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

(11) EP 4 446 075 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
16.10.2024 Bulletin 2024/42

(21) Application number: **22902689.3**

(22) Date of filing: **18.04.2022**

(51) International Patent Classification (IPC):
B26D 5/00 *(2006.01)*

(86) International application number:
PCT/CN2022/087310

(87) International publication number:
WO 2023/103249 (15.06.2023 Gazette 2023/24)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **09.12.2021 CN 202111495187**

(71) Applicant: **Hangzhou Iecho Science & Technology Co., Ltd.**
Hangzhou, Zhejiang 310053 (CN)

(72) Inventors:
- **ZHANG, Dongsheng**
  Hangzhou, Zhejiang 310053 (CN)
- **TANG, Pei**
  Hangzhou, Zhejiang 310053 (CN)
- **CHEN, Jian**
  Hangzhou, Zhejiang 310053 (CN)

(74) Representative: **CAPRI**
33 rue de Naples
75008 Paris (FR)

(54) CONTROL METHOD OF CUTTING DEVICE

(57) A control method of a cutting device, comprising: first starting an edge finding mechanism to drive a longitudinal sensor to transversely move, detecting a longitudinal marking line on a material by means of the longitudinal sensor, and stopping the edge finding mechanism after the longitudinal sensor detects the longitudinal marking line; after a longitudinal cutter is provided, starting a feed motor to feed the material at a speed v, detecting the position of a transverse marking line on the material by means of transverse sensors, and calculating the transverse offset of a transverse cutting mounting beam relative to the transverse marking line according to the position of the transverse marking line; and then starting a transverse deviation correction mechanism, and adjusting, according to the transverse offset, the transverse cutting mounting beam for mounting a transverse cutter, such that the transverse cutting mounting beam is parallel to the transverse marking line. According to the control method of the cutting device, automatic transverse deviation correction of the transverse cutting mounting beam is achieved by means of the transverse sensors and the transverse deviation correction mechanism, such that the transverse cutting mounting beam is parallel to the transverse marking line, the deviation is avoided, and the manpower consumption in the deviation correction process is reduced.

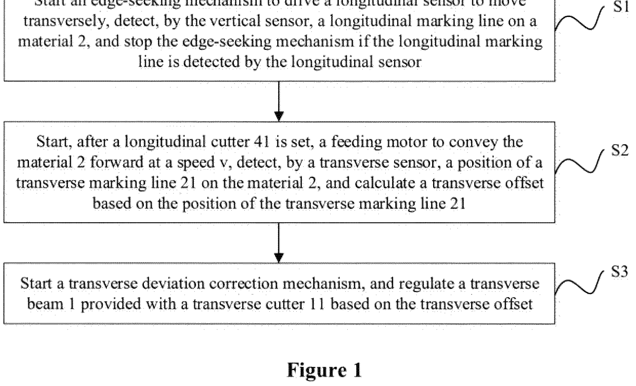

Figure 1

EP 4 446 075 A1

Description

[0001] The present application claims priority to Chinese Patent Application No.202111495187.3, titled "CONTROL METHOD OF CUTTING DEVICE", filed on December 9, 2021 with the China National Intellectual Property Administration, which is incorporated herein by reference in its entirety.

FIELD

[0002] The present disclosure relates to the technical field of cutting devices, and in particular to a control method for a cutting device.

BACKGROUND

[0003] In the advertising, carpet, composite materials and other industries, post-press products printed in bulk are cut transversely and longitudinally, in order to divide the post-press products into small portions. During the cutting process, the cutting effect is directly influenced by a placement angle of a base material, and a cutting line is often inclined due to the inclined placement of the base material, which affects the quality of the final product, and even causes the product to be scrapped, causing loss to the enterprise.

[0004] According to the conventional technology, manual alignment and deviation correction are usually performed, which has disadvantages such as low work efficiency, high labor intensity, and uncertain influence factors.

[0005] Therefore, how to control the cutting device to perform automatic deviation correction is a technical problem urgently to be solved by those skilled in the art.

SUMMARY

[0006] The object of the present disclosure is to provide a control method for a cutting device, in which a transverse sensor detects a position of a transverse marking line, a transverse offset of a transverse beam is calculated, and an angle of the transverse beam is regulated based on the transverse offset, to achieve transverse deviation correction, to avoid the accumulation of deviations during the cutting process, and to improve the efficiency of deviation correction.

[0007] In order to achieve the above objects, a control method for a cutting device is provided according to the present disclosure. The control method includes: starting an edge-seeking mechanism to drive a longitudinal sensor to move transversely, detecting, by the longitudinal sensor, a longitudinal marking line on a material, and stopping the edge-seeking mechanism if the longitudinal marking line is detected by the longitudinal sensor; starting, after a longitudinal cutter is set, a feeding motor to convey the material at a speed v, detecting, by a transverse sensor, a position of a transverse marking line on the material, and calculating a transverse offset based on the position of the transverse marking line; and starting a transverse deviation correction mechanism, and regulating a transverse beam provided with a transverse cutter based on the transverse offset.

