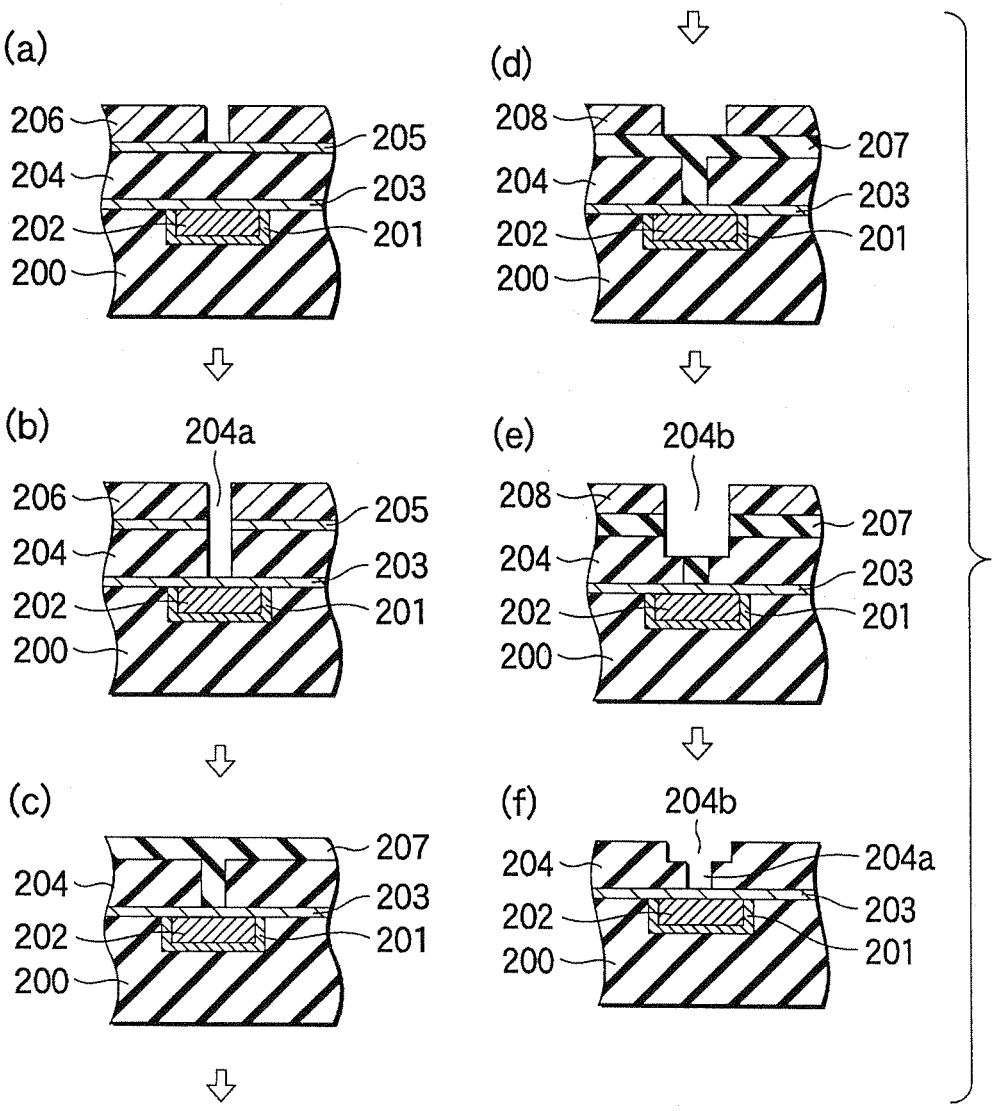

(a)
206
205
204
203
202
201
200
(b)
204a
206
205
204
203
202
201
200
(c)
207
204
203
202
201
200
(d)
208
207
204
203
202
201
200
(e)
204b
208
207
204
203
202
201
200
(f)
204b
204
204a
202
203
200
201

