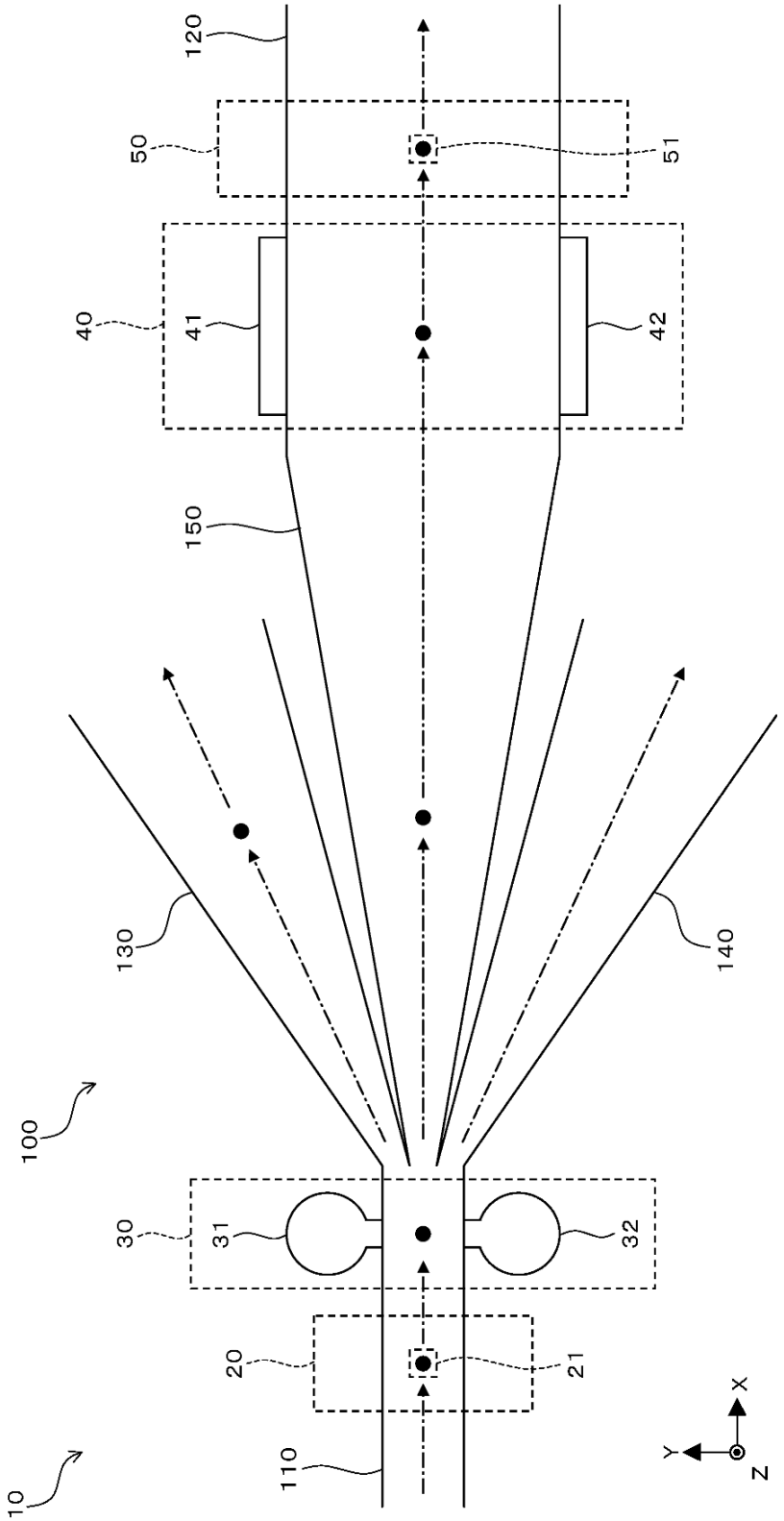
FIG. 1



EMBODIMENT 1

FIG. 2

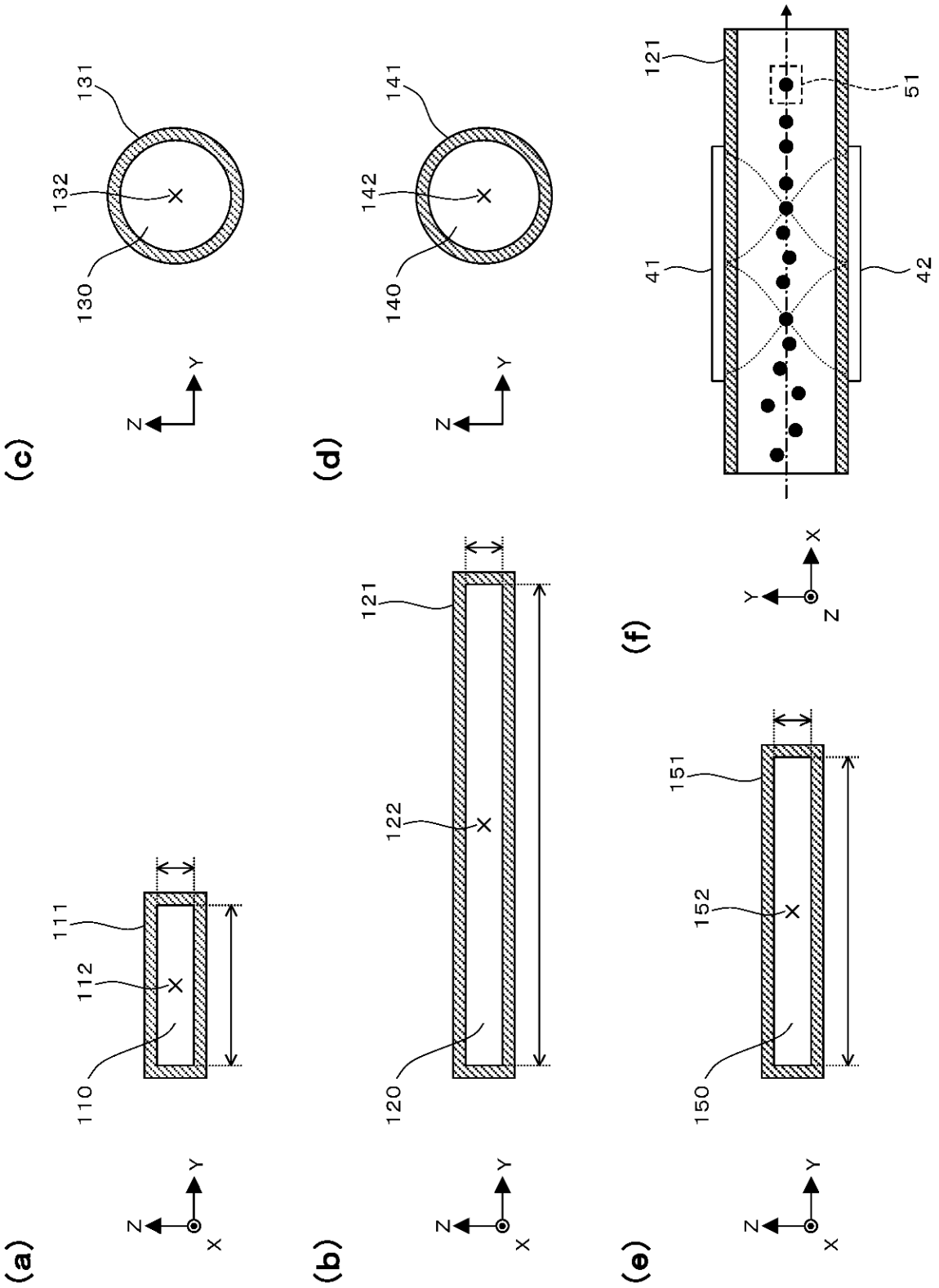

(a)
110
111
112
Y
Z
X
(b)
120
121
122
Y
Z
X
(c)
130
131
132
Y
Z
(d)
140
141
142
Y
Z
(e)
150
151
152
Y
Z
X
(f)
41
42
51
121
X
Y
Z

