

## Claims

1. A liquid material discharging apparatus comprising:
  - a liquid chamber which communicates with a discharging port;
  - a plunger which has a piston and whose front end portion moves forward and rearward inside the liquid chamber;
  - an elastic body which applies a biasing force to the plunger;
  - a pressurizing chamber in which the piston is arranged and to which compressed gas is supplied;
  - a pressure supply source; and
  - a switching valve which switches between a first position where the pressure supply source and the pressurizing chamber communicate with each other and a second position where the pressurizing chamber and the atmosphere communicate with each other,
- wherein the liquid material is discharged through the discharging port by causing the plunger to move forward,
- wherein the elastic body biases the plunger in a rearward movement direction,
- wherein the compressed gas supplied to the pressurizing chamber applies a driving force to the piston to cause the plunger to move forward by locating the switching valve at the first position, and the air pressure of the pressurizing

chamber can be adjusted, and

wherein the elastic body applies the biasing force to cause the piston to move rearward and the front end portion integrally moves with the piston.

2. The liquid material discharging apparatus according to Claim 1, wherein the elastic body biases the piston.

3. The liquid material discharging apparatus according to Claim 1 or 2, further comprising:

a stroke adjustment mechanism which comes into contact with the plunger and adjusts the most rearward movement position of the plunger.

4. The liquid material discharging apparatus according to Claim 3, wherein the stroke adjustment mechanism comes into contact with the piston.

5. The liquid material discharging apparatus according to any one of Claims 1 to 4, further comprising:

a position determining mechanism which includes a contact portion disposed in the plunger and a position determining member opposing the contact portion, and which determines the most forward movement position of the plunger.

6. The liquid material discharging apparatus according to Claim 5,

wherein the contact portion comprises a convex member disposed in a forward movement direction of the piston, and the position determining member comprises a wall surface opposing the piston of the pressurizing chamber.

7. The liquid material discharging apparatus according to Claim 5, further comprising:

a distance adjustment mechanism which adjusts a distance between the position determining member and the pressurizing chamber.

8. The liquid material discharging apparatus according to Claim 7,

wherein the contact portion comprises a convex member disposed in a forward movement direction of the piston.

9. The liquid material discharging apparatus according to Claim 7,

wherein the plunger has a rod portion connecting the piston and the front end portion, and the contact portion is disposed in the rod portion.

10. The liquid material discharging apparatus according to

any one of Claims 1 to 9, further comprising:

a biasing force adjustment mechanism which includes a moving member holding the elastic body by opposing the piston and a position adjustment mechanism adjusting a position of the moving member, and which adjusts a biasing force of the elastic body.

11. The liquid material discharging apparatus according to any one of Claims 1 to 10, further comprising:

a pressure intensifier which intensifies a pressure of the compressed gas to be supplied to the pressurizing chamber; and

a pressure regulator which reduces a pressure of the compressed gas whose pressure is intensified by the pressure intensifier, to be a desired pressure, and which supplies the compressed gas to the pressurizing chamber.

12. The liquid material discharging apparatus according to Claim 11,

wherein a buffer tank is disposed in a flow path which allows the pressure intensifier and the pressurizing chamber to communicate with each other.

13. The liquid material discharging apparatus according to any one of Claims 1 to 12, further comprising:

a flow valve which controls a flow rate of the compressed gas ejected from the pressurizing chamber.

14. The liquid material discharging apparatus according to any one of Claims 1 to 13,

wherein the pressurizing chamber is divided into two air-tight spaces by the piston; and

wherein the liquid material discharge apparatus further includes a flow valve which controls a flow rate of gas flowing in the pressurizing chamber when the piston rises.

15. The liquid material discharging apparatus according to any one of Claims 1 to 14, wherein the piston is formed at a rear end portion of the plunger.

16. The liquid material discharging apparatus according to any one of Claims 1 to 15, wherein the liquid material is supplied to the liquid chamber.

17. A liquid material discharge method of using a liquid material discharging apparatus that includes a liquid chamber which communicates with a discharging port; a plunger which has a piston and whose front end portion moves forward and rearward inside the liquid chamber; an elastic body which biases the plunger in a rearward movement direction; a

pressurizing chamber in which the piston is arranged and to which compressed gas is supplied; a pressure supply source; and a switching valve which switches between a first position where the pressure supply source and the pressurizing chamber communicate with each other and a second position where the pressurizing chamber and the atmosphere communicate with each other, the method comprising:

a filling process of causing the plunger to move in a rearward movement direction by ejecting the compressed gas inside the pressurizing chamber by locating the switching valve at the second position; and

a discharging process of causing the plunger to move forward at a desired speed by supplying the compressed gas which is adjusted to have a desired pressure to the pressurizing chamber by locating the switching valve at the first position,

wherein in the filling process, the elastic body applies the biasing force to cause the piston to move rearward and the front end portion integrally moves with the piston.

18. The liquid material discharge method according to Claim 17, wherein the elastic body biases the piston.

19. The liquid material discharge method according to Claim 17 or 18,

wherein the liquid material discharge apparatus further

includes a position determining mechanism which includes a contact portion disposed in the plunger and a position determining member opposing the contact portion, and which determines the most forward movement position of the plunger: and

wherein the liquid material is discharged in a droplet state after applying inertia force to the liquid material by causing the plunger to move forward in a state where the front end portion of the plunger and an inner wall of the liquid chamber are not in contact with each other.

20. The liquid material discharge method according to Claim 19,

wherein the discharging process comprises:

a process of extruding the liquid material having an amount required for forming a desired droplet from the discharging port by causing the plunger to move forward to the most forward movement position where the plunger is not in contact with the liquid chamber; and

a process of forming a very small amount of droplets after dividing the liquid material extruded from the discharging port by subsequently causing the plunger to move rearward.

21. The liquid material discharge method according to any one of Claims 17 to 20,

wherein the liquid material discharge apparatus further includes a pressure intensifier which intensifies a pressure of the compressed gas to be supplied to the pressurizing chamber, and a pressure regulator which reduces a pressure of the compressed gas whose pressure is intensified by the pressure intensifier, to be a desired pressure, and which supplies the compressed gas to the pressurizing chamber; and

wherein the discharging process comprises a process of supplying the compressed gas whose pressure has been regulated.

22. The liquid material discharge method according to Claim 21,

wherein a buffer tank is disposed in a flow path which allows the pressure intensifier and the pressurizing chamber to communicate with each other.

23. The liquid material discharge method according to any one of Claims 17 to 22,

wherein the liquid material discharge apparatus further includes a flow valve which controls a flow rate of the compressed gas ejected from the pressurizing chamber; and

wherein the filling process comprises a process of controlling the flow rate of the compressed gas ejected from the pressurizing chamber.

24. The liquid material discharge method according to any one of Claims 17 to 23,

wherein the pressurizing chamber is divided into two air-tight spaces by the piston; and

wherein the liquid material discharge apparatus further includes a flow valve which controls a flow rate of gas flowing in the pressurizing chamber when the piston rises; and

wherein the filling process comprises a process of controlling the flow rate of the gas flowing into the pressurizing chamber.

25. The liquid material discharge method according to any one of Claims 17 to 24, wherein the piston is formed at a rear end portion of the plunger.

26. The liquid material discharge method according to any one of Claims 17 to 25, wherein the liquid material is supplied to the liquid chamber.