FIG.1

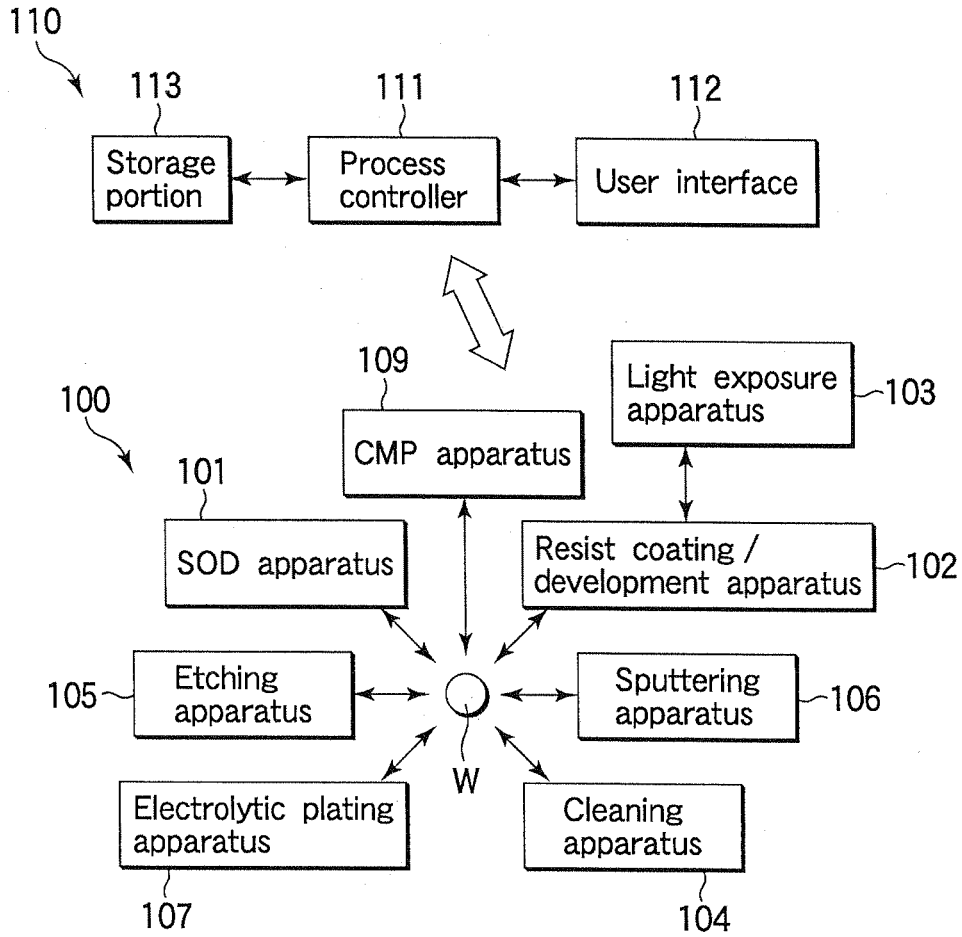

110
113
Storage portion
111
Process controller
112
User interface
109
CMP apparatus
Light exposure apparatus
103
100
101
SOD apparatus
Resist coating / development apparatus
102
105
Etching apparatus
Sputtering apparatus
106
W
Electrolytic plating apparatus
107
Cleaning apparatus
104

FIG.2

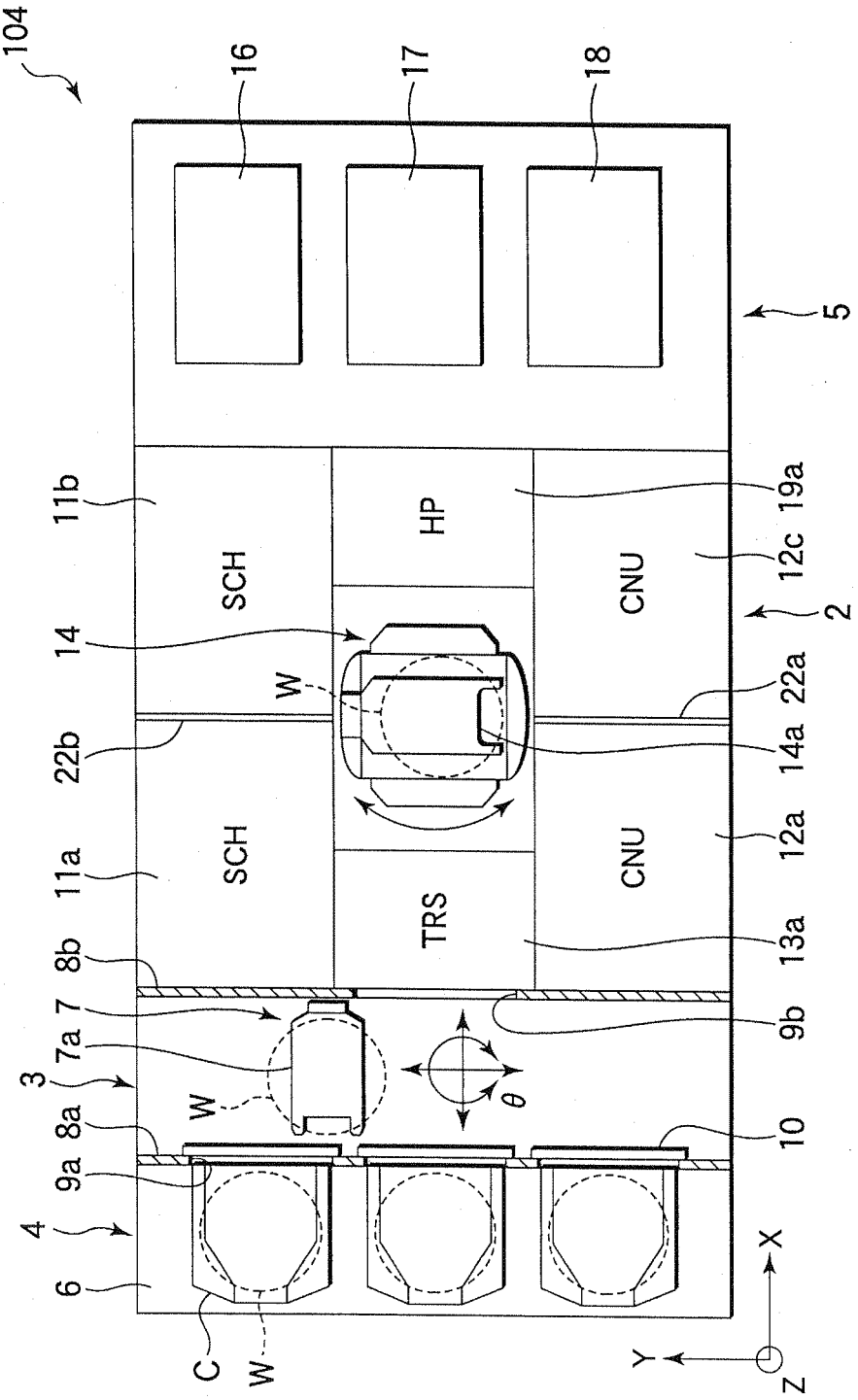

104
16
17
18
5
11b
SCH
HP
19a
12c
CNU
2
14
W
22a
22b
14a
SCH
CNU
12a
11a
TRS
13a
8b
7
9b
7a
3
W
θ
8a
10
9a
4
6
C
W
X
Y
Z

