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the mounting position; a moving unit (26) that moves the LED head array (8a) to an irradiation position interlockingly with mounting operation of the process cartridge (3a), using the mounting operation as a driving force; and a fixing unit (34) that fixes the process cartridge (3a) to the mounting position and that fixes the LED head array (8a) to the irradiation position, when the process cartridge (3a) has been mounted to the mounting position.

Description

[0001] The present invention relates to an image forming apparatus such as a copying machine, a facsimile, and a printer, and more particularly to an image forming apparatus that includes a light-emitting diode (LED) head array functioning as an exposure unit and a removable process cartridge.

[0002] In recent years, an LED head array is widely adopted as an exposure unit used in an electrophotographic image forming apparatus.

[0003] The LED head array is generally disposed close to a photosensitive element. For this reason, as compared with an image forming apparatus that uses a polygon mirror and the like in the exposure unit, an apparatus body can be miniaturized. Meanwhile, when a so-called process cartridge, configured to adopt therein the postpositive element or a developing unit which are of consumption goods, is exchanged, because the photosensitive element and the LED head array are provided close to each other, a lens surface of the LED head array may be damaged or a lens may be contaminated due to adhesion of a scattered toner.

[0004] Therefore, known is a technology that provides a withdrawing unit to withdraw (separate) the LED head array from the photosensitive element so as to prevent the lens from being damaged or contaminated, when the process cartridge is exchanged in Japanese Patent Application Laid-open No. 2001-175046.

[0005] However, in the conventional technology disclosed in Japanese Patent Application Laid-open No. 2001-175046, the withdrawing unit of the LED head array performs a withdrawn operation interlockingly with an inserting/extracting operation of a paper cassette or an opening/closing operation of an exterior cover at the time of jam processing, regardless of exchange work of the process cartridge. For this reason, in situations other than the exchange of the process cartridge, the LED head array is unnecessarily withdrawn.

[0006] If the LED head array is frequently withdrawn, position precision thereof may get out of order, and image information is not securely reflected onto a surface of the photosensitive element. As a result, an image defect such as a color deviation may occur.

[0007] In the configuration where the LED head array is withdrawn interlockingly with the inserting/extracting operation of the paper cassette or the opening/closing operation of the exterior cover, the number of interlocking members increases and a cost thereby increases or a structure becomes complicated. Therefore, a mechanical trouble may easily occur.

[0008] It is an object of the present invention to at least partially solve the problems in the conventional technology.

[0009] According to an aspect of the present invention, there is provided an image forming apparatus including a process cartridge that has a photosensitive element and is provided removably at a mounting position of an

apparatus body of the image forming apparatus; an LED head array that is provided in the apparatus body and illuminates the photosensitive element stored in the process cartridge with exposure light; a withdrawing unit that withdraws the LED head array to a withdrawn position separated from the process cartridge, when the process cartridge is not mounted at the mounting position of the apparatus body; a moving unit that moves the LED head array to an irradiation position near to the process cartridge interlockingly with mounting operation of the process cartridge to the mounting position of the apparatus body, using the mounting operation of the process cartridge as a driving force; and a fixing unit that fixes the process cartridge to the mounting position and that fixes the LED head array to the irradiation position in the apparatus body, when the process cartridge has been mounted to the mounting position of the apparatus body.

[0010] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

Fig. 1 is a lateral cross-sectional view illustrating a main cross-section of an image forming apparatus according to an embodiment;

Fig. 2 is a perspective view illustrating a state in which a process cartridge of the image forming apparatus according to the embodiment is mounted to an apparatus body;

Fig. 3 is a perspective view illustrating a state in which the process cartridge of the image forming apparatus according to the embodiment is extracted from the apparatus body;

Fig. 4 is a top view illustrating a state in which the process cartridge of the image forming apparatus according to the embodiment is mounted to the apparatus body; and

Fig. 5 is a lateral cross-sectional view illustrating a state in which the process cartridge of the image forming apparatus according to the embodiment is mounted to the apparatus body.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] Hereinafter, an embodiment will be described with reference to the drawings.

[0012] First, the configuration will be described.

