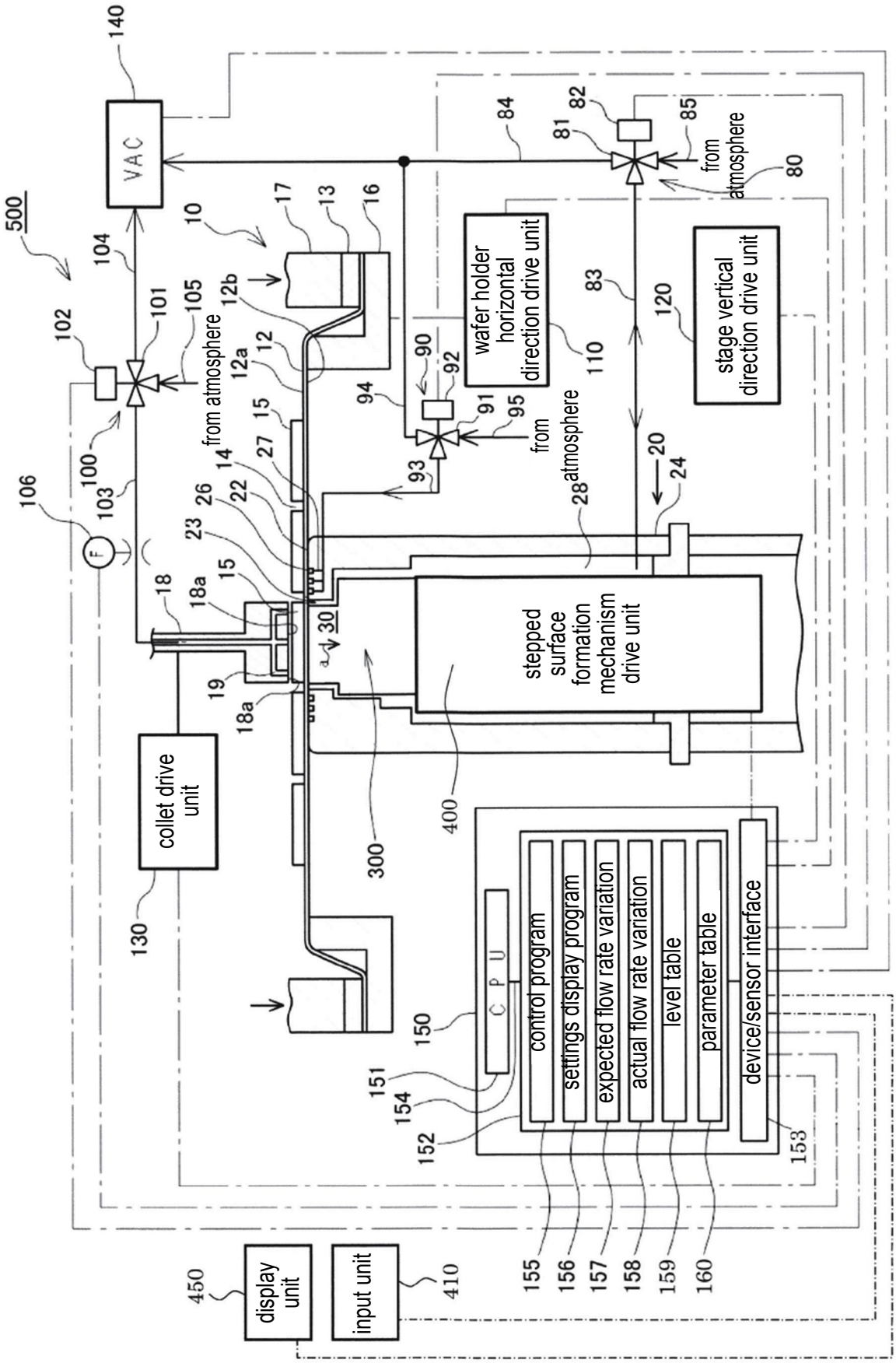

500
VAC
140
104
101
105
102
100
103
106
F
from atmosphere
10
17
13
16
12b
12
12a
15
27
14
26
22
23
18
18a
19
collet drive unit
130
30
300
400
84
81
82
85
from atmosphere
80
wafer holder horizontal direction drive unit
110
83
120
stage vertical direction drive unit
90
92
94
91
95
from atmosphere
93
28
20
24
stepped surface formation mechanism drive unit
CPU
control program
settings display program
expected flow rate variation
actual flow rate variation
level table
parameter table
device/sensor interface
150
151
154
152
153
155
156
157
158
159
160
450
display unit
410
input unit