[0008] Preferably, the number of the transverse sensor is two, the transverse beam is hinged with a frame, and the transverse deviation correction mechanism is configured to drive the transverse beam to rotate around a hinge shaft, where the detecting, by a transverse sensor, a position of a transverse marking line, and calculating a transverse offset based on the position of the transverse marking line includes: determining a first time instant when the transverse marking line is detected by one of the two transverse sensors as t1; determining a second time instant when the transverse marking line is detected by the other transverse sensor as t2; calculating a detection point deviation Δy according to an equation $\Delta y = \int_{t_2}^{t_1} v\,dt$; and according to an equation ΔY=Δy*AB/OY, where ΔY represents the transverse offset, AB represents a distance between the two transverse sensors, and OY represents a distance from a hinge joint O at which the transverse beam is hinged with the frame to an adjusting point.

[0009] Preferably, the transverse deviation correction mechanism includes: a transverse deviation correction motor, a transverse deviation correction lead screw in transmission connected to the transverse deviation correction motor, and a transverse deviation correction base connected to the transverse beam. A transverse deviation correction nut matching the transverse deviation correction lead screw is arranged in the transverse deviation correction base. The starting a transverse deviation correction mechanism, and regulating a transverse beam provided with a transverse cutter based on the transverse offset includes: starting the transverse deviation correction motor, calculating the number P of pulses for deviation correction according to an equation P=ΔY/m*i*n, outputting current with P pulses to the transverse deviation correction motor, where m represents a lead of the transverse deviation correction lead screw, n represents the number of pulses for driving the transverse deviation correction motor to rotate for one circle, and i represents a speed ratio of the transverse deviation correction motor to the transverse deviation correction lead screw.

[0010] Preferably, after the longitudinal cutter is set, the control method further includes: starting a longitudinal cutter motor. After the calculating a transverse offset based on the position of the transverse marking line, and before the starting a transverse deviation correction mechanism, and regulating a transverse beam provided with a transverse cutter based on the transverse offset, the control method further includes: conveying the material forward until a next transverse marking line is detected by the transverse sensor, and stopping the feeding motor; stopping the longitudinal cutter motor; starting a transverse cutter motor, and transversely cutting the material to form a transverse semi-manufactured product; and starting the longitudinal cutter motor, and longitudinally cutting the transverse semi-manufactured product to form a product.

[0011] Preferably, the conveying the material forward until a next transverse marking line is detected by the transverse sensor includes: conveying the material forward for a preset length L, where the preset length L is a distance from the transverse sensor to the transverse cutter; and conveying the material forward until the next transverse marking line is detected by the transverse sensor.

[0012] Preferably, the stopping the edge-seeking mechanism if the longitudinal marking line is detected by the longitudinal sensor includes: determining a position of a first longitudinal marking line. After the regulating a transverse beam provided with a transverse cutter based on the transverse offset, the method further includes: determining a position of a second longitudinal marking line; and calculating a longitudinal offset based on the position of the first longitudinal marking line and the position of the second longitudinal marking line. After the starting a transverse deviation correction mechanism, and regulating a transverse beam provided with a transverse cutter based on the transverse offset, the control method further includes: starting a longitudinal deviation correction mechanism, and rotating a longitudinal beam provided with the longitudinal cutter based on the longitudinal offset; and repeating the process of calculating a transverse offset based on the position of the transverse marking line.

[0013] Preferably, the calculating a longitudinal offset based on the position of the first longitudinal marking line and the position of the second longitudinal marking line includes: calculating a detection point deviation $\Delta X1$ based on the position of the first longitudinal marking line and the position of the second longitudinal marking line; and calculating a longitudinal correction value ΔX according to an equation $\Delta X=\Delta X1+\Delta X2=\Delta X1+OX*\Delta Y/OY$ where ΔX represents the longitudinal correction value, $\Delta X2$ represents a transverse correction value, OX represents a distance from the hinge joint O at which the transverse beam is hinged with the frame to a mounting axis of the longitudinal cutter.

[0014] Preferably, the starting a feeding motor to convey the material at a speed v includes: regulating a position of the material to ensure that the transverse marking line is located behind the transverse sensor; controlling the feeding motor to rotate forwardly, conveying the material forward at a low speed u, detecting, by the transverse sensor, the transverse marking line until the transverse marking line moves to the front of the transverse sensor, and stopping the feeding motor; determining a feature of the transverse marking line as a basis for the transverse sensor to identify the transverse marking line on the same material; controlling the feeding motor to rotate reversely until the transverse marking line moves to a position behind the transverse sensor, and stopping the feeding motor; and controlling the feeding motor to rotate forwardly, conveying the material forward at the speed v, where the low speed u is less than the speed v.

