FIG. 1A

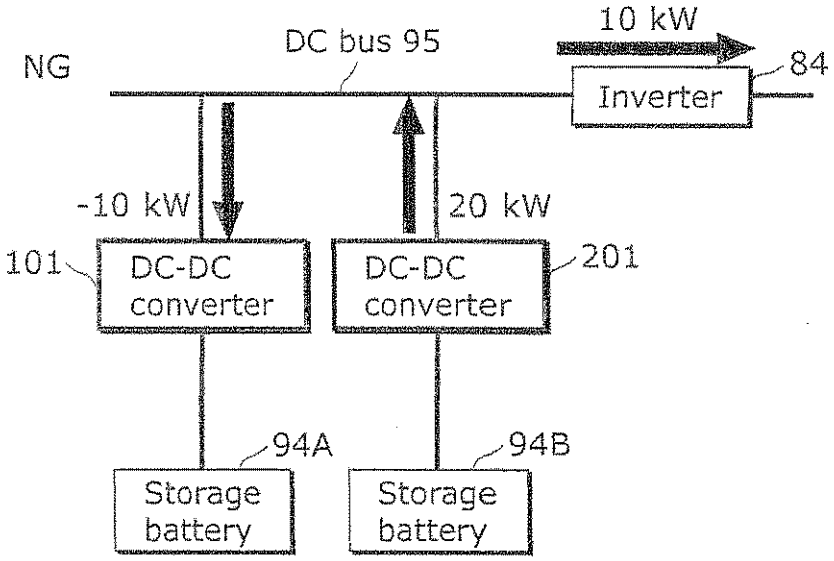

NG
DC bus 95
10 kW
84
Inverter
-10 kW
20 kW
101
DC-DC converter
DC-DC converter
201
94A
94B
Storage battery
Storage battery

FIG. 1B

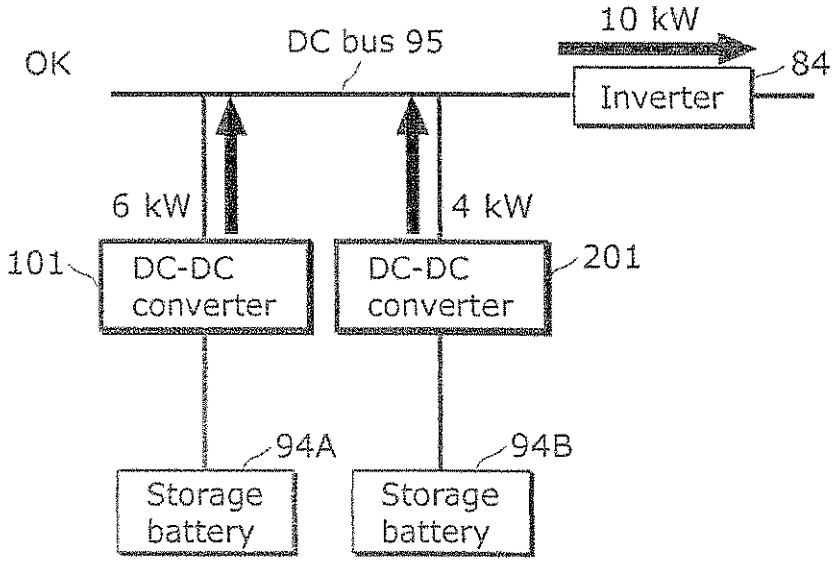

OK
DC bus 95
10 kW
84
Inverter
6 kW
4 kW
101
DC-DC converter
DC-DC converter
201
94A
94B
Storage battery
Storage battery

FIG. 2

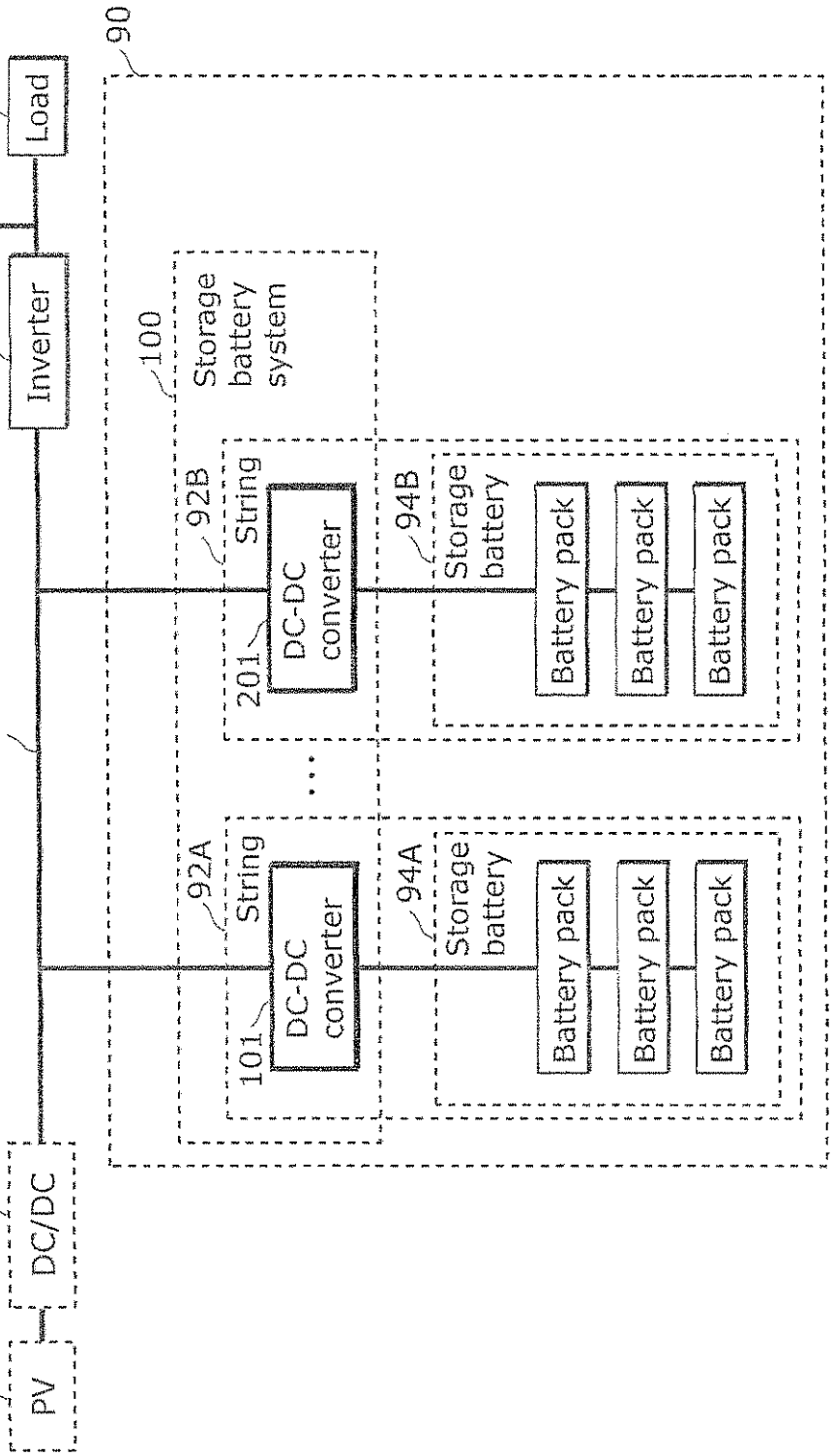

88
PV
86
DC/DC
DC bus 95
80
Power system
84
Inverter
82
Load
90
100
Storage battery system
92A
String
101
DC-DC converter
94A
Storage battery
Battery pack
Battery pack
Battery pack
92B
String
201
DC-DC converter
94B
Storage battery
Battery pack
Battery pack
Battery pack

