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(54) **SHEET STICKING APPARATUS AND SHEET STICKING METHOD**

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(57) **ABSTRACT**

A sheet sticking apparatus **10** includes a first case **20** for accommodating a table **11** for supporting a semiconductor wafer W, a second case **21** for forming a decompression chamber C with the first case **20**, and feeding means **15** for feeding an adhesive sheet S to a position where the adhesive sheet S faces the semiconductor wafer W. The second case **21** includes a bulkhead **30** for forming a pressure adjusting chamber C**1** in a state where a single decompression chamber C is formed, the pressure adjusting chamber C**1** being capable of controlling the pressure therein independently of the decompression chamber C, wherein the adhesive sheet S is stuck to the semiconductor wafer W under decompression by setting the decompression chamber C in a decompression state and relatively increasing the pressure in the pressure adjusting chamber C**1**.

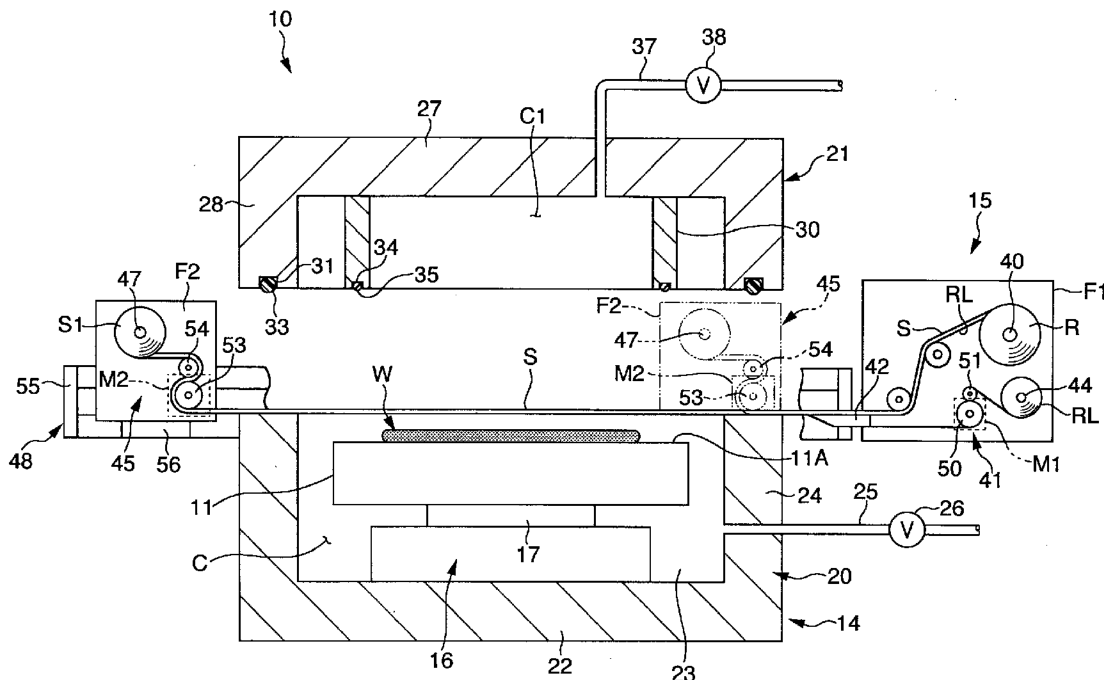


FIG. 1

FIG. 2

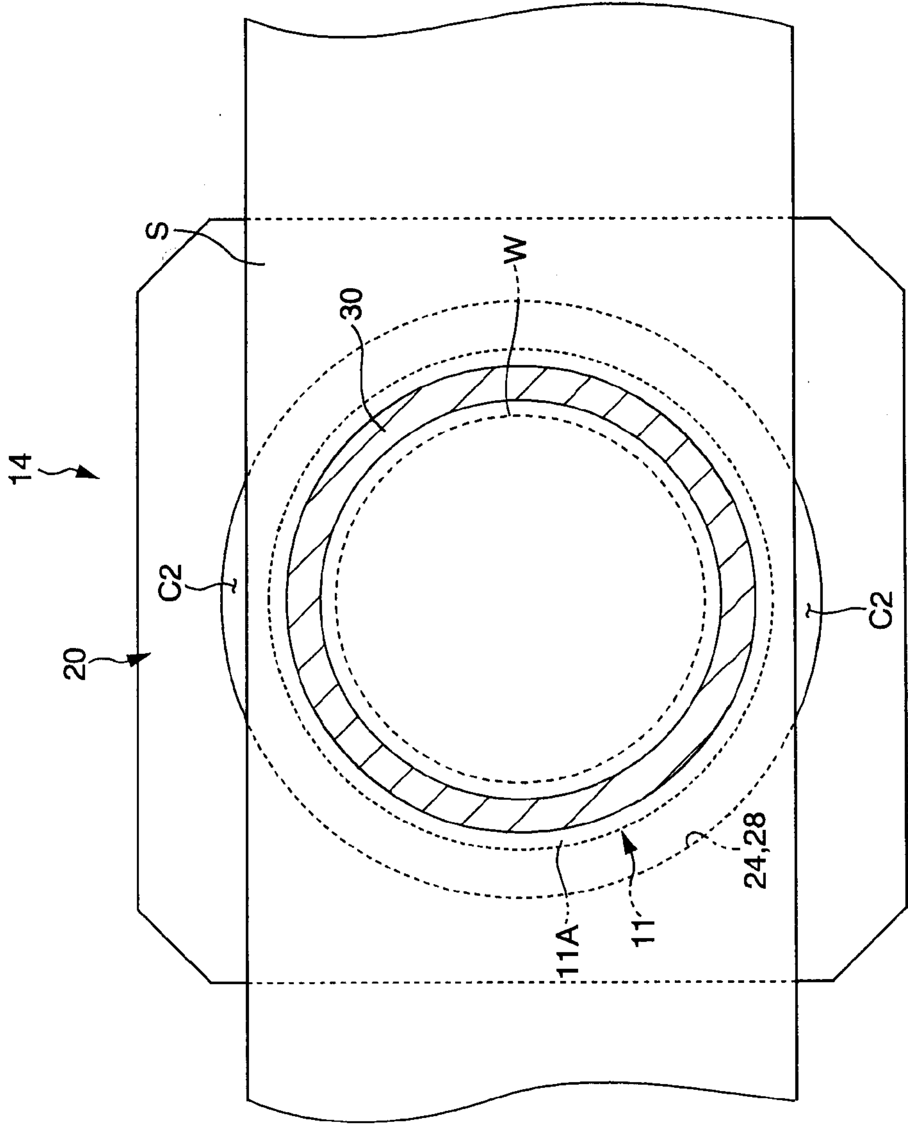
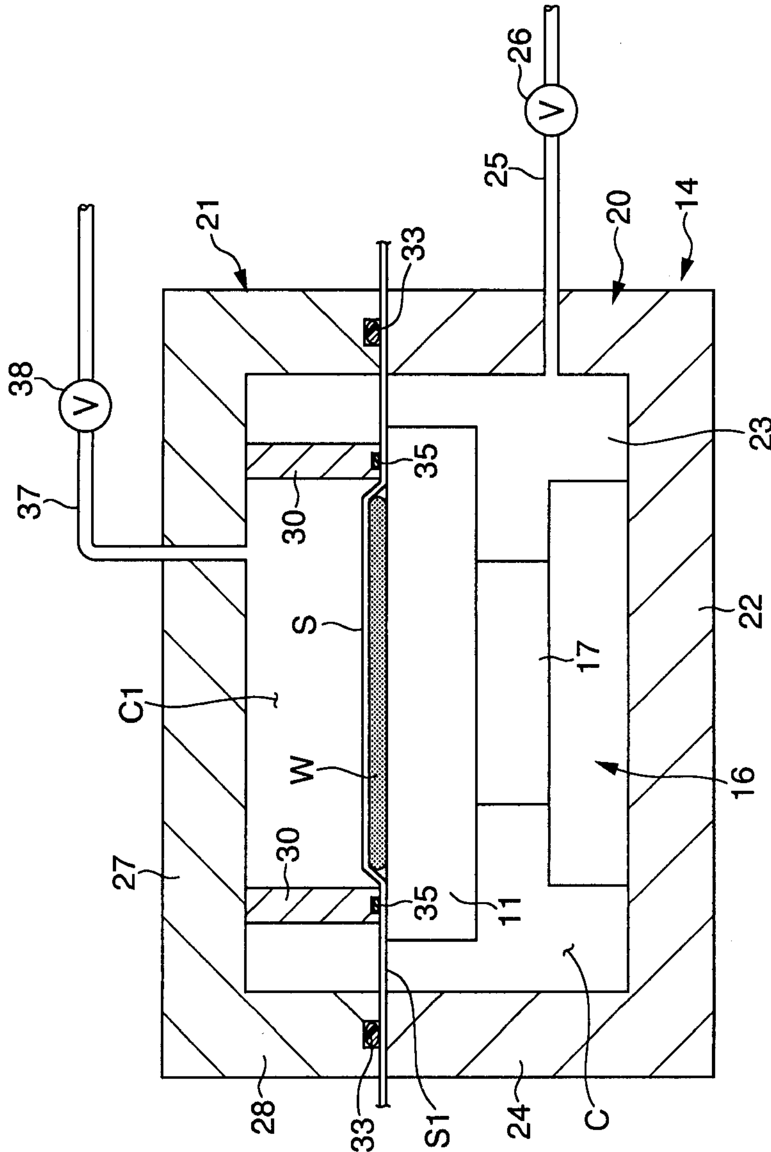


