FIG.1

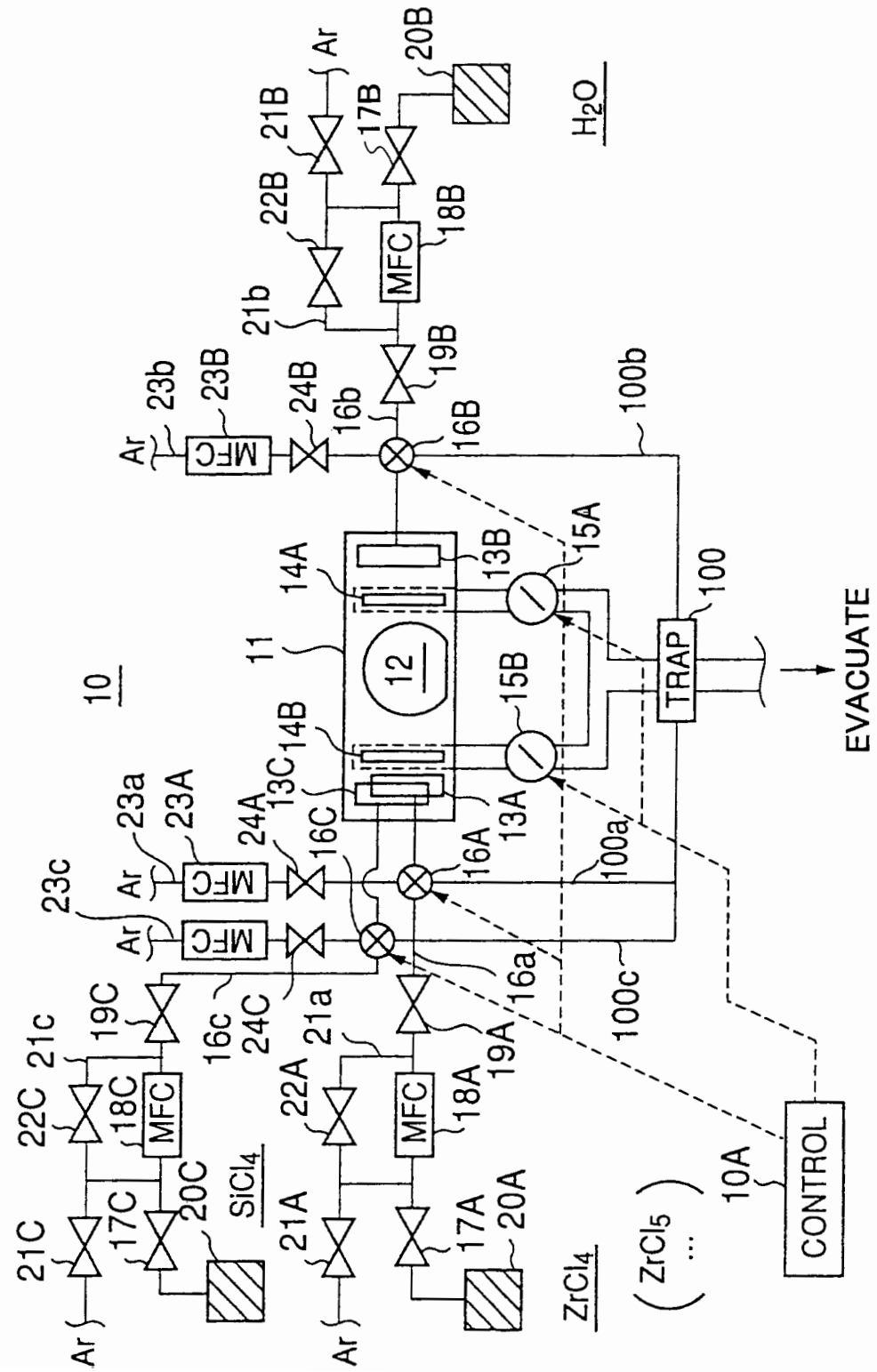

10
11
12
13A
13B
13C
14A
14B
15A
15B
16A
16B
16C
16a
16b
16c
17A
17B
17C
18A
18B
18C
19A
19B
19C
20A
20B
20C
21A
21B
21C
21a
21b
21c
22A
22B
22C
23A
23B
23C
23a
23b
24A
24B
24C
100
100a
100b
100c
10A
Ar
MFC
TRAP
EVACUATE
CONTROL
$SiCl_4$
$ZrCl_4$
H_2O
($ZrCl_5$ ...)

FIG.2

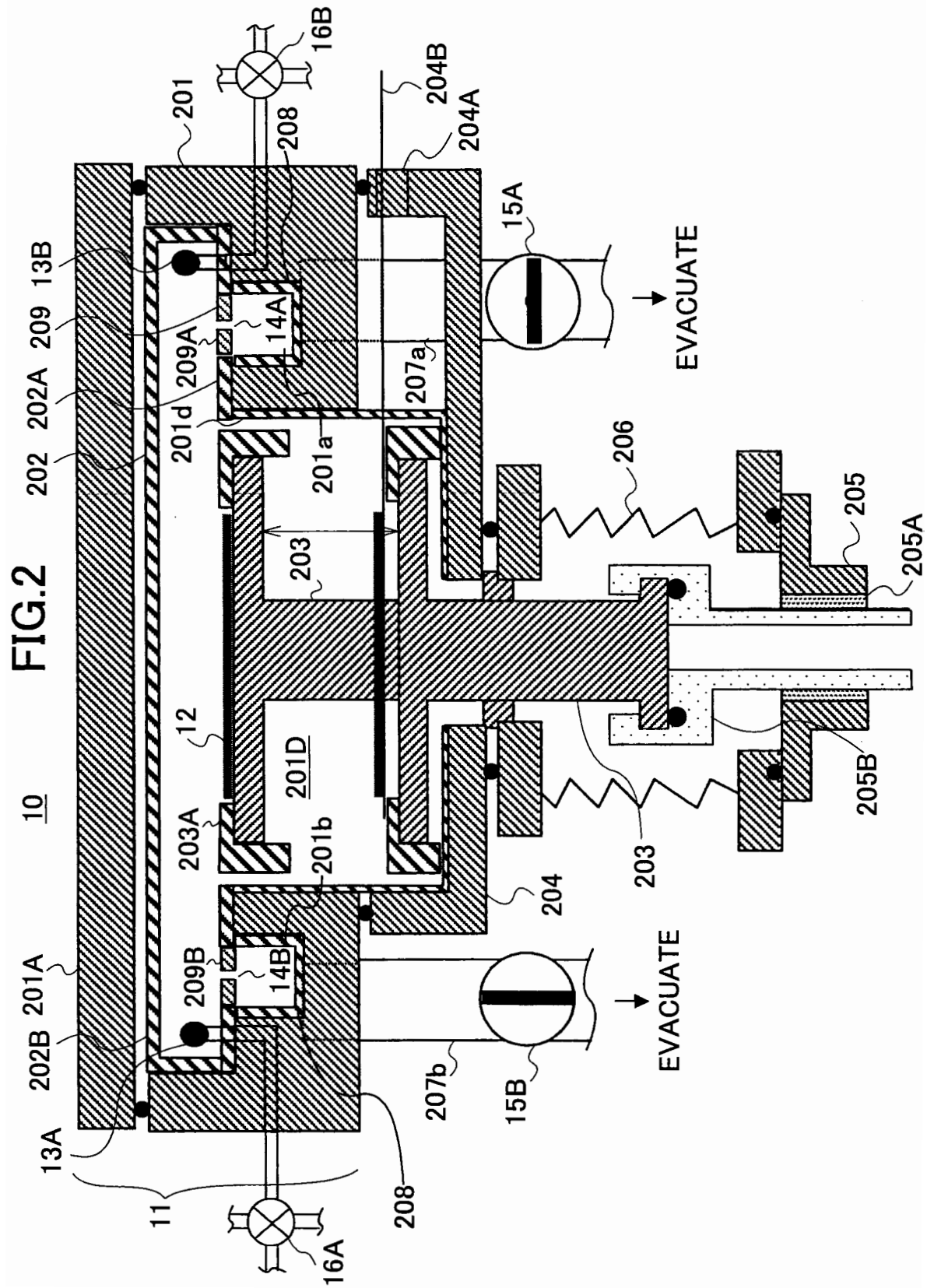

10
11
12
13A
13B
14A
14B
15A
15B
16A
16B
201
201A
201D
201a
201b
201d
202
202A
202B
203
203A
204
204A
204B
205
205A
205B
206
207a
207b
208
209
209A
209B
EVACUATE
EVACUATE

FIG.3

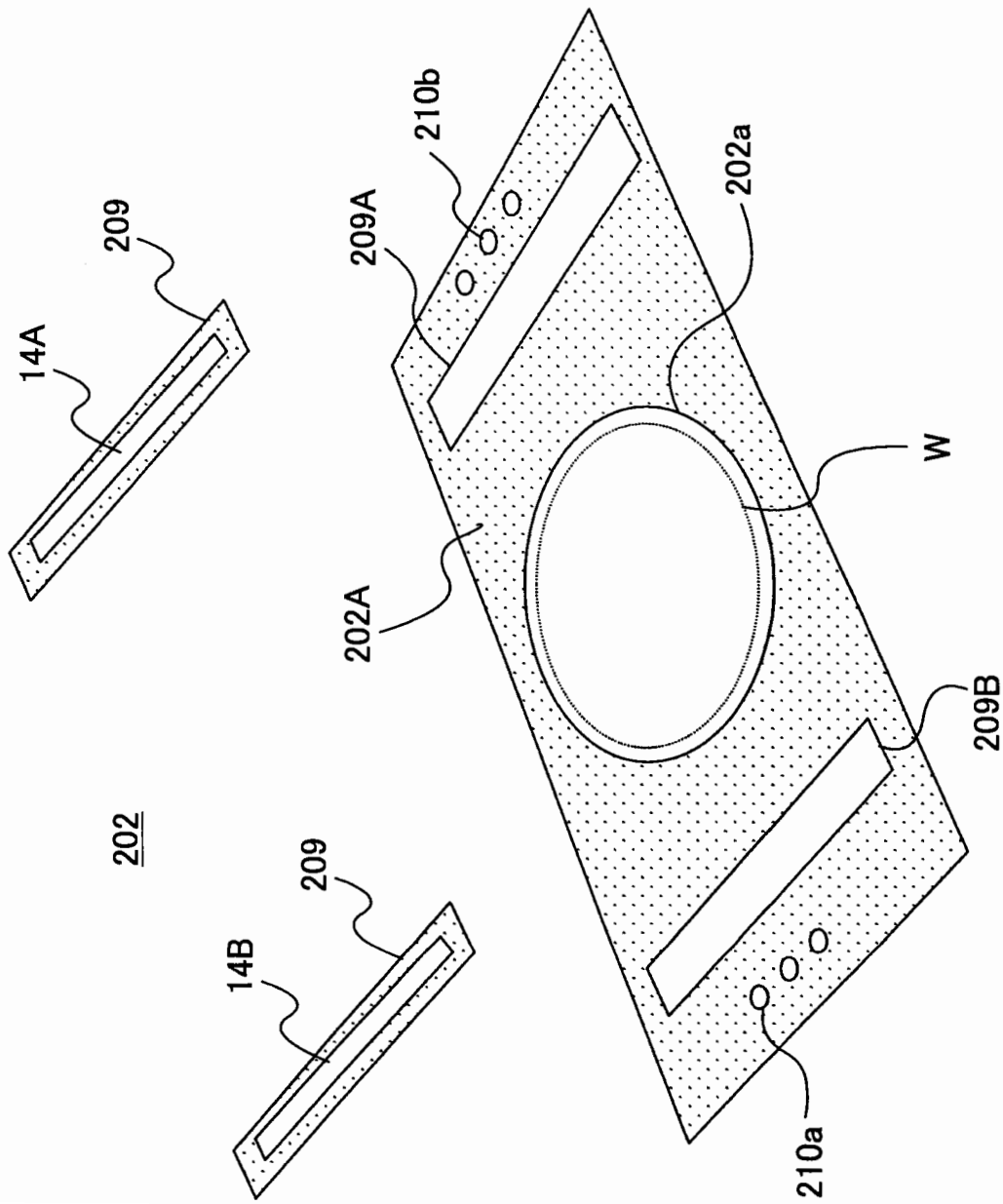


FIG.4

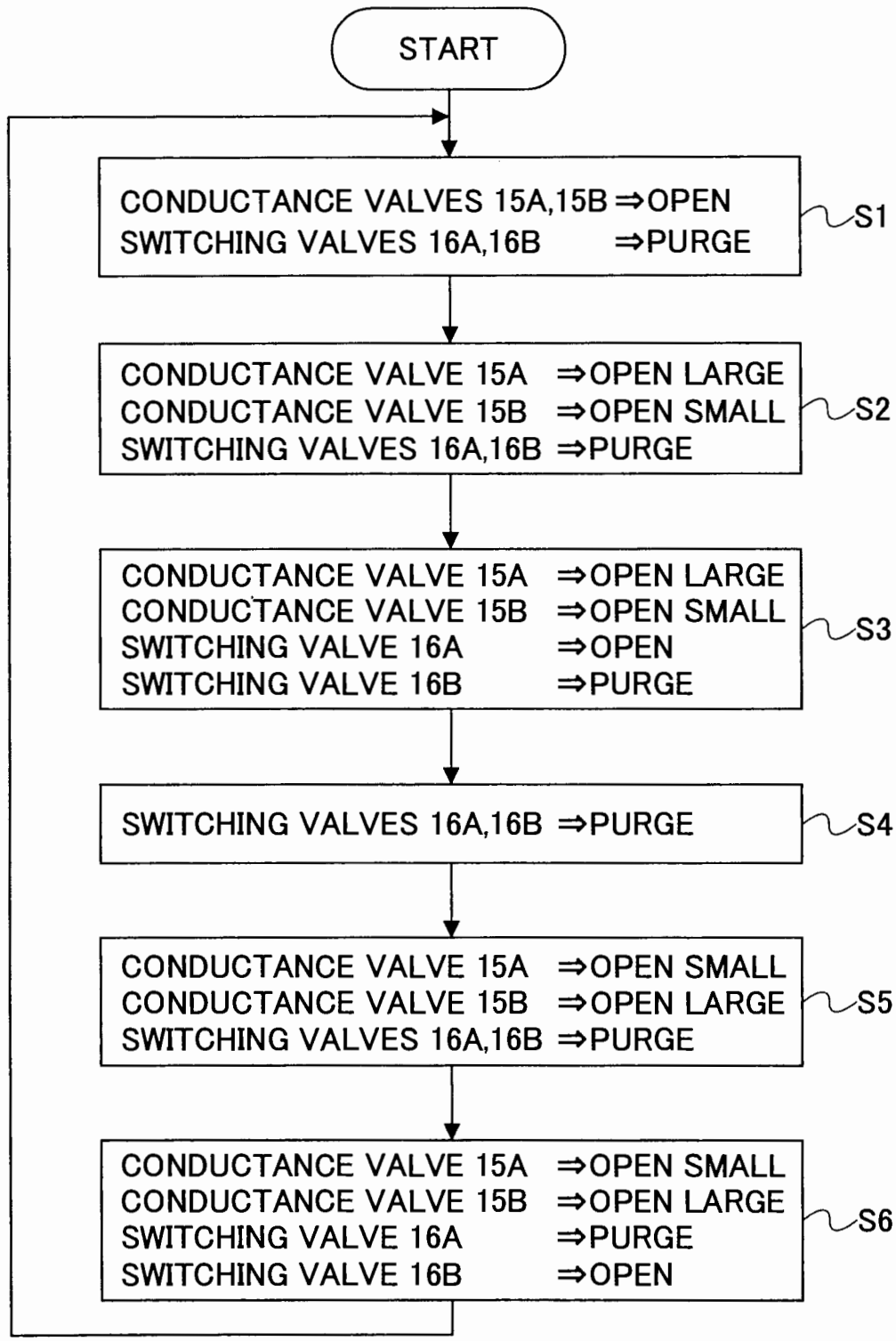

START
CONDUCTANCE VALVES 15A,15B ⇒OPEN
SWITCHING VALVES 16A,16B ⇒PURGE
S1
CONDUCTANCE VALVE 15A ⇒OPEN LARGE
CONDUCTANCE VALVE 15B ⇒OPEN SMALL
SWITCHING VALVES 16A,16B ⇒PURGE
S2
CONDUCTANCE VALVE 15A ⇒OPEN LARGE
CONDUCTANCE VALVE 15B ⇒OPEN SMALL
SWITCHING VALVE 16A ⇒OPEN
SWITCHING VALVE 16B ⇒PURGE
S3
SWITCHING VALVES 16A,16B ⇒PURGE
S4
CONDUCTANCE VALVE 15A ⇒OPEN SMALL
CONDUCTANCE VALVE 15B ⇒OPEN LARGE
SWITCHING VALVES 16A,16B ⇒PURGE
S5
CONDUCTANCE VALVE 15A ⇒OPEN SMALL
CONDUCTANCE VALVE 15B ⇒OPEN LARGE
SWITCHING VALVE 16A ⇒PURGE
SWITCHING VALVE 16B ⇒OPEN
S6

FIG.5

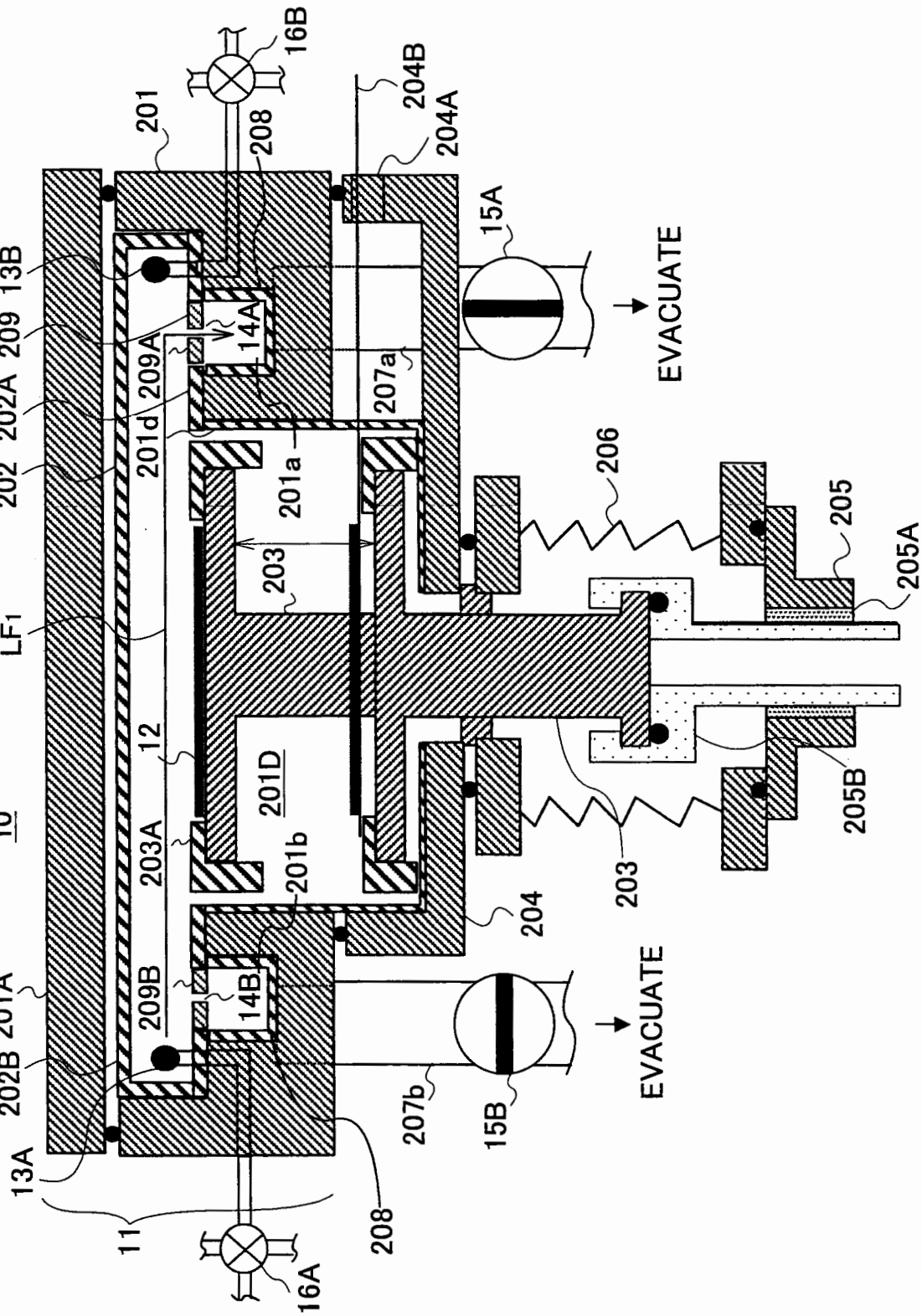

10
11
12
13A
13B
14A
14B
15A
15B
16A
16B
201
201A
201a
201b
201d
201D
202
202A
202B
203
203A
204
204A
204B
205
205A
205B
206
207a
207b
208
209
209A
209B
LF1
EVACUATE
EVACUATE

