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

(11) EP 1 728 920 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.12.2006 Bulletin 2006/49

(51) Int Cl.:
D21F 3/02 *(2006.01)*

(21) Application number: **06011248.9**

(22) Date of filing: **31.05.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **31.05.2005 JP 2005159661**

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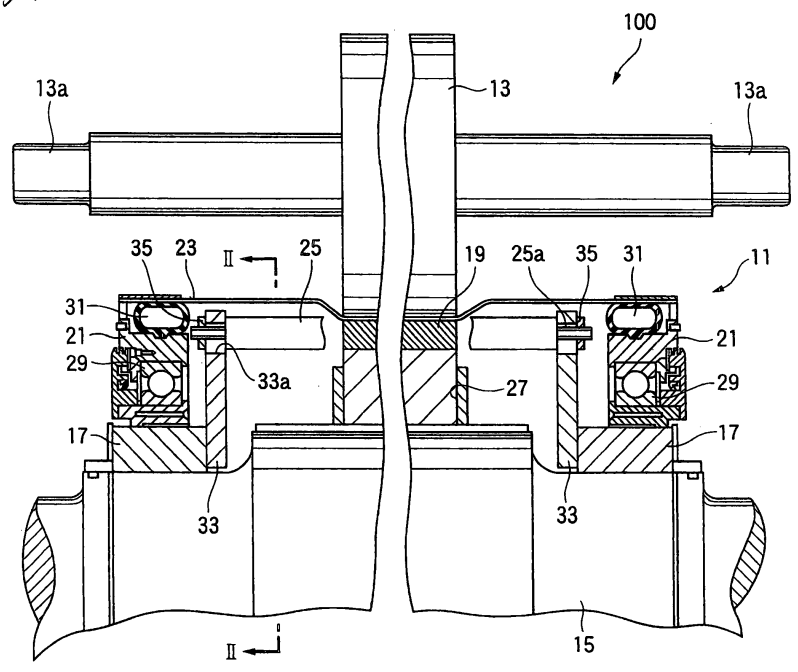
(54) Shoe press mechanism of paper machine

(57) A shoe press mechanism 100 of a paper machine includes a shoe press 11, and a press roll 13 disposed so as to face the shoe press 11. A wet paper web to be fed is nipped by the press roll 13 and the press shoe 19 together with an annular belt. The shoe press 11 includes a supporter 15, a press shoe 19 that is provided to the supporter 15 so as to move in the direction of approaching or being separated from the press roll 13, a pair of supporting disks 21 that is rotatably supported by the supporter 15, an annular belt 23 that is fixed to the supporting disks 21 and is disposed so as to include the press shoe 19 therein, and adjusting stay bars 25 that are disposed parallel to an axis of the annular belt 23. A mounting position of the adjusting stay bar 25 with respect to the supporter 15 can be adjusted, and the tension of the annular belt 23 is adjusted by adjusting the mounting position.

Fig. 1



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Description

[0001] The present invention relates to a shoe press mechanism. It relates, specifically, to a shoe press mechanism of a paper machine, and more specifically to a shoe press mechanism of a paper machine that can stably make paper and lengthen the life span of an annular belt, in some embodiments by tightening the annular belt which runs while the inner periphery thereof comes in slide contact with a press shoe.

[0002] In a shoe press mechanism, a press roll is disposed so as to face a press shoe, and a nip portion is formed by the press roll and the press shoe. An annular belt is disposed so that the inner periphery of the annular belt comes in slide contact with the press shoe. The annular belt is pressed against the press roll by the press shoe with a feeding felt. Then, as the press roll is rotated, the annular belt is pulled by the contact frictional force against the feeding felt. Accordingly, the annular belt takes around the press shoe.

[0003] A shoe press mechanism, in which a tube-shaped guide shell having a finished outer surface is disposed at the inside of the annular belt to support the annular belt, has been known as the conventional shoe press mechanism having the above-mentioned structure (for example, see Patent Document 1). The diameter of the guide shell is set smaller than that of the annular belt, and a gap is formed between the annular belt and the guide shell. In addition, a belt cover is disposed on the outside of the annular belt so as to prevent the oscillation caused by the running of the annular belt.

[0004] Furthermore, the press shoe is disposed on a supporter so as to be freely oscillated, and a tube-shaped press jacket is provided so as to surround the press shoe and the supporter. In addition, mounting-aid strips are fixed parallel to the supporter in the inside of the press jacket (for example, see Patent Document 2).

[Patent Document 1] JP-A-56-37395

[Patent Document 2] JP-A-2-104791

[0005] The annular belt (that is, press jacket) is disposed so as to surround the press shoe. Accordingly, as the press roll is rotated, the annular belt runs so as to circulate while the inner periphery of the annular belt comes in slide contact with the press shoe. The annular belt is an endless belt that includes a base member, a reinforcing member, and a resin layer covering the base member and the reinforcing member. The base member and the reinforcing member are made of material, which hardly elongate, such as polyamide and polyethylene terephthalate (PET). The annular belt is heated at 20 to 70 °C during the papermaking, and is pressed by the press roll and the press shoe at a pressure in the range of 100 to 1500 KN/m. Further, pressure air is supplied to the inside of the annular belt.