FIG. 1

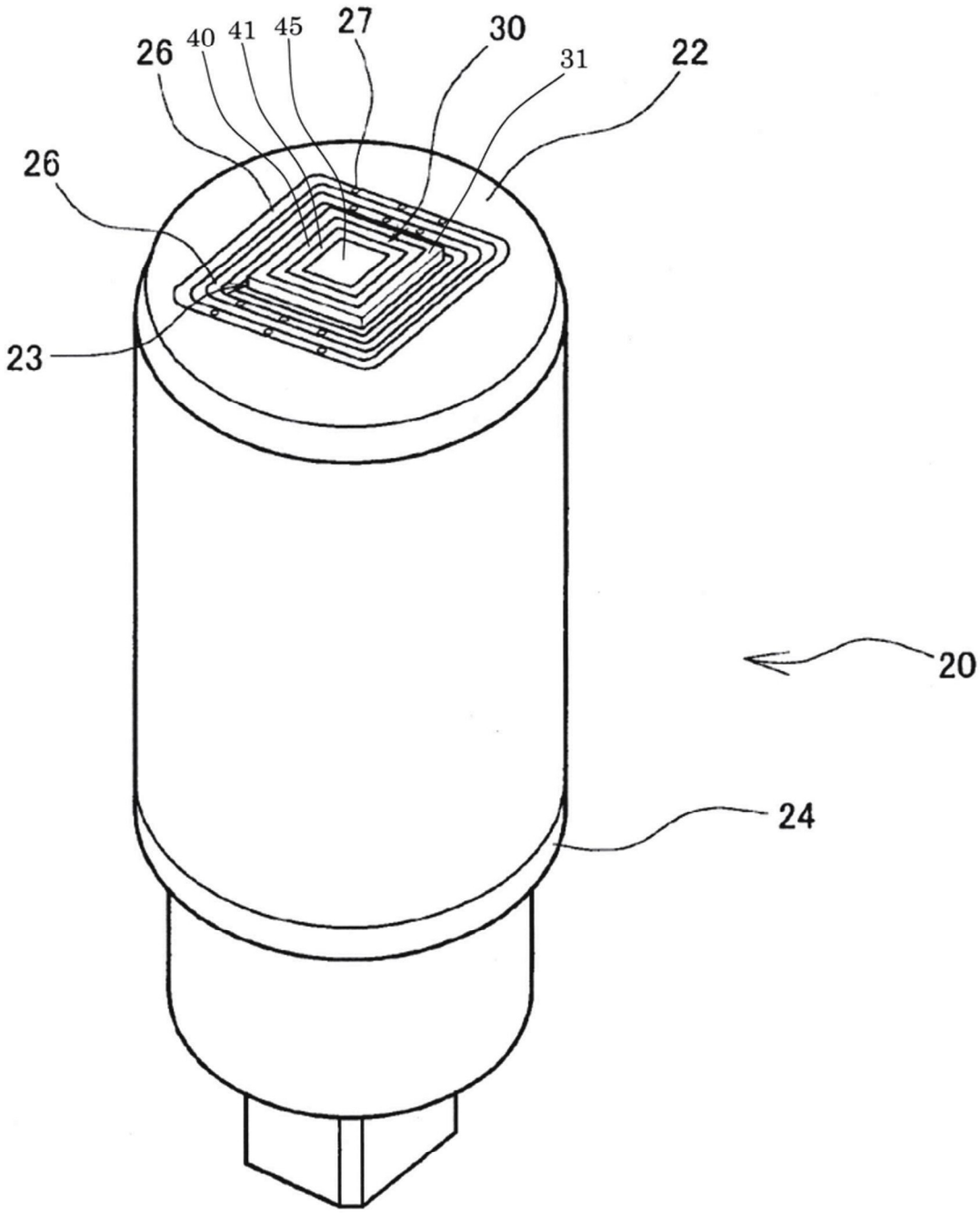


FIG. 2

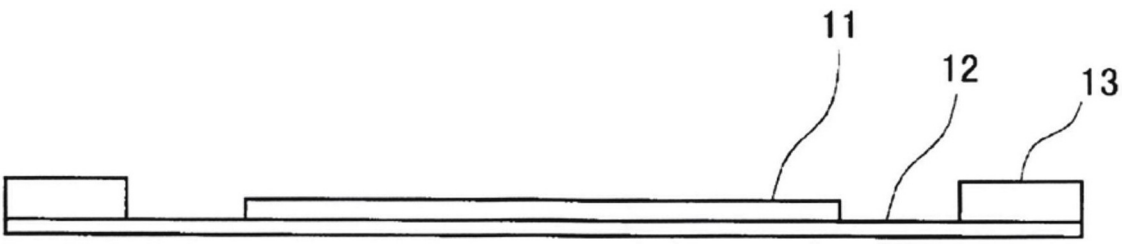


FIG. 3

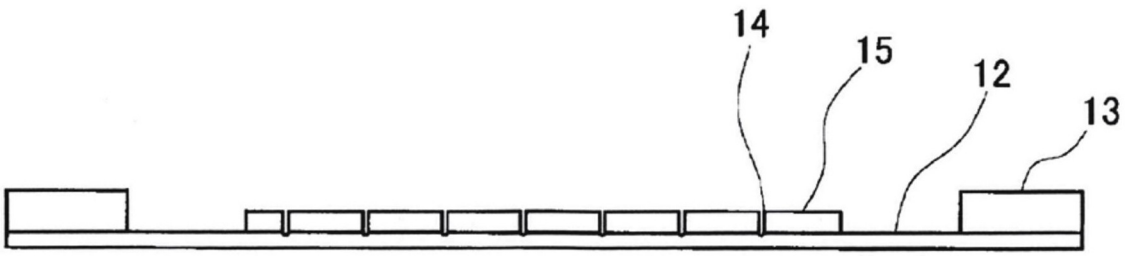


FIG. 4

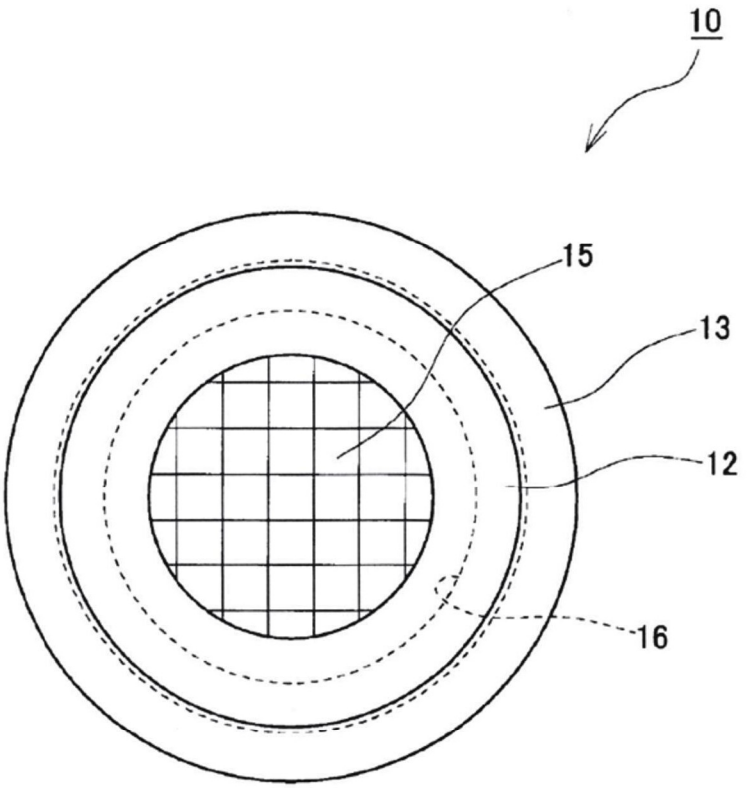


FIG. 5A

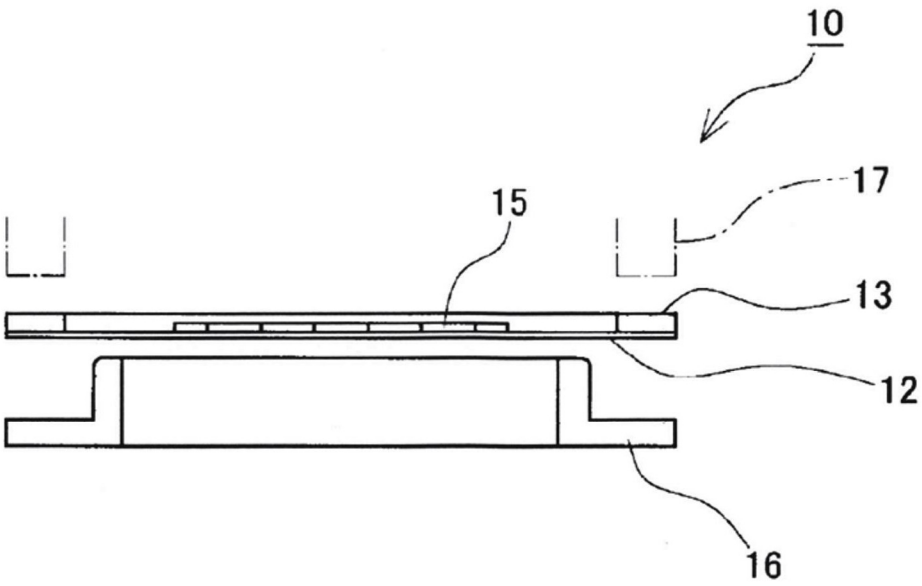


FIG. 5B

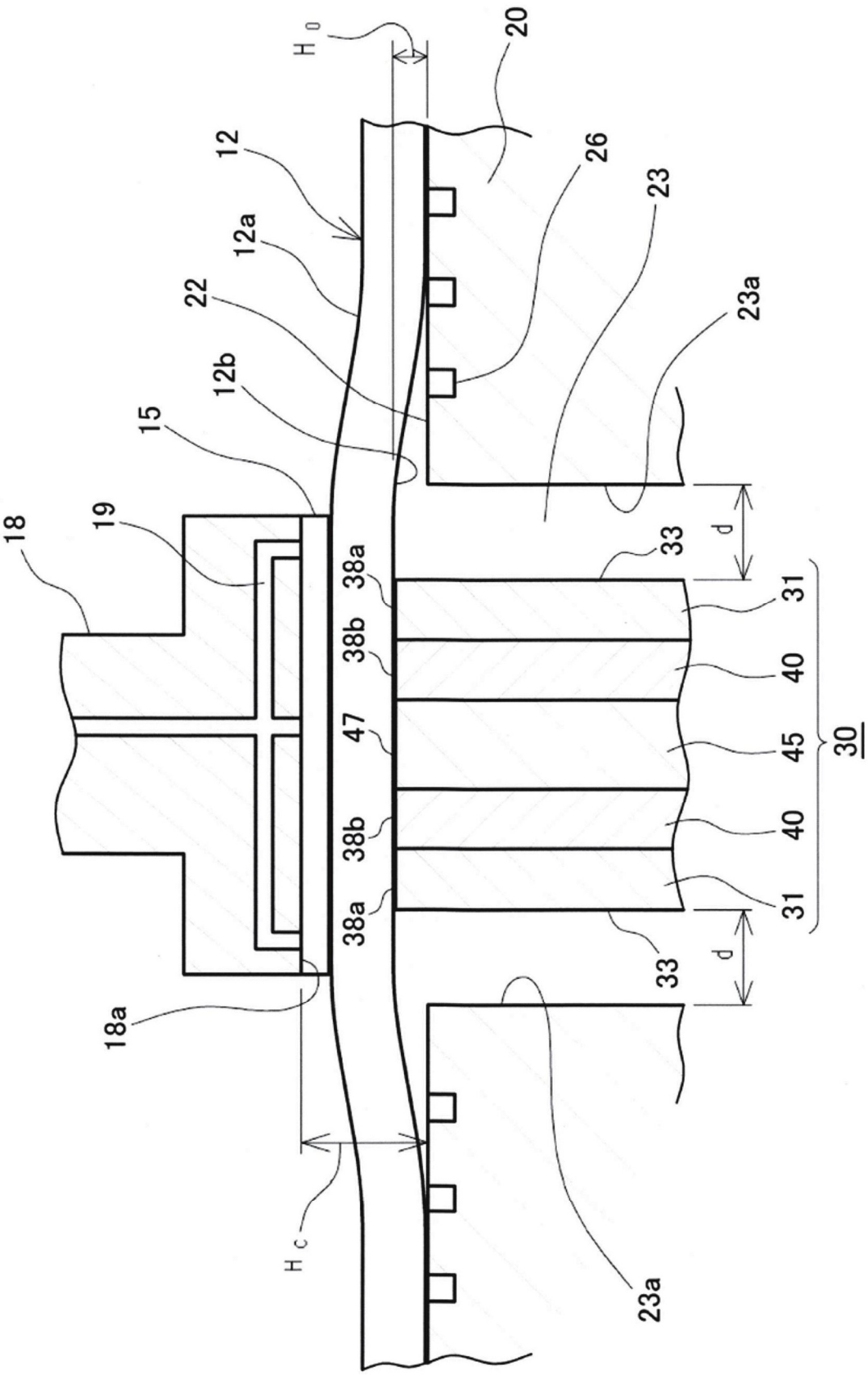

H 0
20
12
12a
22
12b
15
18
19
26
23
23a
33
d
31
40
45
30
38a
38b
47
18a
H c

FIG. 6

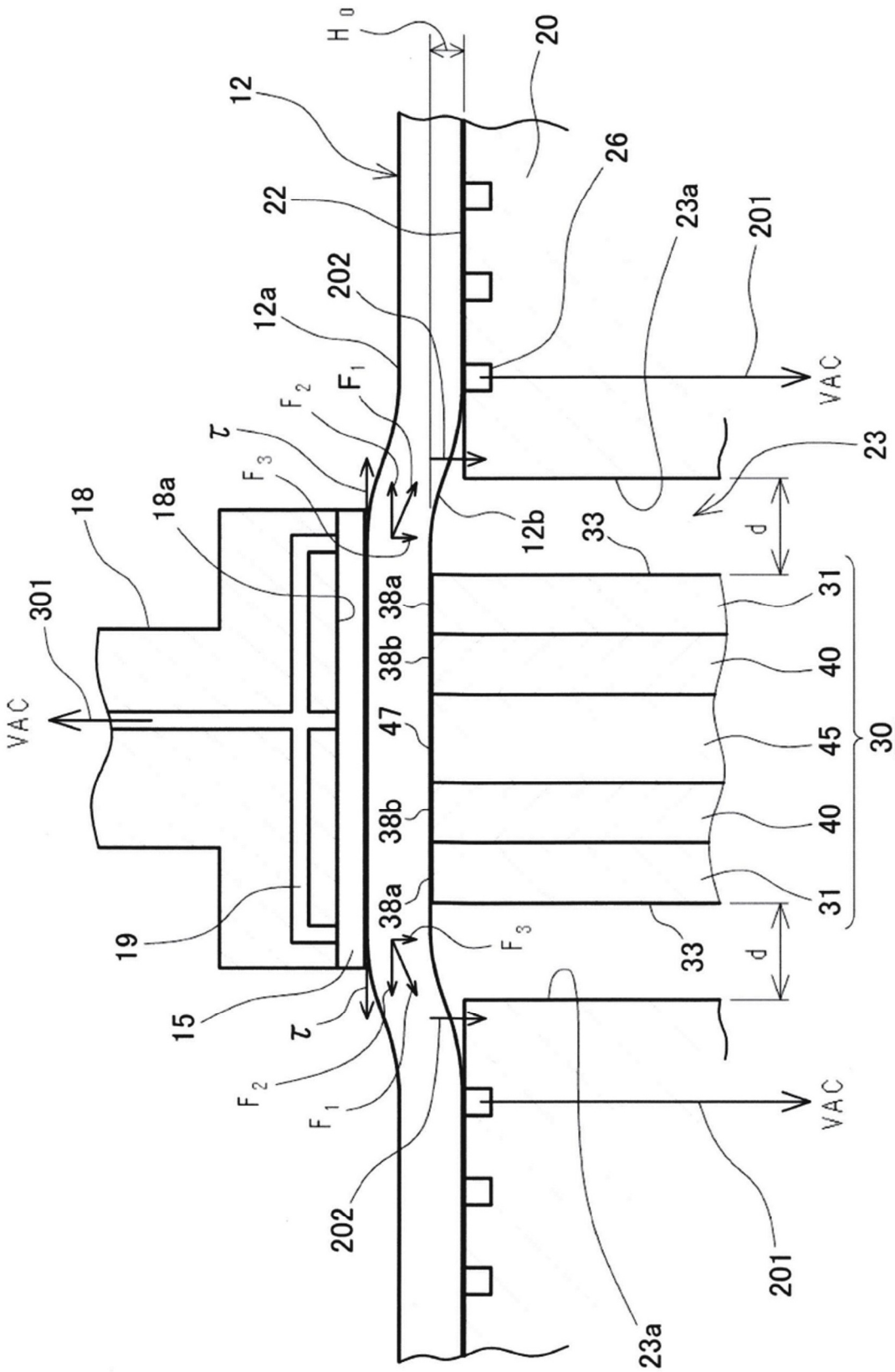

H 0
20
12
26
22
23a
201
202
12a
VAC
F1
F2
τ
F3
23
18
18a
12b
33
d
301
38a
31
38b
40
VAC
47
45
30
38b
40
38a
31
19
F3
33
d
15
τ
F2
F1
VAC
202
201
23a

FIG. 7

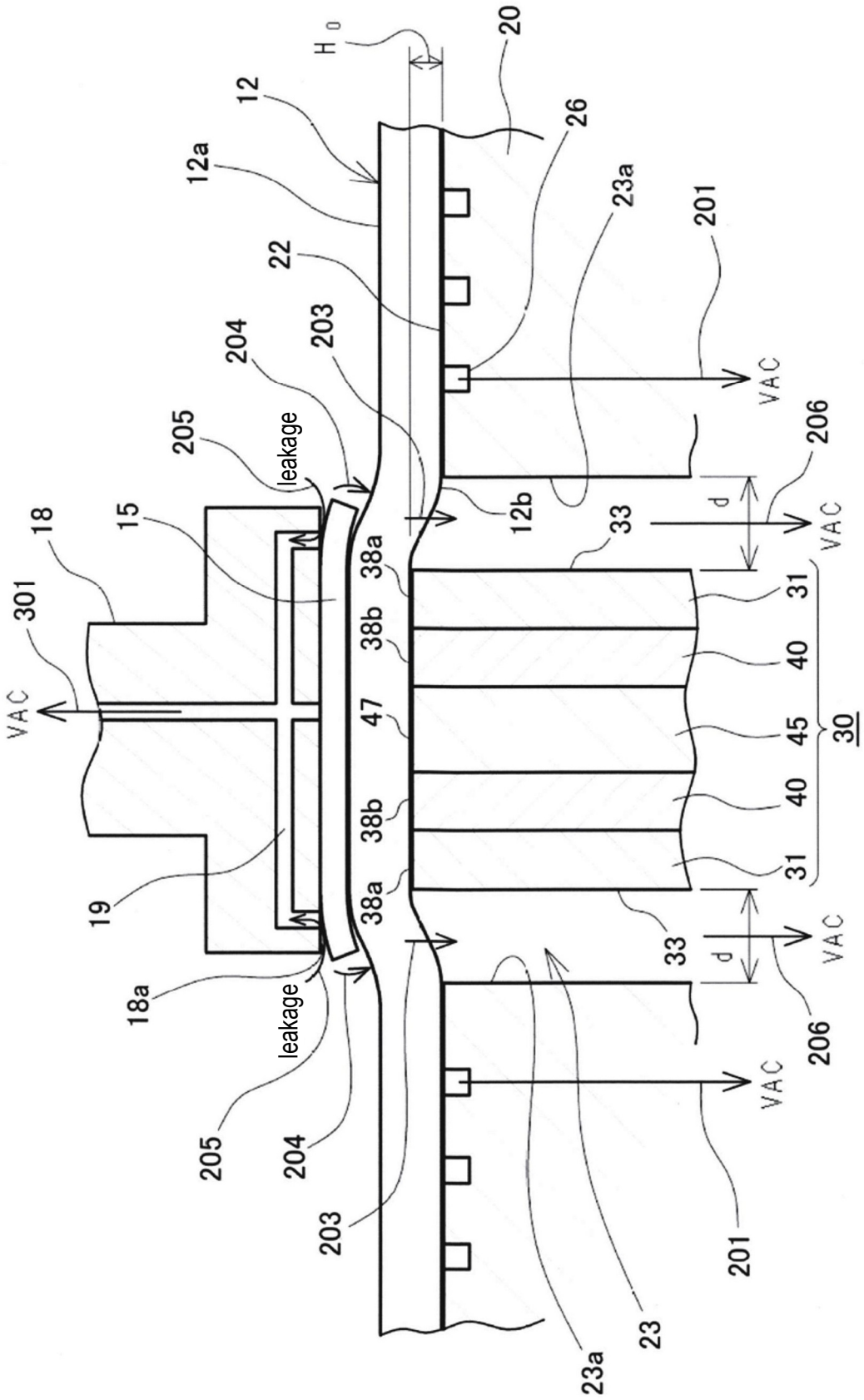

H0
20
12
12a
26
23a
201
22
203
204
205
leakage
VAC
206
18
15
12b
33
d
38a
38b
31
40
47
45
30
301
VAC
19
18a
leakage
205
204
203
23
23a
201

FIG. 8

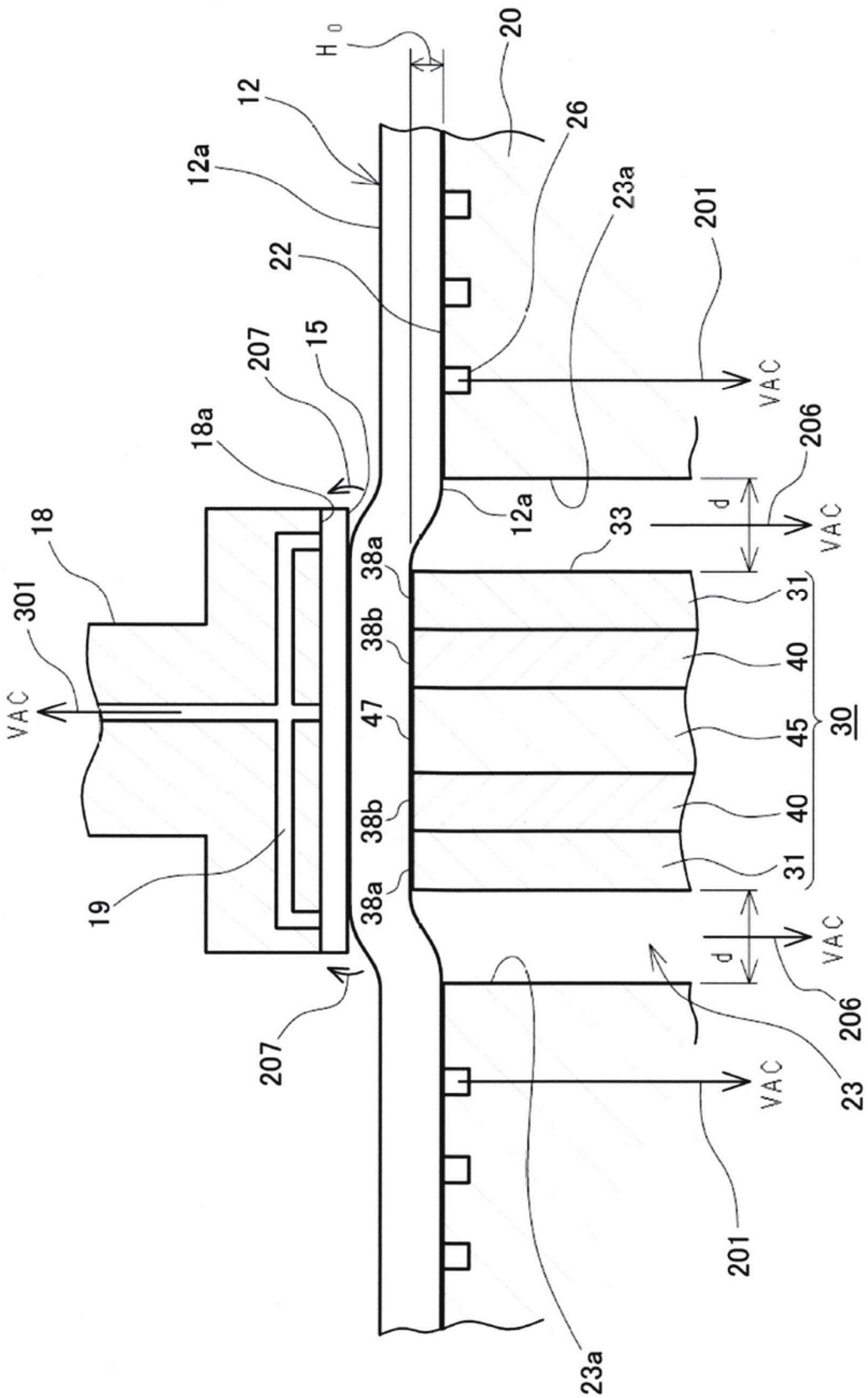

H 0
20
12
12a
26
22
23a
201
207
15
VAC
18a
206
18
12a
d
33
VAC
301
38a
31
38b
40
VAC
47
45
30
19
38b
40
38a
31
d
VAC
206
207
23
VAC
201
23a

