Description

VALVE FOR PREVENTING REVERSE-FLOW

Technical Field

[1] The present invention relates to a valve for preventing reverse-flow, and more specifically to a valve for preventing reverse-flow, which is disposed between a vacuum chamber and a vacuum pump, comprising a valve body; first and second connecting portions that extend from both ends of the valve body and are connected to exhaust pipes extending from the vacuum chamber and the vacuum pump, respectively; a rotating shaft that is hinge-connected to the inner upper end of the valve body so as to be rotated about a hinge shaft; a isolating plate that is connected to one end of the rotating shaft, has a diameter which is larger than the inner diameter of the first connecting portion and is smaller than the inner diameter of the valve body, and is rotated toward the first connecting portion to prevent a flow of fluid when an abnormality occurs in a vacuum line; and a power source that is connected to the other end of the rotating shaft to provide a driving force for driving the isolating plate.

Background Art

[2] When semiconductors or plasma display panels (PDP) are manufactured, etching, deposition, exhaustion and the like are performed. When such processes are performed, various devices including a vacuum chamber and the like are used. Further, a vacuum pump is used to maintain a vacuum state. However, when the vacuum pump is not operated because of a breakdown or a stoppage of power supply, contaminated materials in the air, such as vapor and the like, may flow reversely into the vacuum chamber, resulting in the contamination of the product which is being manufactured.

[3] Therefore, various methods have been proposed, in which when a vacuum pump is stopped, such a reverse flow is prevented and the inside of a vacuum chamber is blocked from the external air such that a product within the vacuum chamber can be protected. Korean Patent Laid-Open Publication No. 2004-0085926 has disclosed a semiconductor manufacturing device having a valve for preventing reverse-flow. The valve for preventing reverse-flow includes a discharge section which has a switching valve and sets an environment of a process chamber, a cleaning section which cleans impurities discharged by the discharge section, and a reverse flow prevention section which is provided between the discharge section and the cleaning section so as to prevent the impurities from flowing reversely. The reverse flow prevention section is composed of a first projection member which projects inwardly from one end of piping and a second projection member which projects inwardly from the other end of the piping. The reverse flow prevention section is formed in the piping which introduces

impurities, discharged from the discharge section, into the cleaning section. The reverse flow prevention section can prevent impurities such as water which flow reversely from the cleaning section to the discharge section from advancing. Korean Utility Model Laid-Open No. 1993-016166 has disclosed a prevention valve including a slider which is coupled to the outside of an ejection port formed on a vacuum line so as to slide along a shaft; a blade which is formed on the outer periphery of the slider so as to receive an effect of atmospheric pressure; a bearing which is inserted into the inner surface of the slider such that an operation is smoothly performed; and an O-ring which is inserted and fixed to a connection surface between the ejection port and the slider so as to maintain air tightness. Korean Patent Laid-Open Publication No. 2000-0007260 has disclosed a valve for preventing reverse-flow including a supporting shaft which is fixed to cross an inner path of a discharge pipe; a left rotating blade of which one end is hinge-connected to the left side of the supporting shaft and the other end is rotated by atmospheric pressure to block the inner path in the left side of the supporting shaft, when the external air flows reversely; a right rotating blade of which one end is hinge-connected to the right side of the supporting shaft and the other end is rotated to block the inner path in the right side of the supporting shaft; and a stopper which fixes the left and right blades to the positions for blocking the inner path, when the external air flows reversely.

[4] The prevention valves according to the above-described inventions have no structure that can achieve two-way prevention. Therefore, it is difficult to prevent a damage caused by a sudden stoppage of a vacuum pump. Before this invention is filed, the present inventor has applied for a patent on a valve for preventing reverse-flow (Korean Patent Laid-Open Publication No. 2004-0104557), in order to solve such a problem. The valve for preventing reverse-flow includes a first cylindrical body which is sealed by a first lid having an entrance connected to a tube at a vacuum chamber and a second lid having an entrance connected to a tube at a vacuum pump and has an empty space formed therein; a second cylindrical body which is inserted and assembled into the empty space of the first cylindrical body and has an empty space with a predetermined diameter formed in the center thereof; a third cylindrical body which is inserted and assembled into the central empty space of the second cylindrical body; and a isolating plate which is installed between the third cylindrical body and the first lid and opens and closes a flow path while being moved vertically by a pressure difference between the vacuum chamber and the vacuum pump. The second cylindrical body, which is formed in a donut shape, has a projection formed on the outer surface thereof. When the second cylindrical body is inserted into the first cylindrical body, a vertical flow path is formed between both circumferential surfaces of the first and second cylindrical bodies. Further, the second cylindrical body has flow-path