[0006] For this reason, as the papermaking operation is performed, the annular belt tends to elongate in the MD direction (Machine Direction) (that is, in the running direction of a wet paper web) and in the CMD direction (Cross Machine Direction) (that is, in the width direction). In addition, the annular belt is pulled in the MD direction by the rotation of the press roll, and then is turned thereabout. Accordingly, tensile force is applied to the annular belt in the MD direction, and then the annular belt elongates.

[0007] Actually, during the papermaking operation, the vicinity of the middle portion of the annular belt in the CMD direction (in the width direction) tends to more easily elongate compared to the both end portions thereof. This tendency is caused by the following reasons. The reasons includes the variation in the width direction (in the CD direction) of the pressure applied to the annular belt by the press roll and the press shoe of CCR (crown control roll), which have larger diameters at the middle portions than those of both ends; temperature factors such as the variation of the temperature of the wet paper web in the press mechanism of the previous step and the variation of the heating temperature of the wet paper web by a steam box, which is provided to improve the permeability of the annular belt; and a dynamic friction factor caused by the variation of the amount of lubricating oil to be supplied to the annular belt.

[0008] As described above, the annular belt tends to elongate in the MD direction during the papermaking operation and thus the entire length thereof increases, and the vicinity of the middle portion of the annular belt in the CMD direction (in the width direction) tends to elongate locally. All of the guide shell and the mounting-aid strips, which are provided to guide the annular belt or the press jacket by coming in slide contact with the inner periphery of the annular belt or the press jacket, are fixed to the supporter, and do not have a function to adjust the tension of the annular belt in accordance with the elongation of the annular belt or the press jacket.

[0009] Accordingly, when the looseness occurs due to the elongation of the annular belt or the press jacket, the annular belt or the press jacket meanders or wrinkles are occur locally on the annular belt or the press jacket. In the extreme case, since a crack or abrasion of the resin occurs, the annular belt may be broken down or it may be difficult to make paper. In this case, it is necessary that the replacement of the annular belt taking a long time be performed. The life span of the annular belt is reduced due to the problem, and thus the efficiency of the papermaking operation deteriorates. As a result, since the cost of paper products increases, improvement of the papermaking efficiency is radically required.

[0010] The invention is made in consideration of the above-mentioned problems, and it is an object of the invention to provide a press shoe mechanism of a paper machine in which the above issues are at least partially addressed. For example, a press shoe mechanism of a paper machine is provided, which can easily adjust the tension of an annular belt and correct the elongation of the annular belt occurring in the MD and CMD directions during the papermaking operation, thereby causing the annular belt to stably run with an adequate tension.

[0011] In order to achieve the above-mentioned object, a shoe press mechanism of a paper machine according to independent claim 1 is provided. In one aspect, a shoe press mechanism of a paper machine according to the invention is characterized in the following (1), (2), and/or (3).

(1) A shoe press mechanism of a paper machine includes a press roll; a supporter of which both ends are fixed to a machine casing; a press shoe that is provided to the supporter so as to move in the direction of approaching or being separated from the press roll; a pair of supporting disks which is provided on both sides of the press shoe so as to be rotatably supported by the supporter, respectively; an annular belt which is disposed so as to include the press shoe therein, of which both ends are fixed to the pair of supporting disks, and which runs while the inner periphery thereof comes in slide contact with the press shoe; and an adjusting stay bar of which both ends are fixed to the supporter so as to be parallel to an axis of the annular belt. In this case, a wet paper web to be fed by a feeding felt is nipped by the press roll and the press shoe together with the annular belt. In other words, the mechanism is arranged such that during operation, the wet paper web is nipped as described above. Further, a mounting position of the adjusting stay bar with respect to the supporter is adjustable, and the tension of the annular belt is adjusted or adjustable by adjusting the mounting position.

(2) In the shoe press mechanism of a paper machine of (1),
the adjusting stay bar is typically a straight bar, and the mounting position thereof is typically adjusted or adjustable in the radial direction of the annular belt.

(3) In the shoe press mechanism of a paper machine of (1),
the middle portion of the adjusting stay bar in the axial direction is optionally curved like a bow, and, further optionally,
the tension of the annular belt is adjusted in order to tighten the middle portion of the annular belt in the width direction thereof by adjusting a rotational phase of the adjusting stay bar with respect to the supporter, and then by fixing the adjusting stay bar to the supporter. In other words, the tension of the annular belt is adjustable such as to tighten the middle portion of the annular belt in the width direction thereof, by adjusting a rotational phase of the adjusting stay bar with respect to the supporter, and then by fixing the adjusting stay bar to the supporter.

[0012] According to the shoe press mechanism of a paper machine having the structure disclosed in (1), a mounting position of the adjusting stay bar with respect to the supporter can be adjusted, and the tension of the annular belt can be adjusted by adjusting the mounting position. Accordingly, it is generally possible to constantly apply adequate tension to the annular belt by adjusting the mounting position of the adjusting stay bar in accordance with the elongation of the annular belt. As a result, the life span of the annular belt may be lengthened, and it may be thus possible to stably make the paper for a long time by solving problems, for example, the occurrence of the meandering, wrinkles or cracks of the annular belt caused by the looseness of the annular belt.