FIG. 3

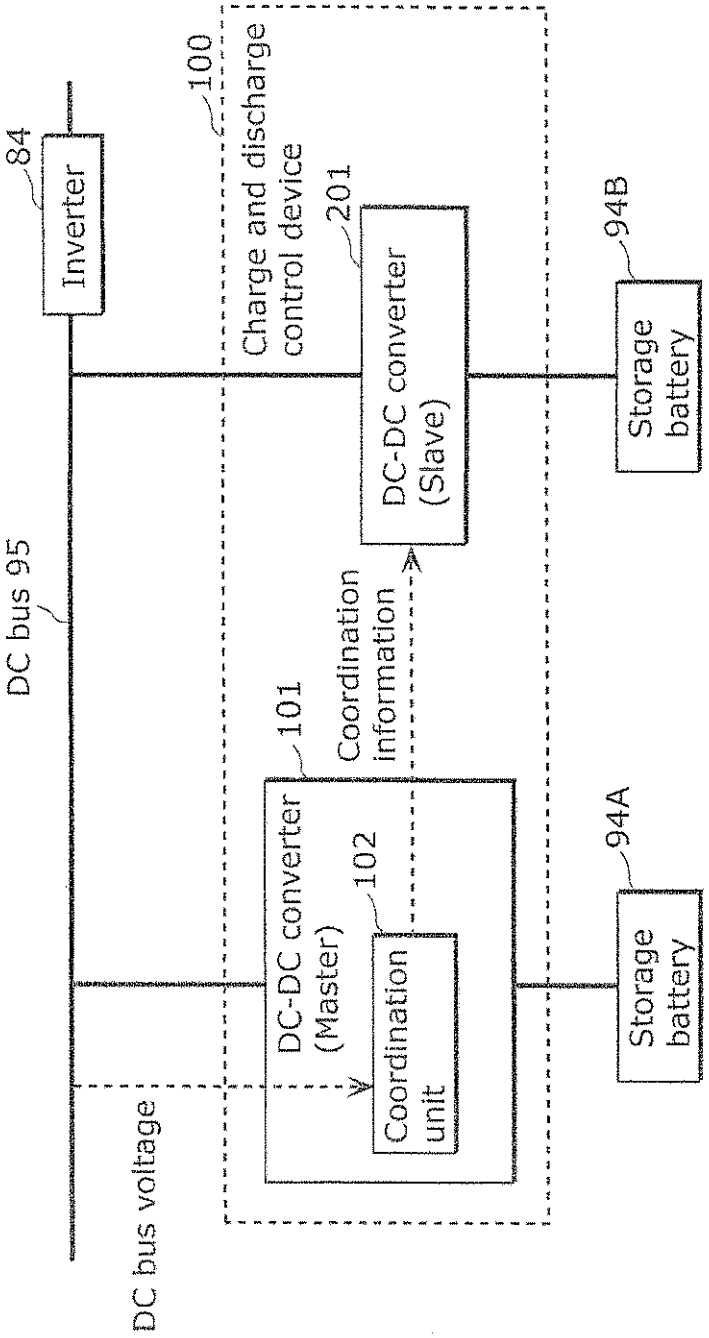

84
Inverter
100
Charge and discharge control device
201
DC-DC converter (Slave)
94B
Storage battery
DC bus 95
Coordination information
101
DC-DC converter (Master)
102
Coordination unit
94A
Storage battery
DC bus voltage

FIG. 4

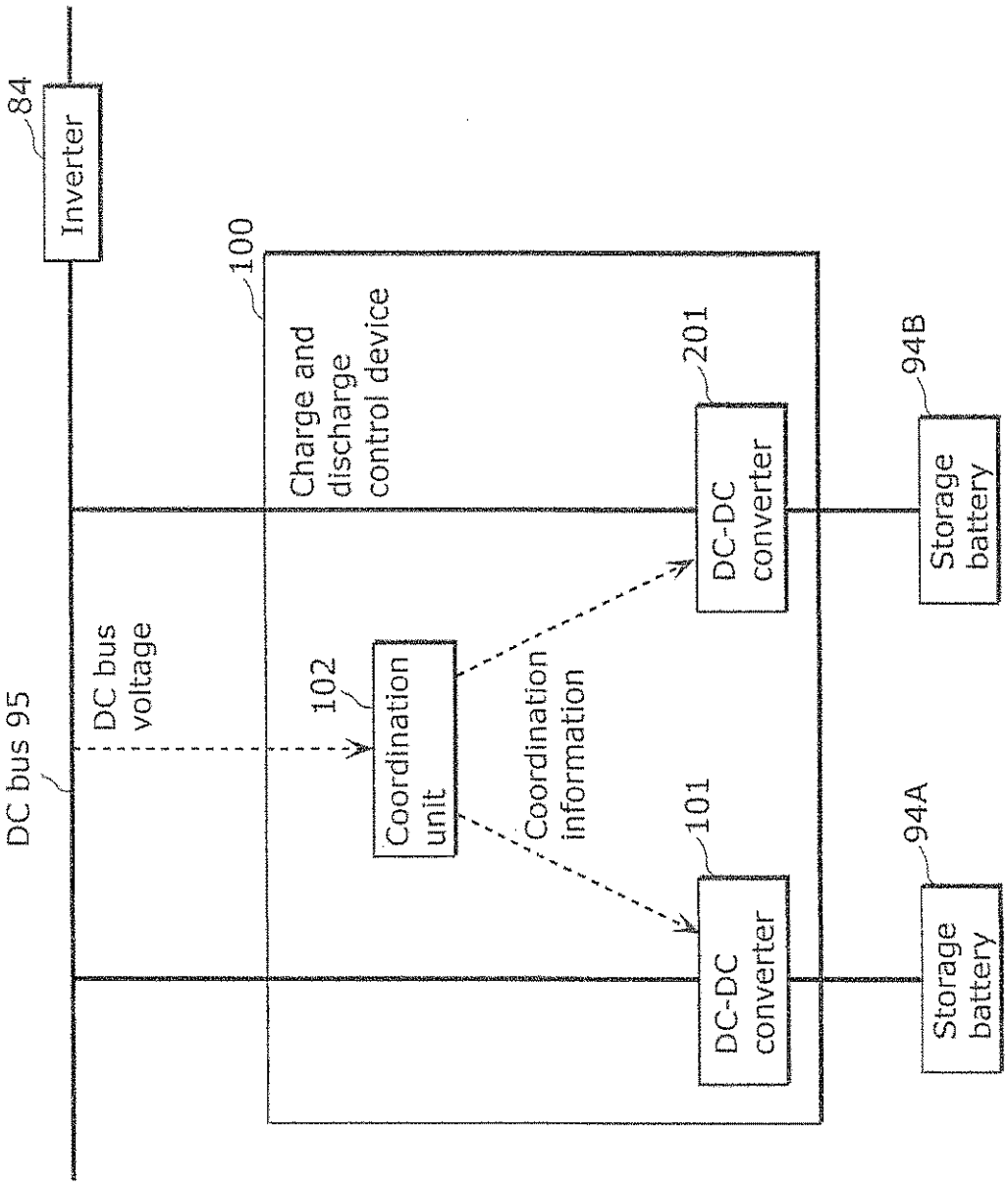

84
Inverter
100
Charge and discharge control device
201
DC-DC converter
94B
Storage battery
DC bus 95
DC bus voltage
102
Coordination unit
Coordination information
101
DC-DC converter
94A
Storage battery