[0015] With the control method for the cutting device according to the present disclosure, an edge-seeking mechanism is started to drive a longitudinal sensor to move transversely, the longitudinal sensor detects a longitudinal marking line on a material, and the edge-seeking mechanism is stopped if the longitudinal marking line is detected by the longitudinal sensor. After a longitudinal cutter is set, a feeding motor is started to convey the material at a speed v, a transverse sensor detects a position of a transverse marking line on the material, and a transverse offset of the transverse beam relative to the transverse marking line is calculated based on the position of the transverse marking line. A transverse deviation correction mechanism is started, and the transverse beam provided with a transverse cutter is regulated based on the transverse offset, so that the transverse beam is parallel to the transverse marking line.

[0016] With the control method for a cutting device, the transverse beam performs transverse automatic deviation correction through the transverse sensor and the transverse deviation correction mechanism, so that the transverse beam is parallel to the transverse marking line, thereby avoiding deviation and reducing the manpower consumption during the deviation correction process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] In order to more clearly illustrate technical solutions in embodiments of the present disclosure or in the conventional technology, the drawings to be used in the description of the embodiments or the conventional technology are briefly described below. Apparently, the drawings in the following description show only some embodiments of the present disclosure, and other drawings may be obtained by those skilled in the art from the drawings without any creative work.

Figure 1 is a flowchart of a control method for a cutting device according to the present disclosure; and

Figure 2 is a schematic diagram illustrating a process of a cutting device conveying a material.

[0018] The reference numerals in Figure 1 and Figure 2 are:

1	transverse beam;	2	product;
3	material;	4	longitudinal beam;
5	frame;	11	transverse cutter;
21	transverse marking line;	22	longitudinal marking line;
41	longitudinal cutter.		

DETAILED DESCRIPTION

[0019] The technical solutions in the embodiments of the present disclosure are described clearly and completely in conjunction with the drawings in the embodiments of the present disclosure hereinafter. It is apparent that the described embodiments are only some rather than all embodiments of the present disclosure. All other embodiments obtained by those skilled in the art based on the embodiments of the present disclosure without any creative work fall within the protection scope of the present disclosure.

[0020] In order to provide those skilled in the art with a better understanding of the technical solutions of the present disclosure, the present disclosure is described in further detail below in conjunction with the drawings and specific embodiments.

[0021] Reference is made to Figure 1 and Figure 2. Figure 1 is a flowchart of a control method for a cutting device according to the present disclosure. Figure 2 is a schematic diagram illustrating a process of a cutting device conveying a material.

[0022] The control method for a cutting device according to the present disclosure includes the following steps S1 to S3.

[0023] In step S1, an edge-seeking mechanism is started to drive a longitudinal sensor to move transversely, the longitudinal sensor detects a longitudinal marking line 22 on a material 3, and the edge-seeking mechanism is stopped if the longitudinal marking line 22 is detected by the longitudinal sensor.

[0024] After the cutting device is started, a material is fed into the cutting device. The material 3 is clamped by a nip roller and a feeding roller of the cutting device. The feeding roller is driven by a feeding motor to rotate, to push the material 3 to move by means of friction in a direction where a transverse cutter 11 and a longitudinal cutter 41 are located, that is, to push the material 3 to move forward.

[0025] The edge-seeking mechanism is connected to a frame 5 of the cutting device, and may drive the longitudinal sensor to move transversely. The edge-seeking mechanism may be in a structure such as a cylinder or a lead screw pair. In an embodiment of the present disclosure, the edge-seeking mechanism includes an edge-seeking lead screw, an edge-seeking motor, and a mounting base for the longitudinal sensor. An edge-seeking nut matching the edge-seeking lead screw is arranged in the mounting base for the longitudinal sensor. The edge-seeking motor drives the edge-seeking lead screw to rotate, thus pushing the longitudinal sensor to move transversely. The longitudinal sensor while moving constantly detects the longitudinal marking line 22 on a surface of the material 3. If the longitudinal marking line 22 on the surface of the material 3 is detected, the edge-seeking mechanism is stopped. In such case, the longitudinal sensor monitors the longitudinal marking line 22 on the surface of the material 3 and an area surrounding the longitudinal marking line 22. The longitudinal marking line 22 may have a transverse offset during cutting and feeding the material. Usually, an offset range of the longitudinal marking line 22 is within a monitoring range of the longitudinal sensor.

[0026] In addition, the cutting device may be provided with a touch screen or other devices, and the operator may confirm that the feeding of the material is completed, or the like by clicking an option on the touch screen.

[0027] In step S2, after the longitudinal cutter 41 is set, the feeding motor is started to convey the material 3 at a speed v, a transverse sensor detects a position of a transverse marking line on the material 3, and the transverse offset is calculated based on the position of the transverse marking line.