[0013] Fig. 1 is a lateral cross-sectional view illustrating a main cross-section of an image forming apparatus according to the embodiment. When an inserting/extracting of a process cartridge 3a is operated in the image forming apparatus using an LED head array 8a functioning as an exposure unit, the present invention has the following points. Since the LED head array 8a is withdrawn from the photosensitive element 4a only during the inserting/

extracting operation of the process cartridge 3a, an interlocking member or an interlocking mechanism, which is interlocked with an exchanging operation of other consumption goods or interlocked with a jam processing operation or the like, is not needed. The points will be described in detail below.

[0014] In an image forming apparatus 50 of Fig. 1, main components of an apparatus body 1 includes therein following units. An image forming unit 2 has a plurality of process cartridges 3a, 3b, 3c, and 3d disposed removably from the apparatus body 1. In this embodiment, the process cartridges 3a, 3b, 3c, and 3d are configured to be removable at the front side of Fig. 1.

[0015] Each of the process cartridges 3a to 3d stores each of the drum-like photosensitive elements 4a, 4b, 4c, and 4d as image carrier, respectively, and toner images of different colors are formed on the photosensitive elements 4a, 4b, 4c, and 4d, respectively.

[0016] In an example illustrated in the drawings, a black toner image, a cyan toner image, a magenta toner image, and a yellow toner image are formed on surfaces of the photosensitive elements 4a to 4d, respectively.

[0017] The photosensitive elements 4a to 4d are disposed in parallel at a predetermined interval. An intermediate transfer belt 4 that is configured as an intermediate transfer body is disposed to face lower sections of the photosensitive elements 4a to 4d. As the intermediate transfer body, a drum may be used. However, in the example illustrated in the drawings, the intermediate transfer belt 4 that is an endless belt to be stretched on a plurality of support rollers (support rollers 5 and 6) and be driven is used. The support roller 6 of the support rollers 5 and 6 is a driving roller.

[0018] Around the photosensitive elements 4a to 4d, charging units 7a to 7d that execute a charging process on the surfaces of the photosensitive elements 4a to 4d, LED head arrays 8a to 8d that irradiate optical image information onto the surfaces of the photosensitive elements 4a to 4d, and developing units 9a to 9d that visualize electrostatic latent images formed on the surfaces of the photosensitive elements 4a to 4d by exposure are provided, respectively. In light emitting units of the LED head arrays 8a to 8d at the side of the photosensitive elements 4a to 4d, lenses (not illustrated in the drawings) that condense light are provided.

[0019] Next, an operation of the image forming apparatus will be described.

[0020] If image formation starts according to a printing start signal from a host (not illustrated in the drawings), the photosensitive element 4a is rotatably driven by a driving source (not illustrated in the drawings). At this time, the surface of the photosensitive element 4a is charged with the predetermined polarity, by the charging unit 7a.

[0021] Next, exposure light (laser light) based on the image information from the LED head array 8a is irradiated onto a charging surface. Thereby, an electrostatic latent image is formed on the photosensitive element 4a.

[0022] The electrostatic latent image that is formed on the surface of the photosensitive element 4a is visualized as a toner image by the developing unit 9a; and the toner image on the photosensitive element 4a is transferred to the intermediate transfer belt 4 by a primary transfer roller 10a.

[0023] When a color image is formed, the image forming operation describe above is performed by all of the photosensitive elements 4a to 4d. As a result, the black toner image, the cyan toner image, the magenta toner image, and the yellow toner image that are formed on surfaces of the photosensitive elements 4a to 4d respectively are sequentially overlapped and transferred to the intermediate transfer belt 4.

[0024] In the apparatus body 1, a secondary transfer roller 12 is disposed to face the support roller 6 as the driving roller, with the intermediate transfer belt 4 nipped by the secondary transfer belt and the support roller.

[0025] Meanwhile, in a paper cassette 21 that is disposed on a lower section of the image forming unit 2, sheets 23 are stacked and a paper feeding roller 22 to feed the stacked sheets 23 is provided therein. The sheet 23 that is fed from the paper cassette 21 is fed to a registration roller 11; and a leading edge of the sheet 23 abuts the stopped registration roller 11.

[0026] Thereby, after the sheet 23 is aligned, at operational timing when the color toner image formed on the intermediate transfer belt 4 is aligned with the leading edge of the sheet 23 by a secondary transfer section (nip section of the secondary transfer roller 12 and the support roller 6) provided with the secondary transfer roller 12, then the registration roller 11 restarts and the sheet 23 is fed to the secondary transfer section.