FIG. 3

FIG. 4



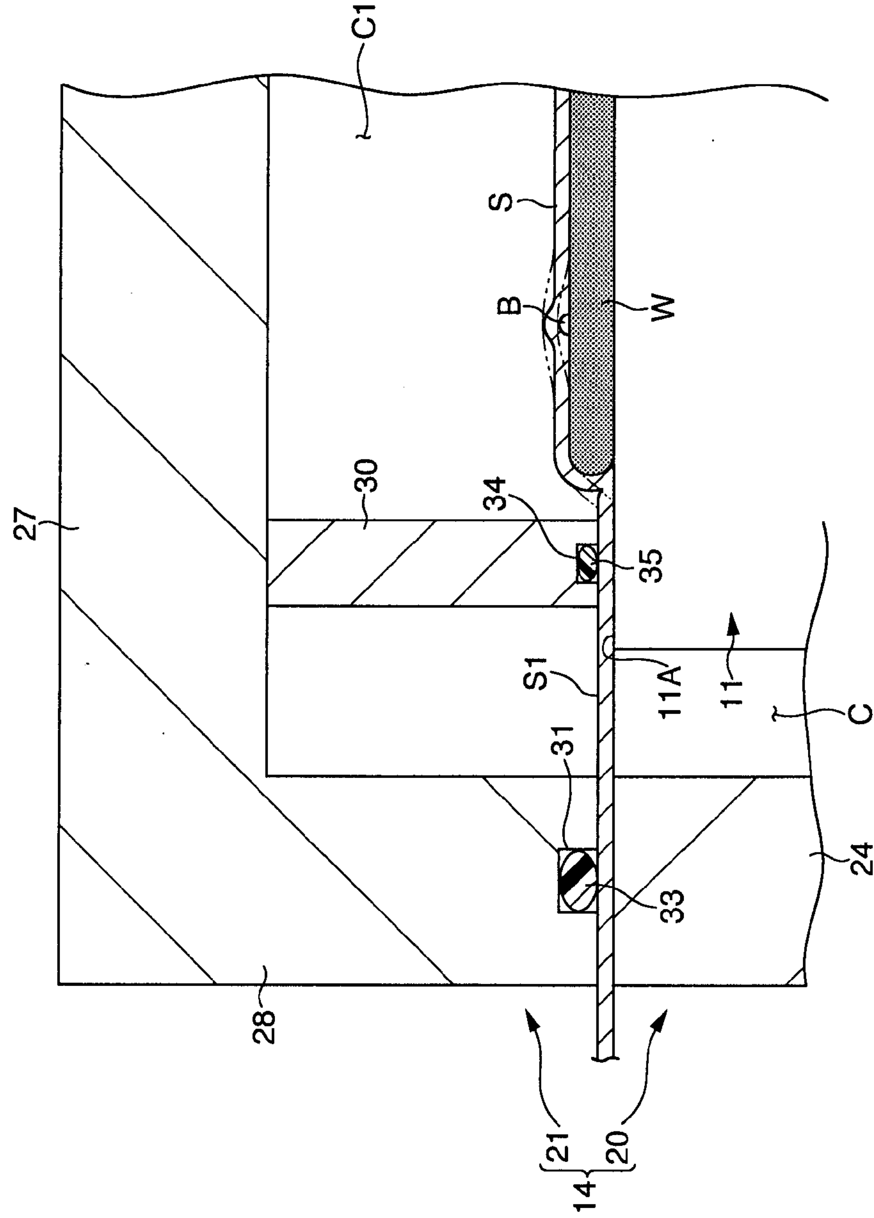


FIG. 5

SHEET STICKING APPARATUS AND SHEET STICKING METHOD

TECHNICAL FIELD

[0001] The present invention relates to a sheet sticking apparatus and a sheet sticking method, and more particularly a sheet sticking apparatus and a sheet sticking method that can stick an adhesive sheet to an adherend under decompression.

BACKGROUND ART

[0002] Conventionally, semiconductor wafers (simply referred to as "wafers" below) are designed to stick an adhesive sheet to a circuit surface and a back surface of the wafers, and are subjected to various processes such as backgrinding and dicing.

[0003] Patent Document 1 discloses an adhesive sheet sticking apparatus. The apparatus includes a lower housing for accommodating a mount table, and an upper housing abutting an upper end of the lower housing. The apparatus is configured to interpose the adhesive sheet between the housings so that two upper and lower decompression chambers (process chambers) partitioned by the adhesive sheet can be formed, and the adhesive sheet is stuck to the wafers under decompression.

Patent Document 1: Japanese Patent Application Laid-Open No. 60-80249

SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

[0004] However, the sheet sticking apparatus in the Patent Document 1 forms the two decompression chambers above and below by the adhesive sheet. In the sheet sticking apparatus having such configuration, the adhesive sheet deforms due to the difference in pressure caused between two decompression chambers when the decompression chambers are decompressed prior to sticking of the sheet, so that the adhesive sheet is stuck to a wafer and pulled in the opposite direction from the wafer before