FIG. 3

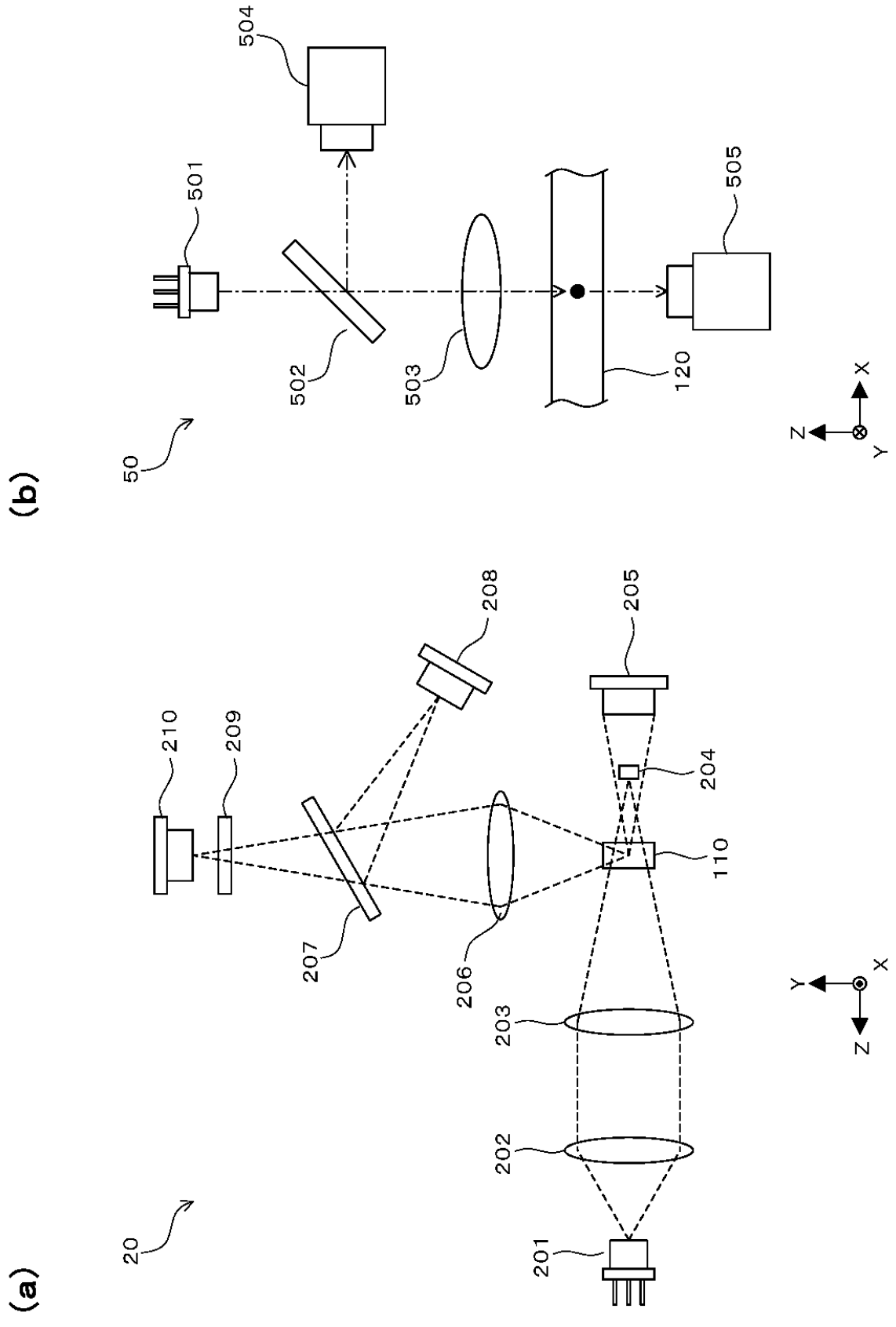

(b)
504
501
505
502
503
120
50
X
Z
Y
(a)
208
205
210
209
204
110
207
206
203
202
201
20
Y
X
Z

FIG. 4

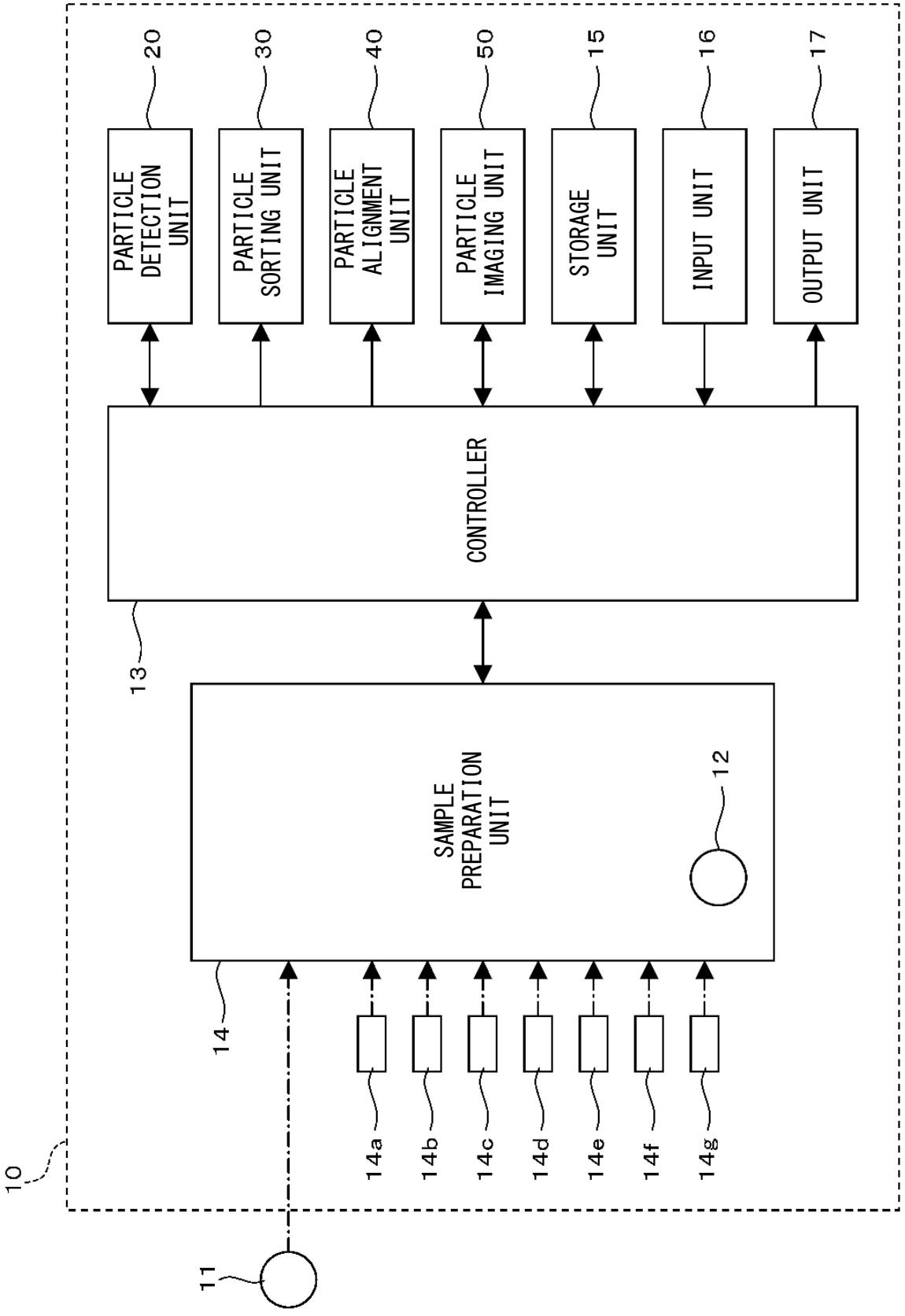

10
11
12
13
14
14a
14b
14c
14d
14e
14f
14g
15
16
17
20
30
40
50
CONTROLLER
SAMPLE PREPARATION UNIT
PARTICLE DETECTION UNIT
PARTICLE SORTING UNIT
PARTICLE ALIGNMENT UNIT
PARTICLE IMAGING UNIT
STORAGE UNIT
INPUT UNIT
OUTPUT UNIT

