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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B31D 1/04 — A1

(11) International Publication Number: **WO 97/47464**

(43) International Publication Date: 18 December 1997 (18.12.97)

(21) International Application Number: PCT/SE97/00998

(22) International Filing Date: 6 June 1997 (06.06.97)

(30) Priority Data:
9602299-1 11 June 1996 (11.06.96) SE

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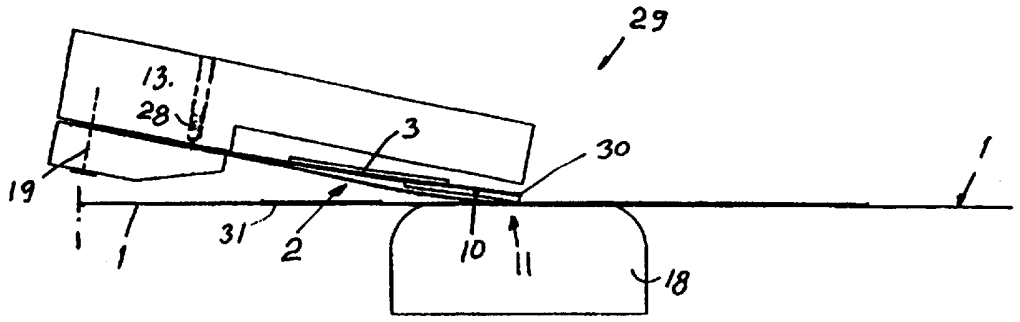
(81) Designated States: PL, SI, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: A METHOD AND A DEVICE FOR CONTROLLING MACHINE FUNCTIONS BY THE USE OF LEVEL CHANGE TRIGGERED SIGNALS



(57) Abstract

The invention relates to a device and a method for controlling functions in, especially, a napkin-manufacturing machine, for instance its cutting position relative to an embossed edging (31) in a running material web (1) used for the napkin manufacture by sensing the presence of level changes exhibited by the web (1) and thereby generating a signal performing said control. A signal transmitter (3) is mounted on a resilient member (2), which is in sliding contact with the material web (1) for the purpose of sensing the presence of level changes exhibited by the web (1) and generating a signal performing said control of function units in the machine.

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A method and a device for controlling machine functions by the use of level change triggered signals

The present invention relates to a method and a device for controlling functions in a machine for processing material webs, especially a napkin-manufacturing machine, e.g. its cutting position relatively an embossed edging in a running material web for the manufacture of napkins, by sensing level changes exhibited by the web material in question and by generating a corresponding signal for carrying out said control.

In the manufacture of e.g. napkins from a running tissue paper web there are encountered problems in connection with the cutting-off of the napkins centrally in an embossed, transverse edging in the web. The accuracy is today about ± 4 mms at the cutting of the napkins, which leads to an unacceptably high degree of rejection and/or waste. The reason for this is that up to now it has been difficult to select and to maintain the control of the cutting position in relation to an embossed edging in a running tissue paper web.

The object of the present invention is to solve that problem and to provide an accuracy in the control of the cutting position relatively the embossed edging in the running tissue paper web for the manufcture of napkins, so that the accuracy can be substantially higher than what has sofar been possible to achieve. This has been made possible by means of a method and a device of the type mentioned above. The characteristic features of the invention are set out in the accompanying claims.

Thanks to the invention there has now been provided a method and a device, which in an excellent manner