FIG. 5

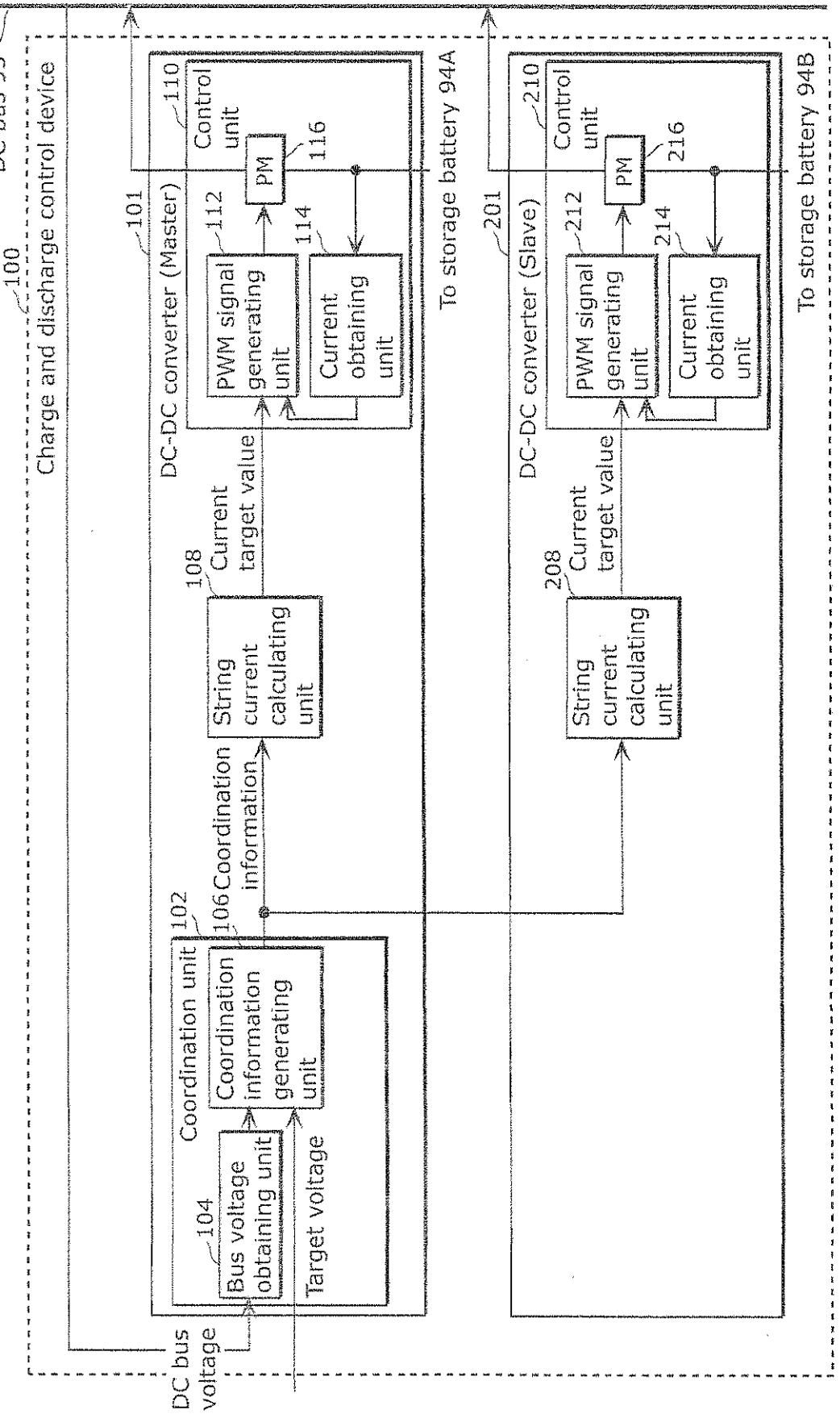

DC bus 95
100
Charge and discharge control device
101
DC-DC converter (Master)
110
Control unit
PM
116
112
PWM signal generating unit
114
Current obtaining unit
To storage battery 94A
201
DC-DC converter (Slave)
210
Control unit
PM
216
212
PWM signal generating unit
214
Current obtaining unit
To storage battery 94B
108
Current target value
String current calculating unit
208
Current target value
String current calculating unit
102
Coordination unit
106
Coordination information
Coordination information generating unit
104
Bus voltage obtaining unit
Target voltage
DC bus voltage

FIG. 6

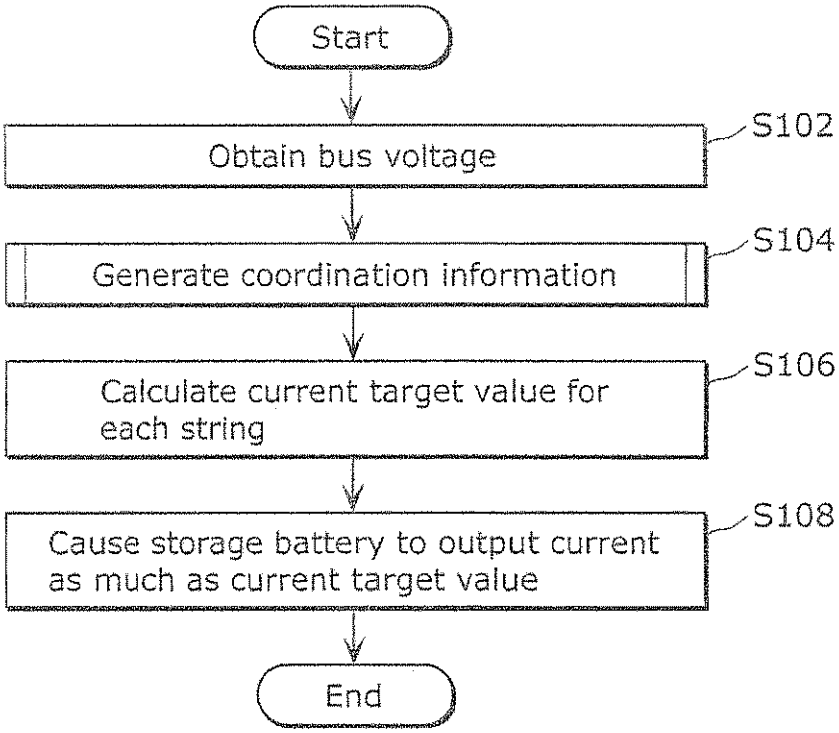

Start
Obtain bus voltage
S102
Generate coordination information
S104
Calculate current target value for each string
S106
Cause storage battery to output current as much as current target value
S108
End