FIG.3

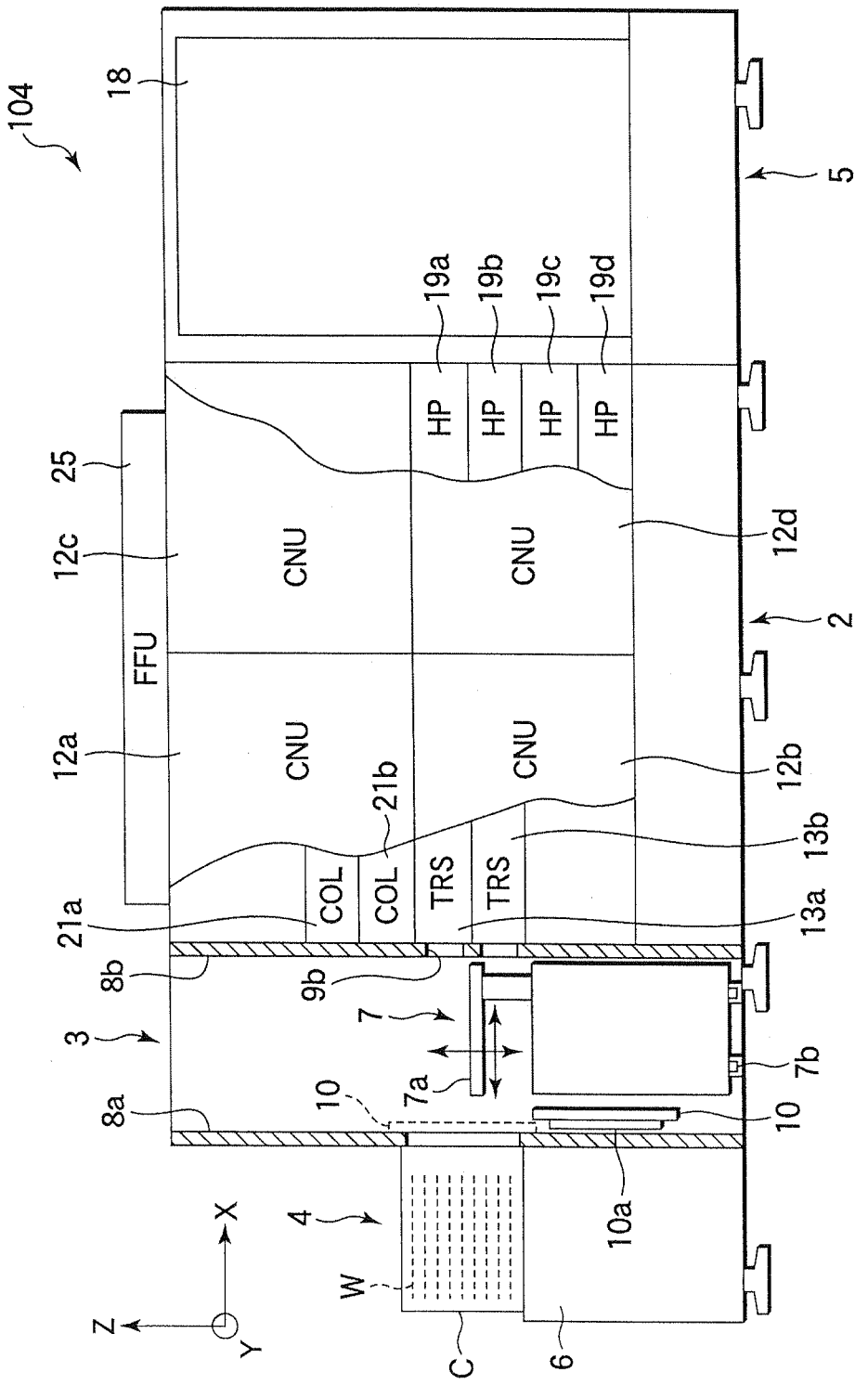

104
18
5
19a
19b
19c
19d
HP
HP
HP
HP
25
12c
CNU
CNU
12d
2
FFU
12a
CNU
CNU
12b
21b
13b
21a
COL
COL
TRS
TRS
13a
8b
9b
7
3
7b
7a
10
10
8a
10a
4
W
X
Z
Y
C
6