FIG. 9

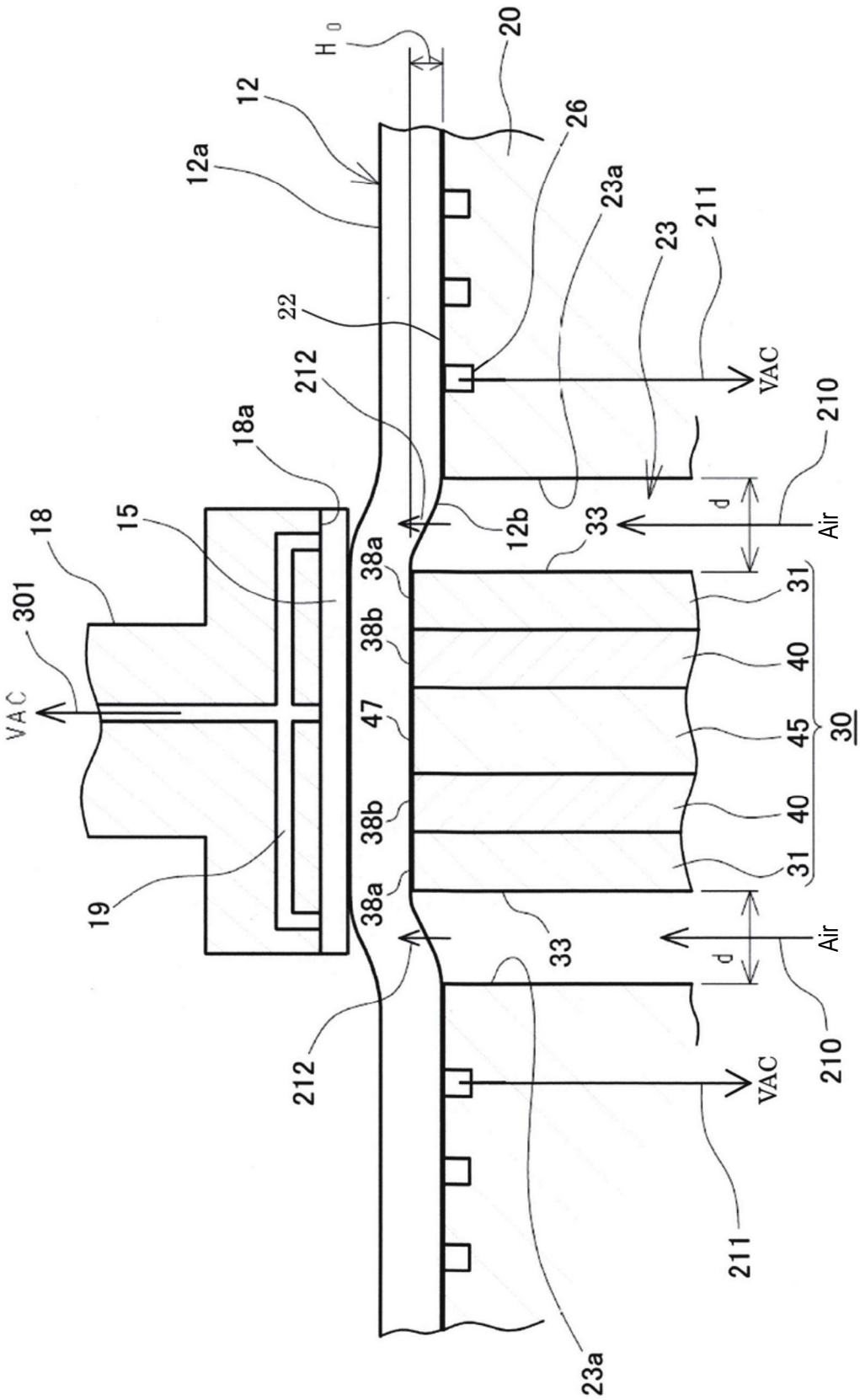

H 0
20
12
12a
26
23a
23
211
22
212
18a
VAC
210
18
15
12b
33
d
Air
301
38a
31
38b
40
47
45
30
19
38b
40
38a
31
33
d
Air
212
VAC
210
211
23a

FIG. 10

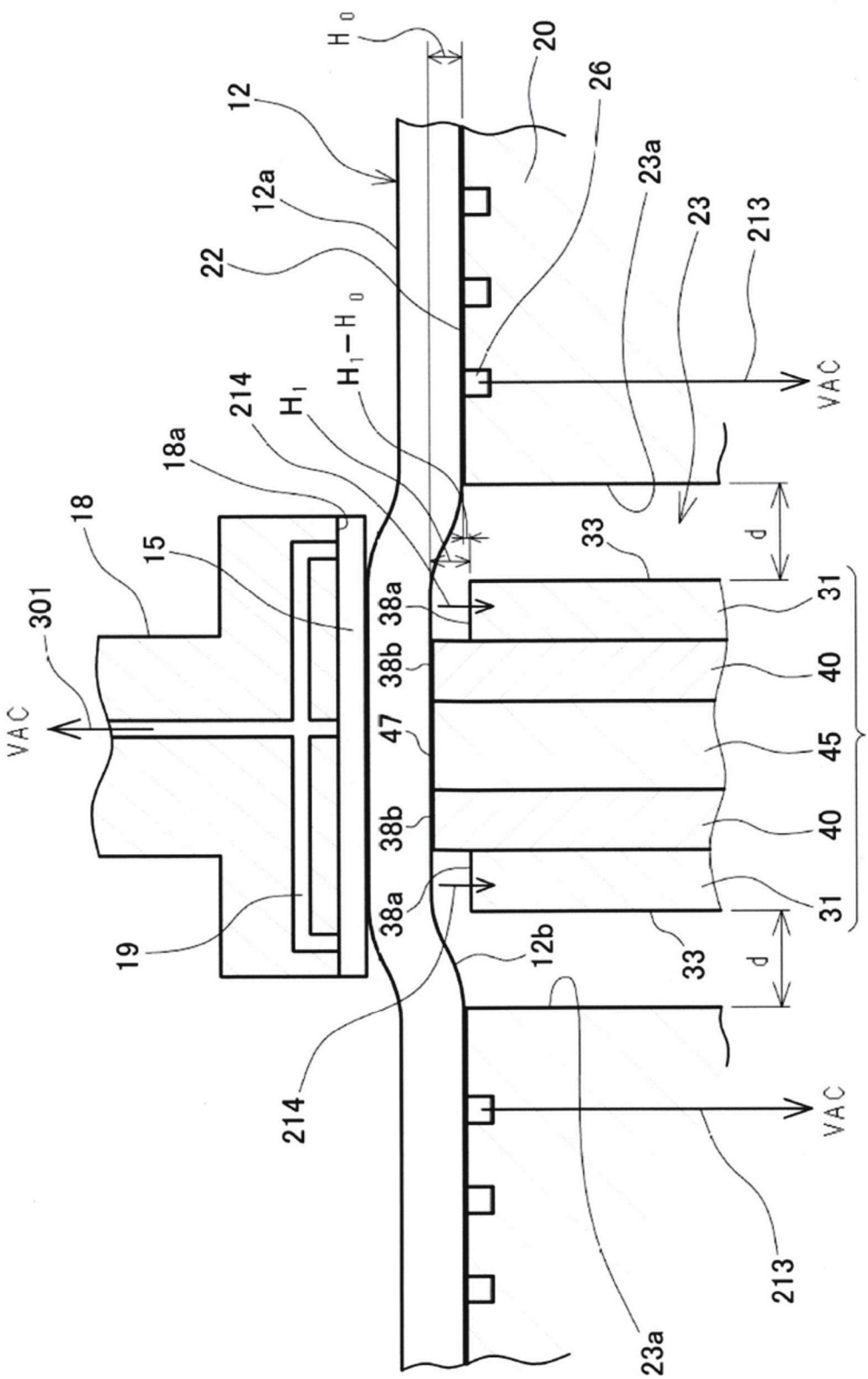

H0
20
26
12
12a
22
H1−H0
214
H1
18a
18
15
301
VAC
19
214
38a
38b
47
38b
38a
12b
23a
213
VAC
33
d
31
40
45
40
31
30
33
d
213
VAC
23
23a

FIG. 11

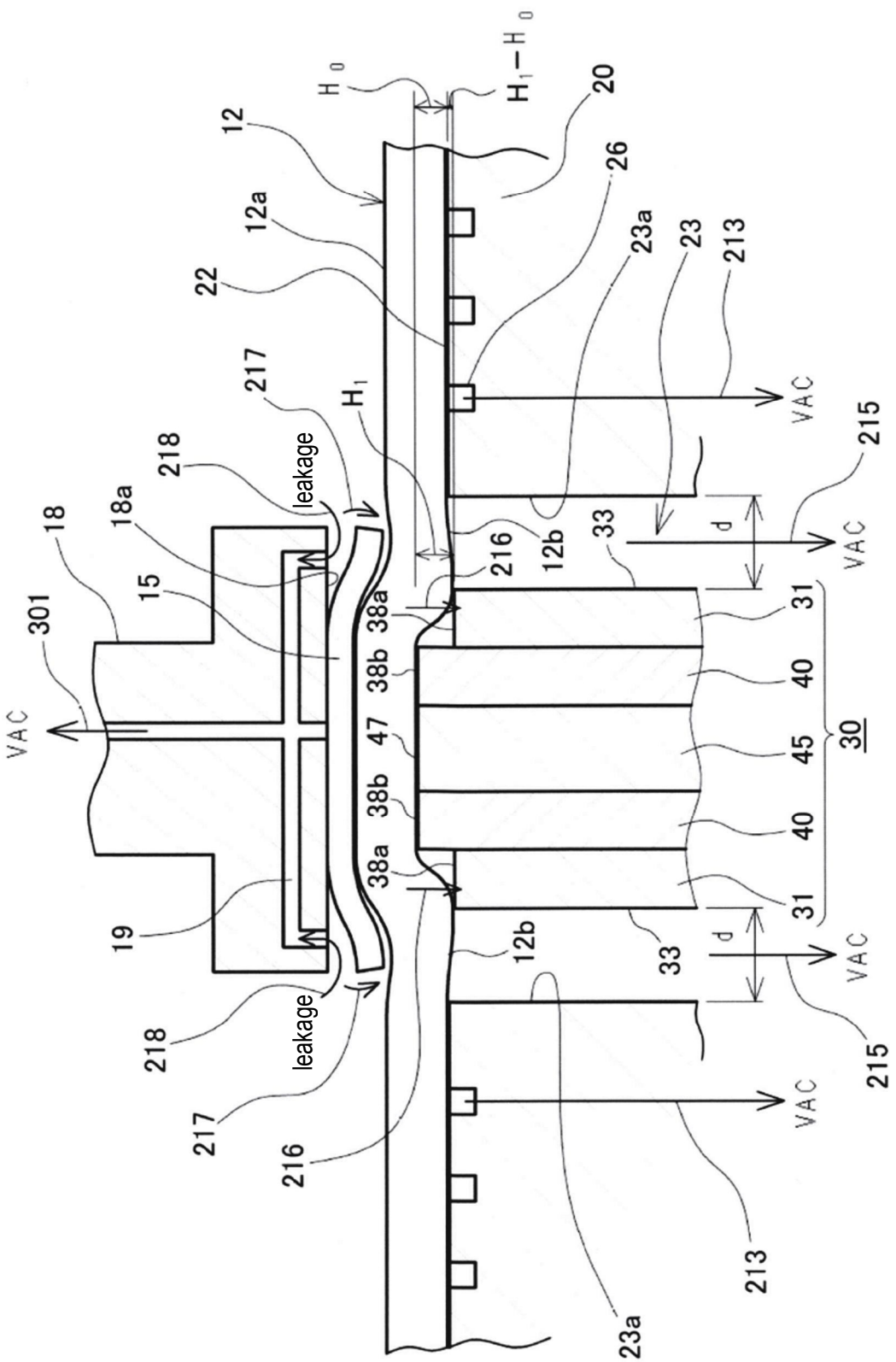

H 0
H1−H0
20
12
26
12a
23a
23
213
22
VAC
217
H1
215
218
leakage
18
18a
216
12b
33
d
VAC
15
38a
31
301
38b
40
VAC
47
45
30
38b
40
38a
31
19
12b
33
d
VAC
218
leakage
215
217
VAC
216
213
23a

FIG. 12

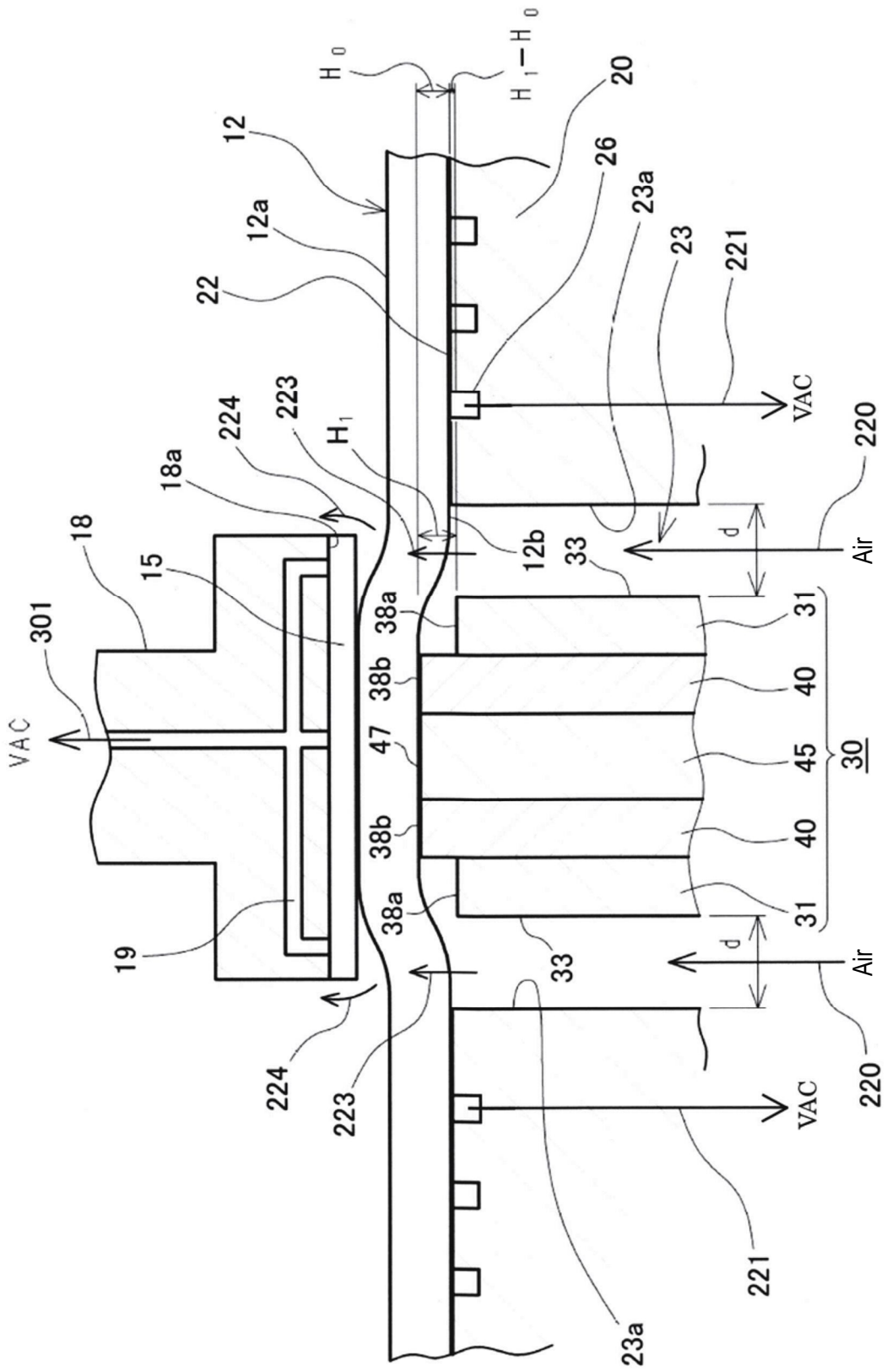

H 0
H 1 − H 0
20
12
26
12a
23a
22
23
221
224
223
H 1
VAC
18a
220
18
12b
33
d
15
Air
301
38a
31
38b
40
VAC
47
45
30
38b
40
38a
31
19
33
d
Air
224
223
220
VAC
221
23a