FIG. 7

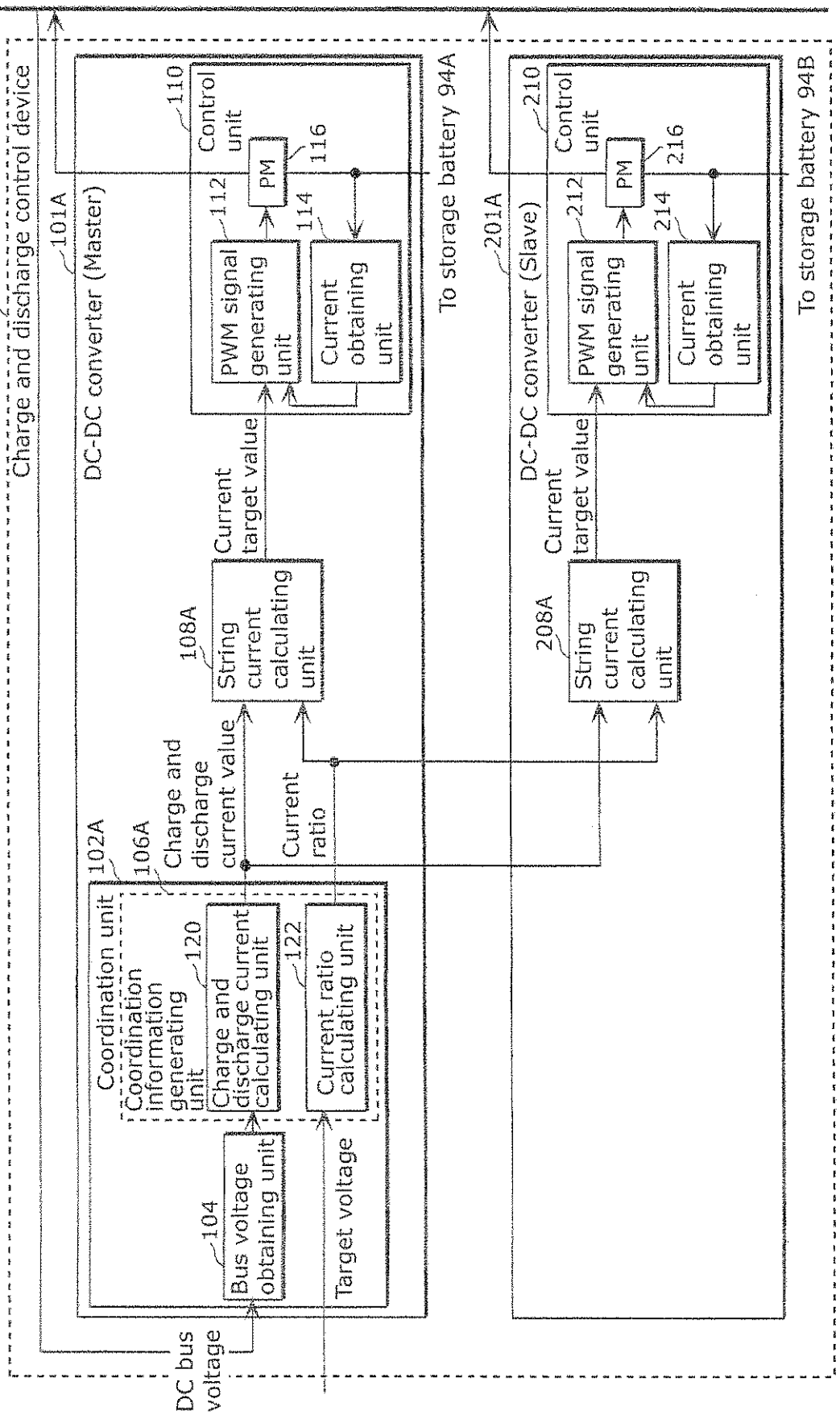

DC bus 95
100A
Charge and discharge control device
101A
DC-DC converter (Master)
110
Control unit
112
PWM signal generating unit
PM
116
114
Current obtaining unit
To storage battery 94A
201A
DC-DC converter (Slave)
210
Control unit
212
PWM signal generating unit
PM
216
214
Current obtaining unit
To storage battery 94B
Current target value
108A
String current calculating unit
208A
String current calculating unit
Charge and discharge current value
Current ratio
102A
Coordination unit
106A
Coordination information generating unit
120
Charge and discharge current calculating unit
122
Current ratio calculating unit
104
Bus voltage obtaining unit
Target voltage
DC bus voltage

FIG. 8

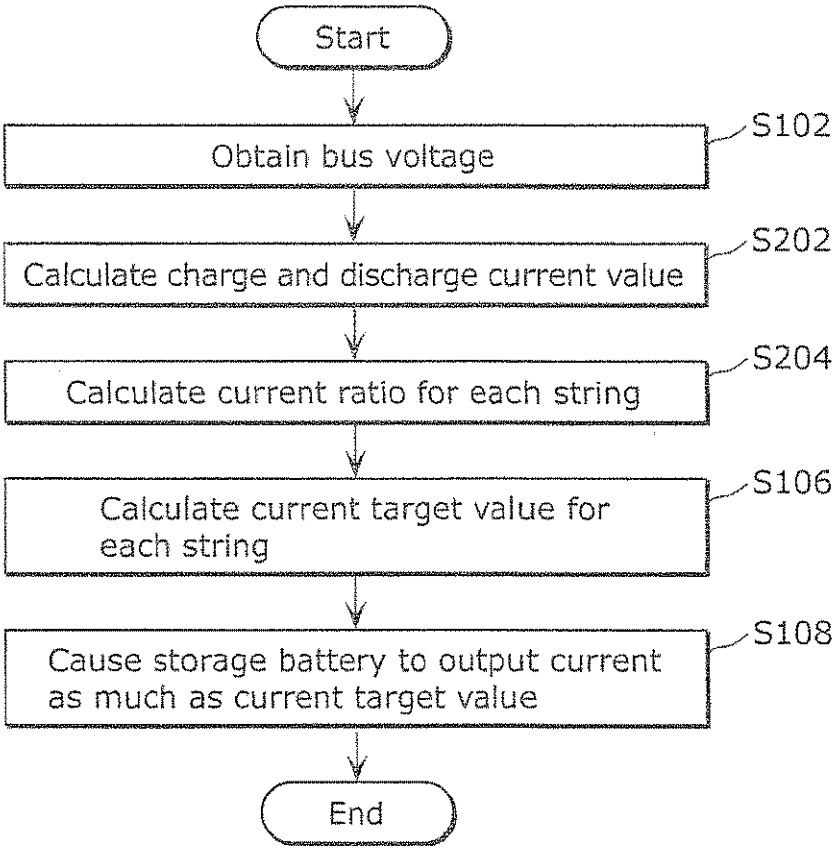

Start
Obtain bus voltage
S102
Calculate charge and discharge current value
S202
Calculate current ratio for each string
S204
Calculate current target value for each string
S106
Cause storage battery to output current as much as current target value
S108
End

