(12) **United States Patent**
Kurakane

(10) **Patent No.: US 9,520,316 B2**
(45) **Date of Patent: Dec. 13, 2016**

(54) **SEPARATION DEVICE AND PICKUP SYSTEM**

(71) Applicant: **TESEC Corporation**, Tokyo (JP)

(72) Inventor: **Takashi Kurakane**, Tokyo (JP)

(73) Assignee: **TESEC Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/493,034**

(22) Filed: **Sep. 22, 2014**

(65) **Prior Publication Data**

US 2015/0083344 A1 Mar. 26, 2015

(30) **Foreign Application Priority Data**

Sep. 26, 2013 (JP) 2013-199287

(51) **Int. Cl.**
H01L 21/683 (2006.01)
B32B 38/10 (2006.01)
H01L 21/67 (2006.01)

(52) **U.S. Cl.**
CPC ***H01L 21/6836*** (2013.01); ***H01L 21/67132*** (2013.01); ***H01L 21/6838*** (2013.01); *B32B 2457/14* (2013.01); *H01L 2221/68322* (2013.01); *H01L 2221/68386* (2013.01); *Y10S 156/932* (2013.01); *Y10S 156/943* (2013.01); *Y10T 156/1132* (2015.01); *Y10T 156/1944* (2015.01); *Y10T 156/1978* (2015.01); *Y10T 156/1983* (2015.01)

(58) **Field of Classification Search**
CPC H01L 21/67132; H01L 27/6838; H01L 2221/68322; H01L 2221/68336; H01L 2221/68381;H01L 2221/68386; B32B 43/006; Y10T 156/1132; Y10T 156/1179; Y10T 156/1944; Y10T 156/1983; Y10S 156/932; Y10S 156/943
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,561,743 B1 * 5/2003 Nakatsu H01L 21/67132 156/750
6,824,643 B2 * 11/2004 Yoshimoto H01L 21/67132 156/716
7,238,593 B2 * 7/2007 Medding H01L 21/67132 438/106
7,240,422 B2 * 7/2007 Cheung H01L 21/67132 156/765

(Continued)

FOREIGN PATENT DOCUMENTS

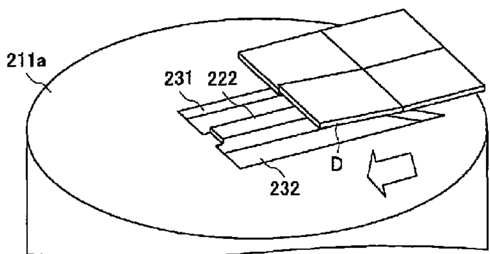
JP 06-236916 A 8/1994

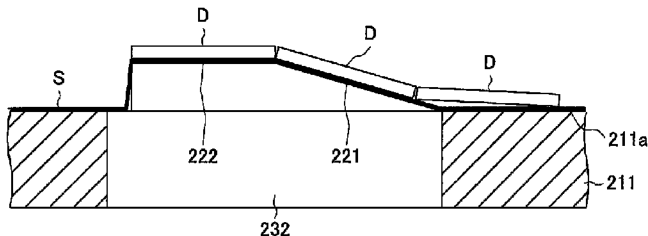
Primary Examiner — Mark A Osele
(74) *Attorney, Agent, or Firm* — Robert C. Kowert; Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C.

(57) **ABSTRACT**

A separation device includes a mount table, projecting portion, and drawing port. The mount table includes a mount surface on which a pressure sensitive adhesive sheet, on which an electronic component is stuck, is mounted. The electronic component is stuck on one surface of the pressure sensitive adhesive sheet, and the mount surface is in contact with the other surface of the pressure sensitive adhesive sheet. The projecting portion is formed on the mount surface and projects toward the pressure sensitive adhesive sheet mounted on the mount surface. The drawing port is open near the projecting portion on the mount surface, and when a negative pressure is applied, draws the pressure sensitive adhesive sheet.

7 Claims, 7 Drawing Sheets





(56) **References Cited**

U.S. PATENT DOCUMENTS

7,757,742	B2 *	7/2010	Cheung	H01L 21/67132 156/66
7,820,006	B2 *	10/2010	Umehara	H01L 21/67126 156/65
8,092,645	B2 *	1/2012	Yip	H01L 21/67132 156/707
8,141,612	B2 *	3/2012	Chan	H01L 21/67132 156/707
2002/0129899	A1 *	9/2002	Mimata	H01L 21/67132 156/707

