CLAIMS

1. A liquid material discharge device comprising:

a nozzle member having a discharge opening through which a liquid material is discharged; and

a discharge controller,

wherein the discharge device further comprises a pressurization section including a pressurization passage through which the liquid material under pressurization is supplied to the nozzle member, a liquid reservoir, and a pressurization source that supplies pressurized air to the liquid reservoir;

a negative pressure section including a shunt passage in which a pressure can be set to be relatively lower than a pressure in the pressurization passage and a negative pressure source that is directly or indirectly communicated with the shunt passage; and

a liquid valve section having a liquid delivery opening in communication with the discharge opening, a liquid material supply opening in communication with the pressurization passage, and a liquid material release opening in communication with the shunt passage;

the liquid valve section including a switching valve that is changed over between a first position at which communication between the discharge opening and the liquid material supply opening is established and communication between the discharge opening and the liquid material release opening is cut off, and a second position at which the communication between the discharge opening and the liquid material release opening is established and the communication between the discharge opening and the liquid material supply opening is cut off.

2. The liquid material discharge device according to claim 1, wherein the discharge device further comprises a liquid chamber in communication with the discharge opening and with the liquid delivery opening of the liquid valve section;

a propulsion force applying member disposed in the liquid chamber and applying, to the liquid material, a propulsion force necessary to discharge the liquid material; and

a driving source for the propulsion force applying member, the driving source operating the propulsion force applying member.

3. The liquid material discharge device according to claim 2, wherein the propulsion force applying member is a rotating screw or a rod-shaped member that gives an inertial force to the liquid material with quick forward movement, the screw and the rod-shaped member each having a smaller diameter than the liquid chamber.

4. The liquid material discharge device according to claim 2, wherein the propulsion force applying member is a rod having a male spiral shape and rotating eccentrically,

the liquid chamber has an inner wall surface having a female spiral shape and cooperating with the propulsion force applying member, and

the propulsion force applying member and the liquid chamber constitute a uniaxial eccentric screw pump mechanism.

5. The liquid material discharge device according to claim 1, wherein the liquid valve section and the nozzle member are communicated with each other through a flexible tube.

6. The liquid material discharge device according to any one of claims 1 to 5, wherein the negative pressure section includes a shunt container for the liquid material, the shunt container having a larger diameter than the shunt passage.

7. The liquid material discharge device according to claim 6, wherein the negative pressure section includes a drain passage through which the liquid material stored in the shunt container is drained.

8. The liquid material discharge device according to Claim 7, wherein the negative pressure section includes a drain passage opening/closing mechanism that establishes or cuts off communication between the drain passage and the outside.

9. The liquid material discharge device according to claim 8, wherein the negative pressure section includes a second pressurization source that supplies pressurized air to the shunt container, and a negative pressure section switching valve having a pressurization position at which the second pressurization source is communicated with the shunt container, and a depressurization position at which the negative pressure source is communicated with the shunt container.

10. The liquid material discharge device according to claim 9, wherein the drain passage opening/closing mechanism is an on/off valve,

the pressurization section includes a pressurization-section on/off valve that establishes or cuts off communication between the

pressurization section and the liquid valve section, and

the discharge controller closes the pressurization-section on/off valve, changes over the switching valve in the liquid valve section to the first position, changes over the negative pressure section switching valve to the pressurization position, and opens the drain passage opening/closing mechanism in accordance with predetermined drain conditions, thereby draining the liquid material in the shunt container to the outside.

11. The liquid material discharge device according to any one of claims 6 to 10, wherein the negative pressure section includes a slender negative pressure adjusting pipe disposed in the shunt container, the negative pressure adjusting pipe having one opening in communication with the shunt passage and the other opening disposed in a space within the shunt container.

12. The liquid material discharge device according to any one of claims 1 to 11, wherein the discharge controller performs control such that, in a discharge stand-by state, a negative pressure force necessary to prevent liquid dripping through the discharge opening is applied to the shunt passage from the negative pressure source, and that, at end of the discharge, a negative pressure force stronger than the negative pressure force applied in the discharge stand-by state is applied to the shunt passage from the negative pressure source.

13. The liquid material discharge device according to any one of claims 1 to 12, wherein the discharge controller performs control such that,

during discharge operation, a pressurization force necessary to discharge the liquid material through the discharge opening is applied to the liquid reservoir from the pressurization source, and that, in a discharge stand-by state, a pressurization force stronger than the pressurization force during the discharge operation is applied to the liquid reservoir from the pressurization source.

14. An application device comprising:

the liquid material discharge device according to any one of claims 1 to 13;

a work table on which an application object is placed;

an XYZ driving mechanism that relatively moves the liquid material discharge device and the work table; and

a driving mechanism controller that controls operation of the XYZ driving mechanism.

15. A liquid material application method using an application device that comprises the liquid material discharge device according to any one of claims 1 to 13, a work table on which an application object is placed, an XYZ driving mechanism that relatively moves the liquid material discharge device and the work table, and a driving mechanism controller that controls operation of the XYZ driving mechanism,

wherein the discharge controller executes steps of, during discharge operation, discharging the liquid material through the discharge opening in a state that the switching valve in the liquid valve section is held at the first position, and

at end of the discharge, stopping the discharge of the liquid

material through the discharge opening by changing over the switching valve in the liquid valve section to the second position.

16. A liquid material application method using an application device that comprises the liquid material discharge device according to any one of claims 1 to 13, a work table on which an application object is placed, an XYZ driving mechanism that relatively moves the liquid material discharge device and the work table, and a driving mechanism controller that controls operation of the XYZ driving mechanism,

wherein the discharge controller executes steps of, during discharge operation, discharging the liquid material through the discharge opening in a state that the switching valve in the liquid valve section is held at the first position, and

at end of the discharge, stopping the discharge of the liquid material through the discharge opening by changing over the switching valve in the liquid valve section to the second position,

the discharge controller further executing steps of, in a discharge stand-by state, applying a negative pressure force, which is necessary to prevent liquid dripping through the discharge opening, to the shunt passage from the negative pressure source, and at the end of the discharge, applying a negative pressure force, which is stronger than the negative pressure force in the discharge stand-by state, to the shunt passage from the negative pressure source.

17. The liquid material application method according to claim 16, wherein the discharge controller executes steps of, during the discharge operation, applying a pressurization force, which is necessary to discharge

the liquid material through the discharge opening, to the liquid reservoir from the pressurization source, and in the discharge stand-by state, applying a pressurization force, which is stronger than the pressurization force during the discharge operation, to the liquid reservoir from the pressurization source.

18. A liquid material application method using an application device that comprises the liquid material discharge device according to claim 10, a work table on which an application object is placed, an XYZ driving mechanism that relatively moves the liquid material discharge device and the work table, and a driving mechanism controller that controls operation of the XYZ driving mechanism,

wherein the discharge controller executes steps of, during discharge operation, discharging the liquid material through the discharge opening in a state that the switching valve in the liquid valve section is held at the first position, and

at end of the discharge, stopping the discharge of the liquid material through the discharge opening by changing over the switching valve in the liquid valve section to the second position,

the discharge controller further executing a step of draining the liquid material in the shunt container to the outside by closing the pressurization section on/off valve, changing over the switching valve in the liquid valve section to the first position, changing over the negative pressure section switching valve to the pressurization position, and opening the on/off valve of the drain passage opening/closing mechanism in accordance with predetermined drain conditions.