(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 315 440 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
02.05.2018 Bulletin 2018/18

(21) Application number: **15896344.7**

(22) Date of filing: **25.06.2015**

(51) Int Cl.:
B65H 23/032 *(2006.01)*

(86) International application number:
PCT/JP2015/068287

(87) International publication number:
WO 2016/208022 (29.12.2016 Gazette 2016/52)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

(71) Applicant: **Nireco Corporation**
Tokyo 192-8522 (JP)

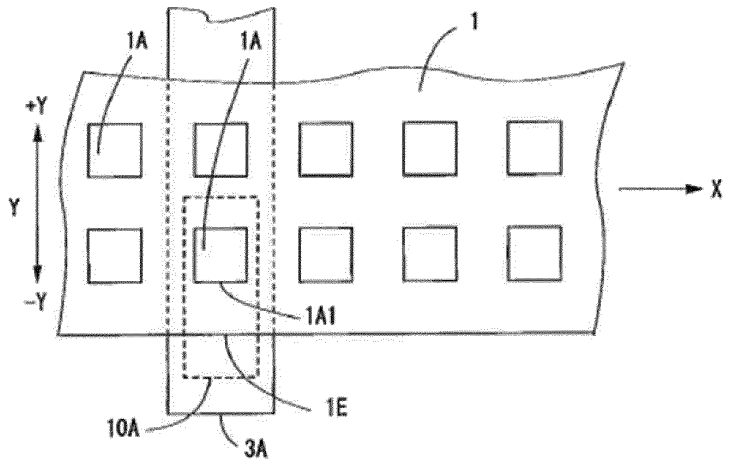
(72) Inventors:
- **MURAMATSU Kouichi**
  Hchioji-shi
  Tokyo 192-8522 (JP)
- **KURODA Takeshi**
  Hchioji-shi
  Tokyo 192-8522 (JP)
- **SASAZAKI Nariaki**
  Hchioji-shi
  Tokyo 192-8522 (JP)

(74) Representative: **Gill Jennings & Every LLP**
The Broadgate Tower
20 Primrose Street
London EC2A 2ES (GB)

(54) WEB MEANDERING CONTROL DEVICE AND CONTROL METHOD

(57) In the present invention, a web end (1 E), which is an end in the width direction perpendicular to the travel direction of a web (1), and a pattern end (1A1), which is an end in the width direction of each pattern (1A) repeatedly printed along the travel direction on the web (1), are detected at a first position in the web travel direction. A web end detection signal (G1) representative of the detected web end (1 E) and a picture end detection signal (G2) representative of the detected pattern end (1A1) are captured, and a control signal for aligning the pattern end (1A1) with a preset picture end reference position (P1) is generated. The web is moved in the width direction by the control signal.

Fig. 2



EP 3 315 440 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a web meandering control device for controlling meandering of a web and a method of controlling based on patterns printed on the web.

BACKGROUND ART

[0002] Figs. 5 (a) and 5 (b) show a conventional web meandering control device applied to the web processing device. The web 1 is rewound from the rewind reel 2 and guided by a deflector roll 3A and a guide roll 3B to travel in the arrow-marked direction X to be subjected to predetermined processing work at a processing device 4. It is to be noted that no mechanism for driving the web to travel is illustrated.

[0003] One example of the web 1 is illustrated in Fig. 6 which is a plan view of the embodiment. The web 1 is printed with identical patterns 1A in plural rows on the upper surface thereof (in Fig. 6, for example, in five rows arranged widthwise in the arrow-marked direction Y perpendicular to the arrow marked direction X). It is to be noted that the intervals between respective neighboring rows are equal to each other where patterns 1A are repeatedly printed with a fixed space therebetween taken in the arrow-marked direction X which corresponds to the web travel direction.

[0004] There are many types of processing device 4, one of which is referred to as a longitudinal cutting device which separates the web along the direction X into plural sections. The web 1 which has arrived at the processing device 4 is cut thereby at a position between respective neighboring rows to be formed into a plurality of sections 1 B.

[0005] The processing device 4 cuts the web 1 in such a way that each cut-off strip 1 B has an equal width in the arrow-marked direction Y with patterns 1 A each taking a center position in the width direction of each section 1 B. The marginal portions 1 C and 1 D are discarded while being cut off by the processing device 4. Another example of the processing device 4 includes a punching type which punches the web to cut off the patterns 1 A individually. Needless to say, the processing device 4 is not limited to the above two examples but there are a variety of types.

[0006] By the way, in case the processing device 4 is a longitudinal cutter, if the web 1 deviates in the width direction Y from the predetermined travel course, the patterns 1A is caused to swerve from their central position to the point where the patterns 1A themselves are severed. Also, in case the processing device 4 is a punching machine, if the web deviate toward the width direction Y from the predetermined travel course, the precise punching work along the circumference of the patterns 1A will not be performed with the result that the patterns 1 A themselves are severed.

[0007] To cope with this problem, a web meandering control device which performs the widthwise control of the web travel course was provided. Referring to Fig. 5, said web meandering control device is comprised of a web end sensor 5 to detect the widthwise position of the travel course of the web 1, an actuator 6 to shift a rewind reel 2 in the direction Y, an actuator control section 7 to drive the actuator 6 into the arrow marked direction Y in accordance with results detected from the web end sensor 5.

[0008] Said web end sensor 5 is for example a sensor to optically detect the position of the web end 1 E in the direction of the arrow mark Y (hereinafter referred to as "web end"), said web end sensor being set close to the rewind reel 2, in other words, between the deflector roll 3A and the guide roll 3B.