formation guides formed on the top and bottom surfaces thereof such that a horizontal flow path is formed. The third cylindrical body has a projection formed on the circumferential surface thereof such that a vertical flow path is formed in a gap between the both circumferential surfaces of the second and third cylindrical bodies. Further, the third cylindrical body has an empty space provided in the center thereof such that a flow path is formed toward the entrance of the second lid.

[5] However, the valve for preventing reverse-flows disclosed in the above-described inventions, including that of the present inventors, may not be operated at a wanted time, when bearing of the valves are not smoothly operated. Further, in such valve for preventing reverse-flows, the isolating plate is disposed in the middle of piping. Such a structure serves to obstruct a flow of fluid and to drive the isolating plate even when a back pressure is applied. However, a flow of fluid is obstructed, so that exhaust conductance is degraded.

Disclosure of Invention

Technical Problem

[6] The present invention provides a valve for preventing reverse-flow which prevents a reverse flow and blocks the inside of a vacuum chamber from the external air, when a vacuum pump is stopped. When an isolating plate is not operated, the valve for preventing reverse-flow moves the isolating plate to a position where a flow of fluid is not obstructed, thereby enhancing exhaust conductance. Further, a pneumatic cylinder is used to quickly open and close the valve, thereby enhancing the reliability of the valve.

Technical Solution

[7] According to an aspect of the invention, provided is a valve for preventing reverse-flow which is disposed between a vacuum chamber and a vacuum pump and comprises a valve body; first and second connecting portions that extend from both ends of the valve body and are connected to exhaust pipes extending from the vacuum chamber and the vacuum pump, respectively; a rotating shaft that is hinge-connected to the inner upper end of the valve body so as to be rotated about a hinge shaft; an isolating plate that is connected to one end of the rotating shaft, has a diameter which is larger than the inner diameter of the first connecting portion and is smaller than the inner diameter of the valve body, and is rotated toward the first connecting portion to prevent a flow of fluid when an abnormality occurs in a vacuum line; and a power source that is connected to the other end of the rotating shaft to provide a driving force for driving the isolating plate.

[8] Preferably, the valve for preventing reverse-flow further comprises a ring-shaped elastic member formed on an inner periphery of an opening of the valve body at the

first connecting portion such that air tightness is enhanced, the opening coming in contact with the isolating plate.

[9] Preferably, the isolating plate is formed in a disk or cone shape.

[10] Preferably, the connection between the isolating plate and the rotating shaft is achieved by coupling the end of the rotating shaft to a circumferential portion of the isolating plate or by coupling the lower central portion of the isolating plate to the end of the rotating shaft.

[11] Preferably, the rotation angle of the rotating shaft ranges from 20 to 90 degrees.

[12] Preferably, the power source is a pneumatic cylinder.

[13] Preferably, the valve for preventing reverse-flow further comprises a bypass path to the valve body from the first connecting portion coming in contact with the isolating plate and a bypass valve for opening and closing the bypass path.

[14] Preferably, the bypass valve is opened and closed by a pneumatic cylinder.

Advantageous Effects

[15] According to the present invention, the valve for preventing reverse-flow employs a pneumatic cylinder to operate the isolating plate. Therefore, a reverse flow caused by a sudden stoppage of the vacuum pump can be rapidly and safely prevented so that the vacuum chamber is prevented from being contaminated. When the isolating plate is not operated, the isolating plate is forcibly moved to close the valve, thereby enhancing reliability.

Brief Description of the Drawings

[16] Fig. 1 is a perspective view of a valve for preventing reverse-flow according to an embodiment of the invention.

[17] Fig. 2 is a cross-sectional view of the valve for preventing reverse-flow, showing states before and after the valve for preventing reverse-flow is operated.

[18] Fig. 3 is a perspective view for explaining one example where an isolating plate and a rotating shaft are coupled to each other.

