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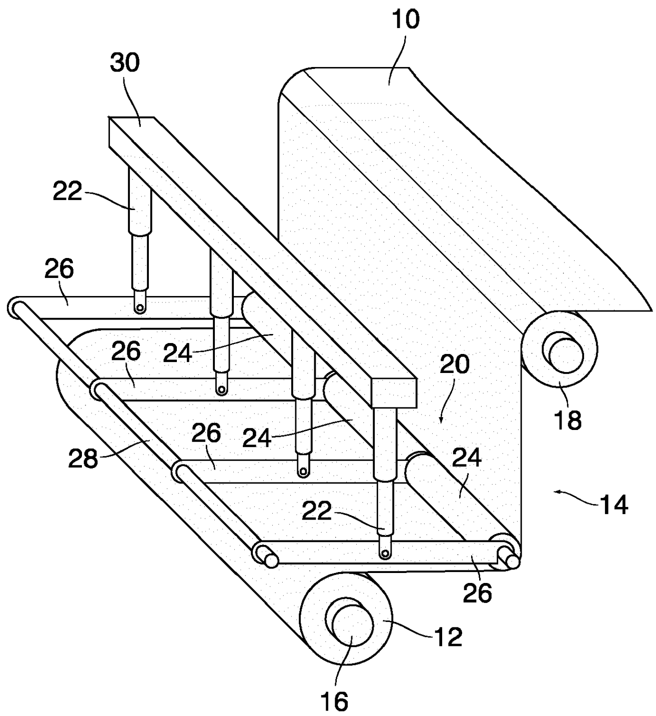
(54) WEB TENSIONING MECHANISM

(57) A web tensioning mechanism for tensioning a print media web (10) conveyed along a feed path (14), the mechanism comprising a dancer (20) that extends over a width of the web (10), and a number of biasing members (22) arranged to bias the dancer against the web (10), characterized in that the dancer (20) is divided lengthwise into a plurality of segments (24), and the number of biasing members (22) is at least equal to the number of segments (24).

Fig. 1



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Description

[0001] The invention relates to a web tensioning mechanism for tensioning a print media web conveyed along a feed path, the mechanism comprising a dancer that extends over a width of the web, and a number of biasing members arranged to bias the dancer against the web.

[0002] In the printing industry, a media web is frequently withdrawn from a roll and conveyed along a feed path that is defined by a number of parallel rollers over which the web is passed with or without deflection, so that the web is guided to and through, for example, a printing machine, a finisher, and the like.

[0003] In order to achieve a high productivity, it is desired that the web is wound on a coil in a large number of layers so that the total length of the web is as large as possible and the web can practically be considered as "endless". In that case, the coil may initially have a considerable weight and, if the width of the web and, correspondingly, the length of the coil is large, a shaft supporting the coil may bend under the weight of the coil, with the consequence that the distribution of the web tension over the width of the web becomes non-uniform. A similar effect may also occur if the overall tension of the web is so large that one or more of the rollers that define the feed path and at which the web is deflected yield to the web tension and become bent. A non-uniform tension of the web due to bending of one or more rolls or rollers may cause damage to the web or may compromise the quality of the resulting product, e.g. the print quality, due to non-uniform stretching of the web.

[0004] A web tensioning mechanism of the type indicated above permits to control the web tension by controlling a force with which the dancer is biased against the web, whereby the web is deflected so that any possible slack in the web is removed. Typically, the dancer is a roller that extends over the entire width of the web and is supported in bearings at both ends. The bearings may be biased against the web by a single biasing member or by two separate biasing members.

[0005] US 4 669 646 and US 3 786 975 disclose so-called web-spreading rollers which are divided into a plurality of segments that are supported on respective adjusting means. The adjusting means may be adjusted so as to enforce a certain curvature of the roller that is composed of the various segments, thereby imposing also a corresponding curvature to the web so that the web will be spread when it passes over the roller. Although the curvature of such a spreading roller has a certain impact on the distribution of the web tension, such spreading rollers are not suitable for appropriately controlling the distribution of the web tension over the width of the web.

[0006] It is an object of the invention to provide a tensioning mechanism that permits to finely control the distribution of the web tension over the width of the web.