FIG. 9

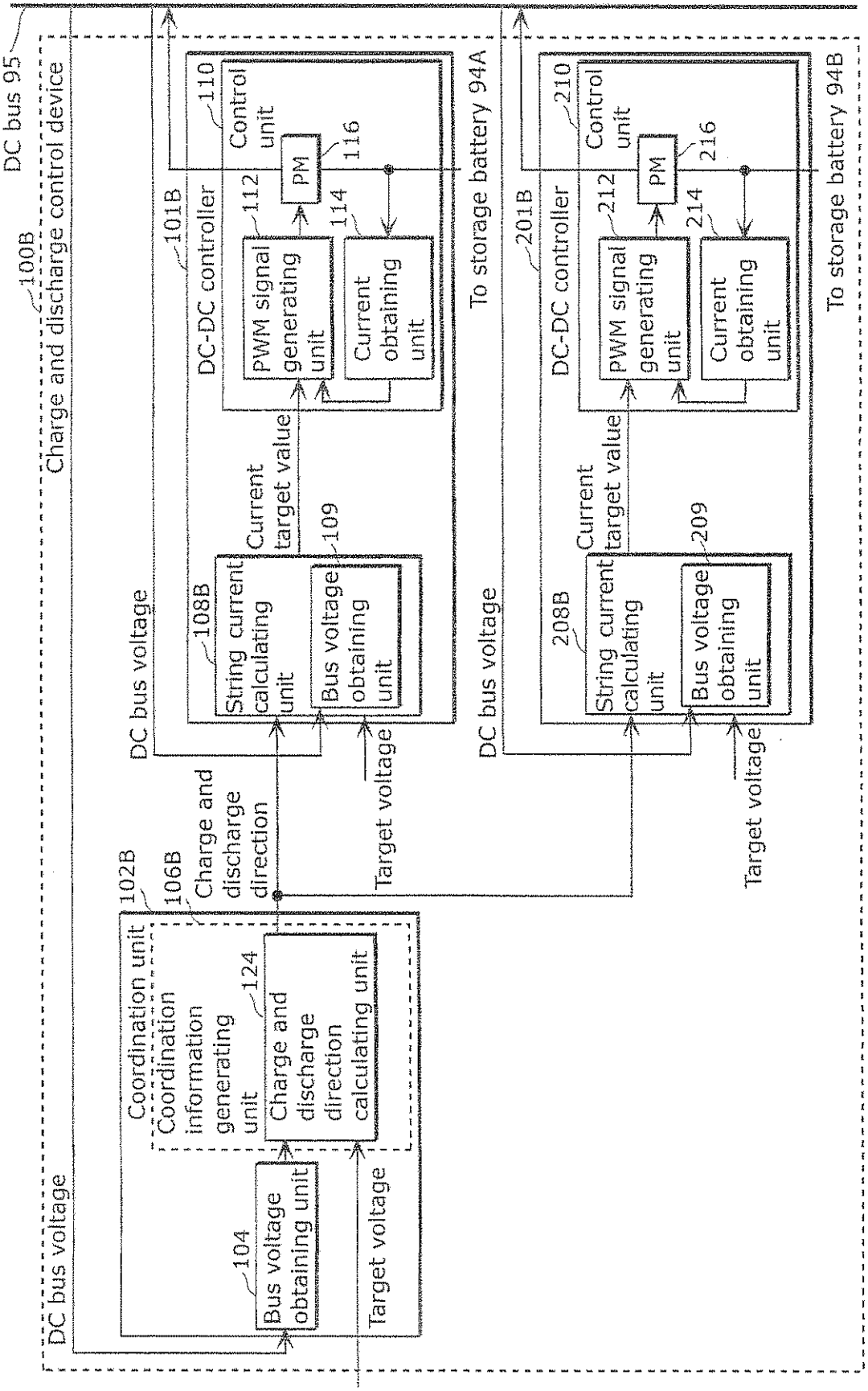

DC bus 95
100B
Charge and discharge control device
DC bus voltage
102B
Coordination unit
106B
Coordination information generating unit
104
Bus voltage obtaining unit
124
Charge and discharge direction calculating unit
Target voltage
Charge and discharge direction
DC bus voltage
101B
DC-DC controller
110
Control unit
112
PWM signal generating unit
PM
116
114
Current obtaining unit
To storage battery 94A
108B
String current calculating unit
Current target value
109
Bus voltage obtaining unit
Target voltage
DC bus voltage
201B
DC-DC controller
210
Control unit
212
PWM signal generating unit
PM
216
214
Current obtaining unit
To storage battery 94B
208B
String current calculating unit
Current target value
209
Bus voltage obtaining unit
Target voltage