[0009] Within the actuator control section 7, the web end reference position is set beforehand as a reference position of the web end 1 E and a control signal is transmitted to the actuator 6 such that the difference between the web end detection signal detected by the web end sensor 5 and said web end reference position stays beneath the threshold value.

[0010] By operating the actuator 6 in accordance with the control signal received from the actuator control unit 7, the rewind reel 2 is shifted in the arrow mark +Y direction or -Y direction to rectify the position of the web end with respect to the arrow marked direction Y such that the web end 1 E coincide with the web end reference position.

[0011] In this way, the conventional web meandering control device attempts to prevent the above mentioned problem observed in the working process of the processing device 4 by monitoring the web end1E to stabilize the position of the web 1 with respect to the arrow marked Y direction.

[0012] However, the following problem can arise in case where it is only attempted to control the web end 1 to take a stabilized position. Specifically, there is a case as shown in Fig. 7 where the distance L0 from the printed web end 1 E to the end of the printed pattern 1 A varies at different parts of the web 1 with respect to the direction X. In such a case, it is impossible to address the problem simply by controlling the web 1 such that the web end 1 E coincide with the web end reference position if the processing device 4 is of a longitudinal cutter type as described referring to Fig. 6, wherein the defective products such as the pattern 1 A printed off the center of the cut-off strip 1B or the severed pattern are observed. Similar cases are seen with the punching type processing device mentioned above; that is, it is impossible to punch the pattern precisely along the circumference of the pattern 1 A to turn out the defective products as a result of the pattern themselves being severed.

[0013] Therefore, there was proposed a technique as shown in Fig. 8, wherein rectifying misregistration of the patterns 1 A was attempted by printing a line 1 F on the

web in the neighborhood of the web end which will not interfere with the patterns 1 A simultaneously with printing the patterns 1 A on the web 1, detecting said line 1 F by a line sensor 8 in place of the web end sensor 5 at the time of feeding the web 1 to the processing devise 4 and preventing misregistration of the web in the arrow-marked direction Y by means of the actuator control unit 7 and the actuator 6 such that the line 1 F coincides with a line reference position preset by the line 1 F.

[0014] However, this technique has a problem of inviting extra cost of printing ink consumption as an inevitable step of printing the line 1 F is involved.

[0015] In order to solve this problem, it has been proposed to provide a web meandering control device which controls the travel of the web 1 such that the patterns 1A1 coincides with the preset pattern end reference position. (Patent Literature 1)

[0016] As shown in Fig. 9, said web meandering control device takes the form of the web meandering control device shown in Fig. 5 which is additionally provided with a pattern detection camera 9 to photograph the patterns 1A downstream of the web end sensor 5, in the neighborhood of the guide roll 3B and immediately upstream of the processing device 4. In this embodiment, the control is done as follows.

[0017] From the image of the pattern 1 A photographed by the pattern detection camera 9, the misregistration amount of the pattern end 1A1 off the pattern end reference position is detected to form a correction signal. At the time of controlling the actuator 6 by the actuator control unit 7, the web end reference position is rectified by said correction signal such that the web end 1E misregistration detected by the web end sensor 5 off the web end reference position becomes zero.

[0018] Specifically, when the misregistration of the pattern end 1A1 off the pattern reference position is toward the +Y direction, the web end reference position is rectified by the correction signal toward the -Y direction. On the other hand, when the misregistration of the pattern end 1A1 off the pattern reference position is toward the -Y direction, the web end reference position is rectified by the correction signal in the + Y direction. In this way, the travel course of the web is controlled by rectifying the web end reference position such that the pattern end 1A1 coincides with the pattern reference position.

Citation List

Patent Literature

[0019] Patent Literature 1: Patent Application Laid-Open No. 2009-122973

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0020] However, in the web meandering control device described referring to Fig. 9, since the web end sensor 5 is arranged in the neighborhood of the rewind reel 2 whereas the pattern detection camera 9 is arranged immediately upstream of the processing device 4 installed downstream of and away from web end sensor 5, the response delay of the pattern end detection signal caused by the feedback control by means of the image photographed by the pattern detection camera 9 is greater than the response delay caused by feedback control of the web end detection signal detected by the web end sensor 5, creating the problem of control instability due to hunting.

[0021] To remove such problem, some measures such as making the gain of the pattern end detection signal less than that of the web end detection signal or filtering the pattern end detection signal are suggested. These measures tend to harm effective use of the pattern end detection signal photographed by the pattern detection camera 9.

[0022] The object of the present invention, therefore, is to provide a web meandering control device and its method which are capable of performing widthwise control of the web travel course effectively based on the pattern reference.

SOLUTION TO THE PROBLEMS

[0023] In order to solve the above mentioned problem, the web meandering control device as set forth is claimed in claim 1 is characterized in web end detection means for detecting a web end at a first position, said web end occurring as a widthwise end perpendicular to a web traveling direction; pattern end detection means for detecting at said first position pattern ends of patterns repeatedly printed on said web, said pattern ends occurring as widthwise ends perpendicular to said web travelling direction; control signal generating means for generating a control signal to bring said pattern end into conformity with a preset pattern end reference position by fetching a web end detection signal detected by said web end detection means and a pattern end detection signal detected by said pattern end detection means; and an actuator to shift said web in said widthwise direction by means of said control signal outputted from said control signal generating means.

