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(54) **Method and arrangement for fiber web machine, and software product**

(57) The invention relates to a method in a fiber web machine. In the method, the position of the splice (14) in a fabric (12) is changed in order to minimize the vibration

level of the fiber web machine. The position of the splice (14) is determined on the basis of the width of the fabric (12). The invention also relates to an arrangement in a fiber web machine, and to a software product.

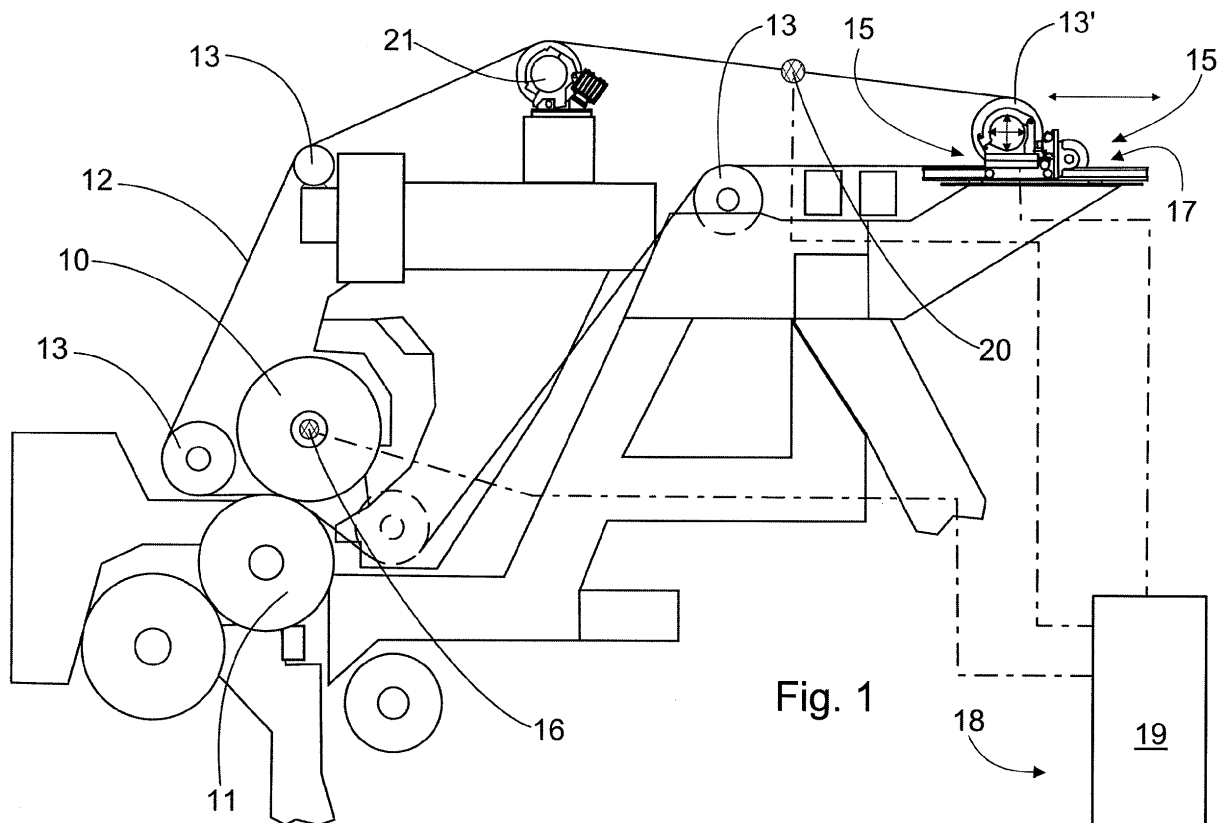


Fig. 1

Description

[0001] The invention relates to a method in a fiber web machine, in which method the position of the splice in the fabric is changed in order to minimize the vibration of the fiber web machine. The invention also relates to an arrangement in a fiber web machine and to a software product.

[0002] The alignment stripe of a fabric used in a fiber web machine is shifted by transferring one end of a roll used in the fabric cycle. This transfer causes a travel distance difference in the fabric between the tending side and the drive side, whereby the distances travelled by the edges of the fabric are different from each other. In this case, the fabric stretches a little and goes askew. Normally, the position of the splice, or seam, in the fabric is also marked on the fabric with an alignment stripe. The changing of the position of the alignment stripe is called splice turning. In press fabrics, the seam is either made by the fabric manufacturer, or the seam is made at the mill. One splice turning device is presented in the applicant's Finnish patent no. 116399. In that patent, the splice turning device also guides the fabric. The fabric in the press section is usually a relatively thick press felt. The objective is to turn the splice in the press felt to avoid a situation where most of the splice goes into the press nip exactly at the same time. By turning the splice, the potential depressions are hence formed in the press felt in an irregular manner and in different positions so that intense vibrations and the repetition of the depressions are avoided. This also extends the service life of the press felt, and the vibration level of the fiber web machine is reduced.