FIG. 5

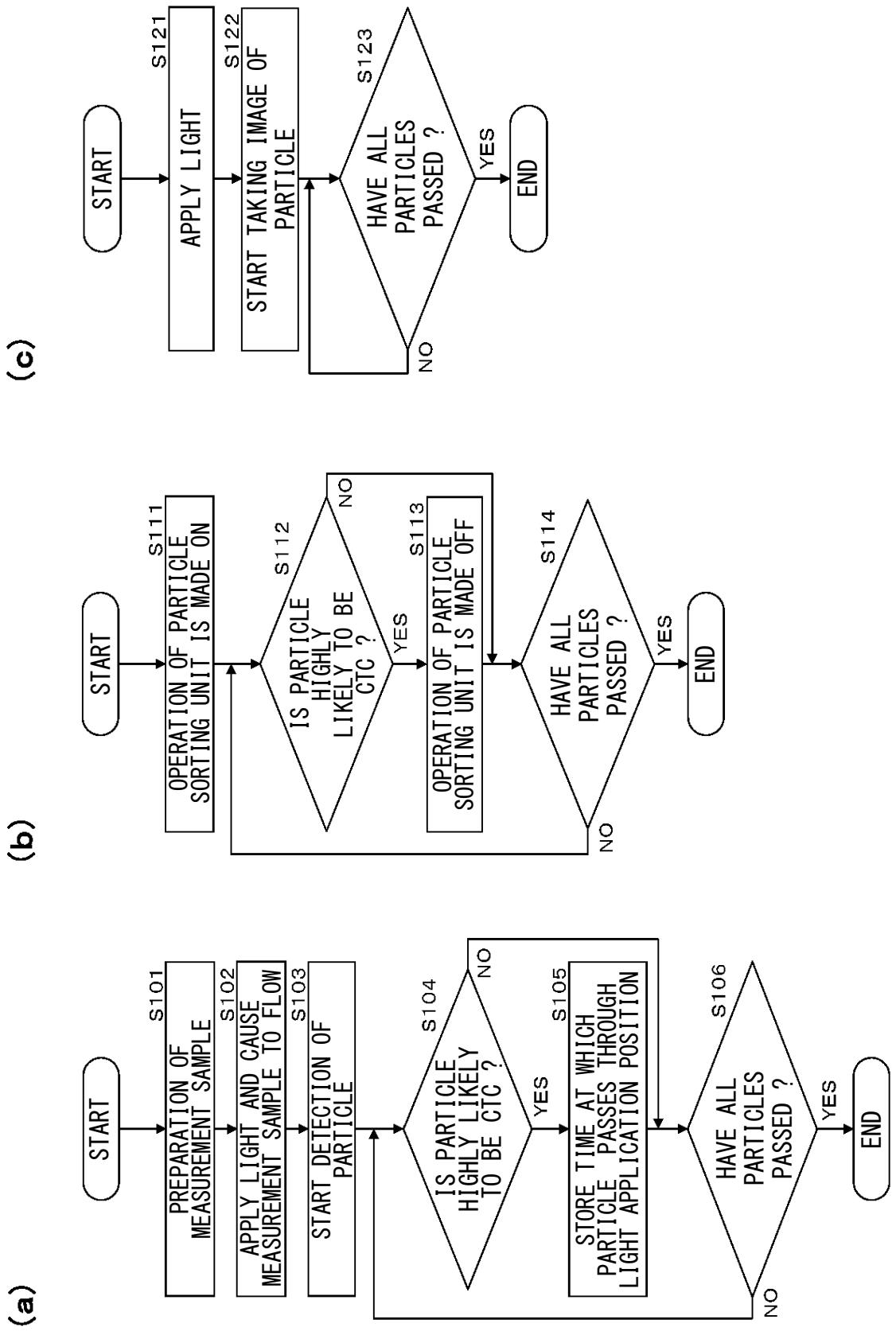

(a)
START
S101
PREPARATION OF MEASUREMENT SAMPLE
S102
APPLY LIGHT AND CAUSE MEASUREMENT SAMPLE TO FLOW
S103
START DETECTION OF PARTICLE
S104
IS PARTICLE HIGHLY LIKELY TO BE CTC ?
NO
YES
S105
STORE TIME AT WHICH PARTICLE PASSES THROUGH LIGHT APPLICATION POSITION
S106
HAVE ALL PARTICLES PASSED ?
NO
YES
END
(b)
START
S111
OPERATION OF PARTICLE SORTING UNIT IS MADE ON
S112
IS PARTICLE HIGHLY LIKELY TO BE CTC ?
NO
YES
S113
OPERATION OF PARTICLE SORTING UNIT IS MADE OFF
S114
HAVE ALL PARTICLES PASSED ?
NO
YES
END
(c)
START
S121
APPLY LIGHT
S122
START TAKING IMAGE OF PARTICLE
S123
HAVE ALL PARTICLES PASSED ?
NO
YES
END

FIG. 6

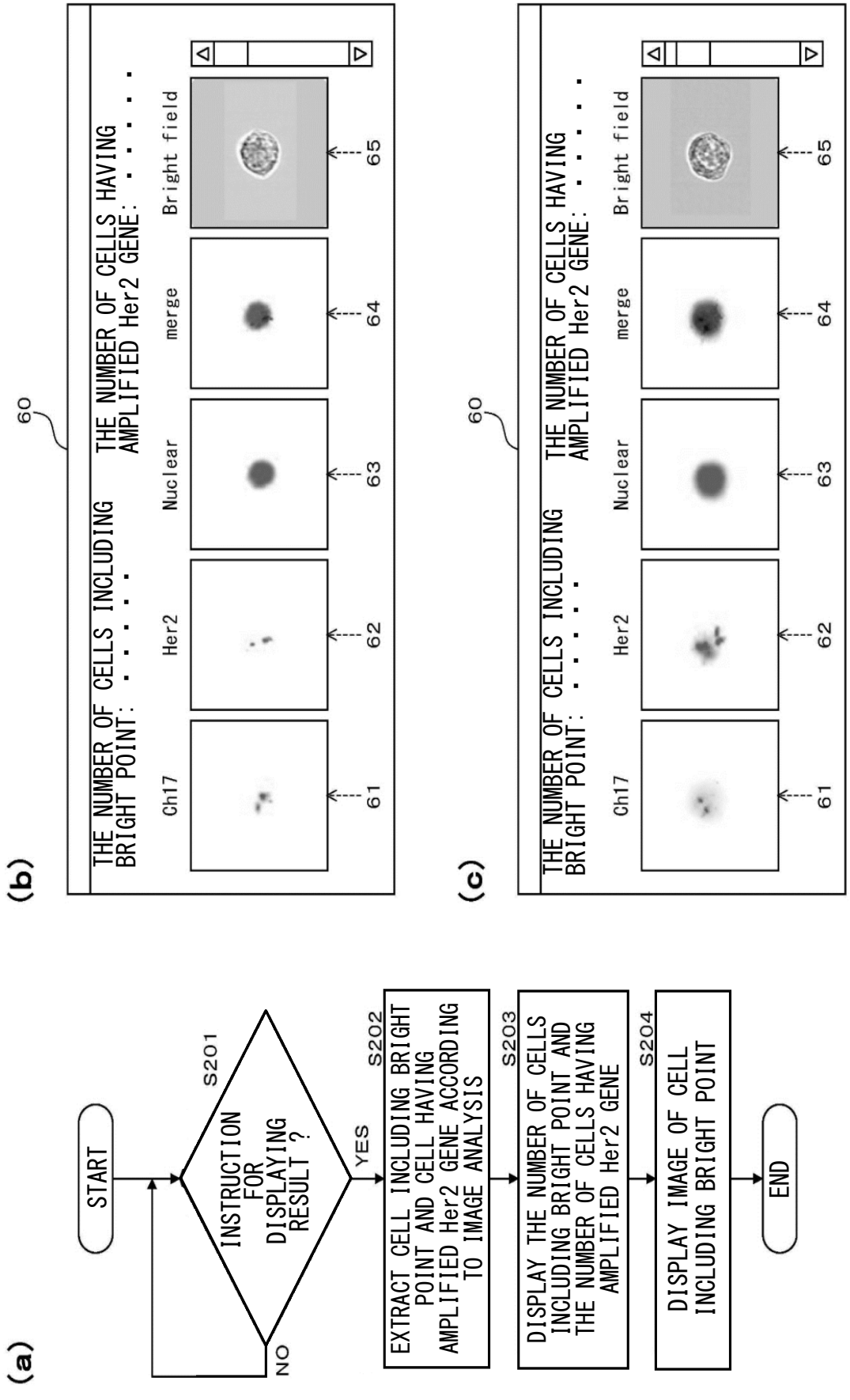
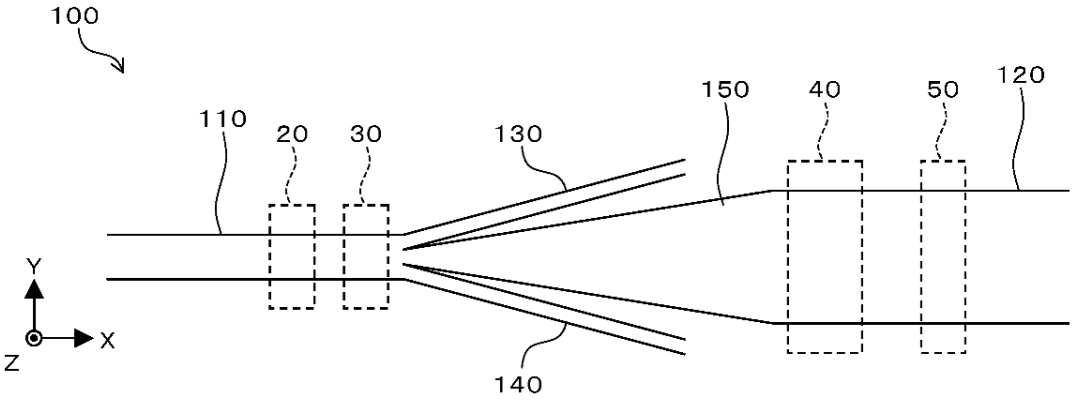
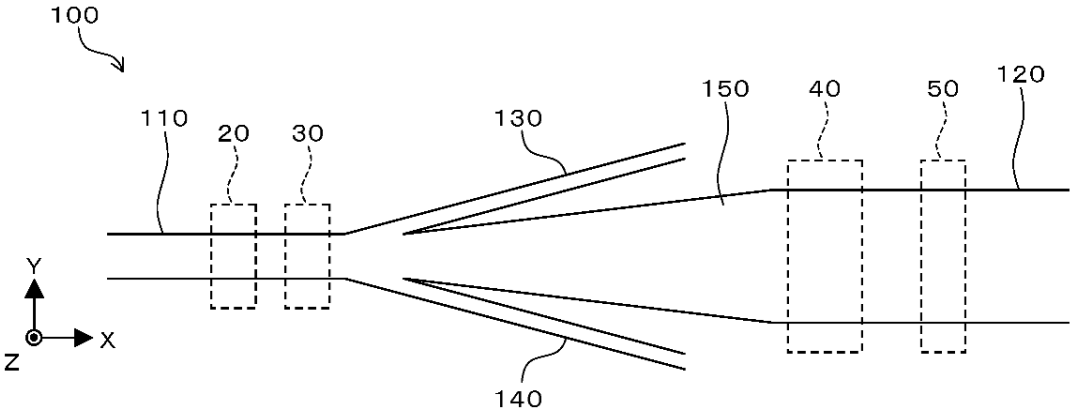