[0024] The invention of claim 2 is the web meandering control device as set forth in claim 1 and is characterized in that said web end detection means and said pattern end detection means composing a single imaging means to capture said web end and said pattern ends in a field of view of said single imaging means and detect said web end and said pattern end.

[0025] The invention of claim 3 is the web meandering control device as set forth in claim 2 and is characterized in that said imaging means including two dimensional imaging means arranged at said first position or one dimensional imaging means arranged at said first position with respect to said widthwise direction of the web.

[0026] The invention of claim 4 is a web meandering control device as set forth in claim 1, 2 or 3 and characterized in that said control signal generating means selecting a web end reference position in accordance with a result of comparing said pattern end detection signal and said pattern end reference position and generating said control signal in accordance with a result of comparing the selected web end reference position and said web end detection signal.

[0027] The invention of claim 5 is a web meandering control method characterized in comprising the steps of detecting a web end of the web, said web end occurring as an end with respect to a widthwise direction perpendicular to a web travelling direction, while detecting ends of patterns repeatedly printed on said web in said web travelling direction, said web end and said pattern ends being detected at a first position respectively with respect to said web travelling direction; feeding a web end detection signal representative of said detected web end and pattern ends detection signal representative of said pattern ends to generate a control signal for bringing said pattern ends into conformity with a preset pattern ends reference position; and shifting said web in said widthwise direction by means of said control signal.

[0028] The invention of claim 6 is a web meandering control method as set forth in claim 5, characterized in detecting said web end and said pattern ends by a single imaging means.

[0029] The invention of claim 7 is a web meandering control method as set forth in claim 5 or claim 6, wherein characterized in the steps of selecting a web end reference position in accordance with a result of comparing said pattern end detection signal and said pattern end reference position in accordance with a result of comparing said selected web end reference position and generate said control signal said web end detection signal.

EFFECTS OF THE INVENTION

[0030] According to the present invention, the detection of the web end and the pattern end at the first position of the web travel course realizes the processing of the web end detection signal and the pattern end detection signal with the equal gain, preventing the generation of hunting due to the difference of delay, thereby improving the control performance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031]

Fig. 1 (a) is a plan view of one embodiment of the web meandering control device according to the present invention and Fig. 1(b) is a side view thereof;
Fig. 2 is an explanatory view of part of the web photographed by the imaging device of the web meandering control device of the embodiment;
Fig. 3 is an explanatory view of the actuator control unit of the web meandering device of the embodiment;
Fig. 4 is an explanatory view to illustrate the web meandering control device based on the pattern reference;
Fig. 5 (a) is an explanatory a web meandering control device according to prior art and Fig. 5 (b) is a side view thereof;
Fig. 6 is an explanatory view of the web printed with patterns thereon being fed along the web travel course in the prior art device;
Fig. 7 is an explanatory view of the web showing the occurrence of widthwise misregistration of the patterns printed on the web travelling in the feed direction;
Fig. 8 is an explanatory view of the example in which a line is printed together with the patterns on the web in the feed direction; and
Fig. 9 is an explanatory view of the prior art web meandering control device to control the web travel based on the pattern reference by detecting the web end and the pattern end.

BEST MODE EMBODIMENT OF THE INVENTION

[0032] Hereinafter, the web meandering control device of the invention according to one embodiment thereof will be described, wherein similar members referred to and shown in Figs. 5-9 are given the similar reference numerals and repetitious explanations are omitted. In the current embodiment as shown in Fig. 1, the web end sensor 5 provided between the deflector roll 3A and the guide roll 3B is replaced with an imaging device 10 such as a CCD camera fixedly arranged above the deflector roll 3A. Here, an illustration of the light source to irradiate the area supposed to be imaged by the imaging device 10 is omitted.

[0033] Said imaging device 10 captures the web end 1 E and the pattern end 1A1 in a single field of view 10A as shown in Fig. 2 and photographs said web end 1 E and sad pattern end A1 as an image thereof and the thus photographed image is subjected to image processing at the image processing unit 11 to generate a web end detection signal G1 which shows the position of the web end 1 E and a pattern end detection signal G2 which shows the position of pattern end 1A1.

[0034] Thus, in this embodiment, the web end 1 E and the pattern end 1A1 are detected at the identical position taken toward the web travel direction shown by the arrow mark X before said detection signal G1 and G2 are transmitted into the actuator controller 12.

[0035] It is to be noted in this connection that the web end 1 E means the right side end of the web 1 with respect to the web travel direction viewed from above while the pattern end 1A1 means the right side end of the pattern end 1 A closest to the web end 1 E of the web 1 with respect to the web travel direction viewed from above.

[0036] The actuator control unit 12 is configured as

shown in Fig. 3. Numeral 12a denotes the first comparing section, numeral 12b denotes the web end reference position storage section wherein the data of the web end reference position is stored, 12c denotes the second comparing section, 12d denotes pattern end reference position storage section wherein one or more pattern end reference position data are stored.

[0037] In the actuator control unit 12, the pattern end detection signal G2 generated at the image processing unit 11 and the pattern end reference position read out from the pattern end reference position storage section 12d in accordance with a processing position of the web 1 executed at the processing device 4 are compared at the second comparison section 12c to obtain a difference and to generate a selection signal based on the thus obtained difference. By means of this selection signal, the web end reference position is read out at the web end reference position storage section 12b. Then, the web end detection signal G1 generated at the image processing section 11 and the web end reference position read out from the web end reference position storage section 12b are compared at the first comparing section 12a to obtain a difference, generate a control signal based on the thus obtained difference and output the same to the actuator 6.

