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United States Patent Application Publication	20250256423
Kind Code	A1
Publication Date	August 14, 2025
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CUTTING CONTROL METHOD, CUTTING DEVICE AND STORAGE MEDIUM

Abstract

Disclosed is a cutting control method that is performed by a cutting device including a cutter that cuts a cutting target medium with a cutter blade based on predetermined design information. The cutting control method includes, in response to the design information including unnecessary region information indicating an unnecessary region to be removed after a first cutting in which the cutter blade cuts the cutting target medium based on the predetermined design information, controlling the cutter to perform special cutting inside the unnecessary region. The special cutting is performed with a second cutting method different from a first cutting method in which the cutter blade is moved to perform the first cutting.

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Appl. No.:	**19/047849**
Filed:	**February 07, 2025**

Foreign Application Priority Data

JP	2024-019887	Feb. 14, 2024
JP	2024-019895	Feb. 14, 2024

Publication Classification

Int. Cl.: **B26F1/38** (20060101); **B26D5/08** (20060101)

U.S. Cl.:

CPC **B26F1/3813** (20130101); **B26D5/08** (20130101); B26F2210/02 (20130101)

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of priority from the prior Japanese Patent Applications No. 2024-019887 and No. 2024-019895, both filed on Feb. 14, 2024, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a cutting control method, a cutting device and a storage medium.

DESCRIPTION OF RELATED ART

[0003] There has been known a cutting device that cuts a medium to be cut. Regarding this cutting device, for example, JP 2007-98505 A discloses an adhesive sheet forming device that cuts on the perimeter of a cut region and cuts out an unnecessary region inside the cut region.

SUMMARY OF THE INVENTION

[0004] According to an aspect of the present disclosure, there is provided a cutting control method that is performed by a cutting device including a cutter that cuts a cutting target medium with a cutter blade based on predetermined design information, the cutting control method including:

[0005] in response to the design information including unnecessary region information indicating an unnecessary region to be removed after a first cutting in which the cutter blade cuts the cutting target medium based on the predetermined design information, controlling the cutter to perform special cutting inside the unnecessary region, [0006] wherein the special cutting is performed with a second cutting method different from a first cutting method in which the cutter blade is moved to perform the first cutting.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0007] FIG. **1** is a block diagram illustrating a cutting system according to an embodiment(s) of the present disclosure.

[0008] FIG. **2** is a block diagram illustrating a functional configuration of a cutting device.

[0009] FIG. **3** is a perspective view illustrating a placement plate on which a mount with a sheet of paper attached is placed.

[0010] FIG. **4** is a block diagram illustrating a functional configuration of a terminal device.

[0011] FIG. **5** is a flowchart illustrating a control procedure for a waste removal cutting process.

[0012] FIG. **6** illustrates an example of waste removal cutting.

[0013] FIG. **7**A illustrates a section of the sheet during the waste removal cutting.

[0014] FIG. **7**B illustrates movement of a cutter blade during the waste removal cutting.

[0015] FIG. **8** illustrates a setting method of a waste removal cutting width and a waste removal cutting length.

[0016] FIG. **9** illustrates a setting method of the waste removal cutting width and the waste removal cutting length.

[0017] FIG. **10** illustrates an example of the waste removal cutting.

[0018] FIG. **11**A illustrates an example of the waste removal cutting.

[0019] FIG. **11**B illustrates an example of the waste removal cutting.

[0020] FIG. **11**C illustrates an example of the waste removal cutting.

[0021] FIG. **11**D illustrates an example of the waste removal cutting.
[0022] FIG. **12** is a flowchart illustrating a control procedure for a cutting data generating process.
[0023] FIG. **13** illustrates an example of a necessity selection receiving screen.
[0024] FIG. **14**A illustrates an example of the necessity selection receiving screen.
[0025] FIG. **14**B illustrates an example of the necessity selection receiving screen.
[0026] FIG. **14**C illustrates an example of the necessity selection receiving screen.
[0027] FIG. **14**D illustrates an example of the necessity selection receiving screen.
[0028] FIG. **15**A illustrates an example of the necessity selection receiving screen.
[0029] FIG. **15**B illustrates an example of the necessity selection receiving screen.
[0030] FIG. **15**C illustrates examples of a symbol mark.
[0031] FIG. **15**D illustrates an example of the necessity selection receiving screen.
[0032] FIG. **16** is a flowchart illustrating a control procedure for the waste removal cutting process according to a modification.

DETAILED DESCRIPTION

[0033] Hereinafter, one or more embodiments of the present disclosure will be described in detail with reference to the drawings. However, the scope of the present disclosure is not limited to the embodiments or illustrated examples. As illustrated in FIG. **1**, a cutting system **1** of an embodiment(s) includes a cutting device **10** and a terminal device **50**.

[0034] The cutting device **10** is a device that cuts a planar medium, for example, a rectangular medium, to be cut (cutting target medium) attached to a mount **32** (described later) placed (set) on a placement plate **31** (described later) into any planar shape. In this embodiment, the cutting target medium is a sheet **60** of A4 size paper (in FIG. **3**), but not limited thereto. The cutting target medium may be another medium that can be cut with a cutter blade, such as a resin sheet, a sticker (seal) or leather.

[0035] The terminal device (cutting data generating device) **50** is a personal computer (PC) or a server that generates/edits cutting data indicating a planar shape, a position and so forth for the cutting device **10** to perform cutting. In addition to this, the terminal device **50** receives inputs of operation information related to the cutting device **10**, displays display information related to the cutting device **10**, and so forth. The terminal device **50** is used in a state of being communicatively connected with the cutting device **10** by wireless communication.