* cited by examiner

FIG. 1

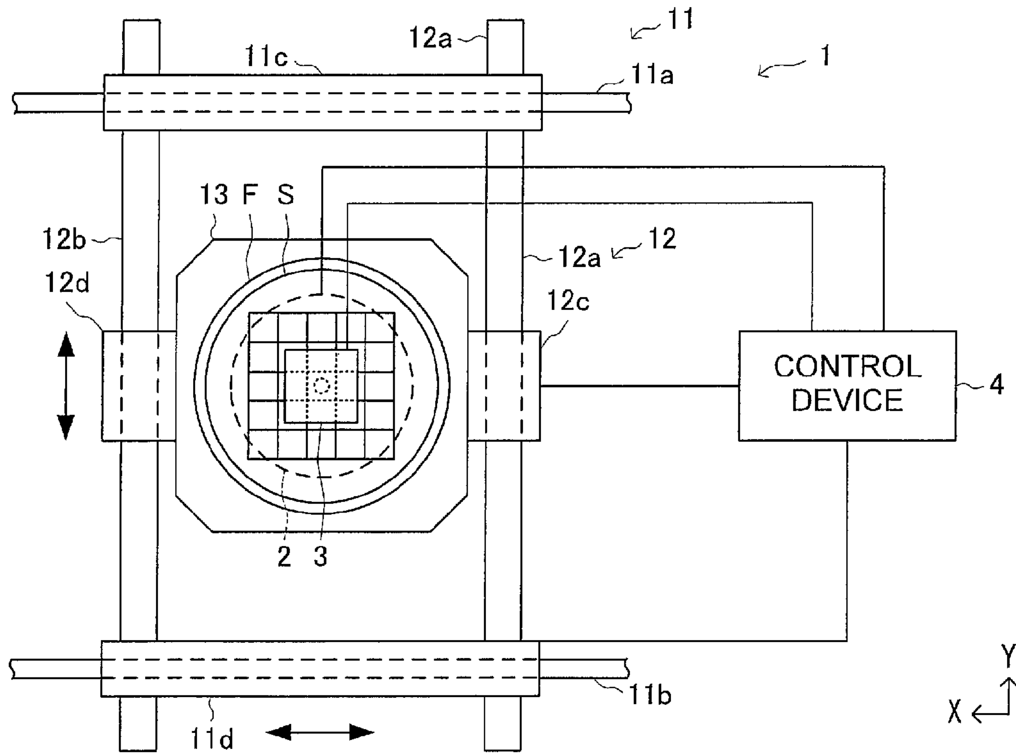


FIG. 2

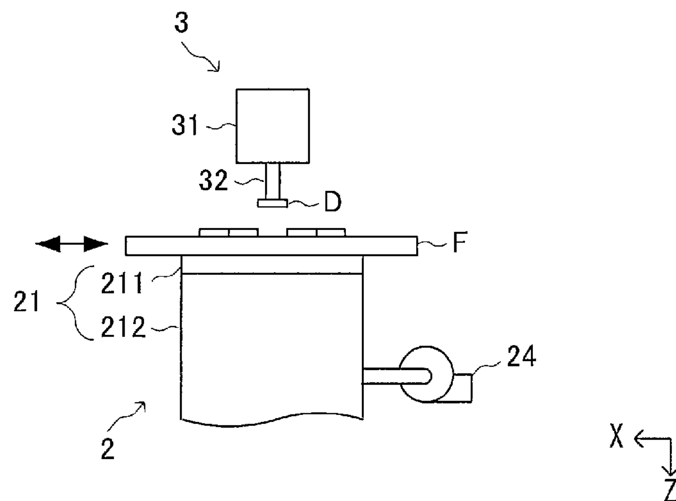


FIG. 3

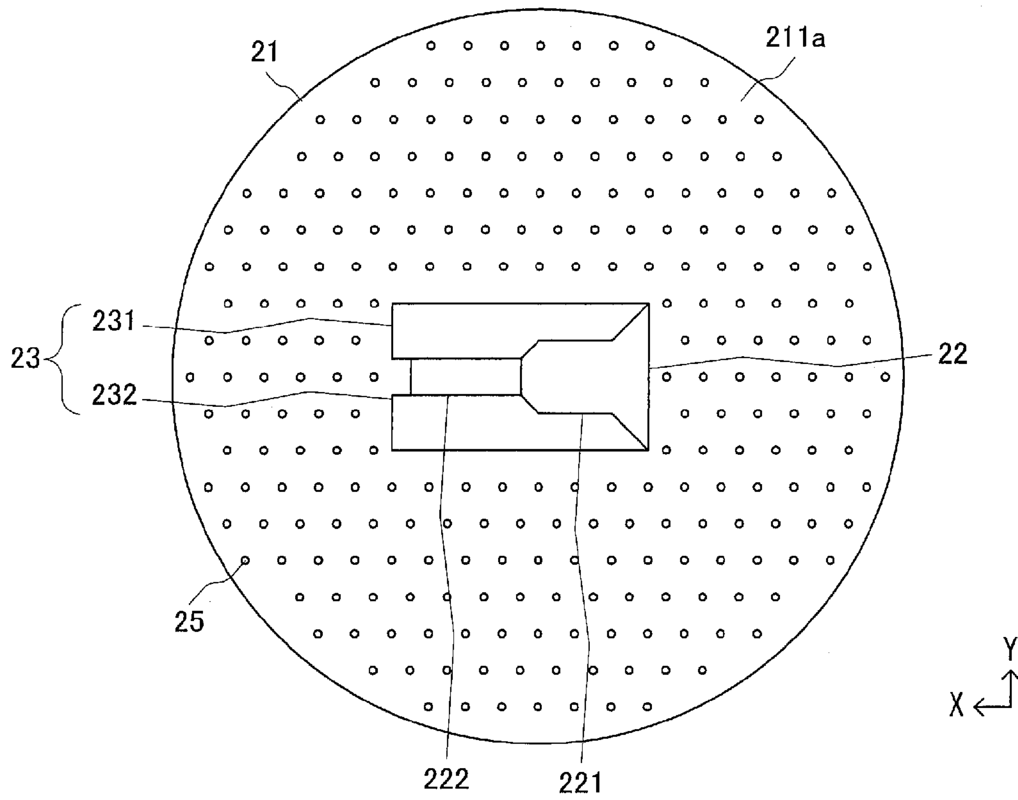


FIG. 4

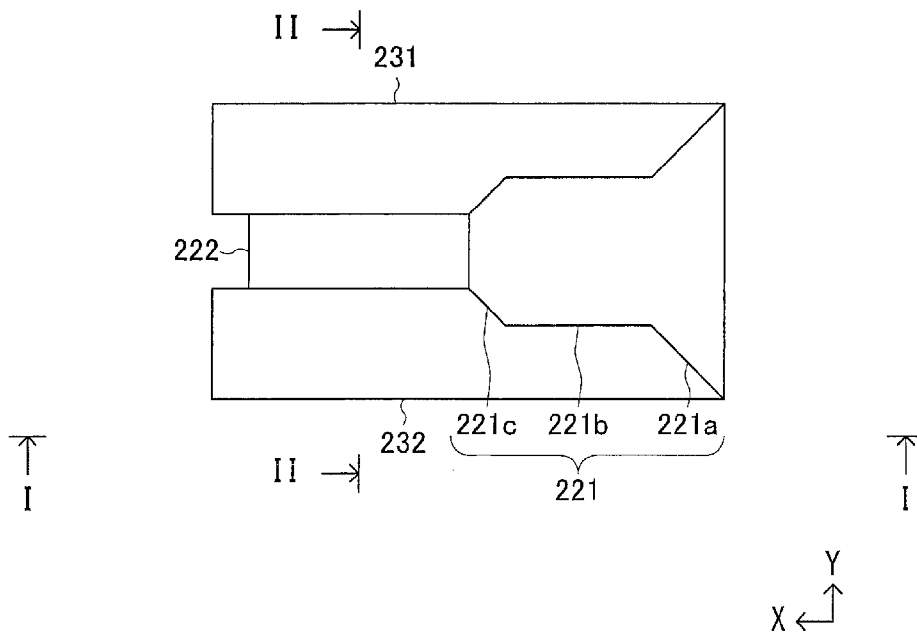


FIG. 5

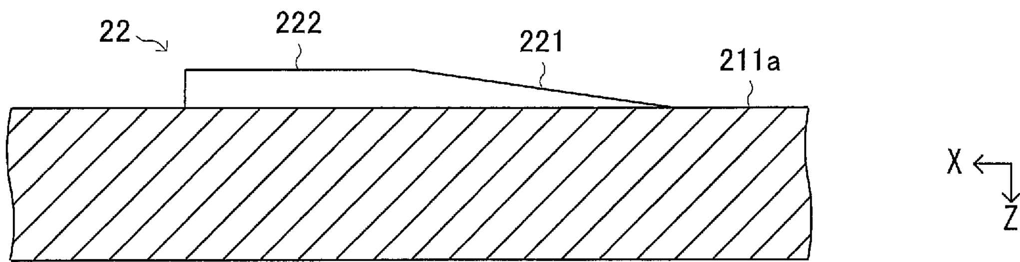


FIG. 6

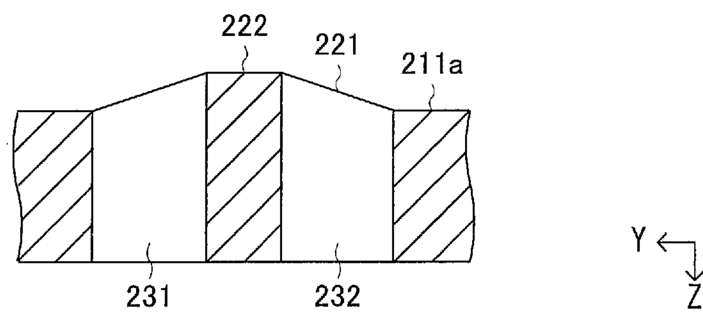


FIG. 7A

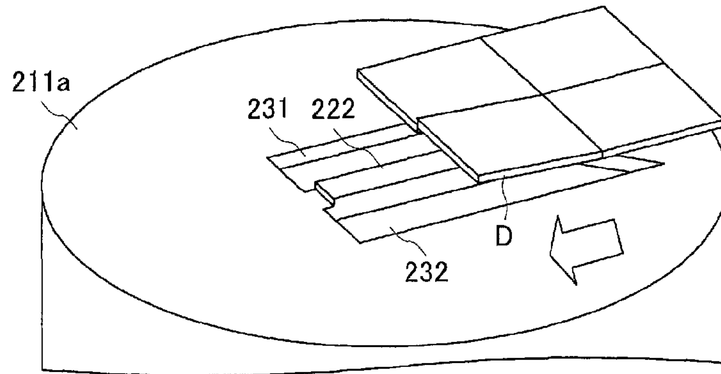


FIG. 7B