FIG. 13

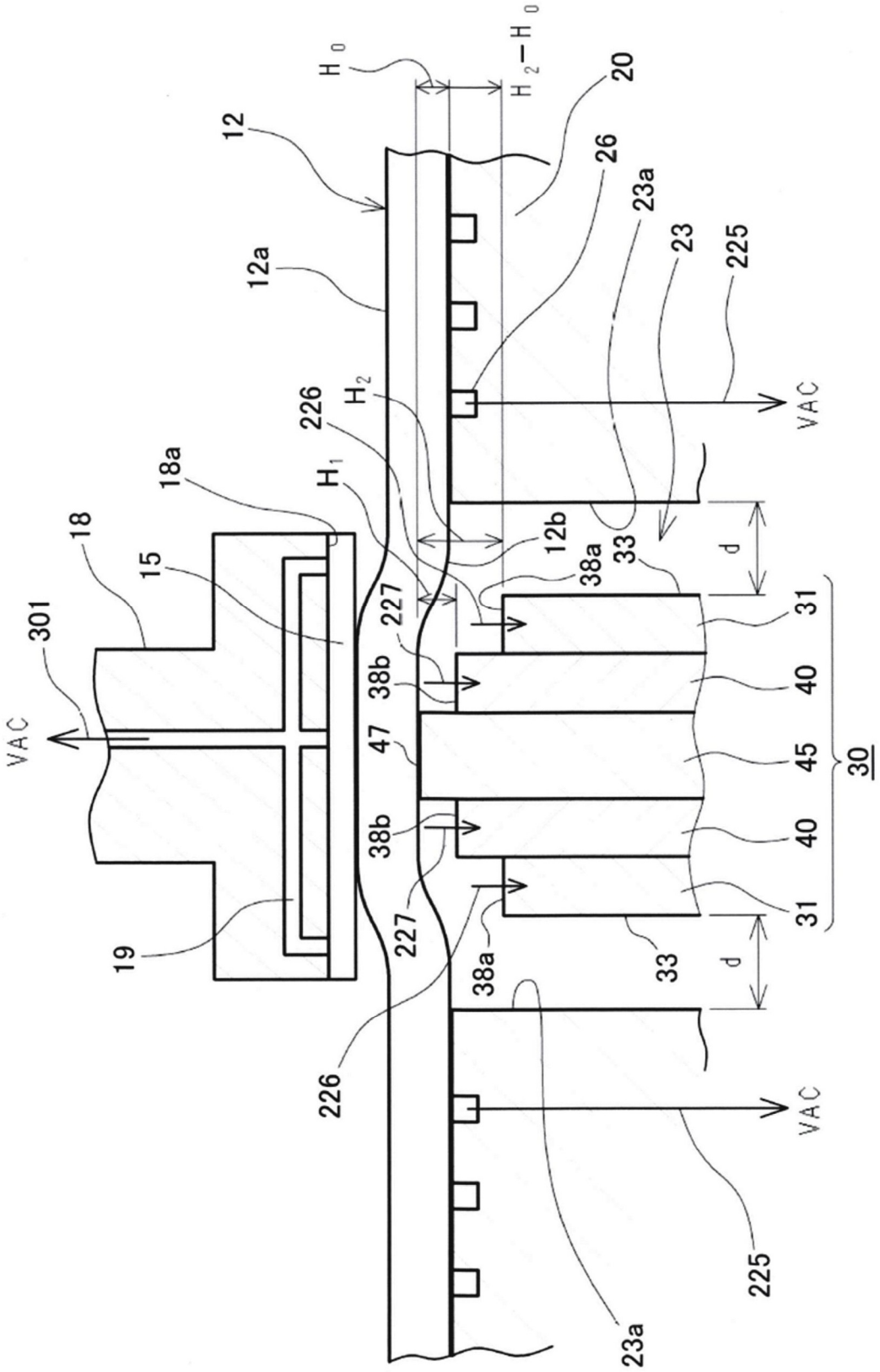

H 0
H 2 − H 0
20
12
26
23a
23
225
12a
H 2
226
H 1
18a
18
15
301
VAC
12b
38a
33
d
227
38b
47
31
40
45
30
19
VAC
225
23a

FIG. 14

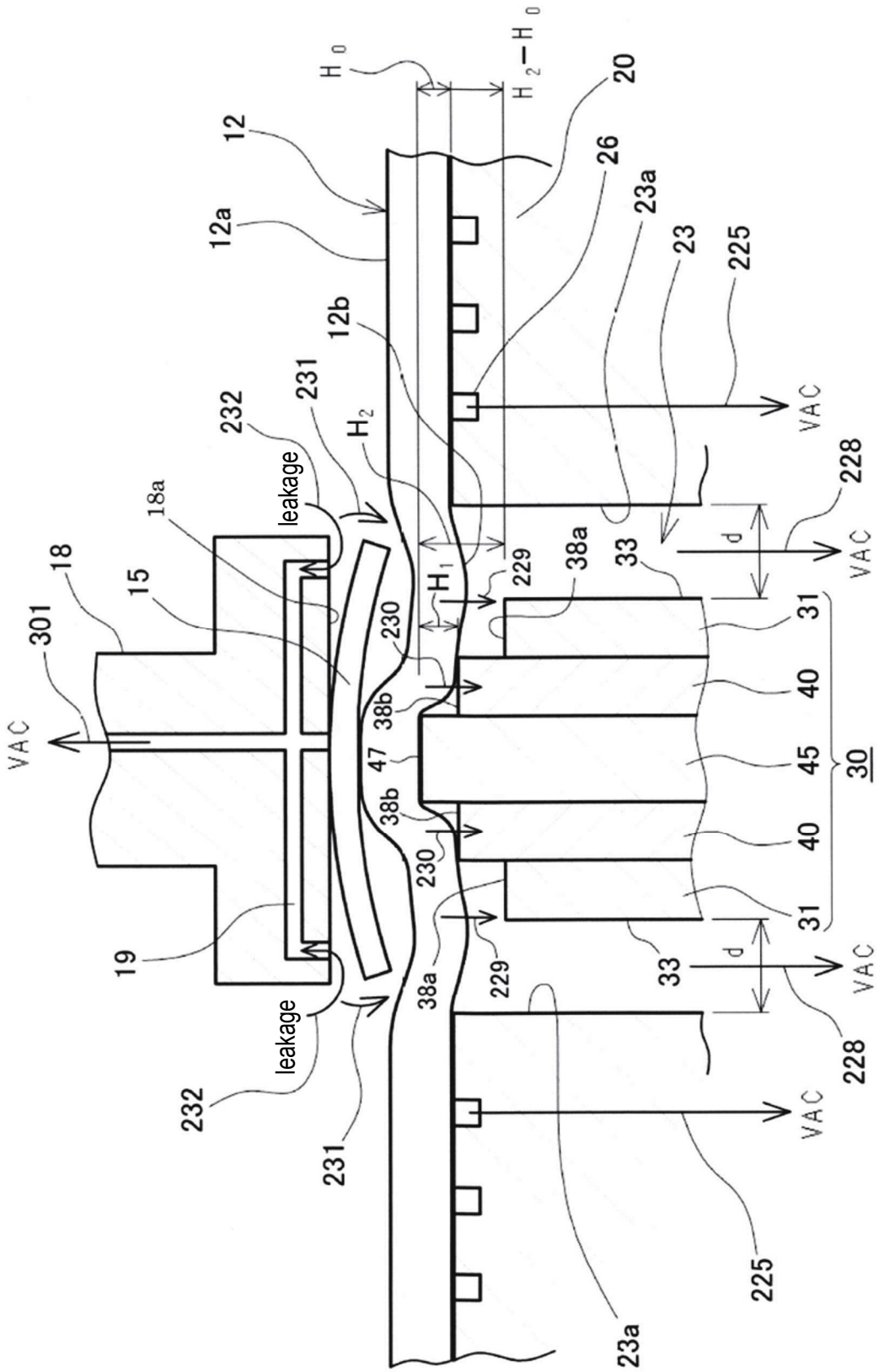

H 0
H 2 − H 0
12
12a
12b
20
26
23a
23
225
VAC
228
d
231
232
leakage
H 2
18a
18
15
301
H 1
229
38a
33
31
40
45
30
38b
47
230
19

FIG. 15

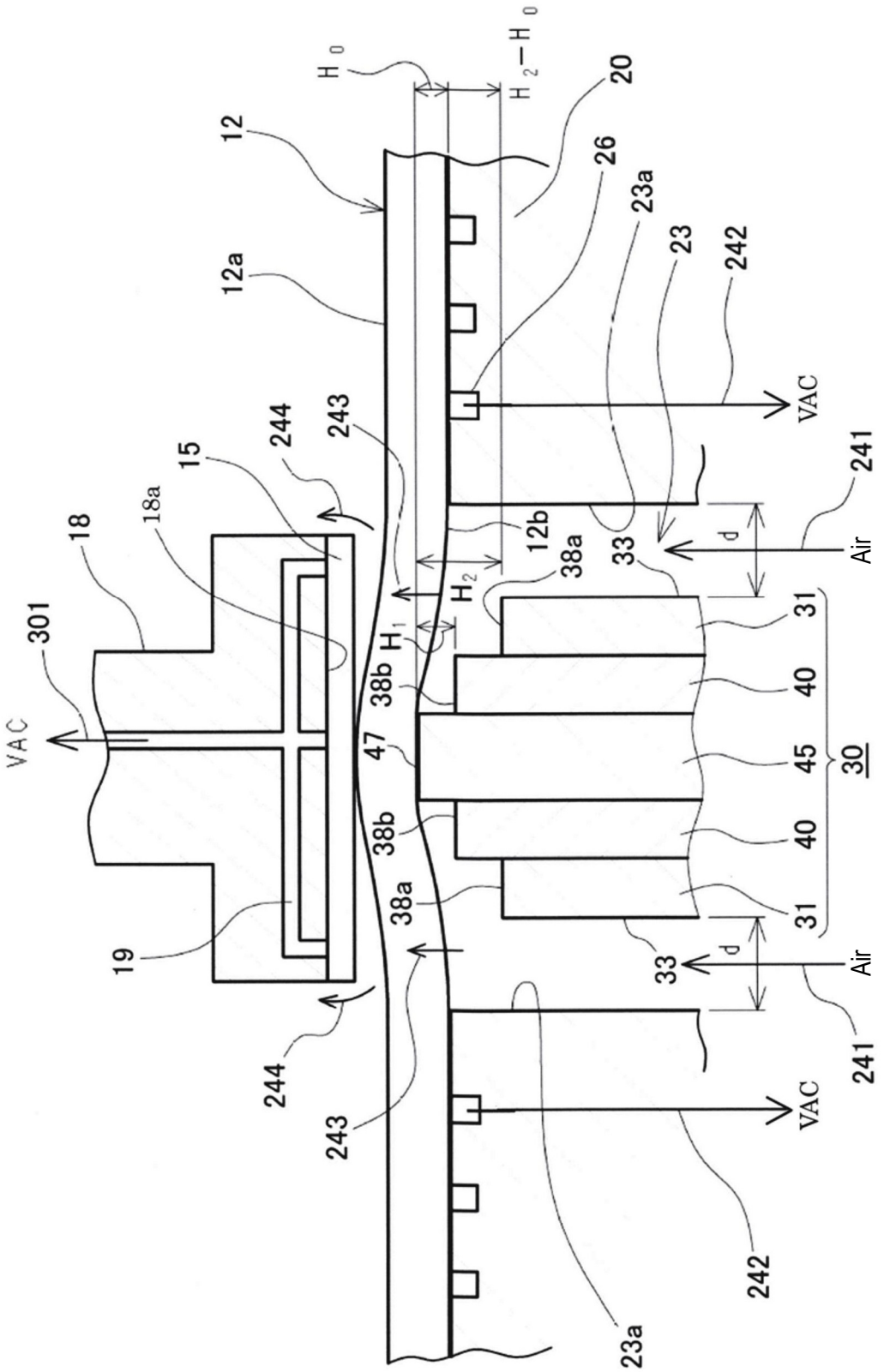

H 0
H 2 − H 0
12
20
26
23a
23
242
12a
VAC
241
Air
d
15
244
243
18
18a
12b
38a
33
H 2
H 1
301
38b
31
40
VAC
47
45
30
38b
40
38a
31
19
33
d
Air
244
241
243
VAC
242
23a

FIG. 16

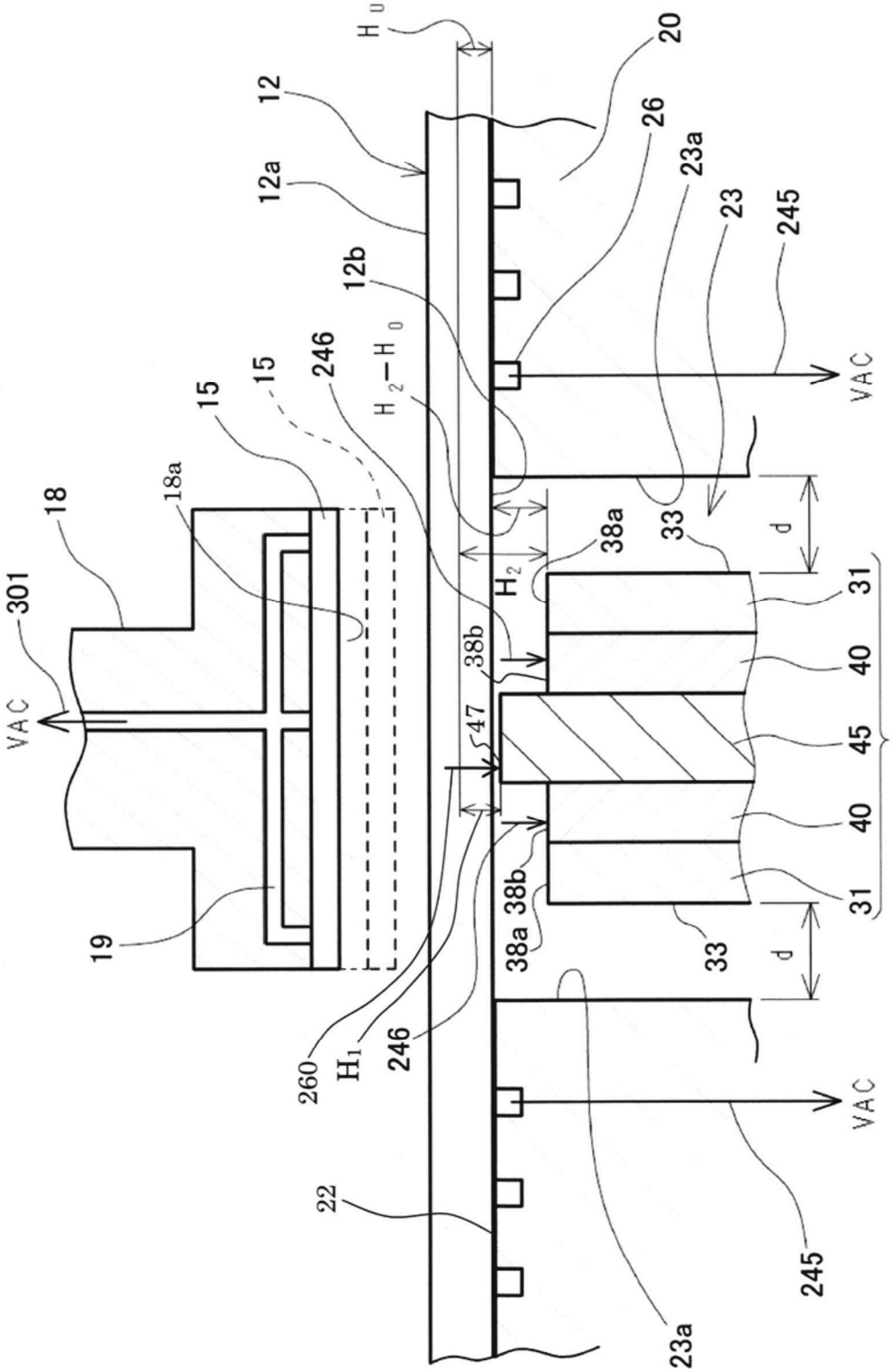

H u
12
12a
12b
20
26
23a
23
245
246
H 2 − H 0
15
15
18a
18
301
VAC
19
38a
33
d
H2
38b
31
40
47
45
30
40
31
38a 38b
33
d
260
H1
246
VAC
22
245
23a