[0003] Nowadays, the splice turning device is used back and forth, and the vibration level of the fiber web machine is monitored at the same time. In practice, however, the way in which the splice turning device is moved is based on running mode patterns produced exclusively by experimenting. It is assumed in this case that the set values are correct. In reality, the position of the alignment stripe and at the same time the position of the splice and the set values of the splice turning device correlate with each other poorly, and the correlation varies on the basis of changes in the fiber web machine, such as roll changes. As a result, the previous completely experimental running mode patterns concerning the position of the splice turning device so that it contributes to vibration damping are invalid. It is therefore necessary to re-experiment the proper running mode after a new fabric has been installed. This takes a long time, and in the worst case, the correct running mode may not be found at all before the fabric has to be replaced again. The position of the splice turning device is typically oscillated continuously within a short period of time and over a distance of for example only ± 7 mm. In this case, the effect of splice turning on the vibration level of the fiber web machine remains unclear if only the vibration level is monitored. Moreover, a measurement based on the mere vibration measurement

actually begins to work only after the vibration has commenced. In other words, the fabric or the nip roll has already been damaged partially or at least deformed by that time. In the worst cases, the press fabric or press roll has to be changed due to the vibrations. In a random example case, the service life of a single fabric has been from 1 to 21 days. The variation in the actual service life has therefore been great. In practice, it has been necessary to change the fabrics just because of the vibrations and the resulting fabric deformation, despite vibration monitoring.

[0004] The purpose of the present invention is to provide a fiber web machine with a new type of method capable of keeping the vibration level of a fiber web machine low. Another purpose of the invention is to provide a fiber web machine with a new type of arrangement, which is suitable for different kinds of fabrics and which works despite changes taking place in the fabric or fiber web machine. Yet another purpose of the invention is to provide a new type of software product, which is suitable for various kinds of fiber web machines and which can be used for controlling a splice turning device. The characteristic features of the method according to the invention are that the position of the splice is determined on the basis of the width of the fabric. Correspondingly, the characteristic features of the arrangement according to the invention are that the arrangement further comprises sensors for determining the width of the fabric. The method according to the invention can provide accurate information on the position of the splice and on its correlation with the vibration level of the fiber web machine. This makes it possible to avoid regions which are susceptible to vibration, and thus to avoid vibrations. The arrangement is simple and it works reliably without complex installations. The software product can be integrated easily into existing fiber web machines and especially into splice turning devices.

[0005] The invention is described below in detail by making reference to the enclosed drawings that illustrate some embodiments of the invention, in which:

- Figure 1 shows a part of the press section of a fiber web machine, provided with the arrangement according to the invention,
- Figure 2 presents the principle of splice turning,
- Figure 3 presents the correlation between the width of the fabric and the vibration level in a fiber web machine,
- Figure 4 presents the correlation between the location of the splice turning device and the width of the fabric in a fiber web machine.

[0006] Figure 1 shows the press section of a fiber web machine. This concept has two press nips, the upper one of which is formed between two rolls 10 and 11. A press fabric, most generally a fabric 12, which is supported by felt rolls 13 and 13', is also arranged to run through the said press nip. The arrangement also comprises a fabric

12 which is seamed and therefore has a splice 14 (Figure 2). The direction of the splice is often marked on the fabric also by means of an alignment strip. The arrangement further comprises actuators 15 for changing the position of the splice 14, and measuring instruments 15' for determining the position of the actuators 15. In Figure 1, the actuators 15 and the measuring instruments 15' are integrated into the fabric stretcher 17. The measuring instruments are used for detecting the position of the actuators within their operating range. The actuators can be used for shifting the end of a roll for example ± 7 mm.

[0007] The arrangement may further comprise monitoring instruments 16 for determining the vibration level of the fiber web machine. The monitoring instruments may consist for example of vibration sensors placed at the end of the roll or on the shaft. The vibration level can also be determined for example from the load pressure of the nip roll. Moreover, a hand-held meter can also be used if vibration monitoring is only occasional.

[0008] Figure 2 shows the movement of the felt/tension roll 13' intended for turning the splice 14. As shown in the figure, this movement is preferably in accordance with the direction of movement of the fabric stretcher. When the felt/tension roll 13' is straight, the splice of the fabric 12 is also usually straight. In Figure 2, the straight splice is illustrated by a dot-and-dash line. As shown in Figure 2, when one end of the felt/tension roll 13' is shifted to the left, the other edge of the fabric 12 stretches and at the same time it turns the entire fabric 12 askew. This also turns the splice 14 askew, which is the objective. In this case, however, the fabric 12 tends to move towards the shorter edge, in other words upwards in Figure 2, which is illustrated by the arrow. The lateral movement is compensated by means of a felt guide 21, whereby the fabric remains at the desired position despite splice turning.

[0009] In order to operate the entire arrangement, the actuators 15 and measuring instruments 15' are connected to the control devices 18, to which the monitoring instruments 16 are also connected here. The control devices can be separate programmable logic controllers, or they can be part of the machine control system 18. According to the invention, the arrangement further comprises sensors 20 for determining the width of the fabric 12. The actuators 15, the measuring instruments 15 and, in the illustrated application, the monitoring instruments 16 and sensors 20 are here connected to the control devices 18; this is illustrated by the dot-and-dash lines. In practice, the arrangement is used for changing the position of the splice 14 in the fabric 12 in order to minimize the vibration level of the fiber web machine. The invention, however, surprisingly uses the fabric itself, more specifically its width, for determining the position of the splice. In other words, according to the invention, the position of the splice 14 is determined on the basis of the width of the fabric 12. In this case, the position of the splice is known at a sufficient accuracy despite fabric changes or other changes in the circumstances. The

splice can therefore be turned within a safe range without a rise in the vibration level. In practice, the position of the splice in the fabric is identified on the basis of the width of the fabric, and the position information is utilized in the elimination of nip vibrations and fabric vibrations.