[0027] The sheet 23 where a non-fixed toner image is transferred by the secondary transfer section is fed to a fixing unit 13 and the non-fixed toner image is fixed to the sheet 23. After that, the sheet 23 is discharged in a direction shown by an arrow A in the drawings by a discharging roller 14 and is discharged onto a discharge tray 15 provided on an upper section of the apparatus body 1.

[0028] Figs. 2 and 3 are perspective views illustrating a state in which the process cartridge 3a is mounted to the apparatus body 1 and a state in which the process cartridge 3a is extracted from the apparatus body 1, respectively. Figs. 4 and 5 are a top view and a lateral cross-sectional view of a state in which the process cartridge 3a is mounted to the apparatus body 1, respectively.

[0029] First, the configuration of a removing mechanism of the process cartridge 3a will be described.

[0030] In the process cartridge 3a, provided are a rocking shaft 26 that makes the LED head array 8a approach to the photosensitive element 4a or makes the LED head array 8a alienate (withdraw) from the photosensitive element 4a; and a cover 34 that functions as a handle to fix the process cartridge 3a to the apparatus body 1 and to extract the process cartridge 3a from the apparatus

body 1. Retaining rings 41a and 41b are attached to both ends of the rocking shaft 26; and the moving amount of the rocking shaft 26 is suppressed by stoppers 40a and 40b that function as a bearing of the rocking shaft 26 incorporated in the process cartridge 3a.

[0031] Meanwhile, at the side of the apparatus body 1, the LED head array 8a that has fitting holes 33a and 33b in both ends thereof in a longitudinal direction is fitted into guide rods 31a and 31b provided in the apparatus body 1 to be movable upward and downward; and at the upper side of the LED head array 8a, provided are elastic members 32a and 32b that bias the LED head array 8a upward, and a rocking member 27 that makes the LED head array 8a approach to the photosensitive element 4a or makes the LED head array 8a alienate (withdraw) from the photosensitive element 4a.

[0032] The image forming apparatus 50 includes: the elastic members 32a and 32b and the rocking member 27 that function as a withdrawing unit to withdraw the LED head array 8a to the withdrawn position separated from the process cartridge 3a, in a state in which the process cartridge 3a is not mounted to the mounting position of the apparatus body 1; the rocking shaft 26 that functions as a moving unit to move the LED head array 8a to the irradiation position near to the process cartridge 3a interlockingly with mounting of the process cartridge 3a to the mounting position of the apparatus body 1, using the mounting of the process cartridge 3a as the driving force; and the cover 34 that functions as a fixing unit to fix the process cartridge 3a to the mounting position in the apparatus body 1 and to fix the LED head array 8a to the irradiation position in the apparatus body, in a state in which the process cartridge 3a is mounted to the mounting position of the apparatus body 1. In this case, the elastic members 32a and 32b and the rocking member 27 that function as the withdrawing unit are provided at the side of the apparatus body 1; and the rocking shaft 26 that functions as the moving unit is provided at the side of the process cartridge 3a. When the cover 34 functioning as the fixing unit is closed, the cover 34 simultaneously fixes the process cartridge 3a to the mounting position in the apparatus body 1 and fixes the LED head array 8a to the irradiation position in the apparatus body 1; and the cover 34 is provided at the side of the process cartridge 3a. The cover 34 is an opening/closing member that is provided in an end of the process cartridge 3a to be freely opened/closed and has a hole 35 that functions as a gripping section to for the process cartridge 3a to be extracted from the apparatus body 1. The process cartridge 3a is extracted from the apparatus body 1 in a direction orthogonal to a conveyance direction of a recording sheet.

[0033] Next, an operation of each component of the removing mechanism of the process cartridge 3a will be described.

[0034] The cover 34 has the hole 35 to insert a finger so as for the hole 35 to function as a handle (gripping section) to extract the process cartridge 3a; lock claws

36a and 36b to fix the cover 34 to the apparatus body 1; and rotating shafts 37a and 37b to rotate the cover 34. The cover 34 can rotate on the rotating shafts 37a and 37b in a direction shown by an arrow E in the drawings.

[0035] The lock claws 36a and 36b can be elastically deformed in a direction shown by an arrow G in the drawings, in a so-called a snap fitting system. As illustrated in Fig. 4, the lock claws 36a and 36b are fitted into hooking holes 38 and 38' provided at the side of the apparatus body 1 and are fixed into the hooking holes.

