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### Solder cutting device, solder cutting unit, part mounting device, and production system

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#### Abstract

A solder cutting device includes a first holding part, a first drive part that feeds a tape-like solder material held by the first holding part in a first direction, a cutting part for cutting the tape-like solder material, and a second drive part that actuates the cutting part. The first drive part is a first actuator that is electrically-driven and that converts a rotational motion of a rotating body, the axis of which extends in the first direction, into a motion in the first direction. The second drive part includes a second actuator that moves a moving body in the first direction, and a connection portion that converts the motion of the moving body into a motion in a second direction and transmits the motion to the cutting part.

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## **Background/Summary**

CROSS-REFERENCE TO RELATED APPLICATION (1) This application is a continuation of PCT International Application No. PCT/JP2020/015378, filed on Apr. 3, 2020, the entire disclosure of which is expressly incorporated by reference herein.

### **BACKGROUND**

#### **Technical Field**

(1) The present invention relates to a solder cutting device that cuts a tape-like solder material into a solder piece, a solder cutting unit, a part mounting device, and a production system.

#### **Related Art**

(2) Conventionally, in a production system including a soldering process, a solder cutting device that cuts a long tape-like solder material into a solder piece, for example, has been used. In a solder supply device described in Patent Document 1 (Japanese Patent No. 4838195), a tape-like solder material (sheet-shaped solder tape) wound around a reel is pulled out from the reel by a sending device via a bridging device, sent to a cutting part, and cut by the cutting part into a solder piece.

(3) The bridging device and the sending device are respectively composed of a plurality of rollers forming a sending path of the sheet-shaped solder tape. A sending roller of the sending device is driven by a first motor to rotate to send out the sheet-shaped solder tape. In the cutting part, a cam is rotated by a second motor, and a punch disposed on the sending path is moved up and down by the cam to cut the sheet-shaped solder tape. Driving force is transmitted from the second motor to the cam via a timing belt.

(4) However, in the above conventional configuration, directions of a shaft of each roller of the bridging device and the sending device, a shaft of the cam, and output shafts of the first and second motors are all a width direction of the tape-like solder material, which is a direction orthogonal to a sending direction of the tape-like solder material. Each drive source that drives the output shafts of the first and second motors is configured on one side of each output shaft. Hence, an issue arises that it is necessary that a dimension in a width direction of the bridging device and the sending device be at least an arrangement dimension as large as an entire motor length including the output shaft and the drive source of each of the first and second motors, and a device width of the solder supply device including the bridging device and the sending device including the first and second motors cannot be made smaller than the width of the bridging device and the sending device. This issue leads to a remarkable problem that, regarding a production system including a plurality of

solder supply devices arranged in parallel in the width direction, an installation area of the production system in a factory is increased.

## SUMMARY

(5) A solder cutting device according to one aspect of the present invention includes: a first holding part, holding and releasing a long tape-like solder material; a first drive part, equipped with the first holding part and causing the tape-like solder material held by the first holding part to be sent linearly in a first direction; a cutting part, including a first cutting member and a second cutting member that face each other and are provided so as to approach and separate from each other, and cutting the tape-like solder material located in a cutting position between the first cutting member and the second cutting member; and a second drive part, actuating at least one of the first cutting member and the second cutting member in a second direction perpendicular to a plane part of the tape-like solder material. The first drive part is a first actuator being electrically-driven and converting a rotational motion of a rotating body whose axis extends in the first direction into a linear motion in the first direction. The second drive part includes a second actuator linearly moving a moving body movable in the first direction, and a transmission mechanism converting the linear motion of the moving body into a linear motion in the second direction and transmitting the same to at least one of the first cutting member and the second cutting member.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. 1 is a perspective view showing a solder supply unit and a solder cutting device provided in a production system of an embodiment of the present invention.

(2) (A) of FIG. 2 is a perspective view of the solder supply unit shown in FIG. 1, (B) of FIG. 2 is a partially enlarged view of a support member in the solder supply unit, and (C) of FIG. 2 is a partially enlarged view of an identification part 262 in (B) of FIG. 2.

(3) (A) of FIG. 3 is a perspective view showing a shape of a downstream portion of an upper surface of a lower guide member of a guidance member, (B) of FIG. 3 is a perspective view showing a shape of an upstream portion of the upper surface of the lower guide member of the guidance member, (C) of FIG. 3 is a perspective view showing a shape of a lower surface of the lower guide member, and (D) of FIG. 3 is a perspective view showing a state in which an attachment guide member is attached to the lower surface of the lower guide member.

(4) FIG. 4 is a perspective view of the solder cutting device shown in FIG. 1.

(5) FIG. 5 is a front view of the solder cutting device shown in FIG. 4.

(6) (A) of FIG. 6 is an enlarged perspective view showing a first holding part shown in FIG. 4 and FIG. 5, and (B) of FIG. 6 is an enlarged perspective view showing a second holding part shown in FIG. 4 and FIG. 5.

(7) (A) of FIG. 7 is a perspective view of a cutter unit provided in a cutting part, (B) of FIG. 7 is a perspective view of a state in which a support member supporting the cutter unit and a connection member have been removed, (C) of FIG. 7 is a perspective view of a state in which a guide support member has been removed, (D) of FIG. 7 is a longitudinal sectional view of the cutting part and the vicinity of the cutting part, (E) of FIG. 7 is a front view of the cutting part, (F) of FIG. 7 is a perspective view showing a positional relationship between the cutting part and a cut piece holding part, and (G) of FIG. 7 is a perspective view showing a positional relationship between the cutting part and the guidance member.

(8) FIG. 8 is an enlarged perspective view showing a cut solder transfer part shown in FIG. 4 and FIG. 5.

(9) FIG. 9 is an explanatory view of an operation from feeding of a tape-like solder material by the first holding part to cutting of the tape-like solder material by the cutting part in the solder cutting

device shown in FIG. 5.

(10) (A) of FIG. 10 is a perspective view showing a part mounting device provided in the production system of an embodiment of the present invention, and (B) of FIG. 10 is a perspective view of the part mounting device of (A) of FIG. 10 taken along a first direction (feeding direction) as viewed from a direction different from that of (A) of FIG. 10.

(11) (A) of FIG. 11 to (E) of FIG. 11 are schematic views showing each type of the part mounting device provided in the production system of an embodiment of the present invention.

(12) (A) of FIG. 12 to (D) of FIG. 12 are schematic views showing the production system provided with each type of the part mounting device shown in (A) of FIG. 11 to (E) of FIG. 11.

(13) (A) of FIG. 13 is a perspective view showing a shape of the upper surface of the lower guide member of the guidance member provided in the solder supply unit shown in FIG. 1, and showing a state in which the attachment guide member is attached to the lower guide member. (B) of FIG. 13 is a perspective view showing a shape of the lower surface of the lower guide member of the above guidance member, and showing a state in which the attachment guide member is attached to the lower guide member.

(14) FIG. 14 is a perspective view of a solder cutting device of another embodiment of the present invention.

(15) FIG. 15 is a front view of the solder cutting device shown in FIG. 14.

(16) FIG. 16 is an enlarged perspective view showing the first holding part and the second holding part shown in FIG. 14 and FIG. 15.

#### DESCRIPTION OF THE EMBODIMENTS

(17) The present invention realizes a solder cutting device, a solder cutting unit, a part mounting device and a production system capable of effectively utilizing the installation area.

(18) According to one aspect of the present invention, it is possible to reduce a device width of the solder cutting device in a width direction of the tape-like solder material. Accordingly, in a system including the solder cutting device and using a solder piece supplied from the solder cutting device, even if a plurality of the solder cutting devices are installed in parallel in the width direction, since a device width of the part mounting device can be controlled, the part mounting device can be reduced in size.

#### Embodiment 1

(19) Hereinafter, an embodiment of the present invention will be described in detail. A production system 1 includes a part mounting device 5 and a temperature processing device 57 shown in (A) of FIG. 12 to (D) of FIG. 12. FIG. 1 is a perspective view showing a solder supply unit 2 and a solder cutting device 3 (solder cutting unit 4) provided in a solder piece manufacturing device 12 included in the part mounting device 5 (see (A) of FIG. 10 and (B) of FIG. 10) configured in the production system 1 (see FIG. 11) of the present embodiment. In the following description, a direction (tip side of a tape-like solder material 21) in which the tape-like solder material 21 is sent, or a direction (side where a solder piece obtained by cutting is taken out) in which a solder piece cut from the tape-like solder material 21 is sent is described as a downstream side, and a direction opposite thereto is described as an upstream side.

(20) The tape-like solder material 21 is formed in a predetermined length, width and thickness. In the present embodiment, the tape-like solder material 21 is prepared and supplied in a state of being wound around a reel (not shown) attached to a reel holder 23 from one end of the tape-like solder material 21 to a tip at the other end so as to overlap in order in a thickness direction and accommodated. The tape-like solder material 21 is formed in which the width (for example, 50 mm or less) is smaller than the length. The tape-like solder material 21 is treated with a surface on one side in the thickness direction as an upper surface and a surface on the other side as a lower surface. In the present embodiment, a surface on an outer peripheral side in the state of being wound on the reel is treated as the lower surface. As the tape-like solder material 21, a plurality of tape-like solder materials of different widths are prepared, wound around reels having widths suitable for

each size, and supplied. A tape-like solder material may be prepared in a linearly stretched state without using a reel, and may be supplied while remaining a linear body.

(21) (Solder Supply Unit 2)

(22) (A) of FIG. 2 is a perspective view of the solder supply unit 2 shown in FIG. 1, (B) of FIG. 2 is a partially enlarged view of a support member 24 in the solder supply unit 2, and (C) of FIG. 2 is a partially enlarged view of the identification part 262 in (B) of FIG. 2.

(23) As shown in FIG. 1 and (A) of FIG. 2 to (C) of FIG. 2, the solder supply unit 2 includes a base member 22, the reel holder 23, the support member 24, a guidance member 25, and a suppression unit 27, and supplies the long tape-like solder material 21 held by the reel holder 23 to the solder cutting device 3. The solder supply unit 2 includes an identification area 26.

(24) (Base Member 22)

(25) The base member 22 is an elongated plate-shaped member extending in a feeding direction (hereinafter simply referred to as feeding direction) of the tape-like solder material 21. The base member 22 is supported by a movement mechanism 28 described later, and is provided on a platform 11 so that the solder supply unit 2 is movable in the feeding direction (corresponding to a first direction (X direction)) between an attachment position S provided on the solder cutting unit 4 side and a detachment position R provided away from the solder cutting unit 4.

(26) (Reel Holder 23 and Support Member 24)

(27) The reel holder 23 is provided (on the detachment position R side) on the base member 22, and rotatably holds a reel (not shown) around which the tape-like solder material 21 is wound. The reel holder 23 includes a holder attachment part 23a, a holder support 23b, and a rotation holding member 23c. The holder attachment part 23a is attached to the base member 22. The holder support 23b is provided so as to extend upward on one end side of the holder attachment part 23a orthogonal to the feeding direction, and has a plate shape. The rotation holding member 23c is provided on the holder support 23b and rotatably holds the reel. The reel holder 23 includes a first operation part 23d provided on one side of the holder support 23b and a second operation part 23e provided on the other side of the holder support 23b. The rotation holding member 23c is configured on the holder support 23b to include a rotation axis RC parallel to an axis extending in a direction (width direction) perpendicular to the other surface of the holder support 23b. The rotation axis RC is disposed at the same height position as an extension portion 2512 of the guidance member 25 described later. The first operation part 23d and the second operation part 23e are provided on the holder support 23b with the rotation holding member 23c sandwiched therebetween. The first operation part 23d is disposed above the rotation holding member 23c on the attachment position S side of the holder support 23b. The second operation part 23e is disposed below the rotation holding member 23c on the detachment position R side of the holder support 23b. By providing the first operation part 23d and the second operation part 23e, movement of the movement mechanism 28, that is, reel attachment from a pull-out direction, is facilitated.

(28) The movement mechanism 28 includes: a rail member 281, having a predetermined length in the feeding direction; a moving member 282, configured to be movable on the rail member 281; and an attachment member 283, to which the base member 22 of the solder supply unit 2 is attached. The movement mechanism 28 includes a first restriction member 30 provided on the attachment position S side and restricting movement of the solder supply unit 2 toward the attachment position S side, and a second restriction member 29 provided on the detachment position R side and restricting movement of the solder supply unit 2 toward the detachment position R side.

(29) The rail member 281 is disposed between the attachment position S and the detachment position R and guides movement of the moving member 282.