[0028] After the longitudinal sensor determines a position of the longitudinal marking line, a position of the longitudinal cutter 41 is regulated to a position where the material 3 is to be longitudinally cut. After the longitudinal cutter 41 is set by the operator, the operator confirms that the setting of the longitudinal cutter 41 is completed via the touch screen. The feeding motor is started to drive the feeding roller to rotate, thus conveying the material 3 at a speed v.

[0029] The transverse sensor is arranged on a transverse beam 1, and the material 3 passes through below the transverse sensor. During the movement of the material 3, the transverse sensor detects the position of the transverse marking line 21 on the material 3. As the material 3 moves, positions of two different points on the transverse marking line 21 are detected by the transverse sensor, and the transverse offset is calculated based on the positions of the two points.

[0030] In step S3, a transverse deviation correction mechanism is started, and the transverse beam 1 is regulated based on the transverse offset.

[0031] The transverse beam 1 is connected to the frame 5 of the cutting device through a hinge shaft. An angle of the transverse beam 1 is changed as the transverse beam 1 rotates around the hinge shaft. The transverse deviation correction mechanism is started to perform transverse deviation correction. The transverse deviation correction mechanism may push an end of the transverse beam 1 to drive the transverse beam 1 to rotate, so that the transverse beam 1 is parallel to the transverse marking line 21 on the material.

[0032] In an embodiment, the number of the transverse sensor in the cutting device is two, and a distance between the two transverse sensors is predetermined. The predetermined distance is less than or equal to a minimum width of the material 3, so that the transverse sensor can detect any form of the material 3.

[0033] The transverse sensor detects the position of the transverse marking line, and the transverse offset is calculated based on the position of the transverse marking line by: determining a first time instant when the transverse marking line 21 is detected by one of the two transverse sensors as t1; determining a second time instant when the transverse marking line 21 is detected by the other transverse sensor as t2; and calculating a detection point deviation Δy according to an equation $\Delta y = \int_{t_2}^{t_1} v\,dt$.

[0034] In an embodiment of the present disclosure, the material 3 is conveyed at the speed v, and the speed v is constant, that is, the cutting device conveys the material 3 at a constant speed. In this case, the equation of the detection point deviation is simplified as Δy=(t1-t2)v.

[0035] According to the equation ΔY=Δy*AB/OY, ΔY represents the transverse offset, AB represents a distance between the two transverse sensors, and OY represents a distance from a hinge joint O at which the transverse beam 1 is hinged with the frame 5 to an adjusting point.

[0036] Both the distances AB and OY are related to the model of the cutting device, and are determined. The transverse offset ΔY is calculated by substituting the detection point deviation Δy calculated in the previous step into the equation.

[0037] In an embodiment, the transverse deviation correction mechanism includes: a transverse deviation correction motor, a transverse deviation correction lead screw, and a transverse deviation correction base. The transverse deviation correction lead screw is arranged along a direction in which the material 3 moves. The transverse deviation correction lead screw is in transmission connected to the transverse deviation correction motor. The transverse deviation correction base is connected to the transverse beam 1. A transverse deviation correction nut matching the transverse deviation correction lead screw is arranged in the transverse deviation correction base. The transverse deviation correction motor drives the transverse deviation correction lead screw to rotate, thus pushing the transverse deviation correction base to move along the direction in which the material 3 moves, so that the transverse beam 1 rotates to a position parallel to the transverse marking line 21.

[0038] During the deviation correction process, electric pulse signals are sent to the transverse deviation correction motor. The number of pulses is calculated according to the equation P=ΔY/m*i*n. After the number P of pulses is obtained, current with P pulses is outputted to the transverse deviation correction motor. In the equation, m represents a lead of the transverse deviation correction lead screw, n represents the number of pulses for driving the transverse deviation correction motor to rotate for one circle, and i represents a speed ratio of the transverse deviation correction motor to the transverse deviation correction lead screw.

[0039] In order to ensure the cutting accuracy, a bleed margin is reserved for the material 3. The material 3 is normally conveyed at the speed v to the position of the longitudinal cutter 41. Therefore, after the longitudinal cutter 41 is set, a longitudinal cutter motor is started. After the longitudinal cutter motor is started, the material 3 is cut to prevent the material 3 from bulging caused by the longitudinal cutter motor blocking the material 3.

[0040] In addition, in order to ensure the deviation correction effect, a longitudinal beam 4 provided with the longitudinal cutter 41 is connected to the transverse deviation correction base through a deviation correction connection plate. Mounting plates are arranged on both sides of the frame 5 of the cutting device. Both the deviation correction connection plate and the transverse deviation correction base are arranged on the mounting plates. A roller is arranged between the deviation correction connection plate and the mounting plate. During the transverse deviation correction, the transverse deviation correction mechanism drives the longitudinal beam 4 to rotate together. In order to prevent the material 3 from bulging caused by the longitudinal cutter 41 during the transverse deviation correction, the transverse deviation correction is performed after the material 3 is cut once. That is, the material cutting process is performed after the step of "calculating the transverse offset based on the position of the transverse marking line" and before the step of "starting the transverse deviation correction mechanism, and regulating the transverse beam 1 provided with the transverse cutter 11 based on the transverse offset".