[0007] In order to achieve this object, the web tensioning mechanism according to the invention is characterized in that the dancer is divided lengthwise into a plurality of segments, and the number of biasing members is at least equal to the number of segments.

[0008] Consequently, each segment has its own biasing member or members, which permits to control the force with which the segment is biased against the web individually for each segment, thereby to control the distribution of the web tension over the width of the web. In particular, it is possible to smoothen-out any non-uniformities in the distribution of the web tension by appropriately adjusting the biasing forces of the individual biasing members.

[0009] More specific embodiments of the invention are indicated in the dependent claims.

[0010] In a preferred embodiment, the biasing members are arranged to bias all segments of the dancer against the web with a uniform biasing force per length, which results in a uniform distribution of the web tension regardless of whether or not the coil or any other rollers along the feed path are bent.

[0011] In one embodiment, each of the segments of the dancer may be supported with its opposite ends in a forked bearing structure that is biased against the web by a single biasing member. As an alternative, separate biasing members may be provided for separate bearing structures at the opposite ends of each segment.

[0012] In yet another embodiment, the ends of neighboring dancer segments may be flexibly linked to one another and each link may be supported on a corresponding biasing member, so that the adjacent ends of two different dancer segments share a common biasing member. The flexible links between the segments may be formed by articulated universal joints, for example, or by a continuous flexible shaft passing through and supporting all the segments of the dancer.

[0013] Embodiment examples will now be described in conjunction with the drawings, wherein:

Fig. 1 is a perspective view of a web tensioning mechanism according to an embodiment of the invention;

Figs. 2 to 4 are schematic side views of dancers and biasing members of tensioning mechanisms according to different embodiments of the invention;

Fig. 5 illustrates a state of the tensioning mechanism shown in Fig. 4 in case of a non-uniform distribution of the web tension; and

Fig. 6 is a schematic side view of the web tensioning mechanism according to yet another embodiment of the invention.

[0014] As is shown in Fig. 1, a print media web 10 is withdrawn from a coil 12 and conveyed along a feed path 14 only part of which has been shown in the drawing.

The coil 12 is wound on a core 16 that extends over the entire width of the web 10 and is supported with its opposite ends in bearings that have not been shown here.

[0015] The portion of the feed path 14 that has been shown in Fig. 1 includes a deflection roller 18, at which the web 10 is deflected by 90° in this example, and a so-called dancer 20. The dancer 20 is a roller which also extends over the entire width of the web 10 and serves to control the tension of the web. To that end, a number of biasing members 22 are provided for biasing the dancer 20 against the web 10. In the example shown, the web 10 is deflected at the dancer 20 by 90°, so that the conveying direction of the web changes from an approximately horizontal direction between the coil 12 and the dancer 20 to an approximately vertical direction between the dancer 20 and the deflection roller 18, and the dancer is biased in a downward direction, so that the web tension will increase in proportion to the biasing force exerted by the biasing members 22.

[0016] The dancer 20 is divided into a plurality of segments 24. In this simplified example, the dancer has only three segments 24, but the number of segments may be significantly larger in a practical embodiment.

[0017] The opposite ends of each segment 24 are rotatably supported at a support beam 26. The adjacent ends of each pair of neighboring segments 24 share a common support beam 26. All four support beams are rotatable independently of one another about a shaft 28.

[0018] In this example, the adjacent ends of two neighboring segments 24 are interconnected by a flexible link, so that they are connected for joint rotation about their longitudinal axes but can be angled relative to one another to a certain extent, so that the support beams 26 are free to move independently of one another.

[0019] The biasing members 22 may be constituted by pneumatic cylinders, for example, and are linked to the respective support beams 26 at a point between the shaft 28 and the dancer 20, whereas the top ends of the biasing members are supported by a common cross bar 30. All support beams 26 have the same length, and the distance between the shaft 28 and the joint linking the biasing member 22 to the support beam 26 is the same for all support beams, so that the biasing members 22 urge the segments 24 downwards with the same leverage.