(30) The moving member 282 is guided by the rail member 281 and is moved between the attachment position S and the detachment position R.

(31) The attachment member 283 is a plate-shaped member of a predetermined length, in which an

attachment part (not shown) provided on one side is attached to the moving member **282**. The attachment member **283** includes a defining portion **22a** defining an attachment position provided on the attachment member **283** when the base member **22** is attached to the attachment member **283**, and a mounting portion **22c** on which the base member **22** is mounted and fixed (see FIG. 4). When the solder supply unit **2** is removed from the attachment member **283**, fixation of the base member **22** to the mounting portion **22c** is canceled, and engagement between the base member **22** and the defining portion **22a** is released. When attachment including re-attachment of the solder supply unit **2** to the attachment member **283** is performed, the base member **22** is engaged with the defining portion **22a**, and after that, the base member **22** is fixed to the mounting portion **22c**. Since the base member **22** can be positioned with the defining portion **22a** as a reference, the solder supply unit **2** can be appropriately positioned and attached in a predetermined position.

(32) The attachment member **283** is attached to the moving member **282**. The attachment member **283** includes a first engagement member **284** engaged with the first restriction member **30** and a second engagement member **285** engaged with the second restriction member **29**. The first engagement member **284** and the second engagement member **285** are provided separated from each other in the feeding direction with the moving member **282** sandwiched therebetween. By moving the attachment member **283** to the attachment position S and engaging the first engagement member **284** with the first restriction member **30**, the solder supply unit **2** is positioned in the attachment position S. By moving the attachment member **283** to the detachment position R and engaging the second engagement member **285** with the second restriction member **29**, the solder supply unit **2** is positioned in the detachment position R.

(33) The support member **24** is provided on the base member **22** (on the attachment position S side on the base member **22**) and supports the guidance member **25**. Specifically, the support member **24** extends in an up-down direction and supports the guidance member **25** so that the guidance member **25** is horizontal at a predetermined height position. The support member **24** includes a base attachment part **24L** attached to the base member **22** and a guidance attachment part **24U** on which the guidance member **25** is supported and attached. The guidance attachment part **24U** rollably supports a lower roller **24c**. The lower roller **24c** is rollable about an axis LRC parallel to a width direction of the lower roller **24c**. A lower surface of the tape-like solder material **21** guided by the guidance member **25** to move abuts against the lower roller **24c**. In the support member **24** in the present embodiment, two plate-shaped members are disposed at a distance from each other in the width direction, including a first support member **24a** disposed on one side and a second support member **24b** disposed on the other side. The lower roller **24c** is supported by and disposed between a guidance attachment part of the first support member **24a** and a guidance attachment part of the second support member **24b**. The guidance attachment part **24U** is provided with a suppression attachment part (not shown) to which the suppression unit **27** described later is attached.

(34) (Identification Area **26**)

(35) As shown in (B) of FIG. 2 and (C) of FIG. 2, the identification area **26** is a portion where the identification part **262** is detected by an identification mechanism **261** (described later) provided on the platform **11**. The identification part **262** is, for example, provided on the base member **22** of the solder supply unit **2**. The identification part **262** includes an identification attachment part **262a** attached to the base member **22** and a plurality of marking portions **262b** to be detected by the identification mechanism **261**. The plurality of marking portions **262b** are formed of a plurality of holes in the present embodiment.

(36) Among the plurality of marking portions **262b**, a predetermined marking portion **262b** is provided separately according to the type (at least, type of width=width size) of the tape-like solder material **21** held by the reel holder **23**. In the example of (C) of FIG. 2, the marking portion **262b** is two holes formed side by side in the up-down direction. These holes **262b** and **262b** are detected by a detection unit **261b** (in the present embodiment, two detection units **261b** out of three), thereby

determining the type of the tape-like solder material **21**. In the identification mechanism **261** and the identification part **262** of the identification area **26**, the identification mechanism **261** may be configured on the base member **22**, and the identification part **262** may be configured on the platform **11**.

(37) The identification mechanism **261** is provided on the platform **11** and includes a detection attachment part **261a**, a detection unit attachment part **26b**, and a plurality of detection units **261b**. The detection attachment part **261a** is attached to the first restriction member **30** that restricts movement of the solder supply unit **2** to be moved to the attachment position S side. The detection unit **261b** detects the plurality of marking portions **262b** of the identification part **262**. As the detection unit **261b**, a photodetection sensor is adopted in the present embodiment. The detection unit **261b** is attached to the detection unit attachment part **26b**. In the present embodiment, three detection units **261b** are disposed and attached at predetermined intervals in the up-down direction.

(38) Since the solder supply unit **2** includes the identification part **262** of the identification area **26**, for example, the solder cutting device **3** is able to identify what reel width the reel has, that is, what type (width) of the tape-like solder material **21** is held in the solder supply unit **2**.

(39) In this way, when the solder supply unit **2** is removed from the solder piece manufacturing device **12** and a new solder supply unit **2** is attached, it is difficult to determine the type of the tape-like solder material **21** set in the new solder supply unit **2** only by appearance. However, in the solder supply unit **2** in the present embodiment, the type of the tape-like solder material **21** set on the reel can be easily identified by the identification area **26** provided in the solder supply unit **2** itself. Hence, even if an operator sets a wrong reel of the tape-like solder material **21** in the solder supply unit **2** by mistake, since the mistake can be reliably detected, a product defect due to human error can be prevented from occurring.

(40) (Guidance Member **25**)

(41) (A) of FIG. **3** is a perspective view showing a shape of a downstream portion of an upper surface of a lower guide member **251** of the guidance member **25**, (B) of FIG. **3** is a perspective view showing a shape of an upstream portion of the upper surface of the lower guide member **251** of the guidance member **25**, (C) of FIG. **3** is a perspective view showing a shape of a lower surface of the lower guide member **251**, and (D) of FIG. **3** is a perspective view showing a state in which the lower surface of the lower guide member **251** is attached to (engaged with) an attachment guide member **39**.

(42) The guidance member **25** extends in the feeding direction and guides the tape-like solder material **21** fed out from the above reel. The guidance member **25** may be configured to guide at least the lower surface of the tape-like solder material **21**.

(43) As shown in (A) of FIG. **2** and (A) of FIG. **3** to (D) of FIG. **3**, the guidance member **25** includes the lower guide member **251** and an upper guide member **252** extending in the feeding direction. The guidance member **25** includes a guidance fixing part **251a** provided on one end side in the feeding direction and attached to the guidance attachment part **24U** of the support member **24**, and a tip **251b** provided on the other end side in the feeding direction and defined in the solder cutting unit **4**.

(44) The upper guide member **252** is a plate member configured to be superimposed on the lower guide member **251** from above the lower guide member **251** and having a shape extending in the feeding direction. The upper guide member **252** has the same width as the lower guide member **251** and is disposed on the upper surface of the lower guide member **251** over the feeding direction of the lower guide member **251**.

(45) The lower guide member **251** guides the lower surface and a side surface (side part) of the tape-like solder material **21**. That is, in the lower guide member **251**, a guideway **2511** is formed of the extension portion **2512** extending in the feeding direction (predetermined direction) and guidance side walls **2513** and **2513** guiding the side part of the fed-out tape-like solder material **21**. Specifically, in the lower guide member **251**, the guidance side walls **2513** and **2513** are formed



extending downward from one end of the upper surface of the lower guide member **251** between both ends in a direction orthogonal to the feeding direction and are provided to face each other, and the extension portion **2512** is formed continuous with the other end of each of the guidance side walls **2513** and **2513**, thereby forming the guideway **2511**. In the lower guide member **251**, the height of the guidance side walls **2513** and **2513** and a distance therebetween are set according to the width and thickness that differ depending on the type of the tape-like solder material **21**, and the guideway **2511** is formed.

(46) Accordingly, the guidance member **25** restricts downward movement of the fed-out tape-like solder material **21** by the extension portion **2512** of the lower guide member **251**. By restricting both side parts of the tape-like solder material **21** by the guidance side walls **2513** and **2513**, movement of the fed-out tape-like solder material **21** in the width direction is restricted. Upward movement of the fed-out tape-like solder material **21** is restricted by a lower surface of the upper guide member **252** disposed facing the extension portion **2512**. Accordingly, in the guidance member **25**, stable guidance can be performed between the guidance fixing part **251a** and the tip **251b** in the feeding direction of the tape-like solder material **21**.

(47) By adopting the guidance member **25** corresponding to the type of the tape-like solder material **21**, the fed-out tape-like solder material **21** can be optimally transferred. That is, in the guidance member **25**, the extension portion **2512** and the guidance side wall **2513** form the guideway **2511** of the tape-like solder material **21**, the lower surface of the tape-like solder material **21** can be guided by the extension portion **2512**, and the side part of the tape-like solder material **21** can be guided by the guidance side wall **2513**.

(48) As shown in (B) of FIG. 3, the extension portion **2512** includes a first extension portion **2531** having the guidance side walls **2513** and **2513** provided on both sides thereof, and a second extension portion **2532** provided continuous with the first extension portion **2531** and not having the guidance side walls **2513** and **2513** provided on both sides thereof. The guidance side walls **2513** and **2513** include first guidance side walls **2541** and **2541** provided at an interval allowing both to guide the tape-like solder material **21**, and second guidance side walls **2542** and **2542** provided at an interval greater than that of the first guidance side walls **2541**. Accordingly, in the solder supply unit **2**, the tip of the tape-like solder material **21** can be easily positioned and attached on the guideway **2511** of the guidance member **25**.

(49) In the lower guide member **251**, when the tip **251b** is attached to the solder cutting device **3** described later, the tip **251b** is defined by a guidance defining part **338** provided in the solder cutting device **3**. The reason is to guide the tape-like solder material **21** to a cutting position of the solder cutting device **3** where the fed-out tape-like solder material **21** is cut. In detail, in the lower guide member **251**, on both side parts of the tip **251b** in the width direction, inclined parts **251b1** and **251b1** having a predetermined angle are formed from the tip side in the feeding direction toward each side part of the lower guide member **251**. In the lower guide member **251**, a certain range of both side parts of the tip **251b** in the width direction continuous with the inclined parts **251b1** and **251b1** is set as side tips **251c1** and **251c1** to be defined by the guidance defining part **338**. In the lower guide member **251**, a predetermined range in a lower part of the tip **251b** from the tip side in the feeding direction is set as a lower tip **251b2** to be defined by the guidance defining part **338**.

(50) As shown in (A) of FIG. 3 to (D) of FIG. 3, the guidance member **25** includes a lower guide **2514** and side guides **2515** and **2515** on a back surface of the lower guide member **251**. In the present embodiment, in the lower guide **2514**, an upper surface part extending in the width direction is formed. The side guides **2515** and **2515** are respectively provided extending upward from the back surface of the lower guide member **251** at both ends of the lower guide **2514** in the width direction. Accordingly, the side guides **2515** and **2515** are formed in a groove shape extending in the feeding direction and opening on the tip side at the tip **251b** at one end of the lower guide member **251** in a position on the lower surface of the guidance member **25**, that is, the

lower guide member **251**, on one side in the width direction.

(51) In the case where the solder supply unit **2** is attached to the solder cutting device **3**, the lower guide **2514** and the side guides **2515** and **2515** are guided by the attachment guide member **39** included in the solder cutting device **3**, and the tip **251b** of the lower guide member **251** is positioned and attached in the cutting position of the solder cutting device **3**. That is, the lower guide **2514** is provided at a tip (on one side) of the extension portion **2512** in the feeding direction, and during movement to an attachment position where the solder supply unit **2** is attached, the lower guide **2514** is guided by the attachment guide member **39** as downward movement of the extension portion **2512** is defined in a predetermined position. During movement to the attachment position where the solder supply unit **2** is attached, the lower guide **2514** is guided and positioned in the cutting position by the side guides **2515** and **2515** as lateral movement of the extension portion **2512** is defined in a predetermined position.

(52) Accordingly, when the solder supply unit **2** is attached on the upstream side of the solder cutting device **3**, by the lower guide **2514** and the side guides **2515** and **2515**, the tip **251b** of the guidance member **25** is guided to the attachment position set at a predetermined position in the solder cutting device **3**. In the attachment position, by defining the tip **251b** by the guidance defining part **338** of the solder cutting device **3**, the solder cutting device **2** can be efficiently and accurately attached to the solder cutting device **3**. Accordingly, the tape-like solder material **21** fed out by the guidance member **25** can be accurately fed out to and set in the cutting position of the solder cutting device **3**. Even in the case of the guidance member **25** corresponding to the tape-like solder material **21** of a different type, since the lower guide **2514**, the side guides **2515** and **2515** and the tip **251b** are provided in common, the tip **251b** of the guidance member **25** can be efficiently and accurately attached in the cutting position of the solder cutting device **3**.