[0036] The terminal device **50** communicatively connected with the cutting device **10** is not limited to a PC, but may be another terminal device, such as a smartphone or a tablet PC. In this embodiment, the communication method of the wireless communication between the cutting device **10** and the terminal device **50** is Bluetooth®, but not limited thereto. The communication method of the wireless communication may be another communication method, such as Wi-Fi®. The communication connection between the cutting device **10** and the terminal device **50** is not limited to wireless communication, but may be wired communication. The wired communication is, for example, a universal serial bus (USB) communication via a communication cable.

[0037] As illustrated in FIG. **2**, the cutting device **10** includes a micro processing unit (MPU) **11** as a controller (processor), an operation receiver **12**, a storage **13**, an indicator **14**, a wired communicator **15**, a wireless communicator **16**, a cutter **17**, an origin position detector **18**, a sheet feeder **19**, and a sheet feeding detector **20**. These components of the cutting device **10** are connected with one another via a bus **21**.

[0038] The MPU **11** controls the components of the cutting device **10**. The MPU **11** includes a central processing unit (CPU) and a random access memory (RAM). The CPU reads a specified program among various programs stored in the storage **13**, loads the specified program to the RAM, and performs a process among various processes in cooperation with the loaded program. The RAM is a volatile semiconductor memory and forms a work area where various data and programs are stored temporarily. The operation receiver **12** has various buttons, and receives press inputs made by a user onto the buttons and outputs pieces of operation information corresponding to the inputs to the MPU **11**. The various buttons of the operation receiver **12** include a position key to move the position of the sheet **60**, a button to pause cutting, a button to set the sheet **60**, and a button to remove the sheet **60**.

[0039] The storage **13** is an information readable-and-writable storage (non-transitory computer-readable storage medium), such as a flash memory. The storage **13** stores various data, such as cutting data mentioned above, and various programs. The storage **13** stores a waste removal cutting program **131** to perform a waste removal cutting process described later. The indicator **14** includes a light emitter, such as a light emitting diode (LED), and indicates various states of the cutting device **10** by lighting and no-lighting. The indicator **14** includes, for example, a power lamp that indicates power-on and power-off. The indicator **14** causes the light emitter to emit light or not to emit light in accordance with an instruction from the MPU **11**.

[0040] The wired communicator **15** is an interface for wired communication conforming to a communication standard such as USB. The MPU **11** transmits and receives information to and from external devices, such as the terminal device **50**, via the wired communicator **15** and a communication cable. The wireless communicator **16** includes an antenna, a modulation-and-demodulation circuit and a signal processing circuit, and is an interface for Bluetooth communication with external devices, such as the terminal device **50**. The MPU **11** transmits and receives information to and from external devices, such as the terminal device **50**, via the wireless communicator **16**.

[0041] The cutter **17** includes an X-axis motor **171**, a Z-axis motor **172**, a carriage **173**, and a cutter blade **174**. The cutter **17** moves the cutter blade **174** mounted on the carriage **173** in the X-axis direction and the Z-axis direction by driving the X-axis motor **171** and the Z-axis motor **172** in accordance with instructions from the MPU **11**. By moving the cutter blade **174**, the cutter **17** cuts the sheet **60** attached to the mount **32** placed (set) on the placement plate **31** into any planer shape. The cutter blade **174** is mounted on the carriage **173** in a state in which the cutter blade **174** is freely rotatable on an axis (drive axis) **174***c* (in FIG. **7**A). That is, the edge **174***a* (in FIG. **7**A) of the cutter blade **174** is designed to face a cutting direction when the sheet **60** (cutting target medium) is cut. The edge **174***a* of the cutter blade **174** can be made to face a desired direction (e.g., cutting direction) by driving the carriage **173** and/or the sheet feeder **19** in a state in which the tip (edge **174***a*) of the cutter blade **174** is slightly in contact with the sheet **60**. Hereinafter, the sheet **60** attached to the mount **32** placed on the placement plate **31**, the X-axis, the Y-axis and the Z-axis will be described with reference to FIG. **3**.

[0042] The mount **32** is used in order to, for example, prevent the cutter blade **174** from damaging the placement plate **31** and to place the sheet **60** at a correct position. The mount **32** has a planar rectangular shape. Since the mount **32** is placed on the placement plate **31**, the mount **32** has a shape that fits with the planar shape of the placement plate **31**. The mount **32** is made of a soft material that does not damage the cutter blade **174** when the sheet **60** is cut. An adhesive is applied to the upper face of the mount **32** for the sheet **60** to be attached thereto. On the placement plate **31**, the mount **32** with the sheet **60** attached is placed. The X-axis corresponds to a main-scanning direction in a case where the placement plate **31** (mount **32** and sheet **60**) is conveyed. The Y-axis is perpendicular to the X-axis and is a conveyance direction (sheet feeding direction or sub-scanning direction) in which the placement plate **31** (mount **32** and sheet **60**) is conveyed. The Z-axis is perpendicular to the XY plane and is a direction in which the cutter blade **174** moves up and down with respect to the sheet **60**.

[0043] Returning to FIG. **2**, the X-axis motor **171** is a motor that drives the carriage **173** in the X-axis direction in accordance with an instruction from the MPU **11**. The Z-axis motor **172** is a motor that drives the cutter blade **174** in the Z-axis direction in accordance with an instruction from the MPU **11**. The carriage **173** is a movable component that is movable in the X-axis direction and provided with the cutter blade **174**. The cutter blade **174** is a cutting instrument made of a conductive material, such as metal, to cut the sheet **60**, and has, for example, an oblique edge (edge

174*a*) at its tip.

[0044] The origin position detector **18** is a position detector, such as an optical sensor, that detects in accordance with an instruction from the MPU **11** whether the cutter blade **174** is at the position of the origin in the X-axis direction. The origin position detector **18** outputs the detection result of whether the cutter blade **174** is at the position of the origin to the MPU **11**. The MPU **11** controls the position of the cutter blade **174** of the cutter **17** in the X-axis direction, using the detection result of whether the cutter blade **174** is at the position of the origin.