satisfy their purposes, in addition to which the invention is both simple and cheap to work. The special device for controlling the functions of especially a napkin-manufacturing machine - e.g. the cutting position relatively an embossed edging in a running tissue paper web used in the manufacture of the napkins - yields a very accurate control of the cutting position, so that the cutting will with a great precision sever the edging centrally. By arranging a signal transmitter on a resilient member in sliding contact with the material web it becomes possible accurately to fix the cutting positions on the web in relation to e.g. an embossed edging creating a level change, which by means of the signal transmitter generates a signal controlling the cutting position in relation to the embossed edging. Further, disturbances caused by conventional surface irregularities in the material can be reduced resulting in better signal characteristics as far as the sensed level changes in the material web are concerned. This is achieved by mounting the signal transmitter on a separate resilient element forming part of the resilient member, especially in the shape of a shorter leaf spring, which has been provided with a vibration damper and is in contact with a longer and more flexible spring element contacting the web. The presence of an intended level change appears clearly and separated from any background noise, because the special resilient element in the form of a leaf spring has its bending end in contact with the resilient element, past which the web slides triggering a movement due to the level change. That movement is perpendicular to the feeding direction of the web, i.e. the resilient sliding element is arranged to create a spring movement in the contact portion substantially perpendicular to the web.

A preferred embodiment of the invention will be described below in greater detail and with reference to the attached drawings.

Fig. 1 is a diagrammatic lateral view of a device designed in accordance with the invention for generating a signal triggered by a level change in a continuously fed material web for the purpose of controlling machine functions.

Fig. 2 is a diagrammatic plan view of the signal transmitter unit illustrated in Fig. 1, when removed from its carrier.

Fig. 3 is a diagrammatic plan view of a machine for the manufacture of napkins including the device according to the invention.

As appears from Figs. 1 and 2, it is there shown a preferred embodiment of a device for controlling functions in, especially, a napkin-manufacturing machine. The control does generally concern e.g. the cutting position relatively an embossed edging 31 in a running web used in the manufacture of napkins and the control is governed by level changes in the web material 1 in question. This generates a signal for carrying out said control so that the cutting position can, at a high accuracy, take place a number of napkin blank sections downstream the sensing position. The device according to the invention is constituted by a signal transmitter 3 mounted on a resilient member 2 in sliding contact with the material web 1 for the purpose of sensing a level change and generating a control signal, which e.g. after the determination of an average value feeds a control signal to the function units upstream as well as downstream the sensing position.

In accordance with a preferred embodiment the resilient member 2 is constituted by at least two spring leaves 4 and 5 and the signal transmitter 3 is mounted on the spring leaf 4, which shall be in resilient contact with the spring leaf 5 in sliding contact with the web material. The signal transmitter used may be e.g. a piezo-electric cell, a strain gauge, an inductive gauge, an accelerometer or an optical signal system.

The spring leaf 4 supporting the signal transmitter 3 comprises a portion 7, which is freely movable above the web 1 and spaced from its mounting portion 6 in a carrier means 13 and it is in contact with the central portion 9 of the leaf spring 5 in sliding contact with the material web 18 and a movement-equalizing portion 8 is arranged outside thereof. On the opposite side of the web 1 there is arranged a support 18, where the end 30 of the movable portion 7 is in contact with the central portion 9. Further, the leaf spring 4 supporting the signal transmitter 3 is provided with a vibration-damping element 10 in the position 11, where it is in contact with the leaf spring 5, which by means of two screws 19 is likewise fixed in a mounting portion 12 secured to the carrier member 13 extending across the web 1. Thanks to this mounting arrangement of the leaf springs 4 and 5 and to the fact that the leaf spring 4 is provided with said vibration-damping element 10 level changes in the web can be sensed without the control signal from the signal transmitter 3 being disturbed by irregularities in the tissue material.

In order to create a stronger signal from the leaf spring 4, which is exposed to a flexing force and supports the signal transmitter 3, it has been provided with a portion having a reduced resistance against flexing. According to the embodiment in Fig. 2 cut-outs 14, 15 have been made at the outer edges 16, 17 and

further there is an orifice 27 at the location of the signal transmitter 3 on the leaf spring 4. The leaf springs 4 and 5 are by screws 19 mounted in the carrier 13, which by means of a set screw 28 can be adjusted for the purpose of bringing the signal transmitter unit 29 in contact with the web 1. Thanks to this mounting arrangement the resilient slide leaf 5 will, at its contact or central portion 9, carry out a spring movement almost perpendicular to the material web 1.