FIG. 10

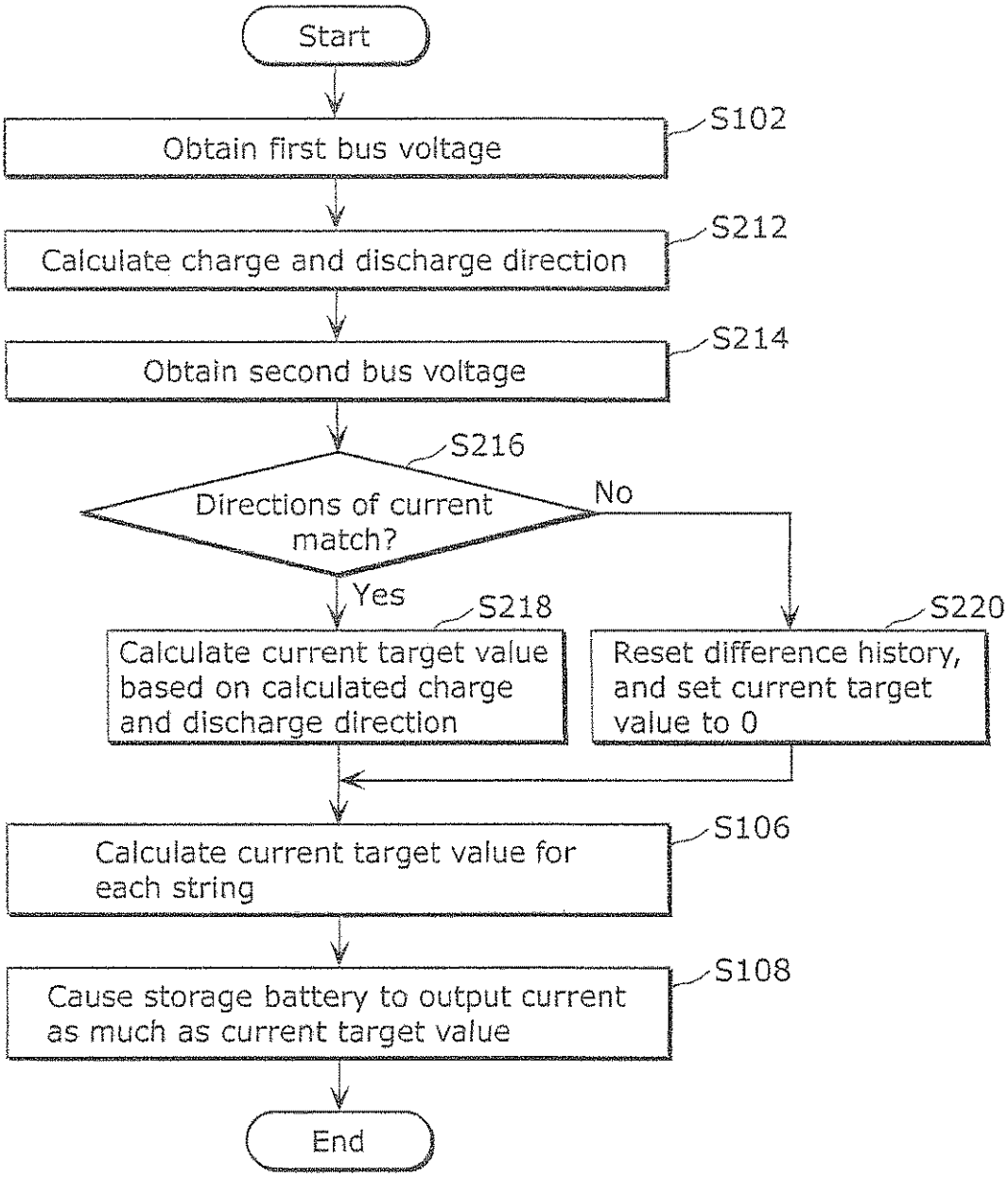

Start
Obtain first bus voltage
S102
Calculate charge and discharge direction
S212
Obtain second bus voltage
S214
S216
Directions of current match?
No
Yes
S218
Calculate current target value based on calculated charge and discharge direction
S220
Reset difference history, and set current target value to 0
Calculate current target value for each string
S106
Cause storage battery to output current as much as current target value
S108
End

FIG. 11

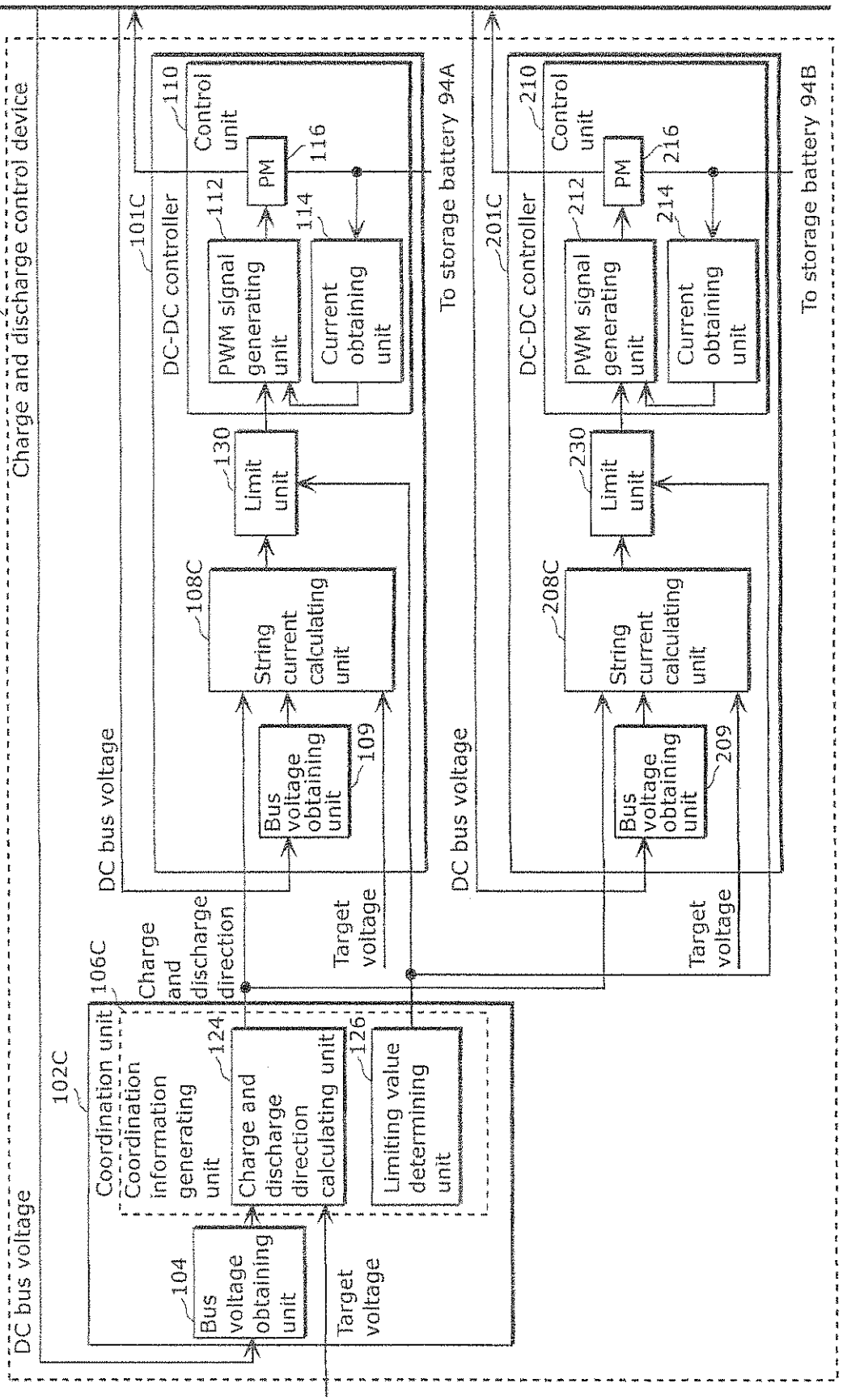

DC bus 95
100C
Charge and discharge control device
DC bus voltage
102C
Coordination unit
106C
Coordination information generating unit
Charge and discharge direction
124
Charge and discharge direction calculating unit
126
Limiting value determining unit
104
Bus voltage obtaining unit
Target voltage
101C
DC-DC controller
110
Control unit
PM
116
112
PWM signal generating unit
114
Current obtaining unit
To storage battery 94A
130
Limit unit
108C
String current calculating unit
109
Bus voltage obtaining unit
DC bus voltage
Target voltage
201C
DC-DC controller
210
Control unit
PM
216
212
PWM signal generating unit
214
Current obtaining unit
To storage battery 94B
230
Limit unit
208C
String current calculating unit
209
Bus voltage obtaining unit
DC bus voltage
Target voltage