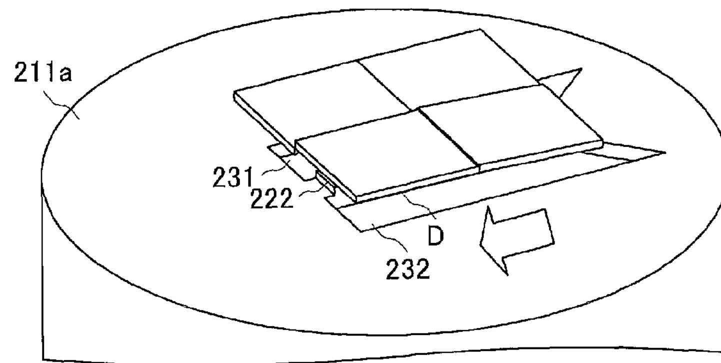


FIG. 7C

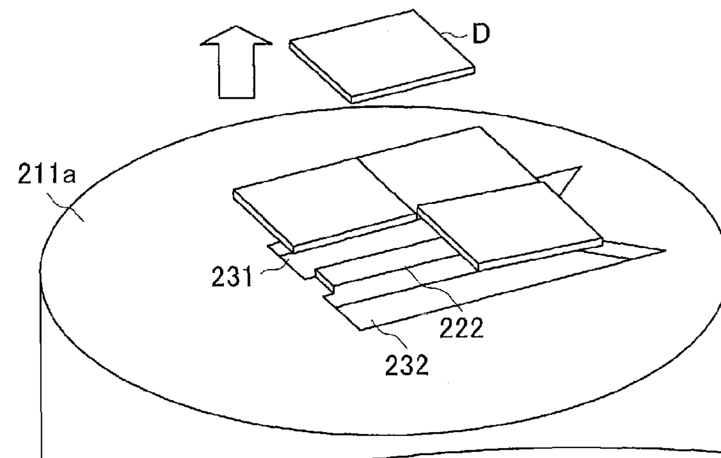


FIG. 8

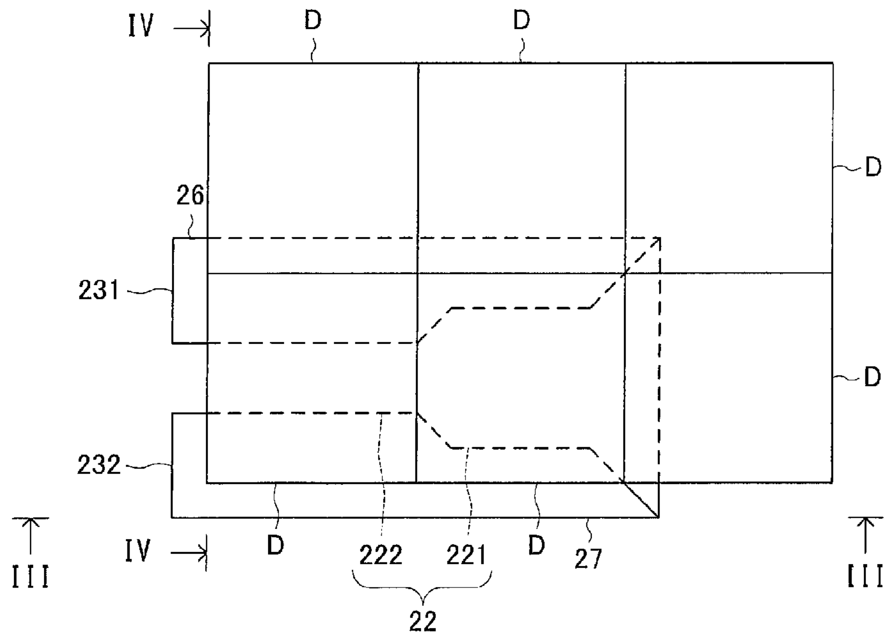


FIG. 9

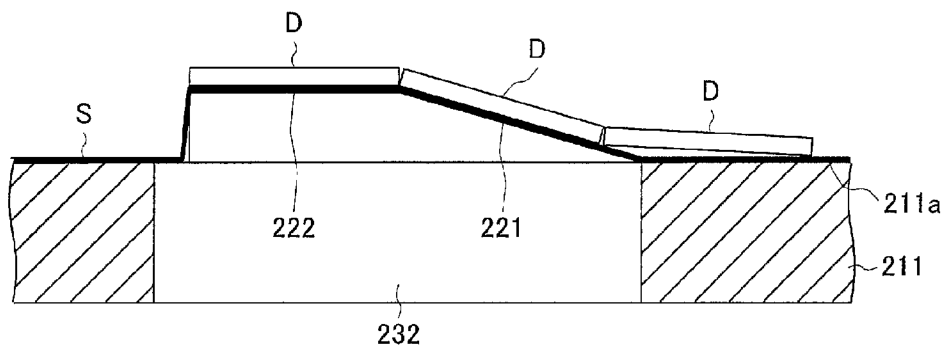


FIG. 10

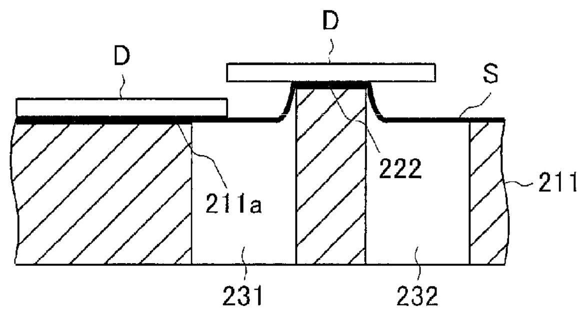


FIG. 11

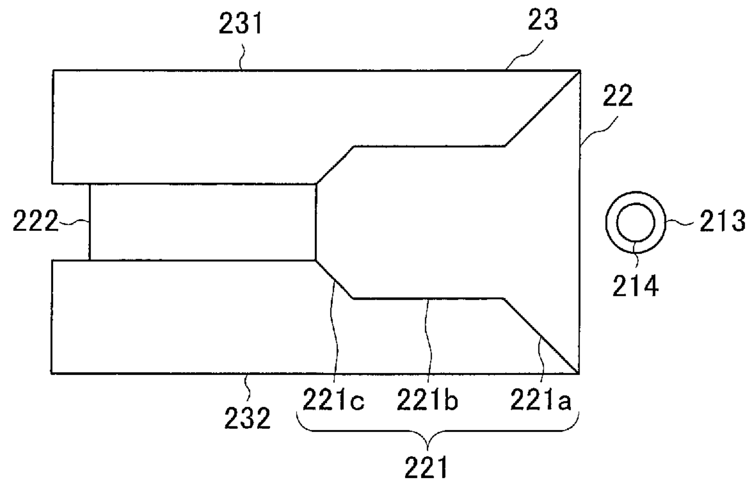


FIG. 12

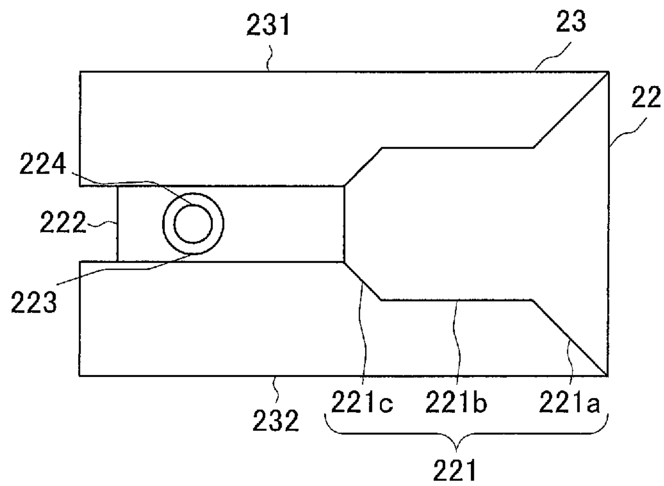
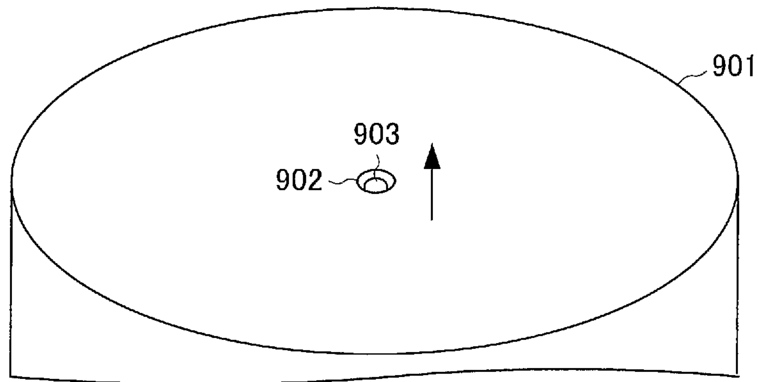