[0045] The sheet feeder **19** includes a Y-axis motor **191**. The sheet feeder **19** is a conveyor that conveys, in the Y-axis direction, the placement plate **31** on which the mount **32** with the sheet **60** attached is placed by driving the Y-axis motor **191** in accordance with an instruction from the MPU **11**. The sheet feeding detector **20** is a detector, such as an optical sensor, that detects in accordance with an instruction from the MPU **11** whether the placement plate **31**, on which the mount **32** with the sheet **60** attached is placed, is fed (set) into a sheet feeding port of the sheet feeder **19**. The sheet feeding detector **20** outputs, to the MPU **11**, the detection result of whether the sheet **60** is set.

[0046] As illustrated in FIG. **4**, the terminal device **50** includes a CPU **51**, a RAM **52**, a storage **53**, a display **54**, an operation receiver **55**, and a communicator **56**. These components of the terminal device **50** are connected with one another via a bus **57**. The CPU **51** is a processor that reads and executes programs **531** stored in the storage **53** to perform various types of arithmetic processing, thereby controlling operation of each component of the terminal device **50**. The RAM **52** provides a working memory space for the CPU **51** and stores temporary data. The storage **53** is a non-transitory storage medium readable by the CPU **51** as a computer, and stores the programs **531** and various data (e.g., cutting data).

[0047] The display **54** is configured by a liquid crystal display (LCD), an electro luminescence (EL) display or the like, and performs various types of display in accordance with pieces of display information (display instructions) from the CPU **51**. The operation receiver **55** includes a key inputter, such as a keyboard, and a pointing device, such as a mouse, and receives inputs of key operations and position operations made by a user and outputs pieces of operation information corresponding to the inputs to the CPU **51**. The CPU **51** receives the inputs of the operations made by the user on the basis of the pieces of operation information transmitted from the operation receiver **55**. The communicator **56** is, for example, a communicator employing a wireless standard, such as Bluetooth, or a wired communicator, such as a USB terminal.

[0048] The cutting device **10** performs waste removal cutting in the waste removal cutting process (in FIG. **5**). This waste removal cutting (special cutting) makes it easy to identify an unnecessary region(s) (waste region(s)) of the sheet **60** having been cut into a shape, and brings about, what is called, turned-up (which generates curls) that makes it easy to remove the unnecessary region. In the aforementioned adhesive sheet forming device disclosed by JP 2007-98505 A, if shapes of unnecessary regions inside a cut region(s) are various, a removing device (extrusion device) cannot be used to remove the unnecessary regions. In such a case, the unnecessary regions inside the cut region(s) need to be removed manually, which may be time-consuming and damage necessary regions. Therefore, in the present disclosure, in order to easily and smoothly remove unnecessary regions inside cut regions, the waste removal cutting is performed. Hereinafter, a mode of the waste removal cutting will be described with reference to FIG. **6**.

[0049] As illustrated in FIG. **6**, the sheet **60** is cut on (along) a perimeter **62** (cut line) of a necessary region **61** the contour of which forms an octagonal shape, and also cut on a perimeter **64** (cut line) of an unnecessary region **63** having a vertically elongated oval shape inside the necessary region **61**. Inside the unnecessary region **63**, the aforementioned waste removal cutting is performed, so that a zigzag cut C is formed. In other words, a wedge-shaped (V-shaped) cut is made multiple times. This cut C is formed by driving the cutter blade **174** zigzag. At the time, the edge **174***a* of the cutter blade **174** does not follow movement of the axis **174***c* of the cutter blade **174**. Therefore, disorder of the sheet **60**, such as the sheet **60** being turned-up, occurs at corners

