

What is claimed is:

1. A substrate holding apparatus comprising:

5 a top ring body having a substrate holding surface configured to hold and press a substrate against a polishing surface;

a retaining ring configured to surround the substrate and to contact the polishing surface; and

10 a drive ring comprising a ring member configured to hold the retaining ring on a lower surface thereof, a central member disposed at a central part of the top ring body and supported by the top ring body, and a connecting portion configured to connect the ring member and the central member;

wherein the drive ring comprises a first material and a second material having a modulus of longitudinal elasticity smaller than the first material.

15 2. The substrate holding apparatus according to claim 1, wherein the second material comprises a rubber material.

3. The substrate holding apparatus according to claim 1 or 2, wherein the connecting portion comprises a plurality of connecting arms.

20

4. A substrate holding apparatus comprising:

a top ring body having a substrate holding surface configured to hold and press a substrate against a polishing surface;

25 a retaining ring configured to surround the substrate and to contact the polishing surface; and

a drive ring comprising a ring member configured to hold the retaining ring on a lower surface thereof, a central member disposed at a central part of the top ring body and supported by the top ring body, and a plurality of connecting arms configured to connect

the ring member and the central member;

wherein the drive ring comprises a central section including the central member and the plurality of connecting arms, and a ring section comprising the ring member, the central section and the ring section being connected to each other by fasteners, or

5 the drive ring comprises a central section including the central member and radially inner portions of the connecting arms, and a ring section including radially outer portions of the connecting arms and the ring member, the central section and the ring section being connected to each other by fasteners.

10 5. The substrate holding apparatus according to claim 4, wherein the central section comprises a first material; and

a portion comprising a second material having a modulus of longitudinal elasticity smaller than the first material is provided at the connecting portion of the central section and the ring section.

15

6. The substrate holding apparatus according to claim 4, wherein a rubber material is provided at the connecting portion of the central section and the ring section.

7. A substrate holding apparatus comprising:

20 a top ring body configured to hold and press a substrate against a polishing surface;

a retaining ring configured to surround the substrate and to contact the polishing surface; and

25 a drive ring comprising a ring member configured to hold the retaining ring on a lower surface thereof, a central member disposed at a central part of the top ring body and supported by the top ring body, and a plurality of connecting arms configured to connect the ring member and the central member;

wherein the central member comprises a first material; and

a portion comprising a second material having a modulus of longitudinal elasticity smaller than the first material is provided between the central member of the drive ring and a guide shaft fixed to the central member of the drive ring and inserted in a bearing provided in the top ring body.

5

8. The substrate holding apparatus according to claim 7, wherein the second material comprises a rubber material.

9. The substrate holding apparatus according to claim 2, 6, or 8, wherein the rubber material comprises one of EPDM, fluororubber, nitrile rubber, urethane rubber, silicone rubber, and synthetic rubber with an increased damping capability.

10

10. The substrate holding apparatus according to claim 2, 6, 8, or 9, wherein the rubber material comprises a molded rubber material.

15

11. The substrate holding apparatus according to claim 3 or 6, wherein the connecting portion of the connecting arm has a shape configured to compress the rubber material provided between surfaces of the connecting portion so as to receive tensile, compressive, shearing, and bending loads applied thereto.

20

12. The substrate holding apparatus according to any one of claims 3 to 11, wherein the drive ring is supported so that the drive ring is capable of tilting and vertically moving, by a guide shaft connected to the central member of the drive ring, and a spherical bearing disposed at the central part of the top ring body; and

25

each of the connecting arms is sandwiched between a pair of rollers supported on a carrier holding a membrane so that movement of the drive ring in a rotational direction is restricted.

13. A polishing apparatus comprising:

a substrate holding apparatus according to any one of claims 1 to 12; and

5 a polishing table configured to support a polishing pad having a polishing surface.

What is claimed is:

1. A substrate holding apparatus comprising:
 - a top ring body having a substrate holding surface configured to hold and press a substrate against a polishing surface;
 - a retaining ring configured to surround the substrate and to contact the polishing surface;
 - and
 - a drive ring comprising a ring member configured to hold the retaining ring on a lower surface thereof, a central member disposed at a central part of the top ring body and supported by the top ring body, and a connecting portion configured to connect the ring member and the central member;
 - wherein the drive ring comprises a first material and a second material having a modulus of longitudinal elasticity smaller than the first material; and
 - wherein the retaining ring is configured to be vertically movable and to be tiltable independently of the top ring body.
2. The substrate holding apparatus according to claim 1, wherein the second material comprises a rubber material.
3. The substrate holding apparatus according to claim 2, wherein the rubber material comprises one of EPDM, fluororubber, nitrile rubber, urethane rubber, silicone rubber, and synthetic rubber with an increased damping capability.
4. The substrate holding apparatus according to claim 2, wherein the rubber material comprises a molded rubber material.
5. A substrate holding apparatus comprising:
 - a top ring body having a substrate holding surface configured to hold and press a substrate against a polishing surface;

a retaining ring configured to surround the substrate and to contact the polishing surface;
a drive ring comprising a ring member configured to hold the retaining ring on a lower surface thereof, a central member disposed at a central part of the top ring body and supported by the top ring body, and a connecting portion configured to connect the ring member and the central member;

wherein the drive ring comprises a first material and a second material having a modulus of longitudinal elasticity smaller than the first material; and

wherein the connecting portion comprises a plurality of connecting arms.