[0010] In the method, the width of the fabric 12 is monitored, and this information is used for avoiding a situation where the fabric 12 is at its widest. When the position of the splice and the vibration level are known, it is possible to draw up an analysis of their mutual correlation. Based on the analysis, it is possible to calculate the correlation between the location of the splice turning device and the width of the fabric. The analysis can employ for example second-order regression analysis, on the basis of which an exact response has been obtained in the tests. In the example analysis, the maximum of the regression line correlates with a location of the splice turning device where the width of the fabric is at its maximum (Figure 3). The analysis can be carried out in different ways. The analysis is preferably carried out immediately after a maintenance shutdown by running the splice turning device once over its entire range of motion. An analysis can also be carried out after a first analysis during the entire operation while the splice turning device is in motion. In other words, the correlation analysis is carried out both after fabric replacement and while using the fabric. The analysis can be re-performed easily and swiftly also if the other circumstances change.

[0011] Preferably, only a set of as new measuring points as possible are taken for the analysis. In other words, the analysis preferably employs a relatively small set of recent measuring points. In this case, the measuring point set and the analysis made of it represent the prevailing conditions in the best possible way, and the impact of a change in the width of the fabric due to its aging is avoided. In practice, factors such as the width of the fabric change slowly as the fabric gets older. By using a small set of measuring points, the measuring points can be placed accurately on the correlation line. It has also been found in the tests that an analysis period as short as three days includes too much and too old measurement data. The correlation response remains accurate by using a short analysis period and by repeating the analyses frequently.

[0012] The analysis enables the determination of the correlation between the location of the splice turning device and the measured vibration level during the service life of a particular fabric. In practice, the vibrations can be avoided by moving the splice turning device in an area where the vibration level is at its lowest. In other words, the area most susceptible to vibration is avoided by determining the disadvantageous area, in the simplest manner, from the perpendicular splice position to each direction. In order to eliminate the vibrations, the location of the splice turning device can hence be changed in an area other than the area of the perpendicular splice. The changes may consist of continuous oscillation, or the splice turning device is shifted at appropriate intervals.

The correlation is preferably determined by changing the position of the splice and by simultaneously measuring the vibration level. This provides real-time data on the correlation.

[0013] Figure 3 shows graphs obtained from test measurements in a fiber web machine. The analysis according to the invention has been made here within a short time period of three days. In this case, the location of the splice turning device correlates very well with the width of the fabric. Similarly, the measured vibration level correlates very well with both the width of the fabric and with the location of the splice turning device. It is also important to note how the graph shows very clearly that the closer the point of the perpendicular splice, the higher the vibration level. In fact, the ratio of the width of the fabric to the vibration level is amazingly clear and explicit. Similarly, the shape of the calculated correlation lines and their maximums are virtually identical to each other. The light points represent vibration levels in the drive side bearing housing of a nip roll. These readings are on the Y-axis, and their quantity is mm/s², with the readings ranging from 0.5 to 1.0 mm/s². The dark points represent the actual measured widths of the fabric. These readings are also on the Y-axis, and their quantity is mm, with the readings ranging within 70 mm. Second-order correlation lines have also been calculated of both measured readings, and the shapes of these lines correlate with each other. At the common top point of the correlation lines, the width of the fabric is at its maximum and therefore the splice is perpendicular, which is why the vibration level is also at its highest. At the point in question, the location of the splice turning device is approx. -3.75 mm. The location readings are on the X-axis, and their quantity is mm, with the readings ranging within ± 15 mm. Based on the analysis, the splice turning device in question can be oscillated for example within ranges -12.0 to -8.0 or 2.0 to 7.5. Point -3.75 mm can also be passed just as long as the splice turning device is at this point for as short a time as possible.

[0014] Figure 4 presents the correlation between the location of the splice turning device and the width of the fabric. The said correlation is very good and accurate. A highly precise analysis is obtained by analysing a situation where the splice turning device is moving to a direction where the width of the fabric increases. In this case, when the location of the splice turning device changes, the width of the fabric follows accurately and with a minimal delay the change in the location of the splice turning device. The step graph indicates the location of the splice turning device. The location readings here are on the Y-axis, and their quantity is mm, with the readings ranging from -6.0 to 9.0. The envelope here is the relative width of the fabric calculated as the sum of measurements from the tending side and drive side. The relative width readings here are on the Y-axis, and their quantity is mm, with the readings ranging from 55.0 to 85.0. As the fabric becomes wider, the said value decreases.

[0015] In practice, the splice turning device can be os-

cillated alternately on each side of the disadvantageous area. It is possible to move from one side to the other without edge tear disturbance even with the web, because the fabric is at its widest when the perpendicular splice point is passed. During the shift from one side to the other, a new correlation analysis concerning the correlation between the location of the splice turning device and the width of the fabric can be carried out. In other words, it is good to perform a new correlation analysis as often as possible. The correlation between the position of the splice and the vibration level of the fiber web machine can even be determined essentially continuously. By means of frequently repeated or continuous analysis, it is possible to eliminate effectively the impact of a change in the width of an ageing fabric, nip load, amount of water, or any other phenomenon which changes the width of the fabric. Moreover, even if there is no shift from one side to the other, the correlation analysis is preferably carried out continuously. After a shift from one side to the other, the earlier analysis result is rejected entirely. In this case, a shift to a different side forms a new set of measuring points, which corresponds to the conditions on the new side.