[0038] In operation, the control procedures will be described referring to Fig. 4. As shown in Fig. 4 (a), in case the pattern end 1A1 deviates by L1 toward the +Y direction away from the pattern end reference position P1 which has been read out from the pattern end reference position storage section 12d, a selection signal corresponding to the amount L1 and the direction of deviation is generated at the second comparing section 12c. As a result, the web end reference position read out from the web end reference position storage section 12b becomes the web end reference position Q1 which has shifted by L1 in the -Y direction. The actuator control unit 12 generates a control signal in accordance with the comparison result between the web end detection signal G1 and the web end reference position Q1 and emits said control signal to the actuator 6, which drives the rewind reel 2 to shift in the arrow-marked -Y direction such that the web end 1 E shifts in the arrow-marked - Y.

[0039] Even if the current pattern 1 A leaves the field 10A of the imaging device 10, the control of the web end 1 E retains the selection signal as it is until the pattern end 1A1 of the succeeding pattern 1 A is detected by the imaging device 10. Then, when the pattern end 1A1 of the succeeding pattern is detected, the second comparison section 12c renews the selection signal such that the similar control is performed by the renewed selection signal.

[0040] As a result of such control procedure being repeated, the pattern end 1A1 of the pattern 1A coincides with the pattern reference position P1 as shown in the right side portion of Fig. 4(a).

[0041] It is to be noted that in cases the pattern end 1A1 is misaligned by L2 toward the - Y direction away the pattern end reference position P1 read out from the pattern end reference position storage section 12d, the rewind reel 2 is driven to shift into the + Y direction as opposed to the control procedure as shown in Fig. 4(a) such that the end 1A1 of the pattern 1 A coincides with the pattern reference position P1 as shown in at the right end portion of Fig. 4(b).

[0042] As described in the foregoing, the control procedures are repeated such that said rewind reel 2 is shifted into the arrow marked - Y direction or + Y direction by actuator 6. As a result, the pattern end 1A1 fed into the processing device 4 coincides with the pattern end reference position P1 even though the distance LO between the pattern end 1A1 and the web end 1 E varies at any position in the arrow marked direction X as pointed out referring to Fig. 7. By presetting the pattern end reference position P1 in accordance with the cutting position at the processing device 4, the meandering of the web 1 is controlled such that the web maintain its position in accordance with the pattern end reference position P1 to assure that precise work is performed at the processing device 4.

[0043] In the current embodiment, since the pattern end 1A1 and the web end 1 E are detected at the same travel position (that is, the position of the deflector roll 3A) with respect to the web travel direction as arrow marked X, the obtained pattern end detection signal G2 is fetched into the actuator control unit 12 simultaneously with the web end detection signal G1. This eliminates the need of adjusting or filtering the gain of pattern end detection signal G2 as the both signals G1 and G2 are treated with the identical gain with the result that the effective use of the pattern end detection signal G2 is realized, thus improving the control performance.

[0044] In this connection, while the two-dimensional imaging device such as a CCD camera is used in this embodiment, a one-dimensional imaging device such as a line sensor may be used, where it is possible to detect the web end 1 E and the pattern end 1A1 simultaneously if said one-dimensional imaging device is arranged in the width direction of the web 1.

[0045] Further, while the web end 1 E and the pattern end 1A1 are detected by the single imaging device 10 at the same position with respect to the travel direction of the web 1 in this embodiment, it may be configured that a web end sensor means for detecting the web end 1 E and a pattern end sensor means for detecting the pattern end 1A1 are arranged separately at the same position with respect to the web travel direction.

[0046] Further, while the image processing unit 11 generates the web end detection signal G1 and the pattern end detection signal G2 in this embodiment and said signals G1 and G2 are fed into the actuator control unit 12 for calculation to generate a control signal to control the actuator 6, the invention is not limited to the use of this configuration. For example, it may be configured such that the web end detection signal G1 and the pattern end detection signal G2 are detected in the image processing unit 11 while said signals G1 and G2 are calculated to

produce control signals by a similar calculation to the one as described referring to Fig. 3; and said control signals are transmitted to the actuator 12 such that said actuator 6 is controlled by the actuator control unit 12. In this case, the control signal produced by the image processing unit 11 is amplified at the actuator control section 12. In this way, the control signal to control actuator 6 may be produced at either of the image processing unit 11 and the actuator control unit 12. In this meaning, the image processing section 11 and the actuator control section 12 may be referred to collectively as the control signal generating means.

[0047] Further, while it is described in this embodiment that the meandering of the web is controlled based on the repeatedly printed pattern at a fixed pitch in the travel direction shown by the X-marked arrow, the invention is not limited to the use of the typical pattern to be cut off later. For example, although the cut mark, the register mark for controlling the web meandering at the time of printing or the dragonfly mark are repeatedly printed at a fixed interval in the travel direction to be finally cut off, such marks are also included as treated in the same way as the above described pattern for the meandering control.

List of Reference Numerals

[0048]

1:	web
1A:	pattern
1B	cut-off strip
1C, 1D	margin
1E:	web end
1F:	line
2:	rewind reel
3A:	deflector roll 3B: guide roll
4:	processing device
5:	web end sensor
6:	actuator
7:	actuator control unit
8:	line sensor
9:	pattern detection sensor
10:	imaging device
11:	image processing unit
12:	actuator control unit

Claims

1. A web meandering control device comprising;
web end detection means for detecting a web end at a first position, said web end occurring as a widthwise end perpendicular to said web traveling direction;

pattern end detection means for detecting at said first position pattern ends of patterns repeatedly printed on said web, said pattern ends occurring as widthwise ends perpendicular to said web travelling direction;
control signal generating means for generating a control signal to bring said pattern end into conformity with a preset pattern end reference position by fetching a web end detection signal detected by said web end detection means and a pattern end detection signal detected by said pattern end detection means; and
an actuator to shift said web in said widthwise direction by means of said control signal outputted from said control signal generating means.