the decompression is completed, thereby causing the sheet to be tore. From this, each decompression chamber must be decompressed while maintained at the same pressure. Therefore, there is a disadvantage that the pressure control is very complicate. Moreover, even when decompressing means common to the two decompression chambers is used, the same disadvantage as described above does not resolved because of the difference in time it takes to reach a predetermined decompression state due to the difference in volumes of the decompression chambers.

OBJECT OF THE INVENTION

[0005] The present invention is made in view of such disadvantages, and has its object to provide a sheet sticking apparatus and a sheet sticking method that can stick an adhesive sheet to an adherend under decompression without any complicated control for decompression control.

Means to Solve the Problems

[0006] To achieve the above object, the present invention adopts the following configuration: a sheet sticking apparatus, comprising: a table for supporting an adherend, an openable and closable case for accommodating the table and forming a decompression chamber in the case, and feeding means for feeding an adhesive sheet to a position where the adhesive sheet faces the adherend; the case being closed, and the adhesive sheet being stuck to the adherend under decompression; wherein in a state where the case is closed to form a single decompression chamber, a pressure adjusting chamber is provided so as to be capable of being formed with the adherend and the adhesive sheet on the adherend enclosed in the decompression chamber, the pressure adjusting chamber being capable of controlling the pressure therein independently of the decompression chamber.