(a)
START
S201
INSTRUCTION FOR DISPLAYING RESULT ?
NO
YES
S202
EXTRACT CELL INCLUDING BRIGHT POINT AND CELL HAVING AMPLIFIED Her2 GENE ACCORDING TO IMAGE ANALYSIS
S203
DISPLAY THE NUMBER OF CELLS INCLUDING BRIGHT POINT AND THE NUMBER OF CELLS HAVING AMPLIFIED Her2 GENE
S204
DISPLAY IMAGE OF CELL INCLUDING BRIGHT POINT
END
(b)
60
THE NUMBER OF CELLS INCLUDING BRIGHT POINT: . . . . . .
THE NUMBER OF CELLS HAVING AMPLIFIED Her2 GENE: . . . . . .
Ch17
Her2
Nuclear
merge
Bright field
61
62
63
64
65
(c)
60
THE NUMBER OF CELLS INCLUDING BRIGHT POINT: . . . . . .
THE NUMBER OF CELLS HAVING AMPLIFIED Her2 GENE: . . . . . .
Ch17
Her2
Nuclear
merge
Bright field
61
62
63
64
65

FIG. 7

(a) EMBODIMENT 2



(b) EMBODIMENT 3



(c) EMBODIMENT 4

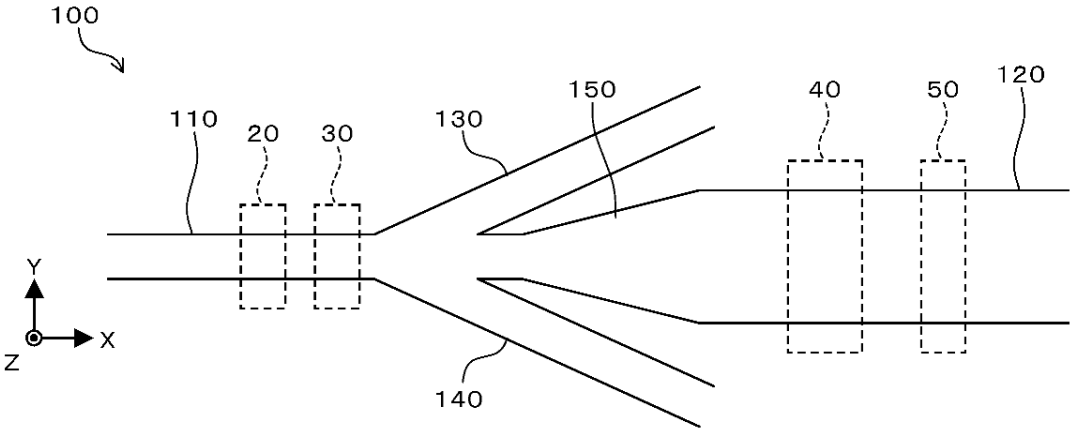
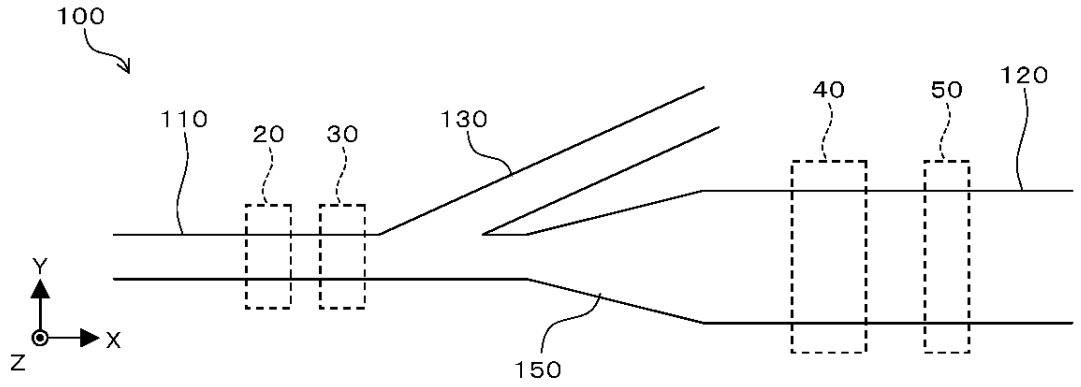
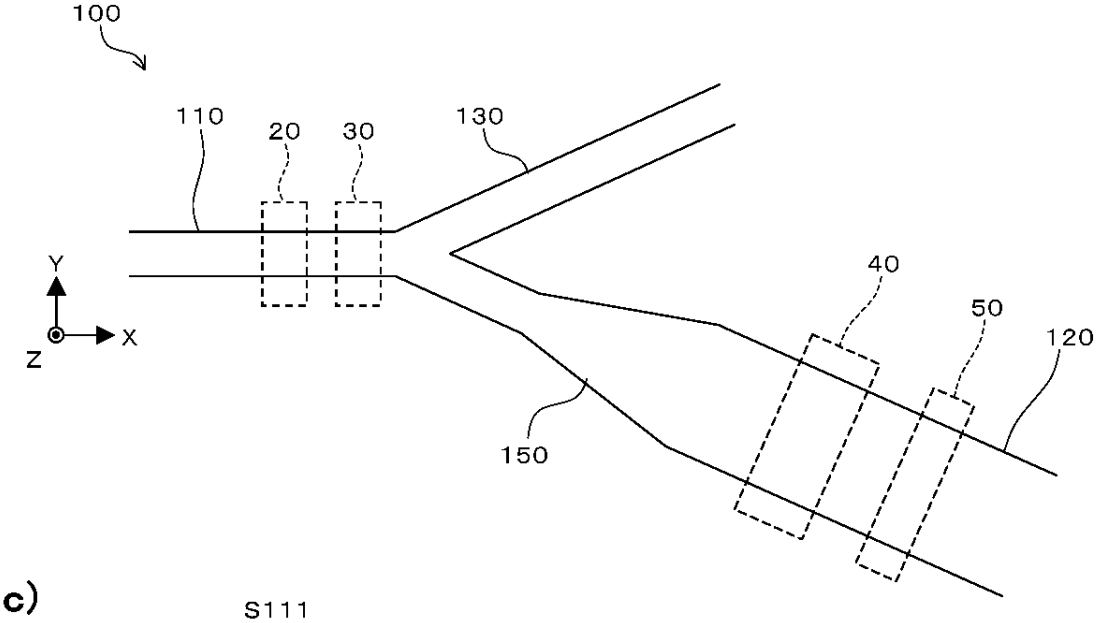