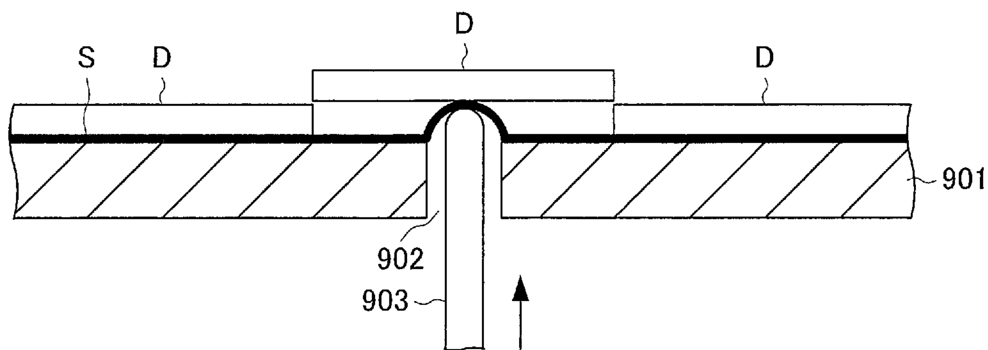


FIG. 13



RELATED ART

FIG. 14



RELATED ART

SEPARATION DEVICE AND PICKUP SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a separation device which separates, from a pressure sensitive adhesive sheet, an electronic component stuck on the pressure sensitive adhesive sheet, and a pickup system including the separation device.