FIG.6

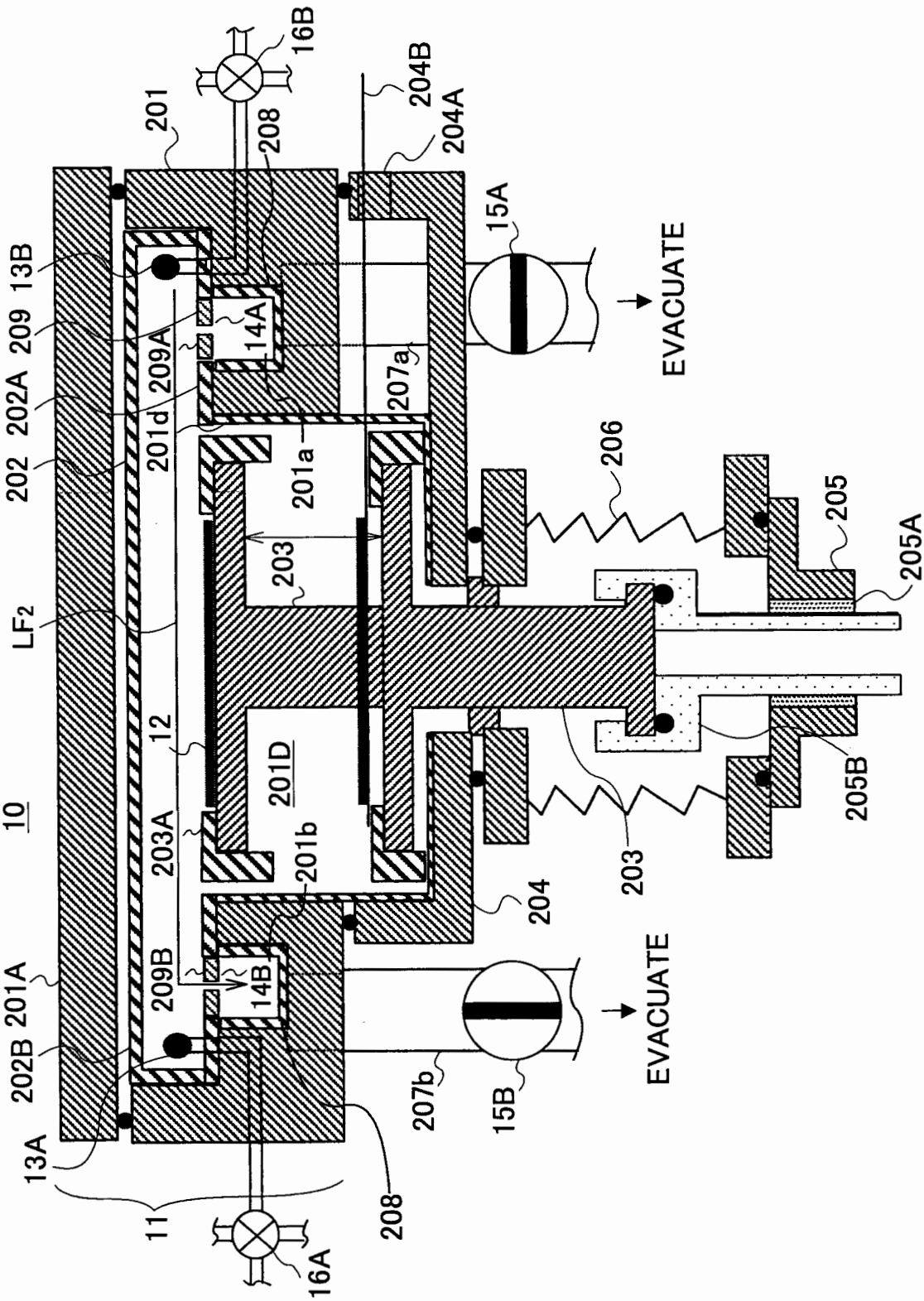

10
11
12
13A
13B
14A
14B
15A
15B
16A
16B
201
201A
201a
201b
201d
201D
202
202A
202B
203
203A
204
204A
204B
205
205A
205B
206
207a
207b
208
209
209A
209B
LF_2
EVACUATE
EVACUATE

FIG.7

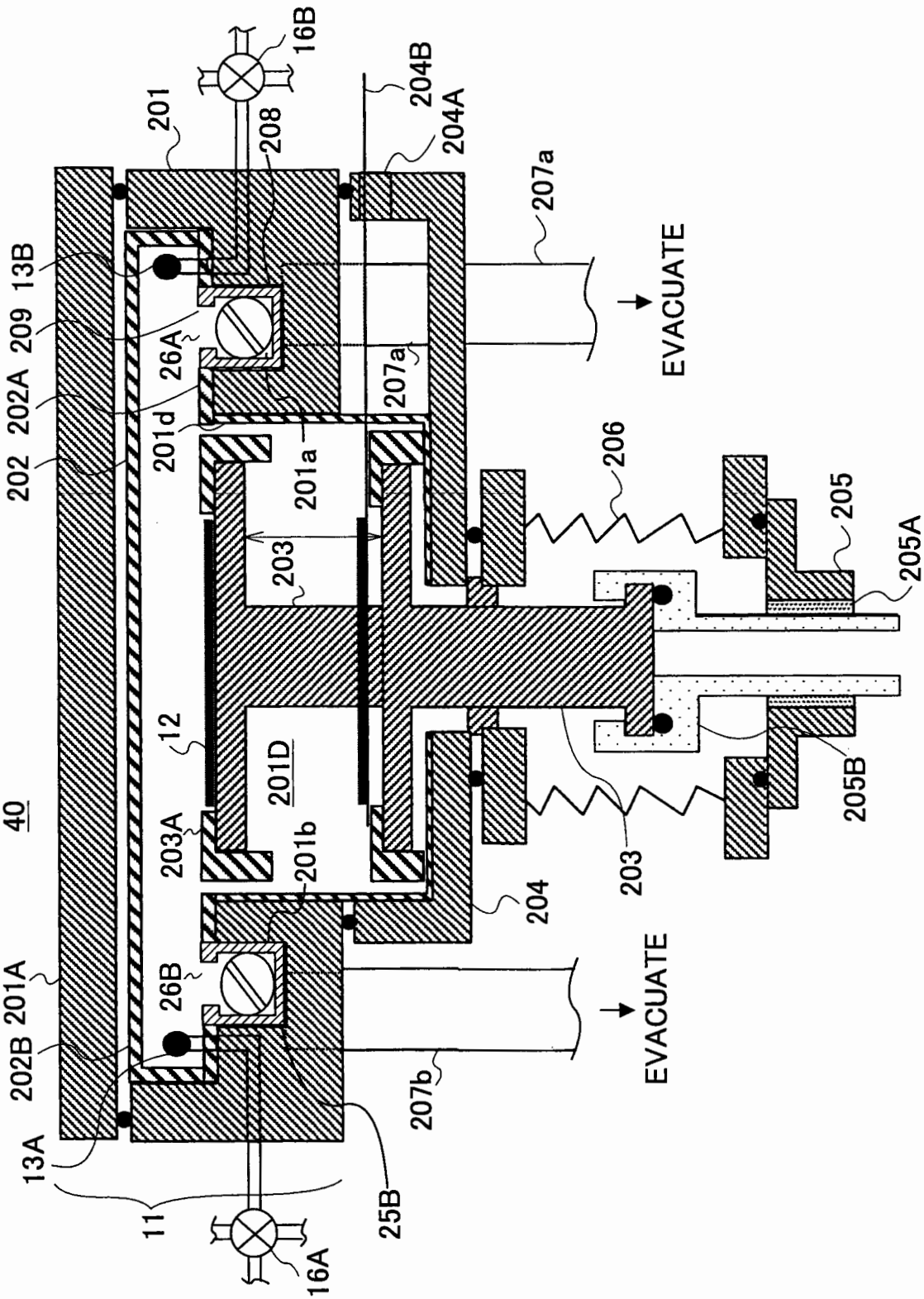

16B
201
208
204B
204A
207a
13B
209
202A
202
26A
201d
207a
EVACUATE
201a
206
205
205A
203
12
201D
40
203A
201b
204
203
205B
201A
26B
202B
207b
EVACUATE
13A
11
25B
16A

FIG.8

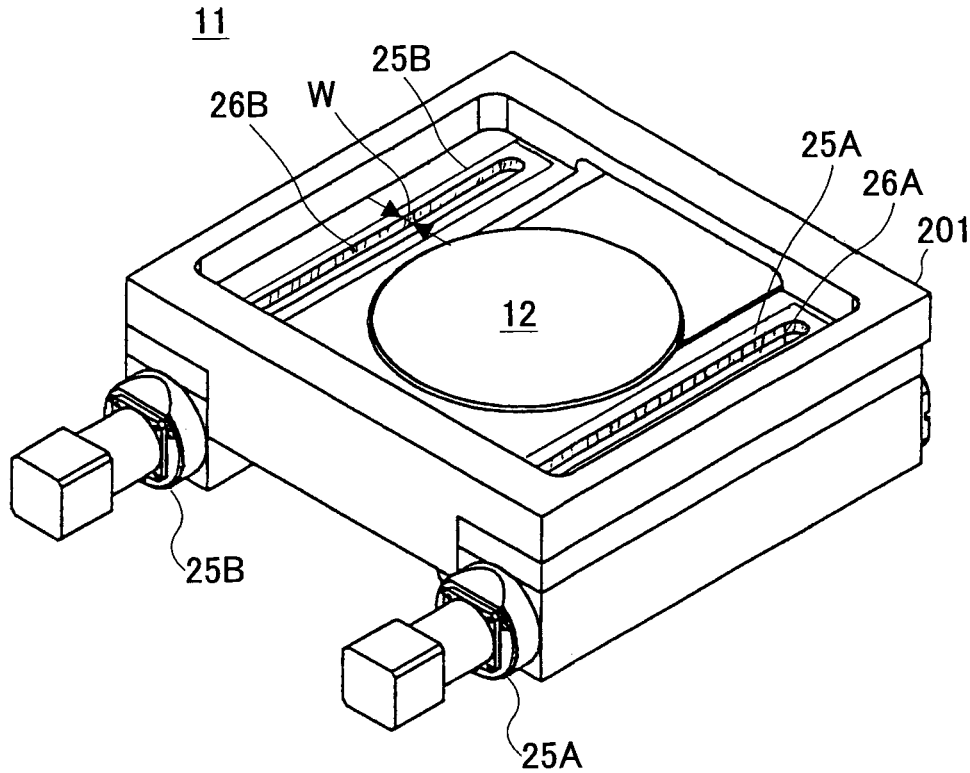


FIG.9A

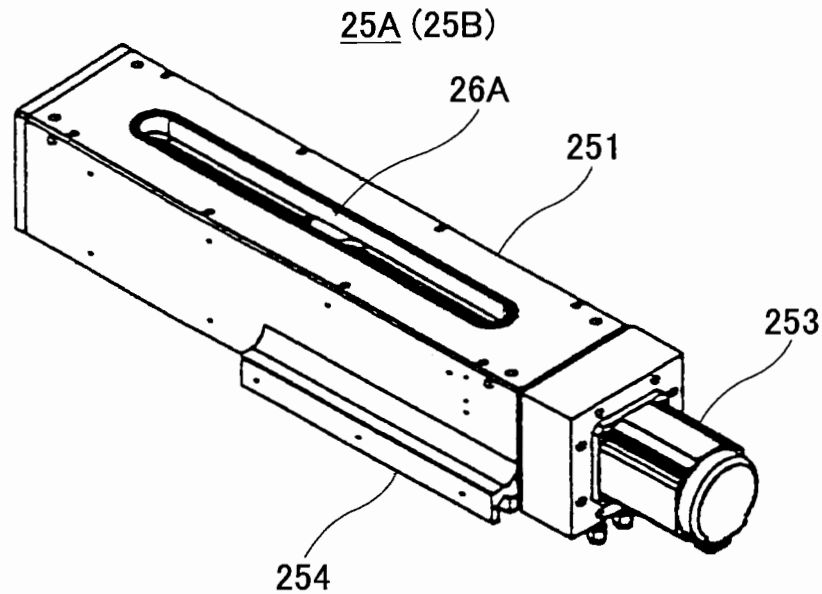


FIG.9B

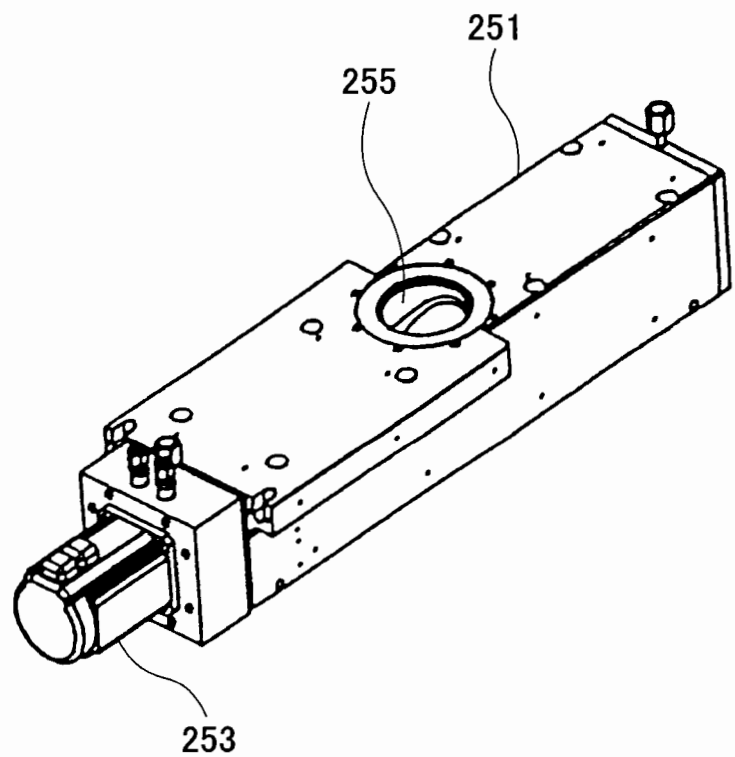


FIG.10

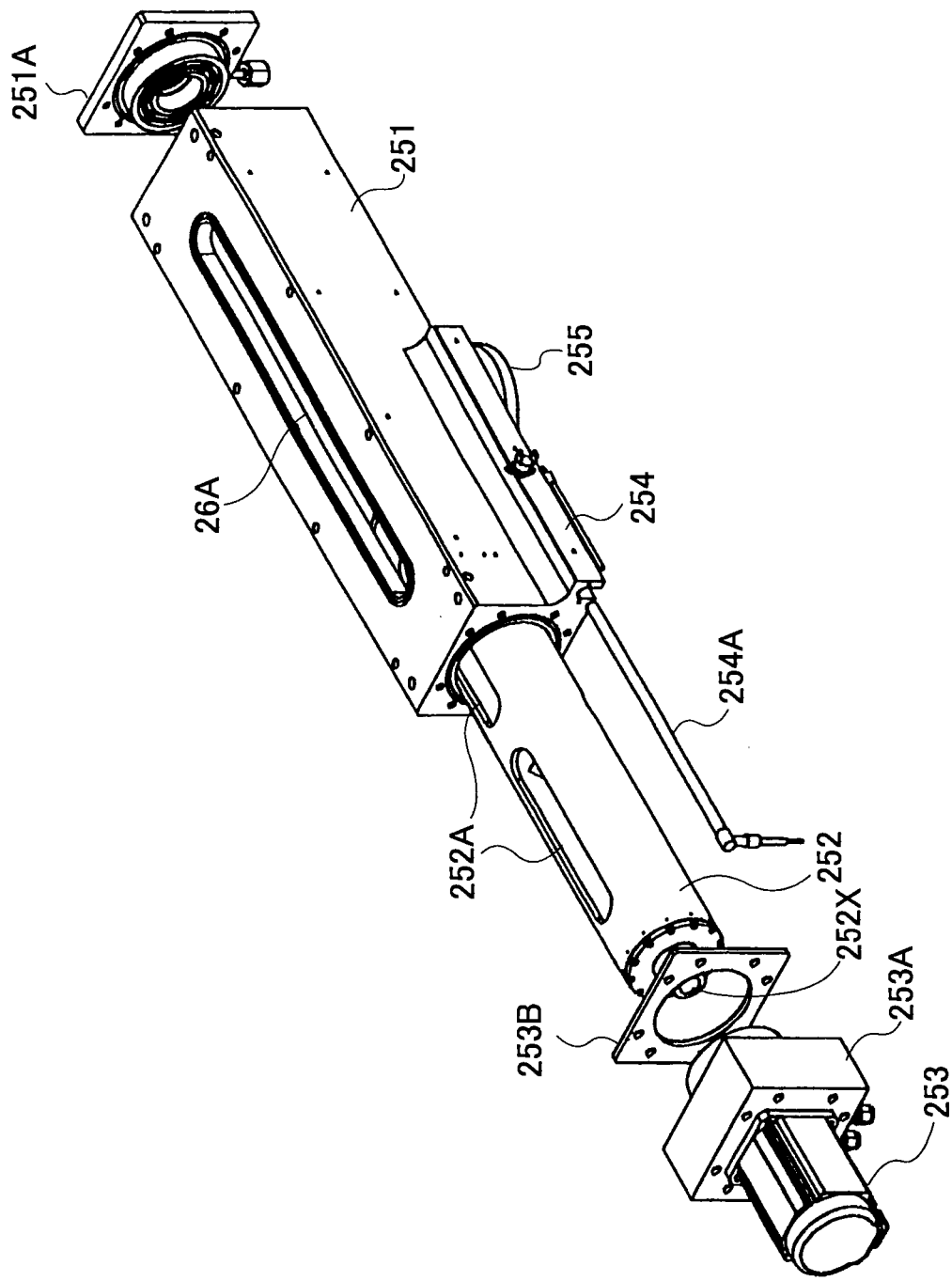


FIG.11A

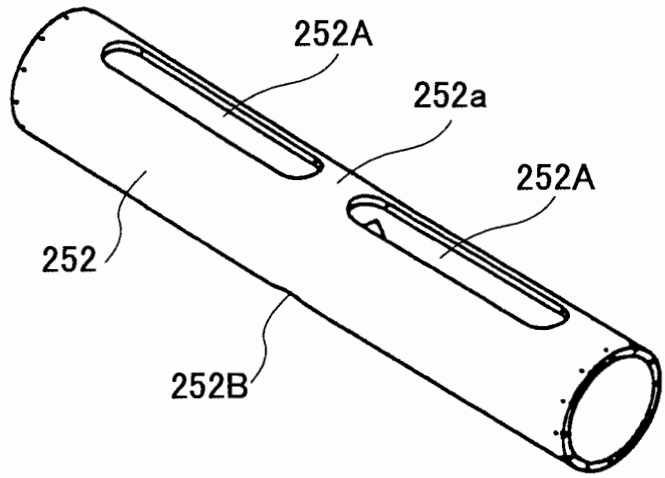


FIG.11B

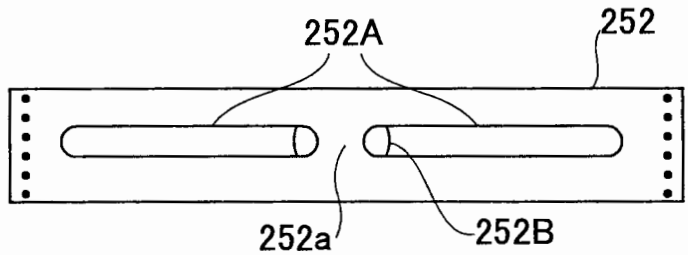


FIG.11C

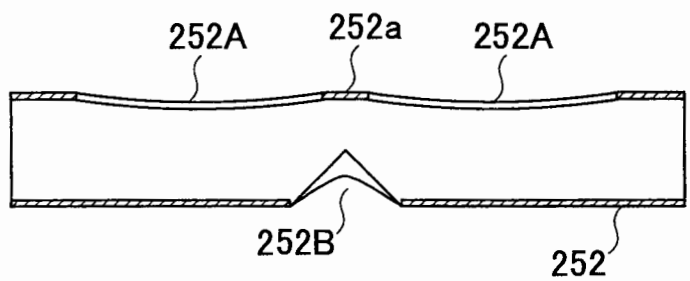


FIG.11D

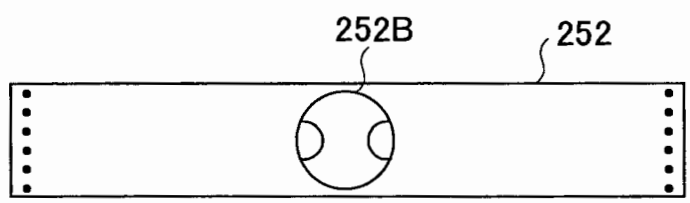
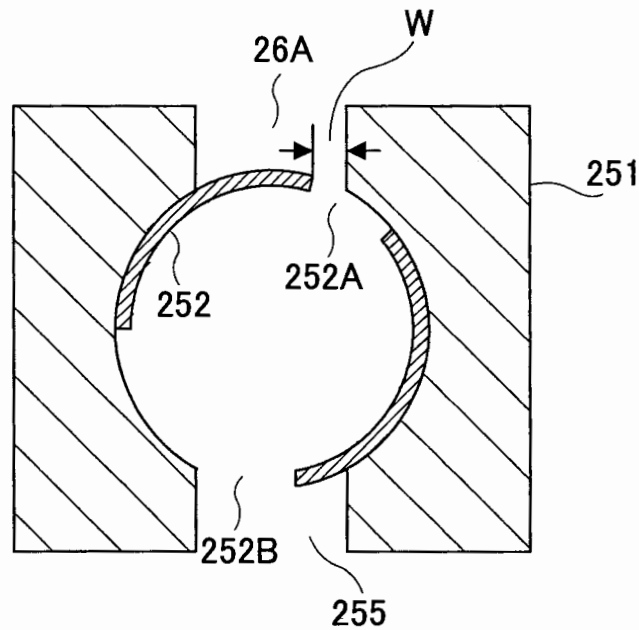
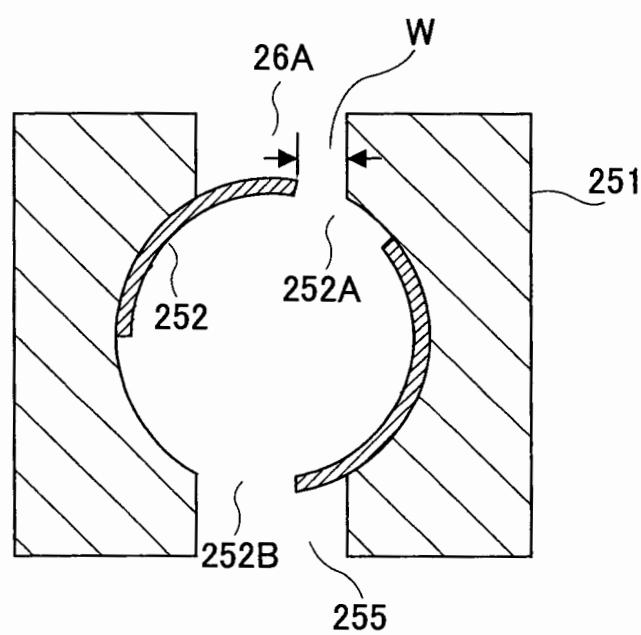