FIG. 17

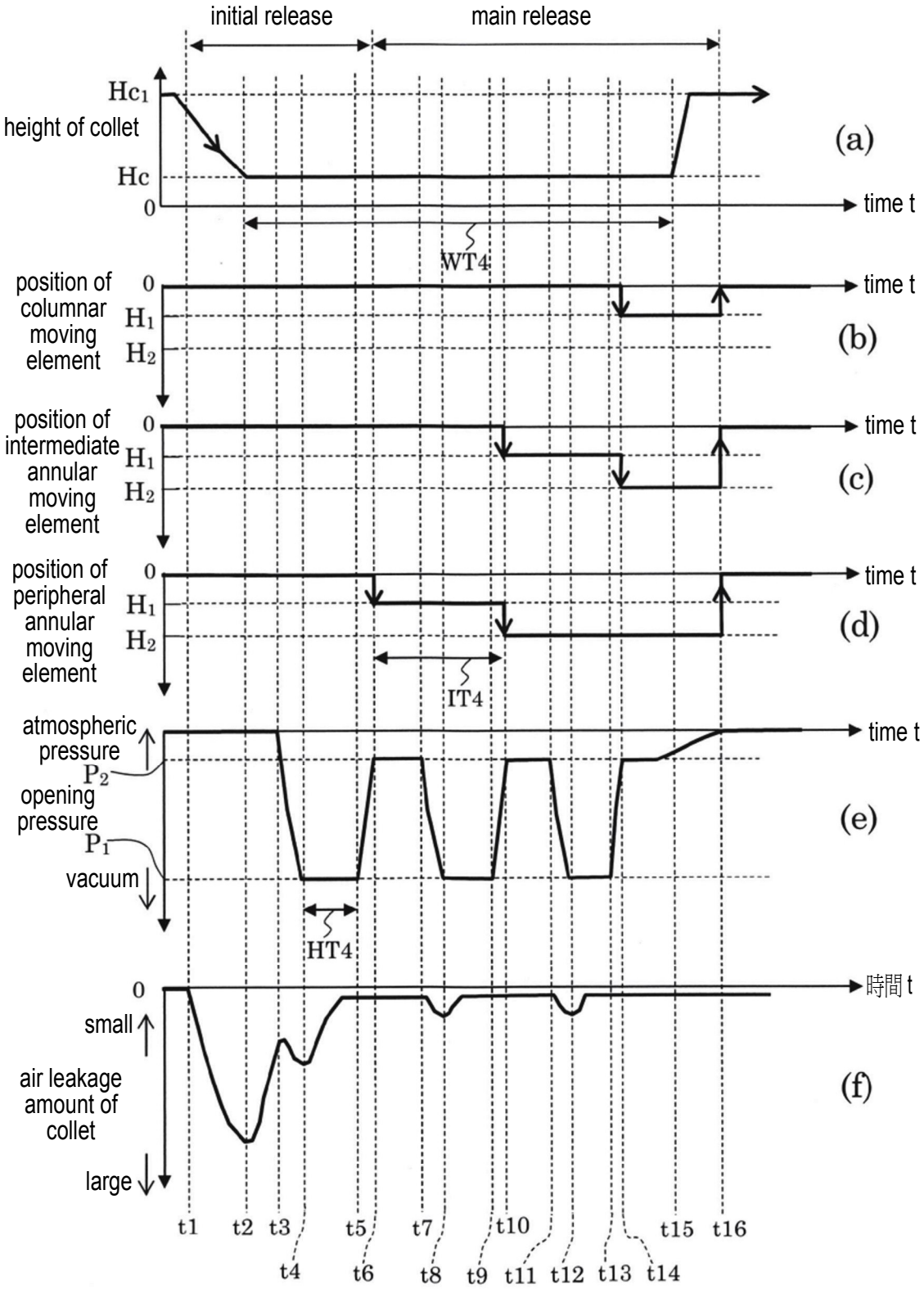

initial release
main release
Hc1
height of collet
Hc
0
time t
(a)
WT4
position of columnar moving element
H1
H2
(b)
position of intermediate annular moving element
(c)
position of peripheral annular moving element
(d)
IT4
atmospheric pressure
P2
opening pressure
P1
vacuum
(e)
HT4
時間 t
small
air leakage amount of collet
large
(f)
t1
t2
t3
t4
t5
t6
t7
t8
t9
t10
t11
t12
t13
t14
t15
t16

FIG. 18

160

release parameter	high speed ← level → low speed (stable)							
	1	2	3	4	5	6	7	8
number of switches of opening pressure during initial release (FSN)	1 (FSN1)	1	1	1 (FSN4)	2	3	3	4 (FSN8)
number of switches of opening pressure during main release (SSN)	1 (SSN1)	1	2	2 (SSN4)	2	3	4	4 (SSN8)
holding time of first pressure (HT)	100 (HT1)	130	130	130 (HT4)	140	140	150	150 (HT8)
number of moving elements descended simultaneously (DN)	3 (DN1)	2	2	0 (DN4)	0	0	0	0 (DN8)
descending time interval between moving elements (IT)	0 (IT1)	100	210	240 (IT4)	300	350	350	450 (IT8)
collet waiting time (WT)	460 (WT1)	540	660	710 (WT4)	990	1140	1290	1590 (WT8)
pickup time (PT)	570 (PT1)	650	770	820 (PT4)	1100	1250	1400	1700 (PT8)

FIG. 19

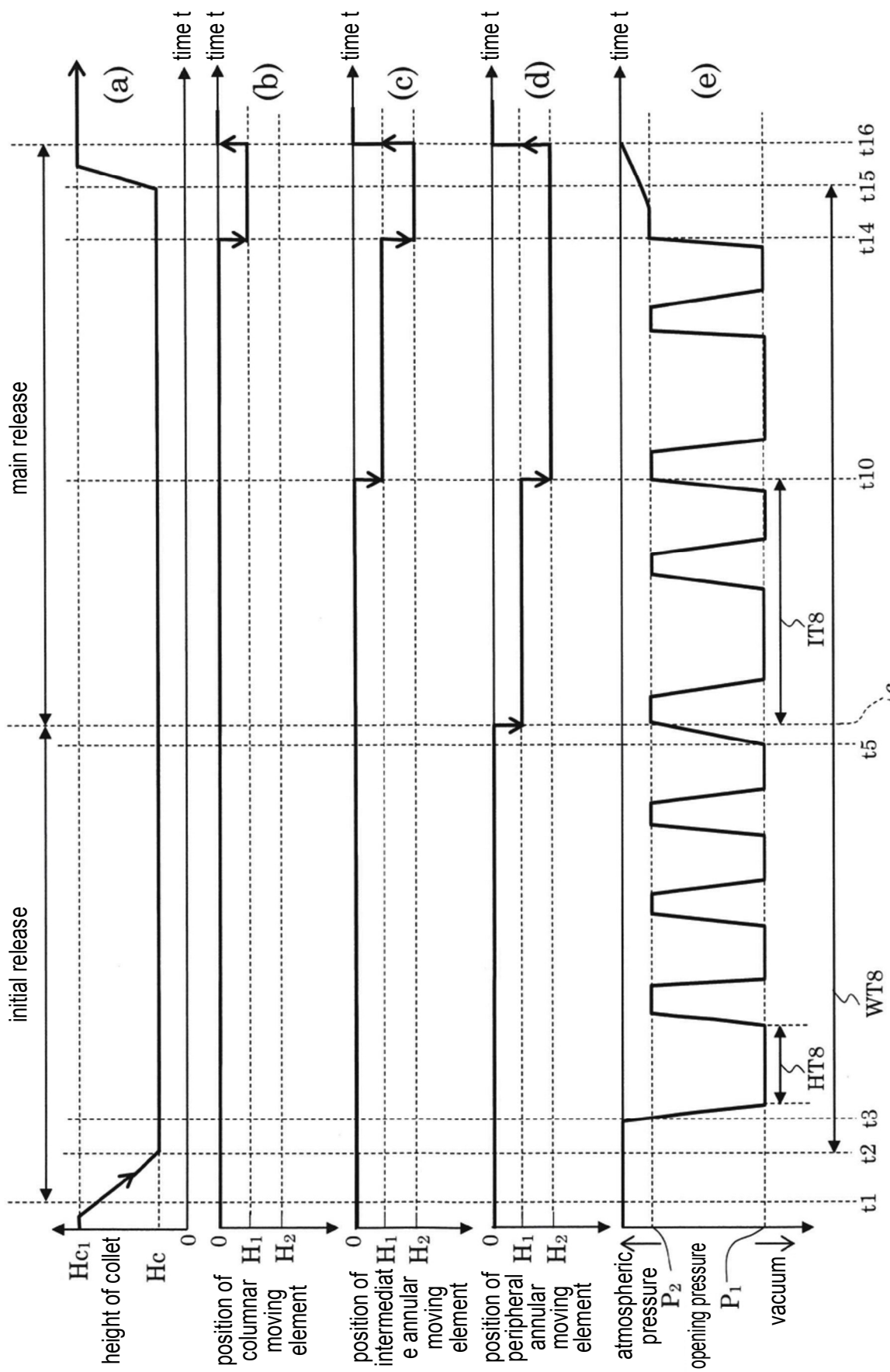

initial release
main release
(a)
(b)
(c)
(d)
(e)
time t
Hc1
height of collet
Hc
0
position of columnar moving element
position of intermediate annular moving element
position of peripheral annular moving element
H1
H2
atmospheric pressure
P2
opening pressure
P1
vacuum
t1
t2
t3
t5
t6
t10
t14
t15
t16
HT8
WT8
IT8

FIG. 20

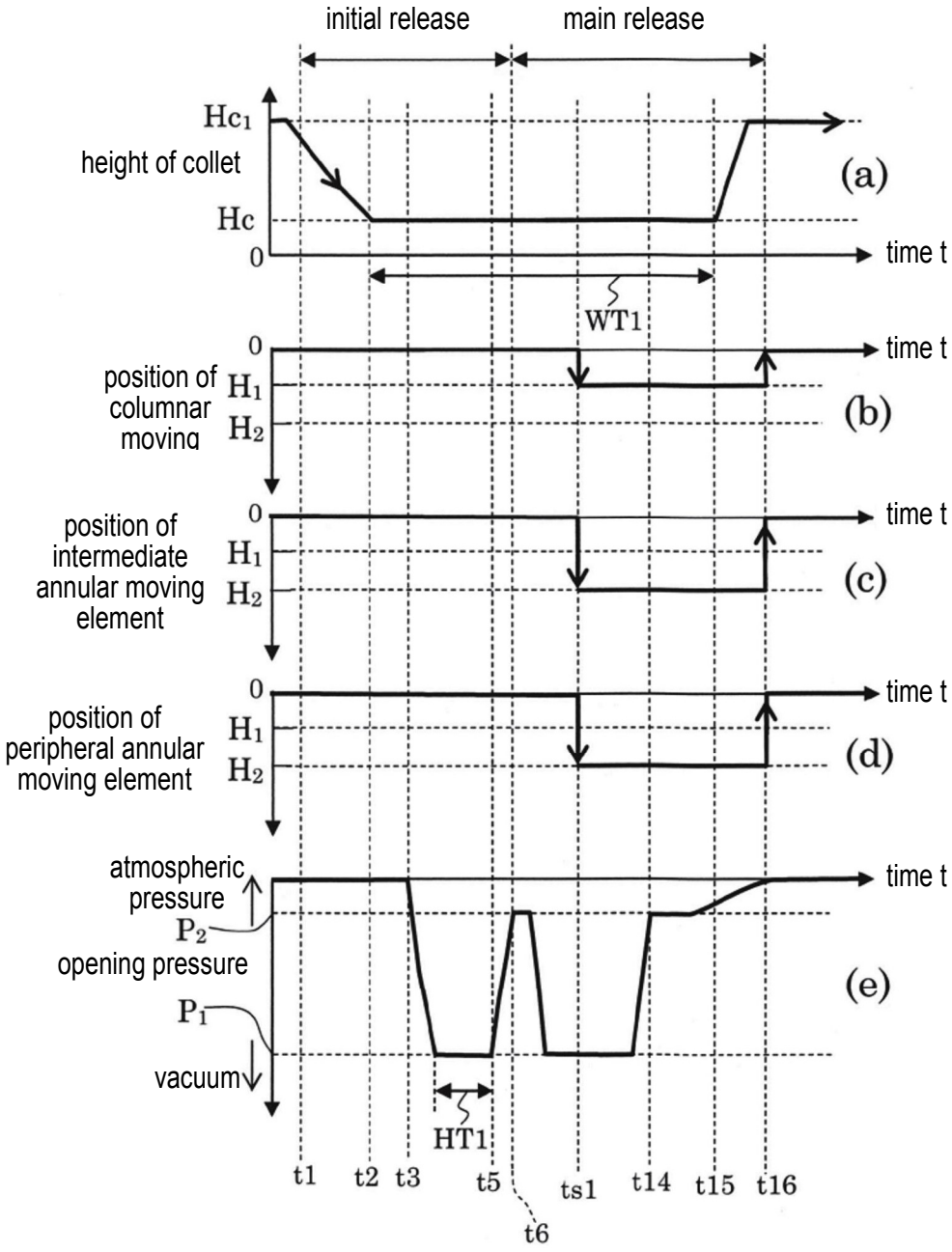

initial release
main release
Hc1
height of collet
Hc
0
(a)
time t
WT1
0
position of columnar moving
H1
H2
(b)
time t
position of intermediate annular moving element
(c)
position of peripheral annular moving element
(d)
atmospheric pressure
P2
opening pressure
P1
vacuum
(e)
HT1
t1
t2
t3
t5
t6
ts1
t14
t15
t16

FIG. 21

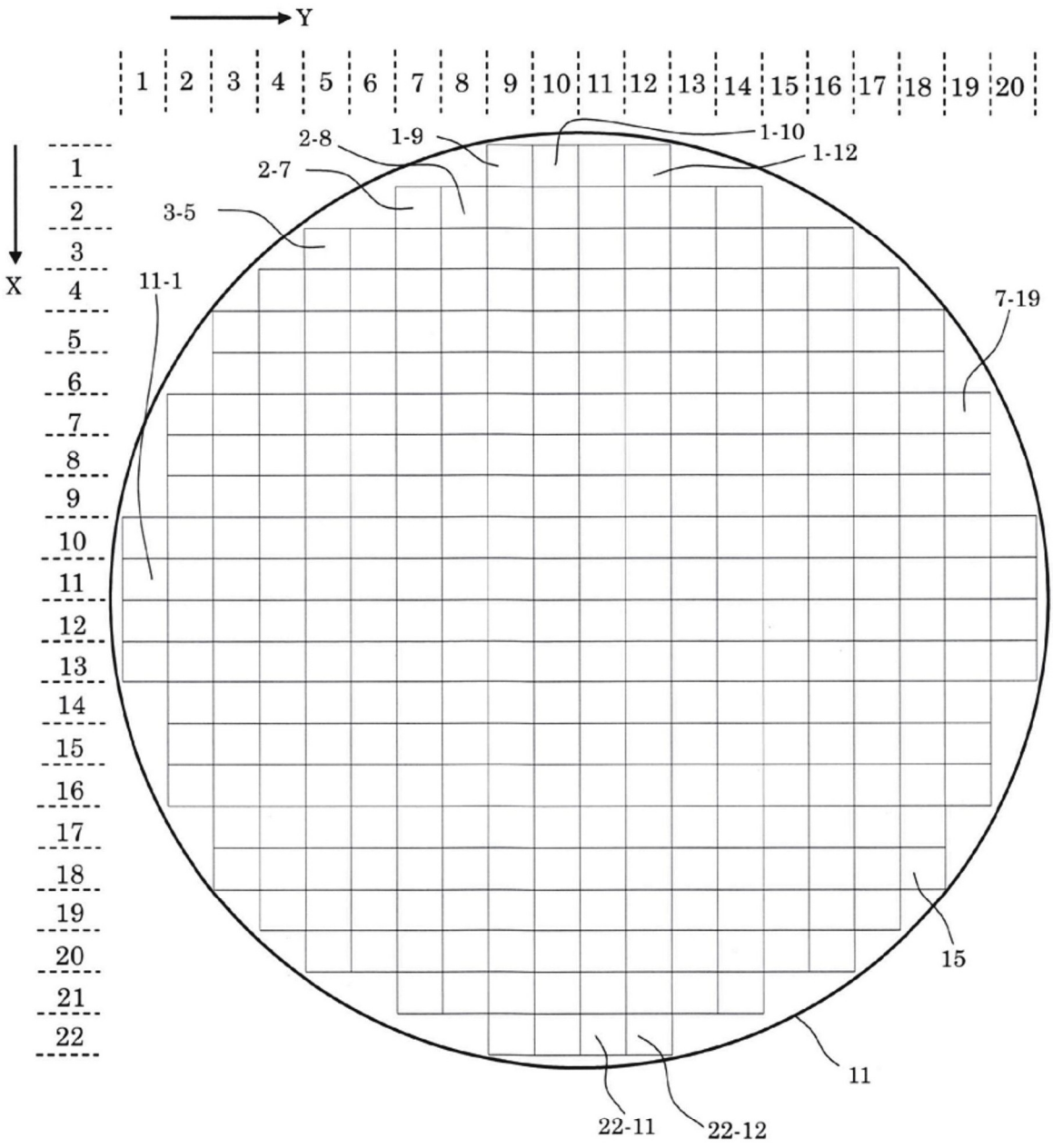

Y
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
X
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
2-8
1-9
1-10
1-12
2-7
3-5
11-1
7-19
15
11
22-11
22-12