There has been proposed a system which picks up an electronic component from a pressure sensitive adhesive sheet on which a plurality of electronic components are stuck, and inspected or stored in a predetermined container. Japanese Patent Laid-Open No. 6-236919 (literature 1) has disclosed a technique associated with this system. As shown in FIG. **13**, this system includes a flat plate-like suction stage **901** on which a pressure sensitive adhesive sheet is mounted. The suction stage **901** includes an opening **902** formed at almost the center of the suction stage **901**, and a push-up pin **903** which projects from the opening **902**.

When picking up an electronic component stuck on a pressure sensitive adhesive sheet, first, the pressure sensitive adhesive sheet is mounted on the suction stage **901** with a surface, on which no electronic component is stuck, facing down, and an electronic component to be picked up is arranged on the opening **902**. In this state, as shown in FIG. **14** an electronic component D is pushed up by the push-up pin **903** via a pressure sensitive adhesive sheet S, separating the electronic component D from the pressure sensitive adhesive sheet S. The electronic component D is then picked up by a collet or the like.

However, in the above-described related art, the electronic component D is pushed up by the push-up pin **903**, so a shock is applied to the electronic component D to damage it in some cases.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a separation device and pickup system capable of separating a pressure sensitive adhesive sheet without damaging an electronic component.

There is provided a separation device comprising a mount table including a mount surface on which a pressure sensitive adhesive sheet, on which an electronic component is stuck, is mounted, the electronic component being stuck on one surface of the pressure sensitive adhesive sheet and the mount surface being in contact with the other surface of the pressure sensitive adhesive sheet, a projecting portion which is formed on the mount surface and projects toward the pressure sensitive adhesive sheet mounted on the mount surface, and a drawing port which is open near the projecting portion on the mount surface, and when a negative pressure is applied, draws the pressure sensitive adhesive sheet.

There is provided a pickup system comprising a holding device which movably holds a pressure sensitive adhesive sheet having one surface on which an electronic component is stuck, a separation device which separates the electronic component from the pressure sensitive adhesive sheet, and a suction device which sucks the electronic component separated by the separation device, the separation device including a mount table including a mount surface on which the pressure sensitive adhesive sheet is mounted to bring the other surface of the pressure sensitive adhesive sheet into contact with the mount surface, a projecting portion which is formed on the mount surface and projects toward the pressure sensitive adhesive sheet mounted on the mount surface, and a drawing port which is open near the projecting portion on the mount surface, and when a negative pressure is applied, draws the pressure sensitive adhesive sheet.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view showing the overall arrangement of a pickup system;

FIG. **2** is a front view showing the overall arrangement of the pickup system;

FIG. **3** is a plan view showing a separation device;

FIG. **4** is a plan view showing the main part of the separation device;

FIG. **5** is a sectional view taken along a line I-I in FIG. **4**;

FIG. **6** is a sectional view taken along a line II-II in FIG. **4**;

FIGS. **7**A to **7**C are perspective views for explaining a separation operation;

FIG. **8** is a plan view for explaining the separation operation;

FIG. **9** is a sectional view taken along a line III-III in FIG. **8**;

FIG. **10** is a sectional view taken along a line IV-IV in FIG. **8**;

FIG. **11** is a plan view showing the first modification of the separation device;

FIG. **12** is a plan view showing the second modification of the separation device;

FIG. **13** is a perspective view showing a suction stage related to the present invention; and

FIG. **14** is a sectional view showing the suction stage related to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will now be described in detail with reference to the accompanying drawings.

[Arrangement of Pickup System]

A pickup system shown in FIGS. **1** and **2** includes a holding device **1**, separation device **2**, suction device **3**, and control device **4**. The holding device **1** is configured to movably hold a wafer sheet (pressure sensitive adhesive sheet) S having one surface on which an electronic component D is stuck. The separation device **2** is configured to separate, from the wafer sheet S, at least part of the electronic component D stuck on one surface of the wafer sheet S. In other words, the separation device **2** separates at least part of the wafer sheet S sticking to the electronic component D. The suction device **3** is configured to suck the electronic component D at least partially separated by the separation device **2**. The control device **4** is configured to control the operation of the overall pickup system.

For descriptive convenience, a direction in which the electronic component D is moved to separate the wafer sheet S by the separation device **2** will be defined as an "X-axis direction" (first direction). A direction perpendicular to the X-axis direction will be defined as a "Y-axis direction" (second direction). A direction perpendicular to the X-axis direction and Y-axis direction will be defined as a "Z-axis direction". In the embodiment, a horizontal plane is constituted by the X- and Y-axes. That is, the X-axis direction and Y-axis direction are horizontal directions, and the Z-axis direction is a vertical direction.

<Arrangement of Holding Device **1**>

The holding device **1** includes an X moving mechanism **11** which moves in the X-axis direction, a Y moving mechanism **12** which is fixed to the X moving mechanism **11** and moves in the Y-axis direction, and a holding unit **13** which is fixed to the Y moving mechanism **12** and holds a wafer frame F.

The X moving mechanism **11** includes a pair of X rails **11***a* and **11***b*, and X moving units **11***c* and **11***d*. The X rails **11***a* and **11***b* are rod-like rails which extend in the X-axis direction and are disposed at a predetermined interval in the Y-axis direction. The X moving units **11***c* and **11***d* are attached to the X rails **11***a* and **11***b*, respectively, extend along the X rails **11***a* and **11***b*, and move along the X rails **11***a* and **11***b*.