(53) In the extension portion **2512** of the lower guide member **251** of the guidance member **25**, a first opening **2516** as an opening penetrating the extension portion **2512** in the up-down direction is formed. The first opening **2516** includes a first periphery **2551** formed in a predetermined length in an extension direction being the predetermined direction of the extension portion **2512**, and a second periphery **2552** formed continuous with the first periphery **2551** and formed in a length shorter than a width of the extension portion **2512**. The first opening **2516** is formed in a predetermined width allowing it to receive a first gripper (corresponding to a second holding member **312** among a first holding member **311** and the second holding member **312** shown in FIG. **6**) of the solder cutting device **3** moving in the up-down direction. Accordingly, by disposing the tape-like solder material **21** guided by the guidance member **25** between the first holding member **311** and the second holding member **312** of the first gripper in the first opening **2516**, and making the first holding member **311** and the second holding member **312** approach and respectively abut against the upper surface and the lower surface of the tape-like solder material **21**, it is possible to grip the tape-like solder material **21**.

(54) The first opening **2516** is formed in the predetermined length in the feeding direction so that the second holding member **312** is able to move in the feeding direction. Accordingly, it is possible for the first gripper to grip the tape-like solder material **21** in the first opening **2516** and move the tape-like solder material **21** in the feeding direction while gripping it.

(55) In the lower guide member **251** of the guidance member **25**, a second opening **2517** is formed in a position (cutting position side) downstream of the first opening **2516** in the feeding direction. The second opening **2517** is formed in a predetermined width allowing it to receive a second gripper (corresponding to a second holding member **352** among a first holding member **351** and the second holding member **352** shown in FIG. **6**) of the solder cutting device **3** moving in the up-down direction. Accordingly, by disposing the tape-like solder material **21** guided by the guidance member **25** between the first holding member **351** and the second holding member **352** of the second gripper in the second opening **2517**, and making the first holding member **351** and the second holding member **352** approach and respectively abut against the upper surface and the lower

surface of the tape-like solder material **21**, it is possible to grip the tape-like solder material **21**. During cutting of the tape-like solder material **21** in the solder cutting device **3**, the second gripper is able to grip the tape-like solder material **21** in the second opening **2517**, and the solder cutting device **3** is able to stably cut the tape-like solder material **21**. By the second gripper gripping the tape-like solder material **21**, the grip of the tape-like solder material **21** by the first gripper can be released, and preparation can be made for a next feeding operation of the tape-like solder material **21**.

(56) As shown in (A) of FIG. **2**, in the upper guide member **252** of the guidance member **25**, an opening **2521** of a predetermined length and width is formed in the feeding direction in a state in which the tip **251b** side in the feeding direction is open. Specifically, in the opening **2521**, an opening continuous from the tip **251b** in the feeding direction toward the guidance fixing part **251a** is formed up to a position matching a position of an end on the guidance fixing part **251a** side of the first opening **2516** in the up-down direction. By forming the opening **2521** in this way, an open space is formed in which the opening **2521** communicates with the first opening **2516** and the second opening **2517** in the up-down direction.

(57) On the lower surface of the lower guide member **251** of the guidance member **25**, a recess **2518** (see (C) of FIG. **3**) formed in a predetermined length and width in the feeding direction and at a predetermined height from the lower surface of the lower guide member **251** is formed from the tip **251b** side in the feeding direction toward the guidance fixing part **251a** while the tip **251b** side is open. Specifically, the recess **2518** is formed from the tip **251b** in the feeding direction up to a position matching the position of the end on the guidance fixing part **251a** side of the first opening **2516**. That is, the recess **2518** is formed in an area from a front end of the first opening **2516** on the lower surface of the guidance member **25** to the tip of the guidance member **25**. A bottom surface of the guideway **2511** and a bottom surface of the recess **2518** are formed in which the bottom surfaces are adjacent to each other with a second thickness dimension smaller than a first thickness dimension being a dimension between the upper surface and the lower surface of the lower guide member **251**. Accordingly, an operation distance between a gripping state position and a grip release position of the first and second grippers can be set as a distance greater than the second thickness dimension and smaller than the first thickness dimension. In the guidance member **25**, since the recess **2518** is formed on the lower surface within the width of the lower guide member **251** within the dimension of the guidance member **25** in the width direction, occupied area in the width direction can be effectively utilized.

(58) (Suppression Unit **27**)

(59) The suppression unit **27** is provided above the guidance member **25** and is configured to be movable between a standby position when the tape-like solder material **21** is to be attached to the guidance member **25** and the attachment position when the tape-like solder material **21** is attached to the guidance member **25**. The suppression unit **27** energizes the upper surface of the tape-like solder material **21** located on the guideway **2511** toward the extension portion **2512**. Specifically, the suppression unit **27** includes a suppression mechanism **271** suppressing upward movement of the tape-like solder material **21** guided by the guidance member **25**, and a suppression support **272** supporting the suppression mechanism **271**. The suppression mechanism **271** includes a suppression member (suppression roller) **271b** abutting against the upper surface of the tape-like solder material **21**, and a suppression moving body **271a** supporting and moving the suppression member **271b**. The suppression member **271b** is provided at a moving end of the suppression moving body **271a** and is configured to be rollable about a rotation axis URC set parallel to the width direction. The suppression support **272** includes a suppression moving support **272b** movably supporting the suppression moving body **271a**, and a movement support attachment part **272a** attaching the suppression moving support **272b** to the support member **24** so that the suppression moving support **272b** is capable of supporting in a position away from the guidance member **25**. The suppression moving body **271a** is axially supported by the suppression moving support **272b**

so as to be rotatable about an axis HC extending in a direction parallel to the width direction of the tape-like solder material **21** fed out from the reel. Accordingly, the solder supply unit **2** is able to stably guide the tape-like solder material **21** fed out from the reel by the guidance member **25** and the suppression unit **27**.

(60) (Advantages of Solder Supply Unit **2**)

(61) In the solder supply unit **2**, since the guidance member **25** is provided on the support member **24**, and the reel holder **23** and the support member **24** are provided on the base member **22** and are integrally configured, for example, in the case of replacing the solder supply unit **2** attached to the solder cutting device **3**, the solder supply unit **2** can be attached and detached by attachment and removal of the base member **22**.

(62) (Solder Cutting Device **3**)

(63) FIG. **4** is a perspective view of the solder cutting device **3** shown in FIG. **1**. FIG. **5** is a front view of the solder cutting device **3** shown in FIG. **4**.

(64) As shown in FIG. **4** and FIG. **5**, the solder cutting device **3** includes a first holding part **31**, a first drive part **32**, a cutting part **33**, a second drive part **34**, a second holding part **35**, a cleaning unit **36**, a cut solder transfer part **37**, and a frame **38**. The solder cutting device **3** includes the movement mechanism **28** movably supporting the solder supply unit **2** between the attachment position S and the detachment position R. The solder cutting device **3** includes the identification mechanism **261** identifying the type of the tape-like solder material **21** to be supplied.

(65) (Frame **38**)

(66) The frame **38** is provided on the platform **11** and includes a lower base portion **381** and an upper base portion **382**. The lower base portion **381** is a plate-shaped member having a predetermined width and having a predetermined length extending in a sending direction (feeding direction) of the tape-like solder material **21**. The upper base portion **382** is a plate-shaped member located above the lower base portion **381**, having substantially the same width as the lower base portion **381**, and having a predetermined length extending in the sending direction in parallel with the lower base portion **381**. The upper base portion **382** is a plate-shaped member of a shorter length than the lower base portion **381**. The upper base portion **382** is connected to a connection portion **383** supported by the lower base portion **381** at a downstream end (one end). The upper base portion **382** is connected to an auxiliary connection portion **383a** supported by the lower base portion **381** upstream of the downstream end. In other words, the lower base portion **381** and the upper base portion **382** are connected by the connection portion **383** connected to each other on one side in the first direction (X direction, feeding direction) and the auxiliary connection portion **383a** connected to each other on the other side in the first direction, and the frame **38** is integrally formed.

(67) (First Holding Part **31**)

(68) (A) of FIG. **6** is an enlarged perspective view showing the first holding part **31** shown in FIG. **4** and FIG. **5**, and (B) of FIG. **6** is an enlarged perspective view showing the second holding part **35** shown in FIG. **4** and FIG. **5**. As shown in FIG. **5** and (A) of FIG. **6**, the first holding part **31** holds and releases the tape-like solder material **21** supplied from the solder supply unit **2**. As shown in (A) of FIG. **6**, the first holding part **31** includes the first holding member **311** and the second holding member **312** as well as a first holding drive part **313**. The first holding part **31** includes a first holding mounting part **31a** supporting the first holding member **311** and the second holding member **312** as well as the first holding drive part **313**.

(69) The first holding member **311** and the second holding member **312** face each other and are provided so as to approach and separate from each other. In the present embodiment, the first holding member **311** and the second holding member **312** are provided so as to approach and separate from each other in the up-down direction. The first holding drive part **313** actuates the first holding member **311** and the second holding member **312** in a second direction (Z direction: up-down direction) perpendicular to a plane part of the tape-like solder material **21**. Each tip of the

first holding member **311** and the second holding member **312** is formed in a plane shape, formed and disposed so that their respective faces are able to abut against each other. Each tip of the first holding member **311** and the second holding member **312** is disposed so as to be in a central part of the guidance member **25** in the width direction.

(70) The first holding drive part **313** includes a third actuator **3131** being a drive source of the first holding member **311** and the second holding member **312**, and a transmission mechanism **3133** transmitting driving force to the first holding member **311** and the second holding member **312**. The third actuator **3131** includes a holding moving body **3132** movable in the first direction (X direction), and the holding moving body **3132** is reciprocated linearly between a holding operation position set on one side in the first direction and a holding release position set on the other side in the first direction. The third actuator **3131** is supported by a support **31b** supported by the first holding mounting part **31a**. The holding moving body **3132** is movably supported by a support **31c** supported by the first holding mounting part **31a**. In the present embodiment, the holding moving body **3132** is a member having a triangular shape in a side view, disposed so that a first surface **313a** faces upward, disposed so that a second surface **313b** faces downward, and disposed in an inclined manner so that a distance between the first surface **313a** and the second surface **313b** gradually decreases toward the first direction.

(71) The transmission mechanism **3133** converts a linear motion of the holding moving body **3132** in the first direction into a linear motion in the second direction (Z direction), and transmits driving force for moving the first holding member **311** and the second holding member **312** in the second direction.

(72) In the present embodiment, the transmission mechanism **3133** actuates the first holding member **311** and the second holding member **312**. Specifically, the transmission mechanism **3133** includes an upper chuck mechanism **3134**, an upper follower part **3135**, an upper elastic member (spring member) **3138**, a lower chuck mechanism **3136**, a lower follower part **3137** and a lower elastic mechanism (spring member) **3139**.

(73) The upper chuck mechanism **3134** includes the first holding member **311** and the upper elastic member **3138**, and the upper follower part **3135** is connected to the first holding member **311**. The upper chuck mechanism **3134** includes an upper support **311a** supported by the first holding mounting part **31a**, and an upper moving body (not shown) to which the first holding member **311** is connected, the upper moving body being provided on the upper support **311a** so as to be movable in the up-down direction. The upper elastic member **3138** has one side connected to the first holding member **311** and the other side connected to the upper support **311a**, thereby imparting downward elastic force (movement force). Since the upper follower part **3135** is maintained in a state of abutting against the first surface **313a** of the holding moving body **3132** by elastic force of the upper elastic member **3138**, the upper chuck mechanism **3134** is able to reciprocate in the second direction as the holding moving body **3132** moves in the first direction.

(74) The lower chuck mechanism **3136** includes the second holding member **312** and the lower elastic member **3139**, and the lower follower part **3137** is connected to the second holding member **312**. The lower chuck mechanism **3136** includes a lower support **312a** supported by the first holding mounting part **31a**, and a lower moving body (not shown) to which the second holding member **312** is connected, the lower moving body being provided on the lower support **312a** so as to be movable in the up-down direction. The lower elastic member **3139** has one side connected to the second holding member **312** and the other side connected to the lower support **312a**, thereby imparting upward elastic force (movement force). Since the lower follower part **3137** is maintained in a state of abutting against the second surface **313b** of the holding moving body **3132** by elastic force of the lower elastic member **3139**, the lower chuck mechanism **3136** is able to reciprocate in the second direction as the holding moving body **3132** moves in the first direction.