FIG. 22

159

die identification number	level
1-9	7
1-10	7
1-11	7
1-12	7
2-7	7
2-8	7
:	:
11-1	7
11-2	7
11-3	6
11-4	6
11-5	5
11-6	5
11-7	4
11-8	4
11-9	3
11-10	3
:	:
21-14	7
22-9	7
22-10	7
22-11	7
22-12	7

FIG. 23

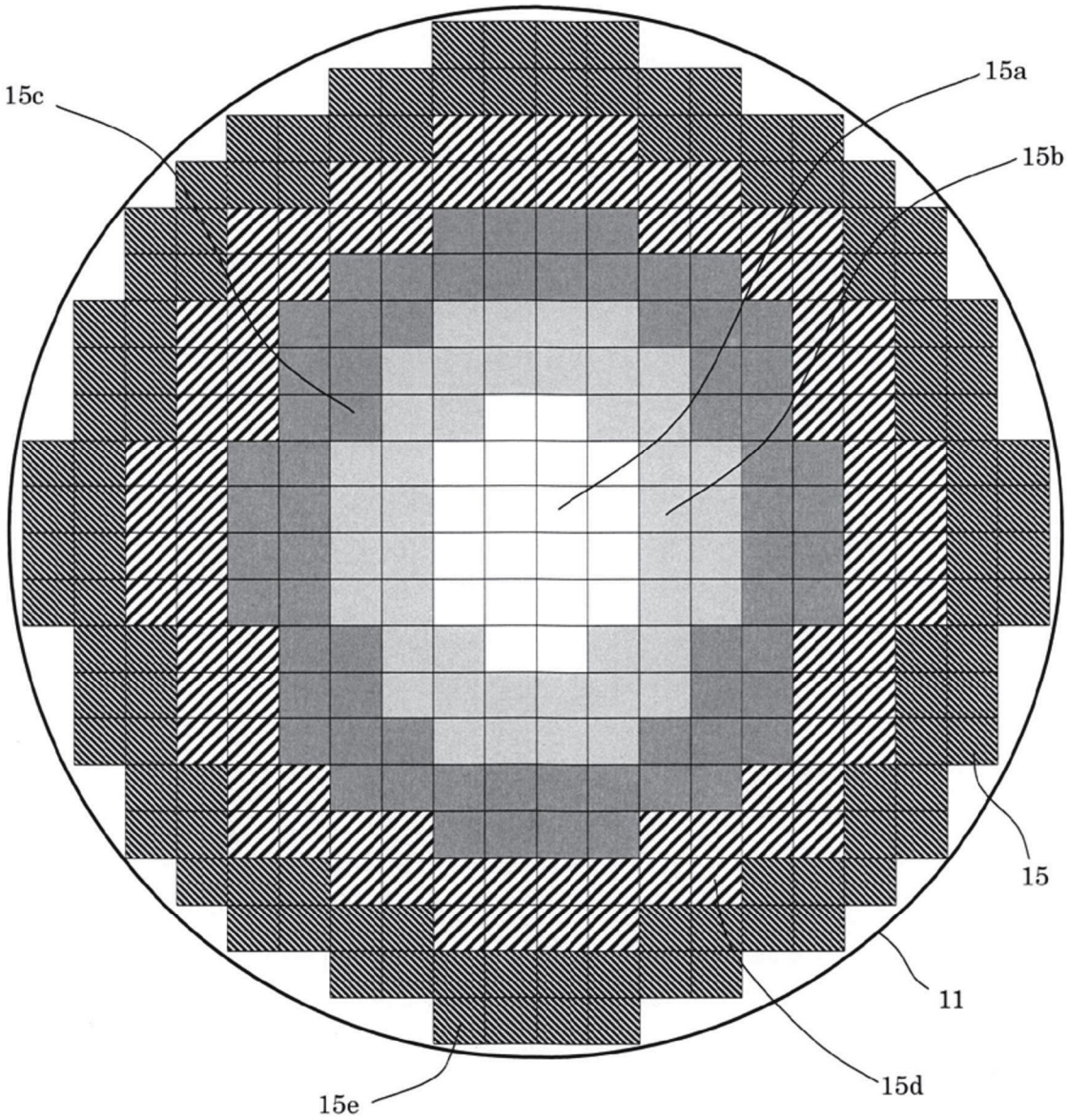


FIG. 24

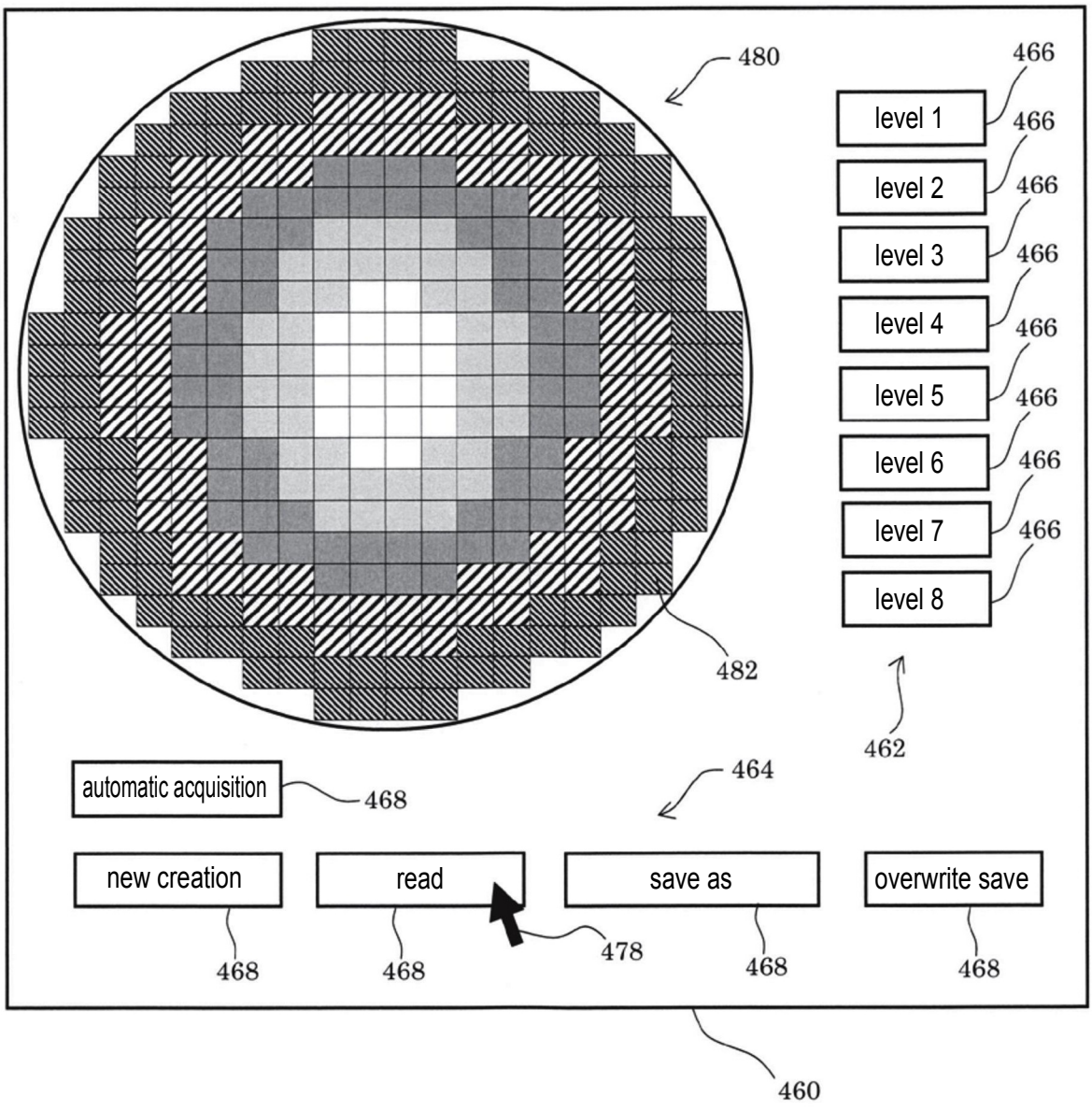

480
466
level 1
level 2
level 3
level 4
level 5
level 6
level 7
level 8
482
462
automatic acquisition
468
464
new creation
read
save as
overwrite save
478
460

FIG. 25

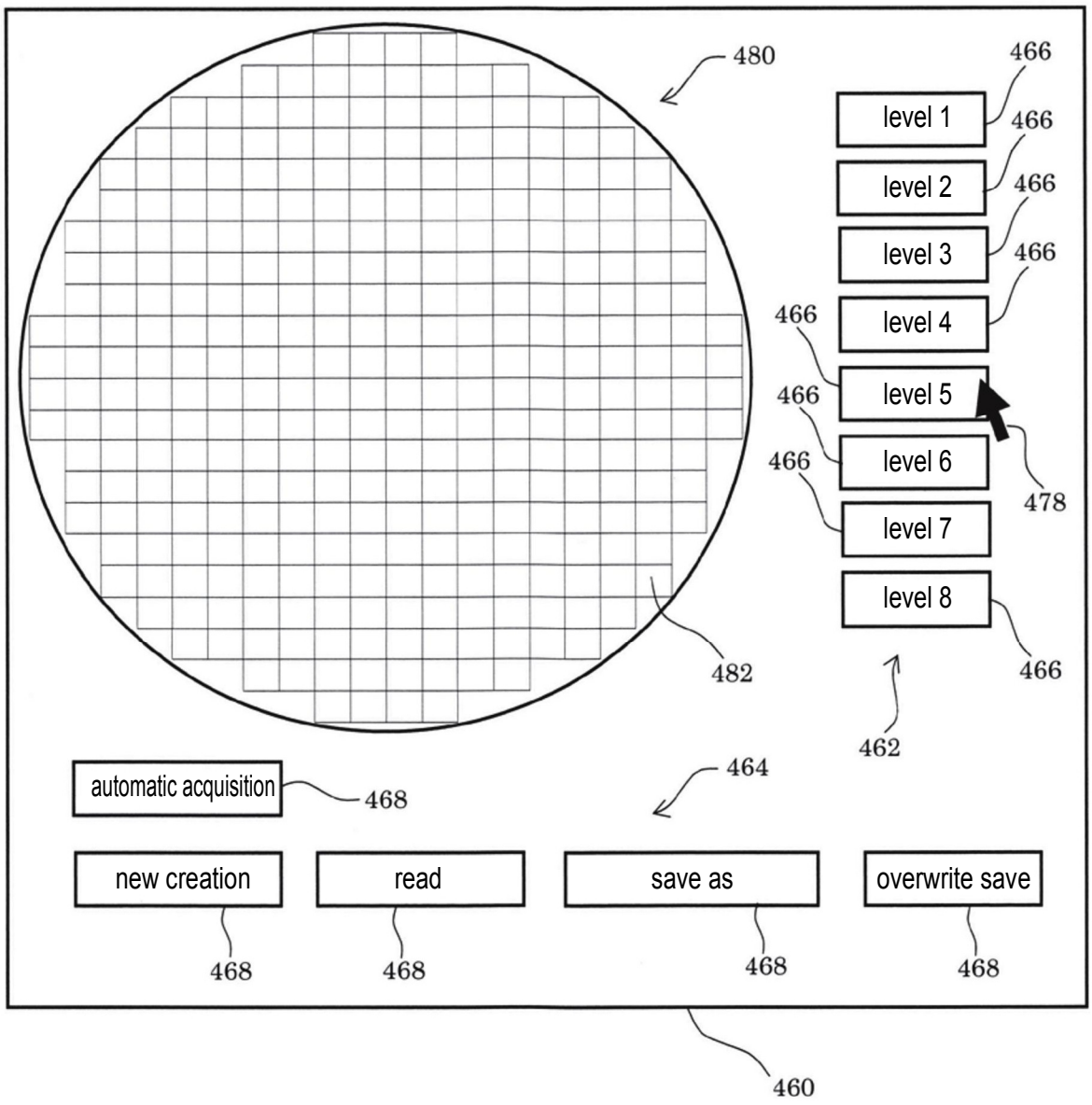

480
466
level 1
level 2
level 3
level 4
level 5
level 6
level 7
level 8
478
482
462
automatic acquisition
468
464
new creation
read
save as
overwrite save
460

FIG. 26

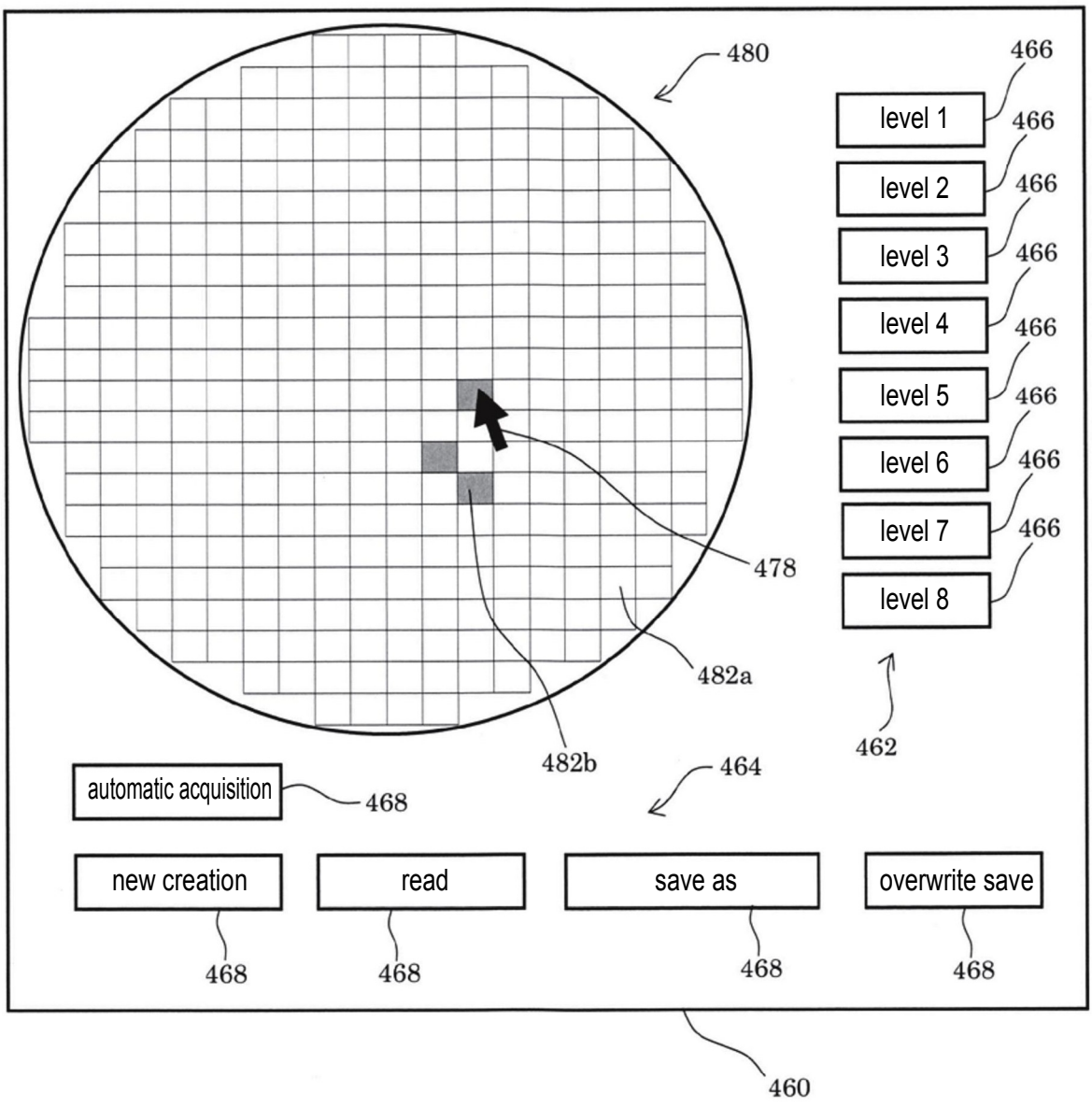

480
466
level 1
level 2
level 3
level 4
level 5
level 6
level 7
level 8
478
482a
482b
462
automatic acquisition
468
464
new creation
read
save as
overwrite save
468
468
468
468
460