FIG. 12

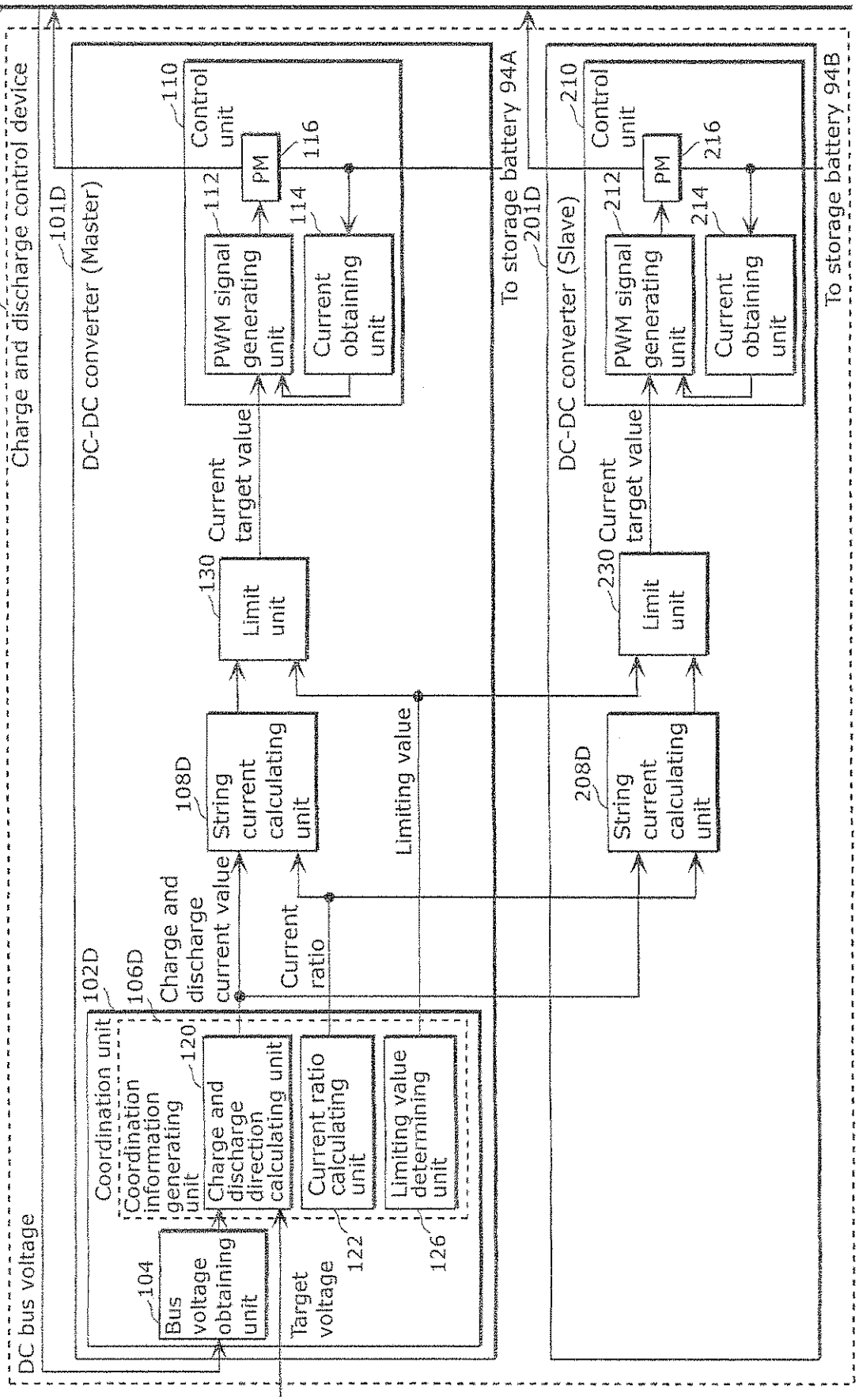

DC bus 95
100D
Charge and discharge control device
DC bus voltage
101D
DC-DC converter (Master)
110
Control unit
PM
116
112
PWM signal generating unit
114
Current obtaining unit
To storage battery 94A
201D
DC-DC converter (Slave)
210
Control unit
PM
216
212
PWM signal generating unit
214
Current obtaining unit
To storage battery 94B
Current target value
130
Limit unit
230
Limit unit
108D
String current calculating unit
208D
String current calculating unit
Limiting value
Charge and discharge current value
Current ratio
102D
Coordination unit
106D
Coordination information generating unit
120
Charge and discharge direction calculating unit
Current ratio calculating unit
Limiting value determining unit
122
126
104
Bus voltage obtaining unit
Target voltage

FIG. 13A

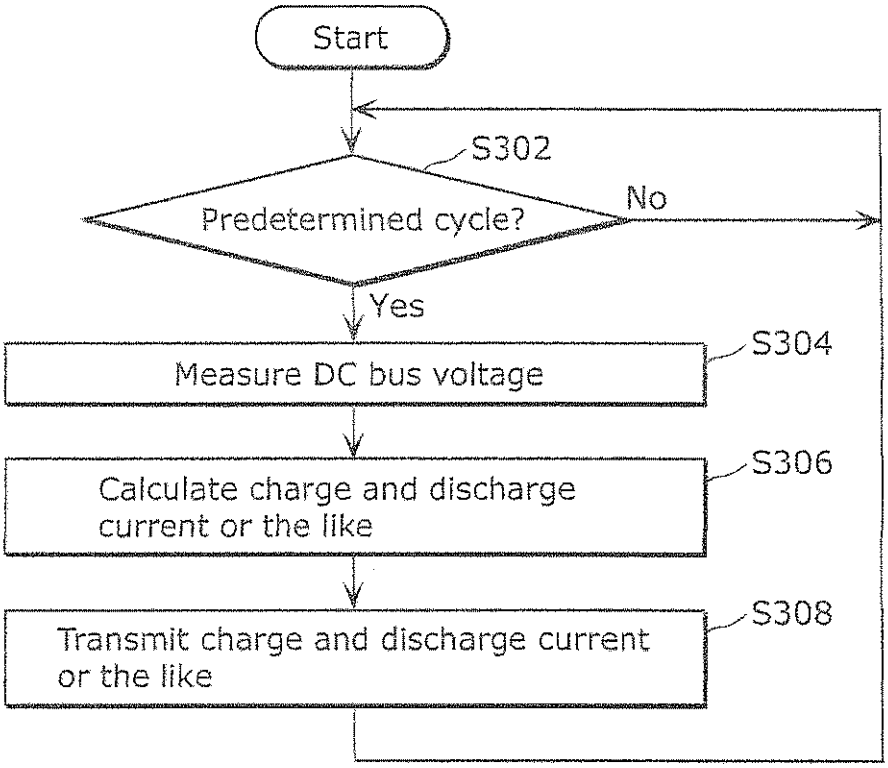

Start
S302
Predetermined cycle?
No
Yes
S304
Measure DC bus voltage
S306
Calculate charge and discharge current or the like
S308
Transmit charge and discharge current or the like

