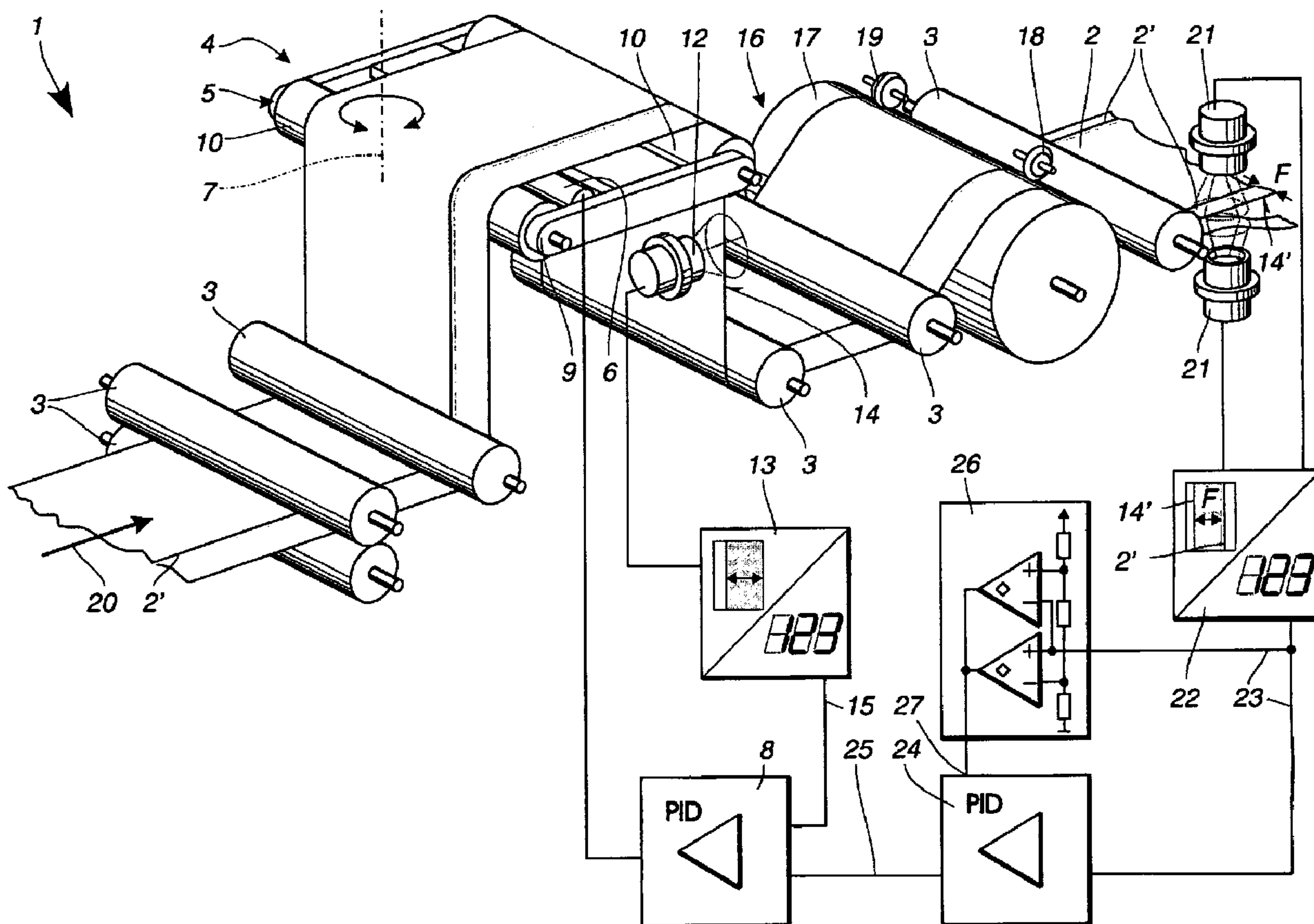




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(54) Titre : PROCEDE ET DISPOSITIF DE TRAITEMENT D'UNE BANDE DE MATIERE DEFILANTE
(54) Title: METHOD AND APPARATUS FOR THE TREATMENT OF A RUNNING MATERIAL WEB



(57) Abrégé/Abstract:

An apparatus (1) for the precisely positioned processing of a moving material web (2) has at least one web-movement-regulating arrangement (4) which influences the movement of the material web (2). This web-movement-regulating arrangement (4) is

(57) Abrégé(suite)/Abstract(continued):

influenced by a first sensor, which senses the position of the material web (2) in the direction transverse to the web-movement direction and is arranged downstream of the web-movement-regulating arrangement (4). This first sensor (12) has arranged downstream of it a material-web-processing apparatus (16) which, in turn, is followed by at least one second sensor (21). This second sensor senses a guidance criterion (F) of the material web, and this, in turn, is in operative connection with the web-movement-regulating arrangement (4).

Abstract

An apparatus (1) for the accurately positioned
5 treatment of a running material web (2) has at least
one web-run control device (4) influencing the web run
of the material web (2). This web-run control device
(4) is influenced by a first sensor which detects the
10 position of the material web (2) transversely with
respect to the web-run direction and which follows the
web-run control device (4). This first sensor (12) is
followed by a material-web treatment apparatus (16)
which, in turn, is followed by at least one second
15 sensor (21). This second sensor detects a guiding
criterion (F) of the material web which, in turn, is
operatively connected to the web-run control device
(4).

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Method and apparatus for the treatment of a running
material web

10 The invention relates to a method for the treatment of
a running material web, with a material-web treatment
process and with preceding web-run control, according
to the precharacterizing clause of Patent Claim 1. The
invention relates, moreover, to an apparatus for
15 carrying out this method, according to the
precharacterizing clause of Patent Claim 8.

EP 05 024 169 A discloses an apparatus for grooving or
cutting a running material web, particularly in the
20 case of a corrugated-board web. In order to achieve an
exactly positioned grooving or exactly positioned
cutting of the running material web, the groover or the
cutting apparatus is preceded by a web-run controller
which guides the running material web transversely with
25 respect to its running direction. This arrangement has
proved appropriate in practice and constitutes the
starting-point of the present invention.

A method and an apparatus for controlling the position
30 of the edge of a running material web are known from US
2005/158 106 A1. The material web in this case runs
through an impression cylinder which prints the latter.
The material web is subsequently guided via a rotary
frame which influences the material-web run. Since the
35 rotary frame follows the impression cylinder, it cannot
influence the delivery of the material web to the
impression cylinder. Consequently, this apparatus
cannot smooth out lateral positioning errors of the

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print on the material web as a result of a corresponding web-run deviation.

5 An apparatus for correcting the zigzag movement of a running web is known from US-A-5 667 123. This apparatus has two control loops for web-run control which are nested one in the other, but which obtain their control signal from a single web-edge sensor. The two control loops nested one in the other in this case
10 ensure, on the one hand, coarse control and, on the other hand, fine control. The required control stroke for fine control is thereby reduced, and fine control consequently, overall, becomes more accurate. However, this publication does not disclose any material-web
15 treatment process which is provided between the first and the second control. The control result is therefore also not influenced by a material-web treatment process.

20 The object on which the invention is based is to provide a method and an apparatus for carrying out this method, of the type initially mentioned, in which the quality of the material-web treatment process is to be improved.

25 This object is achieved, according to the invention, by means of the features of Patent Claims 1 and 8.

In the method according to Claim 1, a running material
30 web is subjected to a material-web treatment process. This material-web treatment process varies the material web in any desired way per se. So that the treatment of the running material web can be carried out with sufficient position accuracy, the material-web
35 treatment process is preceded by a web-run control which influences the run of the material web. This ensures that the material web is delivered correctly to the material-web treatment process. In order further to improve the quality of the material-web treatment

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process, according to the invention a guiding criterion of the material web is detected after the material-web treatment process. This guiding criterion may be an edge position of the material web, but, alternatively, it is also conceivable to determine any other desired guiding criterion. This guiding criterion acts on the web-run control which precedes the material-web treatment process. The web-run control is therefore designed in two stages, since, on the one hand, the web run before the material-web treatment process is controlled and, on the other hand, the guiding criterion after the material-web treatment process is controlled. Owing to this two-stage control, there is advantageously a rapid reaction to faults in the web run as a result of external influences and also in the case of offset-spliced material webs, but, on the other hand, a smoothing-out of the guiding criterion determined after the material-web treatment process. Influences of the material-web treatment process on the guiding criterion are smoothed out in this way, thus resulting in a high treatment quality of the material-web treatment process. Since the guiding criterion can thereby be determined, in spatial terms, only considerably after the web-run control, the control of the guiding criterion, as a rule, has a time lag, so that rapid changes in the web run due to external influences cannot thereby be smoothed out sufficiently quickly. For this purpose, however, the relatively quick web-run control which does not take into account the guiding criterion takes effect.