The Y moving mechanism **12** includes a pair of Y rails **12***a* and **12***b*, and Y moving units **12***c* and **12***d*. The Y rails **12***a* and **12***b* are formed from rod-like members extending in the Y-axis direction. One end and the other end of the Y rail **12***a* are fixed to one end of the X moving unit **11***c* and one end of the X moving unit **11***d*, respectively. One end and the other end of the Y rail **12***b* are fixed to the other end of the X moving unit **11***c* and the other end of the X moving unit **11***d*, respectively. The Y moving units **12***c* and **12***d* are attached to the Y rails **12***a* and **12***b*, respectively, and move along the Y rails **12***a* and **12***b*.

The holding unit **13** is formed from a plate-like member which has an opening formed at the center to fix the wafer frame F, and has a rectangular shape when viewed from the top. One side surface of the holding unit **13** is fixed to the Y moving unit **12***c*, and the other side surface of the holding unit **13** that is face to face with one side surface is fixed to the Y moving unit **12***d*.

The wafer frame F held by the holding unit **13** supports the wafer sheet S. The wafer sheet S is formed from an elastic material, one surface (to be also referred to as an "upper surface" hereinafter) of the wafer sheet S has adhesion, and the other surface (to be also referred to as a "lower surface" hereinafter) does not have adhesion. A plurality of plate-like electronic components D with a rectangular shape when viewed from the top are stuck in a matrix on the adhesive upper surface.

In the holding device **1** having this arrangement, when the X moving units **11***c* and **11***d* move in the X-axis direction along the X rails **11***a* and **11***b*, the Y rails **12***a* and **12***b* fixed to the X moving units **11***c* and **11***d*, the Y moving units **12***c* and **12***d* attached to the Y rails **12***a* and **12***b*, and the holding unit **13** fixed to the Y moving units **12***c* and **12***d* also move in the X-axis direction. As a result, the wafer frame F held by the holding unit **13** moves in the X-axis direction.

When the Y moving units **12***c* and **12***d* move in the Y-axis direction along the Y rails **12***a* and **12***b*, the holding unit **13** fixed to the Y moving units **12***c* and **12***d* also moves in the Y-axis direction. As a result, the wafer frame F moves in the Y-axis direction.

In this way, the holding device **1** can move the wafer frame F held by the holding unit **13** in the X-axis direction and Y-axis direction.

Note that the holding device **1** may further include a Z moving mechanism which moves the X rails **11***a* and **11***b* in the Z-axis direction. The Z moving mechanism is constituted by, e.g., a pair of Z rails and a pair of Z moving units. The Z rails are disposed near the X rails **11***a* and **11***b*, respectively, and extend in the Z-axis direction. The Z moving units are movably attached to the Z rails, respectively, and the neighboring X rails **11***a* and **11***b* are fixed to the Z moving units, respectively. With this Z moving mechanism, the wafer frame F held by the holding unit **13** can be moved even in the Z-axis direction.

<Arrangement of Separation Device **2**>

As shown in FIGS. **2** to **6**, the separation device **2** includes a mount table **21** including a mount surface **211***a* on which the wafer sheet S is mounted, a projecting portion **22** which is fixed on the mount surface **211***a* and projects toward the wafer sheet S mounted on the mount surface **211***a*, and a drawing port **23** which is open near the projecting portion **22** on the mount surface **211***a*, and when a negative pressure is applied, sucks (draws) the wafer sheet S. A drawing pump **24** is connected to the mount table **21**.

The mount table **21** is constituted by a mount plate **211** formed into a disk shape, and a cylindrical base **212** which is formed into a cylindrical shape and has an upper opening closed by the lower surface of the mount plate **211**. The upper surface of the mount plate **211** serves as the above-described mount surface **211***a*. As shown in FIGS. **3** and **4**, the projecting portion **22** and drawing port **23** are formed at the center of the mount surface **211***a* (mount plate **211**). Many (a plurality of) pores **25** are formed in the entire mount surface **211***a* (mount plate **211**). In the drawings other than FIG. **3**, the pores **25** are not illustrated. In the embodiment, the mount surface **211***a* is horizontal and is parallel to the X-axis direction and Y-axis direction.

The projecting portion **22** extends in the X-axis direction. The projecting amount (height) of the projecting portion **22** monotonically increases in the X-axis direction. In the embodiment, as shown in FIG. **5**, the projecting portion **22** is constituted by a sloped portion **221** which has one end continuing from the mount surface **211***a* and has a predetermined gradient, and a flat portion **222** which continues from the other end of the sloped portion **221** and is parallel to the mount surface **211***a*.

As shown in FIG. **4**, the length (to be also referred to as a "width" hereinafter) of the upper surface of the projecting portion **22** in the Y-axis direction monotonically decreases in the X-axis direction. In the embodiment, the upper surface of the sloped portion **221** is constituted by a first region **221***a* which continues from the mount surface **211***a* and is tapered when viewed from the top, a second region **221***b* which continues from the first region **221***a* and has a constant width, and a third region **221***c* which is formed between the second region **221***b* and the flat portion **222** and is tapered when viewed from the top. The upper surface of the flat portion **222** is formed into a rectangular shape with a constant width when viewed from the top.

The width of at least part of the projecting portion **22** is formed to be smaller than the width of the electronic component D. In the embodiment, the first region **221***a* except for this part is formed to have a width smaller than that of the electronic component D.

The aforementioned "monotonic increase" and "monotonic decrease" mean "monotonic increase" and "monotonic decrease" in a broad sense. Hence, the projecting portion **22** may include a portion having a constant projecting amount, or a portion having a constant width.

The drawing port **23** is constituted by a first opening **231** and second opening **232** which are formed to be adjacent to the two sides of the projecting portion **22**. In other words, the projecting portion **22** is interposed between the first opening **231** and the second opening **232**. In the embodiment, the drawing port **23** is formed into a rectangular shape as a whole. By forming the projecting portion **22** at the center of the drawing port **23**, the first opening **231** and second opening **232** are formed into axisymmetrical almost trap-

ezoidal shapes when viewed from the top, with respect to an axis passing the center of the projecting portion **22** along the X-axis. Note that the diameters of the first opening **231** and second opening **232** are much larger than the diameter of the above-mentioned pore **25**.

The drawing pump **24** is constituted by a vacuum generator, has a drawing end connected to the mount table **21**, and draws air in the internal space of the mount table **21** to decrease a pressure in the internal space.

