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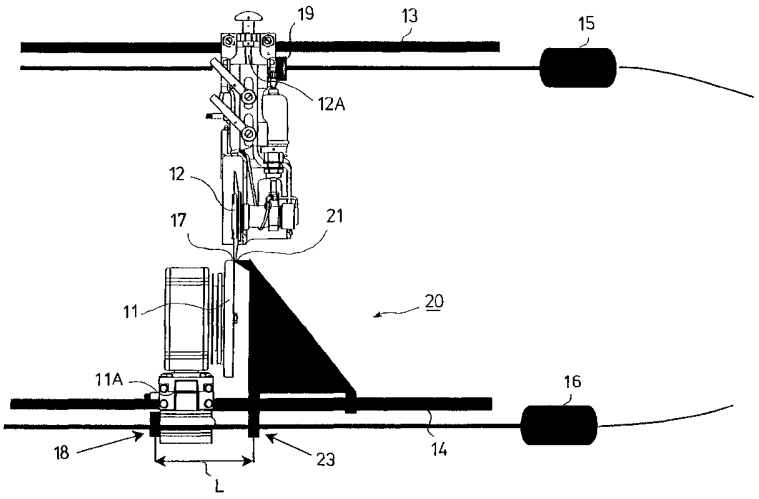
(54) Title: METHOD AND DEVICE FOR CALIBRATING THE POSITION OF BLADES OF A SLITTER-WINDER OF A PAPER OR BOARD MACHINE



(57) Abstract: The invention relates to a method for calibrating the position of blades of a slitter-winder of a paper or board machine, which blades (11,12) are attached to blade carriages (11A,12A) or the like disposed on guides (14,13) or the like, in which method the position of the blades (11,12) of the slitter-winder is measured by means of a multipoint measurement method, whereby the position of the blade carriage (11A,12A) of the respective blade (11,12) is measured. In the method the position of the blades (11,12) is calibrated with a calibration tool (20). A positioning member (21) of the calibration tool (20) is arranged to touch a slitting edge (17) of the blade (11) to be calibrated. The position of the calibration tool (20) is measured by means of the multipoint measurement method and the position of the slitting edge (17) of the blade (11) is determined based on the measurement result of the position of the calibration tool (20). The invention also relates to a device for calibrating the position of blades of a slitter-winder of a paper or board machine, which device is disposed in connection with the slitter-winder of the paper or board machine, which slitter-winder comprises pairs of blades comprising a top blade (12) and a bottom blade (11), attached to their respective blade carriages (1IA,12A) arranged to be movable along a guide (14,13) or the like, in connection of which slitter-winder means (15,16,18,19) are arranged for measuring the position of the blades (11, 12). In the method the device used for calibrating the position of the blades (11,12) is a calibration tool (20) which is arranged to be attached to the same guide (14) with the blade (11) to be calibrated. The calibration tool (20) comprises a means (21) for indicating the slitting edge (17) of the blade (11) and means (23,16) for measuring the position of the calibration tool (20).

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Method and device for calibrating the position of blades of a slitter-winder of a paper or board machine

The invention relates to a method according to the preamble of claim 1.

The invention also relates to a device according to the preamble of claim 7.

In the slitter-winders of paper and board machines a web is cut in the cross-direction into several component webs, and a pair of blades comprising a top blade and a bottom blade is used in the cutting. The width of the component webs to be slit by the blades and thus the position of the slitting blades can vary to a great extent when different blade settings are used, depending on the set widths of the rolls to be produced. The slitting blades have to be positioned, in the lateral direction of the web, in the right slitting position corresponding to the desired roll widths. In order to produce component webs of the desired width the slitting blades of the slitter-winder are spaced apart as desired in the lateral direction of the paper or board web i.e. a change of settings is carried out.

As to prior art related to the invention reference is made to FI patent 68185, which discloses a method and a system for position change. This publication describes the use of the method in a system used in the slitting of a paper web, in which system, to observe the position of the slitting device, a measuring device is used which is in a position arrangement which comprises actuating members for controlling and performing the movement of the measuring device in the cross-direction of the web and which system comprises at least one limiter i.e. for limiting the operation of the measuring device along the distance between the extreme positions such that one extreme position serves as the datum position for the determination. An observing device in both directions of movement observes at least one member of the slitting device. The system comprises drive means for the ac-

tuating members and moving devices performing a corrective movement of a movable device or member. The position of the slitting blades has been determined during a standstill of the machine by means of this known arrangement, having the aim of minimizing the duration of the standstill.