2. A web meandering control device as set forth in claim 1,
said web end detection means and said pattern end detection means composing a single imaging means to capture said web end and said pattern ends in a field of view of said single imaging means and detect said web end and said pattern end.

3. A web meandering control device as set forth in claim 2,
said imaging means including two dimensional imaging means arranged at said first position or one dimensional imaging means arranged at said first position with respect to said width wise direction of the web.

4. A web meandering control device as set forth in claim 1, 2 or 3,
said control signal generating means selecting a web end reference position in accordance with a result of comparing said pattern end detection signal and said pattern end reference position and generating said control signal in accordance with a result of comparing the selected web end reference position and said web end detection signal.

5. A web meandering control method comprising the steps of detecting a web end of the web, said web end occurring as an end with respect to a widthwise direction perpendicular to a web travelling direction, while detecting ends of patterns repeatedly printed on said web in said web travelling direction, said web end and said pattern ends being detected at a first position respectively with respect to said web travelling direction;

fetching a web end detection signal representative of said detected web end and pattern ends detection signal representative of said pattern ends to generate a control signal for bringing said
pattern
ends into conformity with a preset pattern ends reference position;

and
shifting said web in said widthwise direction by means of said control signal.

6. A web meandering control method as set forth in claim 5,
detecting said web end and said pattern ends by a single imaging means.

7. A web meandering control method as set forth in claims 5 or 6,
wherein
selecting a web end reference position in accordance with a result of comparing said pattern end detection signal and said pattern end reference position and generating the control signal in accordance with a result of comparing said selected web end reference position and said web end detection signal.

Fig. 1

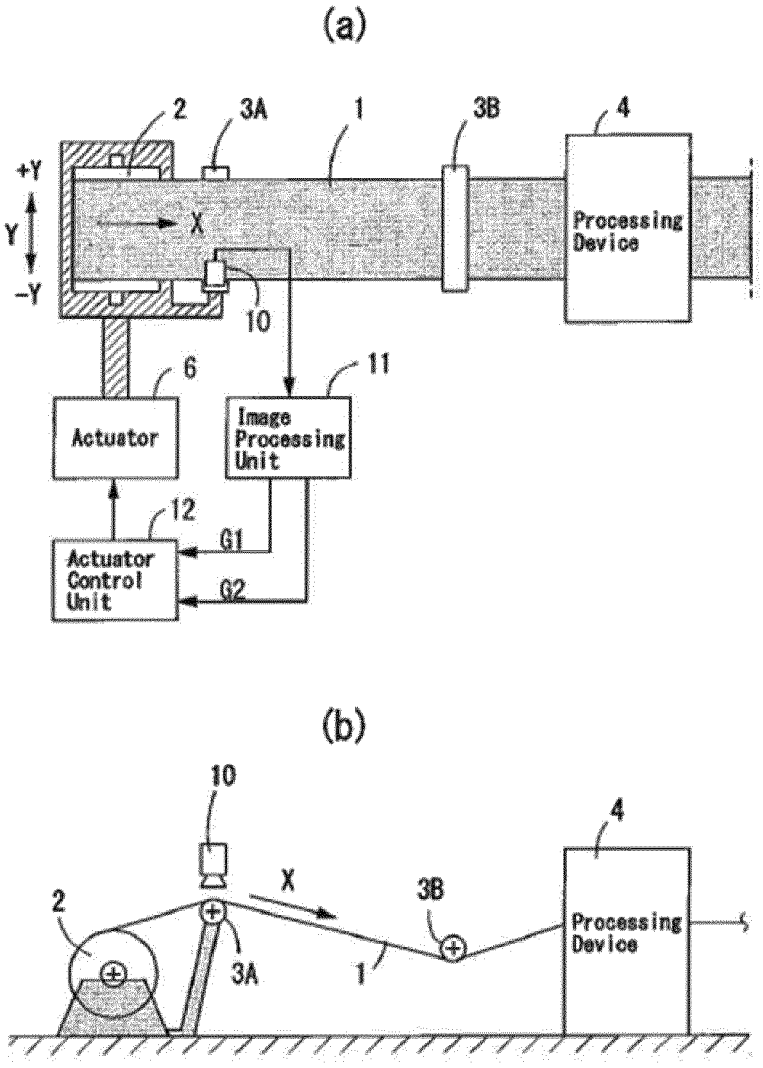

(a)
2
3A
1
3B
4
+Y
Y
-Y
X
Processing Device
10
6
11
Actuator
Image Processing Unit
12
G1
G2
Actuator Control Unit
(b)
10
4
X
3B
2
3A
1
Processing Device