FIG. 27

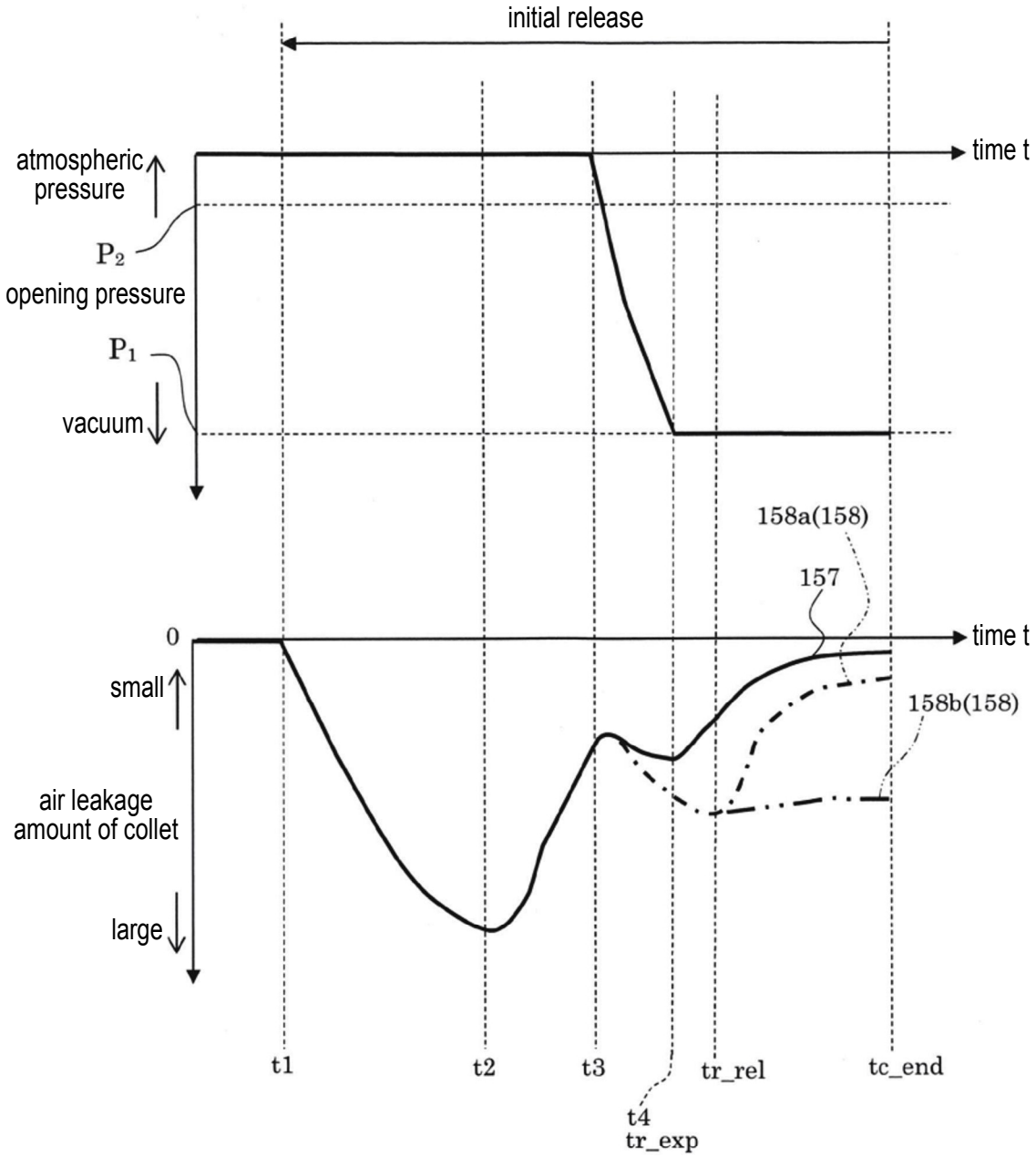

initial release
atmospheric pressure
time t
P2
opening pressure
P1
vacuum
158a(158)
157
0
time t
small
158b(158)
air leakage amount of collet
large
t1
t2
t3
tr_rel
tc_end
t4
tr_exp

FIG. 28

161

threshold value	high speed ← level → low speed (stable)							
	1	2	3	4	5	6	7	8
lower threshold value TH1	0.96	0.91	0.86	0.81	0.76	0.71	0.66	
upper threshold value TH2		0.95	0.90	0.85	0.80	0.75	0.70	0.65

FIG. 29

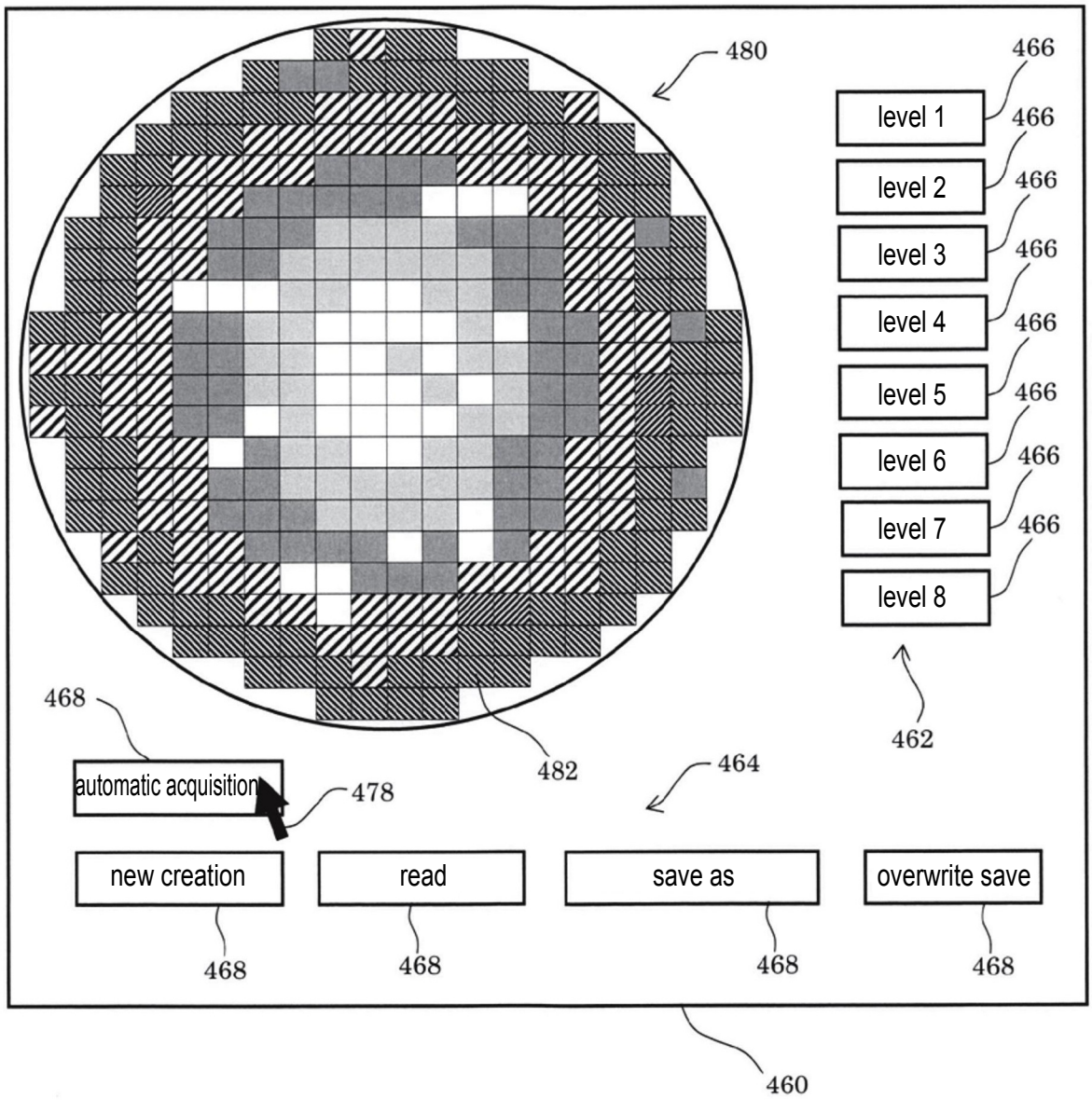

480
466
level 1
level 2
level 3
level 4
level 5
level 6
level 7
level 8
462
468
automatic acquisition
478
482
464
new creation
read
save as
overwrite save
468
468
468
468
460

FIG. 30

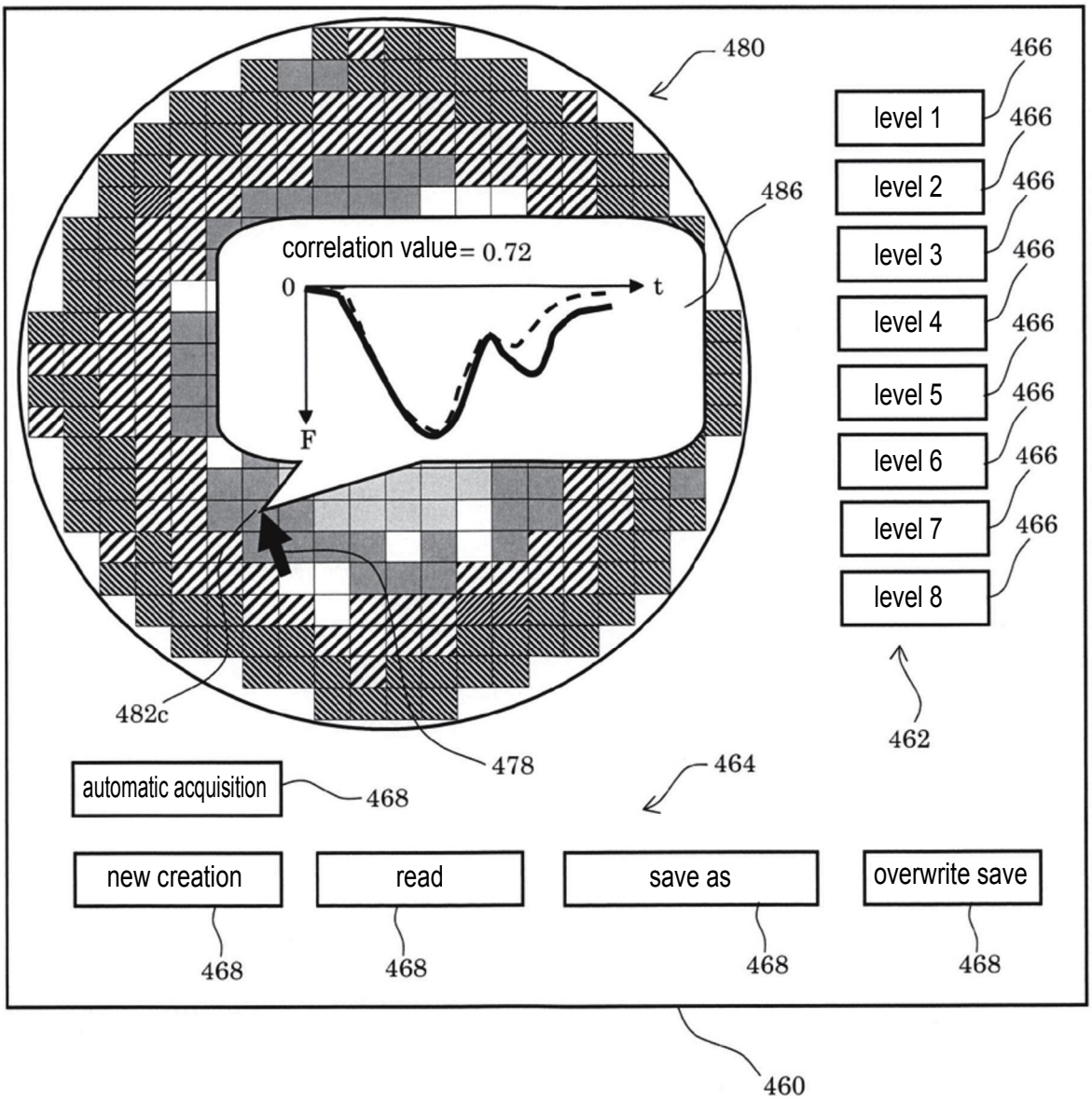

480
466
level 1
level 2
level 3
level 4
level 5
level 6
level 7
level 8
486
correlation value = 0.72
0
t
F
482c
478
462
automatic acquisition
468
464
new creation
read
save as
overwrite save
468
468
468
468
460