[0036] The rocking member 27 has: a pushing section 29 that pushes down the LED head array 8a and is provided in one end thereof; a receiving section 30 of the rocking shaft 26 that is provided in the process cartridge 3a and is provided in the other end thereof; and a rotating shaft 28 that rotates the rocking member 27. The rocking member 27 is pivotally supported to the apparatus body 1 and can rotate in a direction shown by an arrow C in the drawings.

[0037] The state when the process cartridge 3a is mounted on the apparatus body 1 is illustrated in Figs. 2, 4, and 5. The rocking shaft 26 that is incorporated in the process cartridge 3a is pushed in a direction shown by an arrow B in the drawings; when at the same time the process cartridge 3a is fixed by the cover 34; and the receiving section 30 of the rocking member 27 is also pushed in the same direction and rotates in the direction shown by the arrow C in the drawings with the rotating shaft 28 as a supporting point.

[0038] Thereby, the pushing section 29 that is one end of the rotated rocking member 27 pushes the LED head array 8a to the lower side (direction shown by an arrow D) against the biasing force to the upper side (direction shown by an arrow D') by the elastic members 32a and 32b and moves the LED head array 8a to a vicinity of the photosensitive element 4a. In this embodiment, tensile springs (pulling springs) are used as the elastic members 32a and 32b.

[0039] At this time, by the guide rods 31a and 31b provided in the apparatus body 1, the LED head array 8a can be moved without causing the positional deviation.

[0040] Meanwhile, when the process cartridge 3a is extracted from the apparatus body 1, this state is as illustrated in Fig. 3. When the cover 34 is opened, the rocking shaft 26 is released from the pushing force from the cover 34 and the rocking member 27 is released at the same time. As a result, the LED head array 8a that is pushed by the pushing section 29 of the rocking member 27 is also released and the LED head array 8a is pushed to the upper side (direction shown by an arrow D') by the biasing force of the elastic members 32a and 32b.

[0041] By this configuration, the lens of the LED head array 8a can be prevented from being damaged or contaminated due to exchanging work of the process cartridge 3a, and the image forming apparatus 50 that has good operability.

[0042] As illustrated above, the image forming appa-

ratus 50 according to this embodiment includes the process cartridge 3a storing the photosensitive element 4a; and includes the LED head array 8a provided in the apparatus body 1 and illuminating the photosensitive element 4a stored in the process cartridge 3a with exposure light. When the process cartridge 3a is not mounted at the mounted position in the apparatus body 1, the elastic members 32a and 32b and the rocking member 27 function as a withdrawing unit to withdraw the LED head array 8a to the withdrawn position separated from the process cartridge 3a. When the process cartridge 3a is to be mounted to the mounting position of the apparatus body 1, the rocking shaft 26 functions as a moving unit to move the LED head array 8a to the irradiation position approached to the process cartridge 3a interlockingly with mounting of the process cartridge 3a to the mounting position of the apparatus body 1, using the mounting of the process cartridge 3a as the driving force. The cover 34 functions as a fixing unit to fix the process cartridge 3a to the mounting position in the apparatus body 1 and to fix the LED head array 8a to the irradiation position in the apparatus body, when the process cartridge 3a is mounted to the mounting position of the apparatus body 1.

[0043] By this configuration, since the LED head array 8a is withdrawn from the photosensitive element only by inserting/extracting operation of the process cartridge 3a, is not needed an interlocking member or an interlocking mechanism that is interlocked with an exchanging operation of other consumption goods or a jam processing operation or the like.

[0044] Therefore, the LED head array 8a can be withdrawn from the photosensitive element with the simple configuration; and the lens of the LED head array 8a can be prevented from being damaged when the process cartridge 3a is exchanged, or the lens can be prevented from being contaminated due to adhesion of a scattered toner.

[0045] In the image forming apparatus 50 according to this embodiment, the withdrawing unit is provided at the side of the apparatus body 1 and the moving unit is provided at the side of the process cartridge 3a.

[0046] By this configuration, the LED head array 8a can be withdrawn from the photosensitive element with the simple configuration; and the lens of the LED head array 8a can be prevented from being damaged when the process cartridge 3a is exchanged, or the lens can be prevented from being contaminated due to adhesion of a scattered toner.