FIG. 8

(a) EMBODIMENT 5



(b) EMBODIMENT 6



(c)

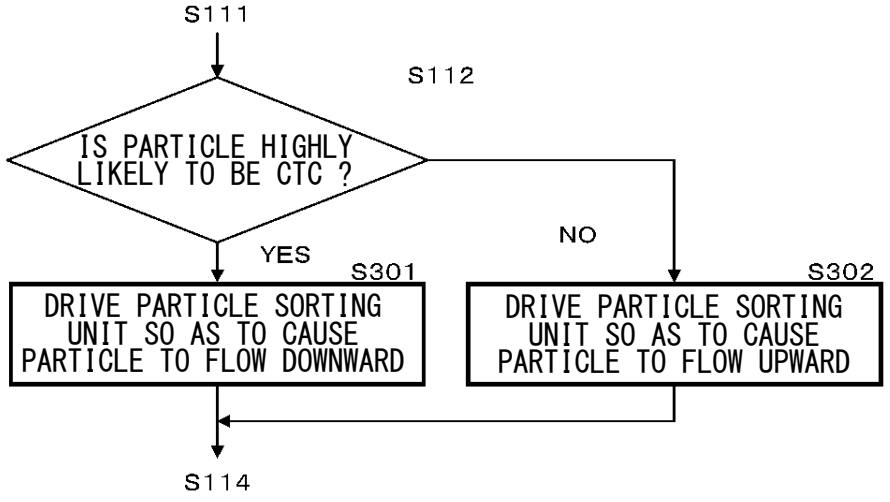


FIG. 9

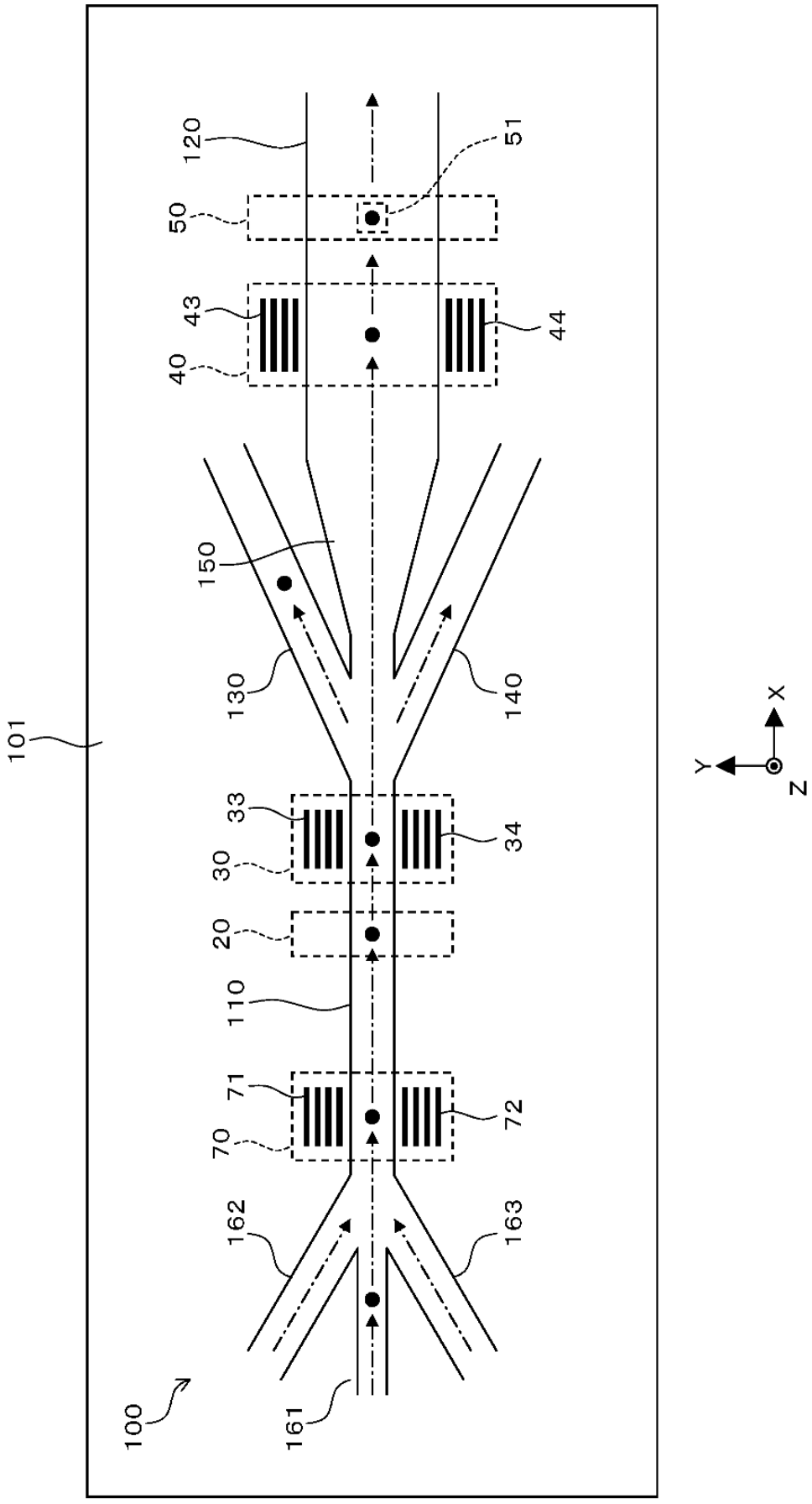

EMBODIMENT 7
100
101
120
51
50
43
44
40
150
130
140
33
34
30
20
110
71
72
70
162
163
161
X
Y
Z

FIG. 10

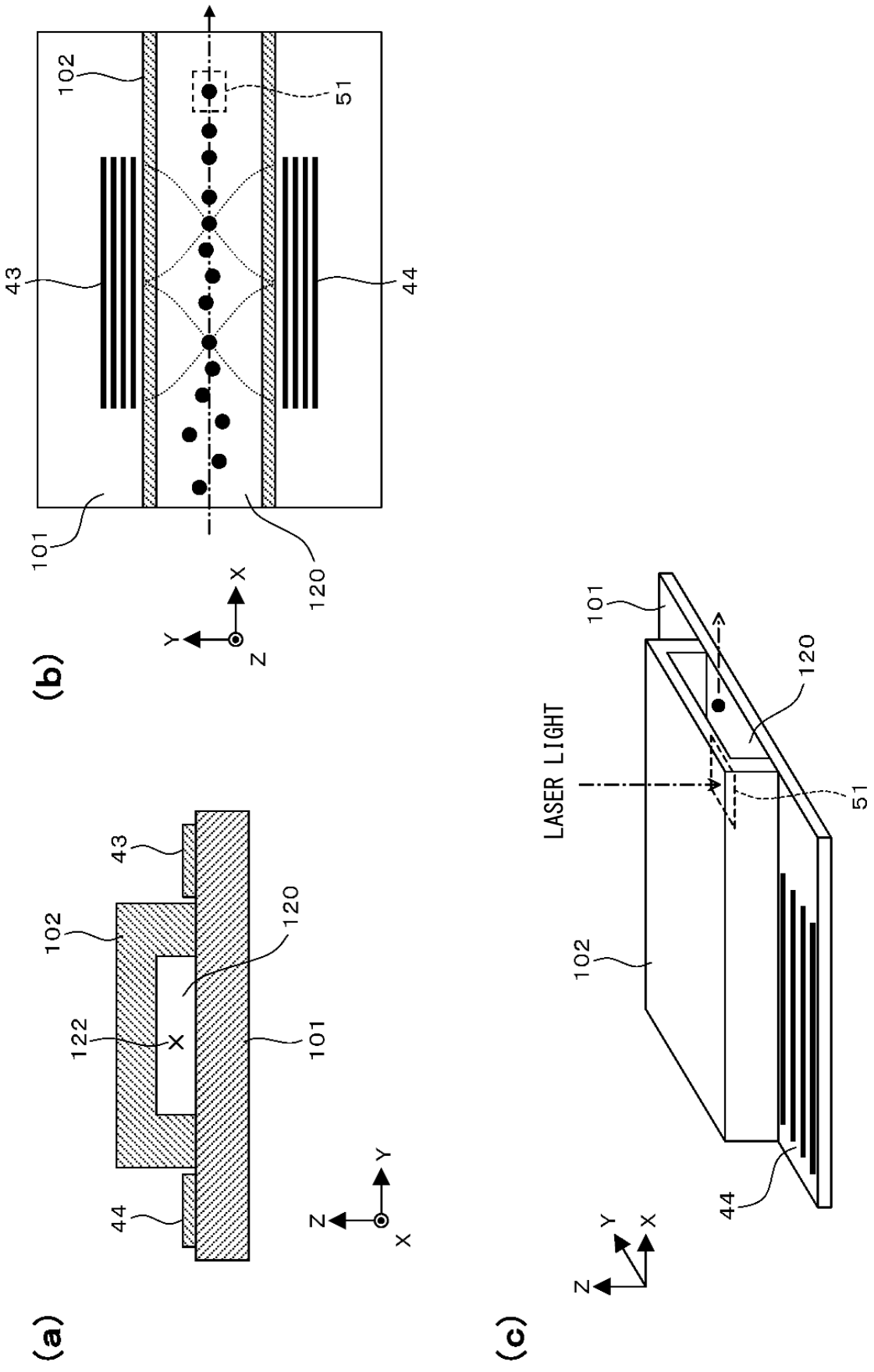

(a)
43
102
120