To achieve a particularly effective monitoring and control of the material-web treatment process, it is advantageous, according to Claim 2, if at least one of the guiding criteria occurs only in the material-web treatment process. Consequently, not only is the guiding criterion influenced by the material-web treatment process, but, on the contrary, it directly indicates the result of the material-web treatment

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process. Thus, a direct monitoring and control of the material-web treatment process take place, with the result that the quality of the latter can be increased correspondingly. In this application, it is technically not possible to detect the guiding criterion before the material-web treatment process, since the guiding criterion is defined such that the guiding criterion does not yet exist at all there. In this case, the two-stage control used has a particularly advantageous effect on the control behaviour of the material web.

The method according to the invention has proved to be advantageous particularly for the material-web treatment processes mentioned in Claim 3. In the printing of a material web, the latter is guided via one or more impression cylinders, in which case, on the one hand, the printing image must be aligned exactly with the material web and, on the other hand, the various printing images must also fit exactly one over the other. Since, as a rule, the impression cylinders are mounted rigidly, the material web must run correctly onto the printing machine. The guiding criterion is in this case preferably that position of the printing image within the material web which can be detected only after it has been printed. In the cutting of a material web, in particular longitudinally with respect to the web-run direction, cut edges are obtained which must be aligned exactly with a printing image, folding edges or the like. The guiding criterion which is in question here is, in particular, that position of the cut edge within the material web which is produced only in the cutting operation. In the grooving, folding or embossing of a material web, predetermined bending points are produced in the material web, at which the latter can, for example, be folded later. These bending lines must be aligned exactly with a printing image already applied to the material web, so that, in this case, the guiding criterion is the relative position of a bending line

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with respect to the printing image. In the straightening of a textile material web, the latter is led via oblique or curved rollers in order to align the weft threads of the fabric perpendicularly with respect to the material-web running direction. In this case, harmful transverse forces on the material web arise which cause the latter to run out of true. The two-stage control according to the invention can guide the material web effectively here, without the need, directly downstream of the straightening machine, for an additional device for influencing the web run. In the lining or bonding of a material web, part-webs must be aligned exactly with one another. An application of adhesive may take place in a predetermined pattern.

For the guiding criterion which is obtained after the material-web treatment process, a function of a spacing between two features listed in Claim 4 has proved appropriate. In this case, the spacing between identical and different feature categories can be measured, for example between two printing images or between a printing image and a margin edge. The position of a printing image is considerably important particularly in the packaging sector. In textile material webs with a very large-area pattern, the position of the printing image within the material web, in particular the repeat, may also be important. The position of a margin edge is often particularly important for the guidance of a material web. If the material-web treatment process has a longitudinal cutting machine, this presents the particular problem that the margin edge to be sensed occurs only in the process. The position of a depression, of a folding edge or of an embossing line is considerably important particularly for cardboard blanks, since these form predetermined bending lines. Particularly where textile material webs are concerned, the position of a marked or absent stitch row, at which, for example, a tubular cloth is to be opened, may also be important.

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Particularly in the case of lining devices, the guiding criterion may be dependent on the relative spacing between features of the material-web topside and underside. The relative spacings of all the abovementioned features may be considered for the guiding criterion, the guiding criterion being determined in detail according to the quality stipulations. The particular advantage of the method according to the invention is in this case that the guiding criterion is detected directly independently of its complexity and, in particular, independently of its occurrence within the overall material-web treatment and is fed back to the web-run control.

A simple implementation of the two-stage web-run control described is obtained, according to Claim 5, in that at least one of the guiding criteria influences the desired value of the web-run control. As a function of the control of the guiding criterion, therefore, the desired value of the web-run control is given an offset to an extent such that the currently determined error is corrected again. Although this type of control has a relative time lag, this does not, however, play any role in practice, since only very slowly changing parameters have to be smoothed out in this way.