FIG. 13B

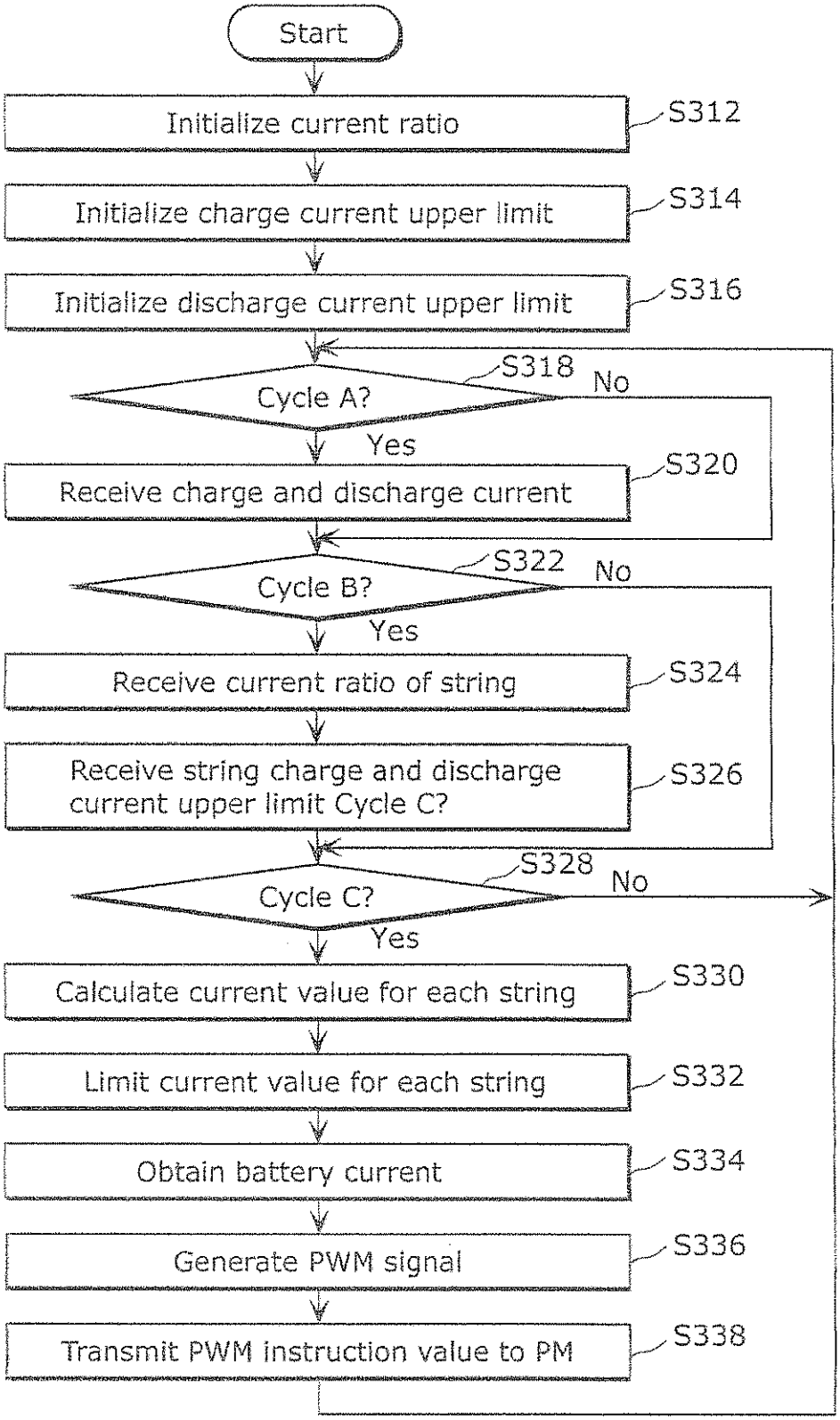
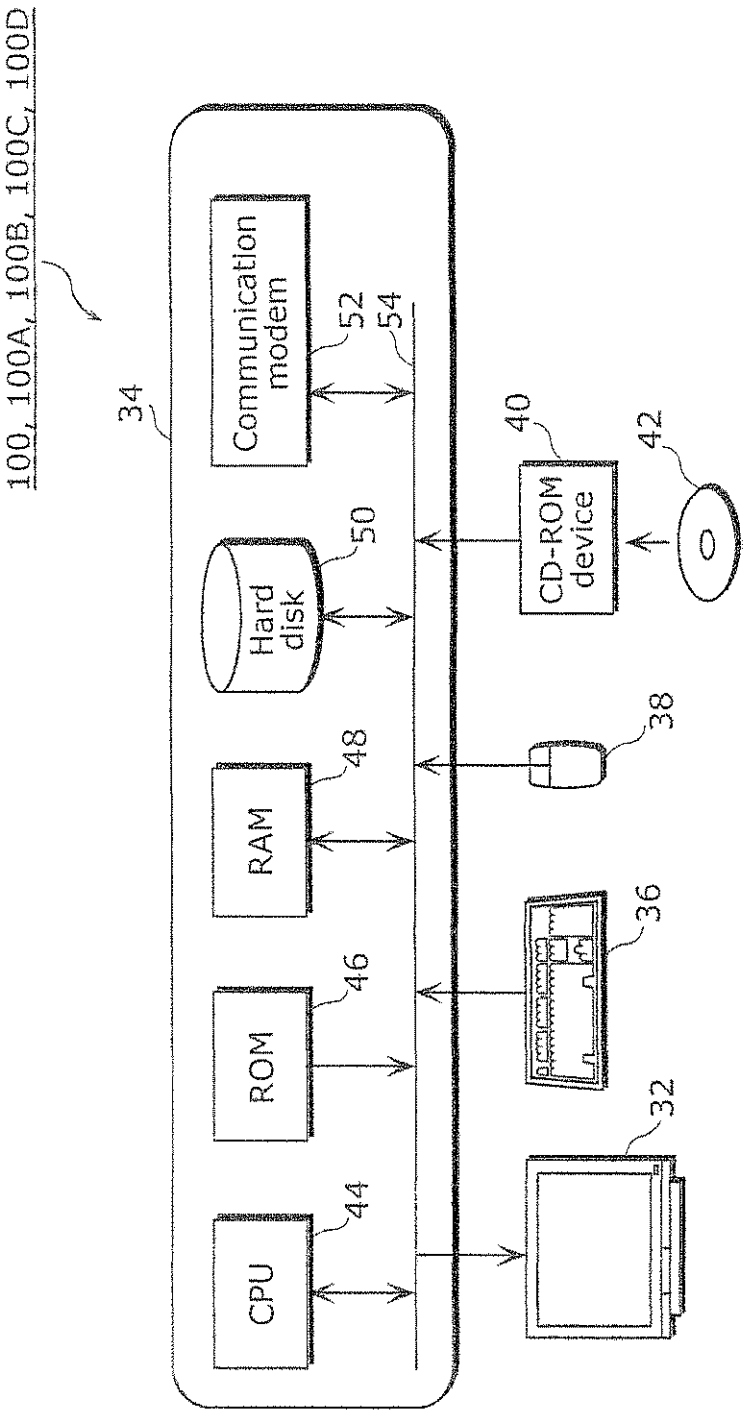

Start
Initialize current ratio
S312
Initialize charge current upper limit
S314
Initialize discharge current upper limit
S316
Cycle A?
S318
No
Yes
Receive charge and discharge current
S320
Cycle B?
S322
No
Yes
Receive current ratio of string
S324
Receive string charge and discharge current upper limit Cycle C?
S326
Cycle C?
S328
No
Yes
Calculate current value for each string
S330
Limit current value for each string
S332
Obtain battery current
S334
Generate PWM signal
S336
Transmit PWM instruction value to PM
S338

FIG. 14


100, 100A, 100B, 100C, 100D
34
CPU
ROM
RAM
Hard disk
Communication modem
CD-ROM device
44
46
48
50
52
54
40
42
38
36
32