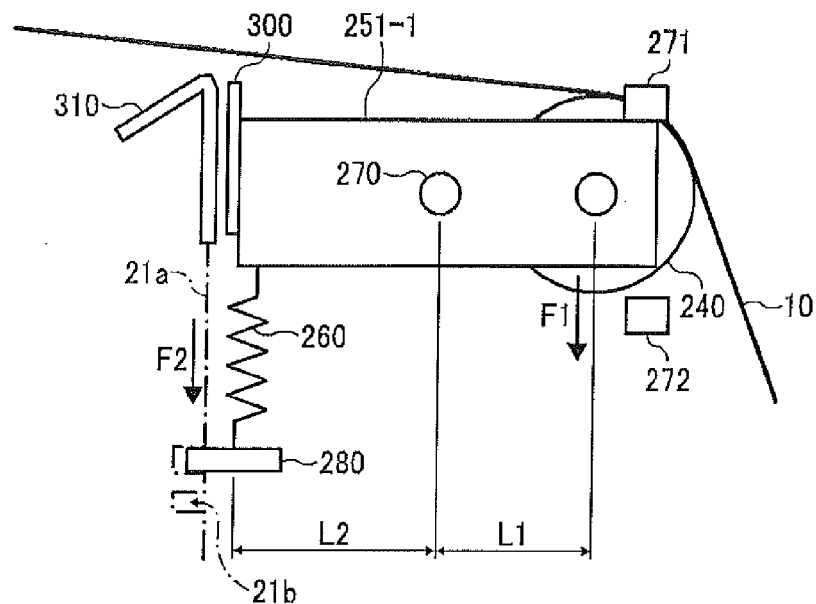


FIG. 8

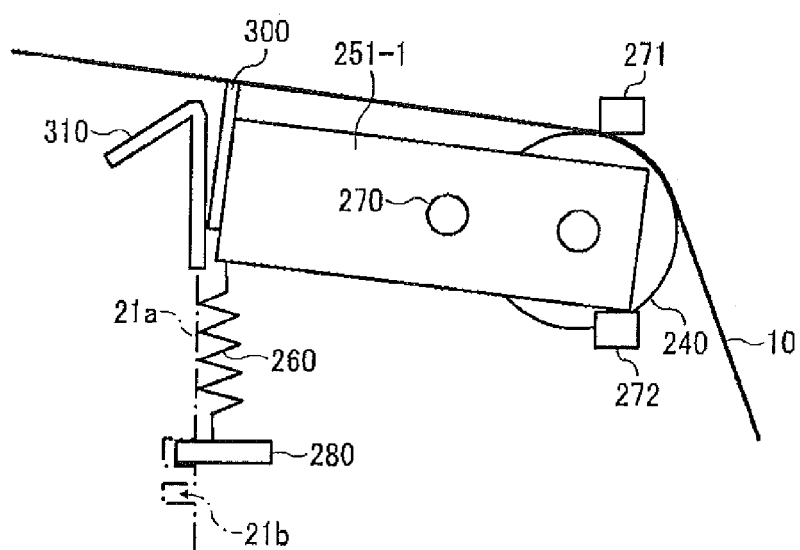


FIG. 9

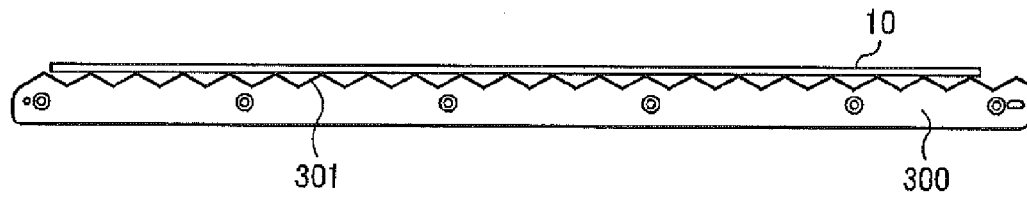


FIG. 10

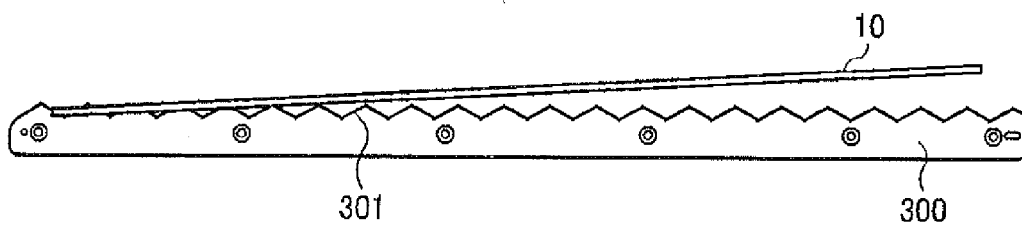


FIG. 11

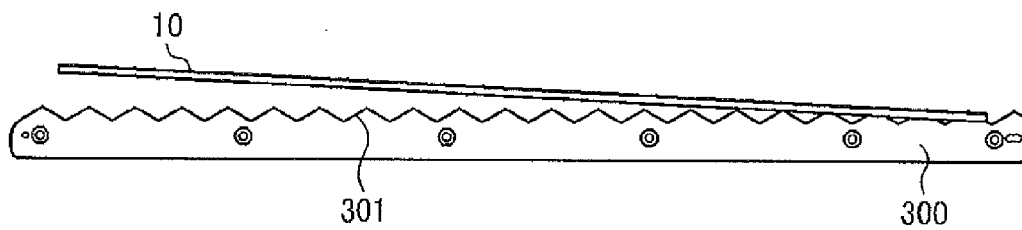
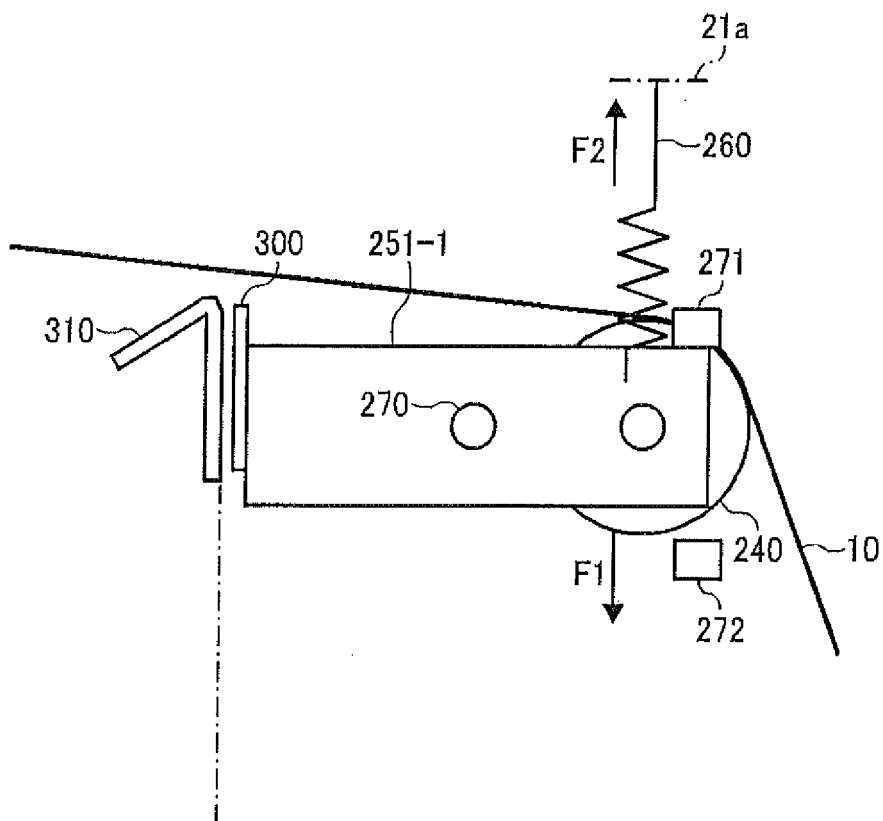


FIG. 12





EUROPEAN SEARCH REPORT

Application Number
EP 14 19 6116

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			B65H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 20 April 2015	Examiner Cescutti, Gabriel
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