(tops of mountain shapes) of the cut C. Hereinafter, movement of the cutter blade **174** during the waste removal cutting will be described with reference to FIG. **7**A and FIG. **7**B.
[0050] As illustrated in FIG. **7**A, during the waste removal cutting, the cutter blade **174** is set such that the edge **174***a* of the cutter blade **174** pierces the sheet **60** whereas the base **174***b* of the cutter blade **174** does not pierce the sheet **60**. As illustrated in FIG. **7**B, during the waste removal cutting, when the axis **174***c* (drive axis) of the cutter blade **174** reaches a corner CN, the axis **174***c* is at the position of c**1**, the edge **174***a* is at the position of a**1**, and the base **174***b* is at the position of b**1**. When the axis **174***c* moves from the position of c**1** to the position of c**2** so as to draw a wedge-shaped (V-shaped) locus, the edge **174***a* moves to the position of a**2** and the base **174***b* moves to the position of b**2** in FIG. **7**B. Since the cutter blade **174** is inserted in the sheet **60** from the edge **174***a* to the base **174***b*, when the edge **174***a* moves from the position of a**1** to the position of a**2** and the base **174***b* moves from the position of b**1** to the position of b**2** in this state, the edge **174***a* and the base **174***b* do not follow the movement of the axis **174***c*, and the sheet **60** being turned-up occurs at or near the region surrounded by the positions of a**1**, b**1**, a**2** and b**2**. Thus, when the waste removal cutting is performed, the wedge-shaped (V-shaped) movement of the axis **174***c* of the cutter blade **174** is repeated, so that the turned-up occurs in an unnecessary region (e.g., unnecessary region **63** in FIG. **6**) collectively. Since the turned-up makes the unnecessary region conspicuous, the unnecessary region can be easily identified. Further, by picking up the curls, which are generated by the turned-up, with tweezers or the like or by making the curls stand up with a finger, the unnecessary region can be easily and smoothly removed.
[0051] Returning to FIG. **5**, when the waste removal cutting process is started, first, the MPU **11** obtains unnecessary region information indicating the shape and the position of an/each unnecessary region (waste region) from cutting data (Step S**1**). It is assumed that in order to perform the waste removal cutting process, a cutting process (contour cutting process) has been performed in advance. The cutting process is a process for cutting out a necessary region (e.g., necessary region **61** in FIG. **6**) and an unnecessary region (e.g., unnecessary region **63** in FIG. **6**) on the basis of cutting data (design information) indicating the shapes and the positions of the necessary region and the unnecessary region.
[0052] Next, the MPU **11** derives the inscribed quadrilateral A having the largest area in the unnecessary region on the basis of the unnecessary region information obtained in Step S**1** (Step S**2**). If there are two or more unnecessary regions, in Step S**2**, the MPU **11** derives, for each unnecessary region, the inscribed quadrangle A having the largest area in the unnecessary region. Then, the MPU **11** performs, for each unnecessary region, processes of Step S**3** and the subsequent steps. In this embodiment, as illustrated in FIG. **8** and FIG. **9**, the inscribed quadrilateral A is rectangular, but may be trapezoidal, parallelogrammatic or rhombic. In this embodiment, of the two pairs of sides of the derived inscribed quadrilateral A, the length of the pair of shorter sides is defined as a width WA, and the length of the pair of longer sides is defined as a height HA. Since the inscribed quadrilateral A is derived on the basis of the unnecessary region information, namely, depends on the shape of the unnecessary region, directions of the width WA and the height HA of the inscribed quadrilateral A each are not necessarily along the X-axis direction or the Y-axis direction of the cutting device **10**. It is noted that if the inscribed quadrilateral A to be derived is square, the inscribed quadrilateral A is derived such that one pair of sides is parallel to the X-axis direction and the other pair of sides is parallel to the Y-axis direction, for example. Then, the length of the pair of sides parallel to the X-axis direction is defined as the width WA, and the length of the pair of sides parallel to the Y-axis direction is defined as the height HA.
[0053] Next, the MPU **11** determines whether the width WA (in FIG. **8** and FIG. **9**) of the inscribed quadrilateral A derived in Step S**2** is greater than a waste removal cutting reference width (Step S**3**). The waste removal cutting reference width is a default value of a waste removal cutting width and set to a predetermined dimension (approximately 1 mm to 3 mm). As illustrated in FIG. **8**, the waste removal cutting width indicates the length of a stroke of the axis **174***c* of the cutter blade **174**

from one corner CN**1** of the zigzag cut C to the next corner CN**2** that is continuous with the one corner CN**1**. Further, a waste removal cutting angle is the angle of corners of the cut C and set to a predetermined angle (90 degrees or less). Still further, a waste removal cutting length indicates the length of the cut C in a direction perpendicular to the direction of the waste removal cutting width.

[0054] In Step S**3**, if the MPU **11** determines that the

[0055] width WA of the inscribed quadrilateral A is greater than the waste removal cutting reference width (Step S**3**; YES), the MPU **11** sets the waste removal cutting width to the waste removal cutting reference width as illustrated in FIG. **8** (Step S**4**). Next, the MPU **11** sets a waste removal cutting position such that one end (e.g., left end in FIG. **8**) of the width WA of the inscribed quadrilateral A and corners to be made by the waste removal cutting (corners of the cut C) closer to the one end (e.g., left end in FIG. **8**) coincide with one another (Step S**5**). The waste removal cutting width may be set to the width WA of the inscribed quadrilateral A when the width WA of the inscribed quadrilateral A is greater than the waste removal cutting reference width. However, the turned-up occurs only at corners made by the waste removal cutting (corners of the cut C). It is preferable to shorten time required for the waste removal cutting by reducing or eliminating time taken by cutting parts other than the corners, which are made by the waste removal cutting. Therefore, when the width WA of the inscribed quadrilateral A is greater than the waste removal cutting reference width, the waste removal cutting width is set to the waste removal cutting reference width. This can prevent the time required for the waste removal cutting from being lengthened. Further, by setting the waste removal cutting position at or near one end of the width WA of the inscribed quadrilateral A, the turned-up can be made to occur at or near an end of the unnecessary region **63**. This can make it easier to remove the unnecessary region **63** as compared with a case where the turned-up is made to occur at the center of the unnecessary region **63**. In Step S**5**, the waste removal cutting position may be set such that the other end (e.g., right end in FIG. **8**) of the width WA of the inscribed quadrilateral A and corners to be made by the waste removal cutting (corners of the cut C) closer to the other end (e.g., right end in FIG. **8**) coincide with one another. Further, although in Step S**5**, the waste removal cutting position is set such that one end of the width WA of the inscribed quadrilateral A and the corners to be made by the waste removal cutting (corners of the cut C) closer to the one end coincide with one another, the waste removal cutting position may be set such that the corners to be made by the waste removal cutting closer to the one end are spaced about 0.5 mm inward from the one end.

[0056] Next, the MPU **11** sets the waste removal cutting length to the height HA of the inscribed quadrilateral A as illustrated in FIG. **8** (Step S**8**). The waste removal cutting length is not necessarily set to the height HA of the inscribed quadrilateral A. For example, if the value of the height HA (length) of the inscribed quadrilateral A is equal to or greater than a predetermined value that is the minimum required for the waste removal cutting, the waste removal cutting length may be set to the predetermined value. This predetermined value is, for example, a value equivalent to the waste removal cutting length of one to ten corners made by the waste removal cutting.

[0057] Next, the MPU **11** adds a cut line (design) for the special cutting to the cutting data on the basis of the waste removal cutting width set in Step S**4**, the waste removal cutting position set in Step S**5**, and the waste removal cutting length set in Step S**8**, and causes the cutter **17** to perform the waste removal cutting (Step S**9**). Then, the MPU **11** ends the waste removal cutting process.