It is known from prior art to measure the position of the blades used in slitting by means of a carriage-type arrangement, in which a sensor is placed in a moving carriage with which, by means of optic or magnetic measurement, the position of the blades has been established. These measurement methods are used in connection with the changing of settings.

In a prior art application based on magnetic measurement each blade carriage is equipped with a fixed permanent magnet, and the distance between the permanent magnet and the slitting blade is constant, and the position of the permanent magnet connected to the blade carriage is measured by means of a magnetic measuring device, thereby establishing the position of the blade. In connection with the changing of blade settings, information is also needed, in addition to the information on the position of the sharpening blades, on the new, replacing blades and, after the detachment and grinding of the blades, position information, since, after these steps, the distance between the slitting blade edge and the magnet of the blade carriage changes, which means that no exact information on the position of the blade is available based on the results from the measurement methods described above. Also, the slitting blade edge wears, which leads to inaccuracy when using the above-mentioned measurement methods. In the above-described situations, when prior art applications have been used, there has been a need to carry out so-called tuning runs in order to determine the position of the slitting blade edge.

It is an object of the invention to provide a solution for eliminating or at least minimizing the disadvantages described above. An object of the invention is to

provide an easy-to-use and reliably operating method and device for calibrating the position of the blades of a slitter-winder.

To achieve the afore-mentioned objects and those that come out later the method according to the invention is mainly characterized in what is presented in the characterizing part of claim 1.

The device according to the invention is in turn characterized in what is presented in the characterizing part of claim 7.

The invention is based on a magnetostrictive sensor known as such, which sends out magnetic pulses on the basis of whose returning time the position of the blade is determined. Each top and bottom blade used in slitting comprises a permanent magnet on the basis of which information is continuously received on the position of the blades.

According to the invention at least one of the measurement points of the sensor is used, and magnetostrictive measurement is most appropriately used as the measurement method, some other equivalent multipoint measurement method also being suitable in this connection.

According to the invention, when the position of the blade carriage changes in relation to the position of the slitting edge, a measuring device i.e. a calibration tool is used, which is placed by the blade so that the positioning member of the calibration tool touches the slitting edge. The calibration tool is located on a guide and the position of the slitting edge is determined based on the measurement results of the magnet pairs or equivalent measuring members. When the blade concerned is known, it is possible to calculate, based on the distances, the exact position for the slitting edge. The device according to the invention is used on a slitter-winder when the blade is calibrated, e.g. when the bottom blade is worn or when changing the top blade, whereby information on the position of the slitting blade

edge is received immediately, e.g. after a blade change, without separate tuning runs or the like.

The device according to the invention comprises, according to one of its advantageous applications, a manually operated measuring device equipped with a permanent magnet and its use in connection with a magnetostrictive sensor in the offset calibration of a slitting blade edge. According to the invention the measuring device can also be positioned using other ways of measurement, e.g. based on optic procedure. Different types of data transfer procedures and wire and wireless, preferably digital, data transfer can be used in connection with the invention.

According to an advantageous application of the invention a manually operated measuring device is pressed against a blade guide and moved sideways to be in contact with the blade to be measured. Attachment to the guides allows the position of the magnet of the measuring device with respect to the sensor to be established, and it ensures that the direction of measurement is right. After this, the position of the magnet of the measuring device is read by means of a magnetostrictive sensor and the distance between the slitting blade edge and the fixed magnet of the blade carriage is calculated by software. According to the invention the calibrated blade positions can be brought accurately to the target i.e. to the desired slitting point without separate control measurements and movements or tuning runs and, in addition, the exact position of the blade is known at all times on the basis of feedback data.

According to a further advantageous feature of the invention the calibration can be automated, for example, so that when the measuring device finds a magnet, it performs the calibration, e.g., after the expiration of ten seconds, or, for example, a control button or an equivalent arrangement is used for performing the measurement.

