by the booster circuit unit 14 continues due to the protection operation by the control unit 17 and shutdown of the DC load 3 continues, thereby causing a startup failure.

[0039] Therefore, the protection setting unit 16 holds the setting of the protection voltage and inhibits the change of the setting until T_stable2 has passed even if the smoothing capacitor voltage has fallen below the protection voltage immediately after stop of supply of the AC voltage from the AC power supply 2 and recovery from the power failure has been detected by the AC voltage detected by the AC-voltage detection unit 19. After supply of the AC voltage from the AC power supply 2 is started and T_stable2 has passed, the protection setting unit 16 changes the setting of the protection voltage. Specifically, after T_stable2 has passed, the protection setting unit 16 calculates a second protection voltage C2 according to the equation (1) described above on the basis of the AC voltage at a point C1 illustrated in (b) in FIG. 3, and changes the setting of the protection voltage from the second protection voltage B2 to the second protection voltage C2. The control unit 17 continues the protection operation from when the protection operation is started at t12 in FIG. 3 to when T_stable2 has passed even if the smoothing capacitor voltage becomes higher than the protection voltage.

[0040] In the power supply device 1, the voltage state becomes "smoothing capacitor voltage > protection voltage" after T_stable2 has passed. Therefore, the control unit 17 does not perform the protection operation and thus the startup failure can be prevented.

[0041] (When the booster circuit unit 14 performs boosting)

A case where the booster circuit unit 14 performs boosting is described with reference to FIG. 4 to FIG. 7.

CLAIMS

1. A power supply device comprising:

a resistor that limits an electric current supplied from an alternating-current power supply;

a switching unit that is connected in parallel with the resistor;

a rectifier circuit unit that is connected to a subsequent stage of the resistor and the switching unit and rectifies an alternating-current voltage of the alternating-current power supply;

a booster circuit unit that boosts a direct-current voltage rectified by the rectifier circuit unit; and

a direct-current-voltage detection unit that detects a direct-current voltage output from the booster circuit unit;

characterized in that

the power supply device further comprises

an alternating-current-voltage detection unit that detects an alternating-current voltage of the alternating-current power supply;

a protection setting unit that calculates a first protection voltage on a basis of a boosting level by the booster circuit unit detected by the direct-current-voltage detection unit, calculates a second protection voltage on a basis of the alternating-current voltage detected by the alternating-current-voltage detection unit, compares the first protection voltage with the second protection voltage, and sets either one of the first protection voltage and the second protection voltage as a protection voltage; and

a control unit that opens the switching unit when the direct-current voltage falls below the protection voltage

set by the protection setting unit and stops boosting performed by the booster circuit unit.

2. The power supply device according to claim 1, wherein the protection setting unit sets the second protection voltage as the protection voltage when the control unit stops boosting performed by the booster circuit unit.

3. The power supply device according to claim 1, wherein the protection setting unit sets the second protection voltage as the protection voltage when an operation of the booster circuit unit has been stopped.

4. The power supply device according to claim 1, wherein the protection setting unit calculates the second protection voltage such that the second protection voltage falls within a limit value with respect to an inrush current of a semiconductor element constituting the booster circuit unit.

5. The power supply device according to claim 1, wherein the protection setting unit changes setting of the protection voltage from the second protection voltage to the first protection voltage, after boosting by the booster circuit unit is started and a first transition period, which is a transition period of the direct-current voltage, passes.

6. The power supply device according to claim 1, wherein if the direct-current voltage falls below the protection voltage immediately after supply of an alternating-current voltage from the alternating-current power supply is stopped, the protection setting unit holds the protection

voltage without changing the protection voltage and, after supply of the alternating-current voltage from the alternating-current power supply is started and a second transition period, which is a transition period of the direct-current voltage, passes, the protection setting unit changes setting of the protection voltage from the first protection voltage to the second protection voltage.

7. The power supply device according to any one of claims 1 to 6, wherein the protection setting unit sets the protection voltage such that the protection voltage does not fall below a set lower limit.

8. The power supply device according to any one of claims 1 to 7, wherein a semiconductor element constituting the booster circuit unit is a wide bandgap semiconductor.

9. The power supply device according to claim 8, wherein the wide bandgap semiconductor is SiC, GaN, or diamond.