[0020] It is further assumed in this example that the pneumatic cylinders constituting the individual biasing members 22 all have the same active piston area, so that, when all biasing members are connected to a common pneumatic pressure source (not shown), all segments 24 of the dancer will be biased downward with an equal force. Further, since all segments 24 have the same length in this example, the biasing force per segment length will be the same for all segments. The three segments 24 of the dancer 20 virtually divide the width of the web 10 into three sections, and since the biasing force per segment length is the same for all three segments, the tension of the web 10 will also be the same in all three segments.

[0021] It shall now be assumed that the core 16 which carries the coil 12 and is supported only at its opposite ends is bent slightly under the weight of the coil 12, so that the coil will slightly sag in the central portion, as seen in width direction of the web. In a conventional belt tensioning mechanism, having only a single rigid dancer 20, the sagging of the coil 12 would result in an increased tension of the central section of the web 10 as compared to the two neighboring sections. However, in the tensioning mechanism according to the invention, the increased tension in the central section will cause the central segment 24 and the associated biasing members 22 to yield, so that the central segment 24 of the dancer will slightly be lifted upwards, thereby reducing the effective length of the associated section of the web, so that the increase in tension is eliminated. In this way, a uniform tension of the web 10 over its entire width can be maintained regardless of any bending of the core 16 or the deflection roller 18 or any other roller along the feed path of the web.

[0022] In the course of a print run, an increasing length of the web 10 will be withdrawn from the coil 12, so that the coil shrinks and its weight becomes smaller. Consequently, the sagging of the core 16 will decrease. However, the corresponding deformation of the coil 12 will always be absorbed by a corresponding (vertical) displacement of the segments 24 of the dancer 20, so that the tension of the web 10 will remain constant and its distribution over the width of the web will remain uniform.

[0023] Of course, it would also be possible to create any desired non-uniform distribution of the tension over the width of the web, e.g. by individually controlling the pneumatic pressure applied to the biasing members 22 or by adjusting the leverages of the biasing members.

[0024] Fig. 2 is a schematic view of a dancer 20a of a tensioning mechanism according to another embodiment of the invention. In this embodiment, the dancer 20a is divided into six segments 24, and each segment 24 has its opposite ends rotatably supported in a forked support member 32 that is held in position and biased downwards by an associated adjusting member 22. Thus, in this embodiment, the number of adjusting members 22 is equal to the number of segments 24 of the dancer, and the individual segments of the dancer are not connected to their respective neighbors. Instead, the segments 24 are aligned only by being held in position by their biasing members 22 and support members 32.

[0025] Fig. 3 illustrates a modified embodiment wherein separate biasing members 22 are provided for the opposite ends of each segment 24, so that the total number of biasing members 22 is twice the number of segments.

[0026] Fig. 4 is a schematic view of a dancer 20b in which the neighboring segments 24 are respectively interconnected by articulated universal joints 36, so that, similarly as in Fig. 1, each pair of neighboring segments 24 may share a common biasing member 22.

[0027] Fig. 5 illustrates the response of the tensioning mechanism shown in Fig. 4 to a non-uniform tension of the web 10 the cross-section of which has been shown as a dashed line. It has been assumed here that, for some reason, the tension of the web 10 is larger in the central part than near the lateral edges, so that the biasing members 22 that are closer to the width-wise center of the web 10 yield upwards and allow the web to assume a curved cross-sectional shape, whereby the differences in web tension are absorbed.

[0028] Finally, Fig. 6 shows an example of a dancer 20c having segments 24 which are supported on a common flexible shaft 38 which constitutes flexible links between the adjacent segments.

Claims

1. A web tensioning mechanism for tensioning a print media web (10) conveyed along a feed path (14), the mechanism comprising a dancer (20; 20a; 20b; 20c) that extends over a width of the web (10), and a number of biasing members (22) arranged to bias the dancer against the web (10), **characterized in that** the dancer (20; 20a, 20b, 20c) is divided lengthwise into a plurality of segments (24), and the number of biasing members (22) is at least equal to the number of segments (24).

2. The web tensioning mechanism according to claim 1, wherein the biasing members (22) are arranged to exert, on each segment (24), a biasing force that is proportional to the length of the respective segment (24), so that all segments are biased with the same biasing force per length.