[0047] In the image forming apparatus 50 according to this embodiment, the cover 34 functions as the fixing unit that fixes the process cartridge 3a to the mounting position in the apparatus body 1 and simultaneously fixes the LED head array 8a to the irradiation position in the apparatus body 1.

[0048] By this configuration, the LED head array 8a can be withdrawn from the photosensitive element with the simple configuration; and the lens of the LED head array 8a can be prevented from being damaged when

the process cartridge 3a is exchanged, or the lens can be prevented from being contaminated due to adhesion of a scattered toner.

[0049] In the image forming apparatus 50 according to this embodiment, the cover 34 that functions as the fixing unit is provided at the side of the process cartridge 3a.

[0050] By this configuration, the LED head array 8a can be withdrawn from the photosensitive element with the simple configuration; and the lens of the LED head array 8a can be prevented from being damaged when the process cartridge 3a is exchanged, or the lens can be prevented from being contaminated due to adhesion of a scattered toner.

[0051] In the image forming apparatus 50 according to this embodiment, the cover 34 that functions as the fixing unit is an opening/closing member that is provided in an end of the process cartridge 3a and that can be opened/closed.

[0052] By this configuration, the LED head array 8a can be withdrawn from the photosensitive element with the simple configuration; and the lens of the LED head array 8a can be prevented from being damaged when the process cartridge 3a is exchanged, or the lens can be prevented from being contaminated due to adhesion of a scattered toner.

[0053] In the image forming apparatus 50 according to this embodiment, the cover 34 that functions as the fixing unit includes the hole 35 that functions as a gripping section for a user to extract the process cartridge 3a from the apparatus body 1.

[0054] By this configuration, the LED head array 8a can be withdrawn from the photosensitive element with the simple configuration; and the lens of the LED head array 8a can be prevented from being damaged when the process cartridge 3a is exchanged, or the lens can be prevented from being contaminated due to adhesion of a scattered toner.

[0055] In the image forming apparatus 50 according to this embodiment, the process cartridge 3a is extracted from the apparatus body 1 in a direction orthogonal to a conveyance direction of a recording sheet.

[0056] By this configuration, the LED head array 8a can be withdrawn from the photosensitive element with the simple configuration; and the lens of the LED head array 8a can be prevented from being damaged when the process cartridge 3a is exchanged, or the lens can be prevented from being contaminated due to adhesion of a scattered toner.

[0057] According to the present invention, there is provided an image forming apparatus that can withdraw an LED head array from a photosensitive element with the simple configuration, and prevent a lens of the LED head array from being damaged when a process cartridge is exchanged, or prevent the lens from being contaminated due to adhesion of a scattered toner.

[0058] In this configuration, the LED head array is withdrawn from the photosensitive element only during an

inserting/extracting operation of the process cartridge. Therefore, an interlocking member or an interlocking mechanism that is interlocked with an exchanging operation of other consumption goods or a jam processing operation or the like is not needed.

[0059] Therefore, the LED head array can be withdrawn from the photosensitive element with the simple configuration; and the lens of the LED head array can be prevented from being damaged when the process cartridge is exchanged, or the lens can be prevented from being contaminated due to adhesion of a scattered toner.

[0060] In this configuration, the LED head array can be withdrawn from the photosensitive element with the simple configuration; and the lens of the LED head array can be prevented from being damaged when the process cartridge is exchanged, or the lens can be prevented from being contaminated due to adhesion of a scattered toner.

[0061] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

[0062] The present application claims priority to and incorporates by reference the entire contents of Japanese Patent Application No. 2010-206693 filed in Japan on September 15, 2010.

Claims

1. An image forming apparatus (50) comprising:

a process cartridge (3a) that has a photosensitive element (4a) and is provided removably at a mounting position of an apparatus body (1) of the image forming apparatus (50);
 an LED head array (8a) that is provided in the apparatus body (1) and illuminates the photosensitive element (4a) stored in the process cartridge (3a) with exposure light;
 a withdrawing unit (27) that withdraws the LED head array (8a) to a withdrawn position separated from the process cartridge (3a), when the process cartridge (3a) is not mounted at the mounting position of the apparatus body (1);
 a moving unit (26) that moves the LED head array (8a) to an irradiation position near to the process cartridge (3a) interlockingly with mounting operation of the process cartridge (3a) to the mounting position of the apparatus body (1), using the mounting operation of the process cartridge (3a) as a driving force; and
 a fixing unit (34) that fixes the process cartridge (3a) to the mounting position and that fixes the LED head array (8a) to the irradiation position in the apparatus body (1), when the process car-

tridge (3a) has been mounted to the mounting position of the apparatus body (1).