<Arrangement of Suction Device **3**>

The suction device **3** includes a base **31** which is supported by a moving unit (not shown) to be movable in the X, Y, and Z directions, and a pickup collet **32** fixed to the base **31**. The pickup collet **32** sucks the electronic component D at the suction end and releases the sucked electronic component D by selectively supplying air of a negative or positive pressure from the vacuum generator (not shown).

<Arrangement of Control Device **4**>

The control device **4** controls the operation of the overall pickup system by controlling the operations of the holding device **1**, separation device **2**, and suction device **3**. The control device **4** is constituted by a computer including an arithmetic device such as a CPU, a storage device such as a memory or HDD (Hard Disk Drive), an input device which detects an external information input, such as a keyboard, mouse, or touch panel, an I/F device which transmits/receives various kinds of information via a communication line such as the Internet, a LAN (Local Area Network), or a WAN (Wide Area Network), and a display device such as a CRT (Cathode Ray Tube) or LCD (Liquid Crystal Display), and also by a program installed in the computer. These hardware resources and software cooperate with each other to control the hardware resources by the program, implementing various operations by the pickup system (to be described later).

<Operation of Pickup System>

Next, the operation of the pickup system according to the embodiment will be explained.

First, the holding device **1** arranges the wafer sheet S on the mount surface **211***a* so that the lower surface of the wafer sheet S having an upper surface on which the electronic component (to be also referred to as a "suction target component" hereinafter) D is stuck contacts the mount surface **211***a* of the separation device **2**. At this time, the suction target component D is arranged so that the center of the suction target component D is positioned on a central axis parallel to the X-axis passing the center of the projecting portion **22**, and one side of the suction target component D becomes perpendicular to the central axis. In the embodiment, a plurality of electronic components D are continuously arranged on the wafer sheet S. The wafer sheet S is arranged so that an axis passing the center of each electronic component D and the center axis of the projecting portion **22** coincide with each other.

After the wafer sheet S is arranged on the mount surface **211***a*, the drawing pump **24** starts driving. Since the drawing pump **24** draws air present between the mount surface **211***a* and the wafer sheet S via the pores **25** formed in the mount table **21**, the wafer sheet S tightly contacts the mount surface **211***a*. In regions where the wafer sheet S is face to face with the first opening **231** and second opening **232**, the wafer sheet S is drawn toward the first opening **231** and second opening **232**. Note that the drawing pump **24** may be driven before the wafer sheet S is mounted on the mount surface **211***a*.

After the wafer sheet S tightly contacts the mount surface **211***a*, the holding device **1** moves the wafer sheet S in the X-axis direction. Then, the suction target component D moves on the upper surface of the projecting portion **22**.

As described above, the holding device **1** moves the wafer sheet S in the X-axis direction so that the center of the suction target component D passes on the center axis of the projecting portion **22**. After the suction target component D passes on the upper surface of the sloped portion **221**, as shown in FIG. **7**A, it reaches the upper surface of the flat portion **222**, as shown in FIG. **7**B.

As shown in FIG. **4**, the width of the projecting portion **22** decreases from the sloped portion **221** toward the flat portion **222**. Thus, the area by which the suction target component D moving on the upper surface of the projecting portion **22** contacts (or is face to face with) the projecting portion **22** via the wafer sheet S decreases toward the flat portion **222**. This means that the area by which the suction target component D does not contact (or is not face to face with) the projecting portion **22**, that is, regions (to be also referred to as "exposed regions" hereinafter) where the suction target component D is exposed toward the first opening **231** and second opening **232** increase toward the flat portion **222**. Since the drawing pump **24** is driven, as described above, drawing forces toward the first opening **231** and second opening **232** act on the wafer sheet S sticking to the exposed regions.

As shown in FIG. **5**, the projecting amount of the projecting portion **22** increases toward the flat portion **222**. The distance between the suction target component D and the mount surface **211***a* gradually increases as the suction target component D moves toward the flat portion **222**. On the wafer sheet S, the difference in height between a region where the wafer sheet S sticks to the suction target component D, and a region where the wafer sheet S is sucked on the mount surface **211***a* gradually increases. Since the wafer sheet S is formed from an elastic material, as described above, a force toward the mount surface **211***a* acts on the wafer sheet S sticking to the exposed regions.

In this manner, the wafer sheet S sticking to the exposed regions of the suction target component D is pulled toward the mount surface **211***a* upon receiving drawing forces from the first opening **231** and second opening **232**, and the elastic force of the wafer sheet S itself. As a result, the wafer sheet S is separated from the exposed regions. This separation is performed as follows.

In the embodiment, the plate-like electronic components D having a rectangular shape when viewed from the top are arranged in a matrix. The wafer sheet S moves so that an axis which is parallel to the array direction of the electronic component D and passes the center of the electronic component D coincides with an axis passing the center of the projecting portion **22**. Along with this, the electronic component D moves on the sloped portion **221** from one side face to face with the projecting portion **22**. At this time, the two end portions of this side are exposed first in the first opening **231** and second opening **232**, and a force arising from the above-described drawing force and elastic force concentrates at these two ends. As a result, the wafer sheet S sticking to these two ends is separated first from the suction target component D. As the suction target component D moves, the regions exposed in the first opening **231** and second opening **232** move from the two ends of this side toward central portions. The wafer sheet S is sequentially separated from the exposed portions.

Finally, as shown in FIGS. **7**B and **10**, when the suction target component D reaches the upper surface of the flat portion **222**, the wafer sheet S is separated from the suction target component D at a portion except for a region of the

electronic component D where it contacts (or is face to face with) the upper surface of the flat portion **222**.

After the suction target component D moves to the upper surface of the flat portion **222**, the suction device **3** brings the suction end of the pickup collet **32** close to the suction target component D. A negative pressure is supplied to the pickup collet **32**, sucking the suction target component D by the pickup collet **32**. The suction device **3** moves up the pickup collet **32** in this state, completely separating the suction target component D from the wafer sheet S, as shown in FIG. **7**C. Then, the suction device **3** transports the suction target component D to a predetermined place.

As described above, according to the embodiment, the electronic component D stuck on the wafer sheet S is positioned on the projecting portion **22** via the wafer sheet S, and a negative pressure is applied to the drawing port **23**. In response to this, the wafer sheet S sticking to the electronic component D is pulled toward the mount surface **211***a*, and the electronic component D can be separated from the wafer sheet S without damaging the electronic component D.