(75) In the upper chuck mechanism **3134**, when the holding moving body **3132** advances, the first holding member **311** is raised from a holding position of the tape-like solder material **21** set in the

second direction to an upper holding release position: when the holding moving body **3132** retreats, the first holding member **311** is lowered from the upper holding release position of the tape-like solder material **21** set in the second direction to the holding position. Similarly, in the lower chuck mechanism **3136**, when the holding moving body **3132** advances, the second holding member **312** is lowered from the holding position of the tape-like solder material **21** set in the second direction to the lower holding release position; when the holding moving body **3132** retreats, the second holding member **312** is raised from the lower holding release position of the tape-like solder material **21** set in the second direction to the holding position. Accordingly, it is possible to hold and release the tape-like solder material **21** by the first holding member **311** and the second holding member **312**. The first holding part **31** may be configured so that the tape-like solder material **21** can be held and released by only the second holding member **312** on the lower side, for example, by the second holding member **312** adhering to and releasing the lower surface of the tape-like solder material **21**. An adhesion member may be adopted so that an adhesion mark is not left when holding is performed by adhesion.

(76) (First Drive Part **32**)

(77) The first drive part **32** includes a first holding moving body **32b** disposed on one side of the upper base portion **382** in the first direction and equipped with the first holding part **31**, and a first drive mechanism **32a** causing the first holding moving body **32b** to be sent linearly in the feeding direction (first direction (X direction)) of the tape-like solder material **21**. The first holding moving body **32b** is a plate-shaped member having a predetermined width and having a predetermined length in the first direction. By mounting and fixing the first holding mounting part **31a** on an upper portion of the first holding moving body **32b**, the first holding part **31** is moved in the first direction together with the first holding moving body **32b**. The first drive mechanism **32a** includes a shaft **32a1** whose axis extends in the first direction, and the first drive mechanism **32a** is a first actuator that is electrically-driven and moves the shaft **32a1** in the first direction by converting a rotational motion of a built-in rotating body (not shown) into a linear motion in the first direction. The first actuator is mounted on the upper base portion **382** and includes a movement position detection means (for example, an encoder)(not shown), and is able to move the shaft **32a1** to any position in the first direction by setting a movement position in the first direction according to numerical data and operating according to numerical control. The first drive part **32** is configured to be able to reciprocate the first holding moving body **32b** in the first direction by connecting one end of the shaft **32a1** to the first holding moving body **32b**.

(78) By configuring the first holding part **31** on the first drive part **32** in this way, the tape-like solder material **21** held by the first holding part **31** can be transferred in the feeding direction. A transfer distance of the tape-like solder material **21** to be transferred in the feeding direction can be arbitrarily set by controlling movement of the shaft **32a1** of the first actuator with numerical data.

(79) (Cutting Part **33**)

(80) (A) of FIG. 7 is a perspective view of a cutter unit **333** provided in the cutting part **33**, (B) of FIG. 7 is a perspective view of a state in which a support member **334** supporting the cutter unit **333** and a connection member **3423** have been removed, (C) of FIG. 7 is a perspective view of a state in which a guide support member **335** has been removed, (D) of FIG. 7 is a longitudinal sectional view of the cutting part **33** and the vicinity of the cutting part **33**, (E) of FIG. 7 is a front view of the cutting part **33**. (F) of FIG. 7 is a perspective view showing a positional relationship between the cutting part **33** and a cut piece holding part **371**, and (G) of FIG. 7 is a perspective view showing a positional relationship between the cutting part **33** and the guidance member **25**.

(81) As shown in (A) of FIG. 7 to (G) of FIG. 7, the cutting part **33** includes the cutter unit **333**, the support member **334**, and the connection member **3423**. The connection member **3423** is connected to a moving member **3331** (described later) of the cutter unit **333** and is supported by the support member **334** so as to be movable in the second direction. The support member **334** defines a position of the cutter unit **333** in the second direction. That is, the support member **334** disposes the

cutter unit **333** above an upper base portion **332**, and supports the cutter unit **333** so that the tape-like solder material **21** can be cut by the cutter unit **333** in a position above the upper base portion **332**.

(82) As shown in (E) of FIG. 7, the cutting part **33** includes a first cutting member **331** and a second cutting member **332** facing each other and provided so as to approach and separate from each other, and cuts the tape-like solder material **21** located in a cutting position between the first cutting member **331** and the second cutting member **332**. In the present embodiment, the first cutting member **331** is configured to be movable in the second direction (Z direction) perpendicular to the plane part of the tape-like solder material **21**. That is, the first cutting member **331** that is capable of moving up and down includes an upper blade part **331a**, and the second cutting member **332** includes a lower blade part **332a** provided in a fixed state at the cutting position. The cutting of the tape-like solder material **21** by the cutter unit **333** is performed by lowering the first cutting member **331** to a position indicated by broken lines and intersecting the upper blade part **331a** with the lower blade part **332a**.

(83) A width of the upper blade part **331a** and the lower blade part **332a** is formed greater than a width of the tape-like solder material **21** to be supplied, and is set to be commonly applicable to cutting of the tape-like solder material **21** of a plurality of width sizes including the tape-like solder material **21** of a maximum width to be supplied. For example, in the present embodiment, the maximum width of the tape-like solder material **21** to be supplied is 50 mm or less, and it is set that a plurality of tape-like solder materials **21** formed in a width smaller than the maximum width can be cut in common.

(84) The cutter unit **333** includes: the moving member **3331** in which the first cutting member **331** is configured; a pair of guide support members **335**, attached to and supported by the connection portion **383** supported by the lower base portion **381**, disposed spaced apart by a predetermined distance in an upper portion of the support member **334**, and guiding movement of the moving member **3331**; a one side holding member **336**, provided in the first direction of the moving member **3331** and restricting movement of the moving member **3331** toward one side in the first direction; and an other side holding member **337**, restricting movement of the moving member **3331** toward the other side in the first direction.

(85) The moving member **3331** includes in an upper part an upper attachment part **3331a** in which the first cutting member **331** is configured and in a lower part a lower connection portion **3331b** connected to the connection member **3423** described later, and includes between the upper attachment part **3331a** and the lower connection portion **3331b** an opening **3332** in which an opening allowing for arrangement of the tape-like solder material **21** is formed. The opening of the opening **3332** is formed in a size allowing the moving member **3331** to move between the standby position and the cutting position when the tape-like solder material **21** supported by the cut piece holding part **371** of the cut solder transfer part **37** described later is to be cut while allowing the cut piece holding part **371** to enter and exit a cutting support position (position adjacent to the second cutting member **332**).

(86) The pair of guide support members **335** are respectively disposed in the width direction of the moving member **3331** and include a guide **335a** guiding movement of the moving member **3331** in the second direction (up-down direction) while restricting movement thereof in the width direction, and a cutting support **335b** to which the second cutting member **332** is attached. The one side holding member **336** is attached to one side of the pair of guide support members **335** in the first direction, and the other side holding member **337** is attached to the other side of the pair of guide support members **335** in the first direction, above the second cutting member **332**.

(87) The one side holding member **336** has, for example, a square frame shape and includes an opening **3371** larger than the opening **3332** of the moving member **3331** in a position corresponding to the opening **3332**. The other side holding member **337** is provided between the moving member **3331** and a portion of the guidance defining part **338** opposite to the first direction

and restricts movement of the moving member **3331** toward the other side in the first direction. As shown in (G) of FIG. 7, the guidance defining part **338** has a first portion **338d** disposed on an upper surface of the other side holding member **337** and a second portion **338e** disposed on an upstream surface among side surfaces of the other side holding member **337**. The second portion **338e** includes an opening **338c** having a shape obtained by cutout in a substantially rectangular shape upward from a lower end of the second portion **338e**. The guidance member **25** is inserted into the opening **338c**, and left and right side parts of the opening **338c** are guide defining portions **338a** and **338a** defining a position of a side part of the guidance member **25**. At left and right lower ends of the opening **338c**, guidance lower defining portions **338b** and **338b** are formed protruding in a direction of the guide defining portion **338a** on the respective opposite sides and defining a position of a lower part of the guidance member **25**.

(88) (Second Drive Part **34**)

(89) The second drive part **34** actuates the first cutting member **331** in the second direction (Z direction) perpendicular to the plane part of the tape-like solder material **21**. The plane part is the upper surface or the lower surface of the tape-like solder material **21**. In the present embodiment, the second drive part **34** actuates the first cutting member **331** between a cutting standby position provided above the upper surface of the tape-like solder material **21** and a cutting completion position provided below the upper surface of the tape-like solder material **21**. The second drive part **34** is disposed on one side of the lower base portion **381** in the first direction, and includes a second moving body **34a** moving in the first direction, and a second actuator **341**. The second drive part **34** includes a transmission mechanism **342** transmitting an operation of the second actuator **341** to a cutting operation of the first cutting member **331**.

(90) The second actuator **341** is mounted on the lower base portion **381** and linearly moves a transmission moving body **343** movable in the feeding direction (first direction (X direction)). The transmission mechanism **342** converts the linear motion of the transmission moving body **343** into a linear motion in the second direction (Z direction) perpendicular to the plane part of the tape-like solder material **21**, and transmits the above linear motion to the upper blade **331**.

(91) As shown in FIG. 5, the transmission mechanism **342** is a plane cam mechanism and includes a plane cam **3421**, a cam follower **3422**, and the connection member **3423**. The transmission moving body **343** is mounted on a moving body mounting member **343a** and driven by the second actuator **341** to move to one side in the first direction. The moving body mounting member **343a** is provided on a mounting member support **343b**. The plane cam **3421** is configured in a downstream portion of the transmission moving body **343**. In the present embodiment, a cam surface **3421a** is in a state inclined diagonally upward from a downstream portion toward an upstream portion.

(92) The cam follower **3422** abuts against the cam surface **3421a** of the plane cam **3421**, and moves in the second direction due to movement of the transmission moving body **343**, that is, the cam surface **3421a**, toward one side in the first direction. The cam follower **3422** is supported by the connection member **3423**, and the connection member **3423** is connected to the moving member **3331** and the first cutting member **331** as described above. In the present embodiment, the cam follower **3422** is pushed down by the cam surface **3421a** of the plane cam **3421** as the transmission moving body **343** moves toward the downstream side in the first direction. Accordingly, the connection member **3423**, the moving member **3331** and the first cutting member **331** of the cutting part **33** move downward, and the tape-like solder material **21** can be cut by the upper blade part **331a** of the first cutting member **331** and the lower blade part **332a** of the second cutting member **332**.

(93) The transmission mechanism **342** of the second drive part **34** includes an energization mechanism **3424** energizing the connection member **3423** upward. The energization mechanism **3424** includes: a moving end **3424a**, connected to the connection member **3423** and moving as the connection member **3423** moves; a fixed end **3424b**, fixed to the lower base portion **381**; and an energization member **3424c** (for example, a spring member as an elastic member), disposed



between the moving end **3424a** and the fixed end **3424b** and imparting upward movement force to the moving end **3424a**.

(94) The first cutting member **331** that has moved downward is imparted with upward movement force from the energization mechanism **3424** due to movement of the transmission moving body **343** toward the other side in the first direction by an operation of the second actuator **341**, and starts an upward movement. In detail, the cam follower **3422** configured on the connection member **3423** abuts against the plane cam **3421** by upward energization force from the energization mechanism **3424**, and its upward movement is restricted. By moving the transmission moving body **343** toward the other side in the first direction, the restriction on upward movement imposed by the plane cam **3421** is gradually removed. The first cutting member **331** is gradually moved upward by gradually removing the restriction on upward movement imposed by the plane cam **3421**, and the upper blade part **331a** configured in the first cutting member **331** will be moved upward as the first cutting member **331** moves upward.

(95) (Second Holding Part **35**)

(96) As shown in FIG. 5 and (B) of FIG. 6, the second holding part **35** is provided between the first holding part **31** and the cutting part **33** in the first direction, and holds and releases the tape-like solder material **21** to be cut. The second holding part **35** includes the first holding member **351** and the second holding member **352** as well as a second holding drive part **353**. The second holding part **35** includes a support **35a** spaced by a predetermined distance from the support member **334** and connected to and supported by the upper base portion **382**, and a mounting part **35b** disposed above and spaced by a predetermined distance from the upper base portion **382** and supported by the support member **334** and the support **35a**. The first holding member **351** and the second holding member **352** as well as the second holding drive part **353** are supported by the mounting part **35b**.