Fig. 3 is a diagrammatic top view showing a tissue paper web passing through a napkin-manufacturing machine exemplifying the invention. As appears from the drawing figure, the tissue paper web 1 is fed between embossing cylinders 20 and 21 and further via positioning means 22 to the level change sensor 23 described above and consisting of the resilient member 2 with the signal transmitter 3 mounted above the web by means of the carrier 13. From there the web 1 continues through a pair of folding cylinders 24 and 25, which fold the paper web into a zigzag shape, whereupon a knife 26 divides the web 1 into two napkin strings, which are then counted and packeted.

The method according to the invention for the generation of signal controlling functions in, especially, a napkin-manufacturing machine is characterized in that level differences in the passing material web are sensed by a signal transmitter mounted on a resilient member, the spring element of which is in sliding contact with the material web 1 and exposed to a bending movement when the napkin surface passes below it and a level difference is encountered, e.g. in the shape of an embossed edging 31. Figs. 1 and 2 show details according to a preferred embodiment of the spring member 2. When an embossment in the material web 1 passes below the resilient member 2 comprising the

signal transmitter 3 the lower leaf spring 5 forming part of the spring member 2 will move in an outward direction and thereby actuate the signal transmitter 3 via the spring 4 supporting it, so that a signal is generated. The signal is treated in an electronic unit with automatic level control and continues to a PLC-system. Unreasonable measured values are discarded by the program, whereas reasonable measurements form an average value from a number of measurements so that the accuracy of the value will be as high as possible. The position reference for the embossment operation is the embossing cylinders 20, 21, to which there is connected a pulse transmitter and the calculated average value is compared with the reference value. Consequently, the program uses the position reference value and the average value for controlling the adjustment motors used to control the functions of the machine.

Claims

1. A device for controlling functions in, especially, a napkin-manufacturing machine, for instance its cutting position relatively an embossed edging (31) in a running material web (1) used for the napkin manufacture, **characterized** by a signal transmitter (3) mounted on a resilient member (2), which is in sliding contact with the material web (1) for the purpose of sensing the presence of level changes exhibited by the web (1) and generating a signal performing said control of function units in the machine.

2. A device as claimed in claim 1, **characterized** in that said resilient member (2) is constituted by at least two leaf springs (4, 5) and in that the signal transmitter (3) is mounted on the leaf spring (4) intended resiliently to contact another leaf spring (5) in sliding contact with the material web (1).

3. A device as claimed in claim 2, **characterized** in that the leaf spring (4) supporting the signal transmitter (3) has a relatively its portion (6) mounted in a carrier (13) above the web (1) freely movable portion (7), the end (30) of which rests against the central portion (9) of the leaf spring (5) in sliding contact with the material web (1).

4. A device as claimed in claim 3, **characterized** in that the leaf spring (4) supporting the signal transmitter (3) comprises a vibration-damping element (10) at the position (11), where it is in contact with the leaf spring (5) in sliding contact with the material web (1) and likewise mounted in the carrier (13) extending above the web (1) by means of a mounting portion (12).

5. A device as claimed in any of the preceding claims, **characterized** in that the leaf spring (4) supporting the signal transmitter (3) comprises a portion, which has a reduced resistance against flexing and is located at the mounting position of the signal transmitter (3) in order to increase the signal-generating movement of the leaf spring (4).

6. A device as claimed in any of the preceding claims, **characterized** in that the leaf spring (5) in sliding contact with the material web (1) is arranged to have its contact or central portion (9) to carry out a spring movement from the material web (1) substantially at right angles from the web above a support (18) located at the opposite side of the web.

7. A device as claimed in any of the preceding claims, **characterized** in that the signal transmitter (3) is constituted by a piezo-electric cell.

8. A method for generating a signal controlling the functions of, especially, a napkin-manufacturing machine, e.g. the cutting position relatively an embossed edging (31) in a running material web for manufacturing napkins, **characterized** in that level changes in the material web (1) are sensed by means of a signal transmitter (3) mounted on a resilient member (2), which is in sliding contact with the surface of the material web (1) and which, upon encountering a level change, is exposed to a bending movement, so that said signal transmitter (3) generates a control signal to function units in the machine.

