

LID OPENING COMPONENT, LID OPENING DEVICE AND WITHDRAWAL SYSTEM

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

[0001] The present disclosure relates to a lid opening component, a lid opening device, and a withdrawal system including the lid opening device. An alignment unit of the lid opening device identifies the position of a lid, and then unpowered needles of the lid opening component correspond in position to the pattern of the lid in order
10 to open the lid.

2. Description of the Related Art

[0002] Chemicals, for example, slurry dedicated to a semiconductor planarization process, are used in processes carried out by semiconductor and electronic plants. In general, the chemicals are stored in chemical solution buckets. The top of each
15 chemical solution bucket has two lids for hermetically sealing an opening of the chemical solution bucket. To withdraw or deposit the chemicals, a step of removing the lids is carried out. In general, the lids of the chemical solution bucket are round and solid and has lateral threads and a pattern (for example, cruciform groove or

polygonal recess) at their tops. Referring to FIG. 1, there is shown a schematic view of a conventional lid opening method. A conventional lid opening process is usually carried out by hand by a worker A0 who uses a lid opening apparatus A1 to apply a force on the pattern at the top of a lid L1 in order to open or hermetically seal the lid L1. However, workers carrying out the conventional lid opening process are likely to be exposed to leaking chemicals or fall victim to explosions.

[0003] An attempt to improve workplace safety brings the development of several types of automated lid opening apparatuses, most of which open lids mechanically rather than manually. There are a wide variety of patterns on the tops of the lids of chemical solution buckets. Thus, to operate an automated lid opening apparatus for performing a lid opening step, it is necessary to prepare a lid opening jig which matches the lids in shape. Although this technique enhances workplace safety, it fails to improve operation efficiency. Furthermore, not every automated lid opening apparatus can be provided with an appropriate lid opening jig, and thus this technique is not in wide use.

BRIEF SUMMARY OF THE INVENTION

[0004] An objective of the present disclosure is to provide a lid opening component,

lid opening device and withdrawal system. The withdrawal system comprises a lid opening device. The lid opening device further comprises a lid opening component.

In order for the withdrawal system to withdraw contents (including but not limited to liquid, gas, mixture of solid and liquid, or the like) of a container (for example, a

5 chemical solution bucket), the alignment unit of the lid opening device identifies positions of the container and its lid. Then, the unpowered needles of the lid opening

components are arranged to correspond in position to the pattern of the lid to effectuate lid opening. Finally, the withdrawal unit withdraws contents of the

container. The lid opening component, lid opening device and withdrawal system are

10 powered by a power source. The lid opening component, lid opening device and

withdrawal system can automatically carry out the lid opening and withdrawal processes without human beings and any appropriate lid opening jig which matches

the pattern on the surface of the lid, so as to enhance workplace safety and operation efficiency.

15 [0005] To achieve at least the above objective, the present disclosure provides a lid

opening component comprising a needle-shaped holder, a plurality of unpowered needles and a driving element. The unpowered needles are movably disposed at the

needle-shaped holder and adapted to move according to the pattern on the surface of

the lid to thereby fit on the surface of the lid. The driving element is connected to the needle-shaped holder and powered to drive the needle-shaped holder to rotate in order to open the lid.

[0006] To achieve at least the above objective, the present disclosure provides a lid opening device comprises an alignment unit and a lid opening unit. The alignment unit has two alignment devices disposed at two opposing ends, respectively. The alignment unit is movable, and the two alignment devices are movable toward or away from each other to identify positions of a bucket and its lid. The lid opening unit has two said lid opening components disposed at two opposing ends, respectively, and being coplanar with the alignment unit. The two lid opening components are movable toward or away from each other. A power source supplies a power to the alignment unit and lid opening unit. After the alignment unit has identified the positions of the lids, the lid opening unit moves to the lids accordingly. Then, the lids are rotated and opened after the unpowered needles of the two lid opening components have fitted on the surfaces of the lids.