FIG.12A



W=6mm OPEN

FIG.12B



W=8mm OPEN

FIG.12C

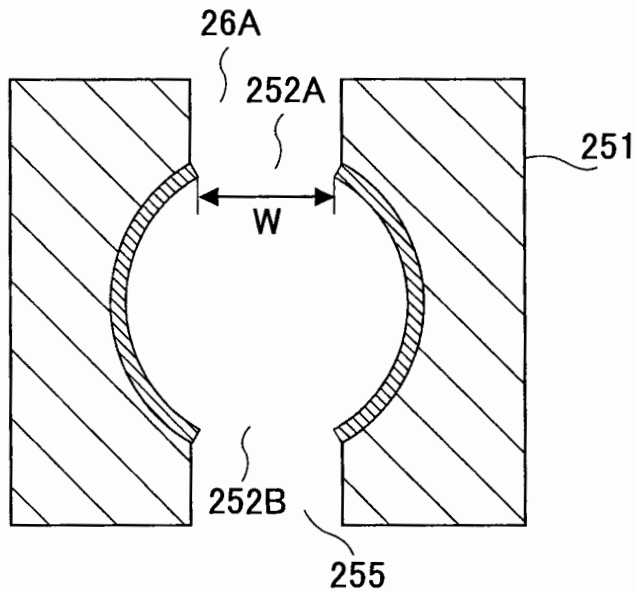


FIG.12D

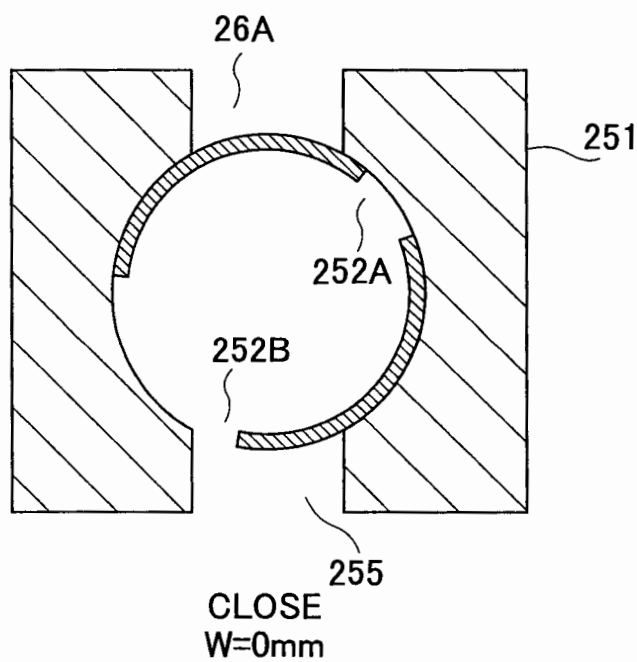


FIG.13

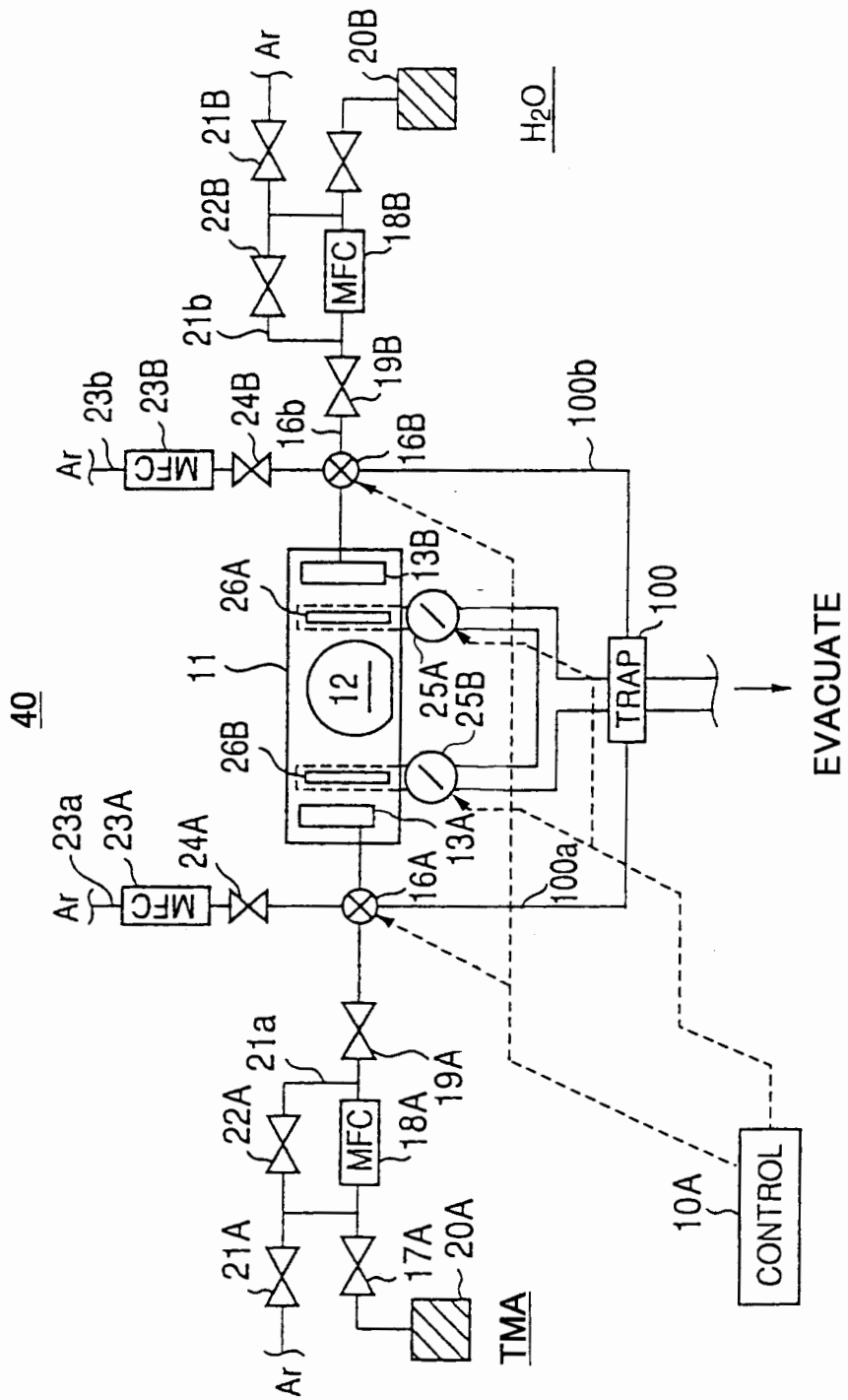

40
Ar
23a
23A
MFC
24A
16A
13A
26B
11
12
26A
13B
25A
25B
TRAP
100
EVACUATE
100a
100b
16B
16b
24B
23B
23b
Ar
MFC
19B
21b
22B
MFC
18B
21B
Ar
20B
H2O
21a
22A
MFC
18A
19A
21A
17A
20A
Ar
TMA
10A
CONTROL

FIG.14

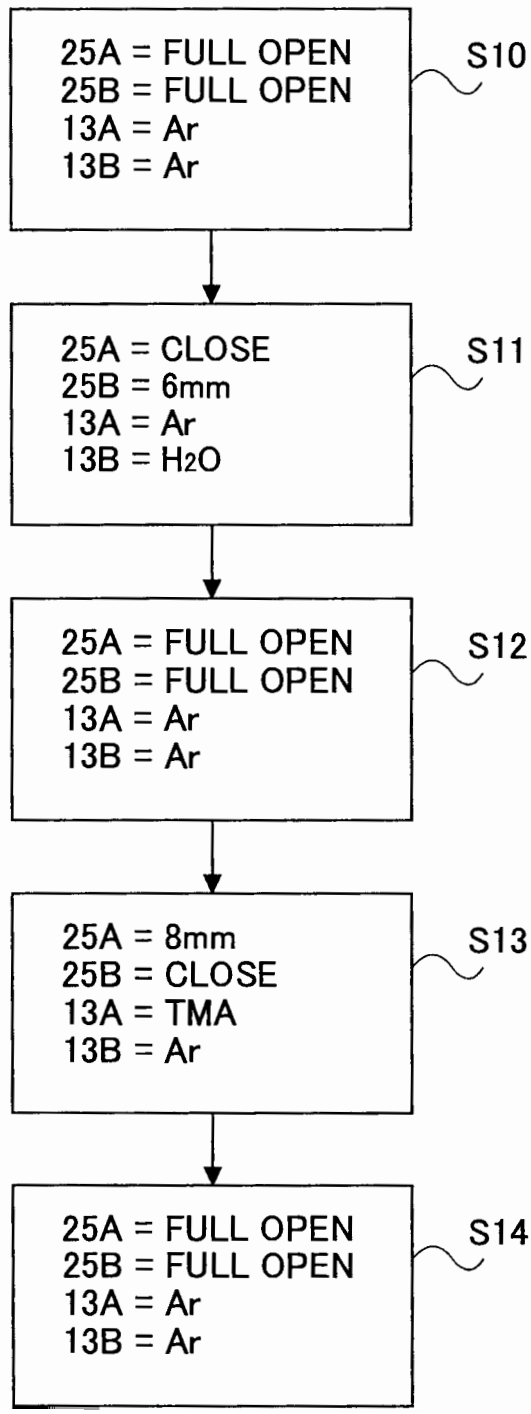

25A = FULL OPEN
25B = FULL OPEN
13A = Ar
13B = Ar
S10
25A = CLOSE
25B = 6mm
13A = Ar
13B = H2O
S11
25A = FULL OPEN
25B = FULL OPEN
13A = Ar
13B = Ar
S12
25A = 8mm
25B = CLOSE
13A = TMA
13B = Ar
S13
25A = FULL OPEN
25B = FULL OPEN
13A = Ar
13B = Ar
S14

FIG.15

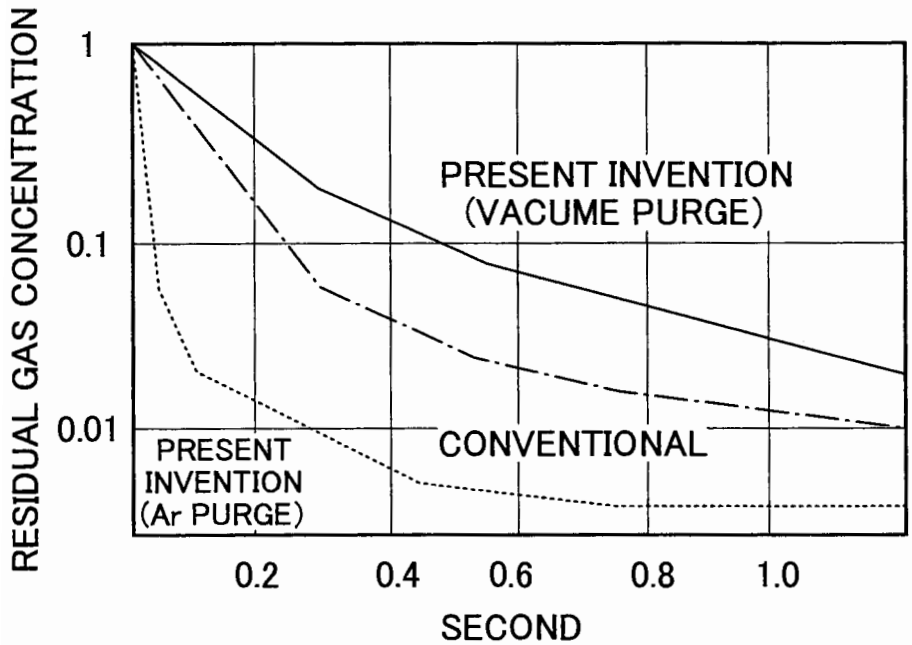

RESIDUAL GAS CONCENTRATION
1
0.1
0.01
PRESENT INVENTION
(VACUME PURGE)
CONVENTIONAL
PRESENT
INVENTION
(Ar PURGE)
0.2
0.4
0.6
0.8
1.0
SECOND

FIG.16

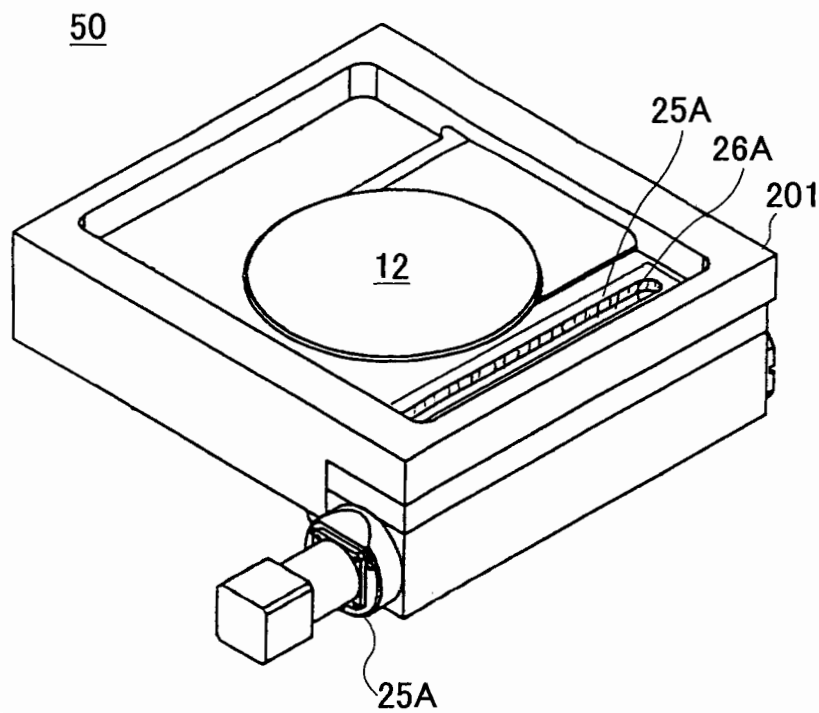

50
25A
26A
201
12
25A

FIG.17

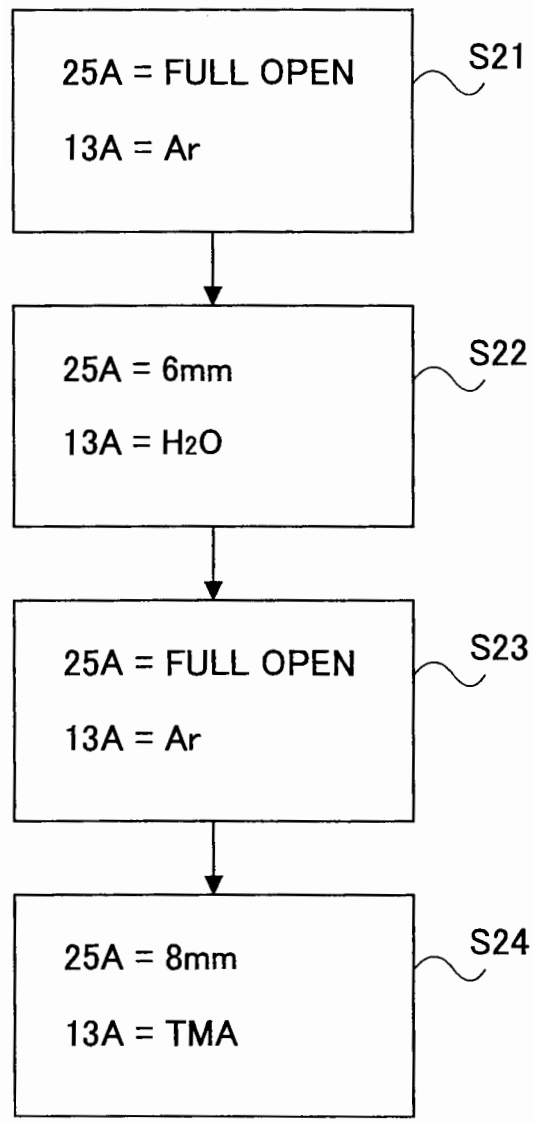

25A = FULL OPEN
13A = Ar
S21
25A = 6mm
13A = H2O
S22
25A = FULL OPEN
13A = Ar
S23
25A = 8mm
13A = TMA
S24

FIG.18

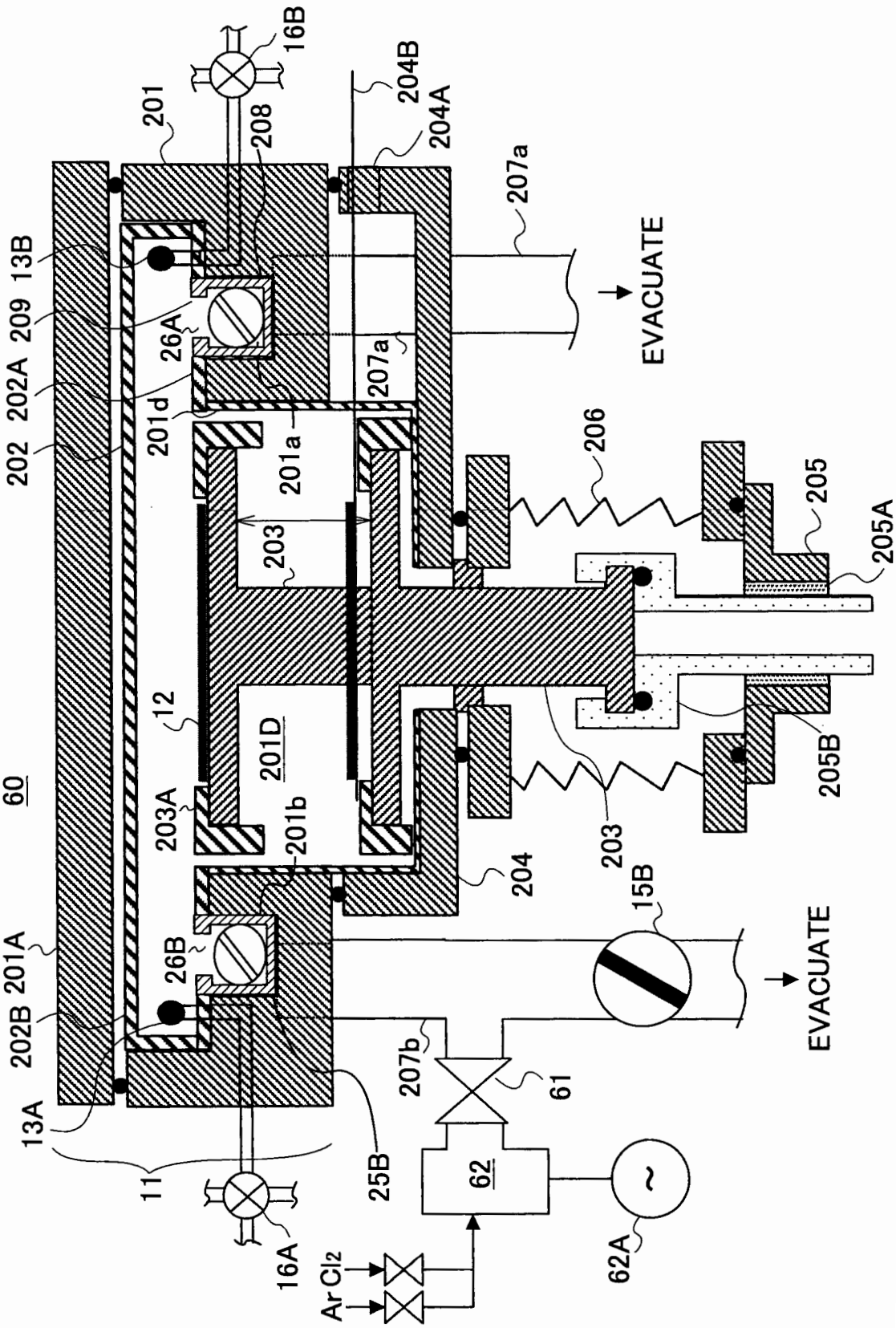

60
201
208
16B
204B
204A
207a
EVACUATE
13B
209
202A
202
26A
201d
207a
201a
206
205
205A
203
12
201D
203A
201b
204
203
205B
15B
EVACUATE
201A
202B
26B
207b
61
13A
11
25B
62
~
62A
16A
Ar
Cl2

FIG.19

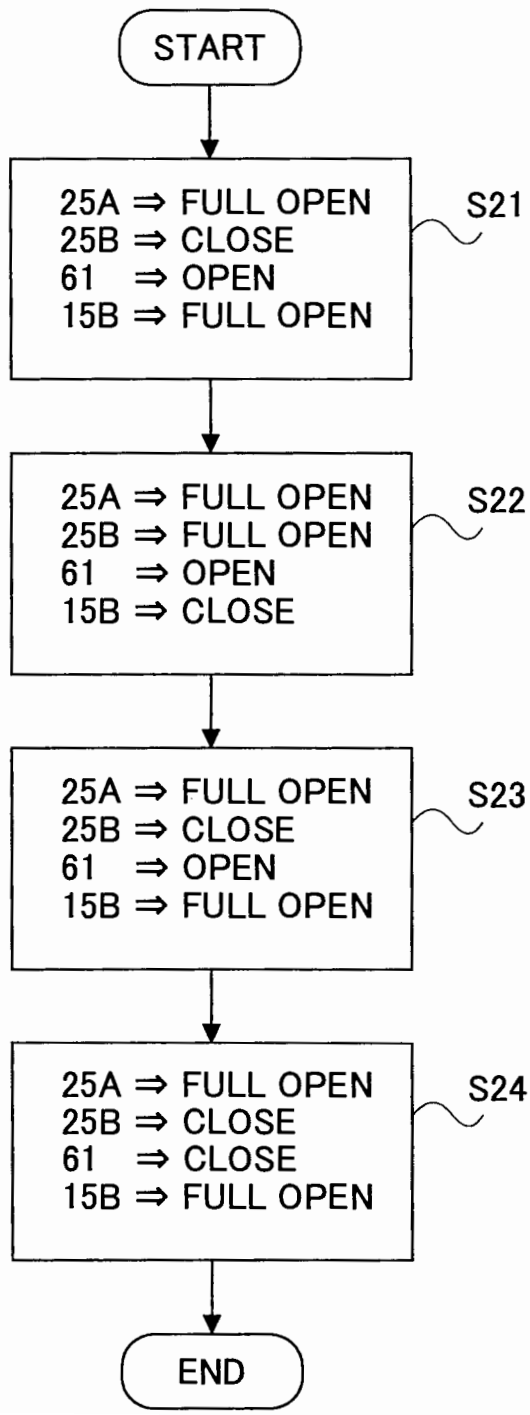

START
25A ⇒ FULL OPEN
25B ⇒ CLOSE
61 ⇒ OPEN
15B ⇒ FULL OPEN
S21
25A ⇒ FULL OPEN
25B ⇒ FULL OPEN
61 ⇒ OPEN
15B ⇒ CLOSE
S22
25A ⇒ FULL OPEN
25B ⇒ CLOSE
61 ⇒ OPEN
15B ⇒ FULL OPEN
S23
25A ⇒ FULL OPEN
25B ⇒ CLOSE
61 ⇒ CLOSE
15B ⇒ FULL OPEN
S24
END