[0041] The material cutting process includes: conveying the material 3 forward until a next transverse marking line 21 is detected by the transverse sensor, and stopping the feeding motor.

[0042] During the conveying process, the material 3 is conveyed forward for a preset length L, where the preset length L is a distance from the transverse sensor to the transverse cutter 11. The transmission efficiency of a conveying wheel is considered in the conveying the material 3 forward for the preset length L. The material 3 is conveyed forward until the next transverse marking line 21 is detected by the transverse sensor, and the feeding motor is stopped.

[0043] When the material 3 moves in position, the longitudinal cutter motor is stopped, a transverse cutter motor is started, and the transverse cutter 11 cuts the material 3 transversely along a transverse position of the material 3 to form a transverse semi-manufactured product. Then, the longitudinal cutter motor is started to drive the transverse semi-manufactured product to move forward, and the longitudinal cutter 41 longitudinally cuts the transverse semi-manufactured product to form a product 2.

[0044] The transverse marking line 21 is usually printed on the surface of the material 3. Different batches of materials are usually different in color of the transverse marking line. As a result, no transverse marking line is detected by the transverse sensor due to the different in the color of the transverse marking line 21. The starting the feeding motor to convey the material 3 at the speed v includes as follows.

[0045] A position of the material 3 is regulated to ensure that the transverse marking line 21 is located behind the transverse sensor.

[0046] If the transverse marking line 21 is located in the front of the transverse sensor, the feeding motor is controlled to rotate reversely to convey the material 3 backward. During conveying the material 3 backward, the transverse sensor constantly detects the transverse marking line until the transverse marking line 21 moves to a position behind the transverse sensor. During conveying the material 3 backward, the conveying speed is reduced, and the material 3 is conveyed backward at a speed less than the speed v, so as to prevent the transverse sensor from missing the transverse marking line 21. If the transverse marking line 21 is located behind the transverse sensor, the process proceeds to the next step.

[0047] The feeding motor is controlled to rotate forwardly, the material 3 is conveyed forward at a low speed u, the transverse sensor detects the transverse marking line 21 until the transverse marking line 21 moves to the front of the transverse sensor, and the feeding motor is stopped.

[0048] The low speed u is less than the speed v. In a case that the material 3 moves forward at the low speed u, the transverse sensor identifies the transverse marking line on the surface of the material 3 based on a preset width, grayscale and other information of the transverse marking line 21.

[0049] A feature of the transverse marking line is determined as a basis for the transverse sensor to identify the transverse marking line 21 on the same material 3.

[0050] The feature of the transverse marking line may include width, grayscale, color or other information. The transverse marking lines on the same batch of materials are almost identical in feature. Therefore, a feature of a first transverse marking line on the same roll of material serves as a basis for identifying other transverse marking lines 21, thereby improving the identification accuracy.

[0051] The feeding motor is controlled to rotate reversely until the transverse marking line 21 moves to a position behind the transverse sensor, and the feeding motor is stopped.

[0052] During the conveying the material 3 backward, the material 3 is conveyed backward at the low speed u, so as to prevent the transverse sensor from missing the transverse marking line 21.

[0053] The feeding motor is controlled to rotate forwardly, and the material 3 is conveyed forward at the speed v.

[0054] The material 3 is conveyed forward again for the secondary detection on the transverse marking line 21.

[0055] After the material 3 moves forward for the preset length L, if no transverse marking line 21 is detected by the transverse sensor, the feeding motor is controlled to rotate reversely. During the reverse rotation process, the transverse sensor constantly detects the position of the transverse marking line, and the process of conveying the material 3 forward at the speed v is repeated if the transverse marking line 21 on the material 3 moves to a position behind the transverse sensor.

[0056] In addition, there is often a deviation in the longitudinal cutter 41. Longitudinal deviation correction is performed after the transverse deviation correction. The position of the longitudinal cutter 41 is regulated based on a position of the longitudinal marking line 22 detected by the longitudinal sensor during edge-seeking. Therefore, the stopping the edge-seeking mechanism if the longitudinal marking line 22 is detected by the longitudinal sensor includes determining a position of a first longitudinal marking line.

[0057] The material 3 is conveyed forward until the next transverse marking line 21 is detected by the transverse sensor, and the position of the longitudinal marking line is determined again as a position of a second longitudinal marking line. A longitudinal offset is calculated based on the position of the first longitudinal marking line and the position of the second longitudinal marking line.