It happens, in practice, that the material-web treatment apparatus sometimes operates incorrectly. For example, a blunt knife of a material-web cutting device may no longer sever the material web completely, so that there is no proper cut edge. If the guiding criterion contains the direct result of the material-web treatment apparatus, that is to say, in the example mentioned, the material-web edge just cut, then there would be a considerable jump in the guiding criterion, since, instead of the current cut edge, the original material-web edge suddenly influences the guiding criterion. This leads, however, to a considerable web displacement and consequently to a

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considerable waste in material-web production. In order to avoid this, it is beneficial, according to Claim 6, if the guiding criterion is compared with at least one tolerance threshold. If this tolerance threshold is
5 overshoot or undershot, the control is interrupted after the guiding criterion. Quick web-run control in this case is maintained in full, so that disturbing influences on the web run are compensated, as before. There is therefore no need to shut down the entire
10 production line for the material web. Basically, it is also conceivable to store the overshooting or undershooting of the tolerance threshold of the guiding criterion, so that that portion of the material web which is affected by this can easily be sorted out
15 later.

In addition, it is advantageous, according to Claim 7, if the guiding criterion influences the material-web treatment process. This is useful particularly in those
20 instances where the material-web treatment process is provided with corresponding actuating means. Thus, for example, a cutting knife or groover could be displaceable transversely with respect to the material-web running direction. The same may also be
25 envisaged in the case of impression cylinders which are accommodated multiply one behind the other in a printing machine, in order to implement register control. The material-web treatment process can thereby also be refined considerably.

30 The apparatus according to Claim 8 serves for carrying out the method according to one of Claims 1 to 7. This apparatus has at least one web-run control device which influences the web run of the material web and which
35 can be implemented in the most diverse possible ways. This web-run control device may have, for example, at least one roller around which the material web is partially looped and which is pivotable about a fixed axis. This roller can thereby exert on the material web

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a force directed transversely with respect to the material-web running direction. Alternatively or additionally, the web-run control device may also have what is known as a rotary frame formed by a pivotable block in which a plurality of deflecting rollers for the material web are mounted. Moreover, it is conceivable that the web-run control device has one or more rolls which are mounted pivotably and press against the material web. It is important, in any event, merely that the web-run control device is capable of exerting on the material web a force directed transversely with respect to its running direction. Moreover, the web-run control device has a controller which receives actual-value signals from a first sensor. This first sensor in this case detects the position of the material web transversely with respect to its running direction, thus resulting in web-run control. The first sensor in this case follows the web-run control device so that a closed control loop can be achieved. The first sensor is followed by at least one material-web treatment apparatus which treats the material web in any way. The material-web treatment apparatus is followed by at least one second sensor which detects a guiding criterion of the material web. This guiding criterion is operatively connected to the abovementioned web-run control device, so that at least two control loops are provided. The first control loop extends over the web-run control device and the following first sensor and implements a web-run control which is known per se. The second control loop extends over the web-run control device, the material-web treatment process and the at least one second sensor and thereby allows a control of the guiding criterion. The guiding criterion may in this case be influenced by the material-web treatment apparatus or simply be generated by the latter.

To achieve a universal applicability of the apparatus, it is beneficial, according to Claim 9, if the at least

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one second sensor is formed by a camera which is directed towards the material web. By means of a camera, the most diverse possible guiding criteria can be obtained by means of following image processing.

5 Thus, for example, any desired elements of a printing image, the three-dimensional structure of the material web, the edge or cutting-line position or the like can be sensed by the camera. The calculation of the concrete guiding criterion may in this case take place

10 by means of a following software application, so that the apparatus as a whole can be used highly flexibly and universally.

To achieve an effective monitoring and control of the material-web treatment apparatus, it is beneficial,

15 according to Claim 10, if the at least one second sensor monitors at least one feature of the material web which has occurred due to the material-web treatment apparatus. Consequently, the direct result of

20 the material-web treatment apparatus is evaluated as part of the guiding criterion, thus resulting in perfect monitoring and control of the material-web treatment apparatus.