6. The substrate holding apparatus according to claim 5, wherein the connecting portion of the connecting arm has a shape configured to compress the rubber material provided between surfaces of the connecting portion so as to receive tensile, compressive, shearing, and bending loads applied thereto.

7. The substrate holding apparatus according to claim 5, wherein the drive ring is supported so that the drive ring is capable of tilting and vertically moving, by a guide shaft connected to the central member of the drive ring, and a spherical bearing disposed at the central part of the top ring body; and

each of the connecting arms is sandwiched between a pair of rollers supported on a carrier holding a membrane so that movement of the drive ring in a rotational direction is restricted.

8. A polishing apparatus comprising:

a substrate holding apparatus according to claim 1; and

a polishing table configured to support a polishing pad having a polishing surface.

9. A substrate holding apparatus comprising:

a top ring body having a substrate holding surface configured to hold and press a

substrate against a polishing surface;

a retaining ring configured to surround the substrate and to contact the polishing surface;

and

a drive ring comprising a ring member configured to hold the retaining ring on a lower surface thereof, a central member disposed at a central part of the top ring body and supported by the top ring body, and a plurality of connecting arms configured to connect the ring member and the central member;

wherein the drive ring comprises a central section including the central member and the plurality of connecting arms, and a ring section comprising the ring member, the central section and the ring section being connected to each other by fasteners; or

the drive ring comprises a central section including the central member and radially inner portions of the connecting arms, and a ring section including radially outer portions of the connecting arms and the ring member, the central section and the ring section being connected to each other by fasteners.

10. The substrate holding apparatus according to claim 9, wherein the central section comprises a first material; and

a portion comprising a second material having a modulus of longitudinal elasticity smaller than the first material is provided at the connecting portion of the central section and the ring section.

11. The substrate holding apparatus according to claim 9, wherein a rubber material is provided at the connecting portion of the central section and the ring section.

12. The substrate holding apparatus according to claim 11, wherein the rubber material comprises one of EPDM, fluororubber, nitrile rubber, urethane rubber, silicone rubber, and synthetic rubber with an increased damping capability.

13. The substrate holding apparatus according to claim 11, wherein the rubber material comprises a molded rubber material.

14. The substrate holding apparatus according to claim 11, wherein the connecting portion of the connecting arm has a shape configured to compress the rubber material provided between surfaces of the connecting portion so as to receive tensile, compressive, shearing, and bending loads applied thereto.

15. The substrate holding apparatus according to claim 9, wherein the drive ring is supported so that the drive ring is capable of tilting and vertically moving, by a guide shaft connected to the central member of the drive ring, and a spherical bearing disposed at the central part of the top ring body; and

each of the connecting arms is sandwiched between a pair of rollers supported on a carrier holding a membrane so that movement of the drive ring in a rotational direction is restricted.

16. A polishing apparatus comprising:

a substrate holding apparatus according to claim 9; and

a polishing table configured to support a polishing pad having a polishing surface.

17. A substrate holding apparatus comprising:

a top ring body configured to hold and press a substrate against a polishing surface;

a retaining ring configured to surround the substrate and to contact the polishing surface;

and

a drive ring comprising a ring member configured to hold the retaining ring on a lower surface thereof, a central member disposed at a central part of the top ring body and supported by

the top ring body, and a plurality of connecting arms configured to connect the ring member and the central member;

wherein the central member comprises a first material; and

a portion comprising a second material having a modulus of longitudinal elasticity smaller than the first material is provided between the central member of the drive ring and a guide shaft fixed to the central member of the drive ring and inserted in a bearing provided in the top ring body.

18. The substrate holding apparatus according to claim 17, wherein the second material comprises a rubber material.

19. The substrate holding apparatus according to claim 18, wherein the rubber material comprises one of EPDM, fluororubber, nitrile rubber, urethane rubber, silicone rubber, and synthetic rubber with an increased damping capability.

20. The substrate holding apparatus according to claim 18, wherein the rubber material comprises a molded rubber material.

21. The substrate holding apparatus according to claim 17, wherein the drive ring is supported so that the drive ring is capable of tilting and vertically moving, by a guide shaft connected to the central member of the drive ring, and a spherical bearing disposed at the central part of the top ring body; and

each of the connecting arms is sandwiched between a pair of rollers supported on a carrier holding a membrane so that movement of the drive ring in a rotational direction is restricted.

22. A polishing apparatus comprising:

a substrate holding apparatus according to claim 17; and
a polishing table configured to support a polishing pad having a polishing surface.