[0058] In an embodiment, a detection point deviation $\Delta X1$ is calculated based on the position of the first longitudinal marking line and the position of the second longitudinal marking line, and a longitudinal correction value ΔX is calculated according to an equation $\Delta X=\Delta X1+\Delta X2=\Delta X1+OX^*\Delta Y/OY$ where $\Delta X2$ represents a transverse correction value, OY represents a distance from the hinge joint O at which the transverse beam 1 is hinged with the frame 5 to a mounting axis of the longitudinal cutter 41.

[0059] The longitudinal deviation correction is performed after the transverse deviation correction, and thus the transverse deviation correction mechanism is started. After the transverse beam 1 provided with the transverse cutter 11 is rotated based on the transverse offset, the control method further includes: starting a longitudinal deviation correction mechanism, and rotating the transverse beam 1 provided with the longitudinal cutter 41 based on the longitudinal offset.

[0060] The longitudinal deviation correction mechanism may be implemented by a lead screw pair mechanism. The deviation correction mechanism includes a longitudinal deviation correction motor, a longitudinal deviation correction lead screw and a longitudinal deviation correction base. The longitudinal beam 4 is connected to the deviation correction connection plate through a guide rail. The longitudinal deviation correction lead screw is parallel to the longitudinal beam 4. The longitudinal deviation correction base is connected to the longitudinal beam 4. A longitudinal deviation correction nut matching the longitudinal deviation correction lead screw is arranged in the longitudinal deviation correction base. The longitudinal deviation correction motor drives the longitudinal deviation correction lead screw to rotate, thus driving the longitudinal beam 4 to move.

[0061] The control method for the longitudinal deviation correction motor may be referred to the control method for the transverse deviation correction motor. The number of pulses for controlling the longitudinal deviation correction is calculated based on a lead of the longitudinal deviation correction leading screw, the number of pulses for driving the longitudinal deviation correction motor to rotate for one circle, and a speed ratio of the longitudinal deviation correction motor to the longitudinal deviation correction lead screw.

[0062] After the longitudinal deviation correction is performed, the transverse offset is re-calculated based on a position of a next transverse marking line 21, and the cutting of the material 3 is continued.

[0063] In this embodiment, with the control method for the cutting device, the transverse sensor detects the transverse marking line 21, thus calculating the transverse offset of the transverse beam 1. The transverse deviation correction mechanism drives the deviation correction connection plate to move based on the transverse offset, so that the transverse beam 1 and the longitudinal beam 4 rotate around the hinge shaft for connecting the transverse beam 1 and the frame 5. Subsequently, the longitudinal deviation correction mechanism drives the longitudinal beam 4 to move transversely based on the longitudinal correction value, achieving the deviation correction on the cutting device. The deviation correction process is performed automatically, greatly reducing the manpower consumption and improving the deviation correction efficiency.

[0064] It should be noted that, terms such as first and second are merely used to distinguish an entity from other entities and do not require or imply that there are any such actual relationships or sequences between these entities herein.

[0065] The control method for the cutting device according to the present disclosure is introduced in detail above. The principle and implementation of the present disclosure are illustrated by using specific embodiments herein. The above descriptions of the embodiments are only used to facilitate understanding of the method and the core idea of the present disclosure. It should be noted that, several improvements and modifications may be made by those skilled in the art to the present disclosure without departing from the principle of the present disclosure, and these improvements and modifications also fall within the protection scope of the claims of the present disclosure.

Claims

1. A control method for a cutting device, comprising:

starting an edge-seeking mechanism to drive a longitudinal sensor to move transversely, detecting, by the longitudinal sensor, a longitudinal marking line (22) on a material (3), and stopping the edge-seeking mechanism if the longitudinal marking line (22) is detected by the longitudinal sensor;
starting, after a longitudinal cutter (41) is set, a feeding motor to convey the material (3) at a speed v;
detecting, by a transverse sensor, a position of a transverse marking line on the material (3), and calculating a transverse offset based on the position of the transverse marking line; and
starting a transverse deviation correction mechanism, and regulating a transverse beam (1) provided with a transverse cutter (11) based on the transverse offset.

2. The control method according to claim 1, wherein the number of the transverse sensor is two, the transverse beam (1) is hinged with a frame (5), and the transverse deviation correction mechanism is configured to drive the transverse beam (1) to rotate around a hinge shaft,
wherein the process of detecting, by a transverse sensor, a position of a transverse marking line, and calculating a transverse offset based on the position of the transverse marking line comprises:

determining a first time instant when the transverse marking line (21) is detected by one of the two transverse sensors as 11;
determining a second time instant when the transverse marking line (21) is detected by the other transverse

sensor as t2;

calculating a detection point deviation Δy according to an equation $\Delta y = \int_{t_2}^{t_1} v dt$; and
according to an equation ΔY=Δy*AB/OY, wherein ΔY represents the transverse offset, AB represents a distance between the two transverse sensors, and OY represents a distance from a hinge joint O at which the transverse beam (1) is hinged with the frame (5) to an adjusting point.