[0007] Moreover, the present invention may adopt the following configuration: a sheet sticking apparatus, comprising: a table for supporting a semiconductor wafer, a first case for accommodating the table and having an opening, a second case for closing the opening and forming a decompression chamber in cooperation with the first case, and feeding means for feeding an adhesive sheet to a position where the adhesive sheet faces the adherend; the adhesive sheet being stuck to the semiconductor wafer under decompression; wherein in a state where the first case is closed by the second case to form a single decompression chamber, a bulkhead is provided to form a pressure adjusting chamber with the semiconductor wafer and the adhesive sheet on the semiconductor wafer enclosed in the decompression chamber, the pressure adjusting chamber being capable of controlling the pressure therein independently of the decompression chamber.

[0008] Preferably, the present invention adopts the following configuration: the table is provided such that an upper surface of the table is able to move forward and backward relative to the bulkhead.

[0009] Moreover, the present invention adopts the following steps: a sheet sticking method, comprising: supporting an adherend; feeding an adhesive sheet to a position where the adhesive sheet faces the adherend; accommodating the adherend and the adhesive sheet and forming a single decompression chamber; decompressing the decompression chamber; forming a pressure adjusting chamber with the adherend and the adhesive sheet on the adherend enclosed in the decompression chamber, the pressure adjusting chamber being capable of controlling the pressure therein independently of the decompression chamber; and sticking the adhesive sheet to the adherend by relatively increasing the pressure in the pressure adjusting chamber relative to the pressure in the decompression chamber.

EFFECTS OF THE INVENTION

[0010] According to the invention, the decompression chamber may be handled as a single decompression chamber so that the invention does not require complicated pressure control that decompresses each decompression chamber while maintaining the pressure in each decompression chamber at the same pressure in the case where a plurality of decompression chambers are formed, because the decompression chamber is not divided into the plurality of chambers by the adhesive sheet. Therefore, the adhesive sheet may be stuck to an adherend only by forming the pressure adjusting chamber and relatively increasing the pressure in the pressure adjusting chamber in a state where the decompression chamber is decompressed.

[0011] Moreover, the table is provided such that the table may advance and retreat toward the bulkhead, and therefore the pressure adjusting chamber may be formed by pressing the table against the bulkhead after the decompression chamber is generally decompressed.

[0012] Note that decompression is used in the description as a concept including a vacuum.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. **1** is a schematic front view showing a sheet sticking apparatus of the embodiment, a part of the apparatus being cross sectioned;
[0014] FIG. **2** is a schematic plan view with a part of FIG. **1** omitted;
[0015] FIG. **3** is a schematic front view showing a state where a decompression chamber is formed;
[0016] FIG. **4** is a schematic cross sectional view showing a state where a pressure adjusting chamber is formed; and
[0017] FIG. **5** is a partial enlarged view showing a state where an adhesive sheet is stuck to a wafer without bubbles.

DESCRIPTION OF REFERENCE NUMERAL

[0018] **10** sheet sticking apparatus
[0019] **11** table
[0020] **14** case
[0021] **15** feeding means
[0022] **20** first case
[0023] **21** second case
[0024] **30** bulkhead
[0025] C decompression chamber
[0026] C**1** pressure adjusting chamber
[0027] S adhesive sheet
[0028] W semiconductor wafer (adherend)

BEST MODE FOR WORKING THE INVENTION

[0029] A preferred embodiment of the present invention will be described below with reference to the drawings.

[0030] FIG. **1** shows a schematic front view of a sheet sticking apparatus according to the embodiment, and FIG. **2** shows a schematic plan view with a part of FIG. **1** omitted. In these drawings, a sheet sticking apparatus **10** comprises a table **11** for supporting a substantially circular wafer W as an adherend, a case **14** for accommodating the table **11** and forming a decompression chamber C therein, and feeding means **15** for feeding a pressure-sensitive adhesive sheet S to a position where the adhesive sheet S faces a surface to be adhered, which is an upper surface of the wafer W, in an opened state of the case **14**. The adhesive sheet S is adopted, which has a width dimension that does not separate the decompression chamber C into upper and lower portions. As shown in FIG. **2**, the adhesive sheet S is adapted to form clearances C**2** without covering an inner-diameter area of the case **14** when fed to the position where the adhesive sheet S faces the surface to be adhered of the wafer W. The clearances C**2** may be a passage such as a pipe and a through-hole to prevent the decompression chamber C from being separated into a plurality of portions.