3. The web tensioning mechanism according to claim 2, wherein all segments (24) of the dancer have the same length.

4. The web tensioning mechanism according to any of the preceding claims, wherein the adjacent ends of each pair of neighboring segments (24) of the dancer are coupled for joint rotation by a flexible link (36; 38).

5. The web tensioning mechanism according to claim 4, wherein each flexible link includes an articulated universal joint (36).

6. The web tensioning mechanism according to any of the claims 1 to 3, wherein each end of each segment of the dancer (20a) is supported via a separate biasing element (22).

7. The web tensioning mechanism according to any of the claims 1 to 3, wherein each segment (24) of the dancer (20a) is supported in a forked support member (32), and each support member (32) is supported via a separate biasing member (22).

Fig. 1

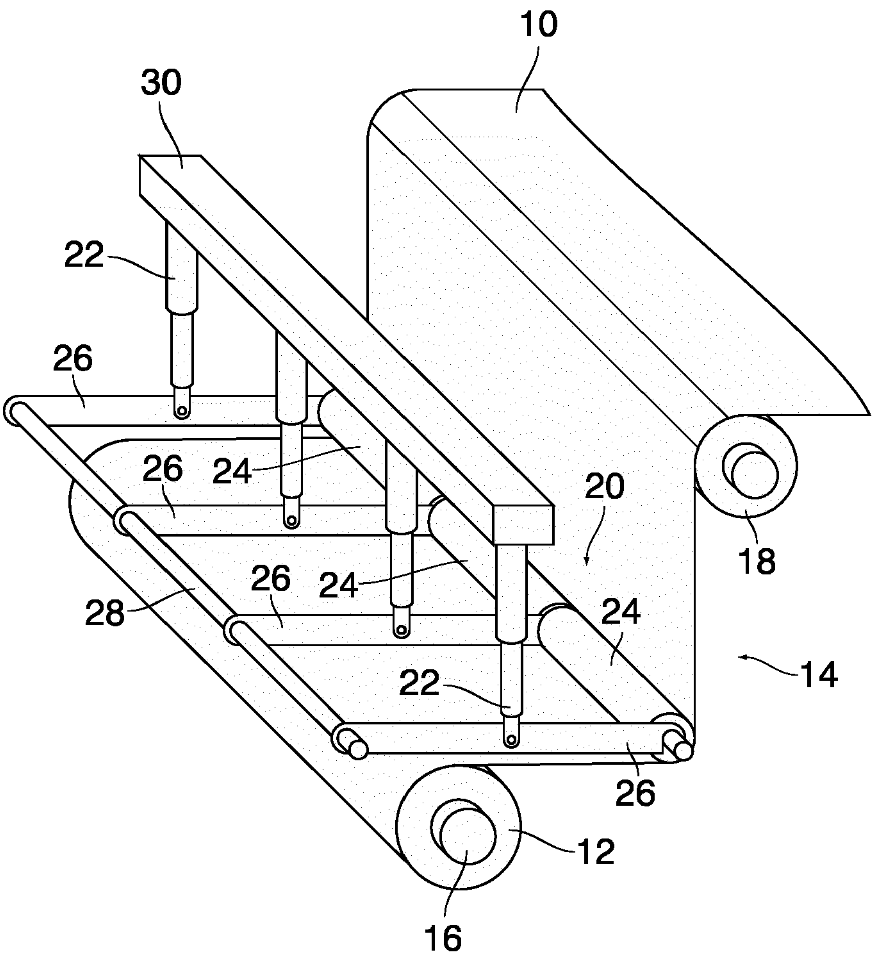


Fig. 2

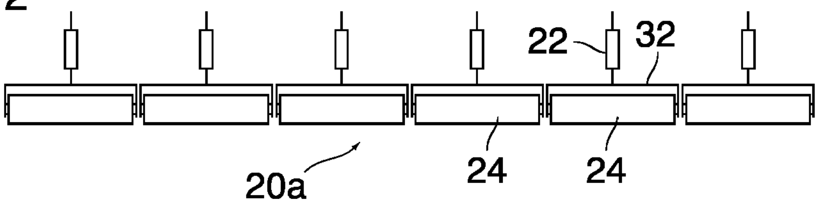


Fig. 3

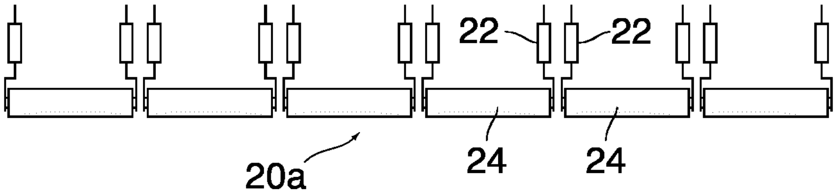


Fig. 4

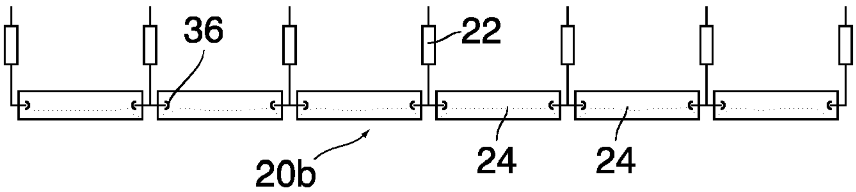


Fig. 5

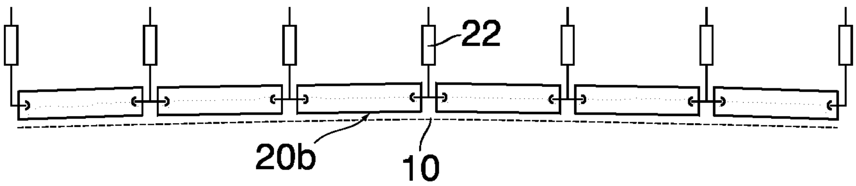
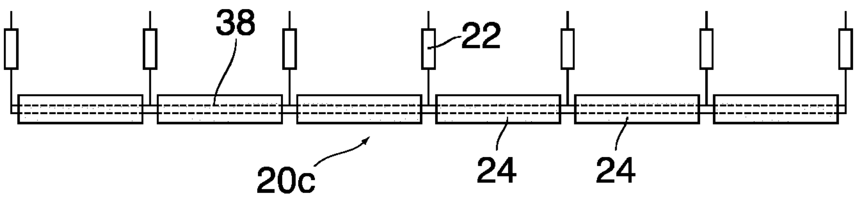


Fig. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 8745

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 648 342 A (DORFEL GERHARD WALTER) 14 March 1972 (1972-03-14) * abstract; figures 1-5, 9 * * the whole document *	1-7	INV. B65H23/025 B65H23/04 B65H23/16