The embodiment has exemplified a case in which the projecting portion **22** projecting up from the mount surface **211***a* is arranged. However, as long as the lower surface of the electronic component D is exposed toward the drawing port **23** when the electronic component D is placed, the structure is not limited to the projecting portion **22**, and a free structure such as a step can be arbitrarily arranged. In the case of the step, by mounting the electronic component D at the boundary of the step, the lower surface of the electronic component D can be exposed to the opening side.

Also, the embodiment has exemplified a case in which the projecting amount of the projecting portion **22** increases toward the flat portion **222** with a predetermined gradient. However, the degree of the projecting amount of the sloped portion **221** is not limited to the predetermined gradient. For example, a parabolic shape or stepwise shape may be appropriately freely set.

If the area by which the projecting portion **22** and electronic component D contact each other via the wafer sheet S is smaller than the area of the lower surface of the electronic component D upon mounting the electronic component D on the projecting portion **22**, the planar shape of the projecting portion **22** can be appropriately freely designed. In other words, it is only necessary that the area of a region of the projecting portion **22** where it is face to face with the electronic component D via the wafer sheet S is smaller than the area of the lower surface of the electronic component D.

Further, the planar shape of the projecting portion **22** can be appropriately freely designed as long as the width of the above-described region of the projecting portion **22** monotonically decreases in the X-axis direction.

In addition, as long as the wafer sheet S sticking to the lower surface of the electronic component D can be sucked (drawn) while the electronic component D is mounted on the projecting portion **22**, the shape and arrangement of the first opening **231** and second opening **232** are not limited to the embodiment, and can be arbitrarily freely designed. This also applies to the number of openings, and the number of openings is not limited to two as in the embodiment.

In the embodiment, a push-up pin may be further arranged. The position at which the push-up pin is arranged suffices to be on the mount table **21**, more specifically, on the moving path of the electronic component D on the mount table **21**, e.g., near the sloped portion **221**, on the sloped portion **221**, or on the flat portion **222**.

For example, as shown in FIG. **11**, an opening **213** formed near the sloped portion **221** of the mount table **21**, and a push-up pin **214** projecting from the opening **213** may be arranged. In this case, when the electronic component D stuck on the wafer sheet S passes on the opening **213** in order to move from the mount surface **211***a* to the sloped portion **221**, the push-up pin **214** slightly pushes up the electronic component D via the wafer sheet S. Then, the electronic component D moves up, and part of the wafer sheet S sticking to the lower surface of the electronic component D, especially, a portion sticking to the edge of the electronic component D is separated. When the electronic component D moves on the projecting portion **22**, part of the wafer sheet S has already been separated from the electronic component D. Thus, the electronic component D can be more easily separated from the wafer sheet S.

Alternatively, as shown in FIG. **12**, an opening **223** formed at the flat portion **222** of the projecting portion **22**, and a push-up pin **224** projecting from the opening **223** may be arranged. In this case, first, a negative pressure is applied to the drawing port **23**. Then, the electronic component D stuck on the wafer sheet S is moved from the sloped portion **221** of the projecting portion **22** to the flat portion **222** to separate, from the electronic component D, the wafer sheet S at a portion except for a region of the electronic component D where it contacts the upper surface of the flat portion **222**. After that, the push-up pin **224** pushes up the lower surface of the electronic component D via the wafer sheet S. As a result, the electronic component D can be separated from the wafer sheet S. When pushing up the electronic component D, part of the wafer sheet S has already been separated from the electronic component D. Hence, the electronic component D can be separated without applying a strong force by the push-up pin **224**. This can prevent damage to the electronic component D.

The present invention is applicable to various devices for picking up an electronic component from a pressure sensitive adhesive sheet on which an electronic component is stuck.

What is claimed is:

1. A separation device comprising:

a mount table including a mount surface on which a pressure sensitive adhesive sheet, on which an electronic component is stuck, is mounted, the electronic component being stuck on one surface of the pressure sensitive adhesive sheet and the mount surface being in contact with the other surface of the pressure sensitive adhesive sheet;

a holding device, which holds the pressure sensitive adhesive sheet and moves the pressure sensitive adhesive sheet in a first direction parallel to the mount surface;

a projecting portion, which is fixed onto the mount surface and projects toward the pressure sensitive adhesive sheet mounted on the mount surface, the projecting portion having a length in the first direction longer than a length of the projecting portion in a second direction parallel to the mount surface and perpendicular to the first direction; and

a drawing port which is open near the projecting portion on the mount surface, and when a negative pressure is applied, draws the pressure sensitive adhesive sheet.

2. The device according to claim **1**, wherein an area of a region of the projecting portion where the projecting portion is face to face with the electronic component via the pressure sensitive adhesive sheet is smaller than an area of a base of the projecting portion.

3. The device according to claim 2, wherein the projecting portion extends in the first direction, and the projecting portion includes a sloped portion of which an amount of projection increases in the first direction.

4. The device according to claim 3, wherein the projecting portion includes a portion of which the length in the second direction decreases in the first direction.

5. The device according to claim 2, wherein the drawing port includes a first opening and a second opening which are formed on two sides of the projecting portion extending in the first direction.

6. The device according to claim 1, further comprising a push-up pin which is formed on the mount table and pushes up the electronic component via the pressure sensitive adhesive sheet.

7. A pickup system comprising:

a pressure sensitive adhesive sheet having one surface on which an electronic component is stuck;

a holding device, which movably holds the pressure sensitive adhesive sheet;

a separation device, which separates the electronic component from the pressure sensitive adhesive sheet; and

a suction device, which sucks the electronic component separated by the separation device,

the separation device including:

a mount table including a mount surface on which the pressure sensitive adhesive sheet is mounted to bring the other surface of the pressure sensitive adhesive sheet into contact with the mount surface;

a projecting portion, which is fixed onto the mount surface and projects toward the pressure sensitive adhesive sheet mounted on the mount surface, the projecting portion having a length in a first direction parallel to the mount surface longer than that of the electronic component and the projecting portion having a length in a second direction parallel to the mount surface and perpendicular to the first direction shorter than that of the electronic component; and

a drawing port which is open near the projecting portion on the mount surface, and when a negative pressure is applied, draws the pressure sensitive adhesive sheet,

wherein the holding device is configured to move the pressure sensitive adhesive sheet in the first direction.

* * * * *