[0013] According to the shoe press mechanism of a paper machine having the structure described in (2), the position of the straight adjusting stay bar can be adjusted in the radial direction of the annular belt. Accordingly, when the annular belt elongates in the MD direction and thus the entire length thereof increases, it is possible to tighten the annular belt in the MD direction, corresponding to its elongation and to apply adequate tension to the annular belt, by causing the adjusting stay bar to move outward in the radial direction in order to adjust the position thereof.

[0014] According to the shoe press mechanism of a paper machine having the structure described in (3), the middle portion of the adjusting stay bar in the axial direction thereof is curved like a bow. Accordingly, when the middle portion of the annular belt in the width direction elongates locally, the middle portion of the adjusting stay bar in the axial direction thereof can protrudes outward in the radial direction by adjusting the rotational phase of the adjusting stay bar with respect to the supporter, and then the adjusting stay bar can be fixed. As a result, it may be possible to adjust the tension of the annular belt in the MD and CMD directions in order to the middle portion of the annular belt in the width direction thereof.

[0015] According to the press shoe of the paper machine, entire elongation of the annular belt or elongation of the entire belt, and local elongation occurring in the middle portion of the annular belt in the width direction thereof disappears, and it is possible to apply adequate tension to the annular belt by adjusting the mounting position of the adjusting stay bar with respect to the supporter, and by adjusting the rotational phase of the adjusting stay bar with respect to the supporter. As a result, the life span of the annular belt may be lengthened and it may be possible to stably make the paper for a long time.

[0016] According to a further aspect, a shoe press mechanism of a paper machine is provided that includes a shoe press, and a press roll disposed so as to face the shoe press. A wet paper web to be fed is nipped by the press roll and the press shoe together with an annular belt. The shoe press includes a supporter, a press shoe that is provided to the supporter so as to move in the direction of approaching or being separated from the press roll, a pair of supporting disks that is rotatably supported by the supporter, an annular belt that is fixed to the supporting disks and is disposed so as to include the press shoe therein, and adjusting stay bars that are disposed parallel to an axis of the annular belt. A mounting

position of the adjusting stay bar with respect to the supporter can be adjusted, and the tension of the annular belt is adjusted by adjusting the mounting position.

[0017] Further advantages, features, aspects and details of the invention are evident from the dependent claims, the description and the drawings.

[0018] The invention is also directed to methods by which the described shoe press mechanism or parts of it operate. It includes method steps for carrying out every function of the shoe press mechanism or manufacturing every part of the shoe press mechanism.

[0019] As described above, the invention is briefly described. Furthermore, details of the invention will be more clearly understood by describing a preferred embodiment according to the invention to be described below with reference to accompanying drawings, wherein

Fig. 1 is a longitudinal cross-sectional view showing main parts of a shoe press mechanism according to the invention.

Fig. 2 is a cross-sectional view taken along the line II-II in Fig. 1.

Fig. 3 is a perspective view schematically showing the main parts of the shoe press mechanism.

Fig. 4 is a side cross-sectional view showing a state in which a radial position and rotational phase of an adjusting stay bar are adjusted and then the adjusting stay bars are fixed to a supporter.

[0020] Hereinafter, a preferred embodiment according to the invention will be described in detail with reference to drawings.

[0021] As shown in Figs. 1 and 2, a shoe press mechanism 100 of a paper machine according to an embodiment of the invention includes a shoe press 11, and a press roll 13 disposed so as to face the shoe press 11. The shoe press 11 includes a supporter 15, a press shoe 19, a pair of supporting disks 21, an annular belt 23, and a plurality of adjusting stay bars 25.

[0022] Both ends of the supporter 15 are fixed to a machine casing (not shown) so that the supporter 15 is disposed parallel to the press roll 13. A hydraulic chamber 27 is formed on a surface (upper surface in Fig. 1) of the supporter 15 facing the press roll 13. The press shoe 19 is fitted to the hydraulic chamber 27 so as to move in the direction of approaching or being separated from the press roll 13. Pressure oil is supplied from a pressure oil supply device (not shown) to the hydraulic chamber 27 so that the press shoe 19 is pressed against the press roll 13 with a predetermined force.

[0023] A pair of supporting disks 21 is rotatably provided in a pair of supporting members 17, which is fixed to both ends of the supporter 15, respectively, by ball bearings 29. The ends of the annular belt 23 are fixed on the outer peripheries of the pair of supporting disks 21 with seal members 31 interposed therebetween, respectively. That is, the supporter 15 and the press shoe 19 are surrounded by the annular belt 23 and disposed at the inside of the annular belt 23 so that the inner periphery of the annular belt 23 comes in contact with the press shoe 19. Accordingly, when pressure air is supplied from a pressure air supply source (not shown) to the inside of the annular belt 23, the annular belt 23 is expanded in a cylindrical shape.