[19] Fig. 4 is a perspective bottom view for explaining another example where an isolating plate and a rotating shaft are coupled to each other

[20] <Code descriptions of the main part of drawings>

[21] 10 valve body 11 O-ring

[22] 20 the first connecting portion 30 the second connecting portion

[23] 40 isolation plate 50 rotating shaft

[24] 51 hinge 60 pneumatic cylinder

[25] 100 valve for preventing reverse-flow

Best Mode for Carrying Out the Invention

[26] Hereinafter, a valve for preventing reverse-flow according to the present invention

will be described in detail with reference to the accompanying drawings.

[27] Fig. 1 is a perspective view of a valve for preventing reverse-flow 100 according to an embodiment of the invention. Fig. 2 is a cross-sectional view of the valve for preventing reverse-flow 100, showing states before and after the valve for preventing reverse-flow 100 is operated. As shown in Figs. 1 and 2, the valve for preventing reverse-flow according to an embodiment of the invention, which is disposed between a vacuum chamber (not shown) and a vacuum pump (not shown), comprises a valve body 10; first and second connecting portions 20 and 30 that extend from both ends of the valve body 10 and are connected to exhaust pipes extending from the vacuum chamber and the vacuum pump, respectively; a rotating shaft 50 that is hinge-connected to the inner upper end of the valve body 10 so as to be rotated about a hinge shaft 51; a isolating plate 40 that is connected to one end of the rotating shaft 50, has a diameter which is larger than the inner diameter of the first connecting portion and is smaller than the inner diameter of the valve body 10, and is rotated toward the first connecting portion 20 to prevent a flow of fluid when an abnormality occurs in a vacuum line; and a power source 60 that is connected to the other end of the rotating shaft to provide a driving force for driving the isolating plate 40.

[28] As described above, the valve for preventing reverse-flow 100 is disposed between the vacuum chamber and the vacuum pump and serves to prevent a reverse flow of air. In some cases, the valve for preventing reverse-flow can be used as a gate valve. In the conventional prevention valve, the isolating plate 40 is placed in the middle portion where a fluid flows. Therefore, a fluid flowing from the vacuum chamber to the vacuum pump forms meanders inside the valve body, thereby reducing exhaust conductance. The isolating plate 40 of the conventional prevention valve serves to slow down a reverse flow to the vacuum chamber by forming meanders even when a reverse flow is formed. However, because of the reduction in exhaust conductance, a process time increases, and exhaust efficiency is degraded. Further, when the pressure of air which flows reversely from the vacuum pump is used as a power source for driving the isolating plate in the conventional prevention valve, the isolating plate is inevitably placed in a position where the isolating plate blocks a flow of fluid. However, when a separate power source for driving the isolating plate is used as in the prevention valve of the invention, the isolating plate is placed so as not to reduce exhaust conductance.

[29] The valve for preventing reverse-flow 100 of the invention comprises the cylindrical valve body 10 and the first and second connecting portions 20 and 30 which extend from both ends of the valve body 10 so as to be connected to exhaust pipes extending from the vacuum chamber and the vacuum pump, respectively. The connection between the first and second connecting portions and the exhaust pipes can

be achieved in a flange shape or the like. Such a structure has no difference from that of the conventional prevention valve. Thus, the descriptions of the structure will be omitted in this specification.