The calibration according to the invention can be carried out easily without slide gauges or other equivalent precision tools. A further advantage of the invention is that, most appropriately, the calibration measurement procedure makes use of the same measurement method that is used in any case in determining the position of the blades.

In addition to the actual calibration tool no separate auxiliary devices or other accessories are needed in the invention and it is suited to be used for both the top and the bottom blades and for left- and right-handed blades. The device according to the invention is easy to use, thus reducing the chance of human mistakes, and the calibration arrangement according to the invention is easy to put into practise and does not require any special know-how.

A further advantage obtained by means of the invention is that, if the blade carriage is in an oblique position, which as such does not affect the mechanical operation of the slitting blade, this defect – irrectifiable as such only by improvement of measurement precision in other procedures – is also eliminated. Since the calibration tool according to the invention performs the measurement from the slitting point, better quality in the width of the component webs to be slit and thus in the delivery tolerance of the rolls can be obtained.

In the following, the invention will be described in greater detail with reference to the figures of the accompanying drawing.

Figure 1 shows an application of the invention as a schematic example.

Figure 2A shows a schematic block diagram representation of a prior art blade change sequence.

Figure 2B shows a schematic block diagram representation of an application of the method according to the invention.

The Figure shows one of the top and bottom blade pairs used in slitting. The bottom blade has the reference number 11 and the top blade has the reference number 12. The top blade 12 is attached to a blade carriage 12A, which is arranged to be movable along an upper guide 13, and the bottom blade 11 is attached to a blade carriage 11A, which is arranged to be movable along a lower guide 14. Each blade carriage 11A, 12A is equipped with a position magnet 18, 19. A magnetostrictive position sensor 15, 16 is arranged below each guide 13, 14, respectively, by means of which sensor the position of the respective position magnet 19, 18 is measured. The calibration tool 20 according to the invention is, in this example, disposed on the lower guide 14 and the control edge 21 of the calibration tool 20 is arranged so that it touches a slitting edge 17 of the bottom blade 11. A position magnet attached in connection with the calibration tool 20 has the reference number 23 and the magnet marking the position of the bottom blade 11 has the reference number 18, which means that the off-set distance L between the position magnet 23 of the calibration tool 20 and the position magnet 18 of the bottom blade 11 can be determined by means of magnetostrictive measurement. When the calibration tool 20 is attached to the blade guide 14 and moved sideways to be in contact with the slitting edge 17 of the ground bottom blade 11, it is achieved, on the basis of measurement results, by reading the position of the magnet 23 of the calibration tool by means of the magnetostrictive sensor 16 and by computing by software the distance between the slitting blade edge and the permanent magnet 18 of the bottom blade 11, whereby the position of the slitting blade edge 17 can be determined precisely.

Figure 2A shows a prior art blade change sequence, according to which, after a blade change, block 31, manual positioning of a bottom and a top blade, block 32, has been carried out, whereafter, according to block 33, generally three control measurements of the blades have been performed by means of a measurement carriage. After this, the blades have been moved to their positions, as shown in block 34, and a control measurement of the blades has been carried out by means

of the measurement carriage, block 35, whereafter, in the last stage, the blades are in their positions according to the setting, block 36. As illustrated by this series of pictures the blade change sequence has consisted of several different stages.

Figure 2B shows a blade change sequence when using the method and device according to the invention in calibrating the position of the blades, whereby, after a blade change, block 41, the blade is calibrated according to the invention, block 42, whereafter the blades have been moved to their positions, block 43. After this, the blades are in their positions according to the setting, block 44. Figures 2A and 2B thus demonstrate that, by means of the calibration according to the invention, many stages can be omitted in connection with the measurements and positionings carried out in connection with blade change.

In the foregoing the invention has been described with reference only to some of its advantageous exemplifying embodiments, to the details of which the invention is, however, by no means intended to be narrowly confined.