[0016] It has also been observed surprisingly in the tests that a highly precise analysis is obtained by analysing a situation where the splice turning device is moving to a direction where the width of the fabric increases. In other words, the correlation is determined when the width of the fabric increases while the position of the splice is changed. In this case, when the location of the splice turning device changes, the width of the fabric follows accurately and with a minimal delay the change in the location of the splice turning device. It has been found out surprisingly that the fabric tends to resist the turning of the splice away from the perpendicular, and the fabric hence becomes wider more rapidly than what it becomes narrower when the splice turning device is turned. When moving from one side of a perpendicular splice to the other side, the objective is to choose the location of the splice turning device so that the splice is as far as possible from the wavelength of the previous point and its harmonic multiples. In this case, the operating range of the splice turning device is certainly within a sufficient and safe distance from the disadvantageous area. When the precise perpendicular position of the splice, at which po-

sition $\arccos \alpha = \frac{L_s}{L_{\max}}$ the width of the fabric is

at a maximum, is known, it is easy to calculate the angle α of the splice at the respective fabric width using the equation:

where L_s is the present width of the fabric and $L_{\max}$ is the maximum width of the fabric. By using this splice angle information, it is possible to attempt to keep the splice as far as possible from the point of the harmonic multiples of the rotation frequencies of

the roll and fabric. In this way, it is possible prevent a rise in the vibration level even before the vibration has begun. When this is done accurately also in terms of the fabric, location measurement can also be arranged in the fabric stretcher. This also provides exact information on the length of the fabric when the precise diameter of the roll is already known.

[0017] In press nips with two fabrics, the position of splices in both fabrics can also be controlled in the above-described manner. Moreover, the entire fiber web machine can be optimized in such a way that the positions of the splices in the fabrics are as far from each other as possible and that the wavelengths calculated from the angles of their splices and their harmonic multiples are as far from each other as possible. In other words, the positions of the splices in the fabrics are arranged into opposite angular positions. Moreover, the positions of the splices in the fabrics passing through the same nip are preferably changed independently. This can prevent vibrations resulting from the mutual effect of the fabrics.

[0018] Especially in the case of old and deformed fabrics, the correlation between the position of the splice and the vibration level can even be lost. In this case, the location of the splice turning device can be optimized only on the basis of the correlation between the splice turning device and the vibration level. The loss of correlation can be seen for example from the variance of residual of the correlation analysis of the fabric and vibration level. Moreover, it can be chosen that the fabric is spread throughout its service life to the extent possible so that the runnability of the edge area of the web would be maintained. The spreading is taken into account when optimizing the angle of the splice within the operating range of the splice turning device. The control system is therefore actually self-learning, and it adapts to the changing conditions.

[0019] Various technical solutions can be used for identifying the width of the fabric. One simple solution is based on the applicant's *UltraEdge* sensors, which are placed on each edge of the fabric. The ultrasonic sensors identify the edges of the fabric, and the width of the fabric can then be determined from the measured values. Correspondingly, with a fabric guide equipped with electro-mechanical *UltraEdge* sensors, edge measurement is already built into the fiber web machine, which means that the necessary investments are small. In the simplest configuration, the prevention and minimization of vibrations can even be accomplished on the basis of the mere measurement data on the width of the fabric, without vibration measurement. This simplifies the structure of the arrangement further.

[0020] In addition to for example mechanical devices, other potential techniques for determining the width of the fabric include ultrasound, visible light, ultraviolet light, infrared light, laser and image recognition, in other words applications with sensors identifying the edge of the fabric or its reflection. An analysis performed on one fabric

can also be used for another, new fabric, at least with some accuracy. In this case, it is not always necessary to perform an analysis. However, an analysis is performed when factors affecting the alignment of the fabric in the fiber web machine have been changed. These factors include a change of rolls or fabric type. In other words, without major changes to the fiber web machine it can be assumed that the widest point, in other words the point of most vibration, is at the former place, in which case it is possible to keep away from it. If the situation of a straight alignment stripe is avoided altogether, even the first impulse given by a straight alignment stripe can be avoided. On the basis of the analysis, the continuous, frequent and non-stopping moving of the splice turning device can even be stopped. Optimized splice turning carried out at prescribed intervals can even give a better result than the constant moving. When the fabric remains in place for a longer period of time, the end product is of an increasingly uniform quality as the nip and fabrics work properly without vibrations.

[0021] The method according to the invention reveals the position of the splice within each operating range of the splice turning device. In the method according to the invention, the control of the arrangement is based on observed values instead of experimental or statistical values. The method uses systematically-obtained measuring point sets, and the analysis of these sets results in a correlation, which is used for control. In this way, it is possible to identify the continuous operating range of the splice turning device, within which range the vibration levels are known to be at their lowest. In other words, the arrangement provides information on the useful operating range and its response to vibration even before the vibration level has increased.

[0022] In practice, the alignment stripe is never perfectly straight, but it may be for example an S-bend, C-bend, or a mere local bend. In this case, a location of the alignment stripe measured only at the ends of the splice would give a false representation of the average angle of the splice. However, when the position of the splice is determined on the basis of the width of the fabric, the resulting information is obtained in a simple manner and, above all, at a sufficient accuracy.

[0023] Figure 1 shows the principle of the control of the arrangement. The splice turning device 15 is connected to the machine control system 19, to which the sensors 20 are also connected. The machine control system is an installed software product, which comprises the program code elements arranged to perform the above-described steps of the method according to the invention.