Fig. 2

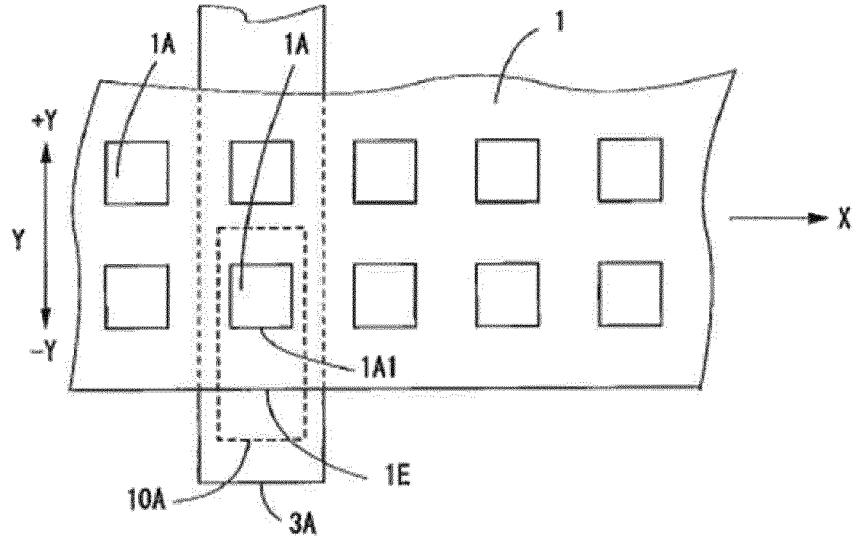

1A
1A
1
+Y
Y
-Y
X
1A1
1E
10A
3A

Fig. 3

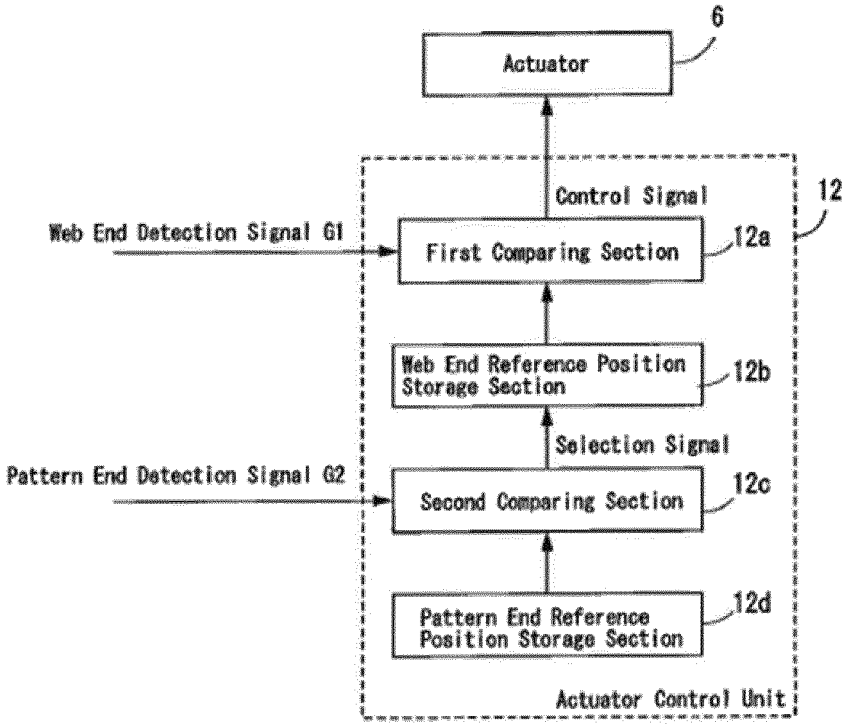

6
Actuator
Control Signal
12
Web End Detection Signal G1
First Comparing Section
12a
Web End Reference Position Storage Section
12b
Selection Signal
Pattern End Detection Signal G2
Second Comparing Section
12c
Pattern End Reference Position Storage Section
12d
Actuator Control Unit