FIG.20A

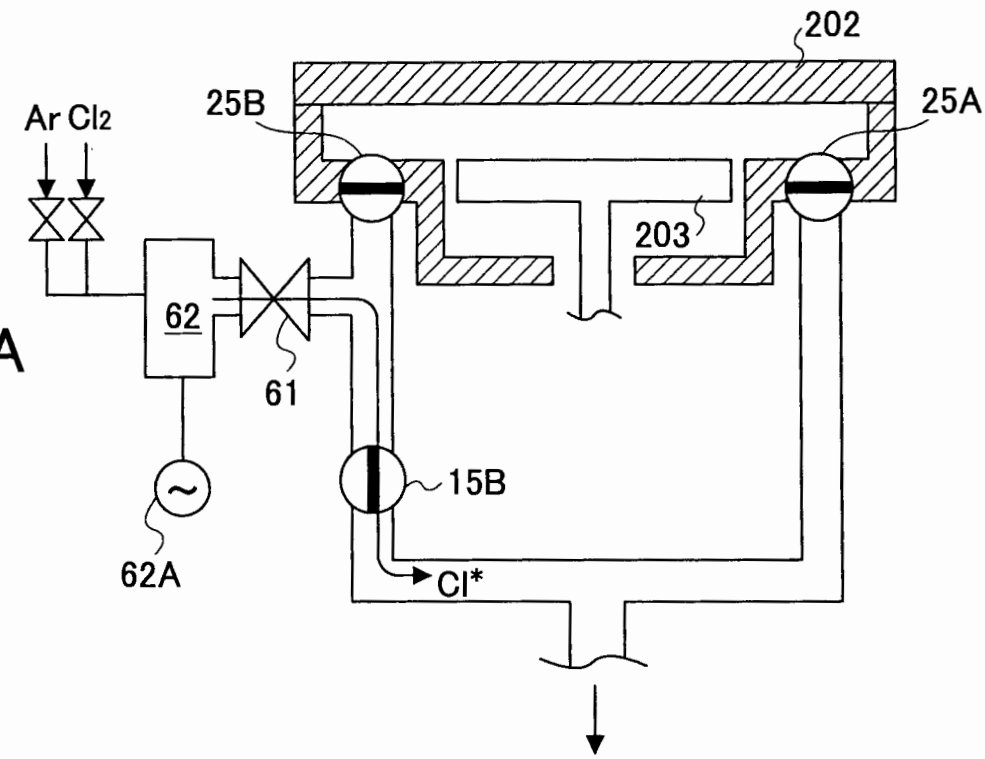


FIG.20B

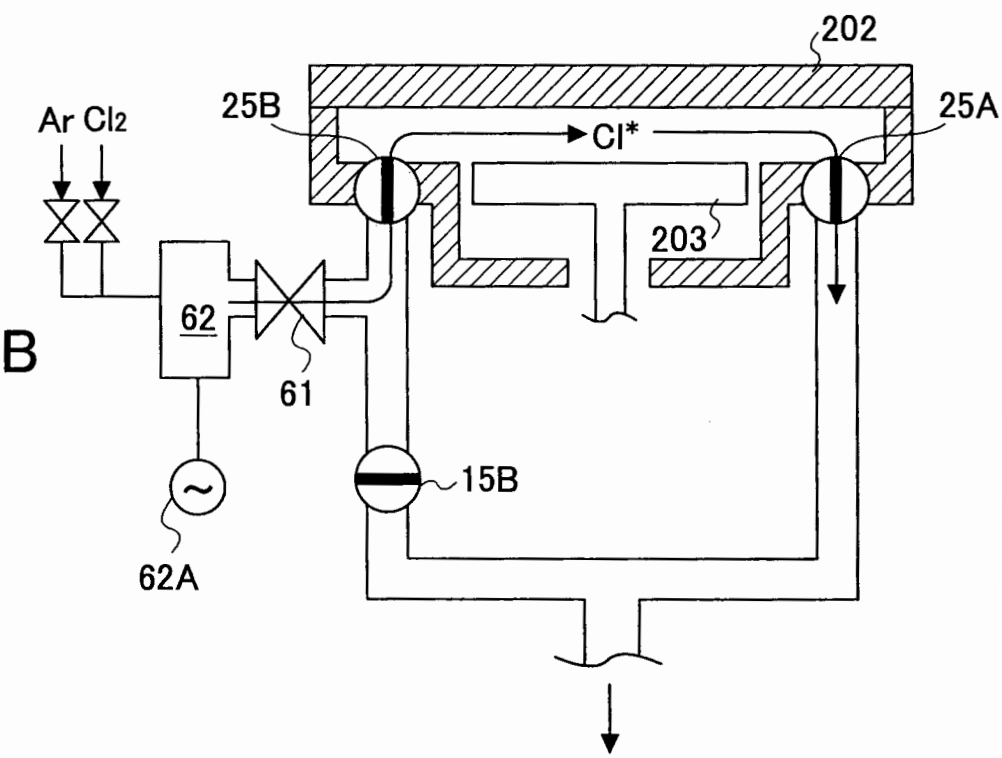


FIG.21A

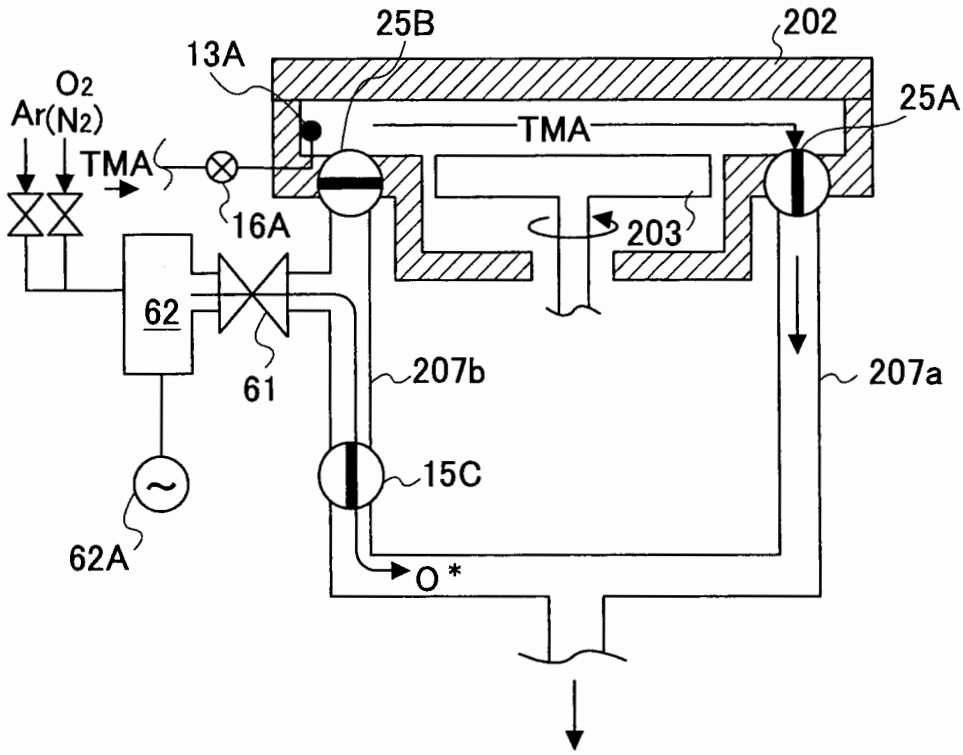


FIG.21B

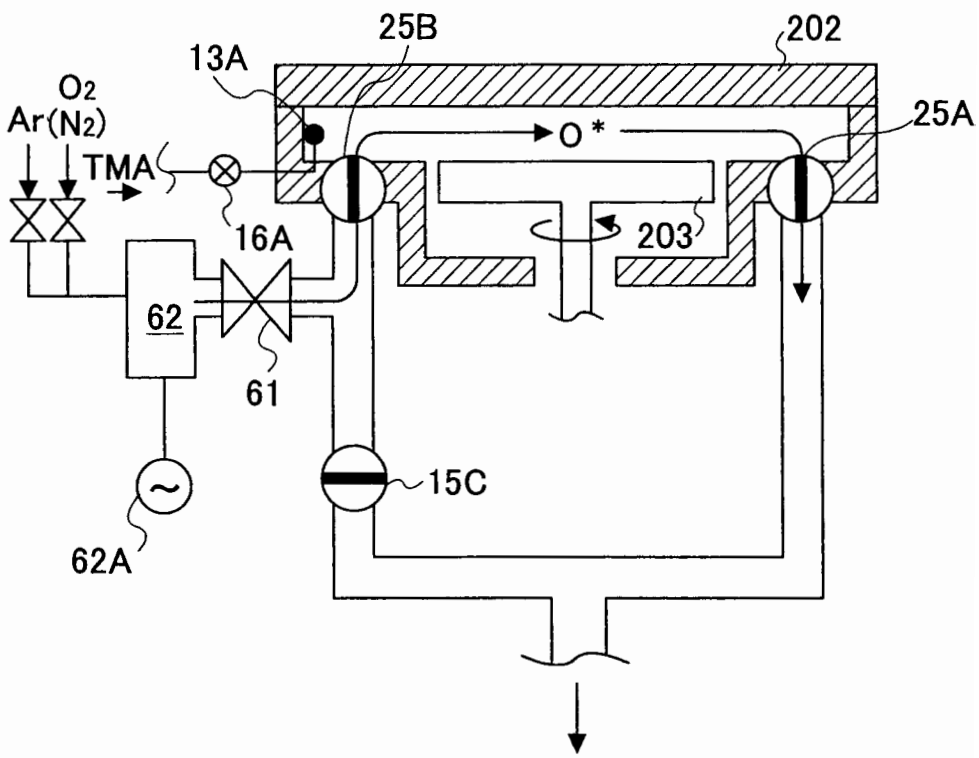


FIG.22

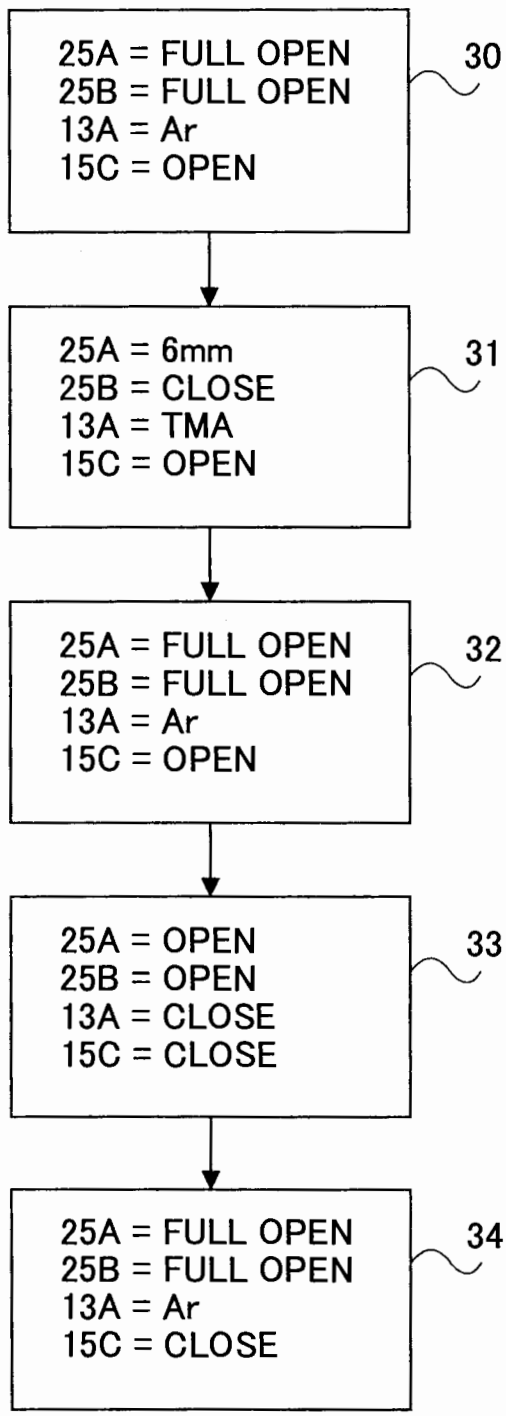

25A = FULL OPEN
25B = FULL OPEN
13A = Ar
15C = OPEN
30
25A = 6mm
25B = CLOSE
13A = TMA
15C = OPEN
31
25A = FULL OPEN
25B = FULL OPEN
13A = Ar
15C = OPEN
32
25A = OPEN
25B = OPEN
13A = CLOSE
15C = CLOSE
33
25A = FULL OPEN
25B = FULL OPEN
13A = Ar
15C = CLOSE
34

FIG.23A

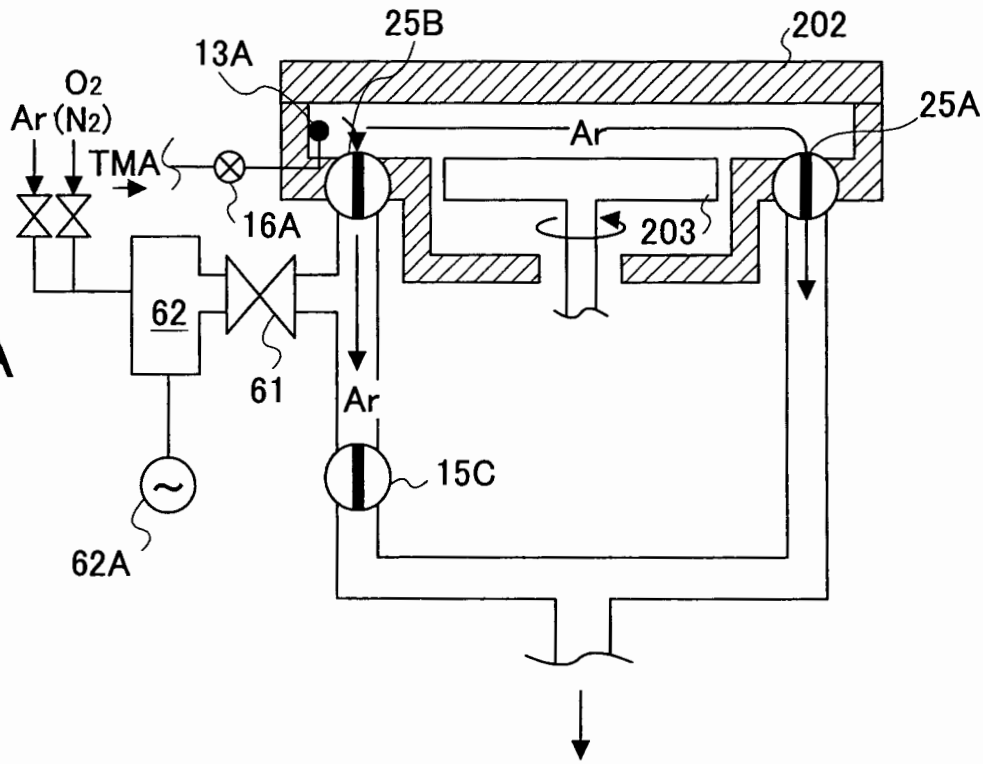
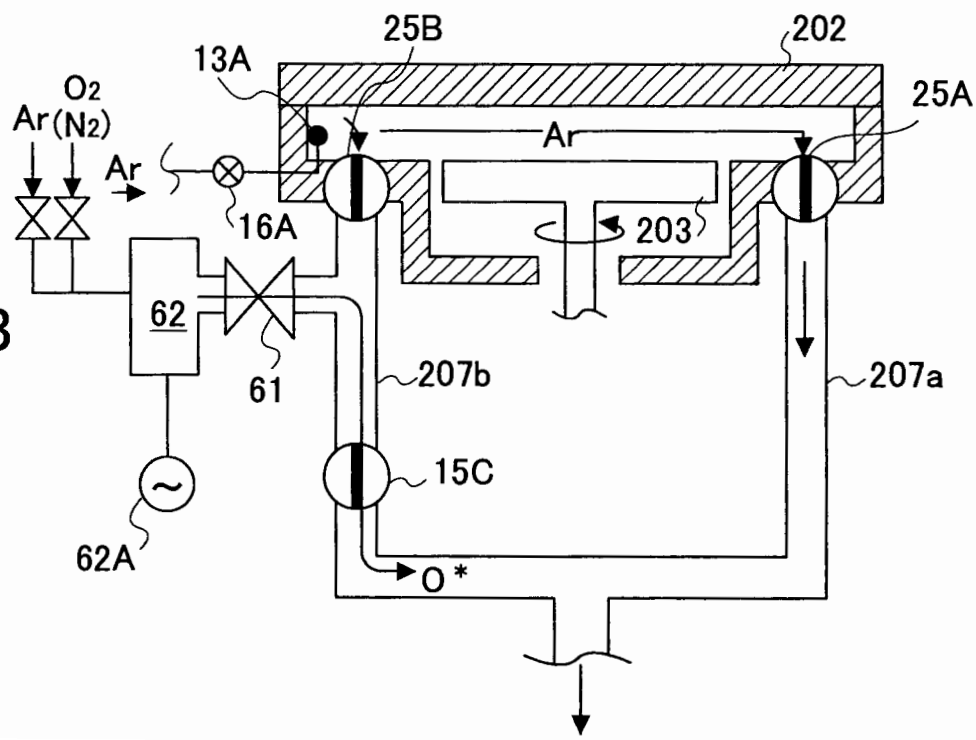