[0007] Optionally, the two lid opening components of the lid opening unit each further comprise a skirt element and an air extracting device. The skirt element encloses the unpowered needles to define an internal space. The air extracting device

is connected to the lid opening component. When the unpowered needles fit on the surface of the lid and then rotate and open the lid, the air extracting device extracts air from the internal space to form simulated vacuum environment conducive to tight engagement of the lid opening components with the lid.

5 [0008] Optionally, the lid opening unit further comprises a first connecting element. Two ends of the first connecting element are connected to the lid opening components, respectively, to enable the lid opening components to move toward or away from each other.

[0009] Optionally, the alignment devices of the alignment unit are each an
10 ultrasonic range finder, an infrared range finder or an alignment lens.

[0010] To achieve at least the above objective, the present disclosure provides a withdrawal system which comprises the lid opening device and the withdrawal unit. The withdrawal unit has two withdrawal components disposed at two opposing ends, respectively, and the two withdrawal components are movable toward or away from
15 each other. After the lid opening device has opened the lid of the bucket, the withdrawal unit moves to the opening of the bucket to withdraw contents of the bucket.

[0011] Optionally, the withdrawal unit forms a right angle with the lid opening unit

of the lid opening device and further comprises a second connecting element. Two ends of the second connecting element are connected to the withdrawal components, respectively, such that the withdrawal components are movable toward or away from each other.

5 [0012] Optionally, the withdrawal system further comprises a bucket securing device disposed below the lid opening device and withdrawal unit.

[0013] Optionally, the bucket securing device further comprises a bucket positioning device. The bucket positioning device has a carrier and at least one clamp.

The carrier carries the bottom of the bucket. The clamp is disposed outside the carrier
10 and has at least three stop portions. When the carrier carries the bucket, the stop portions approach, abut against and secure the bucket.

[0014] Optionally, the bucket positioning device further comprises a horizontal rotating shaft, an oblique rotating shaft and a plurality of rollers. The horizontal rotating shaft is connected to the carrier to drive the horizontal rotation of the carrier.

15 The oblique rotating shaft is connected to the carrier to drive the oblique rotation of the carrier. The rollers are disposed on the surface of the carrier to enable the bucket to slide to above the carrier.

[0015] In short, the present disclosure provides a lid opening component, a lid

opening device, and a withdrawal system including the lid opening device. An alignment unit of the lid opening device identifies the position of a lid, and then unpowered needles of the lid opening component correspond in position to the pattern of the lid in order to open the lid. Then, the withdrawal unit withdraws contents of the container. According to the present disclosure, the lid opening component, lid opening device and withdrawal system ensure user safety, save time, reduce cost, and thus have competitive edges in various markets which focus on semiconductor and electronic products, for example, and have demands for opening and withdrawal (including but not limited to withdrawal of liquid).

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 (PRIOR ART) is a schematic view of a conventional lid opening method.

[0017] FIG. 2 is a block diagram of a withdrawal system according to an embodiment of the present disclosure.

[0018] FIG. 3A is a perspective view of the withdrawal system according to an embodiment of the present disclosure.

[0019] FIG. 3B is a bottom view of the withdrawal system according to an

embodiment of the present disclosure.

[0020] FIG. 3C is a schematic view of a process flow of identifying a bucket and its lid with an alignment device according to an embodiment of the present disclosure.

[0021] FIG. 4A is a cutaway view of a lid opening component according to an

5 embodiment of the present disclosure.

[0022] FIG. 4B is a bottom view of the lid opening component according to an embodiment of the present disclosure.

[0023] FIG. 4C is a perspective view of the lid opening component according to an embodiment of the present disclosure.

10 [0024] FIG. 4D is a perspective view of the lid opening component according to an embodiment of the present disclosure.

[0025] FIG. 5 is a perspective view of a bucket securing device according to an embodiment of the present disclosure.

15 DETAILED DESCRIPTION OF THE INVENTION

[0026] To facilitate understanding of the object, characteristics and effects of this present disclosure, embodiments together with the attached drawings for the detailed description of the present disclosure are provided.

