CLAIMS

1. A discharge device for a liquid material containing solid particles, the discharge device comprising:

a first reservoir that stores the liquid material containing the solid particles;

a first air pressure supply pipe through which pressurized air is supplied to the first reservoir;

a metering portion having a metering hole into which the liquid material is filled;

a plunger moving back and forth in the metering hole;

a nozzle having a discharge port through which the liquid material is discharged;

a switching valve having a first position at which the first reservoir and the metering hole are communicated with each other, and a second position at which the metering hole and the nozzle are communicated with each other;

a first liquid feed pipe that communicates the first reservoir and the switching valve with each other;

a plunger driver that moves the plunger back and forth; and

a switching valve driver that shifts the switching valve between the first position and the second position,

the discharge device further comprising:

a second reservoir that stores the liquid material;

a second air pressure supply pipe through which pressurized air is supplied to the second reservoir;

a branch portion provided in an upper portion of the metering hole and having a branch flow path;

a second liquid feed pipe that communicates the branch flow path and the second reservoir with each other; and

an opening/closing mechanism that establishes or cuts off communication between the second reservoir and the metering hole,

wherein the liquid material inside the first reservoir is transferred to the second reservoir by supplying the pressurized air through the first air pressure supply pipe in a state that the switching valve is held at the first position and the opening/closing mechanism is held at an open position, and the liquid material inside the second reservoir is transferred to the first reservoir by supplying the pressurized air through the second air pressure supply pipe in the state that the switching valve is held at the first position and the opening/closing mechanism is held at the open position.

2. The discharge device for the liquid material containing the solid particles according to claim 1, wherein a volume ratio of the first reservoir to the second reservoir is 1 : 0.5 to 1 or 0.5 to 1 : 1.

3. The discharge device for the liquid material containing the solid particles according to claim 1 or 2, further comprising a discharge control device including a processor and a storage device in which a discharge control program is stored, the discharge control program comprising:

a first transfer step of transferring the liquid material inside the first reservoir to the second reservoir by supplying the pressurized air through the first air pressure supply pipe in the state that the switching valve is held at the first position and the opening/closing mechanism is held at the open position;

a second transfer step of transferring the liquid material inside the second reservoir to the first reservoir by supplying the pressurized air through the second air pressure supply pipe in the state that the switching valve is held at the first position and the opening/closing mechanism is held at the open position; and

a continuous transfer step of alternately executing the first transfer step and the second transfer step.

4. The discharge device for the liquid material containing the solid particles according to claim 3, wherein a tip end of the plunger is brought into a state positioned above the branch flow path in the first and second transfer steps.

5. The discharge device for the liquid material containing the solid particles according to claim 3 or 4, wherein the discharge control program further comprises a discharge preparation step of ending execution of the continuous transfer step after completion of the second transfer step, shifting the opening/closing mechanism to a closed position, and shifting the switching valve to the second position; and

a discharge step of descending the plunger through a desired distance and discharging the liquid material inside the metering hole.

6. The discharge device for the liquid material containing the solid particles according to claim 5, wherein the liquid material inside the metering hole is discharged plural times in the discharge step by repeating an operation of descending and stopping the plunger plural times.

7. The discharge device for the liquid material containing the solid particles according to any one of claims 1 to 6, wherein the pressurized air under constant pressure is continuously supplied through the first air pressure supply pipe, and

the pressurized air under constant pressure is continuously supplied through the second air pressure supply pipe.

8. The discharge device for the liquid material containing the solid particles according to claim 7, wherein the pressurized air is supplied through the first air pressure supply pipe for a preset time, and

the pressurized air is supplied through the second air pressure supply pipe for a preset time.

9. The discharge device for the liquid material containing the solid particles according to claim 7, further comprising:

a first liquid sensor disposed in the first reservoir or the first liquid feed pipe; and

a second liquid sensor disposed in the second reservoir or the second liquid feed pipe,

wherein the pressurized air is supplied during a period until the first liquid sensor detects the absence of the liquid from the first air pressure supply pipe, and

the pressurized air is supplied during a period until the second liquid sensor detects the absence of the liquid from the second air pressure supply pipe.

10. The discharge device for the liquid material containing the solid particles according to any one of claims 1 to 9, further comprising a seal disposed at a lower side of the branch portion and having an opening that allows the plunger to be held in slide contact with the seal,

wherein the open position of the opening/closing mechanism is obtained by positioning the tip end of the plunger above the seal, and

a closed position of the opening/closing mechanism is obtained by positioning the tip end of the plunger under the seal.

11. The discharge device for the liquid material containing the solid particles according to any one of claims 1 to 9, wherein the opening/closing mechanism is constituted by an opening/closing valve.

12. An application apparatus comprising:

the discharge device for the liquid material containing the solid particles according to any one of claims 1 to 11; and

a worktable on which an application target object is placed, and a relatively moving device that moves the discharge device for the liquid material and the application target object relative to each other.

13. A discharge method for a liquid material containing solid particles, the discharge method executing the following steps using the discharge device for the liquid material containing the solid particles according to any one of claims 1 to 11:

a first transfer step of transferring the liquid material inside the first reservoir to the second reservoir by supplying the pressurized air through the first air pressure supply pipe in the state that the switching

valve is held at the first position and the opening/closing mechanism is held at the open position;

a second transfer step of transferring the liquid material inside the second reservoir to the first reservoir by supplying the pressurized air through the second air pressure supply pipe in the state that the switching valve is held at the first position and the opening/closing mechanism is held at the open position;

a discharge preparation step of shifting the opening/closing mechanism to a closed position and shifting the switching valve to the second position; and

a discharge step of descending the plunger through a desired distance and discharging the liquid material inside the metering hole.

14. The discharge method for the liquid material containing the solid particles according to claim 13, wherein the solid particles include solid particles having greater specific gravity than the liquid material.

15. The discharge method for the liquid material containing the solid particles according to claim 14, wherein the solid particles are LED phosphors.

16. The discharge method for the liquid material containing the solid particles according to any one of claims 13 to 15, wherein 60 % or more of the liquid material inside the first reservoir is transferred to the second reservoir in the first transfer step, and

60 % or more of the liquid material inside the second reservoir is transferred to the first reservoir in the second transfer step.