CLAIMS

1. A liquid material discharge device comprising a discharge port, a liquid chamber in communication with the discharge port, and a discharge control device controlling a discharge operation, the liquid material discharge device discharging the liquid material from the discharge port while a workpiece and the discharge port are moved relative to each other,

wherein the liquid material discharge device further comprises a heat-transfer temperature control device including a heat source to adjust a temperature of the liquid chamber, and

a heat-shield temperature control device disposed between the heat-transfer temperature control device and the workpiece, and adjusting a temperature of the heat-transfer temperature control device, and

wherein the heat-shield temperature control device includes a heat-exchange flow path through which a heat-exchange fluid flows.

2. The liquid material discharge device according to claim 1, wherein the heat-transfer temperature control device includes a heat conduction member conducting heat from the heat source to the liquid chamber, and

the heat conduction member is a temperature control jacket covering a periphery of the liquid chamber.

3. The liquid material discharge device according to claim 2, further comprising a nozzle member including the discharge port formed at a lower end thereof,

wherein the temperature control jacket includes a discharge hole through which the nozzle member is inserted, or through which the discharge port and an outside are communicated with each other.

4. The liquid material discharge device according to claim 2 or 3, wherein a bottom surface of the temperature control jacket constitutes at least part of an inner wall of the heat-exchange flow path.

5. The liquid material discharge device according to any one of claims 2 to 4, wherein the heat-shield temperature control device includes a heat shield member blocking radiant heat from the side including the workpiece.

6. The liquid material discharge device according to claim 5, wherein the heat shield member reflects an infrared ray in a particular wavelength range.

7. The liquid material discharge device according to claim 5 or 6, wherein the heat shield member constitutes at least part of an inner wall of the heat-exchange flow path.

8. The liquid material discharge device according to any one of claims 5 to 7, wherein the heat shield member has a bottom area equal to or larger than a bottom surface of the temperature control jacket and is disposed in a covering relation to the bottom surface of the temperature control jacket when viewed from the bottom surface side.

9. The liquid material discharge device according to any one of claims 5 to 8, wherein the heat shield member includes a rising portion covering a lateral surface of the heat-exchange flow path.

10. The liquid material discharge device according to any one of claims 5 to 9, wherein an infrared reflection layer made of a metal surface reflecting an infrared ray in a particular wavelength range or a coating film surface reflecting the infrared ray in the particular wavelength range is formed at a bottom surface of the heat shield member.

11. The liquid material discharge device according to any one of claims 5 to 10, wherein the heat shield member is made of a material having a higher thermal conductivity than the bottom surface of the temperature control jacket and includes a heat transfer layer constituting an inner wall of the heat-exchange flow path.

12. The liquid material discharge device according to claim 11, wherein the heat shield member includes a heat insulating layer disposed between the heat transfer layer and the bottom surface of the heat shield member and made of a material having a lower thermal conductivity than the bottom surface of the heat shield member.

13. The liquid material discharge device according to claim 12, wherein the heat insulating layer is made of resin.

14. The liquid material discharge device according to any one of claims 5 to 13, wherein the heat shield member includes a plate-like member disposed with a gap interposed between the plate-like member and the bottom surface of the temperature control jacket, and the heat-exchange flow path is formed by the gap.

15. The liquid material discharge device according to any one of claims 5 to 13, wherein the heat shield member includes a first plate-like member disposed with a gap interposed between the first plate-like member and the bottom surface of the temperature control jacket, and a second plate-like member disposed with a gap interposed between the second plate-like member and a bottom surface of the first plate-like member, and

the heat-exchange flow path includes an upper heat-exchange flow path formed by a space between the bottom surface of the temperature control jacket and an upper surface of the first plate-like member, and a lower heat-exchange flow path formed by a space between the bottom surface of the first plate-like member and an upper surface of the second plate-like member.

16. The liquid material discharge device according to claim 15, wherein the heat shield member includes a communication tube through which the coolant is supplied to the lower heat-exchange flow path, and a communication hole through which the heat-exchange fluid having passed through the lower heat-exchange flow path is supplied to the upper heat-exchange flow path.

17. The liquid material discharge device according to any one of claims 2 to 16, wherein an infrared reflection layer made of a metal surface reflecting an infrared ray in a particular wavelength range or a coating film surface reflecting the infrared ray in the particular wavelength range is formed at the bottom surface of the temperature control jacket.

18. The liquid material discharge device according to any one of claims 2 to 17, wherein the heat-shield temperature control device includes a temperature sensor measuring a temperature of the temperature control jacket, and

the discharge control device controls a flow rate of the heat-exchange fluid flowing through the heat-exchange flow path in accordance with a signal from the temperature sensor.

19. The liquid material discharge device according to any one of claims 1 to 18, further comprising a heat-exchange fluid delivery device that supplies the heat-exchange fluid to the heat-exchange flow path.

20. The liquid material discharge device according to claim 19, wherein the heat-exchange fluid delivery device is constituted by a circulation pump supplying the heat-exchange fluid in a circulating way.

21. The liquid material discharge device according to claim 19, wherein the heat-exchange fluid delivery device is constituted by an air supply source supplying pressurized air.

22. The liquid material discharge device according to any one of claims 1 to 21, further comprising a supply flow path through which the liquid material is supplied to the liquid chamber,

wherein the heat-transfer temperature control device is disposed in a covering relation to the liquid chamber and the supply flow path.

23. The liquid material discharge device according to any one of claims

1 to 22, further comprising a plunger including a tip portion that is narrower than the liquid chamber and that is disposed in the liquid chamber; and

a plunger driver moving the plunger forward and backward,

wherein the liquid material discharge device is a jet discharge device in which the liquid material is discharged in the form of flying droplets from the discharge port by causing the plunger moving forward to collide against a valve seat formed in an inner bottom surface of the liquid chamber, or by stopping the plunger moving forward immediately before colliding against the valve seat.

24. An application device comprising:

the liquid material discharge device according to any one of claims 1 to 23;

a stage on which the workpiece is placed;

a heater heating the stage;

a relative moving device moving the liquid material discharge device and the stage relative to each other; and

a drive control device controlling the relative moving device.

25. The application device according to claim 24,

wherein the heater has an ability of heating the stage to temperature higher than a room temperature by 20 °C or more, and

the heat-transfer temperature control device adjusts a temperature of the liquid chamber to be kept within a range of ± 10 °C from the room temperature.

26. An application method using an application device,

the application device comprising the liquid material discharge device according to any one of claims 1 to 21,

a stage on which the workpiece is placed;

a heater heating the stage;

a relative moving device moving the liquid material discharge device and the stage relative to each other; and

a drive control device controlling the relative moving device,

wherein the heater has an ability of heating the stage to temperature higher than a room temperature by 20 °C or more,

the heat-transfer temperature control device has an ability of adjusting a temperature of the liquid chamber to be kept within a range of ± 10 °C from the room temperature,

the heat-exchange fluid is a coolant at temperature not higher than the room temperature, and

the liquid material is applied in a state in which the stage is heated by the heater to temperature higher than the room temperature by 20 °C or more.

27. An application method using the liquid material discharge device according to any one of claims 1 to 23, the application method comprising:

a first application step of performing first application under a first temperature environment; and

a second application step of performing second application under a second temperature environment that is different in temperature from the first temperature environment by 10 °C or more.

28. An application method using the application device according to claim 24, the application method comprising:

a step of performing first application on the stage under heating; and

a step of performing second application outside the stage.