[0027] The present disclosure provides a lid opening component, a lid opening device and a withdrawal system. The lid opening device opens a lid of a container (including but not limited to a bucket which contains a chemical solution). Then, the withdrawal unit withdraws contents (including but not limited to liquid, gas, mixture of solid and liquid, or the like) of the container. In order for the lid opening device to open the lid, the alignment unit with two alignment devices identifies the positions of the bucket and lid, and then the lid opening unit with two lid opening components moves according to the identification result, such that the two lid opening components lie on the lid (in general, the container has two lids when it is a chemical solution bucket). Unpowered needles of the lid opening components correspond in position to the pattern on the surface of the lid and receive a power to thereby rotate in order to open the lid. The lid opening component rotates in any directions, for example, clockwise and counterclockwise as needed.

[0028] Referring to FIG. 2, there is shown a block diagram of a withdrawal system according to an embodiment of the present disclosure. As shown in FIG. 2, a withdrawal system 1 comprises a lid opening device 2 and a withdrawal unit 4. The withdrawal unit 4 comprises a withdrawal component 401. The lid opening device 2 comprises a lid opening unit 3 and an alignment unit 6. The alignment unit 6

comprises an alignment device 601. The lid opening unit 3 comprises a lid opening component 301. The lid opening component 301 further comprises a driving element 3011, a needle-shaped holder 3012 and a plurality of unpowered needles 3013.

[0029] The withdrawal system and lid opening device are described further below.

5 Referring to FIG. 3A, there is shown a perspective view of the withdrawal system according to an embodiment of the present disclosure. Referring to FIG. 3B, there is shown a bottom view of the withdrawal system according to an embodiment of the present disclosure. As shown in FIG. 3A and FIG. 3B, the withdrawal system 1 comprises the withdrawal unit 4 and lid opening device 2. The lid opening device 2
10 further comprises the alignment unit 6 and lid opening unit 3. The alignment unit 6 has two alignment devices 601. The two alignment devices 601 are disposed at two opposing ends, respectively. The two alignment devices 601 are connected by a connecting element 602 therebetween, such that the two alignment devices 601 are movable toward or away from each other. The connecting element 602 includes but
15 is not limited to two screws, two linear actuators or comprises two single-axis actuators. The lid opening unit 3 has two lid opening components 301. The two lid opening components 301 are disposed at two opposing ends, respectively. The two lid opening components 301 are connected by a connecting element 302 therebetween,

such that the two lid opening components 301 are movable toward or away from each other. The connecting element 302 includes but is not limited to two screws, two linear actuators or comprises two single-axis actuators. In an embodiment of the present disclosure, the lid opening unit 3 and alignment unit 6 are coplanar and have
5 an included angle of around 45 degrees therebetween, but the present disclosure is not limited thereto. The lid opening unit 3 and alignment unit 6 undergo three-dimensional movement after receiving a power from a power source (not shown).

[0030] The alignment devices 601 includes but is not limited to an ultrasonic range finder, an infrared range finder or an alignment lens. The alignment devices 601
10 identified positions of a bucket of a container and a lid of the bucket. Referring to FIG. 3C, there is shown a schematic view of a process flow of identifying a bucket and its lid with an alignment device according to an embodiment of the present disclosure. Referring to FIG. 3C, in step S1, the alignment devices 601 and bucket T move relative to each other (either the alignment devices 601 move, or bucket T
15 moves) along path P1 to identify distances between four points at the edge of bucket T and thus calculate the center of bucket T. This step is premised on two features: the distance between the two alignment devices 601 is less than the diameter of bucket T, and the two alignment devices 601 flank the center of bucket T. Then, in

step S2, the alignment devices 601 under the second instance of the identification process to determine the midpoint between the two lids to thereby enable the lid opening device to perform lid opening and positioning subsequently. The alignment devices 601 and bucket T move relative to each other (either the alignment devices 601 move, or bucket T moves) along path P2 to identify and thus calculate the midpoint between the two lids L1. The two alignment devices 601 of the alignment unit 6 can even horizontally move toward or away from each other to determine the positions of the two lids L1. Step S1 is not necessarily a step required to identify the bucket and lid of a container with the two alignment devices 601. The purpose of the alignment devices 601 is to identify the centers of the two lids L1 and then position the lid opening device during a lid opening process accordingly. The alignment devices can be operated in the dark, when provided in the form of alignment devices capable of operating without light (for example, ultrasonic range finders); hence, the present disclosure meets the trend toward lights-out factories.