FIG.23B



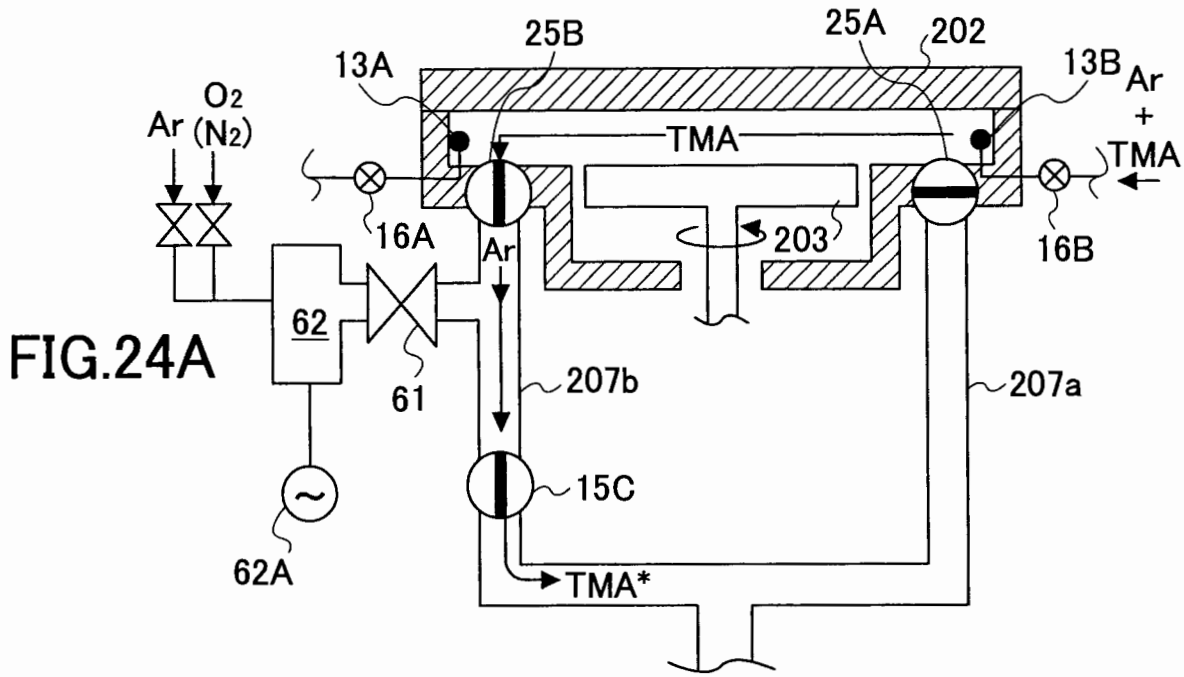


FIG.24A

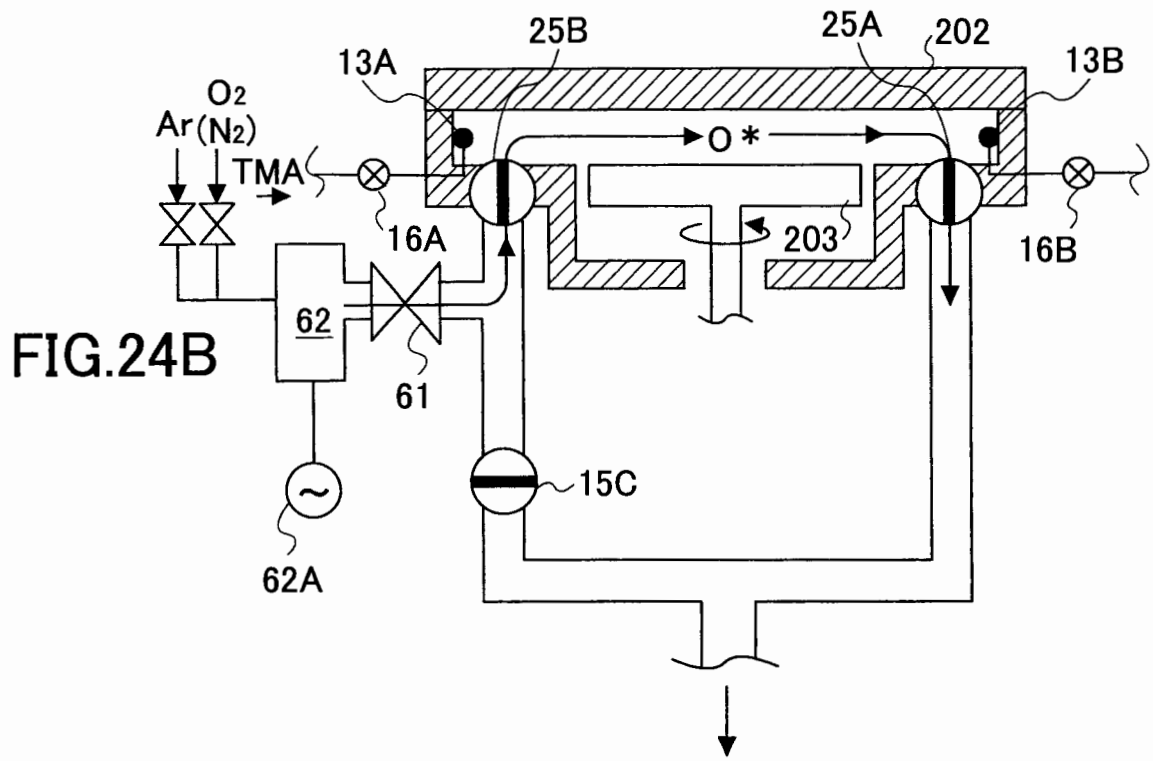


FIG.24B

FIG.25

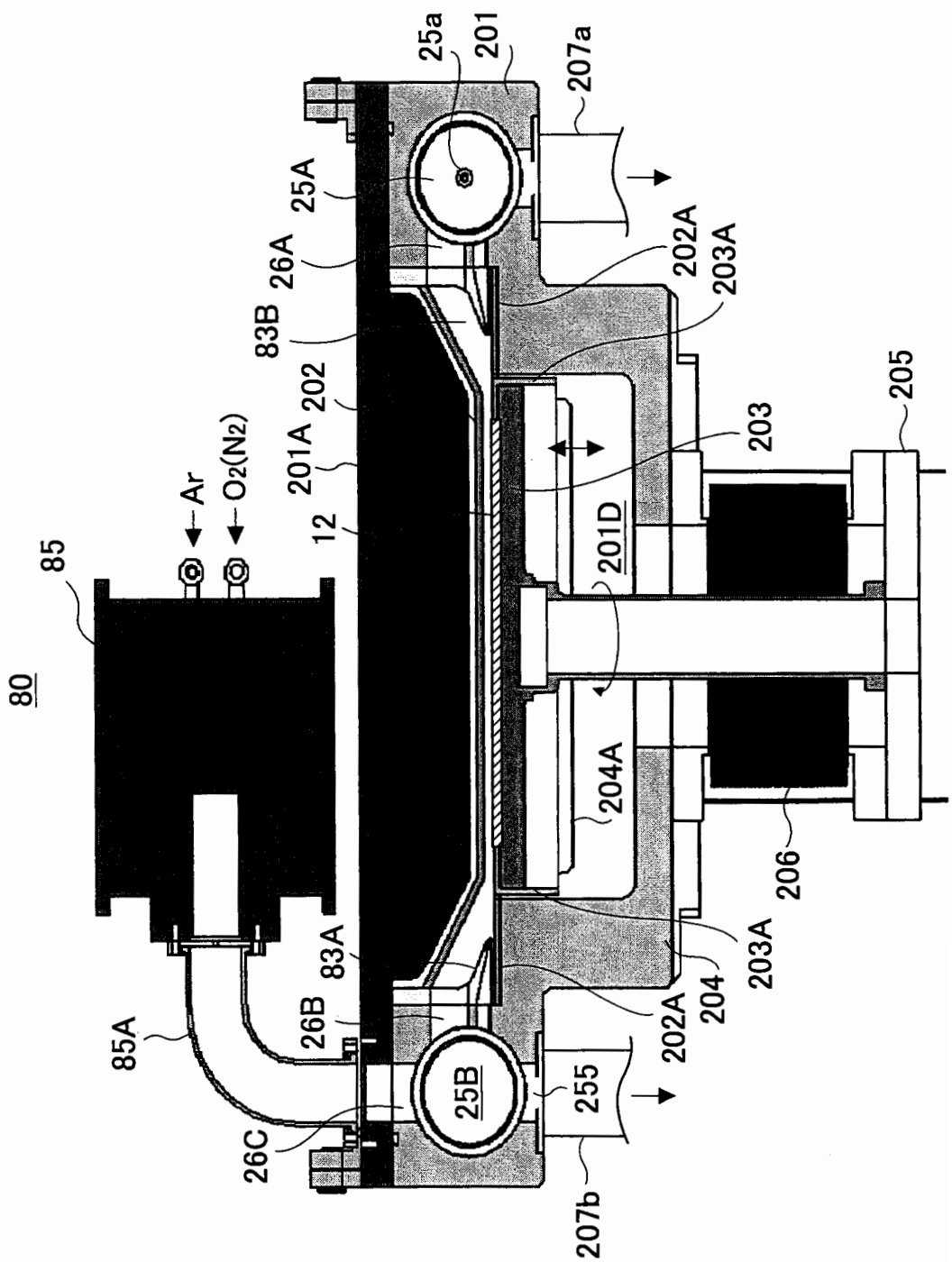

80
85
Ar
O2(N2)
12
201A
202
83B
26A
25A
25a
201
207a
202A
203A
203
205
201D
204A
206
203A
204
202A
83A
26B
85A
25B
255
26C
207b

FIG.26

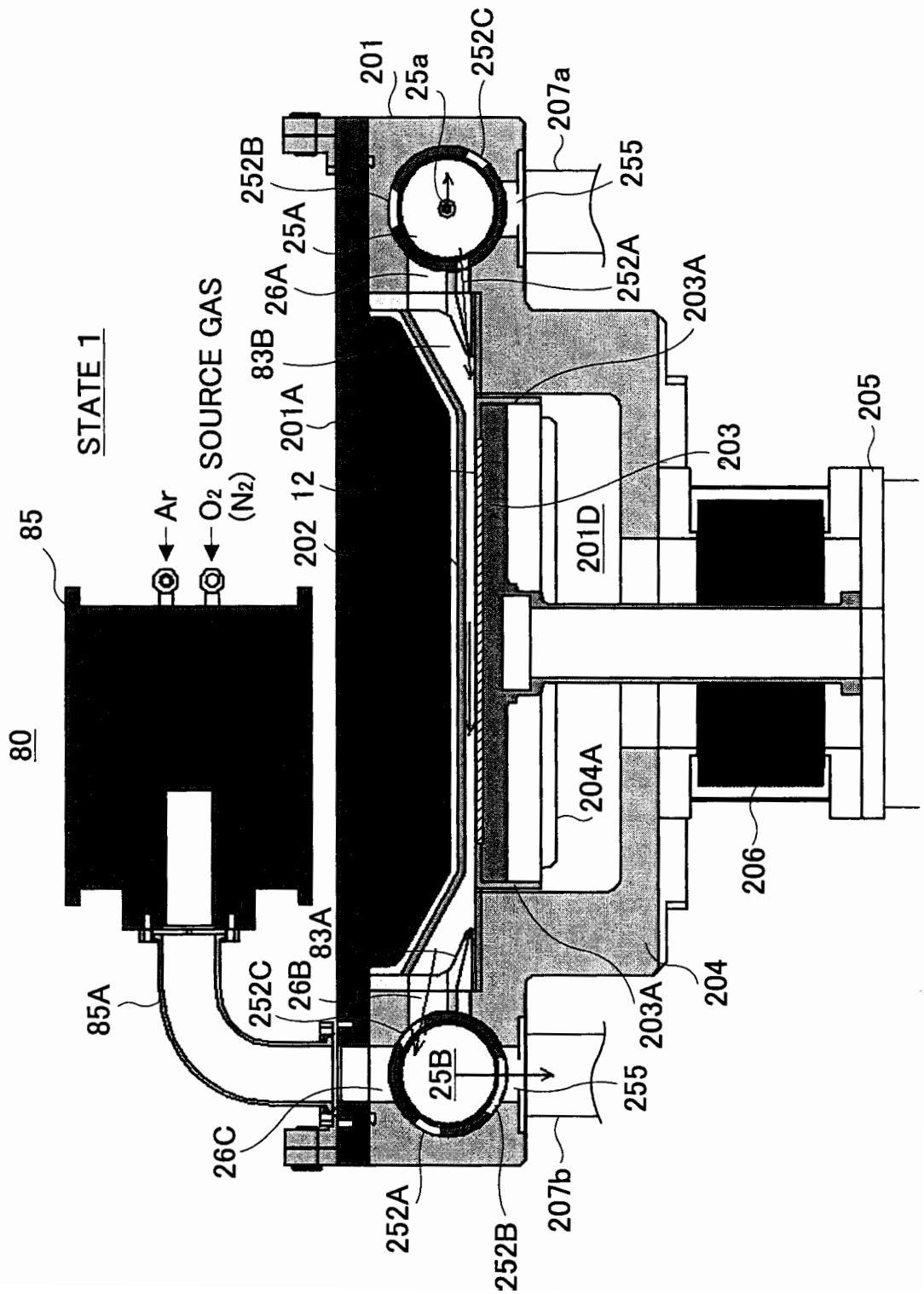

STATE 1
80
85
Ar
O2 (N2) SOURCE GAS
12
202
201
25a
252C
207a
252B
255
25A
252A
26A
203A
83B
201A
203
205
201D
204A
206
83A
85A
252C
26B
204
203A
25B
255
26C
207b
252A
252B

FIG.27

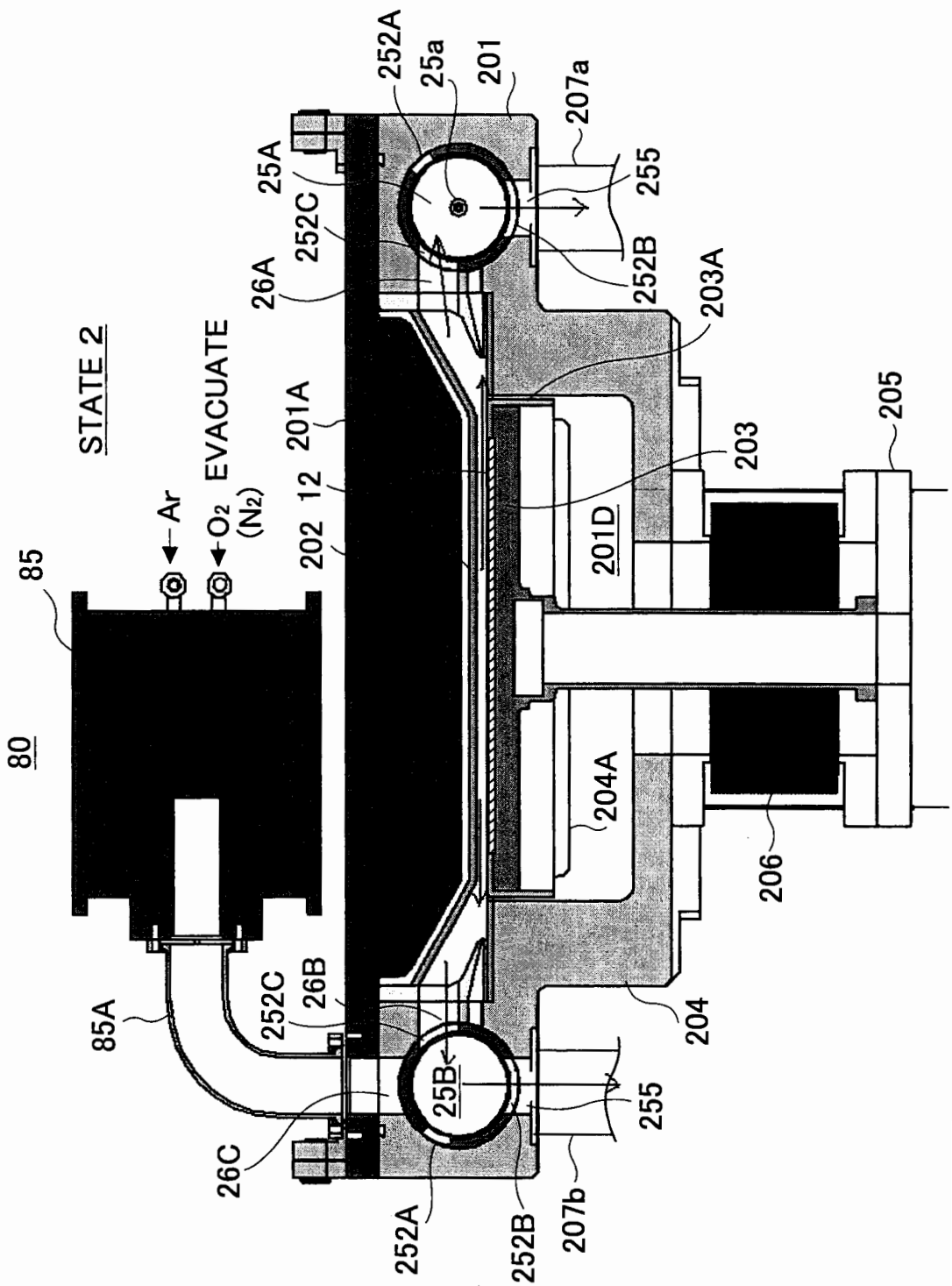

80
85
STATE 2
Ar
O2 (N2)
EVACUATE
12
202
201A
26A
252C
25A
252A
25a
201
207a
255
252B
203A
203
205
201D
204A
206
204
85A
26B
252C
26C
25B
255
252A
252B
207b

FIG.28

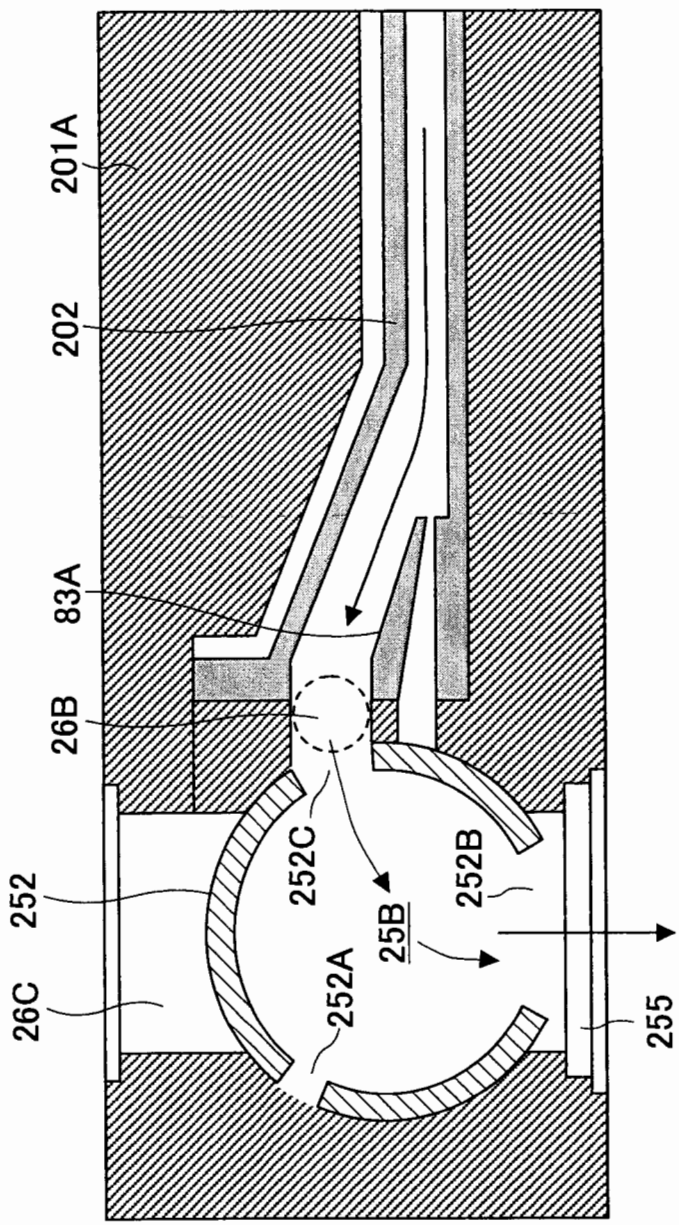


FIG.29

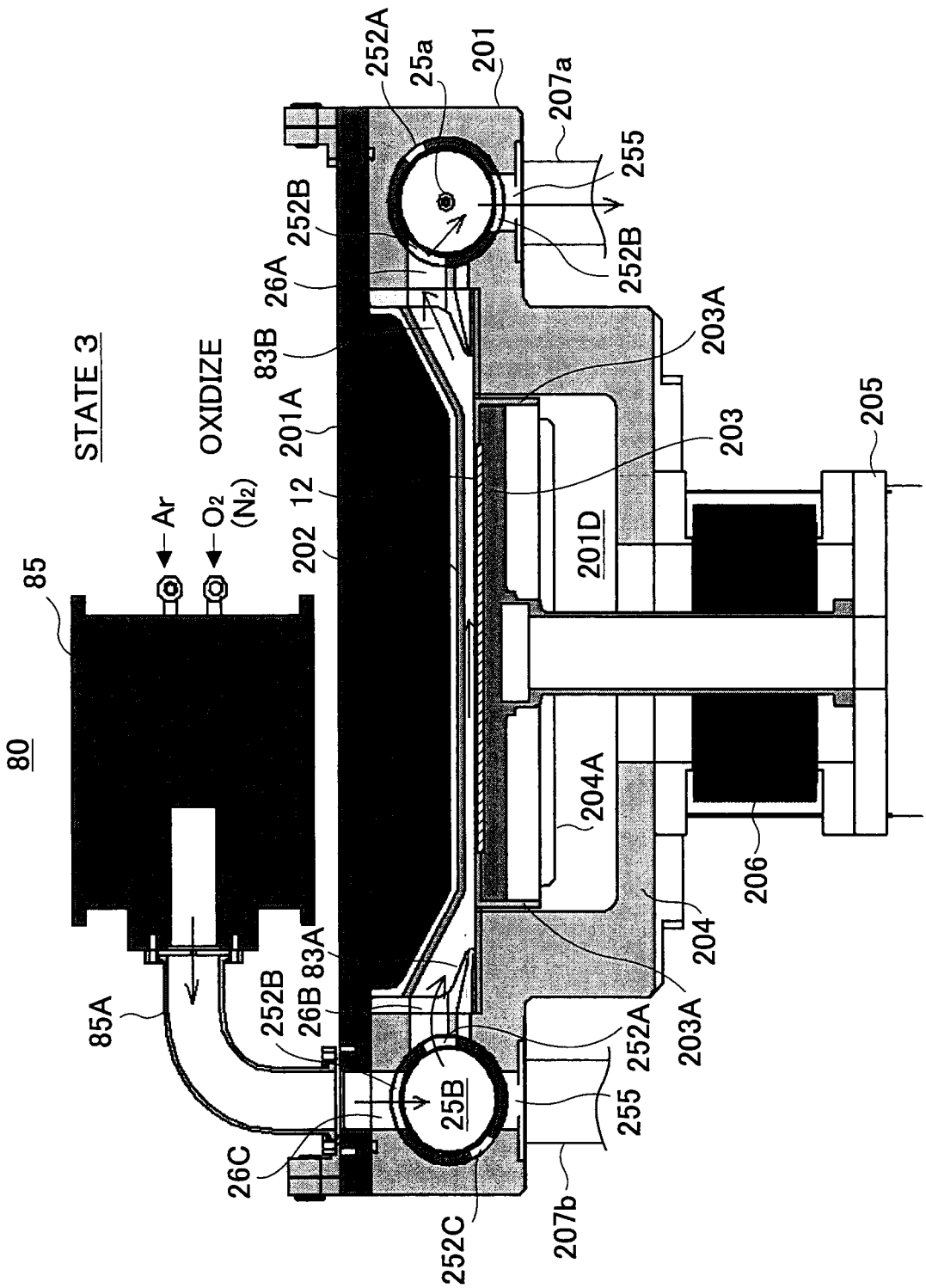

STATE 3
OXIDIZE
Ar
O2 (N2)
80
85
85A
12
202
201A
83B
26A
252B
252A
25a
201
207a
255
203A
203
205
201D
204A
206
204
83A
26B
25B
26C
252C
207b