Claims

1. A method for calibrating the position of blades of a slitter-winder of a paper or board machine, which blades (11,12) are attached to blade carriages (11A,12A) or the like disposed on guides (14,13) or the like, in which method the position of the blades (11,12) of the slitter-winder is measured by means of a multipoint measurement method, whereby the position of the blade carriage (11A,12A) of the respective blade (11,12) is measured, **characterized** in that in the method, the position of the blades (11,12) is calibrated with a calibration tool (20), that a positioning member (21) of the calibration tool (20) is arranged to touch a slitting edge (17) of the blade (11) to be calibrated, that the position of the calibration tool (20) is measured by means of the multipoint measurement method and that the position of the slitting edge (17) of the blade (11) is determined based on the measurement result of the position of the calibration tool (20).

2. A method according to claim 1, **characterized** in that in measuring the position of the blade carriage (11A,12A) and the position of the calibration tool (20) the same multipoint measurement method is used.

3. A method according to claim 1 or 2, **characterized** in that the position of the blade carriage (11A,12A) or the like is determined by measuring, by means of a sensor (16,15) or the like, the position of a measuring member (18,19) attached to the blade carriage (11A,12A) and that the position of the calibration tool (20) is determined by measuring, by means of said sensor or the like, the position of a measuring member (23) attached to the calibration tool (20), whereby, on the basis of measurement results, the position of the slitting blade edge is determined.

4. A method according to any one of claims 1-3, **characterized** in that in the method a magnetostrictive measurement method is used, that the positions of a position magnet (18) attached to the blade carriage (11A) and of a position magnet (23) attached to the calibration tool (20) are determined by means of a magne-

tostrictive sensor (16), the calibration tool (20) being arranged to touch the slitting edge (17) of the blade (11), whereby, on the basis of measurement results, the exact position of the slitting blade edge can be determined.

5. A method according to any one of claims 1-4, **characterized** in that in the method, when calibration is carried out, the sensor (16) measuring the position of the calibration tool (20) automatically performs a measurement when it finds the measuring member (2) of the calibration tool (20).

6. A method according to any one of claims 1-4, **characterized** in that in the method, when the calibration tool (20) is arranged in its position, the measurement is initiated by pressing a control button or the like.

7. A device for calibrating the position of blades of a slitter-winder of a paper or board machine, which device is disposed in connection with the slitter-winder of the paper or board machine, which slitter-winder comprises pairs of blades comprising a top blade (12) and a bottom blade (11), attached to their respective blade carriages (11A,12A) arranged to be movable along a guide (14,13) or the like, in connection of which slitter-winder means (15,16,18,19) are arranged for measuring the position of the blades (11,12), **characterized** in that in the method the device used for calibrating the position of the blades (11,12) is a calibration tool (20) which is arranged to be attached to the same guide (14) with the blade (11) to be calibrated, that the calibration tool (20) comprises a means (21) for indicating the slitting edge (17) of the blade (11) and means (23,16) for measuring the position of the calibration tool (20).

8. A device according to claim 7, **characterized** in that a measuring member (19,18) is attached to the blade carriage (11A,12A), the position of which measuring member can be determined by means of a sensor (15,16) arranged in connection with the slitter-winder and that the calibration tool comprises a positioning member (21) for indicating the position of the slitting edge (17) of the blade (11)

and a measuring member (23) for measuring the position of the calibration tool (20) by means of the sensor (16) or the like.

9. A device according to claim 7 or 8, **characterized** in that the sensor (15,16) is a magnetostrictive sensor, and position magnets are attached to the blade carriage (11A,12A) and to the calibration tool (20).

10. A device according to any one of claims 7-9, **characterized** in that the calibration tool (20) is arranged to be movable along the guide (14,15) or the like, along which the blade carriage (11A,12A) of the blade (11,12) to be calibrated is arranged to be movable.