[0031] The table **11** has a size to form an outer peripheral exposed surface **11**A which is positioned outside of the wafer W with the wafer W centrally supported, wherein the wafer W may be held by holding means (not shown). An output shaft **17** of a linear motor **16** is fixed on a lower surface side of the table **11**. The table **11** is provided such that the table **11** may be moved upward and downward by driving the linear motor **16**.

[0032] The case **14** is composed of a first case **20** located on the lower part side in FIG. **1**, and a second case **21** located on the upper part side therein. The first case **20** comprises a substantially square bottom portion **22** which supports the table **11** via the linear motor **16**, and an erecting portion **24** which continues to the outer periphery of the bottom portion **22** and forms a substantially circular recess portion **23** in the central region thereof, the first case **20** being provided in a form of a container having a bottom with an upper end thereof forming an opening. The first case **20** is connected to a decompression pump (not shown) via a pipe **25** connected to the erecting portion **24** and a first solenoid valve **26**, and is provided so as to be able to be lifted and lowered via elevating means (not shown).

[0033] The second case **21** is comprised of a top portion **27** whose planar shape is a substantially square shape, a drooping portion **28** continuing to the outer periphery of the top portion **27**, and a cylindrical bulkhead **30** provided on the interior surface side of the top portion **27**. The inside diameter of the bulkhead **30** is designed to be larger than the outside diameter of the wafer W, and the outside diameter of the bulkhead **30** is designed to be smaller than the diameter of the table **11**. A recessed groove **31** is formed in a lower end surface of the drooping portion **28** over the entire periphery of the drooping portion **28**. The recessed groove **31** receives an O-ring **33** therein as a packing material. Moreover, a similar recessed groove **34** is also formed in a lower end surface of the bulkhead **30**. The recessed groove **34** receives an O-ring **35** therein.

[0034] The second case **21** is supported movably in a vertical direction via moving means (not shown). The second case **21** is lowered on the first case **20** side, such that the lower end surface of the drooping portion **28** is pressed against an upper end side of the erecting portion **24** and the second case **21** forms the decompression chamber C by interaction with the first case **20**. As shown in FIG. **4**, the lower end surface of the bulkhead **30** is pressed against the outer peripheral exposed surface **11**A of the table **11** in a state where the adhesive sheet S is interposed therebetween when the table **11** is lifted, so that the bulkhead **30** encloses the wafer W and the adhesive sheet S on the wafer W, thereby forming a pressure adjusting chamber C**1** which can control the pressure therein independently of the decompression chamber C. The top portion **27** of the second case **21** is connected with a decompression pump (not shown) via a pipe **37** and a second solenoid valve **38**, so that the pressure control of the pressure adjusting chamber C**1** may be independently conducted through the second solenoid valve **38** and the decompression pump.

[0035] The feeding means **15** comprises: a support roller **40** having a lock mechanism supporting a roll-shaped raw sheet R with a strip-shaped release liner RL temporarily stuck to an adhesive agent layer side of the strip-shaped adhesive sheet S; winding means **41** for collecting the release liner RL; a peel plate **42** for peeling the release liner RL from the adhesive sheet S; drawing and winding means **45** for drawing the adhesive sheet S to the position where the adhesive sheet S faces the surface to be adhered, i.e., the upper surface of the wafer W, and for winding an unnecessary adhesive sheet S**1** which is on a periphery side of the adhesive sheet S stuck to the wafer W; cutting means (not shown) for cutting the adhesive sheet S stuck to the wafer W in accordance with the size of the wafer W; and moving means **48** for supporting the drawing and winding means **45** movably in a horizontal direction in FIG. **1**. Note that the cutting means may use a multi-

jointed robot described in Japanese Patent Application No. 2006-115106 which has already filed by the present applicant.

[0036] The winding means **41** comprises a drive roller **50**, a pinch roller **51** for interposing the release liner RL between the drive roller **50** and the pinch roller **51**, and a release liner winding roller **44** for winding the release liner RL. The drive roller **50** and the release liner winding roller **44** are provided rotatably in synchronization by using a motor M**1** supported by a frame F**1**.