[0024] The plurality of adjusting stay bars 25 is fixed to a pair of stays 33, which is fixed to the supporting members 17, in the circumferential direction of the annular belt 23 so as to be disposed in the vicinity of the inner periphery of the annular belt 23. The adjusting stay bars 25 come in slide contact with the inner periphery of the annular belt 23 to support the annular belt 23 from the inside thereof. In addition, a lubricating oil supply device 37 is provided in the stay 33. The lubricating oil supply device supplies lubricating oil on the inner periphery of the annular belt 23 during the running of the annular belt 23 in order to reduce frictional resistance of the annular belt against the press shoe 19. The lubricating oil lubricates the annular belt 23, and then is drained through an oil drain port 39 provided on the lower side of the supporter 15.

[0025] Both ends 13a of the press roll 13 are rotatably supported by the machine casing and are coupled to a driving unit (not shown) so that the press roll 13 is driven by the driving unit so as to be rotated.

[0026] Next, the adjusting stay bars 25, and a mechanism for fixing the adjusting stay bars 25 to the stays 33 will be described. As shown in Figs. 3 and 4, an adjusting stay bar 25A is formed in the form of a straight cylindrical rod, and male thread portions 25a are formed on both ends thereof, respectively. When the annular belt 23 elongates in the MD direction and thus the entire length thereof increases, the adjusting stay bar is used to adjust the tension of the annular belt 23. Mounting holes 33a for the adjusting stay bar 25A are formed in the pair of stays 33, and are formed in the shape of a slotted hole elongating in the radial direction of the annular belt 23, respectively.

[0027] The male thread portions 25a formed on both ends of the adjusting stay bar 25A are inserted into the mounting holes 33a, respectively, and then the adjusting stay bar is positioned in the slotted hole in the radial direction (direction indicated by an arrow A or B) to adequately apply tension to the annular belt 23. After that, the adjusting stay bar is fixed to the stays 33 by nuts 35. The adjusting stay bar 25A for adjusting the elongation of the entire length of the annular belt 23 may be disposed at least at one position among the plurality of adjusting stay bars 25, which is disposed in the circumferential direction of the annular belt 23 along the inner periphery thereof. Furthermore, the position or the number of the adjusting stay bar for adjusting the elongation of the entire length of the annular belt is not especially limited.

[0028] In addition, when the middle portion of the annular belt 23 elongates in the width direction, an adjusting stay bar 25B is used to adjust the tension of the annular belt 23. The adjusting stay bar 25B is formed in the form

of a cylindrical rod of which middle portion is curved like a bow, and male thread portions 25a are formed on both ends thereof, respectively. Each of mounting holes 33b for the adjusting stay bar 25B, which is formed in the stay 33, is formed in the shape of a circular hole having the same diameter as each male thread portion 25a. The male thread portions 25a formed on both ends of the adjusting stay bar 25B are inserted into the mounting holes 33b, respectively, and then the adjusting stay bar 25B is rotated in the rotational direction indicated by an arrow C or D to adjust a rotational phase of adjusting stay bar. After that, the adjusting stay bar is fixed to the stays 33 by nuts 35.

[0029] When the adjusting stay bar 25B is rotated in the rotational direction indicated by an arrow C, the middle portion of the adjusting stay bar 25B in the axial direction thereof protrudes outward in the radial direction. Accordingly, locally elongated in the width direction, the middle portion of the annular belt 23 is tightened, and thus adequate tension is applied to the annular belt. The adjusting stay bar 25B for adjusting the local elongation of the annular belt 23 may be disposed at least at one position among the plurality of adjusting stay bars 25, which is disposed in the circumferential direction of the annular belt 23 along the inner periphery thereof. Furthermore, the position or the number of the adjusting stay bar for adjusting the local elongation of the annular belt is not especially limited. However, if the adjusting stay bar 25B is disposed in front of the entrance side of the press shoe 19 in the running direction of the annular belt 23, the annular belt 23 is pre-tensioned by the adjusting stay bar 25B. Accordingly, it is effective that the oscillation (that is, the occurrence of the meandering or wrinkles of the annular belt 23 caused by the elongation of the annular belt 23) of the annular belt 23 can be controlled so as to be fed between the press shoe 19 and the press roll 13.

[0030] The operation of the embodiment according to the invention will be described. A press mechanism (not shown) disposed in the upstream of the shoe press mechanism 100 squeezes water from a wet paper web, and the wet paper web is fed between the press shoe 19 and the press roll 13 of the shoe press mechanism 100 together with a feeding felt (not shown). Pressure oil is supplied to the hydraulic chamber 27, and then the press shoe 19 is pressed against the press roll 13 with a predetermined force. Accordingly, the wet paper web is pressed by the press shoe 19 and the press roll 13 together with the annular belt 23, and thus water is further squeezed from the wet paper web. In this case, when the torque of the press roll 13 is transmitted to the feeding felt, the annular belt 23 not to be driven is pulled by the contact frictional force against the feeding felt. Accordingly, the annular belt is taken around the pair of supporting disks 21, and then the annular belt 23 runs so as to circulate while the inner periphery of the annular belt 23 comes in slide contact with the press shoe 19.