[0031] Upon completion of the operation of the alignment unit, the two lid opening units move according to the positions of the two lids and the midpoint therebetween, such that the centers of the two lid opening units shift to the centers of the two lids, so as for the two lid opening units to move to above the lids of the bucket and perform

the lid opening step. The movement of the two lid opening units is powered by the power supplied by the power source. Referring to FIG. 4A, there is shown a cutaway view of a lid opening component according to an embodiment of the present disclosure. Referring to FIG. 4B, there is shown a bottom view of the lid opening component according to an embodiment of the present disclosure. Referring to FIG. 4C and FIG. 4D, there are shown perspective views of the lid opening component according to an embodiment of the present disclosure. Referring to FIG. 4A~FIG. 4D, which show a driving element 3011, a needle-shaped holder 3012, and unpowered needles 3013 of the lid opening component 301, the unpowered needles 3013 are movably disposed on the needle-shaped holder 3012. FIG. 4A shows that the driving element 3011 comprises a driver gear 3011a, driven gear 3011b and gear functioning zone 3011c. Before the lid opening component comes into contact with the lid, the unpowered needles 3013 hang freely as shown in FIG. 4d. When the power source provides a power for the lid opening component 301 to move toward the lid (including but not limited to the scenario where the lid lies below the lid opening component, and the power source enables the lid opening component to move downward), the unpowered needles 3013 are re-arranged (including but not limited to the arrangement of the unpowered needles shown in FIG. 4C, where FIG. 4C does

not show any lid) according to the pattern on the surface of the lid, allowing the unpowered needles 3013 to move according to the pattern on the surface of the lid and thus fit on the surface of the lid. Then, the driving element connected to the needle-shaped holder 3012 drives the needle-shaped holder 3012 to rotate, such that
5 the unpowered needles 3013 drive the lid to rotate, thereby allowing the lid to be opened. According to the present disclosure, the driving element 3011 operates as follows: the driver gear 3011a drives the driven gear 3011b to rotate, thereby driving the gear functioning zone 3011c and the needle-shaped holder 3012 to rotate; however, the present disclosure is not limited thereto. For example, the needle-
10 shaped holder 3012 is connected to a rotating shaft in order to move. Alternatively, the needle-shaped holder is directly connected to a power source, whereas the driving element is a rotating shaft or a component connected to a power source.

[0032] The lid opening component 301 further comprises a skirt element and an air extracting device for assisting with the process of opening and gripping the lid.

15 Referring to FIG. 4A and FIG. 4B, the lid opening component 301 further comprises a skirt element 3014 for enclosing the unpowered needles 3013 to therefore define an internal space and further comprises an air extracting device 3015 connected to the lid opening component 301. The air extracting device 3015 is disposed in the

internal space of the skirt element 3014 and adapted to extract air when the unpowered needles 3013 fit on the surface of the lid to rotate and open the lid; thus, the internal space is in a simulated vacuum state, such that the lid engages tightly with the unpowered needles 3013 to render it easy to open and grip the lid. The present disclosure places no limitations on the material which the skirt element is made of and the shape of the skirt element. For example, the skirt element is in the form of a strip formed by a cutting process or is in the form of soft drapes which hang from the top of the lid opening component. Furthermore, the air extracting device is not restrictive of the present disclosure in terms of type and position and will work, provided that it enables the internal space to enter a simulated vacuum state.

[0033] After the lid of the bucket has been opened and removed, the withdrawal unit of the withdrawal system receives a power from a power source and thus withdraws the contents of the bucket. Referring to FIG. 3A and 3B, the withdrawal unit 4 has two withdrawal components 401 disposed at two opposing ends, respectively. The two withdrawal components 401 are connected by a connecting element 402 therebetween, such that the two withdrawal components 401 are movable toward or away from each other. The connecting element 402 includes but is not

limited to two screws, two linear actuators or comprises two single-axis actuators.