FIG.4

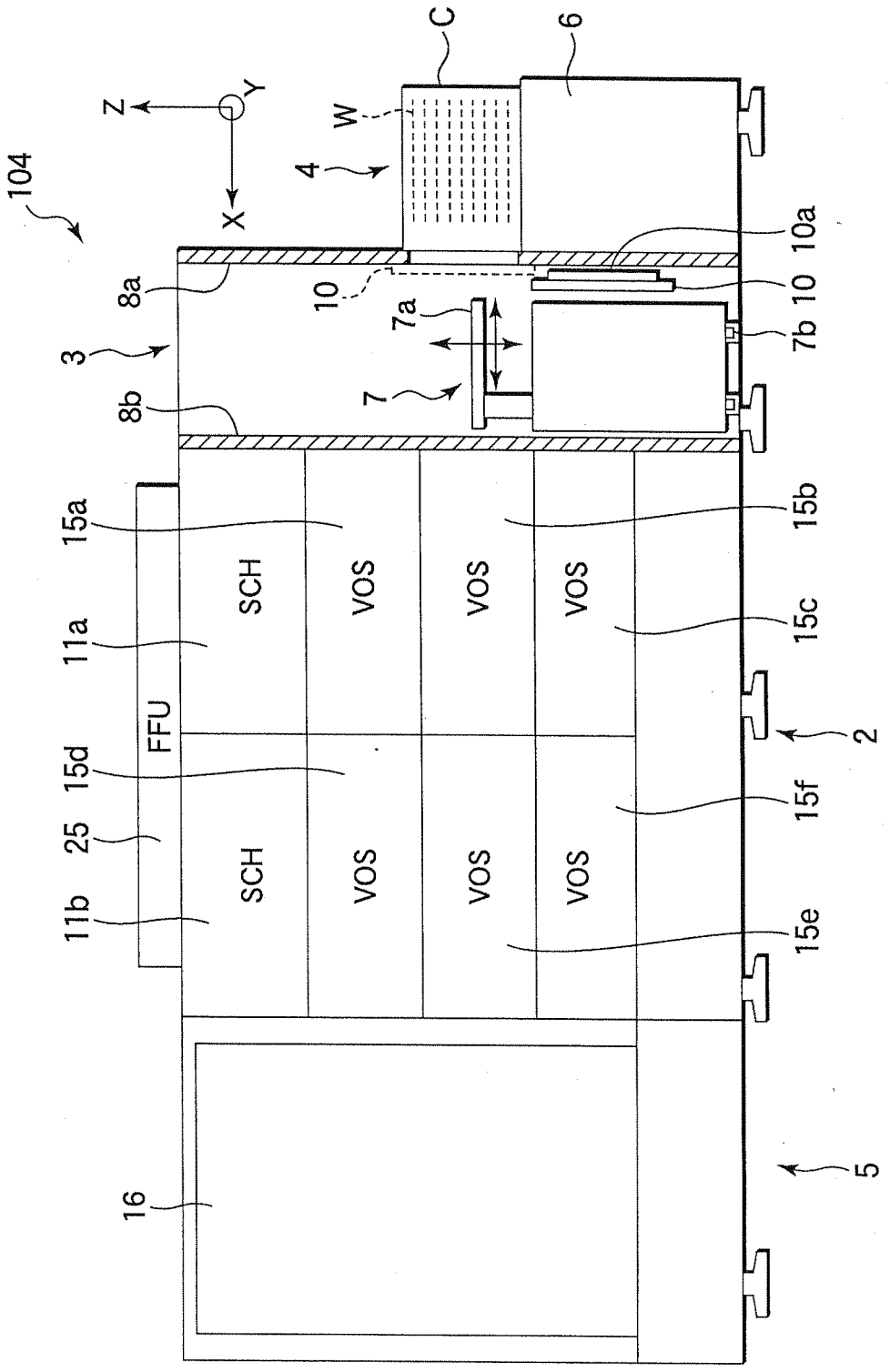

104
Z
Y
X
W
C
6
4
10a
10
8a
7a
7b
3
7
8b
15a
15b
SCH
VOS
VOS
VOS
11a
15c
FFU
2
15d
15f
25
SCH
VOS
VOS
VOS
11b
15e
16
5

FIG.5