FIG. 31

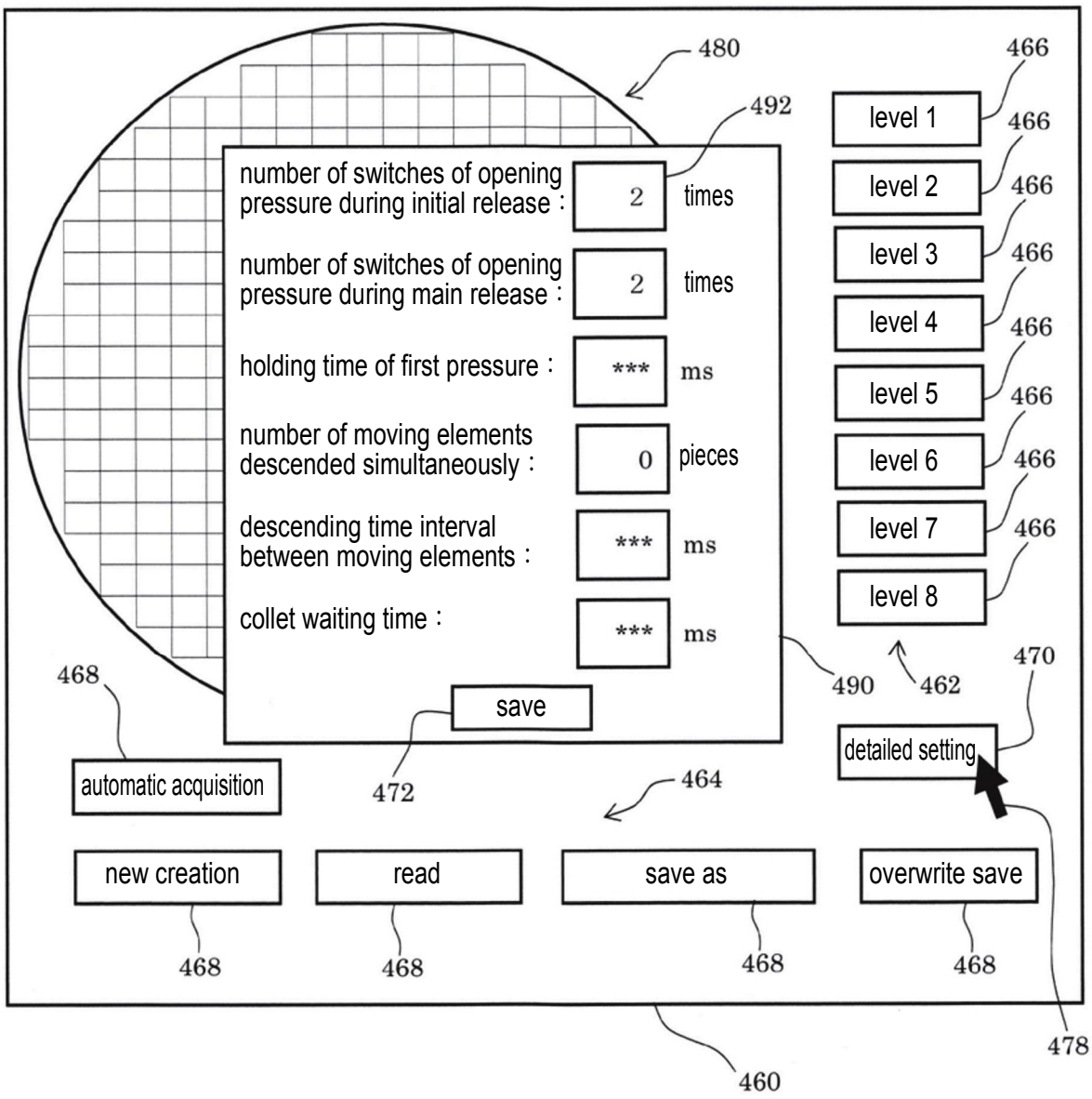

480
492
466
level 1
level 2
level 3
level 4
level 5
level 6
level 7
level 8
number of switches of opening pressure during initial release :
2
times
number of switches of opening pressure during main release :
2
times
holding time of first pressure :
***
ms
number of moving elements descended simultaneously :
0
pieces
descending time interval between moving elements :
***
ms
collet waiting time :
***
ms
490
462
470
detailed setting
468
automatic acquisition
save
472
464
new creation
read
save as
overwrite save
468
468
468
468
460
478

FIG. 32

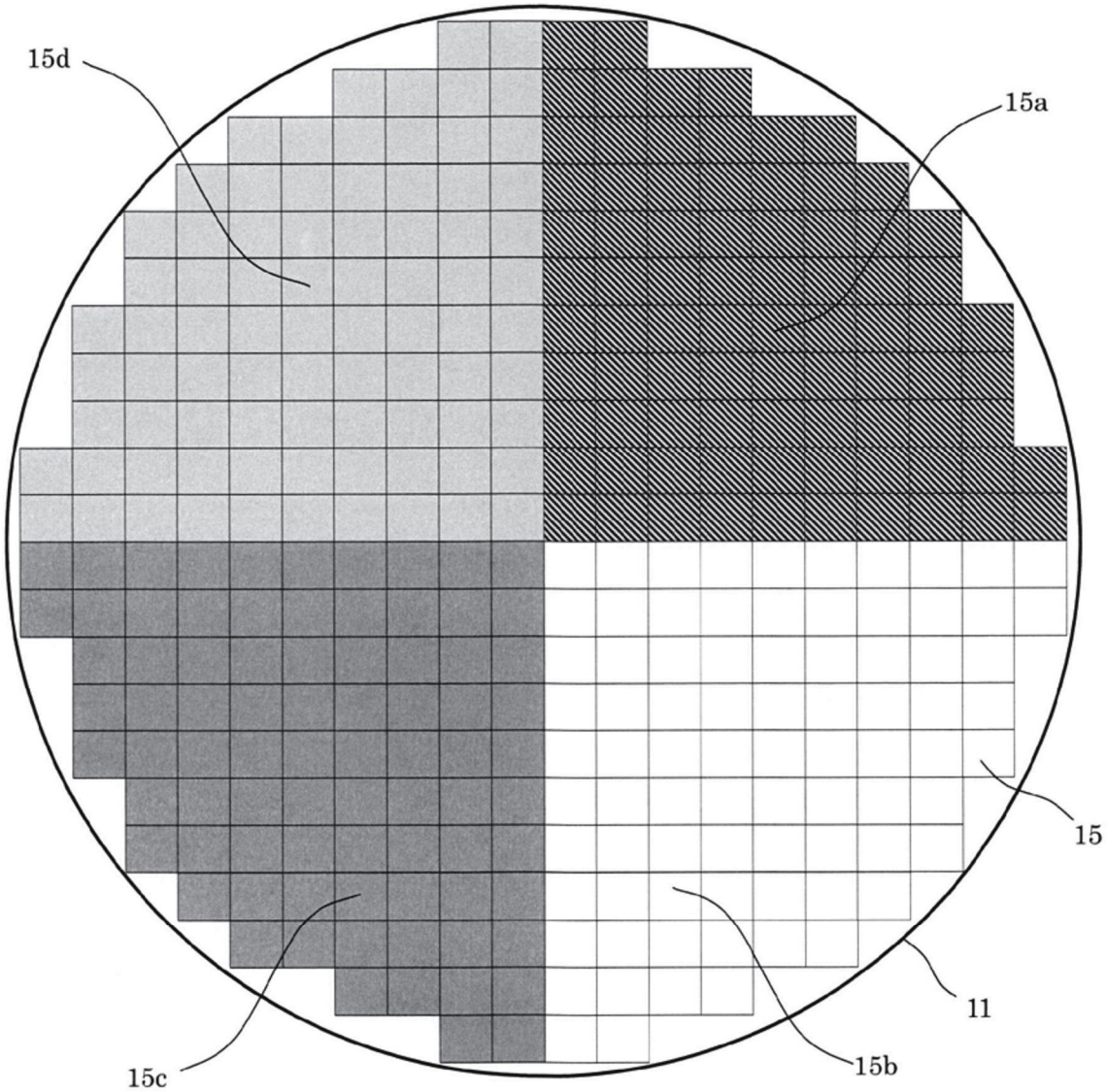


FIG. 33

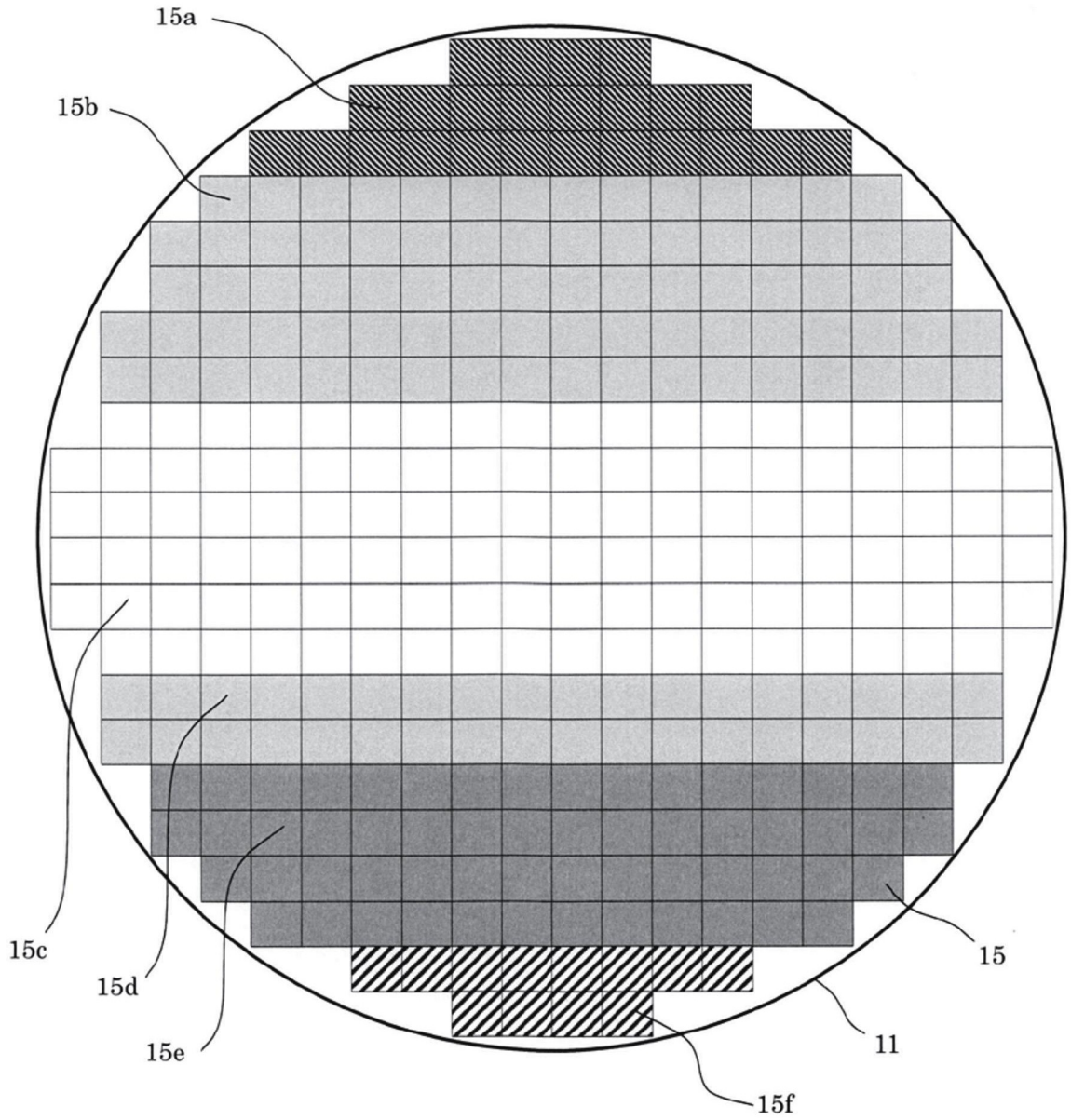


FIG. 34

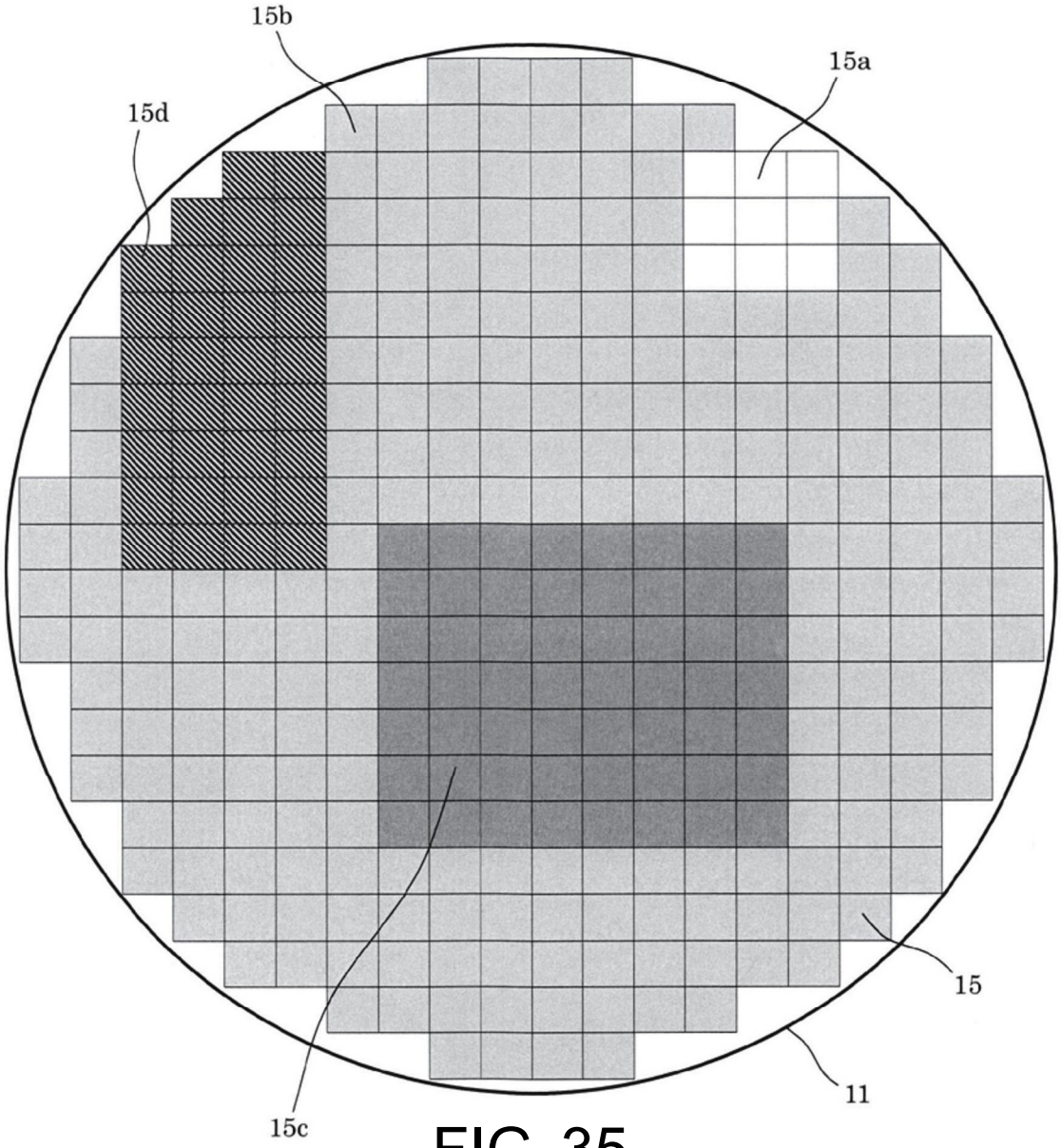

15b
15a
15d
15
11
15c

FIG. 35

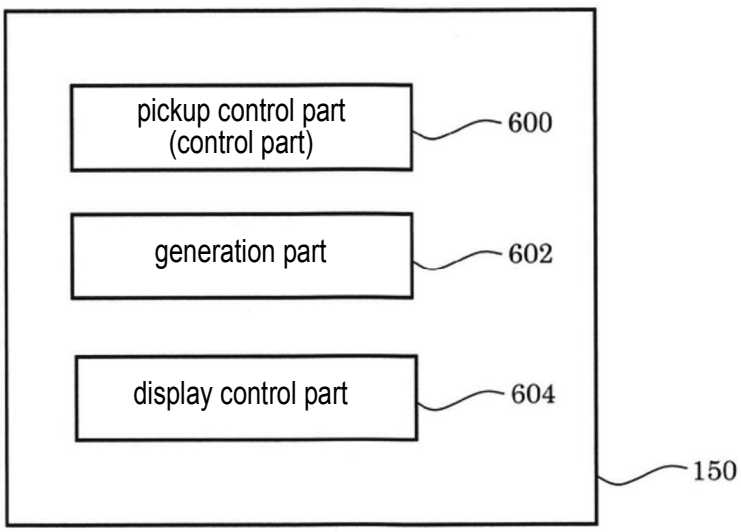

pickup control part
(control part)
600
generation part
602
display control part
604
150

FIG. 36