[0024] As a result of the method and arrangement, the service lives of fabrics are extended considerably, when the premature need to replace the fabric due to vibration can be prevented. The extended service life is an important consideration especially in hard-roll nips and on separate presses, where the deformation of the fabric is most intense. By eliminating vibrations and the deformation of

the fabric and roll, it is possible to attain considerable savings, because the service lives of fabrics are extended without exception by up to weeks. In other words, the vibration problems can be largely avoided regardless of the particular machine position and fabric, without randomness. This means that a rise in the vibration level can be prevented even before it has begun. When the vibration level can be kept low, the press section can use load areas which were previously susceptible to vibration. This has a positive impact on the quality of the end product. Moreover, the speed used in production can be considerably higher than earlier, which means an increase of up to more than 10 per cent in production capacity.

[0025] The inventive idea of the invention to identify the position of the splice on the basis of the width of the fabric enables the use of simple and robust components. Moreover, the position of the splice can be determined without delay when the behavior of the fabric, more specifically the variation of its width as the position of the splice changes, is known. In practice, the width of the fabric indicates expressly the average splice position very accurately. In other words, the width takes very well into account the error caused by the splice not being straight. Moreover, the results of the analysis are obtained quickly; depending on the application, the analysis takes half an hour to 2 hours.

[0026] As an example, the method can be implemented in practice as follows: When a new fabric is taken into use, the operators find, on the basis of the width of the fabric, that location/position of the splice turning device where the splice is in the direction of the nip. During operation, that location/position of the splice turning device and any positions too close to it are avoided. In other words, a splice which is parallel to the nip is avoided. If necessary, the maximum width of the fabric is searched during operation by moving the splice turning device from one side to the other. The position of the splice, in other words the turning angle, is found out on the basis of the current width and maximum width of the fabric measured in this conjunction. Furthermore, a comparison of the locations/positions of the splice turning device that correspond to the current splice and a straight splice indicates the sign (plus or minus) of the turning angle. On the basis of the turning angle, the splice of the fabric can be controlled by moving the splice turning device so that the multiples of the rotation frequency of the roll and fabric are avoided. The correlation between the location/position of the splice turning device, the position of the splice and the vibration level can be calculated continuously.

[0027] Normally, the splice turning device and fabric guide have an impact on different rolls. In other words, by moving two rolls suitably, both the splice can be turned and the fabric can be controlled to travel in the desired manner. The splice turning device and hence the roll which the splice turning device affects can be kept in place in the advantageous area for even a longer period of time when one end of the guide roll moves slowly to

the same direction controlled by automation. It can be concluded from this that the splice continues its movement despite the splice turning roll remains in place. This avoids the generation of vibrations, which would occur in time in the case of a stationary splice irrespective of the position/distance of the splice with respect to a straight splice. The splice turning roll may be stationary for days while the vibrations still decrease constantly. It can be concluded from this that the position of the splice changes slowly by the effect of the guide roll. It is therefore preferred to also follow the movement of the guide roll, preferably its trend. This reveals the direction to which the splice is turning. In other words, the movement of the guide roll can be used as a secondary indication in the control of the overall system.

[0028] The invention relates to a method in a fiber web machine. In the method, the position of the splice (14) in a fabric (12) is changed in order to minimize the vibration level of the fiber web machine. The position of the splice (14) is determined on the basis of the width of the fabric (12). The invention also relates to an arrangement in a fiber web machine, and to a software product.

Claims

1. A method in a fiber web machine, in which method the position of the splice (14) in a fabric (12) is changed in order to minimize the vibration level of the fiber web machine, **characterized in that** the position of the splice (14) is determined on the basis of the width of the fabric (12).
2. A method according to claim 1, **characterized in that** in the method the width of the fabric (12) and/or the position of the actuators (15) used for changing the position of the splice (14) is monitored, and this information is used for avoiding a situation where the fabric (12) is at its widest.
3. A method according to claim 2, **characterized in that** the correlation between the position of the splice (14) and/or of the actuators (15) and the vibration level of the fiber web machine is determined essentially continuously.
4. A method according to claim 3, **characterized in that** the correlation is determined both after a change of fabric (12) and while using the fabric (12).
5. A method according to claim 3 or 4, **characterized in that** the correlation is determined by changing the position of the splice (14) and by simultaneously measuring the vibration level.
6. A method according to any of claims 3 to 5, **characterized in that** the correlation is determined when the width of the fabric (12) increases while the posi-

tion of the splice (14) is changed.

7. A method according to any of claims 1 to 5, **characterized in that** the positions of the splices (14) in the fabrics (12) that travel through the same nip are changed independently. 5
8. A method according to claim 7, **characterized in that** the positions of the splices (14) in the fabrics (12) are arranged into opposite angular positions. 10
9. An arrangement in a fiber web machine, where the arrangement comprises:
- a seamed fabric (12), 15
 - actuators (15) for changing the position of the splice (14),
 - measuring instruments (15') for determining the position of the actuators (15),
 - and 20
 - control devices (18) connected to the actuators (15) and measuring instruments (15'),
 - characterized in that** the arrangement further comprises sensors (20) for determining the width of the fabric (12). 25
10. A software product, which comprises program code elements, **characterized in that** the program code elements are arranged to perform the steps of the method according to any of the above claims 1 to 8. 30