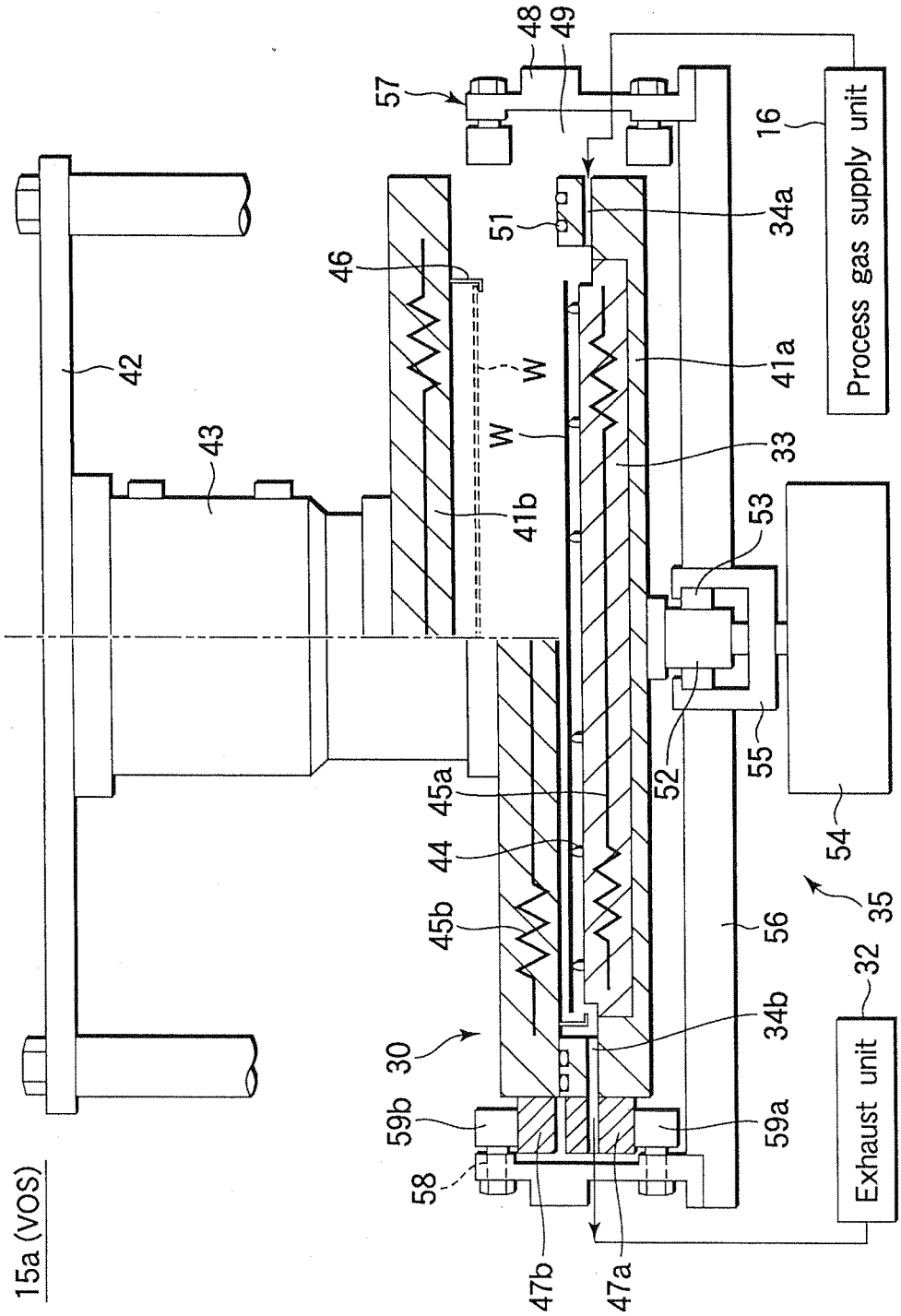

15a (VOS)
42
43
46
W
W
41b
41a
33
53
55
52
54
45a
44
45b
56
35
32
34b
30
59b
59a
58
47b
47a
57
48
49
51
34a
16
Process gas supply unit
Exhaust unit