[0031] In addition, the annular belt 23 is pressed by the press shoe 19 and the press roll 13. Therefore, as the papermaking operation is performed, the annular belt elongates in the MD and CMD directions. The oscillation of the annular belt 23, which is caused by the elongation of the annular belt 23 during the running of the annular belt, hinders the paper from being stably made to deteriorate the quality of the wet paper web. Accordingly, it is necessary that the tension be applied to the annular belt 23 so as to cause the annular belt 23 to run stably. The conventional shoe press mechanism does not have a function to adjust the tension of the annular belt 23. Accordingly, when the oscillation of the annular belt 23 is caused by the elongation of the annular belt 23 during the running of the annular belt and thus the papermaking operation is hindered, there is no countermeasure except for the replacement of the annular belt 23. In the shoe press mechanism 100 of the invention, it is possible to easily adjust the tension of the annular belt 23 according to the following procedure.

[0032] That is, when the annular belt 23 elongates in the MD direction and thus the entire length thereof increases, as shown in Figs. 3 and 4, the male thread portions 25a of the straight adjusting stay bar 25A move in the mounting holes 33a, which are formed in the shape of a slotted hole, in the radial direction (direction indicated by the arrow A or B) to apply the tension to the annular belt 23 and then the adjusting stay bar is fixed to the stays 33 by the nuts 35. The above-mentioned operation is performed as follows: The both supporting disks 21 are separated, and then the tension of the annular belt 23 is adjusted. After that the both supporting disks 21 are mounted. Furthermore, if operation holes are formed through the supporting disks 21 so as to correspond to the positions of the mounting holes 33a of the stays 33, respectively, it is possible to adjust the tension of the annular belt without the separation of the supporting disks 21 whenever the tension thereof is adjusted.

[0033] In addition, when the middle portion of the annular belt 23 in the width direction elongates locally, the adjusting stay bar 25B of which middle portion in the axial direction is curved like a bow is rotated in each mounting hole 33b in the direction indicated by an arrow C or D to adjust the rotational phase thereof so that the middle portion of the adjusting stay bar 25B in the axial direction protrudes outward in the radial direction. Accordingly, locally elongated in the width direction, the middle portion of the annular belt 23 is tightened. Then, the adjusting stay bar 25B is fixed to the stays 33 by the nuts 35.

[0034] Furthermore, when the annular belt 23 elongates in the MD and CMD directions, the fixing positions of the adjusting stay bars 25 to the stays 33 are adjusted as described above. Accordingly, it is possible to apply adequate tension to the annular belt 23 in order to tighten the annular belt 23. As a result, the life span of the annular belt 23 is lengthened, and it is possible to stably make the paper.

[0035] According to the shoe press mechanism 100 of the invention, since the mounting positions of the adjust-

ing stay bars 25 to the supporter 15 can be adjusted, it is possible to adjust the tension of the annular belt 23 by adjusting the mounting positions of the adjusting stay bars 25. Accordingly, it is possible to constantly apply adequate tension to the annular belt 23 by adjusting the mounting positions of the adjusting stay bars 25 in accordance with the elongation of the annular belt 23. As a result, the life span of the annular belt 23 is lengthened and it is possible to stably make the paper for a long time by solving problems, for example, the occurrence of the meandering, wrinkles or cracks of the annular belt 23 caused by the looseness of the annular belt 23.

[0036] Moreover, according to the shoe press mechanism 100 of the invention, the position of the straight adjusting stay bar 25A can be adjusted in the radial direction of the annular belt 23. Accordingly, when the annular belt 23 elongates in the MD direction and thus the entire length thereof increases, it is possible to apply adequate tension to the annular belt 23 by causing the adjusting stay bar 25A to move outward in the radial direction in order to adjust the position thereof.

[0037] According to the shoe press mechanism 100 of the invention, the middle portion of the adjusting stay bar 25B in the axial direction thereof is curved like a bow. Accordingly, when the middle portion of the annular belt 23 in the width direction elongates locally, the middle portion of the adjusting stay bar 25B in the axial direction thereof protrudes outward in the radial direction by adjusting the rotational phase of the adjusting stay bar 25B with respect to the supporter 15, and then the adjusting stay bar 25B is fixed. As a result, it is possible to adjust the tension of the annular belt 23 in the MD and CMD directions in order to tighten the middle portion of the annular belt 23 in the width direction thereof.

[0038] The invention is not limited to the above-mentioned embodiment, and can have adequate modifications. In addition, the material, shape, size, dimension, configuration, arrangement, and the number of each component in the above-mentioned embodiment are set as any values to achieve the invention, and are not limited thereto. In particular, any range or device value given herein may be extended or altered without losing the effects sought, as will be apparent to the skilled person for an understanding of the teachings herein.