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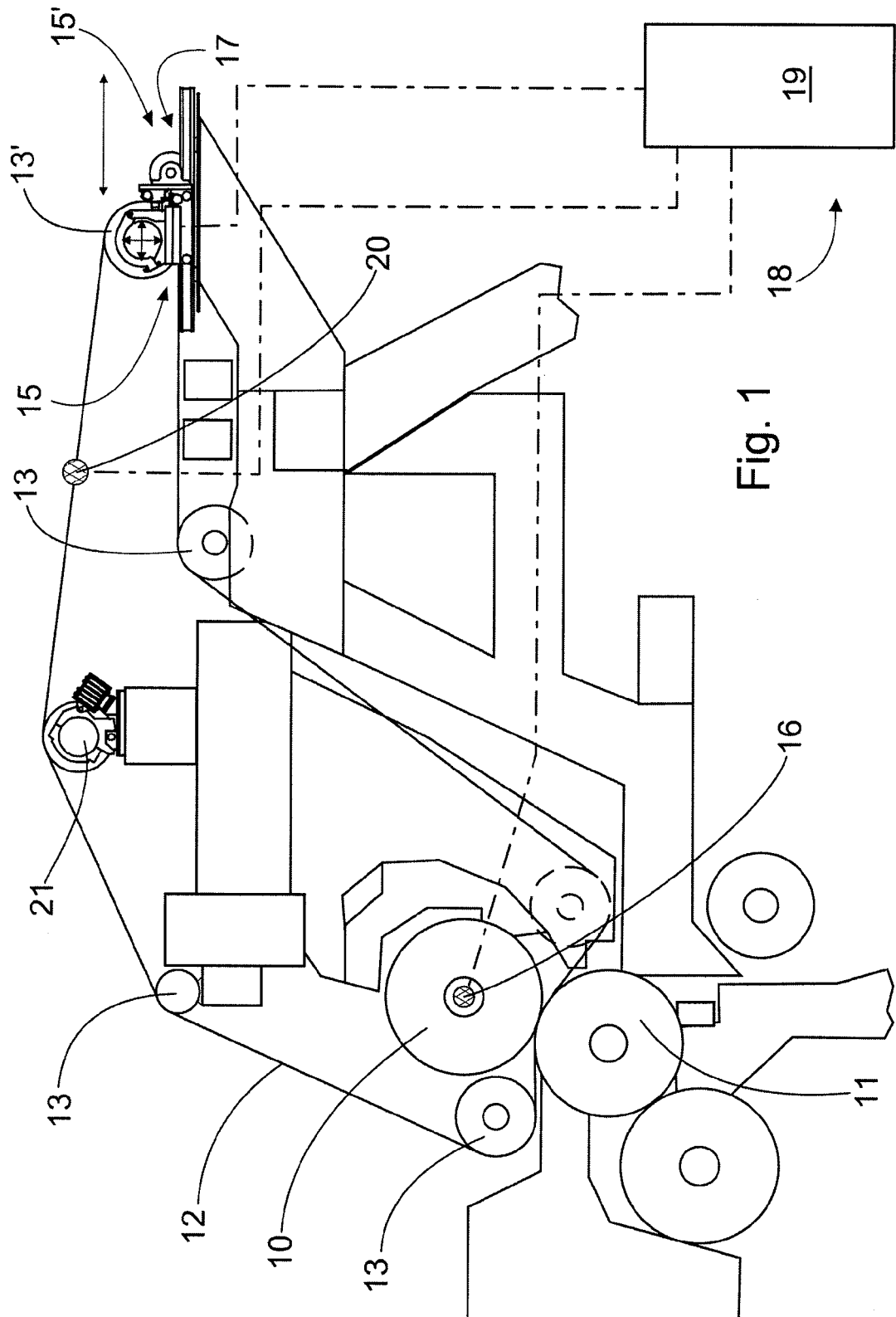