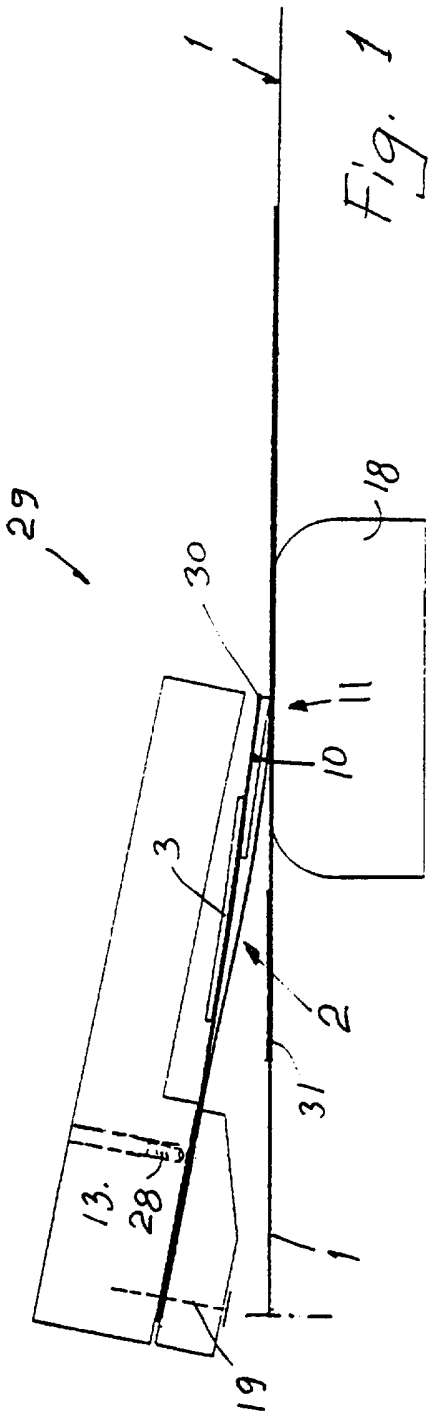

Fig. 1

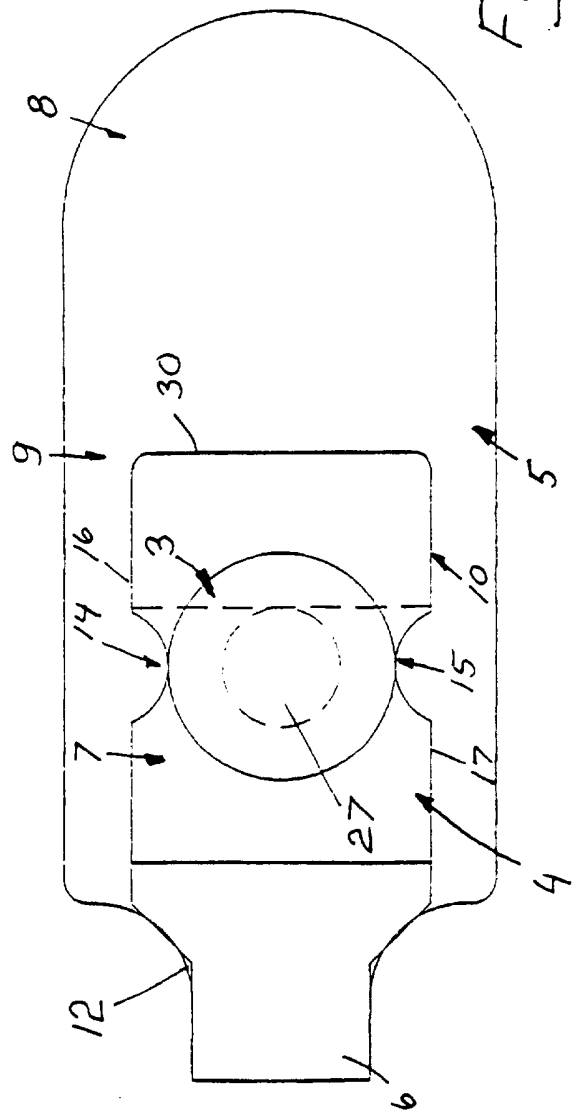

Fig. 2

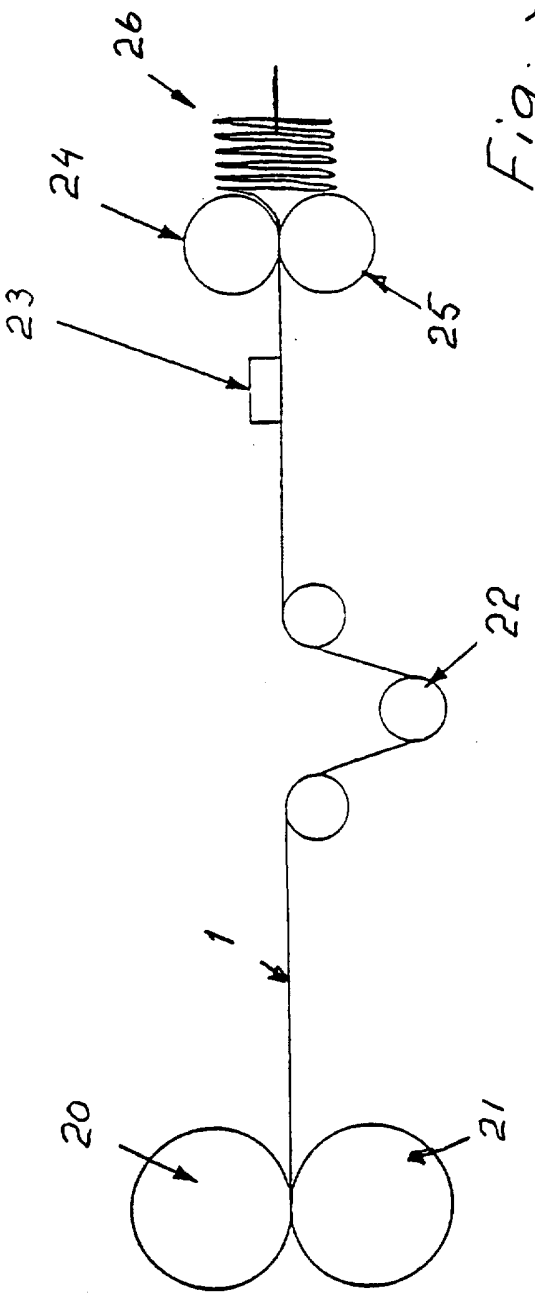

Fig. 3

INTERNATIONAL SEARCH REPORT

Intern. nal application No.
PCT/SE 97/00998

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B31D 1/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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IPC6: B31D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

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

WPI CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 3147968 A1 (FIRMA GUSTAV DEMMLER), 14 July 1983 (14.07.83), figure 1, abstract --	1-8
A	DE 3605085 A1 (HOBEMA MASCHINENFABRIK HERMANN H. RATHS GMBH & CO KG), 20 August 1987 (20.08.87), figure 1, abstract --	1-8
A	WO 9402309 A1 (LOSI, BRUNO), 3 February 1994 (03.02.94), figures 1,2, abstract -- --------	1-8

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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3147968 A1	14/07/83	NONE	
DE 3605085 A1	20/08/87	EP 0234281 A	02/09/87
WO 9402309 A1	03/02/94	AT 143631 T	15/10/96
		AU 4583093 A	14/02/94
		DE 69305151 D,T	30/04/97
		EP 0604633 A,B	06/07/94
		ES 2095066 T	01/02/97
		IT 1259672 B	25/03/96
		IT FI920153 D,V	21/12/92