Claims

1. A shoe press mechanism (100) of a paper machine comprising:

   a press roll (13);
   a supporter (15) of which both ends are fixed to a machine casing;
   a press shoe (19) that is provided in the supporter so as to move in the direction of approaching or being separated from the press roll (13);
   a pair of supporting disks (21) which is provided on both sides of the press shoe (19) so as to be rotatably supported by the supporter (15), respectively;
   an annular belt (23) which is disposed so as to include the press shoe (19) therein, of which both ends are fixed to the pair of supporting disks (21), and which runs while the inner periphery thereof comes in slide contact with the press shoe (19); and
   an adjusting stay bar (25) of which both ends are fixed to the supporter (15) so as to be parallel to an axis of the annular belt (23), wherein
   a wet paper web to be fed by a feeding felt is nipped by the press roll (13) and the press shoe (19) together with the annular belt (23), and
   a mounting position of the adjusting stay bar (25) with respect to the supporter (15) is adjustable, and the tension of the annular belt (23) is adjusted by adjusting the mounting position.

2. The shoe press mechanism according to claim 1, wherein
   the adjusting stay bar (25) is a straight bar, and
   the mounting position thereof is adjusted in the radial direction of the annular belt (23).

3. The shoe press mechanism according to claim 1 or 2, wherein
   the middle portion of the adjusting stay bar (25) in the axial direction is curved like a bow, and
   the tension of the annular belt (25) is adjusted in order to tighten the middle portion of the annular belt in the width direction thereof by adjusting a rotational phase of the adjusting stay bar (25) with respect to the supporter (15), and then by fixing the adjusting stay bar (25) to the supporter (15).