The withdrawal unit 4 can form a right angle with the lid opening unit 3 but not necessarily so. Alternatively, the two withdrawal components 401 and the two lid opening components 301 are connected together to a connecting element of a four-

5 axis screw, and the four axes of the four-axis screw are actuated horizontally to enable the withdrawal components and lid opening components to undergo horizontal displacement across the same plane, thereby cutting cost by dispensing with conventional, expensive robotic arms. Furthermore, the four-axis screw may even have an axle whereby the withdrawal components and lid opening components

10 connected by the four-axis screw can undergo three-dimensional movement; however, the four-axis screw is not restrictive of the present disclosure. Upon removal of the lid from the bucket, the withdrawal unit 4 moves according to the initial position of the lid and with the power supplied by the power source, such that the withdrawal components 401 end up above the opening (the initial position of the lid) of the

15 bucket to withdraw contents of the bucket. The present invention places no limitations on the forms of the withdrawal components. For example, the withdrawal components can be joint valve members which come in different calibers and come with different connectors.

[0034] The withdrawal system further comprises a bucket securing device for holding a container, such as a bucket, to render the alignment step, the lid opening step and the withdrawal steps precise. Referring to FIG. 5, there is shown a perspective view of a bucket securing device according to an embodiment of the present disclosure. As shown in FIG. 5, a bucket securing device 7 comprises an upper securing member 701, lateral securing member 702 and bucket positioning device 703. The upper securing member 701 has a bucket grip zone 7011 and support securing disk 7012. The bucket grip zone 7011 fixes the top of the bucket in place. The support securing disk 7012 enables the withdrawal unit and lid opening device to be positioned in place. The lateral securing member 702 fixes the lateral part of the bucket in place and has a baffle 7021 restrictive of the position of the bucket. The outline of the lateral securing member 702 matches the outline of a lateral part of the bucket, for example, an arcuate surface of the bucket, to reinforce the bucket. Furthermore, the bucket securing device further comprises a weighing device for monitoring the weight of the bucket and contents thereof at any time. The present disclosure places no limitations on the number and position of the weighing device. For example, according to the present disclosure, the weighing devices are mounted on the lateral securing member and/or bucket positioning device.

[0035] The withdrawal processed performed with the withdrawal system is described below. First, the withdrawal system uses the alignment unit to identify the position of the lid of the bucket. After the position of the lid of the bucket has been identified, the two lid opening components of the lid opening unit are moved to above the lid and open the lid by means of the unpowered needles corresponding in position to the pattern on the surface of the lid. The skirt element and the air extracting device are conducive to enhanced engagement between the lid and the unpowered needles and removal of the lid. Furthermore, the withdrawal unit is moved to above the opening (i.e., initial position of the lid) of the bucket and withdraws contents of the bucket. The lid opening components, lid opening device and withdrawal system are also applicable to a lid shutting process, where the unpowered needles of the lid opening components move to above the opening and further rotate to thereby fasten the lid to the bucket.

[0036] Technical features of the lid opening components, lid opening device and withdrawal system of the present disclosure are described below and compared with conventional technical features.

[0037] Conventional lid opening processes are carried out by hand, and in consequence workers carrying out the conventional lid opening processes are likely

to be exposed to leaking chemicals, thereby bringing about the development of automated lid opening equipment. However, existing automated lid opening equipment requires a time-consuming process of changing a lid opening jig to suit different lids but to the detriment of the efficiency of a lid opening operation. By

5 contrast, the present disclosure provides the lid opening components, lid opening device and withdrawal system which use a low-cost alignment device and lid opening unit in order to open a lid, wherein the unpowered needles of the lid opening unit correspond in position to the pattern on the surface of the lid, dispensing with the time-consuming process of changing a lid opening jig. The lid opening device is

10 coupled to the withdrawal system, such that the withdrawal process is carried out automatically, not to mention that the alignment unit of the lid opening device can operate in conjunction with an alignment device which does not rely on light.