X	DE 199 38 618 A1 (SWEGMARK INVEST AB BORAS [SE]) 22 February 2001 (2001-02-22) * abstract; figures 1,2,3 * * paragraphs [0041] - [0046] *	1-7	
X	GB 851 139 A (SCHJELDAHL CO G T) 12 October 1960 (1960-10-12) * abstract; figures 1-3 * * the whole document *	1,2,6,7	
X	EP 0 754 641 A1 (GERBER GARMENT TECHNOLOGY INC [US]) 22 January 1997 (1997-01-22) * abstract; figures 1-3 * * column 2, line 42 - column 3, line 52 * * column 4, line 44 - column 5, line 3 * * column 6, line 38 - column 7, line 55 *	1-7	TECHNICAL FIELDS SEARCHED (IPC)
A	US 5 825 374 A (ALBERTALLI DAVID [US] ET AL) 20 October 1998 (1998-10-20) * abstract; figure 6 *	1-7	B65H

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	28 March 2018	Piekarski, Adam

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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28-03-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3648342 A	14-03-1972	CA 922333 A	06-03-1973
		FI 45589 B	04-04-1972
		US 3648342 A	14-03-1972
DE 19938618 A1	22-02-2001	NONE	
GB 851139 A	12-10-1960	NONE	
EP 0754641 A1	22-01-1997	DE 69601056 D1	14-01-1999
		DE 69601056 T2	17-06-1999
		EP 0754641 A1	22-01-1997
		JP 2766633 B2	18-06-1998
		JP H0940244 A	10-02-1997
		US 5772147 A	30-06-1998
US 5825374 A	20-10-1998	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4669646 A **[0005]**
- US 3786975 A **[0005]**