Fig. 4

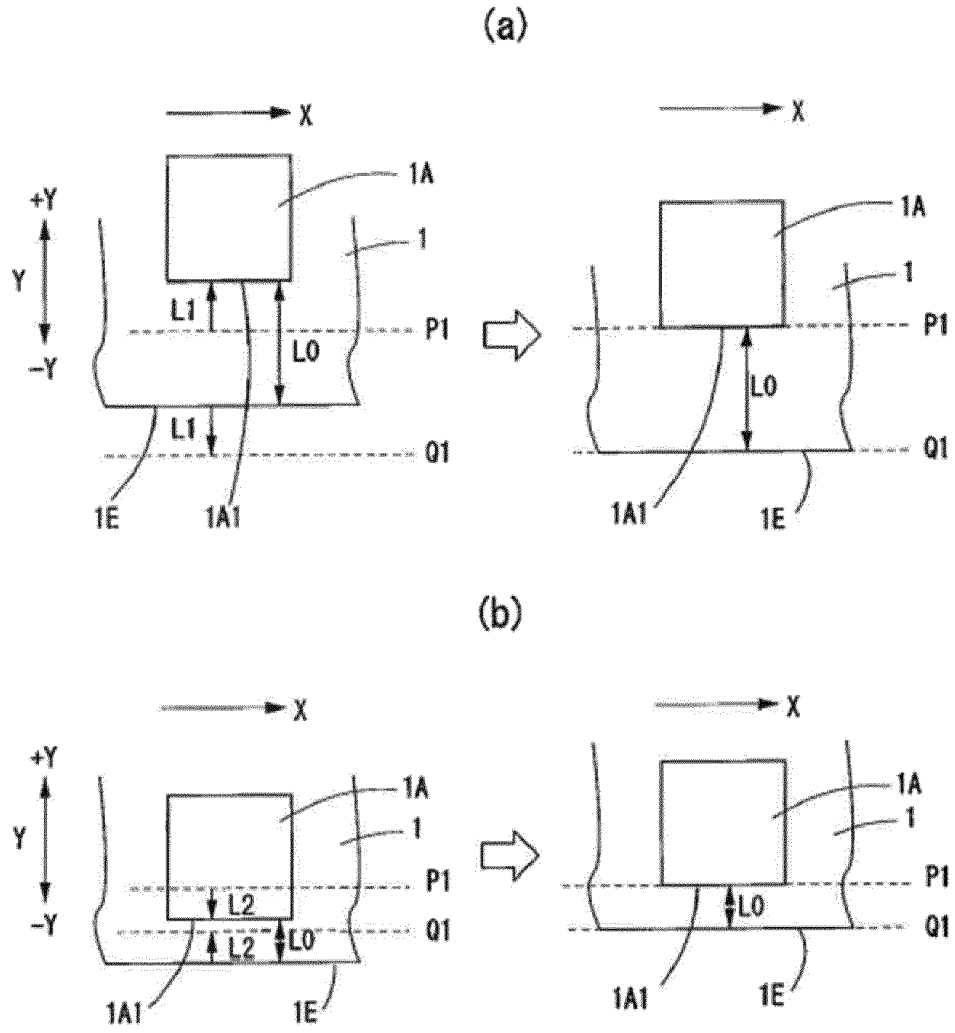

(a)
X
+Y
Y
-Y
1A
1
L1
L0
P1
L1
Q1
1E
1A1
X
1A
1
P1
L0
Q1
1A1
1E
(b)
X
+Y
Y
-Y
1A
1
P1
L2
Q1
L2
L0
1A1
1E
X
1A
1
P1
L0
Q1
1A1
1E

Fig. 5

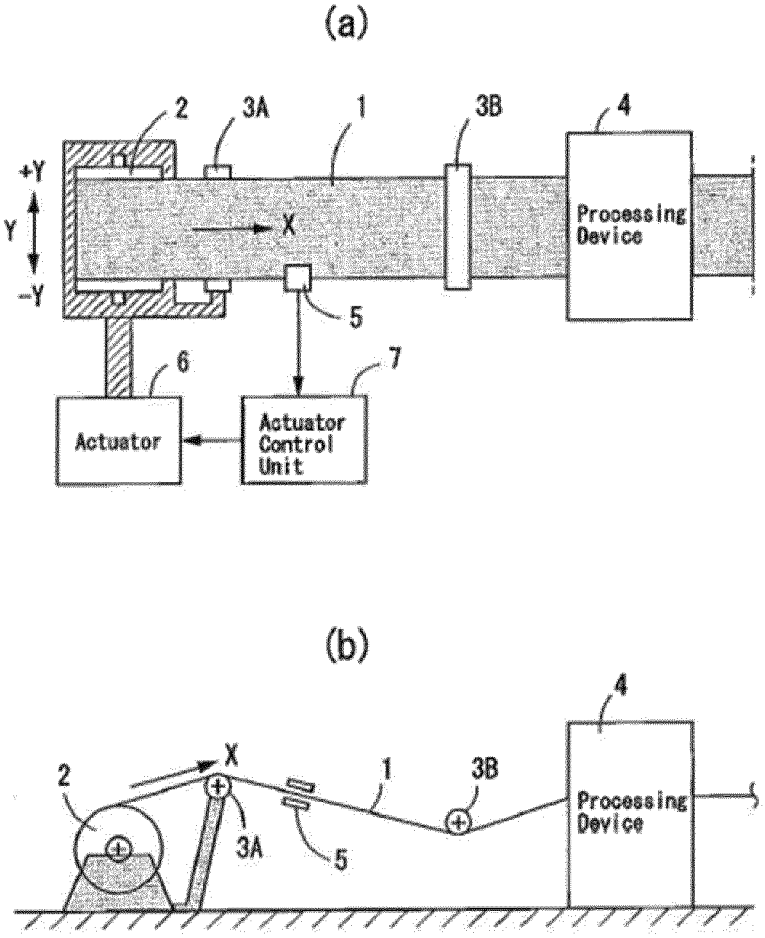

(a)
2
3A
1
3B
4
+Y
Y
-Y
X
Processing Device
5
6
7
Actuator
Actuator Control Unit
(b)
4
X
2
1
3B
Processing Device
3A
5