Therefore, the lid opening device and the withdrawal system of the present disclosure can operate in the dark to thereby meet the trend toward lights-out factories.

15 [0038] While the present disclosure has been described by means of specific embodiments, numerous modifications and variations could be made thereto by those skilled in the art without departing from the scope and spirit of the present disclosure set forth in the claims.

[0039] Symbolic description:

	withdrawal system	1
	lid opening device	2
	lid opening unit	3
5	lid opening component	301
	connecting element	302
	driving element	3011
	driver gear	3011a
	driven gear	3011b
10	gear functioning zone	3011c
	needle-shaped holder	3012
	unpowered needle	3013
	skirt element	3014
	air extracting device	3015
15	withdrawal component	401
	connecting element	402
	alignment unit	6
	alignment device	601
	connecting element	602
20	bucket securing device	7
	upper securing member	701
	bucket grip zone	7011
	support securing disk	7012
	lateral securing member	702
25	baffle	7021
	bucket positioning device	703
	worker	A0

	lid opening apparatus	A1
	lid	L1
	path	P1, P2
	step	S1, S2
5	bucket	T

CLAIMS

What is claimed is:

1. A lid opening component, comprising:

a needle-shaped holder;

5 a plurality of unpowered needles movably disposed at the needle-shaped holder and adapted to move and fit on a surface of a lid according to pattern on the surface of the lid; and

a driving element connected to the needle-shaped holder and, upon receipt of power, driving the needle-shaped holder to rotate in order to open the lid.

10 2. A lid opening device, comprising:

an alignment unit having two alignment devices disposed at two opposing ends, respectively, wherein the alignment unit is movable, and the alignment devices are movable toward or away from each other to identify positions of a bucket and a lid thereof; and

15 a lid opening unit having two lid opening components disposed at two opposing ends, respectively, being coplanar with the alignment unit, being movable toward or away from each other, and being each the lid opening component of claim 1,

wherein at least one power source supplies a power to the alignment unit and

the lid opening unit,

wherein the lid opening unit moves onto the lid after the alignment unit has identified the position of the lid and then rotates and opens the lid after the unpowered needles of the lid opening components have fitted on the surface of the

5 lid.

3. The lid opening device of claim 2, wherein the lid opening components of the lid opening unit each further comprise:

a skirt element enclosing the unpowered needles to define an internal space; and

an air extracting device connected to the lid opening component,

10 wherein, when the unpowered needles fit on the surface of the lid and then rotate and open the lid, the air extracting device extracts air from the internal space to form simulated vacuum environment conducive to tight engagement of the lid opening components with the lid.

4. The lid opening device of claim 2, wherein the lid opening unit further comprises

15 a first connecting element having two ends connected to the lid opening components, respectively, to enable the lid opening components to move toward or away from each other.

5. The lid opening device of claim 2, wherein the alignment devices of the

alignment unit are each an ultrasonic range finder, an infrared range finder or an alignment lens.

6. A withdrawal system, comprising:

the lid opening device of any one of claims 2-5; and

5 a withdrawal unit having two withdrawal components disposed at two opposing ends, respectively, and movable toward or away from each other, wherein, after the lid opening device has opened a lid of a bucket, the withdrawal unit moves to an opening of the bucket to withdraw contents of the bucket.

7. The withdrawal system of claim 6, wherein the withdrawal unit forms a right
10 angle with the lid opening unit of the lid opening device and further comprises a second connecting element with two ends connected to the withdrawal components, respectively, such that the withdrawal components are movable toward or away from each other.

8. The withdrawal system of claim 6, further comprises a bucket securing device
15 disposed below the lid opening device and the withdrawal unit.

9. The withdrawal system of claim 8, wherein the bucket securing device further comprises:

at least one weighing device disposed at the bucket securing device and adapted

to monitoring weight of the bucket and the contents.

10. The withdrawal system of claim 7, wherein the first connecting element comprises two screws of a four-axial screws, and the second connecting element comprises the other two screws of the four-axial screws.