[0058] In Step S**3**, if the MPU **11** determines that the width WA of the inscribed quadrilateral A is not greater than the waste removal cutting reference width (Step S**3**; NO), the MPU **11** sets the waste removal cutting width to the width WA of the inscribed quadrilateral A (Step S**6**) as illustrated in FIG. **9**. Next, the MPU **11** sets the waste removal cutting position such that corners to be made by the waste removal cutting (corners of the cut C) are within the width WA of the inscribed quadrilateral A (Step S**7**). Next, the MPU **11** sets the waste removal cutting length to the height HA of the inscribed quadrilateral A (Step S**8**). The waste removal cutting length is not necessarily set to the height HA of the inscribed quadrilateral A when the width WA of the inscribed quadrilateral A is not greater than the waste removal cutting reference width too. For example, if the value of the height HA (length) of the inscribed quadrilateral A is equal to or greater than a predetermined value that is the minimum required for the waste removal cutting, the waste removal cutting length may be set to the predetermined value.

[0059] Next, the MPU **11** adds a cut line (design) for the special cutting to the cutting data on the basis of the waste removal cutting width set in Step S**6**, the waste removal cutting position set in Step S**7**, and the waste removal cutting length set in Step S**8**, and causes the cutter **17** to perform the waste removal cutting (Step S**9**). Then, the MPU **11** ends the waste removal cutting process.

[0060] As described above, according to this embodiment, the cutting device **10** includes the MPU **11** (processor) and the cutter **17** that cuts the sheet **60** (cutting target medium) on the basis of cutting data (predetermined design information) as first cutting. If the cutting data (predetermined design information) includes unnecessary region information indicating an unnecessary region(s) to be removed after the first cutting, the MPU **11** controls the cutter **17** to perform the waste removal cutting (special cutting), which brings about the turned-up, inside the unnecessary region. Since the waste removal cutting, which brings about the turned-up, is performed inside the unnecessary region, the unnecessary region can be easily and smoothly removed by pinching the curls, which are generated by the turned-up, with tweezers or the like or by making the curls stand up with a finger. Further, since the unnecessary region becomes conspicuous due to the turned-up, the unnecessary region can be easily identified.

[0061] Further, the waste removal cutting (special cutting) is cutting to make a wedge-shaped cut one or more times by moving the drive axis **174***c* of the cutter blade **174** to change the orientation of the edge **174***a* of the cutter blade **174** in the state in which the cutter blade **174** of the cutter **17** is inserted in the sheet **60** (cutting target medium). Normally, when cutting is performed on a bent line that is formed of lines in different directions connected to one another, such as a wedge-shaped line, after cutting is performed on one of the lines of the wedge-shaped line from the start point to the end point, the cutter blade **174** is once evacuated from the sheet **60** and the orientation of the edge **174***a* of the cutter blade **174** is changed in the state in which the cutter blade **174** does not pierce the sheet **60**, and then cutting is performed on the other line of the lines of the wedge-shaped line (first cutting method). Meanwhile, in the waste removal cutting, the wedge-shaped cut is made by moving the drive axis **174***c* of the cutter blade **174** to change the orientation of the edge **174***a* of the cutter blade **174** in the state in which the cutter blade **174** is inserted in the sheet **60** (the cutter blade **174** pieces the sheet **60**) (second cutting method). This can bring about the turned-up appropriately.

[0062] Further, the MPU **11** sets the width (waste removal cutting width), the length (waste removal cutting length) and the position (waste removal cutting position) of the cut C for the waste removal cutting (special cutting) on the basis of the extent and the shape of the unnecessary region. This enables the waste removal cutting to be appropriately performed inside the unnecessary region.

[0063] Further, if the width WA of the inscribed quadrilateral A of the unnecessary region is greater than a reference width (waste removal cutting reference width) of the cut C for the waste removal cutting (special cutting), the MPU **11** sets the width of the cut C to the reference width of the cut C, whereas if the width WA of the inscribed quadrilateral A of the unnecessary region is equal to or less than the reference width of the cut C for the waste removal cutting (special cutting), the MPU **11** sets the width of the cut C to the width WA of the inscribed quadrilateral A. Thus, the width (waste removal cutting width) of the cut C for the waste removal cutting is set according to the width WA of the inscribed quadrilateral A of the unnecessary region. This enables the waste removal cutting to be appropriately performed inside the unnecessary region. Further, since the width (waste removal cutting width) of the cut C is set to the reference width (waste removal cutting reference width) of the cut C for the waste removal cutting when the width WA of the inscribed quadrilateral A of the unnecessary region is greater than the reference width of the cut C,