[0037] The drawing and winding means **45** comprises a drive roller **53**, a pinch roller **54** for interposing the unnecessary adhesive sheet S**1** between the drive roller **53** and the pinch roller **54**, and an unnecessary-sheet winding roller **47**. The drive roller **53** and the unnecessary-sheet winding roller **47** are provided rotatably in synchronization by using a motor M**2** supported by a frame F**2**.

[0038] The moving means **48** comprises a single axis robot **55** extending in a horizontal direction in FIG. **1**. The frame F**2** is fixed to a slider **56** of the single axis robot **55** so that the drawing and winding means **45** can move in a horizontal direction.

[0039] A sheet sticking method according to the embodiment will be now described with reference to FIGS. **3** to **5**.

[0040] First, a lead end of the raw sheet R supported by the support roller **40** is drawn by a predetermined length, in a state where the second case **21** is positioned at a lifted position to open the case **14**; the release liner RL is peeled from the adhesive sheet S at the tip end of the peel plate **42**; and a lead end of the release liner RL is fixed to the release liner winding roller **44**. On the other hand, the adhesive sheet S is fixed to the unnecessary-sheet winding roller **47** of the drawing and winding means **45** which is positioned at a position shown by a two-dot chain line in FIG. **1**.

[0041] When a wafer W is placed on the table **11**, the drawing and winding means **45** moves from a position of the two-dot chain line in FIG. **1** to a position shown by a solid line in a state of locking the rotation of the drive roller **53** and the unnecessary-sheet winding roller **47**, and the winding means **41** is driven in synchronism with such operation so that the release liner is collected. Thus, the adhesive sheet S is fed into a state where the adhesive sheet S extends across and above the first case **20**, i.e. to the position where the adhesive sheet S faces the upper surface of the wafer W.

[0042] Next, the first case **20** is lifted, and the second case **21** is lowered, so that the decompression chamber C is formed by interaction with the first and second cases **20** and **21** (see FIG. **3**). At this time, the decompression chamber C is not separated into the upper and lower portions by the adhesive sheet S. Moreover, at this stage, the pressure adjusting chamber C**1** is not formed as well, but a single decompression chamber C is formed in which the interiors of the first and second cases **20** and **21** are generally communicated with each other. In this state, the decompression chamber C is decompressed through the pipe **25** by controlling the solenoid valve **26**. When the decompressed pressure reaches a predetermined set pressure, the table **11** is lifted so that the lower end surface of the bulkhead **30** is pressed against the outer peripheral exposed surface **11**A of the table **11** via the adhesive sheet S, so that the pressure adjusting chamber C**1** is formed which is capable of controlling the pressure therein independently of the decompression chamber C.

[0043] The pressure in the decompression chamber C is gradually brought close to atmospheric pressure (which eventually becomes atmospheric pressure) through the pipe **37** by controlling the solenoid valve **38**. This operation causes the adhesive sheet S to be stuck to the wafer W. Where the adhesion is performed under such decompression, spaces which are present at the outer peripheral end of the wafer W and around a bump B formed on the wafer W, as shown by a two-dot chain line in FIG. **5**, are eliminated when the pressure therein reaches normal pressure (atmospheric pressure). Therefore, the adhesive sheet S may be stuck to the wafer W without bubbles.

[0044] When sticking of the adhesive sheet S is completed, the pressure in the decompression chamber C except the pressure adjusting chamber C**1** is gradually brought close to atmospheric pressure by controlling the solenoid valve **26**. When the pressure therein reaches atmospheric pressure, the second case **21** is lifted to open the case **14**. The adhesive sheet S, then, is cut into a closed loop shape along the outer periphery of the wafer W, by way of the cutting means (not shown).

[0045] After the adhesive sheet S is cut, the drive roller **53** and the unnecessary-sheet winding roller **47** move to the position shown by the two-dot chain line in FIG. **1** while the rollers **53** and **47** rotate, in a state where the support roller **40** and drive roller **50** are locked. Thus, the unnecessary adhesive sheet S**1** produced by the above cutting is wound.