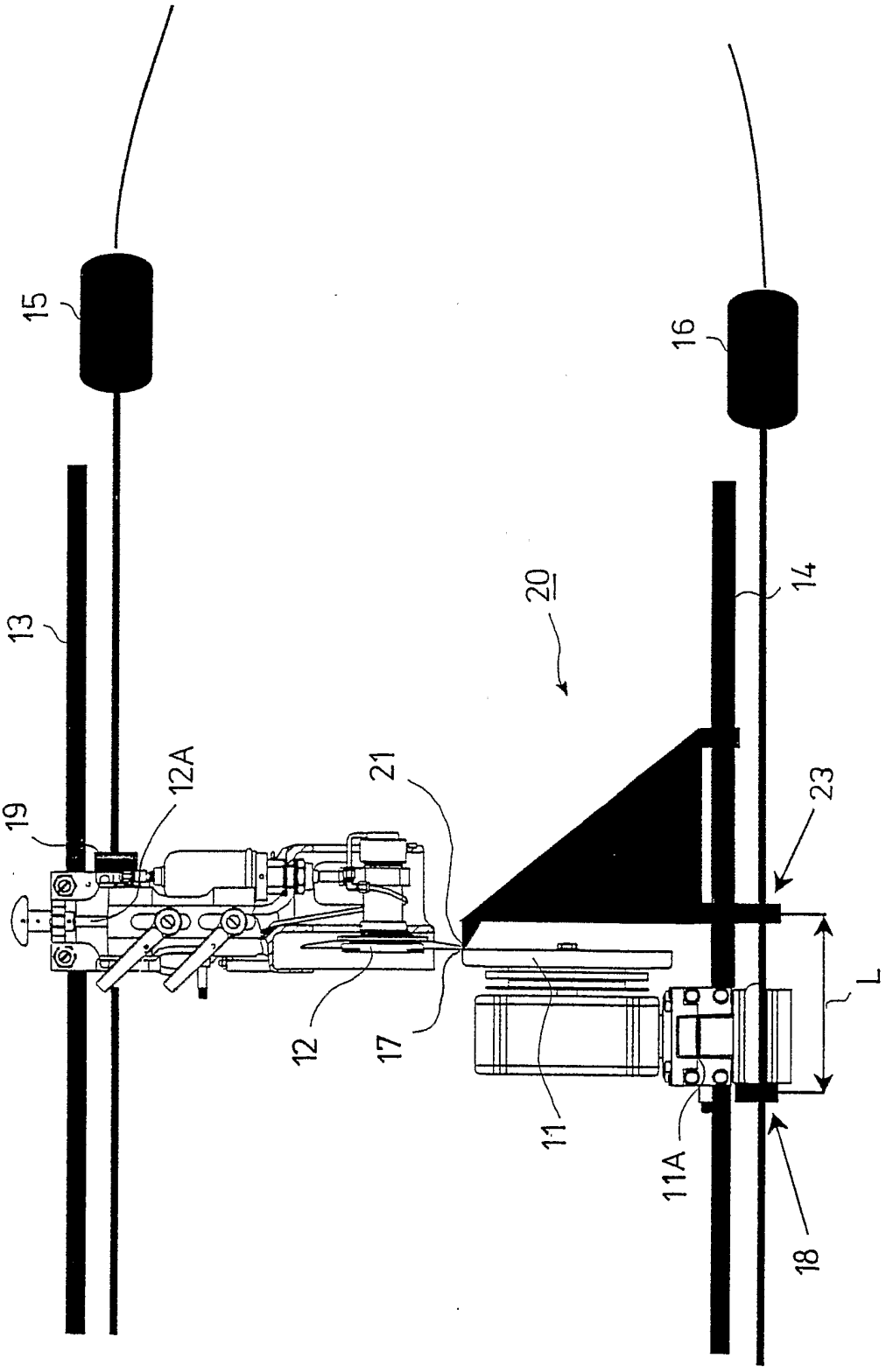

FIG. 1

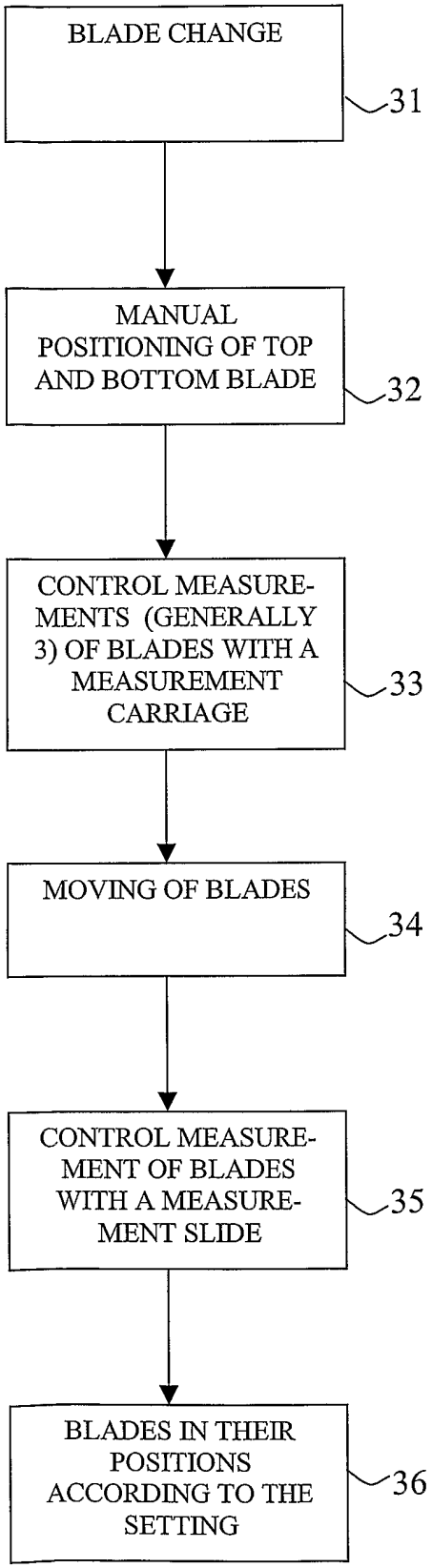

FIG. 2A
PRIOR ART

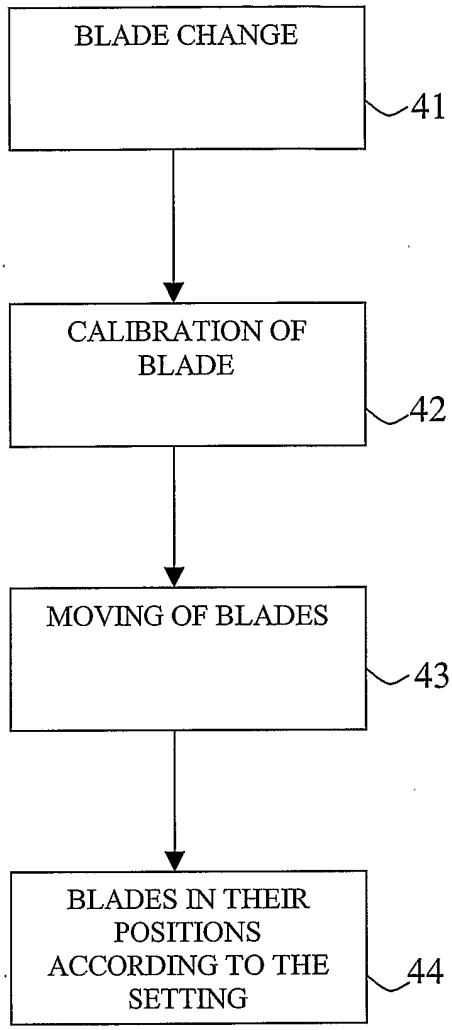

FIG. 2B

INTERNATIONAL SEARCH REPORT

International Application No
PCT/FI 03/00594

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B26D7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B26D B65H

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 548 105 A (KOUTONEN PAULI) 22 October 1985 (1985-10-22) column 1, line 5 - line 14 column 1, line 53 -column 2, line 2; claims 1-12; figures 1,2 abstract ---	1-10
A	US 4 592 259 A (GOERNER BERND ET AL) 3 June 1986 (1986-06-03) column 1, line 53 -column 2, line 25; claims 1-10; figures 1-3 abstract ---	1-10
A	US 6 382 066 B1 (REISINGER FRANZ ET AL) 7 May 2002 (2002-05-07) claims 1,8,14,15; figures 1,2 abstract --- -/--	1-10

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
9 December 2003	12. 01. 04

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/FI 03/00594

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 100 23 210 A (WILHELM BILSTEIN KG SPEZIALFAB) 15 November 2001 (2001-11-15) claims 1-7; figures 1-4 abstract ----	1-10

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