25 The at least one first sensor is preferably provided near the web-run control device, so that it can detect changes in the material-web run on account of the web-run control apparatus with a short reaction time and consequently smooth out these changes quickly. The

30 at least one second sensor has a substantially longer reaction time as a consequence of the system, since the material web first has to run through the entire material-web treatment apparatus before changes in the guiding criterion can be detected by at least one

35 second sensor. To achieve an optimal control behaviour, therefore, it is advantageous, according to Claim 11, if the web-run control has a lower reaction time with respect to the first sensor than with respect to the at least one second sensor. This results in a sufficiently

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quick web-run control and a control of the guiding criterion which has a greater time lag according to the circumstances.

5 To achieve an as efficient influence as possible on the web run by the web-run control device, it is beneficial, according to Claim 12, if the web-run control device has at least one pivotable control roller around which the material web is looped. In this
10 case, the pivot position of this control roller is influenced by at least one control device which is part of the web-run control device. Then, on the one hand, the following at least one first sensor and, on the other hand, the at least one second sensor following
15 the material-web treatment process act on this control device.

The subject of the invention is explained by way of example with reference to the drawing, without the
20 scope of protection being restricted.

The single figure shows an apparatus 1 for treating the running material web 2. The material web 2 could in this case be a paper, film, board, corrugated-board,
25 textile or metal web or a combination of these materials. It is assumed, merely by way of example, that the material web 2 is a board web. It has a longitudinally running embossing edge 2' which serves as a predetermined bending line. The material web 2 is
30 guided by rollers 3.

To influence the web run of the material web 2, the apparatus 1 has a web-run control device 4. This web-run control device 4 is formed by a web-influencing
35 device 5, an actuating drive 6 and a controller 8. The web-influencing device 5 is designed, in the exemplary embodiment illustrated, as a rotary frame 9 which is pivotable about a pivot axis 7 and on which two control rollers 10 are supported pivotably. The material web 2

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is deflected at each of the control rollers 10 through 90° in each case. The entire rotary frame 9 is held rotatably by means of the servomotor 6. The servomotor 6 in this case engages on the rotary frame 9 via a gear, not illustrated. The rotary frame 9 is in each case preceded and followed by a roller 3 which serves as a fixed roller.

The web-run control device 4 is operatively connected to a first sensor 12 which is designed merely by way of example as a camera. The first sensor 12 transmits its image data obtained to an image evaluation device 13 which, for example, determines the position of a web edge 14 of the running material web 2. Alternatively, the first sensor 12 could also detect the web edge 14 directly, for example by means of a light barrier, pneumatically, inductively or mechanically. This position is transferred as an actual value to the controller 8 via a signal path 15.

The sensor 12 is followed by a web treatment apparatus 16 which is formed by at least two deflecting rollers 3 and by a cylinder 17. The treatment apparatus 16 may be configured differently, depending on which actual treatment process is to be applied. In particular, it is conceivable to design the cylinder 17 as an impression cylinder, in order to print the material web 2 with continuous images or with a continuous pattern. Alternatively or additionally, the web treatment apparatus 16 may also have cutting knives 18 or groovers 19 which separate or groove the material web 2 longitudinally with respect to its web-run direction 20. In addition, any other further applications for treating the material web 2 may also be envisaged.

The web treatment apparatus 16 is followed by two second sensors 21, in each case in the form of a camera, which sense the material web 2 from above and from below. The second sensors 21 detect the material

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web 2 after its treatment by the web treatment apparatus 16 and transmit the image data obtained to a further image evaluation device 22.

5 This image evaluation device 22 determines from the image data obtained a guiding criterion F which corresponds, for example, to the spacing of the web edge 14' just cut from the embossing edge 2'. This guiding criterion F is delivered to a further
10 controller 24 via a signal path 23.

This controller 24 is operatively connected on the output side, via a signal path 25, to the controller 8 of the web-run control device 4 and transmits a desired
15 value to this. Two control loops nested one in the other are thus obtained, the inner forming a simple web-run control, while the outer smoothes out a more or less complicated guiding criterion F.

20 The output signal from the image evaluation device 22 is operatively connected, moreover, via the signal path 23 to a comparator 26 which compares this output signal with one or two threshold values. A plausibility check of the evaluated guiding criterion F is thus carried
25 out. By reference to this plausibility check, the comparator 26 decides whether the guiding criterion F has been correctly detected. In this case, the guiding criterion F is processed directly in the controller 24, so that the outer control loop is closed.