2. The image forming apparatus (50) according to claim 1,
 wherein the withdrawing unit (27) is provided at a side of the apparatus body (1), and
 the moving unit (26) is provided at a side of the process cartridge (3a).
3. The image forming apparatus (50) according to claim 1 or 2,
 wherein the fixing unit (34)
 fixes the process cartridge (3a) to the mounting position in the apparatus body (1) and simultaneously
 fixes the LED head array (8a) to the irradiation position in the apparatus body (1).
4. The image forming apparatus (50) according to any one of claims 1 to 3,
 wherein the fixing unit (34) is provided at a side of the process cartridge (3a).
5. The image forming apparatus (50) according to any one of claims 1 to 4,
 wherein the fixing unit (34) is an opening/closing member that is provided at an end of the process cartridge (3a) and that can be opened/closed.
6. The image forming apparatus (50) according to any one of claims 1 to 5,
 wherein the fixing unit (34) includes a gripping section with which the process cartridge (3a) is extracted from the apparatus body (1).
7. The image forming apparatus (50) according to any one of claims 1 to 6,
 wherein the process cartridge (3a) is extracted from the apparatus body (1) in a direction orthogonal to a conveyance direction of a recording sheet.

FIG. 1

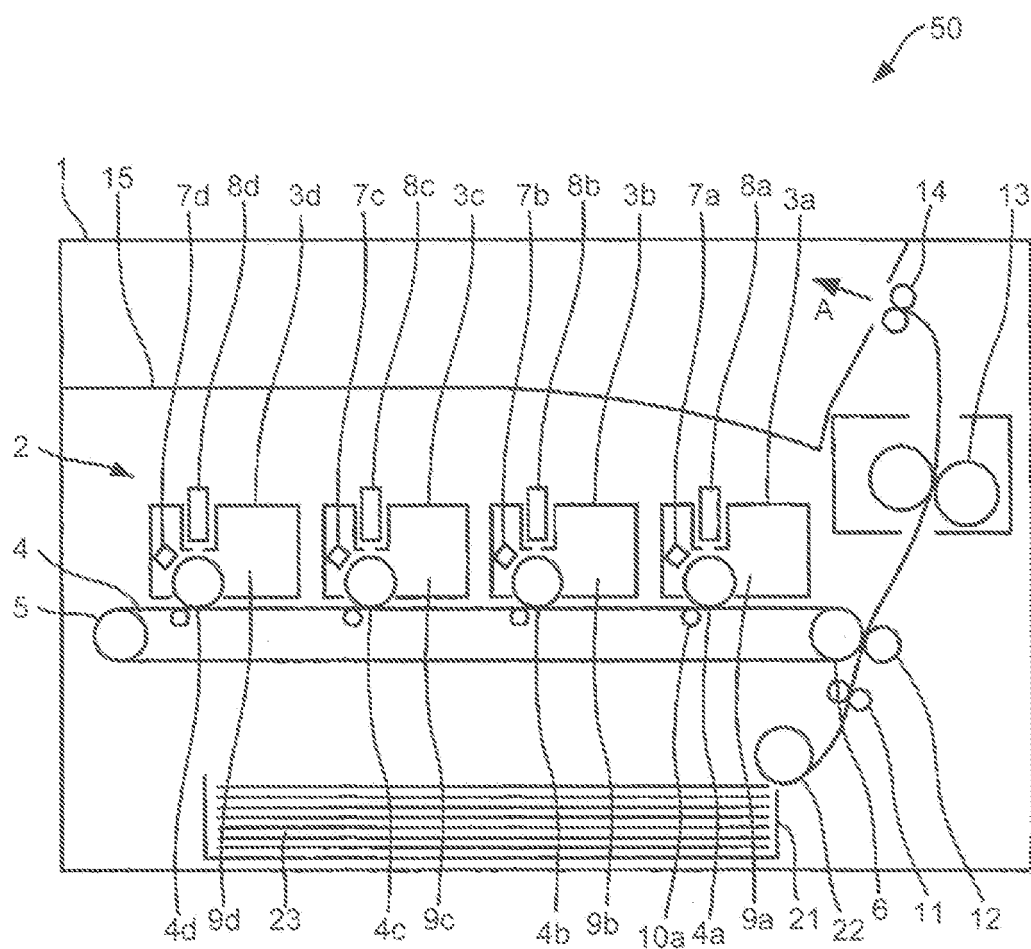


FIG. 2

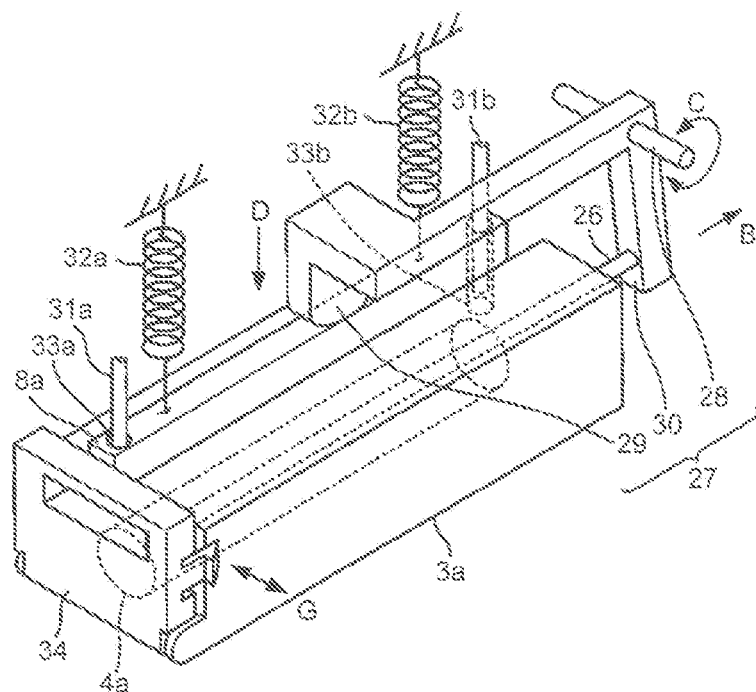


FIG. 3

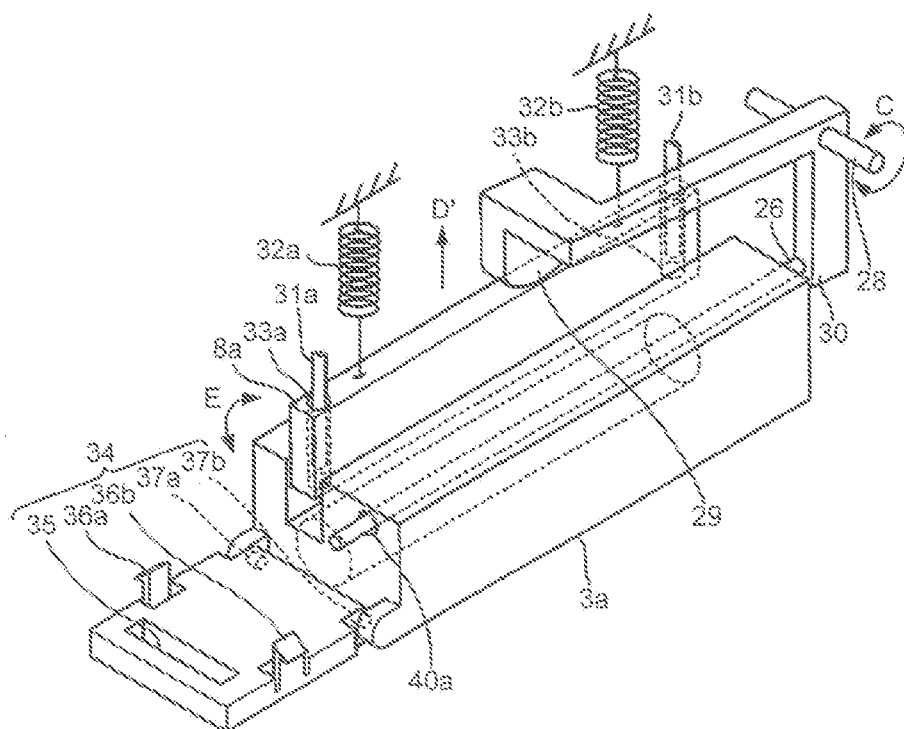


FIG.4

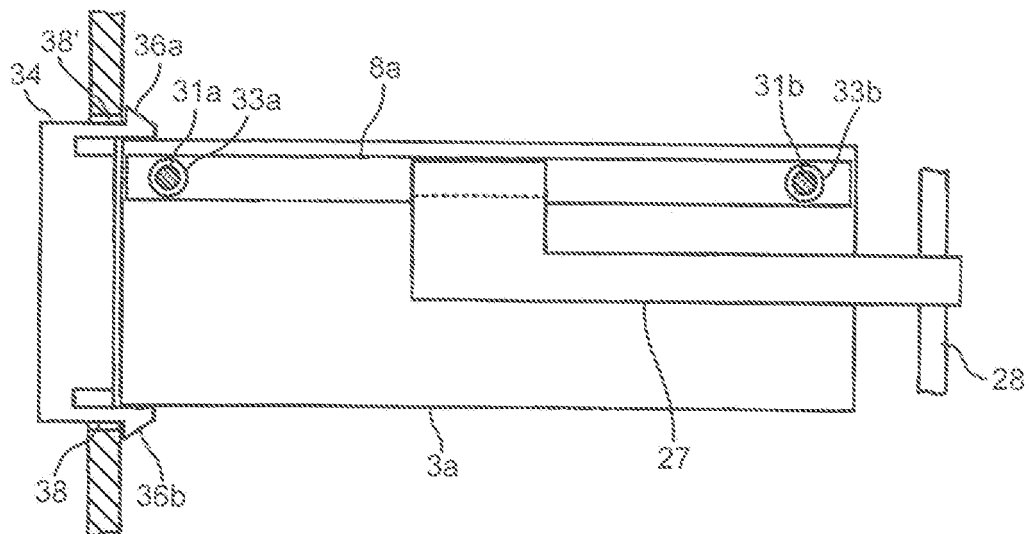
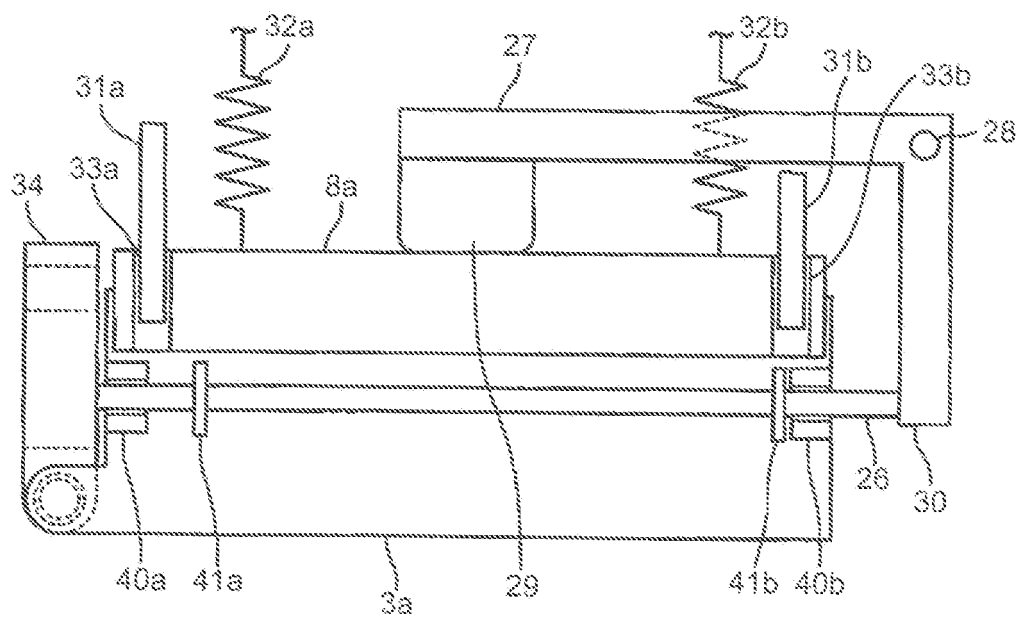


FIG.5





EUROPEAN SEARCH REPORT

Application Number
EP 11 18 0084

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Place of search		Date of completion of the search	Examiner
The Hague		27 January 2012	Van Ouytsel, Krist'l
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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