FIG.6

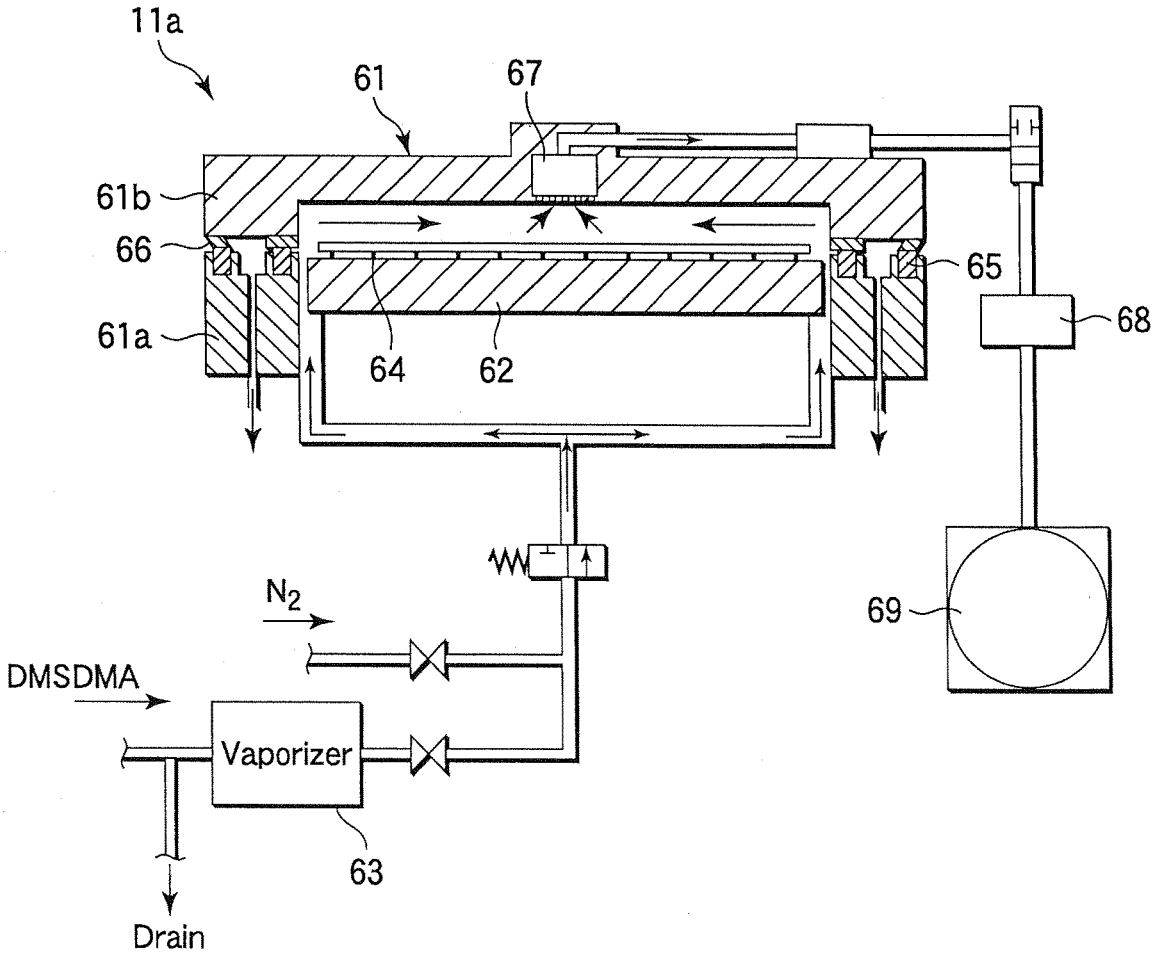


FIG.7

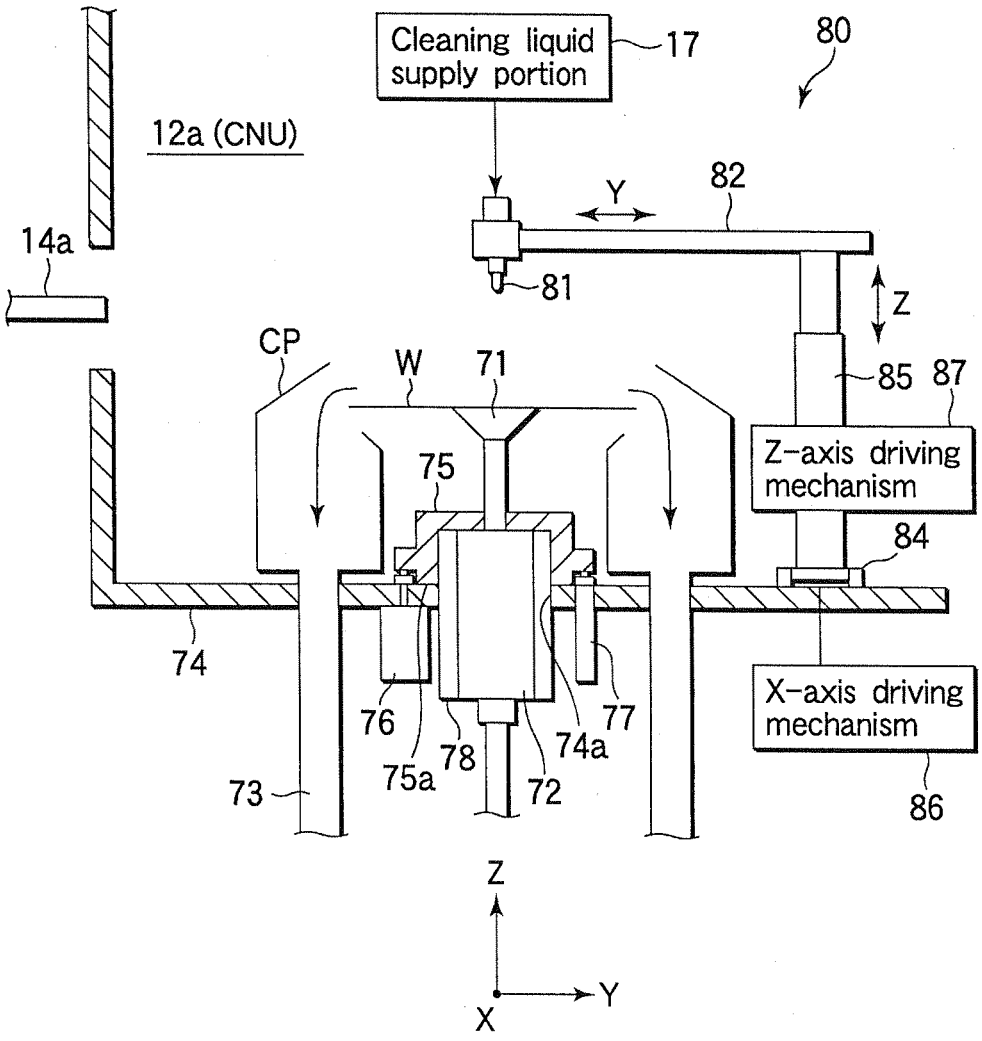

Cleaning liquid supply portion
17
80
12a (CNU)
Y
82
14a
81
Z
CP
W
71
85
87
Z-axis driving mechanism
75
84
74
X-axis driving mechanism
76
78
74a
77
75a
72
73
86
Z
Y
X