(97) The first holding member **351** and the second holding member **352** face each other and are provided so as to approach and separate from each other. The second holding drive part **353** actuates at least one of the first holding member **351** and the second holding member **352** in the second direction (Z direction) perpendicular to the plane part of the tape-like solder material **21**. Each tip of the first holding member **351** and the second holding member **352** is formed in a plane shape, formed and disposed so that their respective faces are able to abut against each other. Each tip of the first holding member **351** and the second holding member **352** is disposed so as to be in a central part of the guidance member **25** in the width direction.

(98) The second holding drive part **353** includes a fourth actuator **3531** and a transmission mechanism **3533**. The fourth actuator **3531** includes an actuator operation part **3532** configured on the mounting part **35b** and movable in the second direction (Z direction). The actuator operation part **3532** is disposed on the mounting part **35b** so as to pass through an opening formed in the mounting part **35b**, and the actuator operation part **3532** is linearly moved in the up-down direction.

(99) In the present embodiment, the transmission mechanism **3533** actuates the first holding member **351** and the second holding member **352**. Specifically, the transmission mechanism **3533** includes an upper chuck mechanism **3534**, an upper elastic member (spring member) **351a**, an upper follower part **3535**, a lower chuck mechanism **3536**, a lower elastic mechanism (spring member) **352a** and a lower follower part **3137**. The transmission mechanism **3533** includes an intermediate transmission mechanism (balance mechanism) **3538** supported by the mounting part **35b** and transmitting the linear motion of the actuator operation part **3532** to the first holding member **351**.

(100) The upper chuck mechanism **3534** includes the first holding member **351** and the upper elastic member (spring member) **351a**, and the upper follower part **3535** is connected to the first holding member **351**. The upper chuck mechanism **3534** includes: an upper support **351b**, supported by the mounting part **35b**; an upper moving body (not shown), to which the first holding member **351** is connected, provided on the upper support **351b** so as to be movable in the up-down direction; and a contact part (not shown) included in the upper support **351b**. The upper elastic

member **351a** has one side connected to the first holding member **351** and the other side connected to the upper support **351b**, thereby imparting downward elastic force (movement force). The upper follower part **3535** is engaged with an intermediate transmission member **3538b** of the intermediate transmission mechanism **3538** described later.

(101) When the actuator operation part **3532** advances, the upper chuck mechanism **3534** rises; when the actuator operation part **3532** retreats, the upper chuck mechanism **3534** lowers. Specifically, since the actuator operation part **3532** abuts against the contact part (not shown) and moves upward, the first holding member **351** is moved upward, and the upper follower part **3535** is also moved upward. Thereby, the upper chuck mechanism **3534** abuts against an engagement part of the intermediate transmission mechanism **3538**. When the actuator operation part **3532** retreats, the first holding member **351** is moved downward by being imparted with downward elastic force (movement force) of the upper elastic member (spring member) **351a**, and the upper follower part **3535** is also moved downward. Thereby, the upper chuck mechanism **3534** is separated from the engagement part of the intermediate transmission mechanism **3538**.

(102) The intermediate transmission mechanism **3538** includes an intermediate support **3538a** supported by the mounting part **35b** and the intermediate transmission member **3538b** swingably supported by the intermediate support **3538a**. The intermediate transmission mechanism **3538** includes a swing restriction mechanism **3538c** restricting a swinging operation in one direction of the intermediate transmission member **3538b**. The intermediate support **3538a** has one side supported by the mounting part **35b**, and swingably supports the intermediate transmission member **3538b** at the other end. The intermediate transmission member **3538b** is a rectangular member, and is axially supported by the intermediate support **3538a** so as to be swingable about an axis whose central part is provided parallel to the first direction. In short, the intermediate transmission mechanism **3538** is configured as a balance mechanism swingably supporting the intermediate transmission member **3538b**. The swing restriction mechanism **3538c** is supported by the mounting part **35b** and restricts upward swinging movement of the other end of the intermediate transmission member **3538b**.

(103) The lower chuck mechanism **3536** includes the second holding member **352** and the lower elastic member **352a**, and the lower follower part **3537** is connected to the second holding member **352**. The lower chuck mechanism **3536** includes a lower support **352b** supported by the mounting part **35b**, and a lower moving body (not shown) to which the second holding member **352** is connected, the lower moving body being provided on the lower support **352b** so as to be movable in the up-down direction. The lower elastic member **352a** has one side connected to the second holding member **352** and the other side connected to the lower support **352b**, thereby imparting upward elastic force (movement force). Since the lower follower part **3537** is maintained in a state of being moved to abut against the other end of the intermediate transmission member **3538b** by elastic force of the lower elastic member **352a**, the lower chuck mechanism **3536** is able to reciprocate in the up-down direction as the other end of the intermediate transmission member **3538b** swings.

(104) In the second holding part **35**, the actuator operation part **3532** abuts against the contact part of the upper chuck mechanism **3534** by advancing (moving) upward, and, by further raising the actuator operation part **3532**, the upper chuck mechanism **3534** is moved upward against downward movement force of the upper elastic member (spring member) **351a**. Then, the upper follower part **3535** is raised as the first holding member **351** is moved upward, and abuts against one end of the intermediate transmission member **3538b** to move one end of the intermediate transmission member **3538b** upward. By moving one end of the intermediate transmission member **3538b** upward, the other end of the intermediate transmission member **3538b** is lowered against upward movement force of the lower elastic member (spring member) **352a**. By lowering the lower follower part **3537** that abuts against the other end, the lower chuck mechanism **3536** is lowered and the second holding member **352** is lowered.

(105) In the second holding part **35**, since the actuator operation part **3532** advances (moves) downward, downward movement force of the upper elastic member (spring member) **351a** is transmitted to the upper chuck mechanism **3534**. By further movement of the actuator operation part **3532** in a direction away from the contact part of the upper chuck mechanism **3534**, the upper chuck mechanism **3534** is moved downward. Then, the upper follower part **3535** is lowered as the first holding member **351** is moved downward, and, by releasing the contact with one end of the intermediate transmission member **3538b**, upward movement of one end of the intermediate transmission member **3538b** is canceled. By cancelation of the upward movement of one end of the intermediate transmission member **3538b**, the lower chuck mechanism **3536** is imparted with upward movement force of the lower elastic member (spring member) **352a**. As the second holding member **352** is raised, the lower follower part **3537** is raised, thereby abutting against the other end of the intermediate transmission member **3538b** and raising the other end. The other end of the intermediate transmission member **3538b** that is moved upward by rising of the lower chuck mechanism **3536** is restricted from moving upward by the swing restriction mechanism **3538c**.

(106) Accordingly, it is possible to hold and release the tape-like solder material **21** by the first holding member **351** and the second holding member **352**. By releasing the holding of the tape-like solder material **21** by the first holding part **31** after the second holding part **35** has held the tape-like solder material **21**, preparation can be made for a next feeding operation of the tape-like solder material **21** by the first holding part **31**. Accordingly, the first holding part **31** for the next cutting can be efficiently prepared.

(107) The second holding part **35** may be configured so that the tape-like solder material **21** can be held and released by only the second holding member **352** on the lower side, for example, by the second holding member **352** adhering to and releasing the lower surface of the tape-like solder material **21**. A holding member may be adopted so that an adhesion mark is not left when holding is performed by adhesion.

(108) (Cleaning Unit **36**)

(109) The cleaning unit **36** is provided in a position on the downstream side of the cutting part **33** on the frame **38**. The cleaning unit **36** cleans the cam surface **3421a** of the plane cam **3421** and the cam follower **3422**, for example, by air blow. Specifically, the cleaning unit **36** includes a nozzle **361** disposed toward the cam surface **3421a** of the plane cam **3421** and the cam follower **3422**, and blows out supplied compressed air from the nozzle **361**. The cleaning unit **36** may be configured to clean at least one of the cam surface **3421a** of the plane cam **3421** and the cam follower **3422**. Accordingly, at least one of the cam surface **3421a** of the plane cam **3421** and the cam follower **3422** can be kept clean, and a malfunction (for example, vibration) of the transmission mechanism **342** can be prevented.

(110) (Cut Solder Transfer Part **37**)

(111) FIG. **8** is an enlarged perspective view showing the cut solder transfer part **37** shown in FIG. **4** and FIG. **5**. As shown in FIG. **8**, the cut solder transfer part **37** includes the cut piece holding part **371** and a cut piece holding drive part **372**. The cut piece holding part **371** receives and holds in the cutting support position a solder piece obtained by cutting by the cutting part **33** from the tape-like solder material **21**. The cut piece holding drive part **372** moves the cut piece holding part **371** between the cutting support position and the takeout position separated from the cutting support position, the takeout position being where the solder piece is taken out.

(112) The cut piece holding drive part **372** is provided on the lower base portion **381**, and includes a support member **37a**, an actuator mounting table **372c**, a fifth actuator **372a**, a moving part **372b**, and a support **371a**. The support member **37a** is provided on the lower base portion **381** and supports the actuator mounting table **372c**. The actuator mounting table **372c** has the fifth actuator **372a** mounted thereon. The fifth actuator **372a** reciprocates the moving part **372b** in the first direction. The support **371a** is provided on a restriction part **371c** and supports, while allowing up-down movement of, a moving body **371b**, that is, the cut piece holding part **371**. Accordingly, it is

possible that the cut piece holding part **371** is driven by the fifth actuator **372a** to reciprocate between the takeout position and the cutting support position in the first direction.

(113) The cut piece holding drive part **372** includes a height adjustment part **373a** adjusting a height position of the cut piece holding part **371**. The height adjustment part **373a** includes an elastic member **371d** imparting upward movement force of the moving body **371b**, and a height adjustment screw **373** restricting upward movement of the moving body **371b** and adjusting the height. The elastic member **371d** is disposed between the moving body **371b** and the restriction part **371c**. The height adjustment screw **373** is fixed to the restriction part **371c** and adjusts upward movement of the cut piece holding drive part **372** by a screw mechanism, thereby adjusting the height position at which the lower surface of the tape-like solder material **21** in the cutting position is supported.

(114) In the above movement of the cut piece holding part **371** by the fifth actuator **372a**, the cut piece holding part **371** is provided so as to be able to pass through the opening **3332** in the moving member **3331** of the cutter unit **333**, and is adjacent to the second cutting member **332** in the cutting position set in the cutter unit **333**. In the cut piece holding part **371**, the height of a support surface supporting the tape-like solder material **21** is adjusted by the height adjustment part (screw mechanism) **373a** so as to be at the same height position as a support surface of the second cutting member **332** supporting the lower surface of the tape-like solder material **21** before cutting. Accordingly, the cut solder transfer part **37** is able to transfer the solder piece from the cutting support position to the takeout position by the cut piece holding part **371**.

(115) (Advantages of Solder Cutting Device **3**)

(116) In the solder cutting device **3**, an axis direction of a drive shaft or a forward/backward direction of a drive part is configured toward the first direction or the second direction rather than the width direction of the tape-like solder material **21**, in other words, the direction orthogonal to the first direction and the second direction. That is, in the solder cutting device **3**, the axis of the drive shaft does not face the width direction of the tape-like solder material **21**, or the drive part does not move forward or backward in the width direction of the tape-like solder material **21**. Thus, in the solder cutting device **3**, it is possible to significantly reduce a device size (dimension) in the width direction of the tape-like solder material **21** as compared with the conventional device described in Patent Document 1 and the like. For example, when the conventional device has a device width of 200 mm, the device width of the solder cutting device **3** at the same scale is 50 mm or less, and the device width is actually  $\frac{1}{4}$  or less. Such an effect is realized in particular by the first drive part **32** being the first actuator, and the second drive part **34** including the holding moving body **3132**, the second actuator **341** and the transmission mechanism **342**. Since the solder cutting device **3** has a significantly small device width per unit, for example, in a system in which a plurality of solder cutting devices **3** are installed side by side in the width direction and a solder piece supplied from each solder cutting device **3** is used, the effect of suppressing the device width is enhanced in proportion to the number of the solder cutting devices **3** installed. As a result, since a footprint of this system becomes smaller, the system can be reduced in size.

(117) (Solder Cutting Unit **4**)

(118) As shown in FIG. **4** and FIG. **5**, the solder cutting unit **4** includes the frame **38**, and the frame **38** is equipped with the first holding part **31**, the first drive part **32**, the cutting part **33**, the second drive part **34** and the second holding part **35** in the solder cutting device **3**. Specifically, on the frame **38**, the upper base portion **382** provided with the first drive part **32**, the support member **334** provided with the cutting part **33**, the lower base portion **381** provided with the second drive part **34** and the mounting part **35b** provided with the second holding part **35** are provided. The first holding part **31** is mounted on the first drive part **32**.