the time required for the waste removal cutting can be prevented from being lengthened.
[0064] Further, if the width WA of the inscribed quadrilateral A of the unnecessary region is greater than the reference width (waste removal cutting reference width) of the cut C for the waste removal cutting (special cutting), the MPU **11** sets the position of the cut C such that one end of the width WA of the inscribed quadrilateral A and the corners of the cut C closer to the one end coincide with one another, whereas if the width WA of the inscribed quadrilateral A of the unnecessary region is equal to or less than the reference width (waste removal cutting reference width) of the cut C for the waste removal cutting (special cutting), the MPU **11** sets the position of the cut C such that all the corners of the cut C are within the width WA of the inscribed quadrilateral A. Thus, the position (waste removal cutting position) of the cut C for the waste removal cutting is set according to the width WA of the inscribed quadrilateral A of the unnecessary region. This enables the waste removal cutting to be appropriately performed inside the unnecessary region. Further, since the position of the cut C is set such that one end of the width WA of the inscribed quadrilateral A and the corners of the cut C closer to the one end coincide with one another when the width WA of the inscribed quadrilateral A of the unnecessary region is greater than the reference width (waste removal cutting reference width) of the cut C for the waste removal cutting, the turned-up can be made to occur at or near an end of the unnecessary region. This can make it easier to remove the unnecessary region as compared with the case where the turned-up is made to occur at the center of the unnecessary region.
[0065] Further, the MPU **11** sets the length of the cut C for the waste removal cutting to the height of the inscribed quadrilateral A of the unnecessary region or less. This enables the waste removal cutting to be appropriately performed inside the unnecessary region.
[0066] Further, the waste removal cutting is performed with the second cutting method different from the first cutting method in which the cutter blade **174** is moved to perform the first cutting. This can bring about the turned-up appropriately when the wedge-shaped cut is made, and accordingly the unnecessary region can be easily and smoothly removed by picking up the curls, which are generated by the turned-up, with tweezers or the like or by making the curls stand up with a finger.
[0067] Those described in the above embodiment are not limitations but mere examples of the cutting device, the cutting control method, and the storage medium storing the program (**131**) according to the present disclosure.
[0068] For example, the waste removal cutting (special cutting) in the above embodiment may be half cutting by which the cutting target medium is not completely cut. For example, if the cutting target medium is a sticker sheet composed of at least two layers, for example, a base material and a sticker, the waste removal cutting may be performed on only the sticker with the second cutting method. If the sticker sheet is cut with the first cutting method, both of the two layers of the base material and the sticker are completely cut.
[0069] Further, in the above embodiment, the waste removal cutting is performed to form the continuous zigzag cut C (in FIG. **6**), but may be performed to form two or more wedge-shaped (V-shaped) cuts C at positions apart from one another as illustrated in FIG. **10**.
[0070] Further, in the above embodiment, pressures and cutting speeds at which the cutter blade **174** cuts the sheet **60** (cutting target medium) in the normal cutting and the waste removal cutting are not specified, but may be specified for the normal cutting and the waste removal cutting separately in order to bring about the turned-up appropriately. For example, the pressure and/or the cutting speed at which the cutter blade **174** cuts the sheet **60** in the waste removal cutting may be greater (or less) and/or faster (or slower) than the pressure and/or the cutting speed in the normal cutting, respectively.
[0071] Further, in Step S**2** of the waste removal cutting process (in FIG. **5**) in the above embodiment, the inscribed quadrilateral A may be derived such that the direction of the width WA of the inscribed quadrilateral A is along the X-axis direction or the Y-axis direction of the cutting

device **10**. In this case, the waste removal cutting may be performed to make the cut C along one side specified in advance from the four sides of the inscribed quadrilateral A. For example, if the left side of the four sides of the inscribed quadrilateral A is specified in advance, as illustrated in FIG. **11**A, the cut C is made with the waste removal cutting position set such that the left side of the inscribed quadrilateral A and corners to be made by the waste removal cutting (corners of the cut C) closer to the left side coincide with one another. As another example, if the right side of the four sides of the inscribed quadrilateral A is specified in advance, as illustrated in FIG. **11**B, the cut C is made with the waste removal cutting position set such that the right side of the inscribed quadrilateral A and corners to be made by the waste removal cutting (corners of the cut C) closer to the right side coincide with one another. As another example, if the upper side of the four sides of the inscribed quadrilateral A is specified in advance, as illustrated in FIG. **11**C, the cut C is made with the waste removal cutting position set such that the upper side of the inscribed quadrilateral A and corners to be made by the waste removal cutting (corners of the cut C) closer to the upper side coincide with one another. As another example, if the lower side of the four sides of the inscribed quadrilateral A is specified in advance, as illustrated in FIG. **11**D, the cut C is made with the waste removal cutting position set such that the lower side of the inscribed quadrilateral A and corners to be made by the waste removal cutting (corners of the cut C) closer to the lower side coincide with one another.

[0072] Although one or more embodiments of the present disclosure have been described above, the scope of the present disclosure is not limited to the above embodiments, but includes the scope of claims and the scope of their equivalents.

[0073] In the waste removal cutting process of the above embodiment (in FIG. **5**), regardless of whether the user desires it, the waste removal cutting is automatically performed in unnecessary regions (e.g., unnecessary region **63** in FIG. **6**) and the turned-up occurs accordingly. This causes a problem that unnecessary regions cannot be used for other purposes (e.g., masking). Further, if an unnecessary region is too small to perform the waste removal cutting therein, a necessary region adjacent to such an unnecessary region is affected by the waste removal cutting due to an error in the drive position of the cutter blade **174**. Therefore, in a cutting data generating process (described later) for generating cutting data according to a modification, whether the waste removal cutting is required is selected for each unnecessary region, and cutting data (unnecessary region information) generated is provided with necessity identification information indicating the selection results for the respective unnecessary regions of whether the waste removal cutting is required. In the waste removal cutting process (described later) of this modification, the waste removal cutting is performed, on the basis of the necessity identification information, only inside an unnecessary region(s) requiring the waste removal cutting.

[0074] The cutting data generating process that is performed by the terminal device **50** will be described with reference to FIG. **12**. When the cutting data generating process is started, the CPU **51** of the terminal device **50** generates cutting data on the basis of a user operation(s) and determines whether generation of cutting data has finished (Step S**101**). In Step S**101**, if the CPU **51** determines that generation of cutting data has not finished (Step S**101**; NO), the CPU **51** repeats the determination process of Step S**101** until generation of cutting data finishes. If the CPU **51** determines that generation of cutting data has finished (Step S**101**; YES), the CPU **51** causes the display **54** to display a necessity selection receiving screen G**1** to receive selections for respective unnecessary regions as to whether the waste removal cutting is required (Step S**102**). If cutting data is generated in advance and stored in the storage **53**, the CPU **51** may cause the display **54** to display the necessity selection receiving screen G**1** in response to obtaining the cutting data from the storage **53**.