3. The control method according to claim 2, wherein the transverse deviation correction mechanism comprises a transverse deviation correction motor, a transverse deviation correction lead screw in transmission connected to the transverse deviation correction motor, and a transverse deviation correction base connected to the transverse beam (1), wherein a transverse deviation correction nut matching the transverse deviation correction lead screw is arranged in the transverse deviation correction base,
wherein the starting a transverse deviation correction mechanism, and regulating a transverse beam (1) provided with a transverse cutter (11) based on the transverse offset comprises:
starting the transverse deviation correction motor, calculating the number P of pulses for deviation correction according to an equation P=ΔY/m*i*n, outputting current with P pulses to the transverse deviation correction motor, wherein m represents a lead of the transverse deviation correction lead screw, n represents the number of pulses for driving the transverse deviation correction motor to rotate for one circle, and i represents a speed ratio of the transverse deviation correction motor to the transverse deviation correction lead screw.

4. The control method according to claim 2, wherein after the longitudinal cutter (41) is set, the control method further comprises: starting a longitudinal cutter motor,
wherein after the calculating a transverse offset based on the position of the transverse marking line, and before the starting a transverse deviation correction mechanism, and regulating a transverse beam (1) provided with a transverse cutter (11) based on the transverse offset, the control method further comprises:

conveying the material (3) forward until a next transverse marking line (21) is detected by the transverse sensor, and stopping the feeding motor;
stopping the longitudinal cutter motor;
starting a transverse cutter motor, and transversely cutting the material (3) to form a transverse semi-manufactured product; and
starting the longitudinal cutter motor, and longitudinally cutting the transverse semi-manufactured product to form a product (2).

5. The control method according to claim 4, wherein the conveying the material (3) forward until a next transverse marking line (21) is detected by the transverse sensor comprises:

conveying the material (3) forward for a preset length L, wherein the preset length L is a distance from the transverse sensor to the transverse cutter (1 1); and
conveying the material (3) forward until the next transverse marking line (21) is detected by the transverse sensor.

6. The control method according to claim 5, wherein the stopping the edge-seeking mechanism if the longitudinal marking line (22) is detected by the longitudinal sensor comprises:

determining a position of a first longitudinal marking line,
wherein after the conveying the material (3) forward until a next transverse marking line (21) is detected by the transverse sensor, and stopping the feeding motor, the method further comprises:

determining a position of a second longitudinal marking line; and
calculating a longitudinal offset based on the position of the first longitudinal marking line and the position of the second longitudinal marking line,
wherein after the starting a transverse deviation correction mechanism, and regulating a transverse beam (1) provided with a transverse cutter (11) based on the transverse offset, the control method further comprises:

starting a longitudinal deviation correction mechanism, and rotating a longitudinal beam (4) provided with the longitudinal cutter (41) based on the longitudinal offset; and repeating the process of calculating a transverse offset based on the position of the transverse marking line.

7. The control method according to claim 6, wherein the calculating a longitudinal offset based on the position of the first longitudinal marking line and the position of the second longitudinal marking line comprises:

calculating a detection point deviation $\Delta X1$ based on the position of the first longitudinal marking line and the position of the second longitudinal marking line; and
calculating a longitudinal correction value ΔX according to an equation $\Delta X-\Delta X1+\Delta X2-\Delta X1+OX*\Delta Y/OY$, wherein ΔX represents the longitudinal correction value, $\Delta X2$ represents a transverse correction value, OX represents a distance from the hinge joint O at which the transverse beam (1) is hinged with the frame (5) to a mounting axis of the longitudinal cutter (41).

8. The control method according to any one of claims 1 to 7, wherein the starting a feeding motor to convey the material (3) at a speed v comprises:

regulating a position of the material (3) to ensure that the transverse marking line (21) is located behind the transverse sensor;
controlling the feeding motor to rotate forwardly, conveying the material (3) forward at a low speed u, detecting, by the transverse sensor, the transverse marking line (21) until the transverse marking line (21) moves to the front of the transverse sensor, and stopping the feeding motor;
determining a feature of the transverse marking line as a basis for the transverse sensor to identify the transverse marking line (21) on a same material (3);
controlling the feeding motor to rotate reversely until the transverse marking line (21) moves to a position behind the transverse sensor, and stopping the feeding motor; and
controlling the feeding motor to rotate forwardly, conveying the material (3) forward at the speed v, wherein the low speed u is less than the speed v.