(119) In a first layer being a lowermost layer of the frame **38**, that is, between the lower base portion **381** and the upper base portion **382**, the second actuator **341** as well as the plane cam **3421**, the cam follower **3422** and a lower part of the connection member **3423** of the transmission

mechanism **342** are provided. Specifically, the tape-like solder material **21** is guided by the guidance member **25** disposed above the first layer and sent above the first layer. Between the tape-like solder material **21** sent in this way and the first layer, the first holding part **31**, the first drive part **32**, the cutting part **33** and the second drive part **34** are provided.

(120) In detail, the first holding member **311** of the first holding part **31** and the first holding member **351** of the second holding part **35** are located above the tape-like solder material **21**. Similarly, the upper blade (first cutting member) **331** of the cutting part **33** is located above the tape-like solder material **21**.

(121) According to the above configuration, in the part mounting device **5** including a transfer unit **54**, even if a plurality of solder cutting devices **3** are provided side by side in the width direction, as described above, since the plurality of solder cutting devices **3** have a small device width overall, a movable width (movement distance) of the transfer unit **54** may also be small. This means that work time required for transferring a solder piece in the part mounting device **5** is shortened. That is, in the part mounting device **5**, it is possible to transfer a solder piece in a short cycle time, and high-speed processing is possible. Since the solder cutting unit **4** can be replaced together with the frame **38**, replacement work is easy and positioning reproducibility at the time of re-installation is good.

(122) As shown in FIG. 5, in the solder cutting unit **4**, the second actuator **341** and the transmission mechanism **342** are provided on the lower base portion **381** in the first layer, and the tape-like solder material **21** is guided by the guidance member **25** disposed above the first layer and is sent above the first layer. The upper base portion **382** is provided between the tape-like solder material **21** to be sent and the first layer, and the upper base portion **382** is provided with the first drive part **32** (first actuator) and the second holding part **35**.

(123) The upper base portion **382** and the lower base portion **381** of the frame **38** include the connection portion **383** connected to each other on one side in the feeding direction (first direction). The first drive part **32** (first actuator) is provided on the other side of the upper base portion **382** away from the connection portion **383**, and the second actuator **341** is provided on the other side of the lower base portion **381** away from the connection portion **383**. According to the above configuration, removal work when the first drive part **32** (first actuator) and the second drive part **34** (second actuator **341**) are removed from the frame **38** from one of a plurality of solder cutting units **4** disposed side by side, in particular, is easy. During this removal work, the solder supply unit **2** is removed from the solder cutting unit **4** prior to removal of the first drive part **32** and the second drive part **34**.

(124) As shown in FIG. 5, in the solder cutting unit **4**, the first holding part **31**, the first drive part **32**, the cutting part **33**, the second drive part **34**, the second holding part **35** and the cut solder transfer part **37** are provided on the frame **38**. On the frame **28**, a solder transfer support provided with the cut solder transfer part **37** is provided. The first holding part **31**, the first drive part **32**, the cutting part **33**, the second drive part **34** and the second holding part **35** are provided on a supply processing side where the tape-like solder material **21** is supplied based on the connection portion **383**, and the cut solder transfer part **37** is provided on a takeout side where a solder piece obtained by cutting is taken out based on the connection portion **383**. Accordingly, since the solder cutting unit **4** can be replaced together with the frame **38** including the cut solder transfer part **37**, replacement work is easy. During this replacement work, the solder supply unit **2** is removed from the solder cutting unit **4** prior to replacement of the solder cutting unit **4**.

(125) (Operation of First Holding Part **31**, First Drive Part **32** and Cutting Part **33**)

(126) FIG. 9 is an explanatory view of an operation from feeding of the tape-like solder material **21** by the first holding part **31** to cutting of the tape-like solder material **21** by the cutting part **33** in the solder cutting device **3** shown in FIG. 5.

(127) As shown in FIG. 9, in the solder cutting device **3**, the tape-like solder material **21** is cut into a solder piece **211** of a predetermined length through steps from state ST91 to state ST98. State

ST91 shows a state in which the first holding member 311 and the second holding member 312 are open. State ST92 shows a state in which the tape-like solder material 21 is fed in. State ST93 shows a state in which the first holding member 311 and the second holding member 312 are closed and the tape-like solder material 21 is sandwiched. State ST94 shows a state in which the first holding member 311 and the second holding member 312 are opened. State ST95 shows a state in which the first holding part 31 is moved backward together with the unit. State ST96 shows a state in which the first holding member 311 and the second holding member 312 are closed and the tape-like solder material 21 is sandwiched again. State ST97 shows a state in which the first holding part 31 is moved forward together with the unit. State ST98 shows a state in which the tip of the tape-like solder material 21 is cut by the upper blade 331 and the lower blade 332, and the solder piece 211 is cut out. After state ST98, the process returns to the step of state ST94 in order to cut out a new solder piece 211 from the tape-like solder material 21, and the steps from state ST94 to state ST98 are repeated in sequence.

(128) (Solder Piece Manufacturing Device 12)

(129) As shown in FIG. 1, the solder piece manufacturing device 12 includes the solder cutting unit 4 and the solder supply unit 2. That is, the solder piece manufacturing device 12 includes: the platform 11; the solder cutting unit 4, attached to the platform 11 and cutting a continuous tape-like solder material 21 at a predetermined length into a solder piece; and the solder supply unit 2, supplying the continuous tape-like solder material 21 to the solder cutting unit 4. Accordingly, in the solder piece manufacturing device 12, during manufacture of the solder piece, since the tape-like solder material 21 can be easily replaced or newly supplied, the solder piece can be efficiently manufactured.

(130) In the solder piece manufacturing device 12 of the above configuration, the solder cutting unit 4 is configured to include the identification mechanism (identification member) 261 identifying a reel width of a reel by detecting the marking portion 262b. Accordingly, in the solder piece manufacturing device 12, in the case of replacing the solder cutting unit 4, even if the base member 22 of the solder cutting unit 4 is attached or removed, the solder cutting unit 4 is able to identify the reel width of the reel by detecting the marking portion 262b by the identification mechanism (identification member) 261.

(131) In the solder piece manufacturing device 12 of the above configuration, in the solder supply unit 2, at least one of the support member 24 and the guidance member 25 has the identification area 26 in a portion thereof. In the identification area 26, the predetermined marking portion 262b corresponding to each of a plurality of reel widths of the reel held by the reel holder 23 is provided. The solder cutting unit 4 is configured to include the identification mechanism (identification member) 261 identifying the reel width of the reel by detecting the marking portion 262b. Accordingly, similarly, in the solder piece manufacturing device 12, in the case of replacing the solder cutting unit 4, even if the base member 22 of the solder cutting unit 4 is attached or removed, the solder cutting unit 4 is able to identify the reel width of the reel by detecting the marking portion 262b by the identification mechanism (identification member) 261.

(132) In the solder piece manufacturing device 12, the frame 38 is provided on the platform 11, the base member 22 is supported by the movement mechanism 28, and is provided on the platform 11 so that the solder supply unit 2 is movable in the first direction between the attachment position S and the detachment position R. The identification area 26 is provided on the platform 11. In the solder piece manufacturing device 12, the reel holder 23 and the support member 24 are provided on the base member 22, the guidance member 25 is provided on the support member 24, and are integrally configured. Accordingly, in the solder piece manufacturing device 12, in the case of replacing the solder supply unit 2, the solder supply unit 2 can be efficiently attached and detached by attachment and removal of the base member 22 of the solder supply unit 2. In the solder piece manufacturing device 12, in the case of replacing the solder supply unit 2 corresponding to various types of tape-like solder materials 21, since the solder cutting unit 4 has a common configuration

for shared use, the solder supply unit **2** corresponding to a plurality of types can be efficiently replaced.

(133) (Part Mounting Device **5**)

(134) (A) of FIG. **10** is a prospective sectional view showing a state of the part mounting device **5** cut along the first direction (feeding direction), and (B) of FIG. **10** is a perspective view of the part mounting device **5** of (A) of FIG. **10** as viewed from a direction of an arrow **10B**.

(135) As shown in (A) of FIG. **10** and (B) of FIG. **10**, the part mounting device **5** is a so-called mounter, and includes the platform **11**, a solder cutting unit group **51**, a mounting support **52**, and the transfer unit **54**. The part mounting device **5** includes an imaging part **58**. The part mounting device **5** includes a first conveyance device **53**.

(136) The platform **11** includes a leg **11a**, a mounting part **11b**, a support **11c** and a base **11d**. The base **11d** is a flat plate-shaped member located in a lower part of the platform **11**. The leg **11a** is a plurality of columnar members provided on the base **11d** and supports the mounting part **11b**. The mounting part **11b** is a flat plate-shaped member on which the solder supply unit **2** and the solder cutting unit **4** are mounted. The support **11c** is provided to the left and right of the solder supply unit **2** and the solder cutting unit **4** on the mounting part **11b** in the width direction, and supports the transfer unit **54**.

(137) As shown in (A) of FIG. **10** and (B) of FIG. **10**, in the part mounting device **5**, a plurality of solder supply units **2** and solder cutting devices **3** (solder cutting units **4**) provided in the solder piece manufacturing device **12** are disposed side by side in the width direction on the platform **11** (mounting part **11b**). In detail, on the platform **11** (mounting part **11b**), a mounting reception member **51a** having a flat plate shape is provided, and the solder piece manufacturing device **12** is provided on the mounting reception member **51a**.

(138) The solder cutting unit group **51** has a configuration in which a plurality of solder cutting units **4** are detachably disposed in parallel on the platform **11**. In the solder cutting unit group **51**, a first solder cutting unit group **511** is disposed on one side in the width direction, and a second solder cutting unit group **512** is disposed on the other side in the width direction. The first solder cutting unit group **511** is supplied with a plurality of types of tape-like solder materials **21** and manufactures a solder piece required for the mounting object **56**. Similarly, the second solder cutting unit group **512** is supplied with the tape-like solder material **21** of the same type as the first solder cutting unit group **511** and manufactures a solder piece required for the mounting object **56**. By manufacturing the same type of solder piece by the first solder cutting unit group **511** and the second solder cutting unit group **512**, even if the manufacture of the solder piece by the first solder cutting unit group **511** is interrupted, it is possible to manufacture the same type of solder piece by the second solder cutting unit group **512** as a backup, and the solder piece can be continuously mounted on the mounting object **56** in the part mounting device **5** without stops.

(139) The mounting support **52** is provided on the platform **11** and supports the mounting object **56** (see FIG. **11**) being a workpiece mounted with the solder piece **211** cut from the tape-like solder material **21**. The mounting object **56** may be a tray accommodating a plurality of solder pieces **211**. In (A) of FIG. **10** and (B) of FIG. **10**, the mounting support **52** is indicated by a dotted ellipse. In the present embodiment, the mounting support **52**, for example, corresponds to a positioning unit (including one engaged with a positioning pin configured on a mounting table) configured in the middle of a conveyor.

(140) The first conveyance device **53** is provided on the platform **11**, conveys the mounting object **56** before mounting of the solder piece **211** to the mounting support **52**, and conveys the mounting object **56** of the mounting support **52** after mounting of the solder piece **211** to the outside of the mounting support **52**. As the first conveyance device **53**, a conveyor including an endless moving member (for example, a chain or a belt), or a conveyor in which a plurality of rollers are arranged, or a moving unit holding and moving the mounting object **56**, or the like, is adopted. In detail, on the platform **11** (mounting part **11b**), the mounting reception member **53a** having a flat plate shape

is provided, and the first conveyance device **53** is provided on the mounting reception member **53a**.  
(141) The transfer unit **54** transfers and mounts each solder piece **211** obtained by cutting by the solder cutting unit group **51** to the mounting object **56** of the mounting support **52**. The transfer unit **54** specifically includes a transfer head unit **541** and a head support **542**. The head support **542** supports the transfer head unit **541**, is provided across two supports **11c** and **11c** provided separated from each other, and is movable in the X direction (feeding direction (first direction)). The transfer head unit **541** is movable in a third direction being a Y direction orthogonal to the X direction. The transfer head unit **541** includes a plurality of (two in the present embodiment) holding units **5411** holding the solder piece **211** (see FIG. **9**) and movable in the second direction (up-down direction) being the Z direction orthogonal to the X direction and the Y direction. Accordingly, the transfer unit **54** holds the solder piece **211** on the cut piece holding part **371** and transfers the solder piece **211** to the mounting object **56** of the mounting support **52**.