[0075] As illustrated in FIG. **13**, on the necessity selection receiving screen G**1**, a cutting image G**11** based on the generated cutting data is displayed, and also message information G**12** prompting the user to select for each unnecessary region whether the waste removal cutting is required (e.g., "Specify region where waste removal cutting is to be performed") is displayed. The cutting image G**11** is displayed such that unnecessary regions G**112** are distinguishable from a necessary region G**111**. For example, the necessary region G**111** is displayed with hatched, and the unnecessary regions G**112** are displayed in white (with a white background). The unnecessary regions G**112** can be specified (selected) with user operations through the operation receiver **55** (e.g., touches on the unnecessary regions G**112**). When an operation to specify an unnecessary region G**112** is made as illustrated in FIG. **13**, the unnecessary region G**112** is specified as a region where the waste removal cutting is to be performed (region requiring the waste removal cutting) and, as illustrated in FIG. **14**A, displayed in a display mode of a predetermined display color (e.g., gray) changed from a display mode of white. On the other hand, when an operation to specify an unnecessary region G**112** is made in a state in which the unnecessary region G**112** is displayed in the display mode of the predetermined display color, the unnecessary region G**112** is specified as a region where the waste removal cutting is not to be performed (region not requiring the waste removal cutting) and displayed in the display mode of white changed from the display mode of the predetermined display color.

[0076] On the necessity selection receiving screen G**1**, the necessary region G**111** and the unnecessary regions G**112** may be distinguishable from one another by, for example, using different display colors or different color densities. Further, when the cutting image G**11** is first displayed on the necessity selection receiving screen G**1**, the unnecessary regions G**112** may not be displayed in white but displayed in the aforementioned predetermined display color. That is, the unnecessary regions G**112** may be displayed in a state in which they all are specified (selected) as the region where the waste removal cutting is to be performed. Alternatively, as illustrated in FIG. **14**B, the cutting image G**11** may be displayed such that only cut lines G**113** to cut out the unnecessary regions G**112** are displayed without the necessary region G**111** and the unnecessary regions G**112** distinguished from one another.

[0077] Further, the method for receiving selections for respective unnecessary regions as to whether the waste removal cutting is required is not limited to receiving the aforementioned user's direct operations on the respective unnecessary regions G**112** to specify the unnecessary regions G**112**. For example, as illustrated in FIG. **14**C, an input form G**13** to input a number(s) of the region where the waste removal cutting is to be performed may be provided, and a selection(s) as to whether the waste removal cutting is required may be received by the input form G**13** in which the number(s) of the region where the waste removal cutting is to be performed is input on the basis of a user operation(s). In this case, the cutting image G**11** is provided with numbers (1 to 4) to identify the respective unnecessary regions G**112**. In the example illustrated in FIG. **14**C, the unnecessary region G**112** corresponding to the number "2" is specified (selected) as the region where the waste removal cutting is to be performed. Alternatively, as illustrated in FIG. **14**D, a selection form G**14** to select for each unnecessary region G**112** whether the waste removal cutting is required may be provided, and selections as to whether the waste removal cutting is required for the respective unnecessary regions G**112** may be received by the selection form G**14**. In this case, the cutting image G**11** is provided with the numbers (1 to 4) to identify the respective unnecessary regions G**112**. In the example illustrated in FIG. **14**D, the unnecessary region G**112** corresponding to the number "2" is specified (selected) as the region where the waste removal cutting is to be performed.

[0078] Further, on the necessity selection receiving screen G**1**, when an unnecessary region(s) G**112** is specified (selected) as the region where the waste removal cutting is to be performed, in addition to the specified unnecessary region(s) G**112** displayed in the predetermined display color, a symbol mark(s) M indicating the position where the waste removal cutting is to be performed may be displayed as illustrated in FIG. **15**A. Alternatively, as illustrated in FIG. **15**B, the specified unnecessary regions G**112** may be displayed not in the predetermined display color but with the symbol marks M, so that the region where the waste removal cutting is to be performed can be identified, namely, is distinguishable from the region where the waste removal cutting is not to be performed. The symbol marks M each are displayed, as illustrated at the left half of FIG. **15**C, in a mode of a circumscribed quadrilateral of a cut (cut C) that is actually to be made by the waste removal cutting, but may be displayed, as illustrated at the right half of FIG. **15**C, in a mode of a center line of the cut (cut C) that is actually to be made by the waste removal cutting. Instead of the symbol marks M, as illustrated in FIG. **15**D, cut lines CL each indicating the cut (cut C) that is actually to be made by the waste removal cutting may be displayed. In this case, the cut lines CL may be displayed in red or in a flashing manner so that the cut lines CL can be recognized easily.

[0079] Returning to FIG. **12**, next, the CPU **51** determines whether selections for the respective unnecessary regions as to whether the waste removal cutting is required have finished on the necessity selection receiving screen G**1** (Step S**103**). In Step S**103**, if the CPU **51** determines that selections for the respective unnecessary regions as to whether the waste removal cutting is required have not finished (Step S**103**; NO), the CPU **51** repeats the determination process of Step S**103** until the selections finish. In Step S**103**, if the CPU **51** determines that selections for the respective unnecessary regions as to whether the waste removal cutting is required have finished (Step S**103**; YES), the CPU **51** links pieces of necessity identification information on the waste removal cutting with the respective unnecessary regions (their corresponding unnecessary regions) on the basis of the selection results for the respective unnecessary regions of whether the waste removal cutting is required received by the necessity selection receiving screen G**1**, thereby providing the cutting data (unnecessary region information) with the (pieces of) necessity identification information for the unnecessary regions (Step S**104**). Then, the CPU **51** ends the cutting data generating process. The method for providing the cutting data with the necessity identification information may be a method of attaching the necessity identification information to the cutting data itself or a method of not attaching the necessity identification information to the cutting data itself but correlating the necessity identification information with the cutting data.