[30] The valve for preventing reverse-flow of the invention includes the rotating shaft 50 which is hinge-connected to the inner upper end of the valve body 10 so as to be rotated about a hinge shaft. As shown in Fig. 2, the rotating shaft 50 is hinge-connected to the inner upper end of the valve body 10 so as to rotate about the hinge shaft. The isolating plate 40 is connected to one end of the rotating shaft 50, and the power source 60 is connected to the other end of the rotating shaft 50. In accordance with the movement of the power source 60, the rotating shaft 50 and the isolating plate 40 connected to the rotating shaft 50 are rotated. The connection between the rotating shaft 50 and the prevention shaft 40 and the connection between the prevention shaft 40 and the power source 60 are carried out by known connection methods, that is, by welding such as brazing or bonding, bolting, or a proper combination of a hinge and a connector such as a bearing, a link or the like. There is no special limitation for the connection methods. As shown in Figs. 2 to 4, the rotating shaft 50 applied to the valve for preventing reverse-flow of the invention can be formed in a shape where shafts extending from the hinge shaft to both sides form a predetermined angle. The shape of the rotating shaft 50 increases a rotation angle of the rotating shaft 50 within a limited region. In this specification, the rotation angle of the rotating shaft 50 means an angle between a state where the isolating plate 40 is moved toward the first connecting portion 20 such that the valve for preventing reverse-flow 100 is closed and a state where the valve for preventing reverse-flow 100 is opened. In other words, the rotation angle of the rotating shaft 50 is referred to as an angle at which the isolating plate 40 is separated from the first connecting portion 20. The rotation angle may differ depending on the usage characteristics required in the valve for preventing reverse-flow. That is, when the maximum exhaust conductance is required, the rotation angle of the rotating shaft 50 is increased so that exhaust resistance can be decreased. Otherwise, if necessary, the rotation angle of the rotating shaft 50 can be reduced. In the valve for preventing reverse-flow of the invention, the rotation angle of the rotating shaft is not limited. However, an angle of 20 to 90 degrees is preferable in accordance with a usage environment of the valve for preventing reverse-flow. The larger the rotation angle of the rotating shaft, the higher the exhaust conductance. In particular, when high exhaust conductance is required, it is preferable that the rotation angle of the rotating shaft 50 is set to approach 90 degrees. In this case, when the valve is opened, the rotating shaft 50 and the isolating plate 40 coupled to the rotating shaft 50 closely approach the inner wall of the valve body 10 so as not to obstruct a flow of fluid. Further, a space required for the rotation of the rotating shaft 50 should be

provided in the valve for preventing reverse-flow.

[31] The valve for preventing reverse-flow 100 of the invention includes the isolating plate 40 that is connected to one end of the rotating shaft 50, has a diameter which is larger than the inner diameter of the first connecting portion and is smaller than the inner diameter of the second connecting portion, and is rotated toward the first connecting portion to prevent a flow of fluid when an abnormality occurs in a vacuum line. As described above, when the vacuum pump is normally operated, the isolating plate 40 is attached on the inner wall of the valve body 10 in order to increase exhaust conductance. Then, when the pressure of the vacuum pump decreases due to a trouble of the vacuum pump or the like, the isolating plate 40 automatically moves toward the vacuum chamber, that is, toward the first connecting portion 20 so as to isolate the vacuum chamber. The shape of the isolating plate 40 is not specially limited. The isolating plate 40 may be formed in any shape as long as the separation of the first connecting portion 20 from the valve body 10 can be achieved. However, it is preferable that the isolating plate 40 is formed in a disk or cone shape, considering air-tightness or the like. Further, the prevention direction of the isolating plate 40 may be set toward the first or second connecting portion and is not specially limited. However, considering the reverse flow, it is preferable that the prevention direction is set toward the first connecting portion, that is, toward the vacuum chamber from the vacuum pump, where the pressure is applied. Further, in order to enhance airtightness, it is preferable that an elastic member such as an O-ring 11 is disposed between the valve body 10 and the isolating plate 40. The connection between the isolating plate 40 and the rotating shaft 50 can be carried out by a known method and is not specially limited. Fig. 3 is a perspective view for explaining one example where the isolating plate 40 and the rotating shaft 50 are coupled to each other. Fig. 4 is a perspective bottom view for explaining another example where the isolating plate 40 and the rotating shaft 50 are coupled to each other. In the former example, the circumferential portion of the disk-shaped isolating plate 40 and the end of the rotating shaft 50 can be manufactured as one part or can be coupled to each other by welding or the like, as shown in Fig. 3. In the latter example, the lower central portion of the disk-shaped isolating plate 40 and the end of the rotating shaft 50 can be connected by welding or can be coupled through a hinge, as shown in Fig. 4. Of the two, the latter example (where the lower central portion of the isolating plate 40 and the end of the rotating shaft 50 are coupled) is more preferable, because pressure is uniformly applied on the isolating plate 40 to increase airtightness.