(142) The imaging part **58** is provided between the solder cutting device **3** and the mounting support **52**, images from below the solder piece held in the solder head unit **541** of the transfer unit **54**, and calculates a correction value being a positional error in an XY direction with respect to a predetermined reference position and a posture error about an Z direction axis with respect to a predetermined reference posture. The imaging part **58** includes an imaging unit including a camera and a light source unit serving as a light source during imaging.

(143) In the part mounting device **5** configured in this way, by adopting the solder piece manufacturing device **12** including the solder cutting unit **4** and the solder supply unit **2** of the present invention, the area occupied by the part mounting device **5** in the width direction can be reduced, and an installation location can be effectively utilized. Since the movement distance by the transfer unit **54** is reduced, the solder piece can be efficiently mounted. In the part mounting device **5**, since the tape-like solder material **21** can be easily replaced, it is possible to continuously and efficiently mount the solder piece **211** on the mounting object **56**.

(144) (Production System **1**)

(145) (A) of FIG. **11** to (E) of FIG. **11** are schematic views showing each type of the part mounting device **5**. In the part mounting device **5** of a standard type TO, the mounting support **52** is provided within an area of the part mounting device **5** and positions and supports the mounting object **56** within the area of the part mounting device **5**. Transfer of the mounting object **56** to the mounting support **52** within the area of the part mounting device **5** or transfer of the mounting object **56** from the mounting support **52** within the area of the part mounting device **5** is performed by a transfer device (not shown) or an operator.

(146) The part mounting device **5** of type T1 is a type in which the first conveyance device **53** is configured in the part mounting device **5** of the standard type TO. In the part mounting device **5** of type T1, the first conveyance device **53** is provided within the area of the part mounting device **5** and transfers the mounting object **56** within the area of the part mounting device **5**. The mounting support **52** is provided in the middle of the first conveyance device **53**, and the mounting object **56** is transferred to the mounting support **52** and from the mounting support **52**. The first conveyance device **53** receives and transfers the mounting object **56** from the outside of the area of the part mounting device **5**, and delivers and transfers the mounting object **56** to the outside of the area of the part mounting device **5**.

(147) The part mounting device **5** of type T2 is a type in which the first conveyance device **53** is configured in the part mounting device **5** of the standard type TO. In the part mounting device **5** of type T2, the first conveyance device **53** is provided so as to pass through the inside of the area of the part mounting device **5**, and transfers the mounting object **56** between the inside and outside of the area of the part mounting device **5**. The mounting support **52** is provided in the middle of the first conveyance device **53**, and the mounting object **56** is transferred to the mounting support **52** and from the mounting support **52**. The first conveyance device **53** receives and transfers the mounting object **56** from the outside of the area of the part mounting device **5**, and delivers and



transfers the mounting object 56 to the outside of the area of the part mounting device 5.

(148) The part mounting device 5 of type T3 is a type in which the first conveyance device 53 is configured in the part mounting device 5 of the standard type TO. In the part mounting device 5 of type T3, the first conveyance device 53 is provided so as to pass through the inside of the area of the part mounting device 5, and transfers the mounting object 56 between the inside and outside of the area of the part mounting device 5. The mounting support 52 is provided within the area of the part mounting device 5 in a direction intersecting a transfer direction of the first conveyance device 53, and the mounting object 56 is transferred between the mounting support 52 and the first conveyance device 53 by a mounting object transfer mechanism (not shown). The first conveyance device 53 receives and transfers the mounting object 56 from the outside of the area of the part mounting device 5, and delivers and transfers the mounting object 56 to the outside of the area of the part mounting device 5.

(149) A configuration (type T3-1) may be adopted in which a second conveyance device 55 (described later) in place of the first conveyance device 53 of the part mounting device 5 of type T3 is disposed outside the area of the part mounting device 5 and adjacent to the part mounting device 5 (type T3-1). The part mounting device 5 of type T3-1 is a type in which the second conveyance device 55 is added to the part mounting device 5 of the standard type TO. In the part mounting device 5 of type T3-1, the second conveyance device 55 is provided so as to convey the mounting object 56 along the inside of the area of the part mounting device 5 while being adjacent to the inside of the area. The mounting support 52 is provided within the area of the part mounting device 5 in a direction intersecting a transfer direction of the second conveyance device 55, and the mounting object 56 is transferred between the mounting support 52 and the second conveyance device 55 by the mounting object transfer mechanism (not shown).

(150) (A) of FIG. 12 to (D) of FIG. 12 are schematic views showing the production system 1 including each type of the part mounting device 5 shown in (A) of FIG. 11 to (E) of FIG. 11. The production system 1 includes the temperature processing device 57 that performs temperature processing on the mounting object 56 mounted with the solder piece 211. In (A) of FIG. 12 to (D) of FIG. 12, the solder piece manufacturing device 12 including the solder supply unit 2 and the solder cutting device 3 (solder cutting unit 4) as well as the transfer unit 54 are omitted.

(151) The production system 1 shown in (A) of FIG. 12 includes the part mounting device 5 of type T1 and the temperature processing device 57. The production system 1 includes a plurality of part mounting devices 5, and the second conveyance device (mounting object transfer device) 55 that conveys the mounting object 56 between the part mounting devices 5, conveys the mounting object 56 within the area of the part mounting device 5, conveys the mounting object 56 to the part mounting device 5 and the temperature processing device 57, and conveys the mounting object 56 to the present production system 1. In the present production system 1, the part mounting device 5 of type T1 is disposed so that a conveyance path of the mounting object 56 is formed continuously (in a straight line in (A) of FIG. 12). In the present embodiment, the conveyance path is formed by connecting the first conveyance device 53 configured in the part mounting device 5 of type T1 and the second conveyance device 55.

(152) The part mounting device 5 disposed in a broken line portion of the present production system 1 may be either the part mounting device 5 of the standard type TO or the part mounting device 5 of type T1. For example, when the part mounting device 5 is installed in advance, the part mounting device 5 disposed in the broken line portion may be composed of the part mounting device 5 of type T1; when the part mounting device 5 is configured in a portion of the second conveyance device 55 configured in advance, the part mounting device 5 disposed in the broken line portion may be composed of the part mounting device 5 of the standard type TO.

(153) The production system 1 shown in (B) of FIG. 12 includes the part mounting device 5 of type T2 and the temperature processing device 57. The present production system 1 includes a plurality of part mounting devices 5, and conveyance of the mounting object 56 between the part mounting

devices 5, conveyance of the mounting object 56 within the area of the part mounting device 5, and conveyance of the mounting object 56 to the part mounting device 5 and the temperature processing device 57 are performed by the first conveyance device 53 included in the part mounting device 5 of type T2. In the present production system 1, the part mounting device 5 of type T2 is disposed so that the conveyance path of the mounting object 56 is formed continuously (in a straight line in (B) of FIG. 12), and the conveyance path is formed by connecting the first conveyance devices 53 configured in each part mounting device 5 to each other.

(154) The production system 1 shown in (C) of FIG. 12 includes the part mounting device 5 of type T3 and the temperature processing device 57. The present production system 1 includes a plurality of part mounting devices 5, and conveyance of the mounting object 56 between the part mounting devices 5 is performed by the first conveyance device 53 configured in each part mounting device 5. The present production system 1 includes the temperature processing device 57, and the second conveyance device 55 that conveys the mounting object 56 to the present production system 1. In the present production system 1, the part mounting device 5 of type T3 is disposed so that the conveyance path of the mounting object 56 is formed continuously (in a straight line in (C) of FIG. 12), and the conveyance path is formed by connecting the first conveyance device 53 configured in the part mounting device 5 and the second conveyance device 55.

(155) The production system 1 shown in (D) of FIG. 12 includes the part mounting device 5 of the standard type TO and the temperature processing device 57. The present production system 1 includes a plurality of part mounting devices 5, and the second conveyance device 55 that conveys the mounting object 56 to each part mounting device 5 and conveys the mounting object 56 to the temperature processing device 57. In the present production system 1, the second conveyance device 55 is provided so that the conveyance path of the mounting object 56 is formed continuously (in a straight line in (D) of FIG. 12), and the part mounting device 5 and the temperature processing device 57 are disposed along the conveyance path on one side of the second conveyance device 55. In the present production system 1, since the part mounting device 5 and the temperature processing device 57 are disposed side by side along the conveyance path of the second conveyance device 55, the part mounting device 5 and the temperature processing device 57 can be easily increased or decreased according to production capacity of the production system 1.

(156) As described above, the production system 1 can be configured by the part mounting device 5, the temperature processing device 57 and the second conveyance device 55. In this configuration, in the case of replacing the solder supply unit 2 attached to the solder cutting device 3, the solder supply unit 2 can be attached and detached by attachment and removal of the base member 22. As a result, operation efficiency of the entire production system 1 is improved.

## Embodiment 2

(157) Another embodiment of the present invention will be described below. For convenience of description, members having the same functions as those described in Embodiment 1 above are denoted by the same reference numerals, and description thereof will not be repeated. In the present embodiment, the production system 1 includes a solder supply unit 6 in place of the solder supply unit 2, and includes a solder cutting device 7 in place of the solder cutting device 3. Other configurations of the production system 1 are the same as those of Embodiment 1.

(158) (Solder Supply Unit 6)

(159) (A) of FIG. 13 is a perspective view showing a shape of an upper surface of a lower guide member 611 of a guidance member 61 provided in the solder supply unit 6 of the present embodiment, and showing a state in which an attachment guide member 73 is attached to the lower guide member 611. (B) of FIG. 13 is a perspective view showing a shape of a lower surface of the lower guide member 611 of the guidance member 61, and showing a state in which the attachment guide member 73 is attached to the lower guide member 611. As shown in (A) of FIG. 13 and (B) of FIG. 13, the solder supply unit 6 includes the guidance member 61 in place of the guidance member 25 of the solder supply unit 2. Other configurations of the solder supply unit 6 are the

same as those of the solder supply unit 2.

(160) (Guidance Member 61)

(161) As shown in (A) of FIG. 13 and (B) of FIG. 13, the guidance member 61 includes the lower guide member 611 and an upper guide member 612 extending in the feeding direction. The lower guide member 611 and the upper guide member 612 have a configuration corresponding to the lower guide member 251 and the upper guide member 252 of the solder supply unit 2. The lower guide member 611 includes a guideway 6111, an extension portion 6112 and a guidance side wall 6113 on the upper surface. The guideway 6111 corresponds to the guideway 2511 of the lower guide member 251, the extension portion 6112 corresponds to the extension portion 2512 of the lower guide member 251, and the guidance side wall 6113 corresponds to the guidance side wall 2513 of the lower guide member 251. The upper guide member 612 has the same shape as the upper guide member 252 of the solder supply unit 2 and includes an opening 6121 corresponding to the opening 2521.

(162) An opening 6114 is formed in the lower guide member 611 of the guidance member 61. The opening 6114 extends toward the upstream side from a downstream end of the lower guide member 611. An upstream end of the opening 6114 is at the same position as an upstream end of the first opening 2516 of the lower guide member 251. The opening 6114 is able to receive a first gripper and a second gripper of the solder cutting device 7 that are inserted from below. A formation range of the opening 6114, for example, matches a formation range of the opening 6121 of the upper guide member 612.

(163) The lower guide member 611 includes a tip 611b, two inclined parts 611b1 and 611b1, two lower tips 611b2 and 611b2, and two side tips 611c1 and 611c1. The tip 611b corresponds to the tip 251b of the lower guide member 251, the inclined part 611b1 corresponds to the inclined part 251b1 of the lower guide member 251, the lower tip 611b2 corresponds to the lower tip 251b2 of the lower guide member 251, and the side tip 611c1 corresponds to the side tip 251c1 of the lower guide member 251. Functions of the above parts of the guidance member 61 are the same as the functions of the corresponding parts of the guidance member 25.

(164) In the case where the solder supply unit 6 is attached to the solder cutting device 7, the attachment guide member 73 included in the solder cutting device 7 is inserted into the opening 6114 from the tip 611b, and guides the lower guide member 611 until reaching an attachment position. Accordingly, when the solder supply unit 6 is attached to the solder cutting device 7, the tip 611b of the guidance member 61 is attached in a predetermined position by being guided by the guidance defining part 338, and an upper surface of the attachment guide member 73 and a surface of the extension portion 6112 can be set at the same height position. Accordingly, the tape-like solder material 21 fed out by the guidance member 61 can be accurately fed out and set in a cutting position of the solder cutting device 7. The solder supply unit 6 has the same advantages as the solder supply unit 2.