Fig. 1

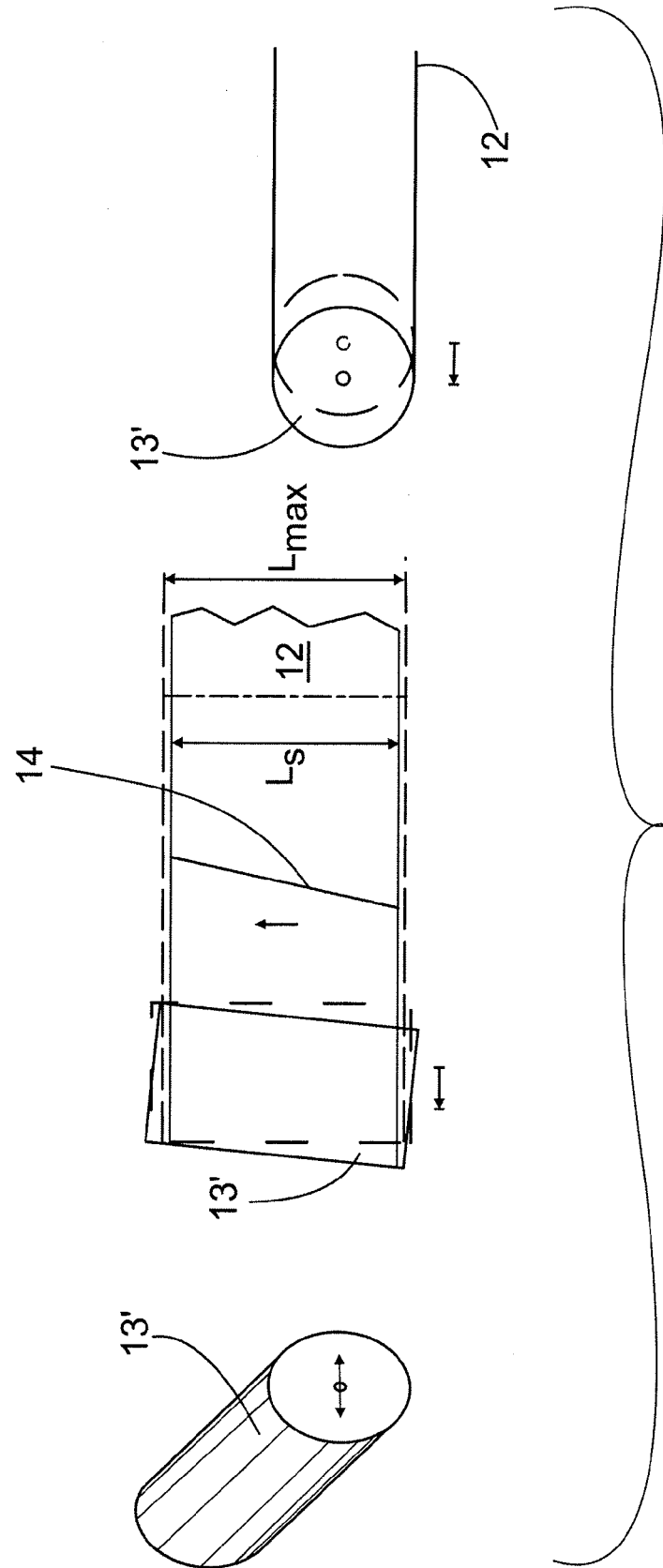


Fig. 2

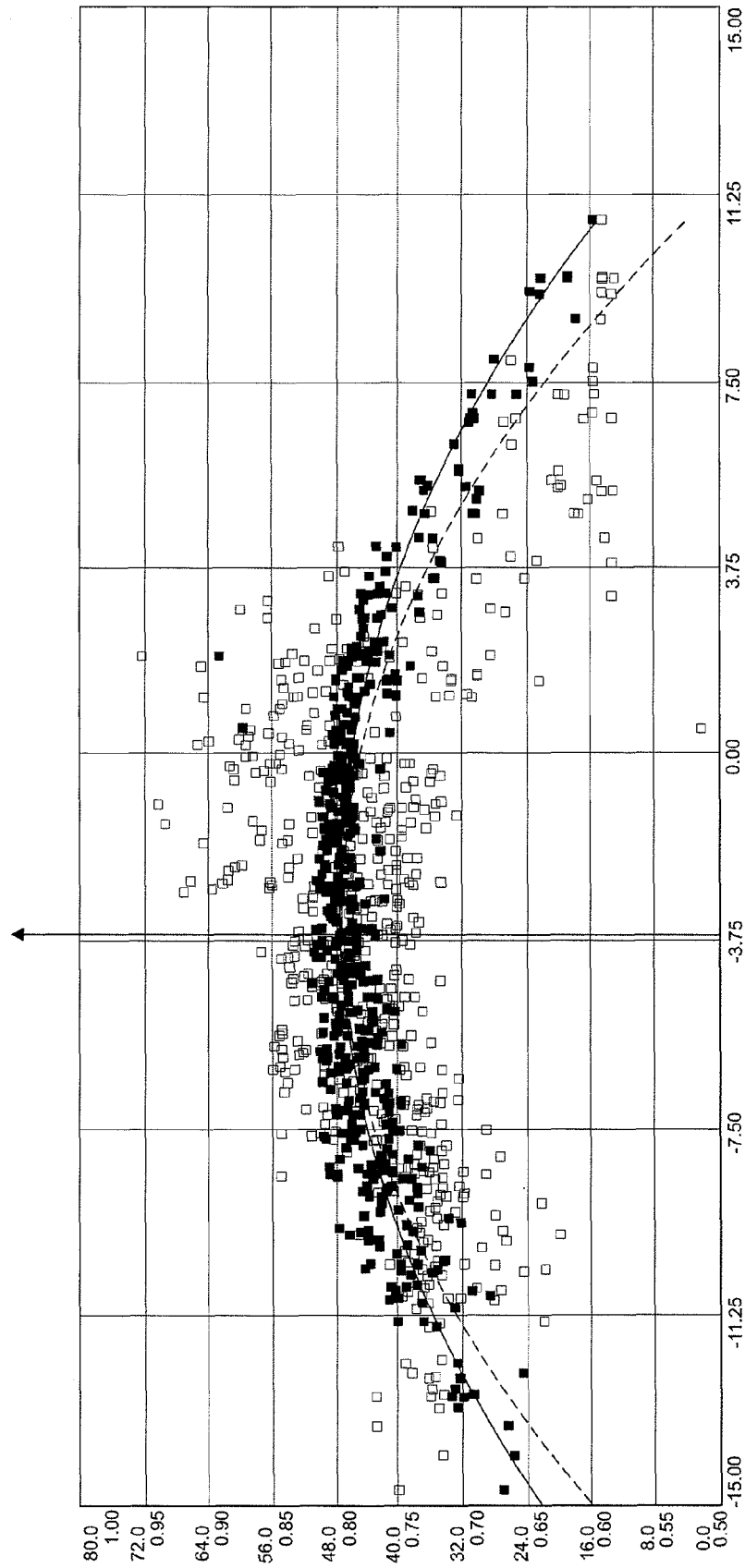


Fig. 3

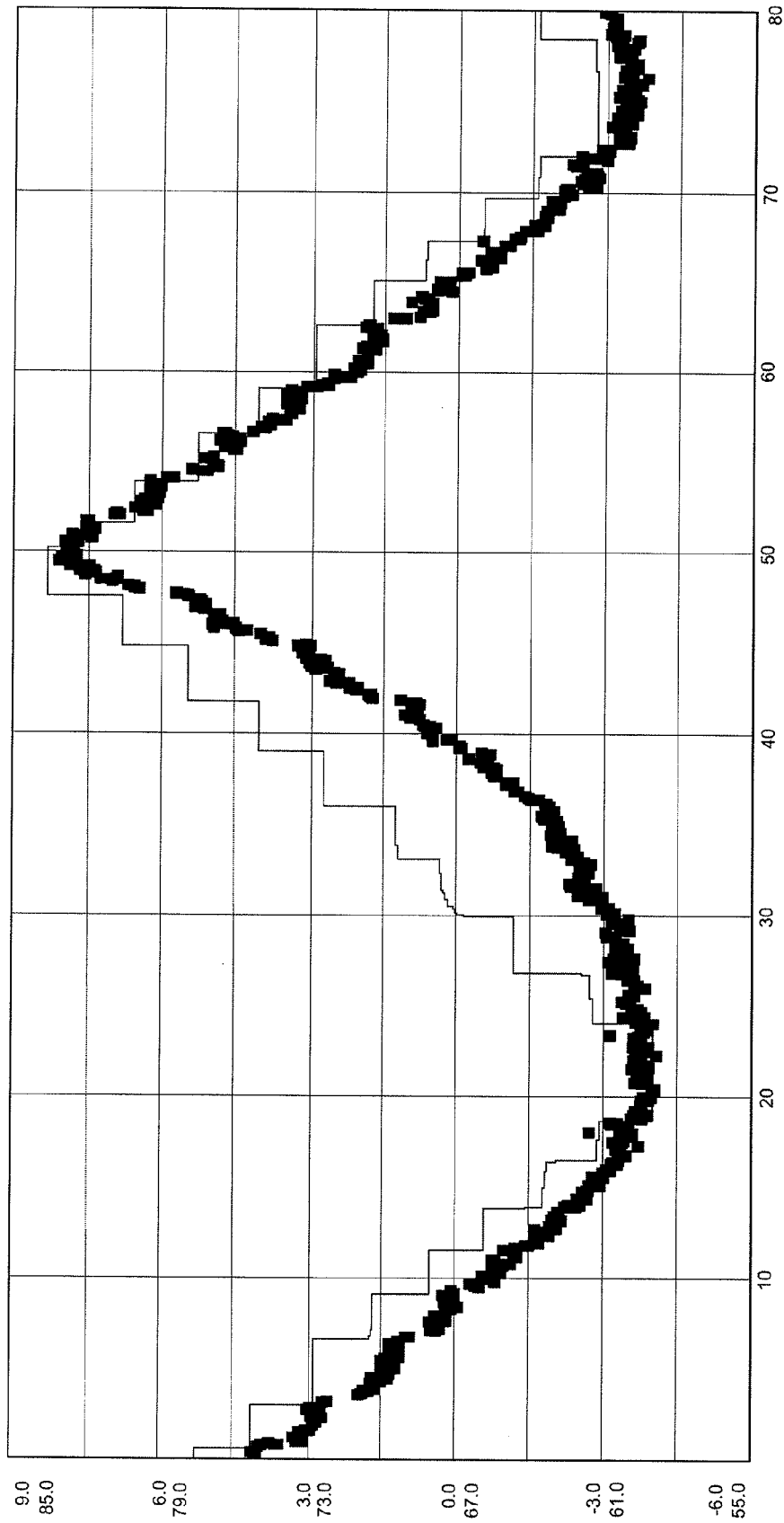


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 6495

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
E	WO 2012/130692 A1 (VOITH PATENT GMBH [DE]; ERKELENZ MARC [DE]; AENGENEYNDT KERST [DE]; NA) 4 October 2012 (2012-10-04) * the whole document *	1-6,9,10	INV. D21F7/00 D21F7/10 D21F3/00 D21F1/36
A	WO 2004/099493 A1 (METSO PAPER INC [FI]; HEIKKILAE PERTTI K [FI]; KAERKKAENEN ERKKI [FI]) 18 November 2004 (2004-11-18) * the whole document *	1-9	
A	DE 10 2006 037961 A1 (VOITH PATENT GMBH [DE]) 14 February 2008 (2008-02-14) * paragraphs [0006], [0007] *	1-9	
			TECHNICAL FIELDS SEARCHED (IPC)
			D21F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 January 2013	Examiner Beckman, Anja
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 1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 18 6495

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29-01-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2012130692 A1	04-10-2012	DE 102011006134 A1 WO 2012130692 A1	27-09-2012 04-10-2012
WO 2004099493 A1	18-11-2004	EP 1620597 A1 FI 20035059 A US 2006249271 A1 WO 2004099493 A1	01-02-2006 06-11-2004 09-11-2006 18-11-2004
DE 102006037961 A1	14-02-2008	NONE	

EPO FORM P0459

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Patent documents cited in the description

- FI 116399 [0002]