FIG.30

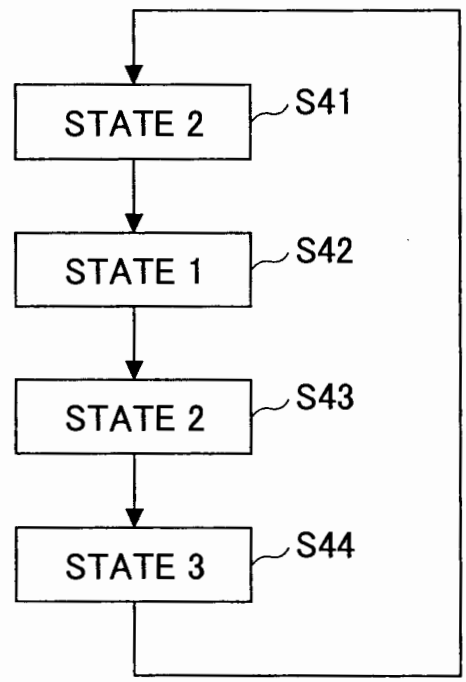


FIG.31

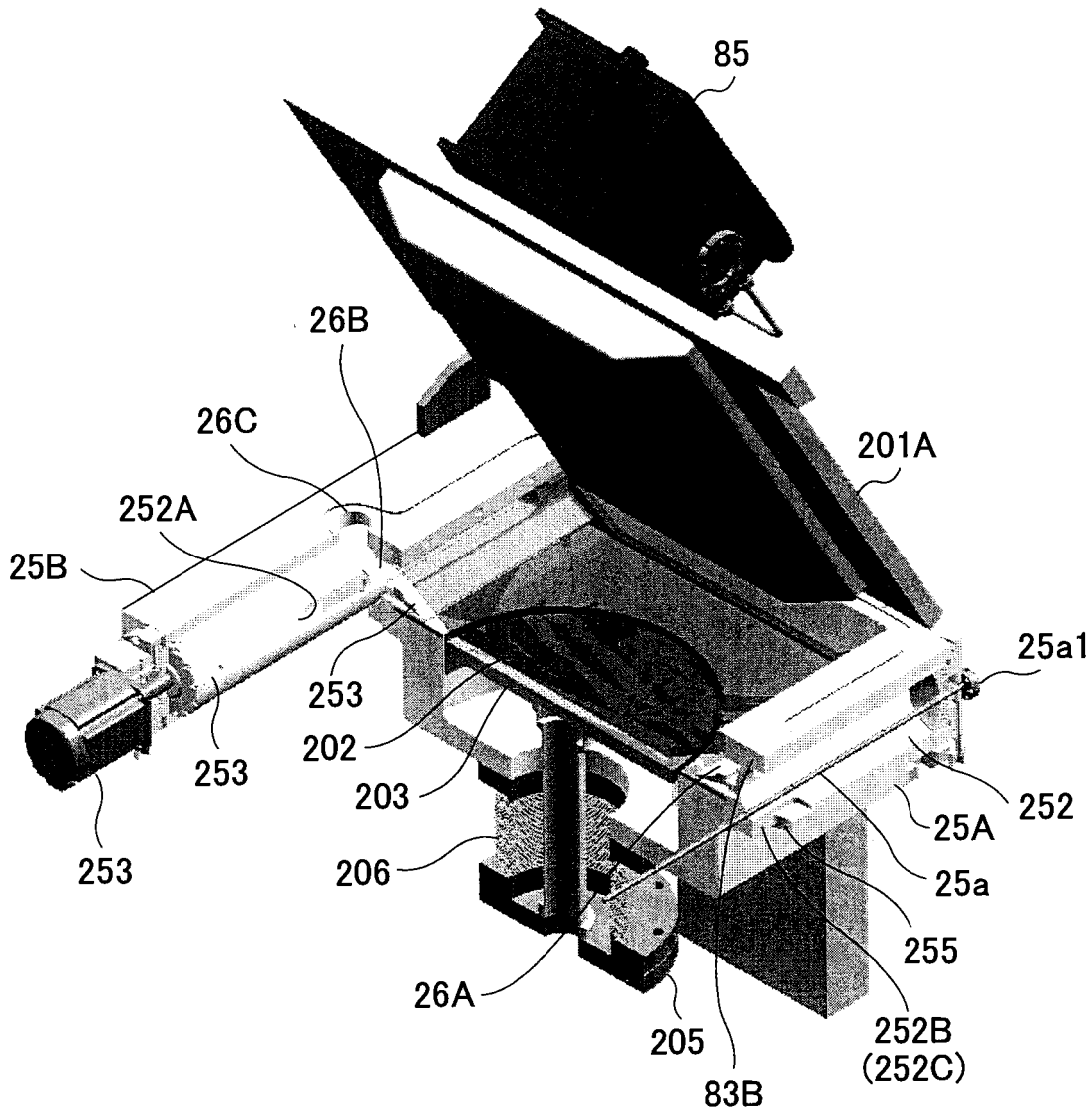

85
26B
26C
201A
252A
25B
25a1
253
202
253
203
253
206
25A
252
25a
255
26A
205
252B
(252C)
83B

FIG.32

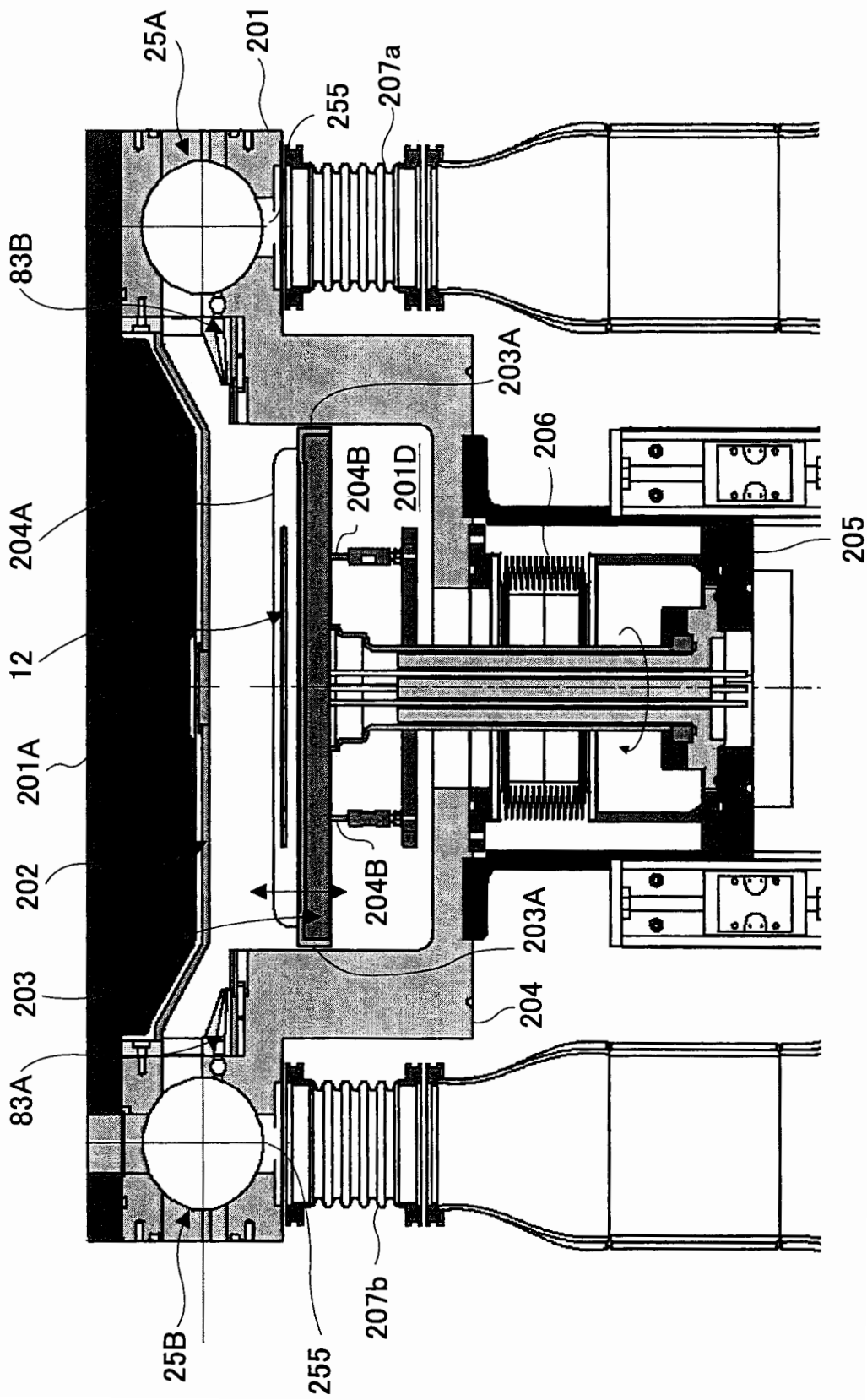

90
25A
201
255
207a
83B
203A
206
204B
201D
204A
205
12
201A
202
204B
203A
203
204
83A
25B
255
207b

FIG.33

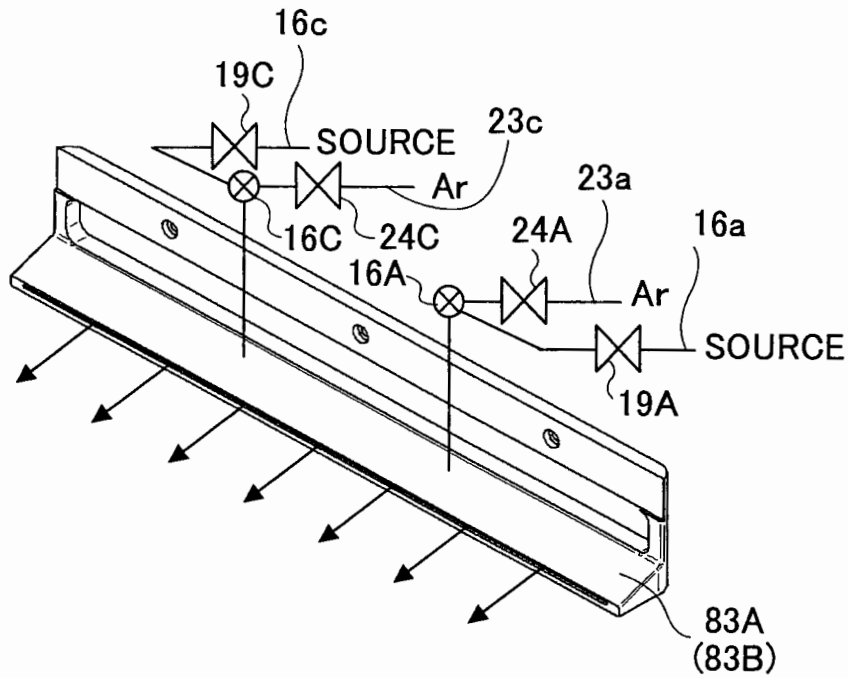

16c
19C
SOURCE
23c
Ar
23a
16a
16C
24C
24A
16A
Ar
SOURCE
19A
83A
(83B)