30 If, by contrast, the comparator 26 arrives at the result that the guiding criterion F has not been correctly detected, the controller 24 is blocked via a holding input 27, so that the output signal of the
35 controller 24 and consequently the desired value of the controller 8 of the web-run control device 4 are kept constant. In this operating state, the outer control loop for the guiding criterion F is interrupted, but the inner control loop for web-run control remains

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operative, with the measurement value of the first sensor 12 as the controlled variable.

List of reference symbols

	1	Apparatus
5	2	Material web
	2'	Embossing edge
	3	Roller
	4	Web-run control device
	5	Web-influencing device
10	6	Actuating drive
	7	Pivot axis
	8	Controller
	9	Rotary frame
	10	Control roller
15	12	First sensor
	13	Image evaluation device
	14	Web edge
	14'	Web edge
	15	Signal path
20	16	Material-web treatment apparatus
	17	Cylinder
	18	Cutting knife
	19	Groover
	20	Web-run direction
25	21	Second sensor
	22	Image evaluation device
	23	Signal path
	24	Groover
	25	Signal path
30	26	Comparator
	27	Holding input
	F	Command criterion

Patent Claims

1. Method for the treatment of a running material web
5 (2), the web run of which is influenced by at least one
web-run control, after which the material web (2) is
subjected to at least one material-web treatment
process, **characterized** in that, after the material-web
treatment process has been carried out, at least one
10 guiding criterion (F) of the material web (2) is
detected which acts on the web-run control.

2. Method according to Claim 1, **characterized** in that
at least one of the guiding criteria (F) occurs only in
15 the material-web treatment process.

3. Method according to Claim 1 or 2, **characterized** in
that the material-web treatment process executes at
least one of the following steps:

20

- A - printing,
- B - cutting,
- C - grooving,
- D - folding,
- 25 E - embossing,
- F - straightening,
- G - lining,
- H - coating and
- I - bonding.

30

4. Method according to Claim 3, **characterized** in that
at least one of the guiding criteria (F) is a function
of at least one spacing between two of the following
features:

35

- A - the position of a printing image,
- B - the position of an adhesive application,
- C - the position of a margin edge,
- D - the position of a depression,

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- E - the position of a folding edge,
- F - the position of an embossing line and
- G - the position of a marked or absent stitch row.

5

5. Method according to at least one of Claims 1 to 4, **characterized** in that at least one of the guiding criteria (F) influences the desired value of the web-run control.

10

6. Method according to at least one of Claims 1 to 5, **characterized** in that at least one of the guiding criteria (F) is compared with at least one tolerance threshold, in the event of the overshooting or undershooting of which the control is interrupted after the at least one guiding criterion (F).

7. Method according to at least one of Claims 1 to 6, **characterized** in that at least one of the guiding criteria (F) influences the material-web treatment process.

8. Apparatus for the treatment of a running material web (2), the apparatus (1) having at least one web-run control device (4) which influences the web run of the material web (2) and which is operatively connected to at least one first sensor (12) which detects the position of the material web (2) transversely with respect to the web-run direction (20) and follows the web-run control device (4) and which is followed by at least one material-web treatment apparatus (16), **characterized** in that the at least one material-web treatment apparatus (16) is followed by at least one second sensor (21) which detects a guiding criterion (F) and which is operatively connected to the web-run control device (4).

9. Apparatus according to Claim 8, **characterized** in that the at least one second sensor (21) is formed by a

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camera (21) which is directed towards the material web (2).

10. Apparatus according to Claim 8 or 9, **characterized**
5 in that the at least one second sensor (21) monitors at least one feature of the material web (2) which has occurred due to the material-web treatment apparatus (16).

10 11. Apparatus according to at least one of Claims 8 to 10, **characterized** in that the web-run control device (4) has a lower reaction time with respect to the at least one first sensor (12) than with respect to the at least one second sensor (21).

15 12. Apparatus according to at least one of Claims 8 to 11, **characterized** in that the web-run control device (4) is formed by at least one pivotable control roller (10), around which the material web (2) is looped, and
20 by at least one control device (8) influencing its pivot position.

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