[32] As described above, the conventional valve for preventing reverse-flow is opened and closed by a pressure difference without any power source. Therefore, when a bearing of the valve is not smoothly operated, the valve may not be operated at a

desired time, which makes it impossible to prevent the vacuum chamber from being contaminated. However, the valve for preventing reverse-flow (100) of the invention drives the isolating plate 40 by using the separate power source 60. Therefore, the vacuum chamber can be isolated quickly and accurately. Further, reliability can be increased, and the airtightness of the vacuum chamber can be enhanced. As for the power source 60, an elastic member, such as a spring, a pneumatic cylinder and the like can be used. In the valve for preventing reverse-flow 100 according to this embodiment, a pneumatic cylinder is adopted. The pneumatic cylinder 60 serving as the power source 60 is connected through a bearing to the other end of the rotating shaft 50 so as to rotate the rotating shaft 50. The disposition and size of the pneumatic cylinder 60 can be properly designed by calculating a required force in consideration of the size and weight of the isolating plate 40 and the rotating shaft 50. The pneumatic cylinder 60 is operated in accordance with opening and closing signals from a separate controller (not shown). When an abnormality occurs in the vacuum pump, an interlock signal is received to drive the cylinder. Then, the cylinder is operated to rotate the rotating shaft 50, such that the isolating plate 40 is moved in an opposite direction to the operational direction of the cylinder so as to quickly close the valve.

[33] The valve for preventing reverse-flow 100 of the invention may further comprise a bypass path (not shown) from the first connecting portion 20 to the valve body 10 and a bypass valve (not shown) capable of opening and closing the bypass path. When the valve for preventing reverse-flow 100 is opened in a state where atmospheric pressure is maintained in the upper portion of the valve for preventing reverse-flow 100 and vacuum is maintained in the lower portion of the valve for preventing reverse-flow 100, a large load is applied to the pump such that the pump can be broken down. Therefore, the bypass path and the bypass valve are constructed in order to flow a fluid little by little. Since the structures and positions of the bypass path and the bypass valve are obvious to those skilled in the art, the detailed descriptions thereof will be omitted in this specification. The bypass path and the bypass valve are opened for a time designated by a timer. After the designated time passes, the isolating plate 40 connected to the rotating shaft 50 is rotated and moved toward the wall surface of the valve body 10 such that main pumping is performed.

[34] While the present invention has been described with reference to exemplary embodiments thereof, it will be understood by those skilled in the art that various changes and modifications in form and detail may be made therein without departing from the scope of the present invention as defined by the following claims.

Claims

[1] A valve for preventing reverse-flow, which is disposed between a vacuum chamber and a vacuum pump, comprising a valve body;
the first and the second connecting portions that extend from both ends of the valve body and are connected to exhaust pipes extending from the vacuum chamber and the vacuum pump, respectively;
a rotating shaft that is hinge-connected to the inner upper end of the valve body so as to be rotated about a hinge shaft;
an isolating plate that is connected to one end of the rotating shaft, has a diameter which is larger than the inner diameter of the first connecting portion and is smaller than the inner diameter of the valve body, and is rotated toward the first connecting portion to prevent a flow of fluid when an abnormality occurs in a vacuum line;
and a power source that is connected to the other end of the rotating shaft to provide a driving force for driving the isolating plate.

[2] The valve for preventing reverse-flow as claimed in claim 1, further comprising a ring-shaped elastic member formed on an inner periphery of the opening at the first connecting portion of the valve body which is coming in contact with the isolating plate so as the air tightness to be enhanced,

[3] The valve for preventing reverse-flow as claimed in claim 1, wherein the isolating plate is formed in a disk or cone shape.

[4] The valve for preventing reverse-flow as claimed in claim 1, wherein the connection between the isolating plate and the rotating shaft is achieved by coupling the end of the rotating shaft to a circumferential portion of the isolating plate or by coupling the lower central portion of the isolating plate to the end of the rotating shaft.

[5] The valve for preventing reverse-flow as claimed in claim 1, wherein the rotation angle of the rotating shaft ranges from 20 to 90 degrees.

[6] The valve for preventing reverse-flow as claimed in one of claims 1 to 5, wherein the power source is a pneumatic cylinder.

[7] The valve for preventing reverse-flow as claimed in claim 6, the valve for preventing reverse-flow further comprises a bypass path to the valve body from the first connecting portion coming in contact with the isolating plate and a bypass valve for opening or closing the bypass path.

[8] The valve for preventing reverse-flow as claimed in claim 7, the opening or closing of the bypass valve is controlled by a pneumatic cylinder.