FIG.8

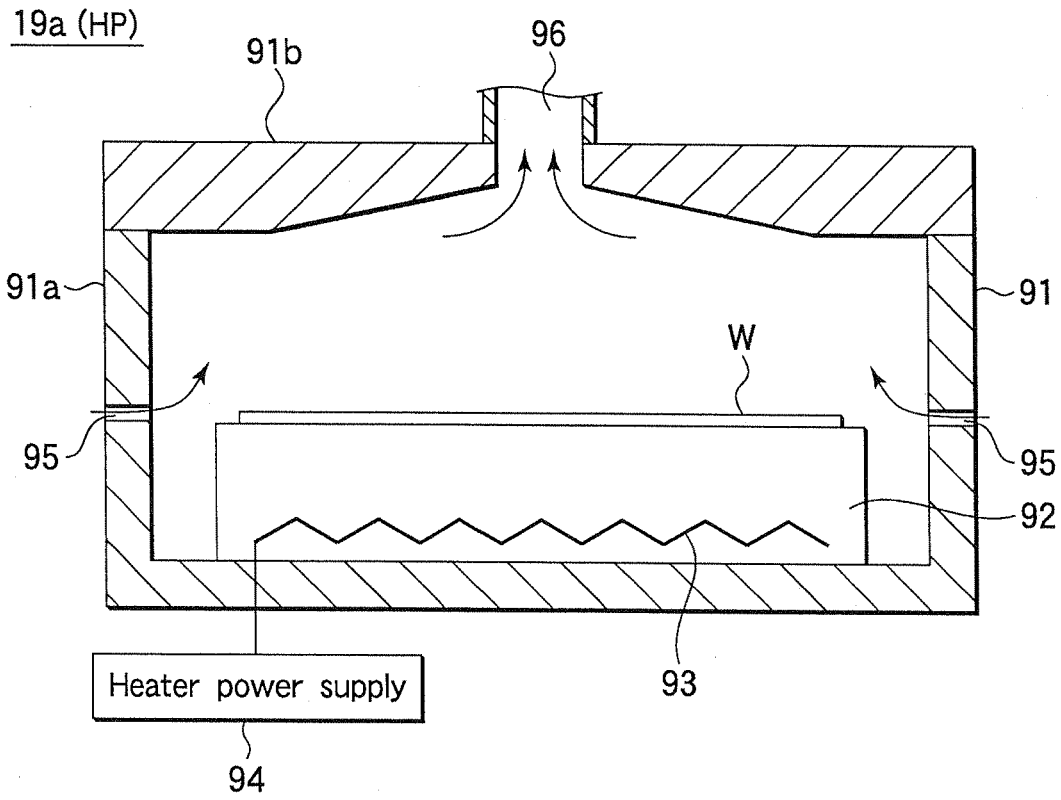


FIG.9

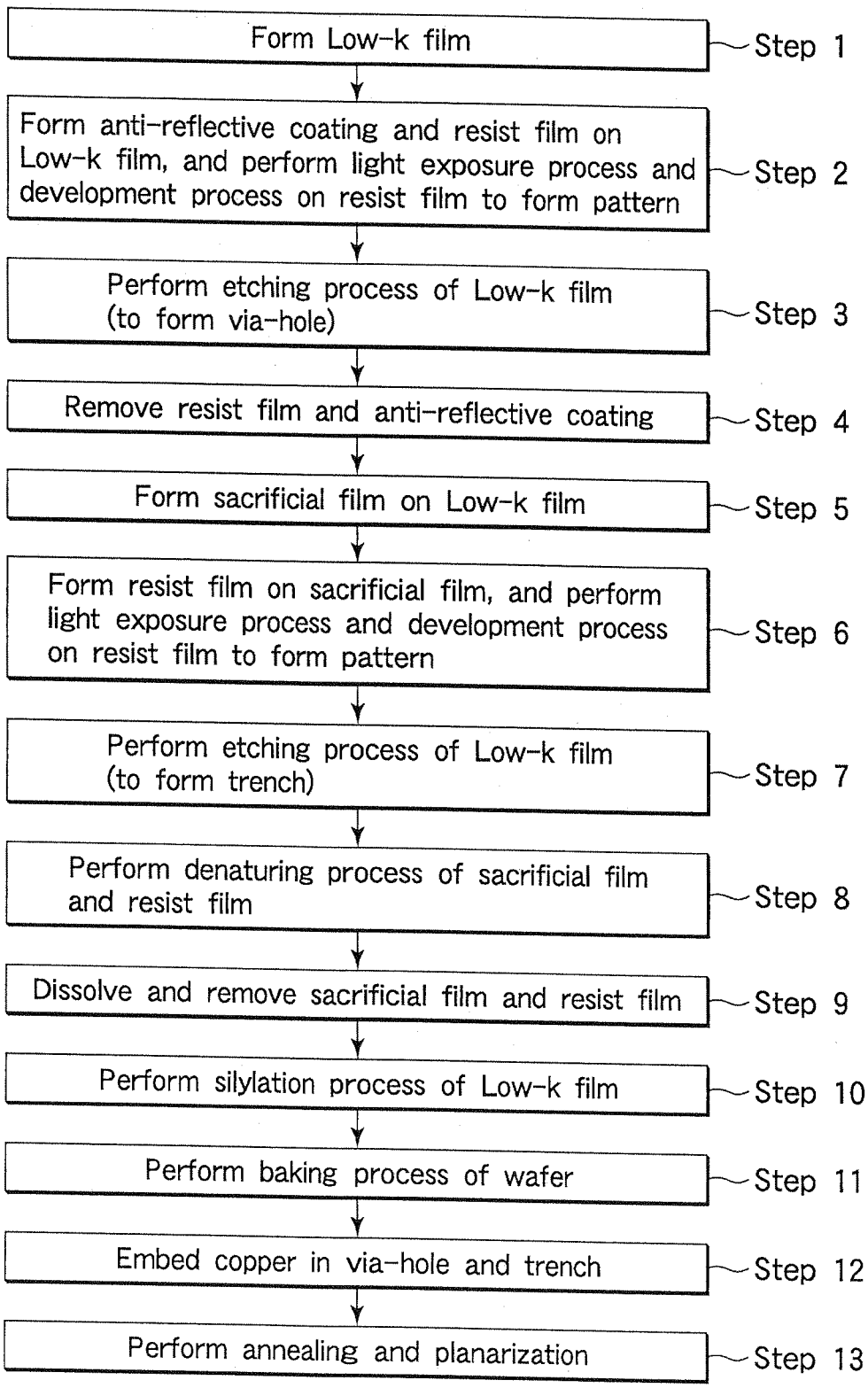

Form Low-k film
Step 1
Form anti-reflective coating and resist film on Low-k film, and perform light exposure process and development process on resist film to form pattern
Step 2
Perform etching process of Low-k film (to form via-hole)
Step 3
Remove resist film and anti-reflective coating
Step 4
Form sacrificial film on Low-k film
Step 5
Form resist film on sacrificial film, and perform light exposure process and development process on resist film to form pattern
Step 6
Perform etching process of Low-k film (to form trench)
Step 7
Perform denaturing process of sacrificial film and resist film
Step 8
Dissolve and remove sacrificial film and resist film
Step 9
Perform silylation process of Low-k film
Step 10
Perform baking process of wafer
Step 11
Embed copper in via-hole and trench
Step 12
Perform annealing and planarization
Step 13