[0046] The wafer W, with the adhesive sheet S stuck, is transferred to a subsequent process or a predetermined storage locker by way of conveying means (not shown), and a subsequent wafer W to be subjected to sticking is transferred on the table **11**, and thereafter the adhesive sheet S is stuck as well.

[0047] According to this embodiment, thus, the embodiment is configured to form the pressure adjusting chamber C**1**, which is capable of controlling the pressure independently, within a single the decompression chamber C, and sticks the adhesive sheet S on the wafer W. Therefore, such configuration does not require conventional complicated pressure control which decompresses a plurality of decompression chamber while maintaining the pressure in the plurality of decompression chambers at the same pressure, and also highly simplify decompression control in the decompression chamber C. In particular, the sticking of the sheet under such decompression enables a problem for bubble intrusion to be avoided when the wafer W includes a bump forming a concave-convex surface.

[0048] Although the best configuration, method, and the like for carrying out the invention have been disclosed in the above description, the invention is not limited thereto.

[0049] Thus, the invention has been particularly illustrated and described mainly in terms of a specific embodiment, but those skilled in the art may make various modifications to the embodiments described above in term of shapes, quantities, and other detailed configurations without deviating from the scope of a technical idea and an object of the invention.

[0050] Accordingly, the description limiting the shapes and the like disclosed above is described as an example in order to facilitate understanding of the invention, and is not intended to limit the invention. Therefore, the descriptions of parts name without part or all of the limiting of the shapes, and the like thereof are within the invention.

[0051] In the embodiment described above, the pressure sensitive adhesive sheet is used as the adhesive sheet S, as an example. However, the present invention is not limited thereto, and may adopt a heat-sensitive adhesive sheet for die

bonding, and the like. In this instance, a heater may be built into the table **11** and air supplied through the pipe **37** may be hot air. Moreover, the adhesive sheet S may also be fed using an adhesive sheet of sheet-fed type.

[0052] Further, the adherend is not limited to the wafer W, but may also glass plates, steel plates or resin plates and the like, and other plate member having no bump. The semiconductor wafer may also be a silicon wafer or a compound wafer.

1. A sheet sticking apparatus, comprising: a table for supporting an adherend, an openable and closable case for accommodating the table and forming a decompression chamber in the case, and feeding means for feeding an adhesive sheet to a position where the adhesive sheet faces the adherend; the case being closed, and the adhesive sheet being stuck to the adherend under decompression;

wherein in a state where the case is closed to form a single decompression chamber, a pressure adjusting chamber is provided so as to be capable of being formed with the adherend and the adhesive sheet on the adherend enclosed in the decompression chamber, the pressure adjusting chamber being capable of controlling the pressure therein independently of the decompression chamber.

2. A sheet sticking apparatus, comprising: a table for supporting a semiconductor wafer, a first case for accommodating the table and having an opening, a second case for closing the opening and forming a decompression chamber in cooperation with the first case, and feeding means for feeding an adhesive sheet to a position where the adhesive sheet faces the adherend;

the adhesive sheet being stuck to the semiconductor wafer under decompression;

wherein in a state where the first case is closed by the second case to form a single decompression chamber, a bulkhead is provided to form a pressure adjusting chamber with the semiconductor wafer and the adhesive sheet on the semiconductor wafer enclosed in the decompression chamber, the pressure adjusting chamber being capable of controlling the pressure therein independently of the decompression chamber.

3. The sheet sticking apparatus according to claim **2**, wherein the table is provided such that an upper surface of the table is able to advance and retreat toward the bulkhead.

4. A sheet sticking method, comprising steps of:

supporting an adherend;

feeding an adhesive sheet to a position where the adhesive sheet faces the adherend;

accommodating the adherend and the adhesive sheet and forming a single decompression chamber;

decompressing the decompression chamber;

forming a pressure adjusting chamber with the adherend and the adhesive sheet on the adherend enclosed in the decompression chamber, the pressure adjusting chamber being capable of controlling the pressure therein independently of the decompression chamber; and

sticking the adhesive sheet to the adherend by relatively increasing the pressure in the pressure adjusting chamber relative to the pressure in the decompression chamber.

* * * * *