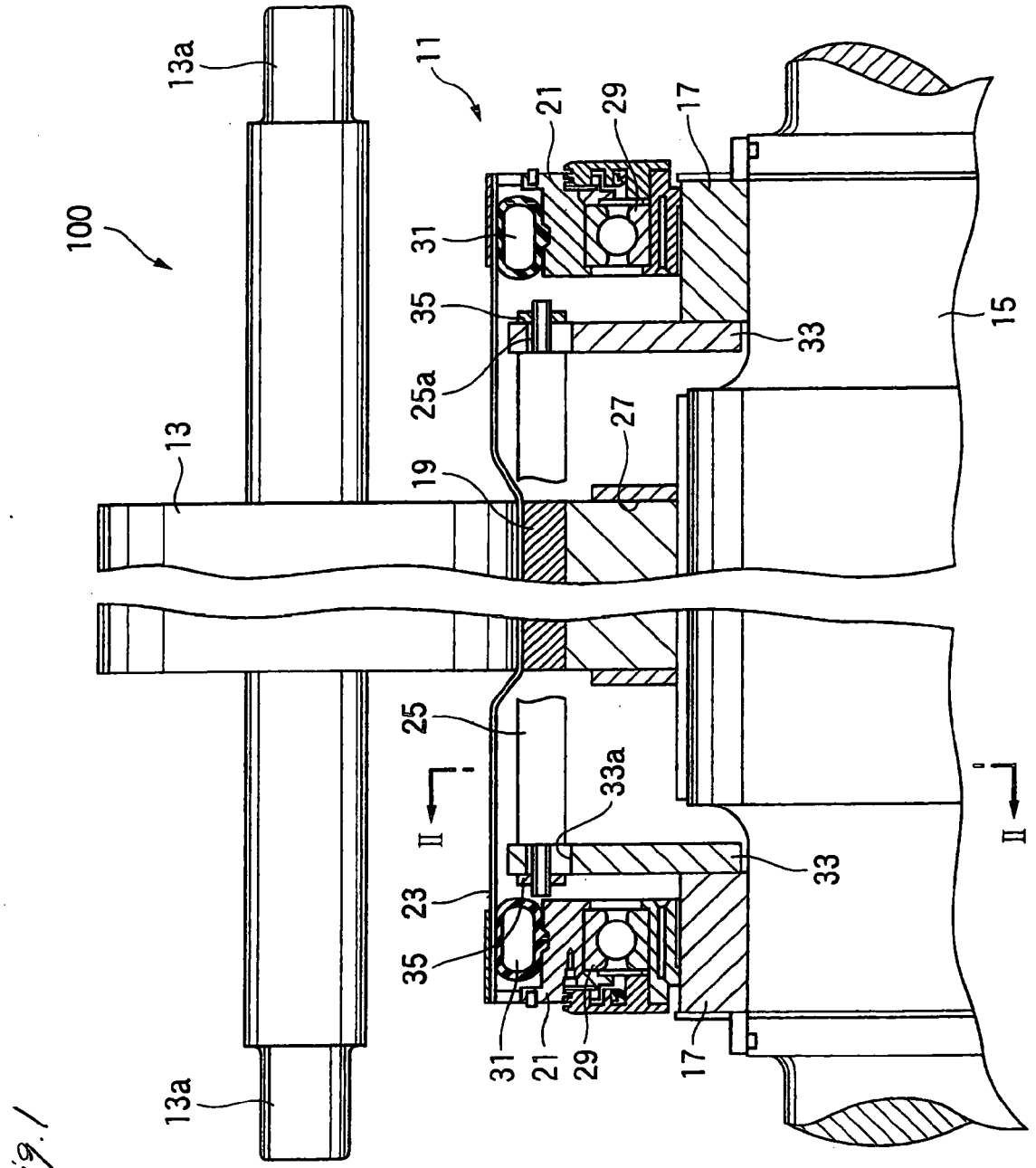
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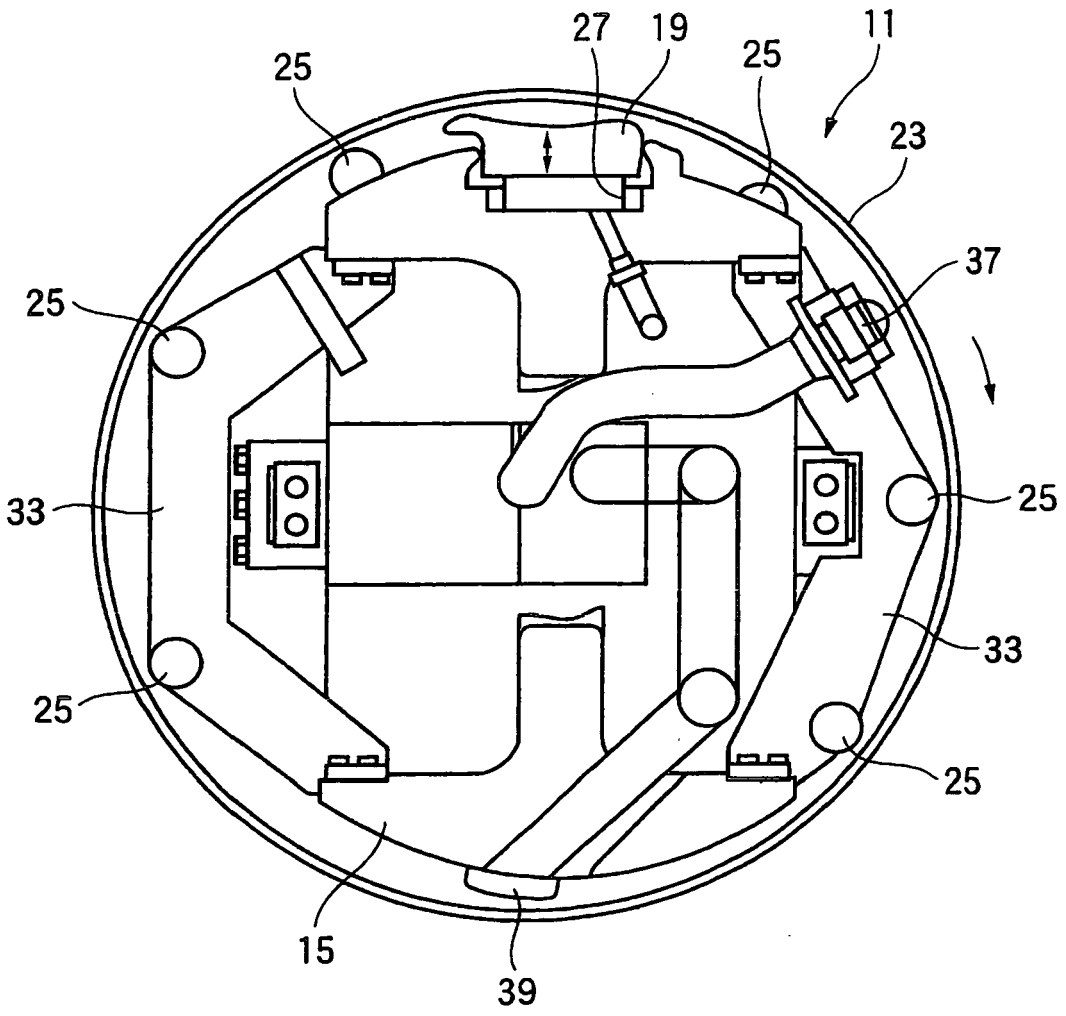
Fig. 1