(165) (Solder Cutting Device 7)

(166) FIG. 14 is a perspective view of the solder cutting device 7. FIG. 15 is a front view of the solder cutting device 7. As shown in FIG. 14 and FIG. 15, the solder cutting device 7 includes a first holding part 71 in place of the first holding part 31 of the solder cutting device 3 and a second holding part 72 in place of the second holding part 35. Other configurations of the solder cutting device 7 are the same as those of the solder cutting device 3.

(167) (First Holding Part 71)

(168) (A) of FIG. 16 is a side view of the first holding part 71 and the second holding part 72 shown in FIG. 14 and FIG. 15, and (B) of FIG. 16 is a partially enlarged perspective view of the first holding part 71 and the second holding part 72. As shown in (A) of FIG. 16 and (B) of FIG. 16, like the first holding part 31 of Embodiment 1, in Embodiment 2, the first holding part 71 includes a first holding member 711 and a second holding member 712 as well as a first holding drive part 713, and holds and releases the tape-like solder material 21. However, in the first holding

part **71**, the first holding member **711** is a moving member able to operate in the up-down direction, and the second holding member **712** is a fixed member that is fixed without movement in the up-down direction. Accordingly, the first holding drive part **713** actuates only the first holding member **711** in the second direction (Z direction) perpendicular to the plane part of the tape-like solder material **21**.

(169) The first holding drive part **713** includes a third actuator **7131** corresponding to the third actuator **3131** of the first holding drive part **313** of Embodiment 1, a transmission mechanism **7133** corresponding to the transmission mechanism **3133** of the first holding drive part **313** of Embodiment 1, and a holding moving body **7132** corresponding to the holding moving body **3132** of Embodiment 1. The transmission mechanism **7133** converts a linear motion of the holding moving body **7132** in the first direction (X direction) into a linear motion in the second direction (Z direction), and transmits the same as a linear motion of the first holding member **711** in the second direction (Z direction).

(170) Specifically, the transmission mechanism **7133** includes an upper chuck mechanism **7134** corresponding to the upper chuck mechanism **3134** of Embodiment 1, an upper follower part **7135** corresponding to the upper follower part **3135** of Embodiment 1, and a spring **7138** corresponding to the upper elastic member **3138** of Embodiment 1. An operation of the transmission mechanism **7133** for actuating the upper chuck mechanism **7134** is the same as that of the transmission mechanism **3133** of Embodiment 1. Like the first holding part **31** of Embodiment 1, the first holding part **71** may have various configurations depending on the application or combination of conventionally known techniques. Nonetheless, the first holding part **71** is not particularly limited to the configuration disclosed above if the tape-like solder material **21** can be held and released.

(171) (Second Holding Part **72**)

(172) As shown in (A) of FIG. **16** and (B) of FIG. **16**, the second holding part **72** includes a first holding member **721** corresponding to the first holding member **351** of the second holding part **35** of Embodiment 1 and a second holding drive part **723** corresponding to the second holding drive part **353** of Embodiment 1, and holds and releases the tape-like solder material **21**.

(173) In the second holding part **72**, the attachment guide member **73** functions as a second holding member (second gripper) in place of the second holding member **352** of the second holding part **35** of Embodiment 1. The attachment guide member **73** is provided in the cutting part **33**, and extends in a direction opposite to the feeding direction. The second holding drive part **723** actuates the first holding member **721** in the second direction (Z direction) perpendicular to the plane part of the tape-like solder material **21**.

(174) The second holding drive part **723** includes a fourth actuator **7231** corresponding to the fourth actuator **3531** of the second holding drive part **353** of Embodiment 1, and a transmission mechanism **7233** corresponding to the transmission mechanism **3533** of the second holding drive part **353** of Embodiment 1. The transmission mechanism **7233** includes an upper chuck mechanism **7234** corresponding to the upper chuck mechanism **3534** of the transmission mechanism **3533** of Embodiment 1. The upper chuck mechanism **7234** includes the first holding member **721** and a spring **7235**. The spring **7235** energizes the first holding member **721** downward.

(175) The upper chuck mechanism **7234** rises with upward movement of a moving body (not shown) of the fourth actuator **7231** when the fourth actuator **7231** operates, and when the fourth actuator **7231** stops operating and the moving body (not shown) of the fourth actuator **7231** moves downward, the upper chuck mechanism **7234** is energized by the spring **7235** to lower with the moving body (not shown) of the fourth actuator **7231**. The first holding member **721** moves the tape-like solder material **21** downward by lowering, and holds the tape-like solder material **21** in the guidance member **61** together with the attachment guide member **73** by being pressed against the attachment guide member **73**.

(176) Accordingly, it is possible to hold and release the tape-like solder material **21** by the first holding member **721** and the attachment guide member **73**. Other operations of the second holding

part 72 are the same as those of the second holding part 35 of Embodiment 1. Like the second holding part 35 of Embodiment 1, the second holding part 72 may have various configurations depending on the application or combination of conventionally known techniques. Nonetheless, the second holding part 72 is not particularly limited to the configuration disclosed above if the tape-like solder material 21 can be held and released.

(177) (Advantages of Solder Cutting Device 7)

(178) The solder cutting device 7 has a configuration in which only the first holding member 711 is raised and lowered in the first holding part 71, and only the first holding member 721 is raised and lowered in the second holding part 72. Accordingly, it is possible to simplify the configuration of the first holding drive part 713 of the first holding part 71 and the second holding drive part 723 of the second holding part 72.

(179) If the solder supply unit 6 is attached to the solder cutting device 7, as shown in (A) of FIG. 13 and (B) of FIG. 13, the second holding member 712 of the first holding part 71 and the attachment guide member 73 are inserted into the opening 6114 of the lower guide member 611 of the guidance member 61, and these function to guide the lower surface of the tape-like solder material 21. Accordingly, the tape-like solder material 21 can be stably guided. Other advantages of the solder cutting device 7 are the same as those of the solder cutting device 3 of Embodiment 1.

(180) [Conclusion]

(181) A solder cutting device according to one aspect of the present invention includes: a first holding part, holding and releasing a long tape-like solder material; a first drive part, equipped with the first holding part and causing the tape-like solder material held by the first holding part to be sent linearly in a first direction; a cutting part, including a first cutting member and a second cutting member that face each other and are provided so as to approach and separate from each other, and cutting the tape-like solder material located in a cutting position between the first cutting member and the second cutting member; and a second drive part, actuating at least one of the first cutting member and the second cutting member in a second direction perpendicular to a plane part of the tape-like solder material. The first drive part is a first actuator being electrically-driven and converting a rotational motion of a rotating body whose axis extends in the first direction into a linear motion in the first direction. The second drive part includes a second actuator linearly moving a moving body movable in the first direction, and a transmission mechanism converting the linear motion of the moving body into a linear motion in the second direction and transmitting the same to at least one of the first cutting member and the second cutting member.

(182) According to the above configuration, in the solder cutting device, it is possible to reduce the width in the direction orthogonal to the first direction and the second direction without a drive shaft or drive part moving in the direction orthogonal to the first direction and the second direction. Such an effect is realized in particular by the first drive part being the first actuator, and the second drive part including the moving body, the second actuator and the transmission mechanism. Accordingly, in a system including the solder cutting device and using the solder piece supplied from the solder cutting device, when a plurality of solder cutting devices that supply solder pieces of different sizes are installed, the area occupied by the solder cutting devices can be reduced.

(183) The present invention is not limited to the embodiments described above, and may be modified in various ways within the scope of the claims. An embodiment derived from a proper combination of technical means disclosed in respective different embodiments is also encompassed in the technical scope of the present invention.

## Claims

1. A solder cutting device, comprising: a first holding part, holding and releasing a long tape-like solder material; a first drive part, equipped with the first holding part and causing the tape-like solder material held by the first holding part to be sent linearly in a first direction; a cutting part,

comprising a first cutting member and a second cutting member that face each other and are provided so as to approach and separate from each other, and cutting the tape-like solder material located in a cutting position between the first cutting member and the second cutting member; and a second drive part, actuating either one of the first cutting member and the second cutting member in a second direction perpendicular to a plane part of the tape-like solder material, wherein the first drive part is a first actuator being electrically-driven and converting a rotational motion into a linear motion in the first direction; and the second drive part comprises a second actuator linearly moving a moving body movable in the first direction, and a first transmission mechanism converting the linear motion of the moving body into a linear motion in the second direction and transmitting the same to either one of the first cutting member and the second cutting member.

2. The solder cutting device according to claim 1, wherein the first transmission mechanism is a plane cam mechanism; and the first transmission mechanism comprises a plane cam configured in the moving body, a cam follower abutting against a cam surface of the plane cam, and a connection member supporting the cam follower and connected to either one of the first cutting member and the second cutting member.

3. The solder cutting device according to claim 1, wherein the first holding part comprises: a first holding member and a second holding member, facing each other and provided so as to approach and separate from each other; and a first holding drive part, actuating either one of the first holding member and the second holding member in the second direction perpendicular to the plane part of the tape-like solder material, wherein the first holding drive part comprises a third actuator comprising a holding moving body movable in the first direction and linearly moving the holding moving body, and a second transmission mechanism converting the linear motion of the holding moving body into a linear motion in the second direction and transmitting the same to either one of the first holding member and the second holding member.

4. The solder cutting device according to claim 2, comprising a cleaning unit that cleans at least one of the cam surface and the cam follower.

5. The solder cutting device according to claim 1, further comprising: a second holding part, provided between the first holding part and the cutting part, and holding and releasing the tape-like solder material to be cut.

6. The solder cutting device according to claim 1, further comprising: a cut solder transfer part, comprising: a cut piece holding part, receiving and holding in a cutting support position a solder piece cut from the tape-like solder material; and a cut piece holding drive part, moving the cut piece holding part between the cutting support position and a takeout position separated from the cutting support position, the takeout position being where the solder piece is taken out.

7. A solder cutting unit, comprising: a frame, equipped with the first holding part, the first drive part, the cutting part, the second drive part and the second holding part in the solder cutting device according to claim 5, wherein the second actuator and the first transmission mechanism are provided in a first layer being a lowermost layer of the frame; the tape-like solder material is sent above the first layer, and the first holding part, the first drive part, the cutting part and the second holding part are provided between the sent tape-like solder material and the first layer.

8. The solder cutting unit according to claim 7, wherein the frame comprises, in the first layer, a lower base portion provided with the second actuator and the first transmission mechanism; the tape-like solder material is sent above the first layer; the frame comprises, between the sent tape-like solder material and the first layer, an upper base portion provided with the first actuator and the second holding part, wherein the upper base portion and the lower base portion each comprise a connection portion connected to each other on one side in the first direction; the first actuator is provided on the upper base portion on the other side away from the connection portion; and the second actuator is provided on the lower base portion on the other side away from the connection portion.

9. A solder cutting unit, wherein the solder cutting device according to claim 1 further comprises: a

second holding part, provided between the first holding part and the cutting part, and holding and releasing the tape-like solder material to be cut; and a cut solder transfer part, comprising: a cut piece holding part, receiving and holding in a cutting support position a solder piece cut from the tape-like solder material; and a cut piece holding drive part, moving the cut piece holding part between the cutting support position and a takeout position separated from the cutting support position, the takeout position being where the solder piece is taken out, and wherein the solder cutting unit comprises a frame equipped with the first holding part, the first drive part, the cutting part, the second drive part, the second holding part and the cut solder transfer part in the solder cutting device according to claim 1; the first holding part, the first drive part, the cutting part, the second drive part and the second holding part are provided on a supply processing side where the tape-like solder material is supplied; and the cut solder transfer part is provided on a takeout side where the solder piece obtained by cutting is taken out.

10. A part mounting device, comprising: a platform; a solder cutting unit group, detachably arranged on the platform and having a plurality of the solder cutting units according to claim 7 disposed in parallel; a mounting support, provided on the platform and supporting a mounting object mounted with a solder piece cut from the tape-like solder material; a first conveyance device, provided on the platform and conveying the mounting object; and a transfer unit, transferring and mounting each of the solder piece obtained by cutting by the solder cutting unit group to the mounting object of the mounting support.

11. The part mounting device according to claim 10, further comprising: a second conveyance device, provided on the platform and conveying the mounting object in the mounting support and outside the mounting support.

12. A production system, performing temperature processing on a mounting object mounted with a solder piece cut from a tape-like solder material, comprising: the part mounting device according to claim 10; a temperature processing device, performing temperature processing on a mounted mounting object; and a mounting object transfer device, transferring the mounting object in the part mounting device and the temperature processing device.

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