FIG.34A

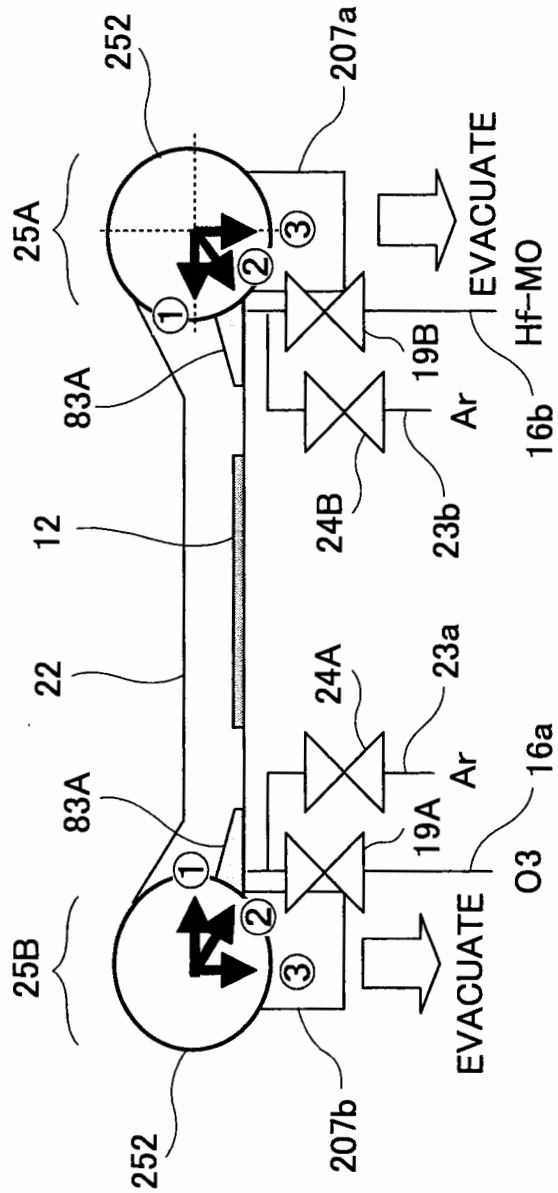


FIG.34B

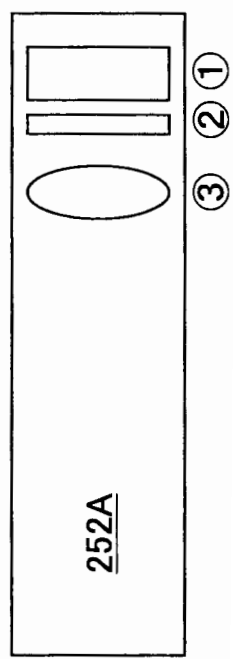


FIG.34C

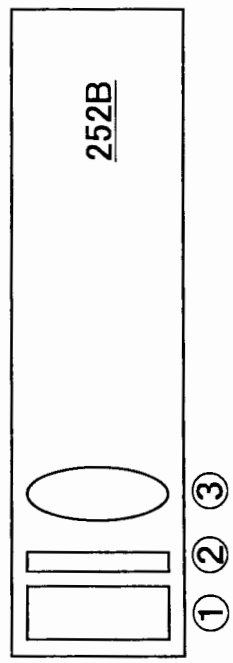


FIG.35A

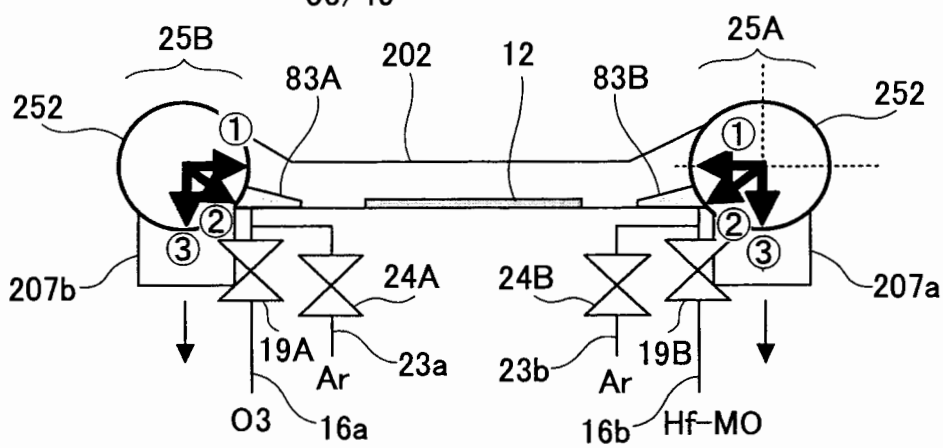


FIG.35B

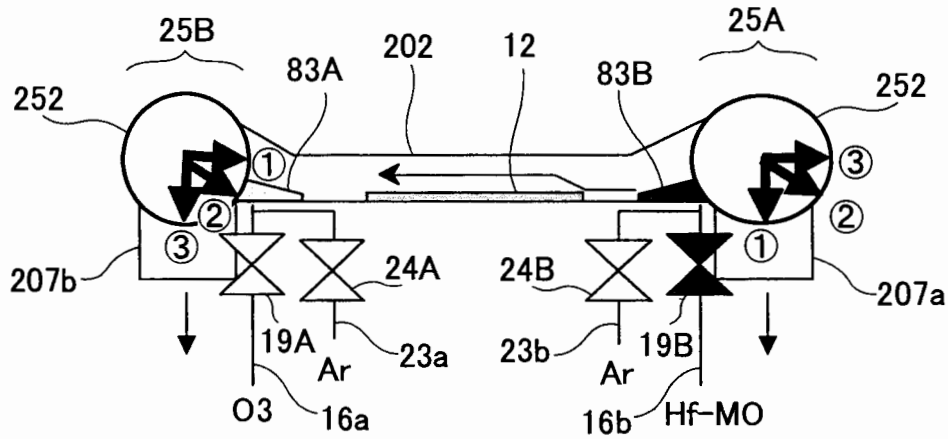


FIG.35C

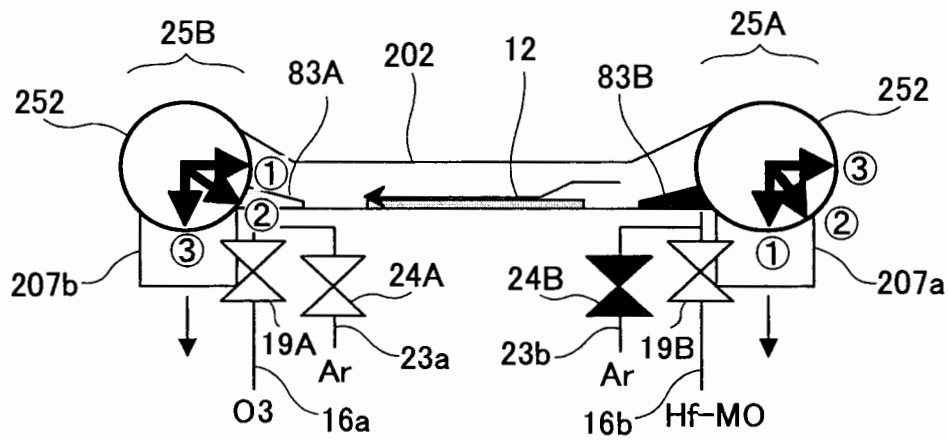


FIG.35D

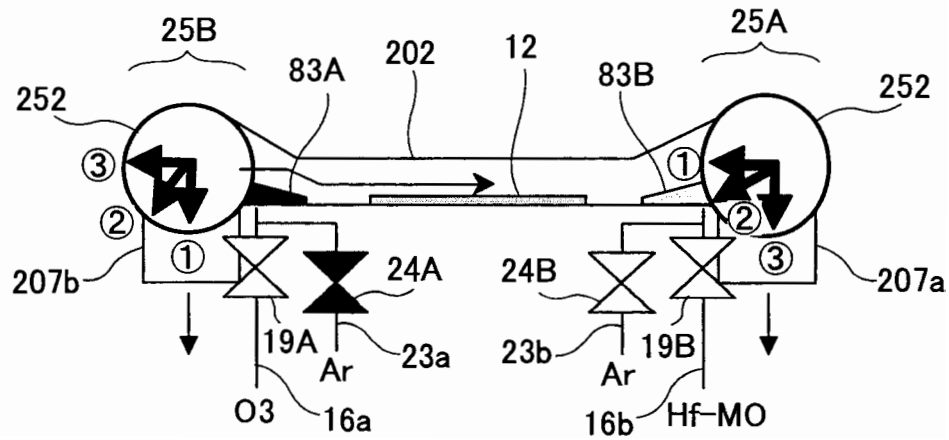


FIG.35E

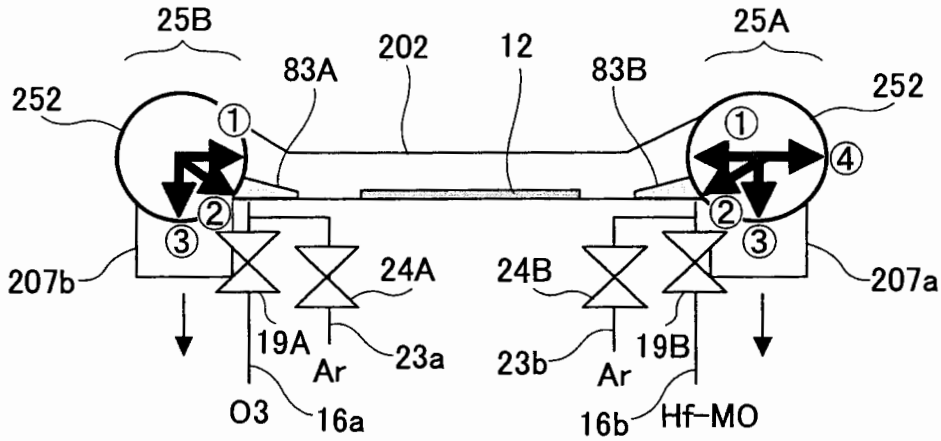


FIG.35F

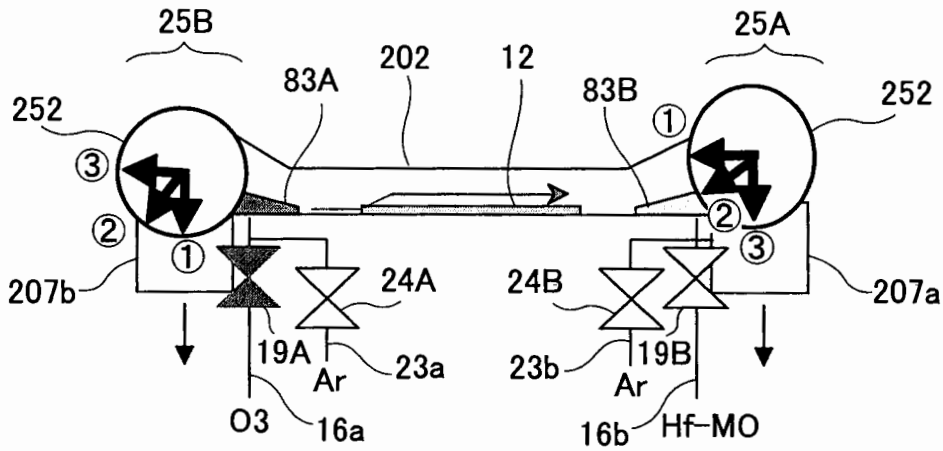


FIG.35G

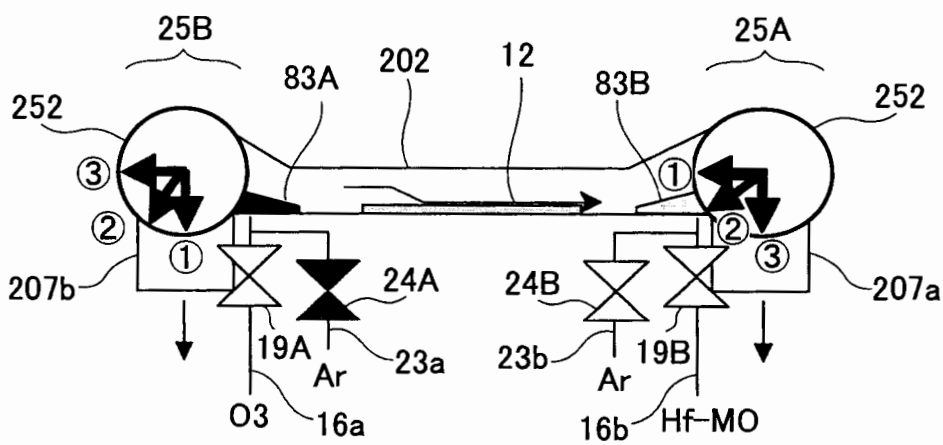


FIG.35H

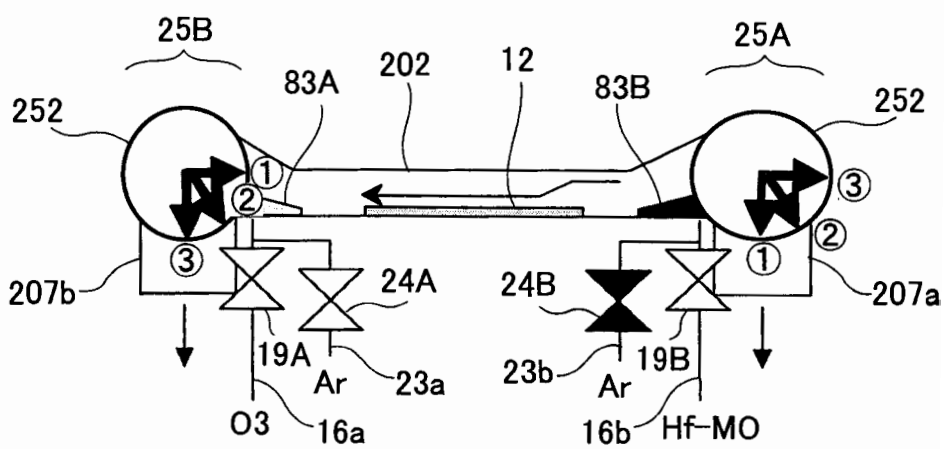


FIG.36A

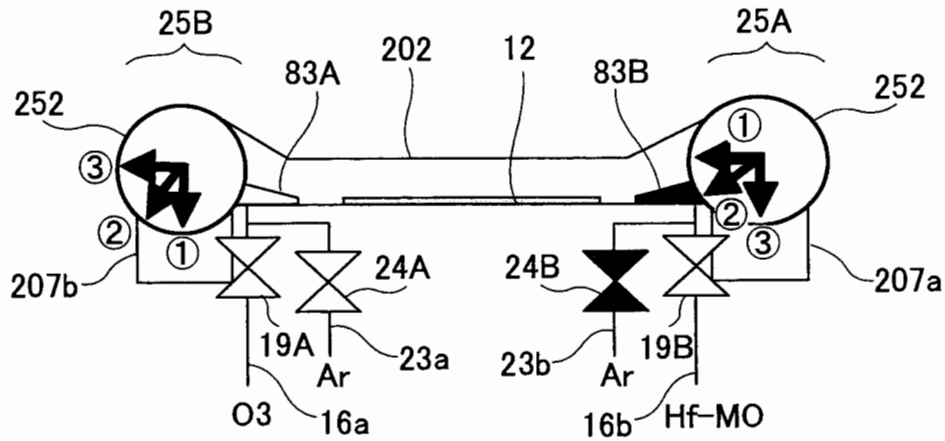


FIG.36B

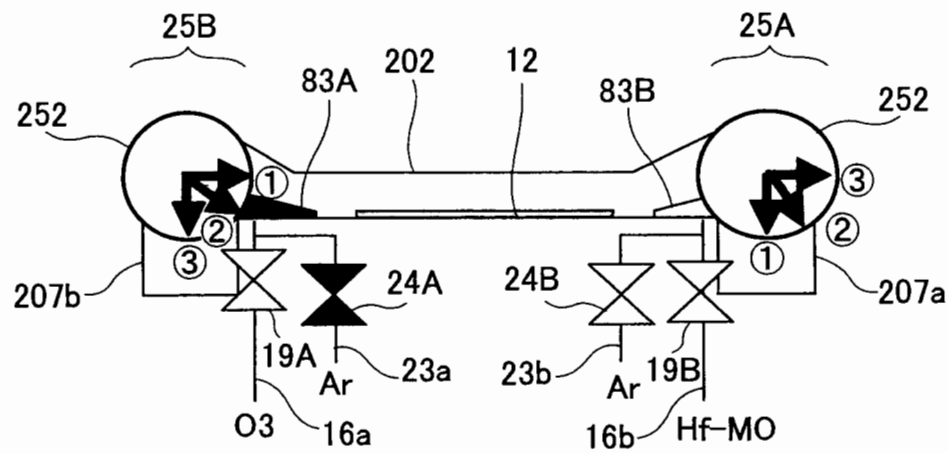


FIG.37

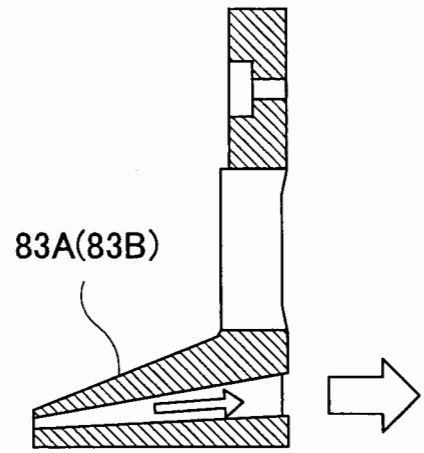


FIG.38A

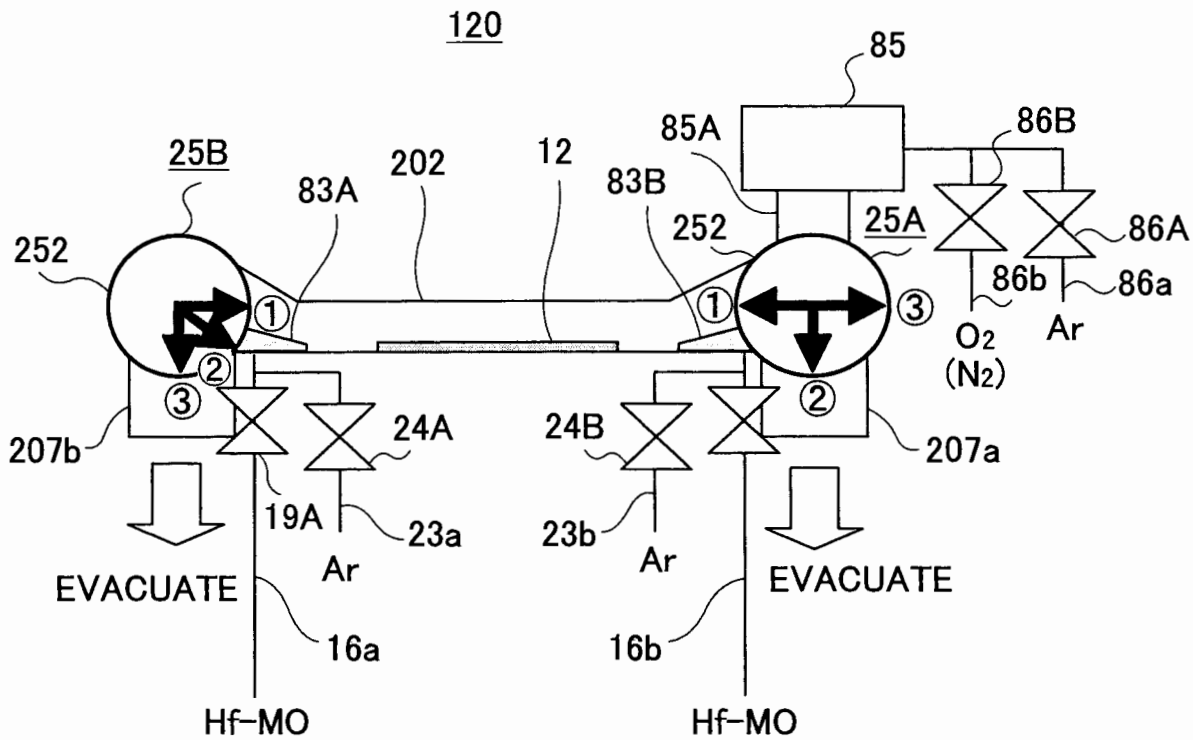


FIG.38B

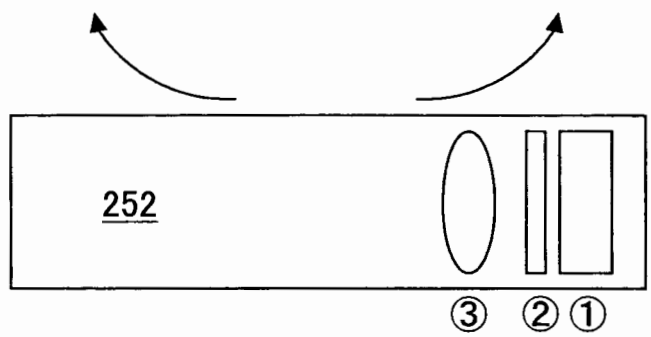


FIG.38C

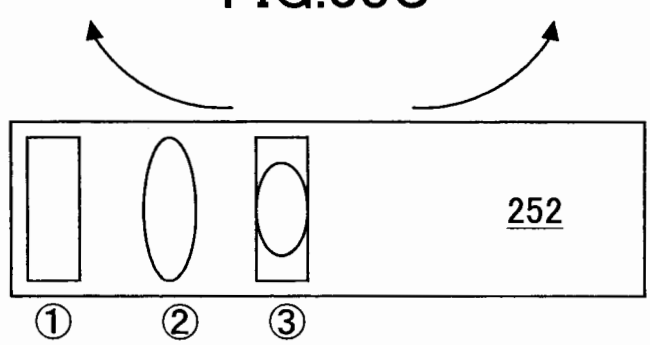


FIG.39A

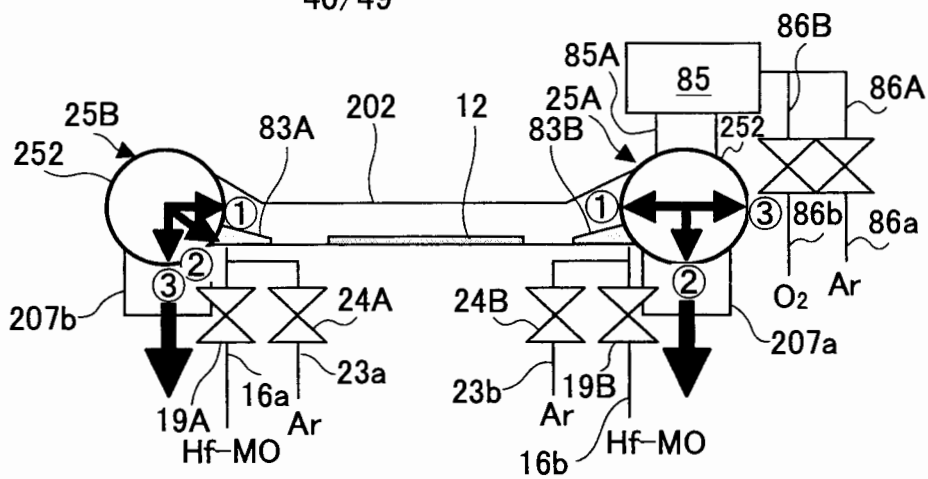


FIG.39B

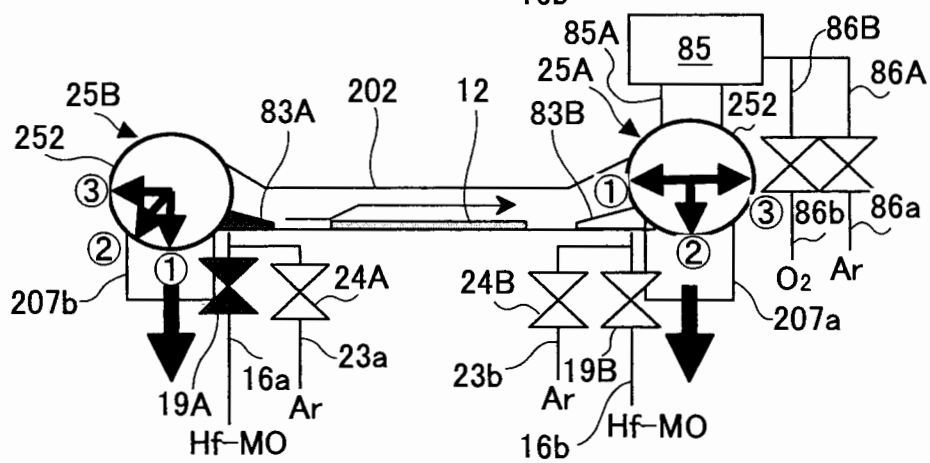


FIG.39C

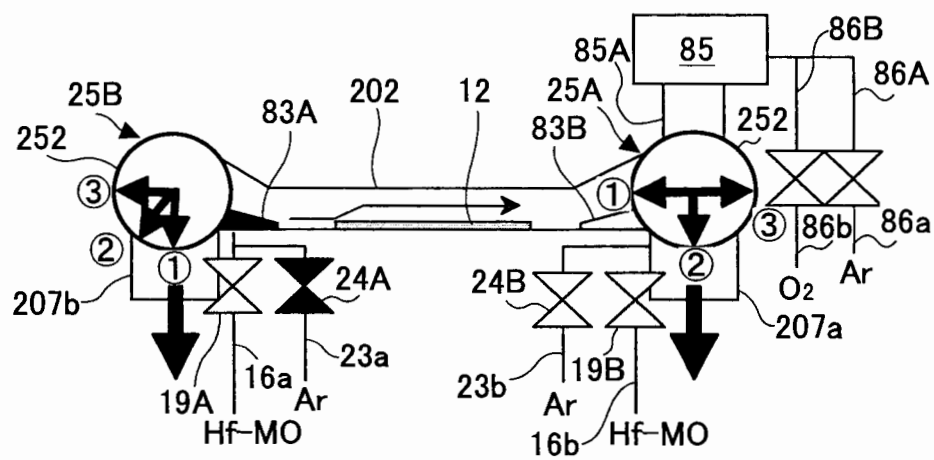


FIG.39D

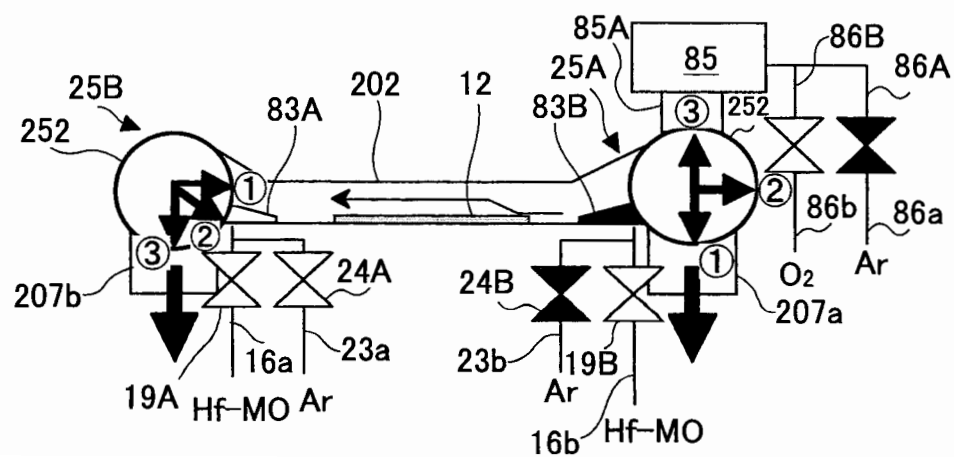


FIG.39E

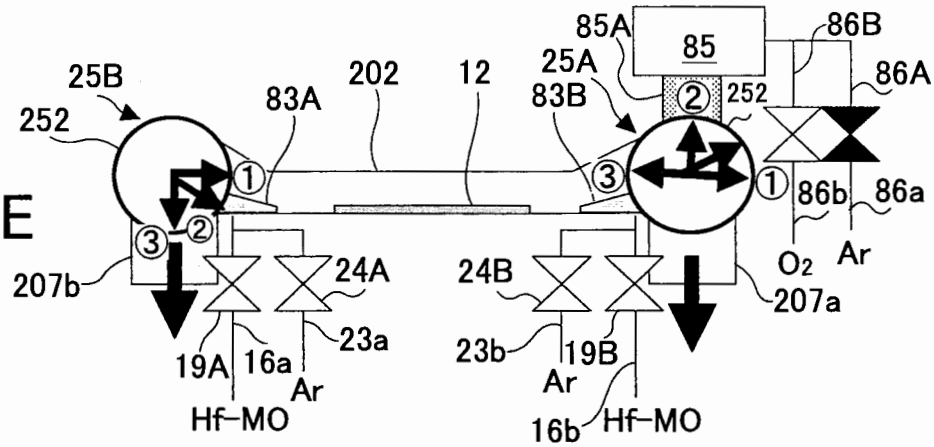


FIG.39F

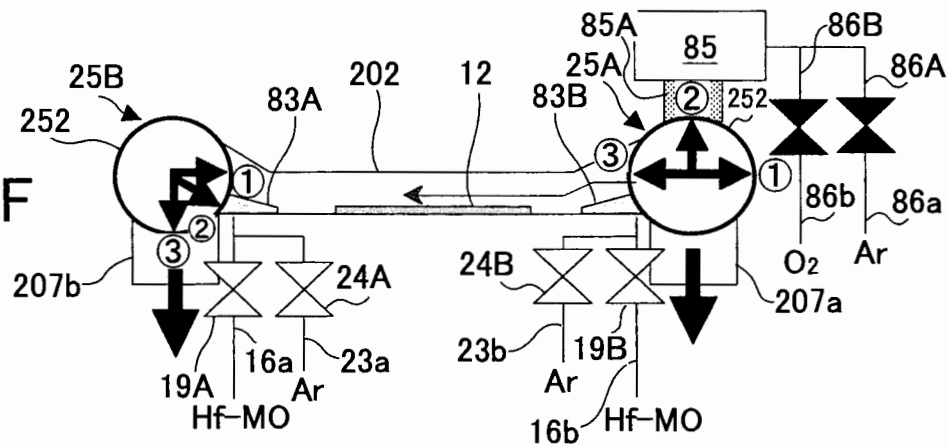


FIG.39G

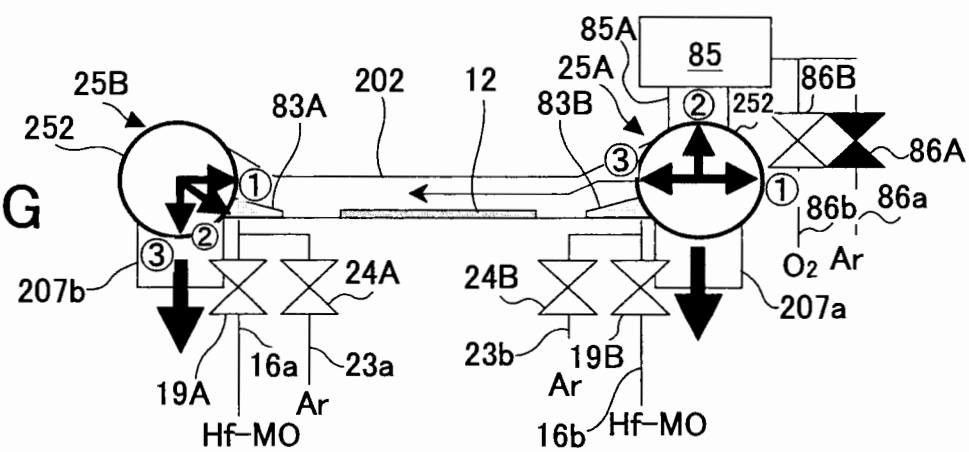


FIG.39H

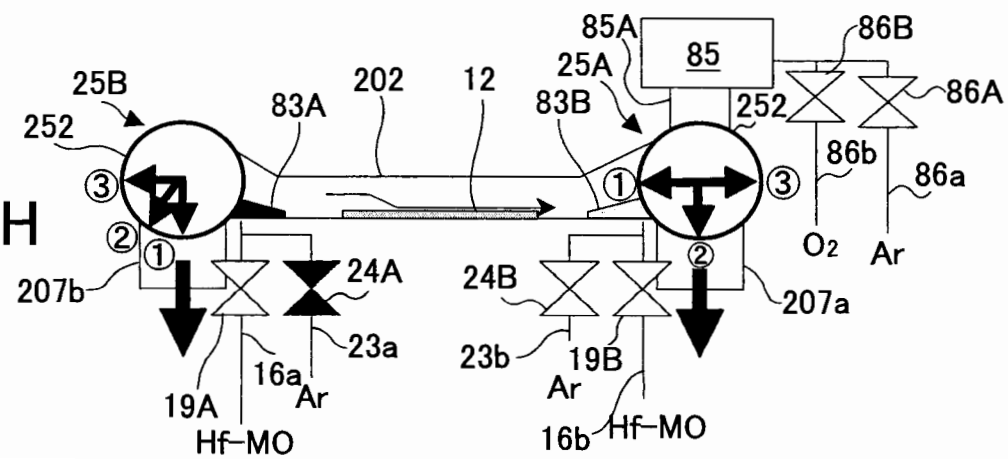


FIG.40

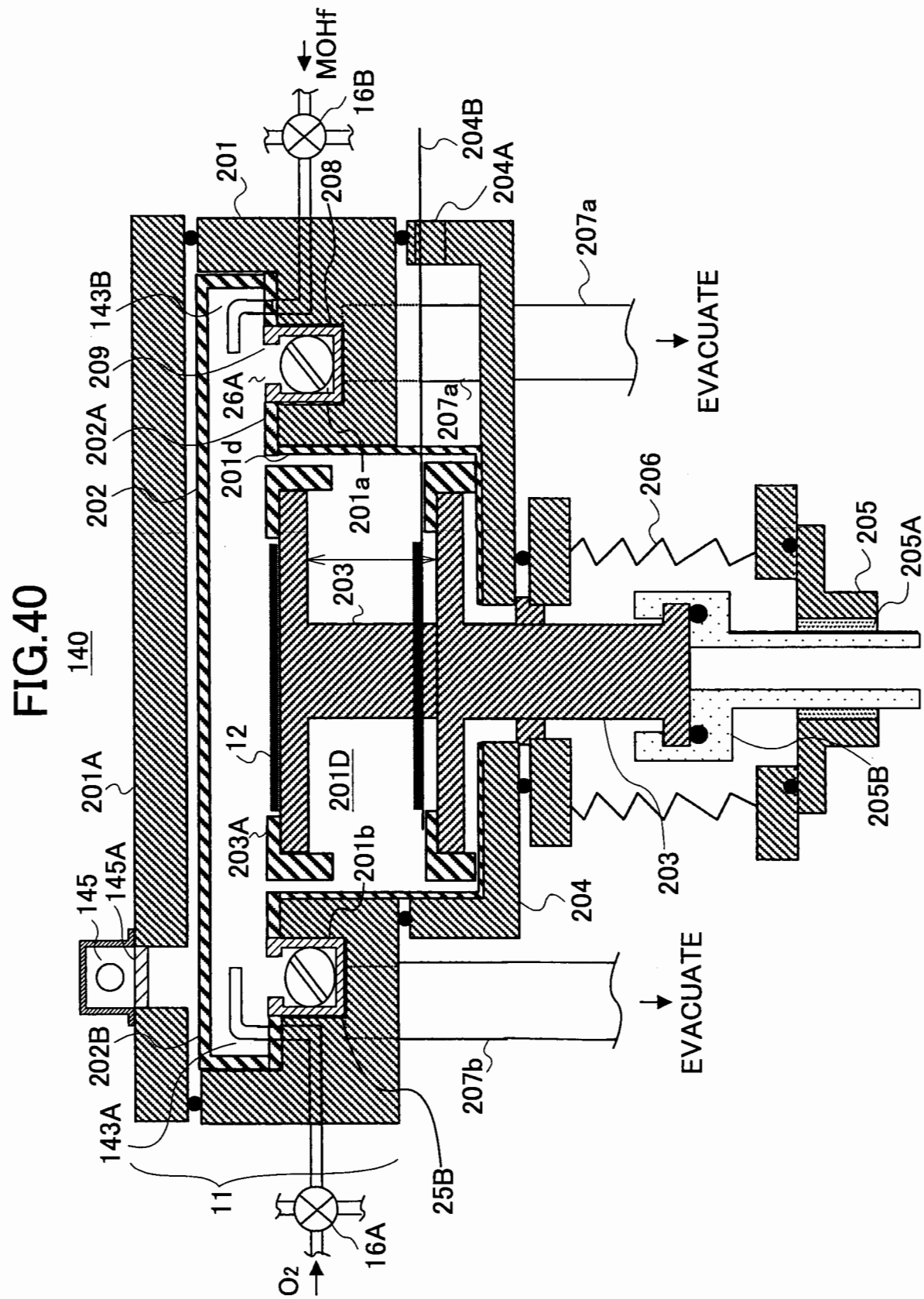

140
MOHf
16B
201
208
204B
204A
207a
143B
209
202A
202
26A
201d
201a
203
206
205
205A
EVACUATE
12
201A
201D
203A
201b
145
145A
202B
143A
11
25B
16A
O2
204
207b
205B