122
101
44
Y
Z
X
(b)
102
51
43
44
101
120
X
Y
Z
(c)
101
120
LASER LIGHT
51
102
44
Y
X
Z

FIG. 11

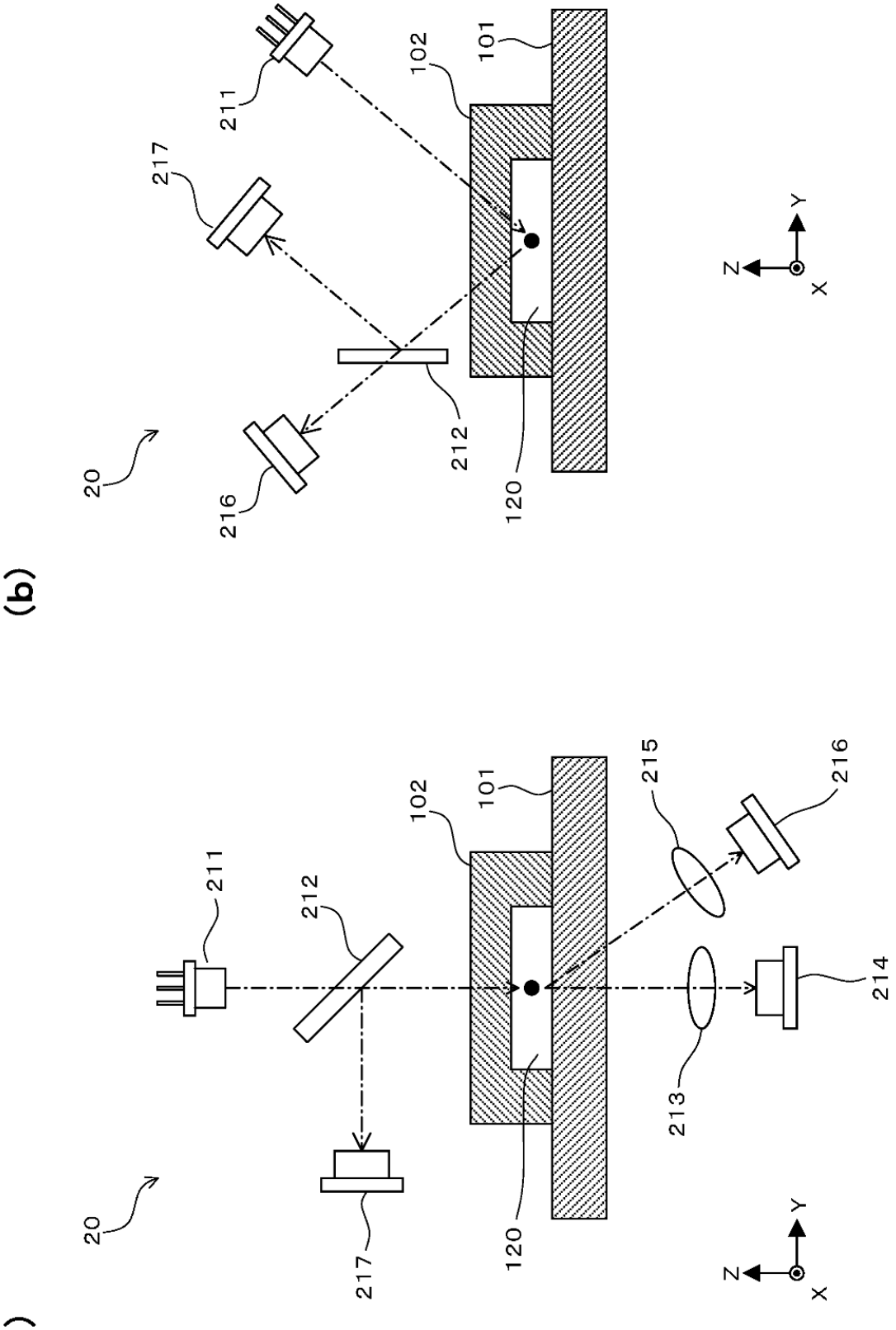
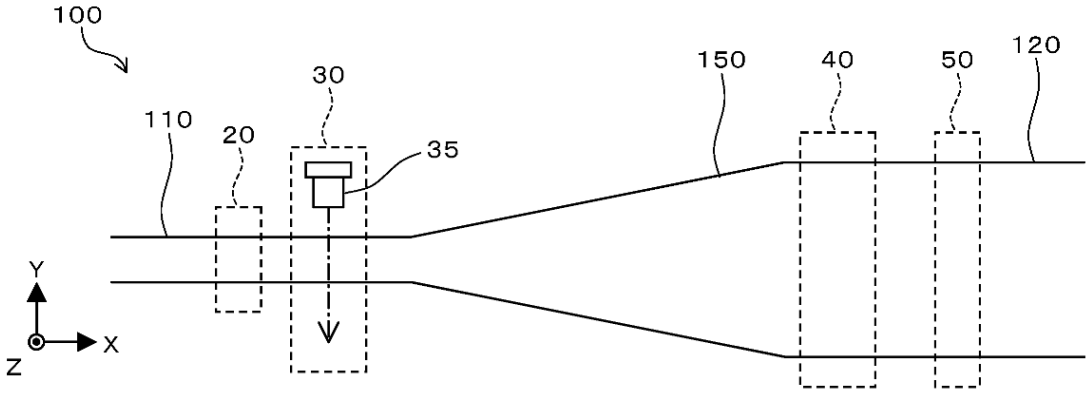

(b)
20
211
217
216
212
102
101
120
Y
Z
X
(a)
20
211
212
217
102
101
120
215
216
213
214
Y
Z
X

FIG. 12

(a) EMBODIMENT 8



(b)