[0080] Next, the waste removal cutting process according to a modification will be described with reference to FIG. **16**. When the waste removal cutting process of this modification is started, the MPU **11** obtains unnecessary region information from the cutting data (Step S**1**) as in the waste removal cutting process of the above embodiment (in FIG. **5**). Next, on the basis of the necessity identification information with which the unnecessary region information is provided, the MPU **11** determines whether there is an unnecessary region(s) requiring the waste removal cutting (Step S**201**). In Step S**201**, if the MPU **11** determines that there is no unnecessary region requiring the waste removal cutting (Step S**201**; NO), the MPU **11** ends the waste removal cutting process. In Step S**201**, if the MPU **11** determines that there is an unnecessary region(s) requiring the waste removal cutting (Step S**201**; YES), the MPU **11** performs the processes of Step S**2** and the subsequent steps on the unnecessary region requiring the waste removal cutting, and then ends the waste removal cutting process. The processes of Step S**2** and the subsequent steps are the same as those of the waste removal cutting process in the above embodiment, and therefore descriptions thereof will be omitted.

[0081] As described above, according to this modification, the CPU **51** of the terminal device **50** causes the display **54** to display unnecessary regions (cutting image G**11**) of the sheet **60** (cutting target medium) that has been cut by the cutting device **10** on the basis of predetermined cutting data as the first cutting. Further, the CPU **51** receives, from the user, selections for the respective unnecessary regions (cutting image G**11**) displayed by/on the display **54** as to whether the waste removal cutting (special cutting), which is performed by the cutting device **10** to bring about the turned-up inside the unnecessary regions, is required. Further, the CPU **51** provides the cutting data with the (pieces of) necessity identification information indicating the received selection results of whether the waste removal cutting is required. Thus, after the first cutting is performed by the cutting device **10**, the waste removal cutting is performed only inside an unnecessary region(s) where the user desires that the waste removal cutting is to be performed. Thus, the waste removal

cutting can be performed flexibly.
[0082] Further, in response to receiving selections for the respective unnecessary regions as to whether the waste removal cutting is required, the CPU **51** causes the display **54** to display the unnecessary region requiring the waste removal cutting in a mode by which the user can identify the unnecessary region requiring the waste removal cutting. This allows the user to check in advance the unnecessary region where the waste removal cutting is to be performed and accordingly can prevent an unnecessary region(s) where the user does not desire that the waste removal cutting is to be performed from being subjected to the waste removal cutting.
[0083] Further, in response to receiving selections for the respective unnecessary regions as to whether the waste removal cutting is required, the CPU **51** causes the display **54** to display a predetermined mark (symbol mark M) at the position where the waste removal cutting is to be performed in the unnecessary region requiring the waste removal cutting. This allows the user to check in advance the unnecessary region where the waste removal cutting is to be performed and to easily visualize the position where the waste removal cutting is actually to be performed.
[0084] Although one or more modifications of the present disclosure have been described above, the scope of the present disclosure is not limited to the above modifications, but includes the scope of claims and the scope of their equivalents.

Claims

1. A cutting control method that is performed by a cutting device including a cutter that cuts a cutting target medium with a cutter blade based on predetermined design information, the cutting control method comprising: in response to the design information including unnecessary region information indicating an unnecessary region to be removed after a first cutting in which the cutter blade cuts the cutting target medium based on the predetermined design information, controlling the cutter to perform special cutting inside the unnecessary region, wherein the special cutting is performed with a second cutting method different from a first cutting method in which the cutter blade is moved to perform the first cutting.
2. The cutting control method according to claim 1, wherein the special cutting is cutting by which a wedge-shaped cut is made one or more times inside the unnecessary region.
3. The cutting control method according to claim 1, wherein the first cutting method is a cutting method of, in cutting on a bent line that is formed of lines in different directions connected to one another, cutting on one of the lines of the bent line from a start point to an end point thereof, evacuating the cutter blade from the cutting target medium, changing an orientation of the cutter blade, and starting to cut on other of the lines of the bent line, and wherein the second cutting method is a cutting method of, in cutting on the bent line, cutting on the one of the lines of the bent line from the start point to the end point thereof, and starting to cut on the other of the lines of the bent line without evacuating the cutter blade from the cutting target medium.
4. The cutting control method according to claim 1, wherein the cutting target medium has a two-layer structure of two layers stacked, wherein the first cutting method is a cutting method of completely cutting both of the two layers of the cutting target medium, and wherein the second cutting method is a half-cutting method of not completely cutting one of the two layers of the cutting target medium.
5. The cutting control method according to claim 1, wherein the first cutting method and the second cutting method are different in pressure at which the cutter blade cuts the cutting target medium.
6. The cutting control method according to claim 1, wherein the first cutting method and the second cutting method are different in speed at which the cutter blade cuts the cutting target medium.
7. A cutting device comprising: a cutter that cuts a cutting target medium with a cutter blade based on predetermined design information; and a processor that in response to the design information including unnecessary region information indicating an unnecessary region to be removed after a

first cutting in which the cutter blade cuts the cutting target medium based on the predetermined design information, controls the cutter to perform special cutting inside the unnecessary region, wherein the special cutting is performed with a second cutting method different from a first cutting method in which the cutter blade is moved to perform the first cutting.

8. A non-transitory computer-readable storage medium storing a program causing, of a cutting device including a cutter that cuts a cutting target medium with a cutter blade based on predetermined design information, a computer to: in response to the design information including unnecessary region information indicating an unnecessary region to be removed after a first cutting in which the cutter blade cuts the cutting target medium based on the predetermined design information, control the cutter to perform special cutting inside the unnecessary region, wherein the special cutting is performed with a second cutting method different from a first cutting method in which the cutter blade is moved to perform the first cutting.