Start an edge-seeking mechanism to drive a longitudinal sensor to move transversely, detect, by the vertical sensor, a longitudinal marking line on a material 2, and stop the edge-seeking mechanism if the longitudinal marking line is detected by the longitudinal sensor — S1

↓

Start, after a longitudinal cutter 41 is set, a feeding motor to convey the material 2 forward at a speed v, detect, by a transverse sensor, a position of a transverse marking line 21 on the material 2, and calculate a transverse offset based on the position of the transverse marking line 21 — S2

↓

Start a transverse deviation correction mechanism, and regulate a transverse beam 1 provided with a transverse cutter 11 based on the transverse offset — S3

Figure 1

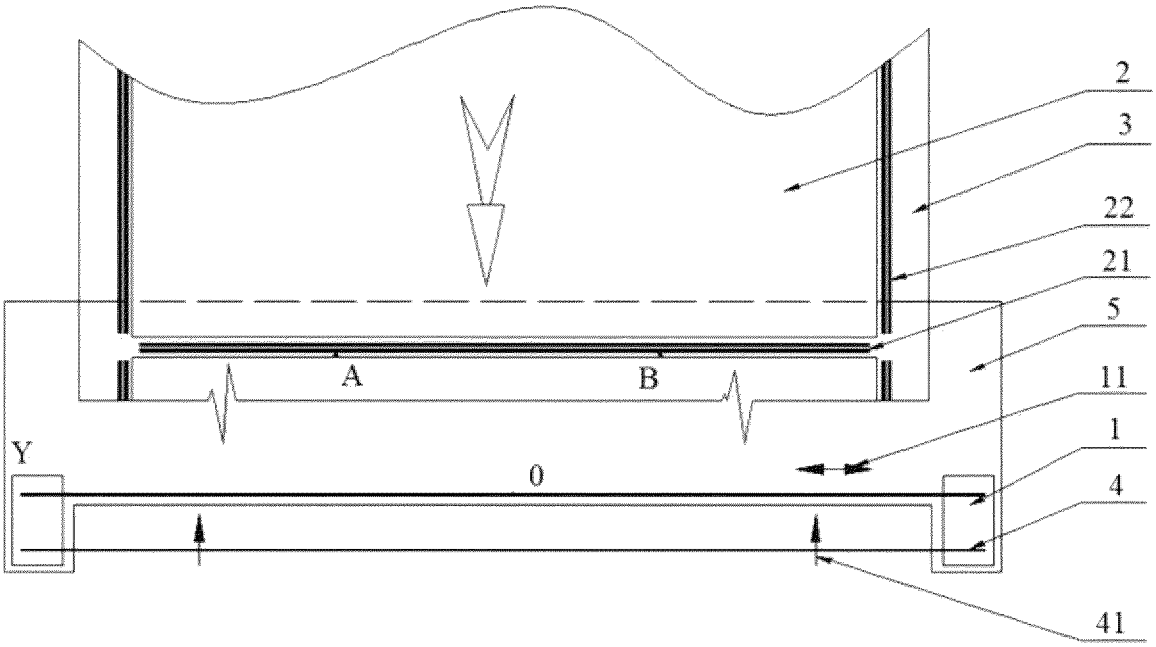

Figure 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/087310

A. CLASSIFICATION OF SUBJECT MATTER

B26D 5/00(2006.01)i

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)

B26D

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 practicable, search terms used)

WPABSC; CNTXT; ENTXTC; CJFD: 切割, 切边, 传感器, 感应器, 横, 纵, 纠偏, 偏移, 线; DWPI; VEN; ENTXT: cut, split, sensor, inductor, wide, width, long, length, offset, line, wire.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 113894852 A (HANGZHOU IECHO SCIENCE & TECHNOLOGY CO., LTD. et al.) 07 January 2022 (2022-01-07) entire document	1-8
X	CN 102862178 A (WUHAN WENLIN TECHNOLOGY CO., LTD.) 09 January 2013 (2013-01-09) description, paragraphs 13-23, and figures 1-3	1
X	CN 112623835 A (HANGZHOU IECHO SCIENCE & TECHNOLOGY CO., LTD.) 09 April 2021 (2021-04-09) entire document	1
A	CN 111360917 A (ZHEJIANG BAIGEDI TECHNOLOGY CO., LTD.) 03 July 2020 (2020-07-03) entire document	1-8
A	JP 2008173833 A (CASIO ELECTRONICS CO., LTD. et al.) 31 July 2008 (2008-07-31) entire document	1-8
A	US 2010120593 A1 (SIEMENS AKTIENGESELLSCHAFT) 13 May 2010 (2010-05-13) entire document	1-8

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"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
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 August 2022	**23 August 2022**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/087310

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	113894852	A	07 January 2022	CN	113894852	B	29 March 2022
CN	102862178	A	09 January 2013	CN	102862178	B	04 June 2014
CN	112623835	A	09 April 2021		None		
CN	111360917	A	03 July 2020	CN	212193368	U	22 December 2020
JP	2008173833	A	31 July 2008		None		
US	2010120593	A1	13 May 2010	DE	102007004309	A1	14 August 2008
				WO	2008092804	A1	07 August 2008

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- CN 202111495187 **[0001]**