CLAIMS

Claim 1. A substrate processing apparatus, wherein

the substrate processing apparatus comprises:

a chamber that is cylindrical and is configured to have at least one opening;

a shutter mechanism configured to open and close the opening;

a substrate support unit configured to support a substrate; and

a baffle plate configured to be provided between the substrate support unit and the shutter mechanism,

the shutter mechanism comprises:

a valve body having a length that is half of the inner circumference of the chamber or longer;

a first electrically conductive surface that is provided on a lower portion of the valve body and comes into contact with a reverse face of the baffle plate;

a second electrically conductive surface that is provided on an upper portion of the valve body and comes into contact with an upper member that is provided along an inner wall of an upper portion of the chamber, the upper member being electrically conductive;

electrically conductive members that are arc-shaped or ring-shaped and are respectively arranged in grooves that are respectively provided on the first electrically conductive surface and the second electrically conductive surface, the grooves being arc-shaped or ring-shaped; and

two or more lifting/lowering mechanisms that are connected to the lower portion of the valve body and lift and lower the valve body,

in a case where the valve body is lifted and the

opening is closed, the first electrically conductive surface comes into contact with the reverse face of the baffle plate in a vertical direction and becomes electrically continuous with the reverse face of the baffle plate by means of the electrically conductive members,

in the case where the valve body is lifted and the opening is closed, the second electrically conductive surface comes into contact with the upper member in the vertical direction and becomes electrically continuous with the upper member by means of the electrically conductive members,

the electrically conductive members have cross sections that are circular,

openings of the grooves on the first electrically conductive surface and the second electrically conductive surface respectively have widths that are smaller than diameters of the cross sections of the electrically conductive members respectively arranged therein, and

wherein a widthwise cross section of the opening of each of the grooves includes a bottom surface parallel to the first electrically conductive surface or second electrically conductive surface, and side surfaces orthogonal to the bottom surface, and includes protruding portions protruding inward in the groove, the protruding portions being at connections in the groove, the connections being between the first electrically conductive surface or second electrically conductive surface and the side surfaces.

Claim 2. The substrate processing apparatus according to claim 1, wherein depths of the grooves are respectively smaller than the diameters of the cross sections of the electrically conductive members respectively arranged

therein.

Claim 3. The substrate processing apparatus according to claim 1, wherein the grooves respectively have widths larger than the diameters of the cross sections of the electrically conductive members respectively arranged therein, the widths each being on the bottom surface between the side surfaces.

Claim 4. The substrate processing apparatus according to claim 3, wherein in a case where the opening has been closed, the electrically conductive members each undergo elastic deformation and each do not come into contact with at least one of the side surfaces.

Claim 5. The substrate processing apparatus according to claim 1, wherein

the electrically conductive members include a first electrically conductive member arranged in a first groove provided on the first electrically conductive surface, and a second electrically conductive member arranged in a second groove provided on the second electrically conductive surface, and

a cross section of the first electrically conductive member has a diameter at a value that is 50% or more of the diameter of a cross section of the second electrically conductive member.

Claim 6. The substrate processing apparatus according to claim 1, wherein

the electrically conductive members include a first electrically conductive member arranged in a first groove provided on the first electrically conductive surface and a

second electrically conductive member arranged in a second groove provided on the second electrically conductive surface, and

in a case where the opening is closed, the first electrically conductive member and the second electrically conductive member undergo elastic deformation, and the upper limit of a deformation amount of the first electrically conductive member is a value larger than the upper limit of a deformation amount of the second electrically conductive member.

Claim 7. The substrate processing apparatus according to claim 6, wherein a plurality of the lifting/lowering mechanisms are capable of outputting, as a total value, thrust larger than the total of: a first reaction force from the elastic deformation of the first electrically conductive member; a second reaction force from the elastic deformation of the second electrically conductive member; and the deadweight of the valve body.

Claim 8. The substrate processing apparatus according to claim 1, wherein

the valve body is ring-shaped, and

the electrically conductive members are respectively arranged in grooves that are ring-shaped and that are respectively provided over the entire circumferences of the first electrically conductive surface and the second electrically conductive surface.

Claim 9. The substrate processing apparatus according to claim 1, wherein

one of end portions of the baffle plate is connected to a base plate positioned below the substrate support

unit, and

in a case where the valve body is lifted and the opening is closed, an electrical path through the electrically conductive members, the baffle plate, and the base plate is formed between the first electrically conductive surface and the chamber, and an electrical path through the electrically conductive members and the upper member is formed between the second electrically conductive surface and the chamber.

Claim 10. A substrate processing apparatus, wherein

the substrate processing apparatus comprises:

a chamber that is cylindrical and is configured to have at least one opening;

a shutter mechanism configured to open and close the opening;

a substrate support unit configured to support a substrate; and

a baffle plate configured to be provided between the substrate support unit and the shutter mechanism,

the shutter mechanism comprises:

a valve body having a length that is half of the inner circumference of the chamber or longer;

a first electrically conductive surface that is provided on a lower portion of the valve body and comes into contact with a reverse face of the baffle plate;

a second electrically conductive surface that is provided on an upper portion of the valve body and comes into contact with an upper member that is provided along an inner wall of an upper portion of the chamber, the upper member being electrically conductive;

electrically conductive members that are arc-shaped or ring-shaped and are respectively arranged in

grooves that are respectively provided on the first electrically conductive surface and the second electrically conductive surface, the grooves being arc-shaped or ring-shaped; and

two or more lifting/lowering mechanisms that are connected to the lower portion of the valve body and lift and lower the valve body,

in a case where the valve body is lifted and the opening is closed, the first electrically conductive surface comes into contact with the reverse face of the baffle plate in a vertical direction and becomes electrically continuous with the reverse face of the baffle plate by means of the electrically conductive members, and

in the case where the valve body is lifted and the opening is closed, the second electrically conductive surface comes into contact with the upper member in the vertical direction and becomes electrically continuous with the upper member by means of the electrically conductive members,

the substrate support unit has an edge ring positioned around an upper surface of the substrate support unit, and further, has a cover ring positioned around the edge ring,

the opening includes a first opening and a second opening,

the first opening has a dimension that allows at least the edge ring to pass therethrough, and

the second opening has a dimension that allows at least the cover ring to be transferred therethrough.

Claim 11. The substrate processing apparatus according to Claim 10, wherein the substrate is transferred via the opening.

Claim 12. The substrate processing apparatus according to claim 10 or 11, wherein the opening is positioned toward a transfer chamber.

Claim 13. The substrate processing apparatus according to claim 1 or 10, wherein the valve body has a cross section that is approximately I-shaped.

Claim 14. The substrate processing apparatus according to claim 1 or 10, wherein the upper member has a portion coated with stainless steel or a nickel alloy.

Claim 15. The substrate processing apparatus according to claim 1 or 10, wherein the electrically conductive members are conductance bands, spirals, or coil springs.