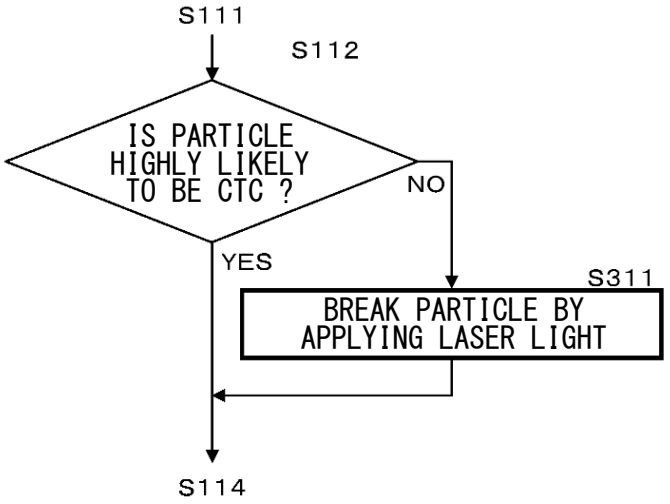


FIG. 13

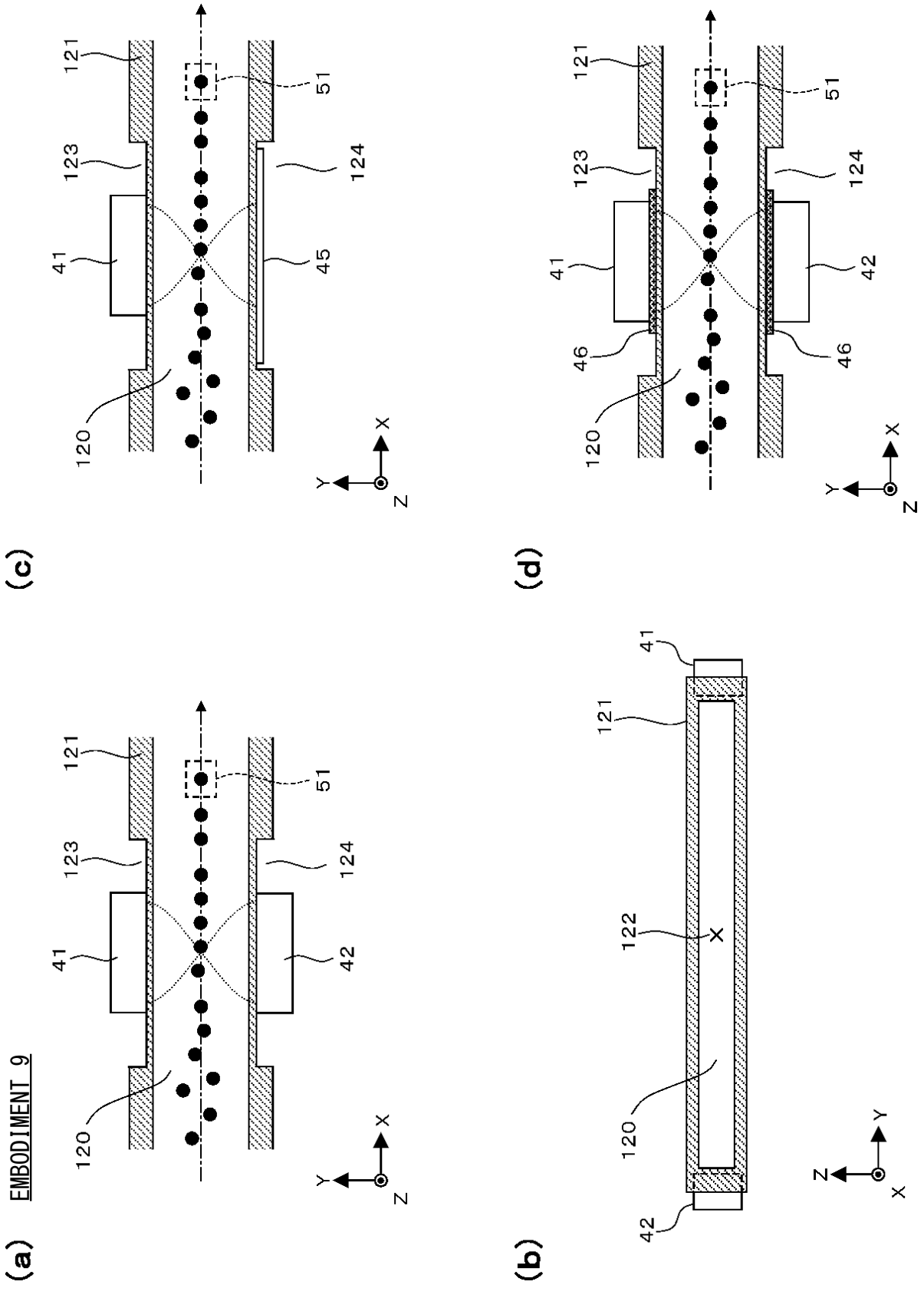


FIG. 14

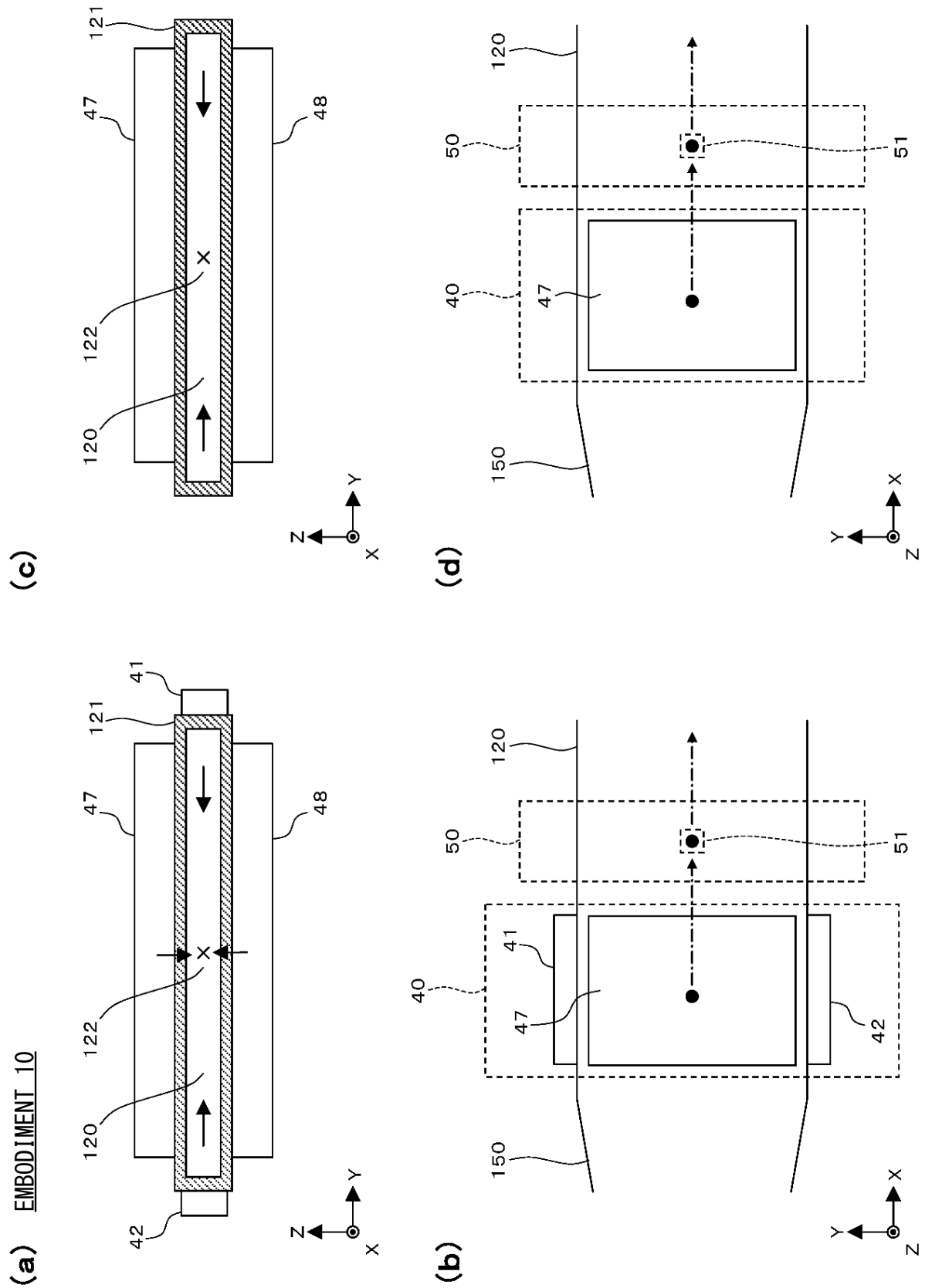


FIG. 15

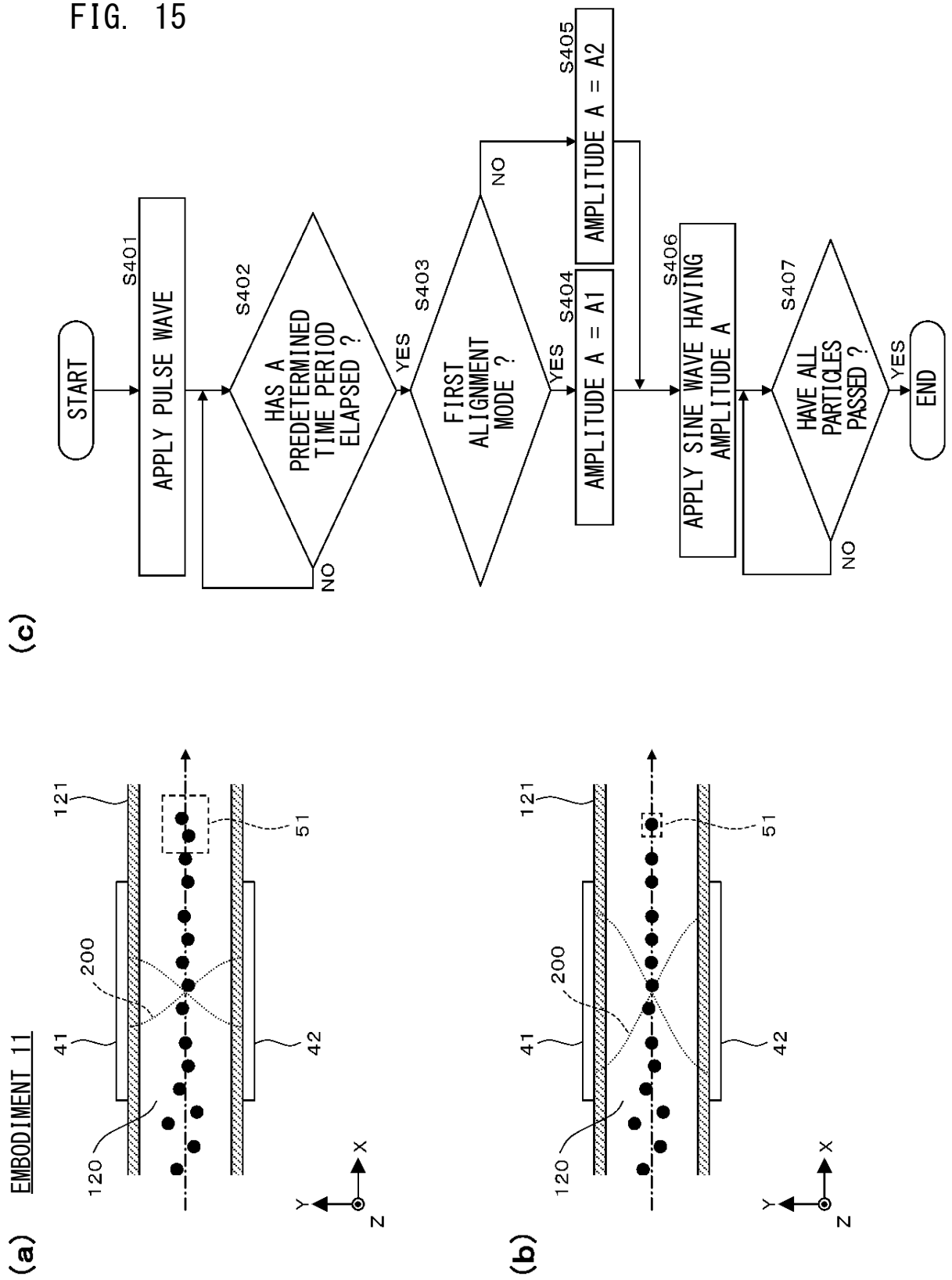

(a)
EMBODIMENT 11
121
51
200
41
42
120
Y
X
Z
(b)
121
51
200
41
42
120
Y
X
Z
(c)
START
S401
APPLY PULSE WAVE
S402
HAS A PREDETERMINED TIME PERIOD ELAPSED ?
NO
YES
S403
FIRST ALIGNMENT MODE ?
NO
YES
S404
AMPLITUDE A = A1
S405
AMPLITUDE A = A2
S406
