CLAIMS

WHAT IS CLAIMED IS:

1. A heating device in a semiconductor apparatus arranged in a process chamber of the semiconductor apparatus comprising:

a heating body configured to carry a wafer, a heating member configured to generate heat being arranged in the heating body;

a cooling structure arranged below the heating bodyand configured to selectively perform heat exchange with the heating body at different positions away from the heating body, and including:

at least one cooling body, a cooling member configured to perform heat exchange with the heating body being arranged in the at least one cooling body; and

a cooling ascending and descending assembly connected to the at least one cooling body and configured to drive the at least one cooling body to ascend and descend to adjust a distance between the at least one cooling body and the heating body in a vertical direction;

a connection member connected to the heating body, the connection member and the heating body forming accommodation space at a bottom of the heating body, the at least one cooling body being located in the accommodation space, and the cooling ascending and descending assembly being extended to outside of the process chamber passing through a through-hole arranged at a bottom of the process chamber; and

a sealing structure, an upper end of the sealing structure being sealed with and connected to the connection member, and a lower end of the sealing structure being sealed with and connected to the bottom of the process chamber to seal the accommodation space and the through-hole.

2. The heating device according to claim 1, wherein the sealing structure includes a bellows and a bellows shaft, wherein:

an upper end of the bellows shaft is connected to the connection member, and a lower end of the bellows shaft is extended to the outside of the process chamber passing through the through-hole to be connected to an ascending and descending drive source; and

the bellows is sleeved at the bellows shaft, an upper end of the bellows is sealed with and connected to the connection member, and a lower end of the bellows is sealed with and connected to the bottom of the process chamber to seal the accommodation space and the through-hole.

3. The heating device according to claim 2, wherein the cooling ascending and descending assembly includes a lift member, at least one screw, and at least one elastic member, wherein hollow space communicating with the accommodation space is arranged in the bellows shaft, the lift member is located in the hollow space, and an upper end of the lift member is connected to the at least one cooling body;

at least one threaded hole is arranged at a bottom surface of the lift member, at least one mounting hole is arranged at an inner surface of the bellows shaft opposite to the bottom surface of the lift member, and each of the at least one mounting hole is coaxially arranged with each of the at least one threaded hole in a one-to-one correspondence;

each of the at least one screw is threadedly connected to the corresponding threaded hole of the at least one threaded hole passing through each of the at least one mounting hole from the bottom of the bellows shaft to top in a one-to-one correspondence; and

each of the at least one elastic member is arranged in a one-to-one correspondence with each of the at least one screw, is located between the bottom surface of the lift member and the inner surface of the bellows shaft, and is in a compressed state.

4. The heating device according to claim 3, wherein lead-out space and two first lead-out through-holes communicating with the lead-out space are arranged n the lift member, two second lead-out through-holes communicating with the hollow space are arranged in the bellows shaft, and the two second lead-out through-holes are coaxially arranged with the two first lead-out through-holes; and

the cooling member further includes the cooling member includes a cooling pipeline configured to transfer cooling water, a water inlet pipeline, and a water outlet pipeline, an end of the water inlet pipeline and an end of the water outlet pipeline are connected to an inlet and an outlet of the cooling pipeline, respectively, and the other end of the water inlet pipeline and the other end of the water outlet pipeline are extended the outside of the process chamber passing through the corresponding first lead-out through-hole and the second lead-out through-hole in sequence.

5. The heating device according to claim 1, wherein the cooling structure includes a plurality of cooling bodies, the plurality of cooling bodies being arranged at intervals in a direction away from a bottom surface of the heating body, and a cooling member configured to perform heat exchange with the heating body being arranged in each of the plurality of cooling bodies.

6. The heating device according to claim 5, wherein the heating device further includes a connection member and a sealing structure, wherein:

the connection member is connected to the heating body, the connection member forms accommodation space with the heating body at a bottom of the heating body, and the plurality of cooling bodies are located in the accommodation space, wherein each of the plurality of cooling members includes a cooling pipeline configured to transfer cooling water, a water inlet pipeline, and a water outlet pipeline, an end of the water inlet pipeline and an end of the water outlet pipeline are connected to an inlet and an outlet of the cooling pipeline, respectively, and the other end of the water inlet pipeline and the other end of the water outlet pipeline are extended to the outside of the process chamber passing through the through-hole arranged at the bottom of the process chamber; and

an upper end of the sealing structure is sealed with and connected to the connection member, and a lower end of the sealing structure is sealed with and connected to the bottom of the process chamber to seal the accommodation space and the through-hole.

7. The heating device according to claim 6, wherein the sealing structure includes a bellows and a bellows shaft, wherein:

an upper end of the bellows shaft is connected to the connection member, a lower end of the bellows shaft is extended to the outside of the process chamber passing through the through-hole to be connected to an ascending and descending drive source, the bellows shaft is provided with hollow space communicating with the accommodation space and a plurality of pairs of lead-out through-holes communicating with the hollow space, and the other end of the water

inlet pipeline and the other end of the water outlet pipeline are extended to the outside of the process chamber through a pair of corresponding lead-out through-holes; and

the bellows is sleeved at the bellows shaft, an upper end of the bellows is sealed with and connected to the connection member, and a lower end of the bellows is sealed with and connected to the bottom of the process chamber to seal the accommodation space and the through-hole.

8. The heating device according to claim 5, wherein an upper surface of a most upper cooling body of the plurality of cooling bodies is attached to a lower surface of the heating body.

9. The heating device according to any one of claim 1 or 5, wherein a lower surface of the heating body is parallel to an upper surface of the cooling body.

10. The heating device according to claim 1 or 6, wherein the heating device further includes a heat exchange gas inlet pipeline, a gas outlet end of the heat exchange gas inlet pipeline is communicated with the accommodation space, and a gas inlet end of the heat exchange gas inlet pipeline is configured to be connected to a heat exchange gas source.

11. A semiconductor apparatus comprising a process chamber, and further comprising the heating device of any one of claims 1 to 10, the heating device being arranged in the process chamber.