FIG.41

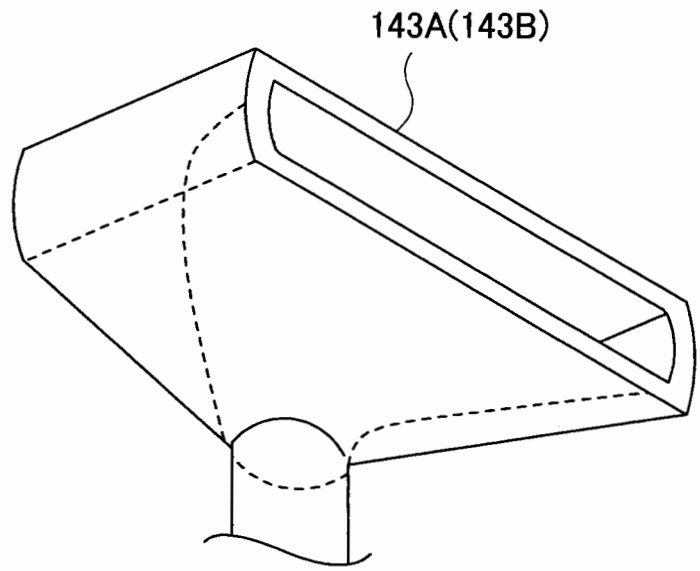


FIG.42

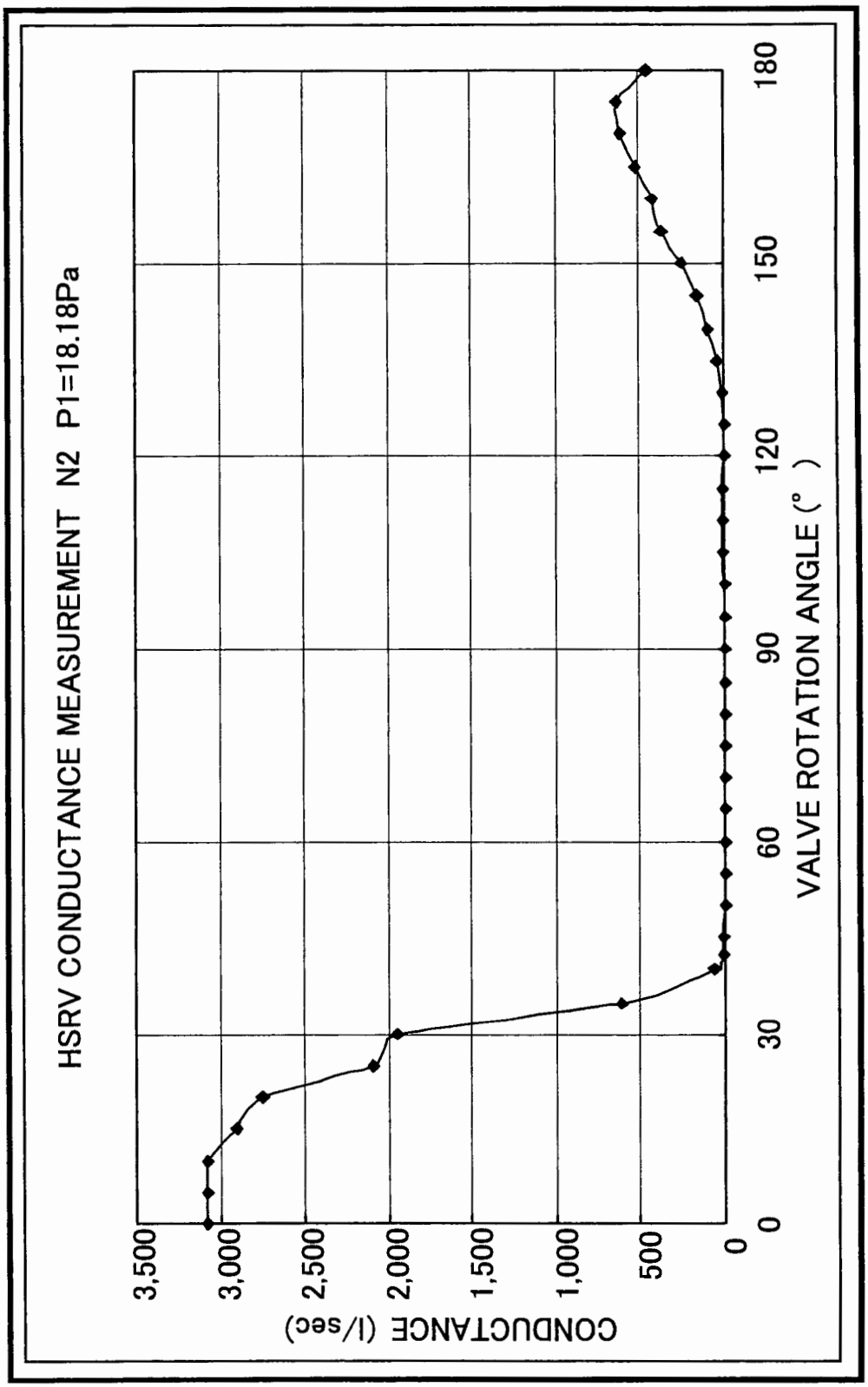

HSRV CONDUCTANCE MEASUREMENT N2 P1=18.18Pa
CONDUCTANCE (l/sec)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
30
60
90
120
150
180
VALVE ROTATION ANGLE (°)

FIG.43

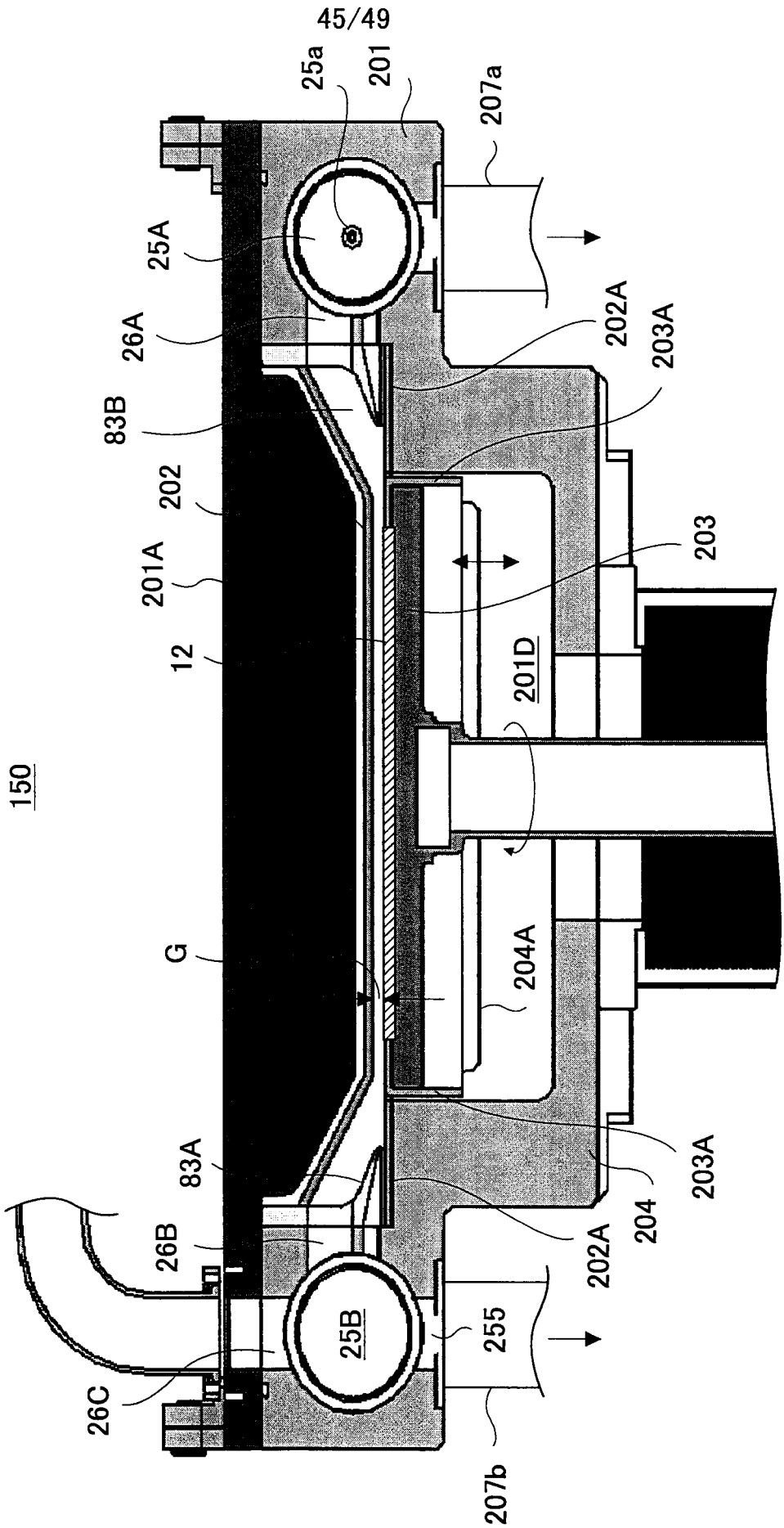

150
12
G
83A
83B
26A
26B
26C
25A
25a
25B
201
201A
201D
202
202A
203
203A
204
204A
255
207a
207b

FIG.44

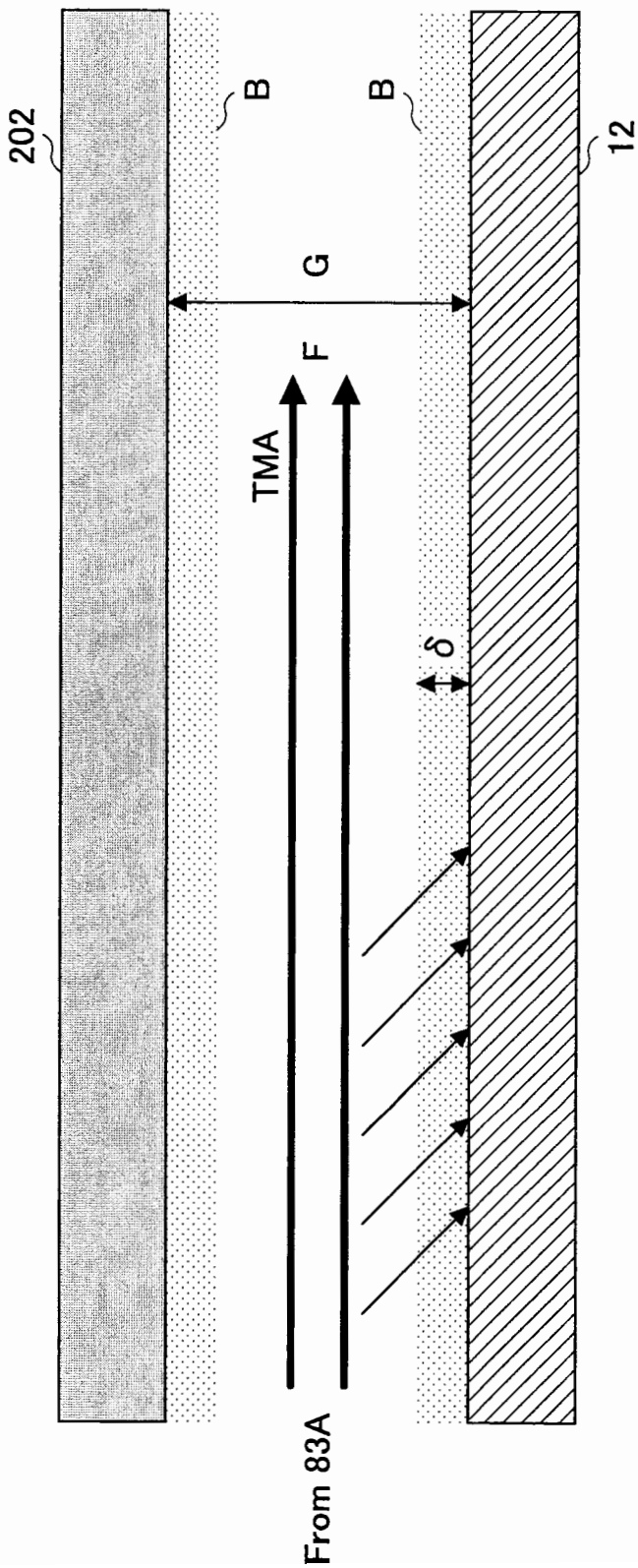


FIG.45

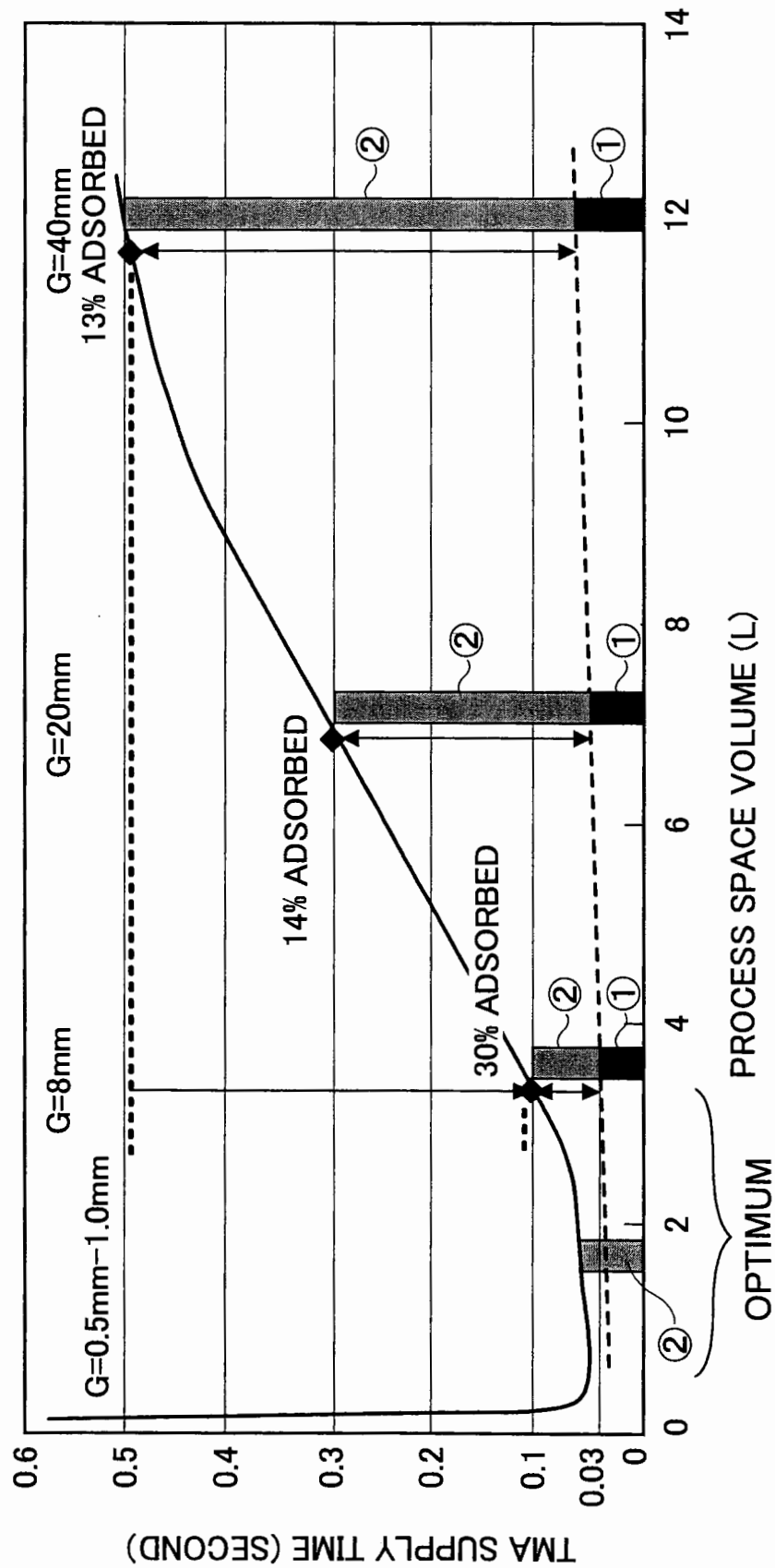

TMA SUPPLY TIME (SECOND)
0.6
0.5
0.4
0.3
0.2
0.1
0.03
0
PROCESS SPACE VOLUME (L)
0
2
4
6
8
10
12
14
OPTIMUM
G=0.5mm−1.0mm
G=8mm
G=20mm
G=40mm
13% ADSORBED
14% ADSORBED
30% ADSORBED
①
②

FIG.46A

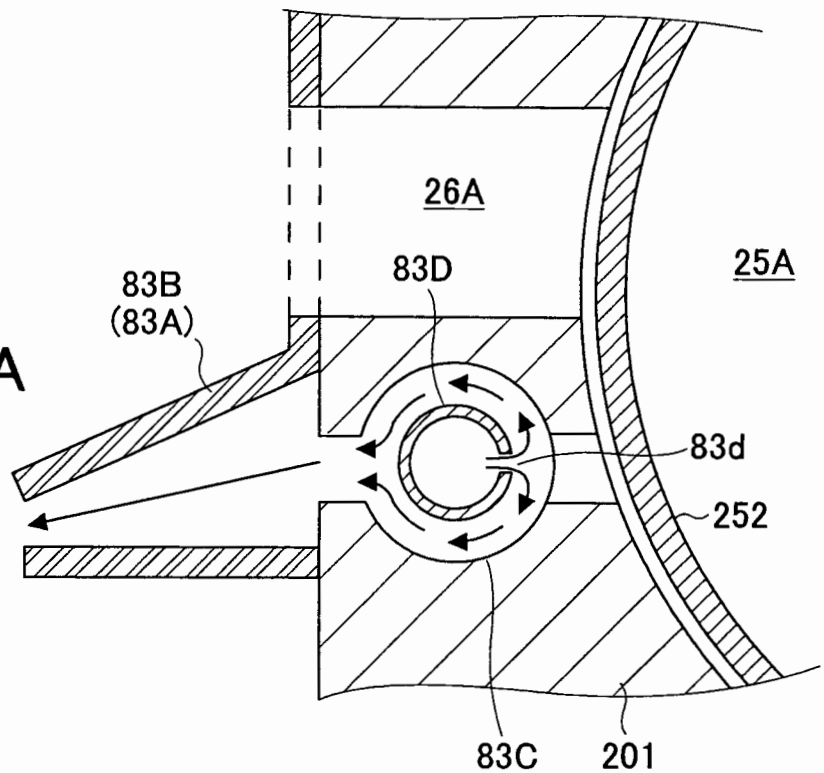


FIG.46B

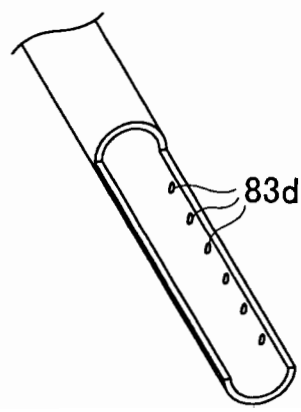


FIG.47