FIG.10

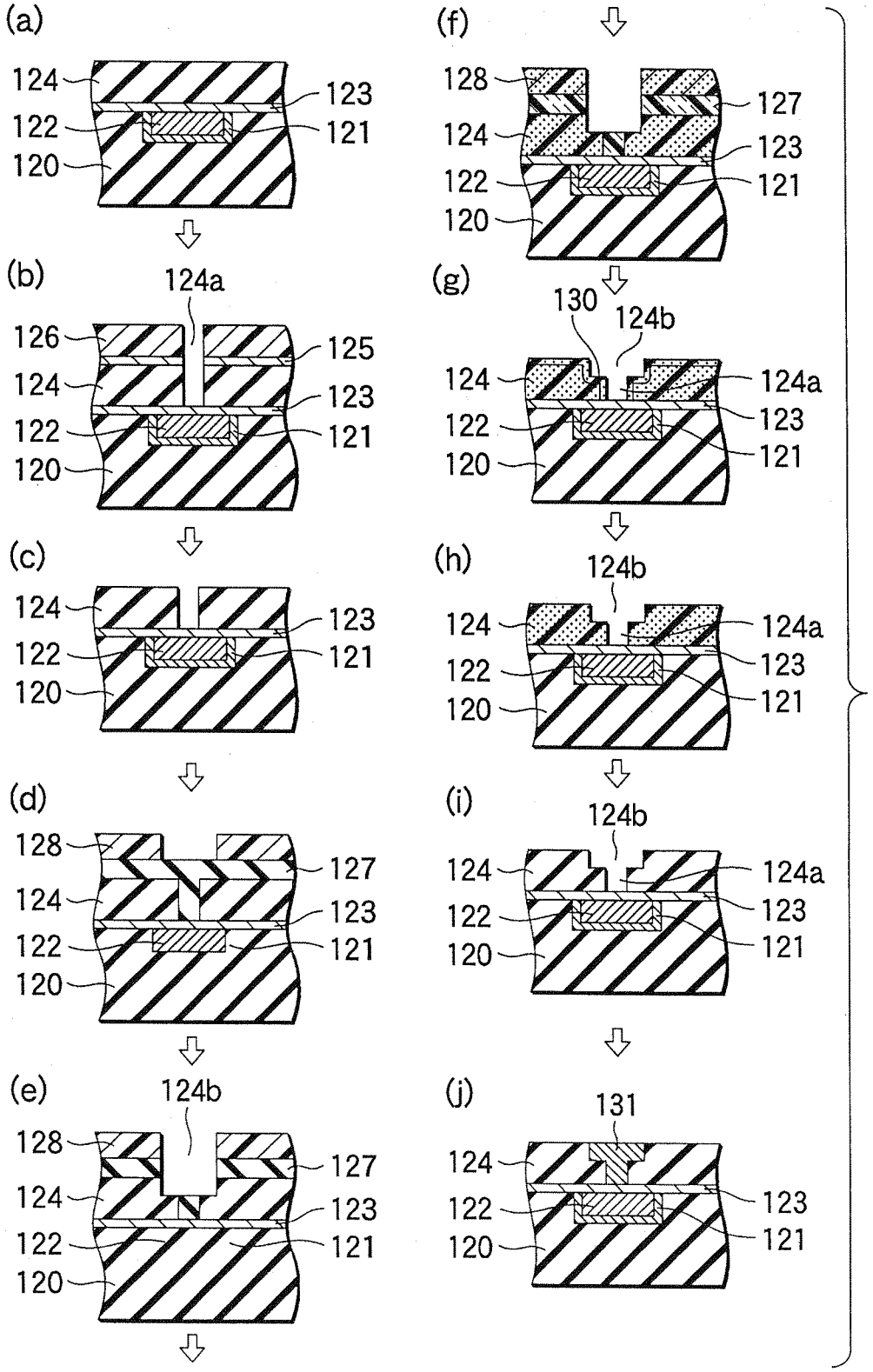

(a)
124
123
122
121
120
(b)
124a
126
125
124
123
122
121
120
(c)
124
123
122
121
120
(d)
128
127
124
123
122
121
120
(e)
124b
128
127
124
123
122
121
120
(f)
128
127
124
123
122
121
120
(g)
130
124b
124
124a
123
122
121
120
(h)
124b
124
124a
123
122
121
120
(i)
124b
124
124a
123
122
121
120
(j)
131
124
123
122
121
120

FIG.11

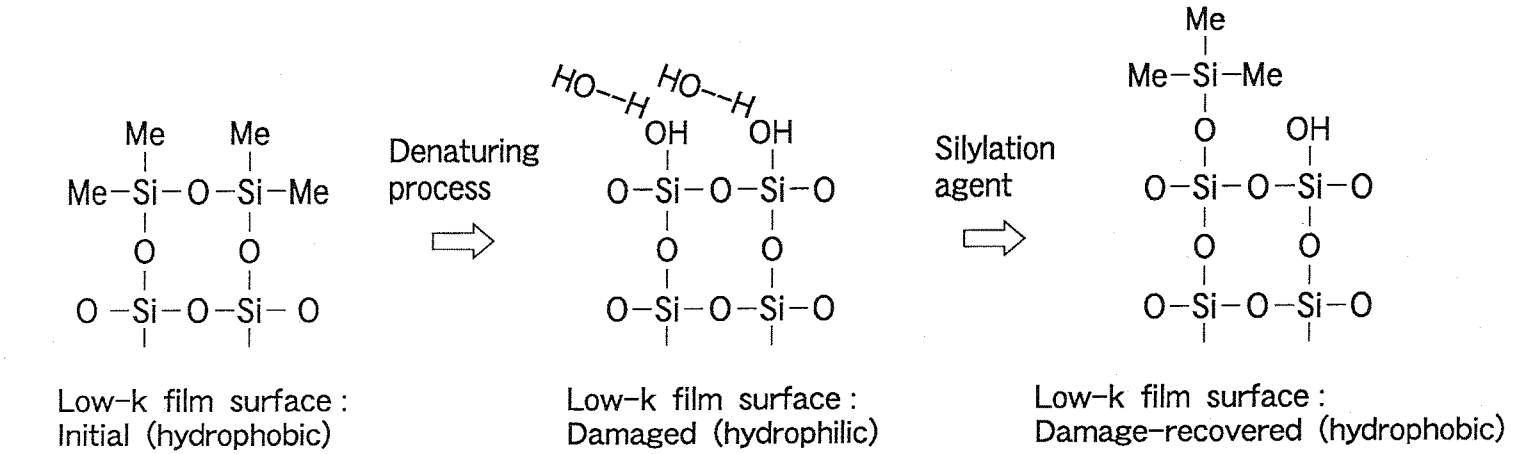

Me
Me
Me–Si–O–Si–Me
O
O
O –Si–O–Si– O
Denaturing process
HO–H
HO–H
OH
OH
O–Si–O–Si–O
O
O
O–Si–O–Si–O
Silylation agent
Me
Me–Si–Me
O
OH
O–Si–O–Si–O
O
O
O–Si–O–Si–O
Low-k film surface : Initial (hydrophobic)
Low-k film surface : Damaged (hydrophilic)
Low-k film surface : Damage-recovered (hydrophobic)

FIG.12