Fig. 2



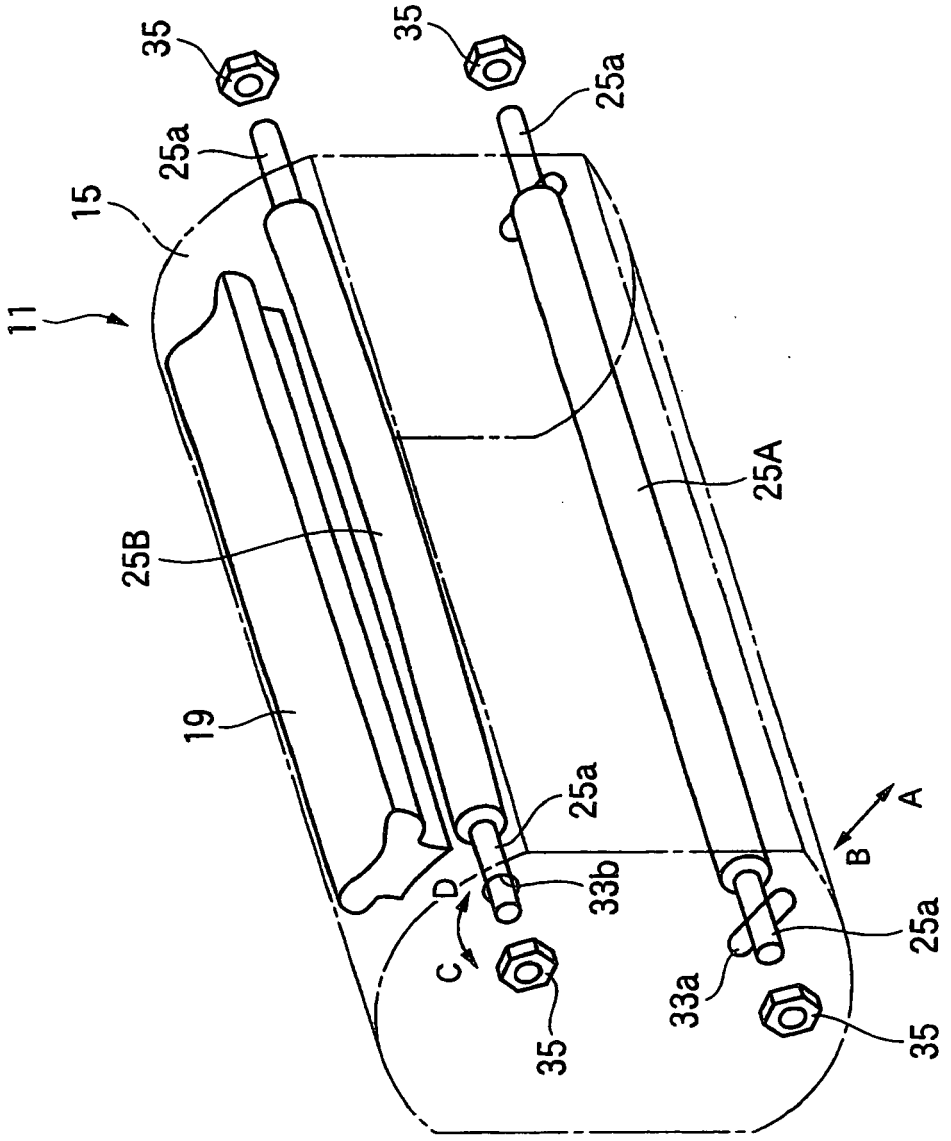
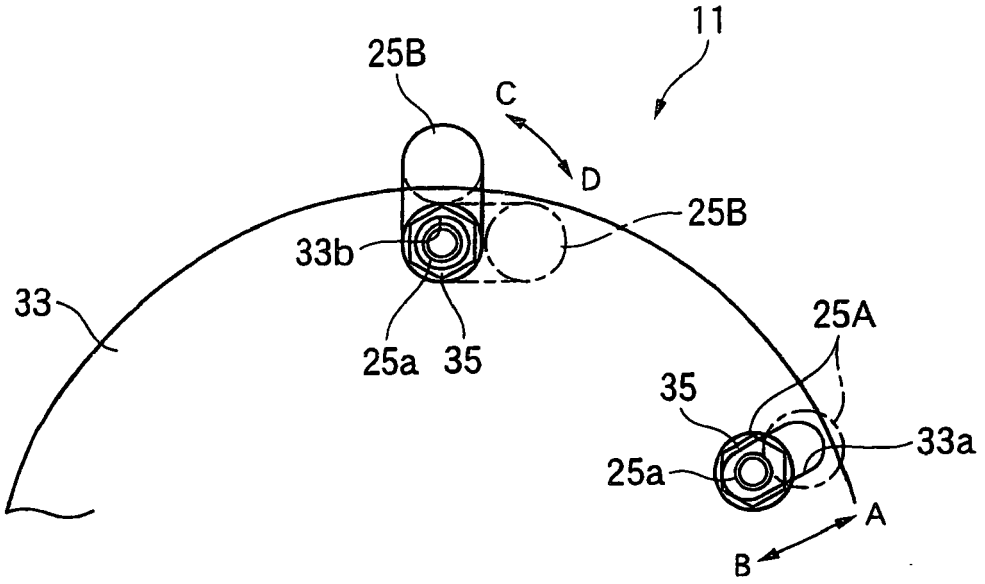


Fig. 3

Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 06 01 1248

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 4 919 761 A (SCHIEL ET AL) 24 April 1990 (1990-04-24) * column 4, lines 25-43 * * figure 1 *	1	INV. D21F3/02
A	GB 2 182 367 A (* SULZER-ESCHER WYSS GMBH) 13 May 1987 (1987-05-13) * page 3, lines 71-109 * * page 4, lines 35-48 * * figures 2,4,8 *	1	
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A	US 4 584 059 A (SCHIEL ET AL) 22 April 1986 (1986-04-22) * column 5, line 61 - column 7, line 48 * * figures 1,3 *	1	
A	US 5 900 118 A (BREITEN ET AL) 4 May 1999 (1999-05-04) * abstract * * figure 1 *	1	TECHNICAL FIELDS SEARCHED (IPC) D21F D21G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 September 2006	Maisonnier, Claire

CATEGORY OF CITED DOCUMENTS

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