Fig. 6

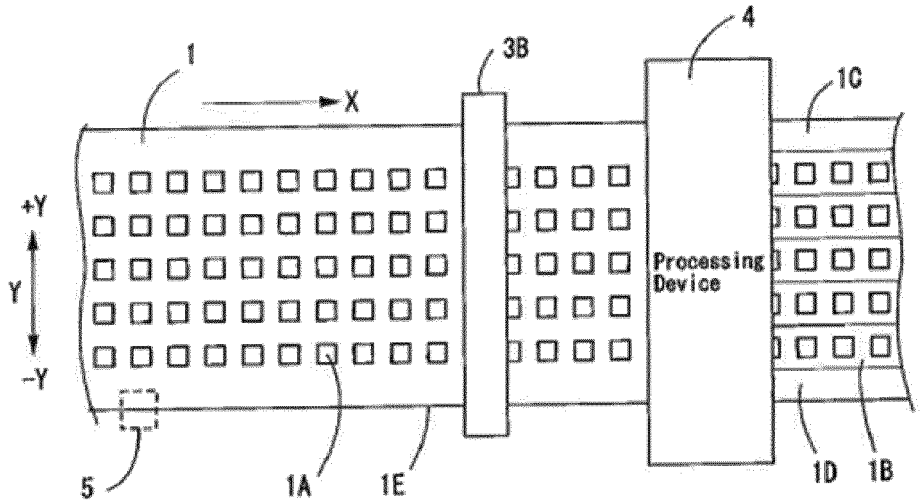

1
X
3B
4
1C
+Y
Y
-Y
Processing Device
5
1A
1E
1D
1B

Fig. 7

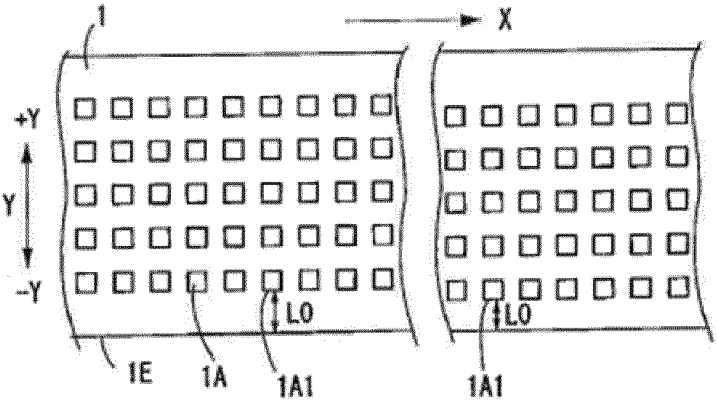

1
X
+Y
Y
-Y
L0
L0
1E
1A
1A1
1A1

Fig. 8

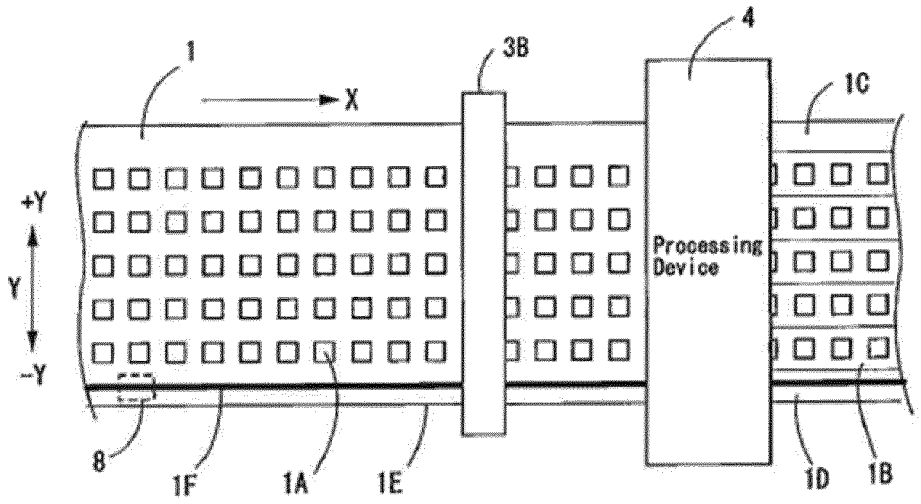
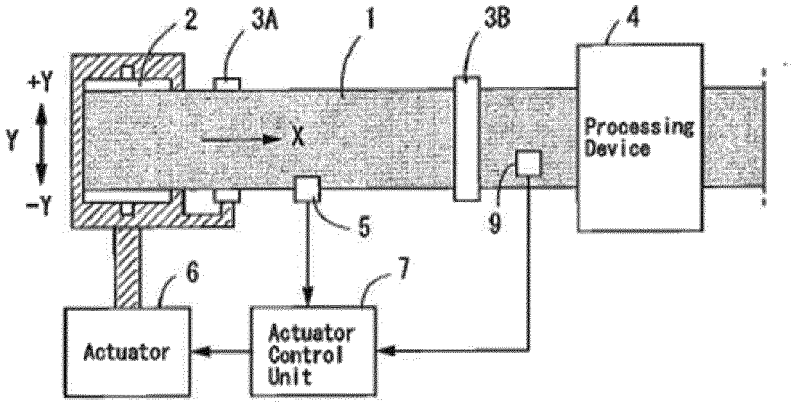

1
X
3B
4
1C
+Y
Y
-Y
Processing Device
8
1F
1A
1E
1D
1B

Fig. 9


2
3A
1
3B
4
+Y
Y
-Y
X
Processing Device
5
9
6
7
Actuator
Actuator Control Unit

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/068287

A. CLASSIFICATION OF SUBJECT MATTER
B65H23/032(2006.01)i

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)
B65H23/00-23/34, 26/00-26/08, 27/00, G05D3/12, B26D5/30, 5/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-263660 A (Dainippon Printing Co., Ltd.), 26 September 2000 (26.09.2000), paragraphs [0001], [0023], [0035] to [0041]; fig. 1 (Family: none)	1-7
A	JP 2009-122973 A (Nireco Corp.), 04 June 2009 (04.06.2009), paragraphs [0050], [0081] to [0099], [0109] to [0131], [0159] to [0181]; fig. 1 to 15 (Family: none)	1-7

☒ 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 application or patent 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
02 September 2015 (02.09.15)	15 September 2015 (15.09.15)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/068287

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 8-12146 A (Fujitsu Ltd.), 16 January 1996 (16.01.1996), claim 9; paragraphs [0030], [0045], [0057]; fig. 9, 10 (Family: none)	1-7
A	JP 2009-039824 A (Nireco Corp.), 26 February 2009 (26.02.2009), entire text; all drawings (Family: none)	1-7

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2009122973 A **[0019]**