APPLY SINE WAVE HAVING AMPLITUDE A
S407
HAVE ALL PARTICLES PASSED ?
NO
YES
END

FIG. 16

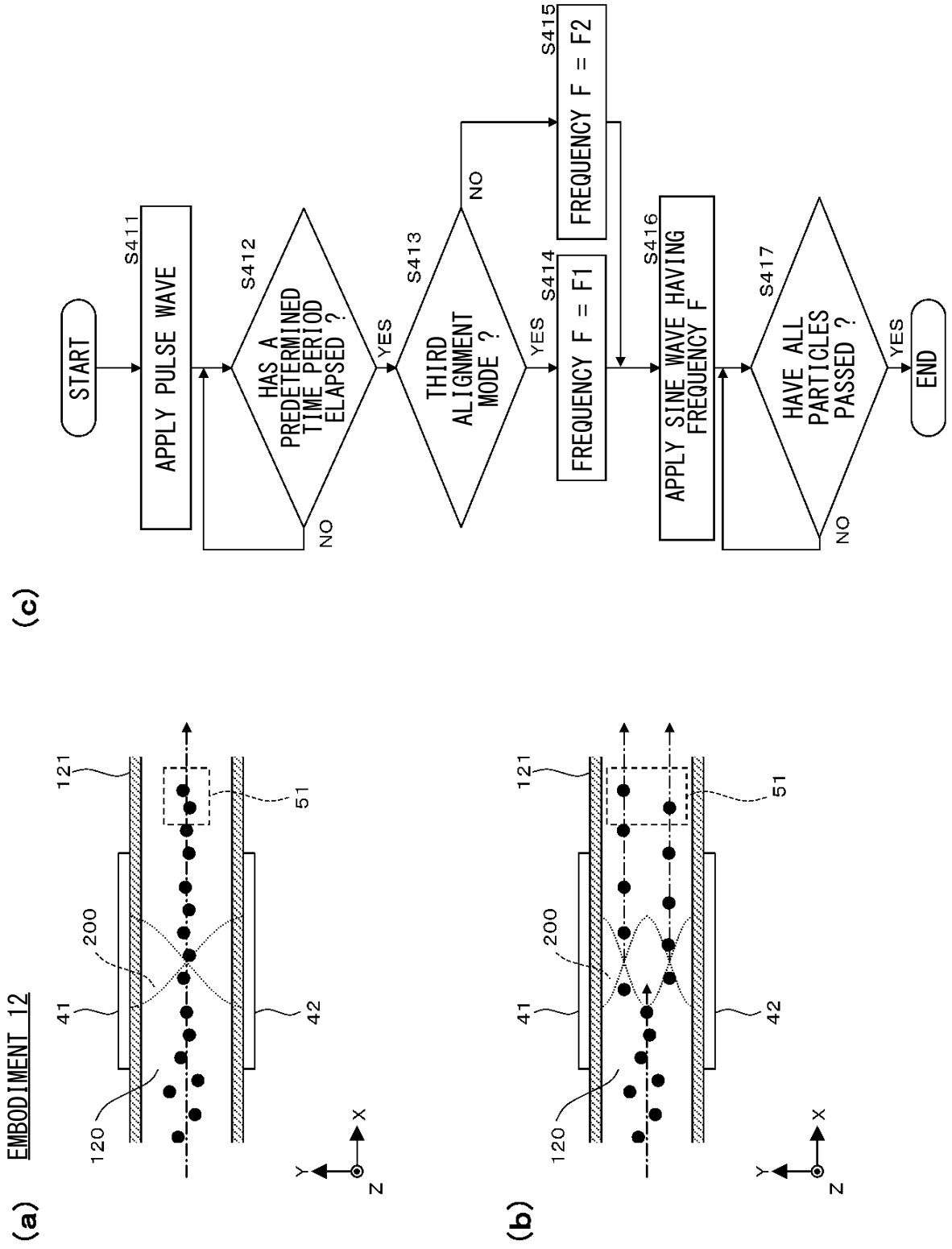

(a)
EMBODIMENT 12
121
51
200
41
42
120
Y
X
Z
(b)
121
51
200
41
42
120
Y
X
Z
(c)
START
S411
APPLY PULSE WAVE
S412
HAS A PREDETERMINED TIME PERIOD ELAPSED ?
NO
YES
S413
THIRD ALIGNMENT MODE ?
NO
YES
S414
FREQUENCY F = F1
S415
FREQUENCY F = F2
S416
APPLY SINE WAVE HAVING FREQUENCY F
S417
HAVE ALL PARTICLES PASSED ?
NO
YES
END

FIG. 17

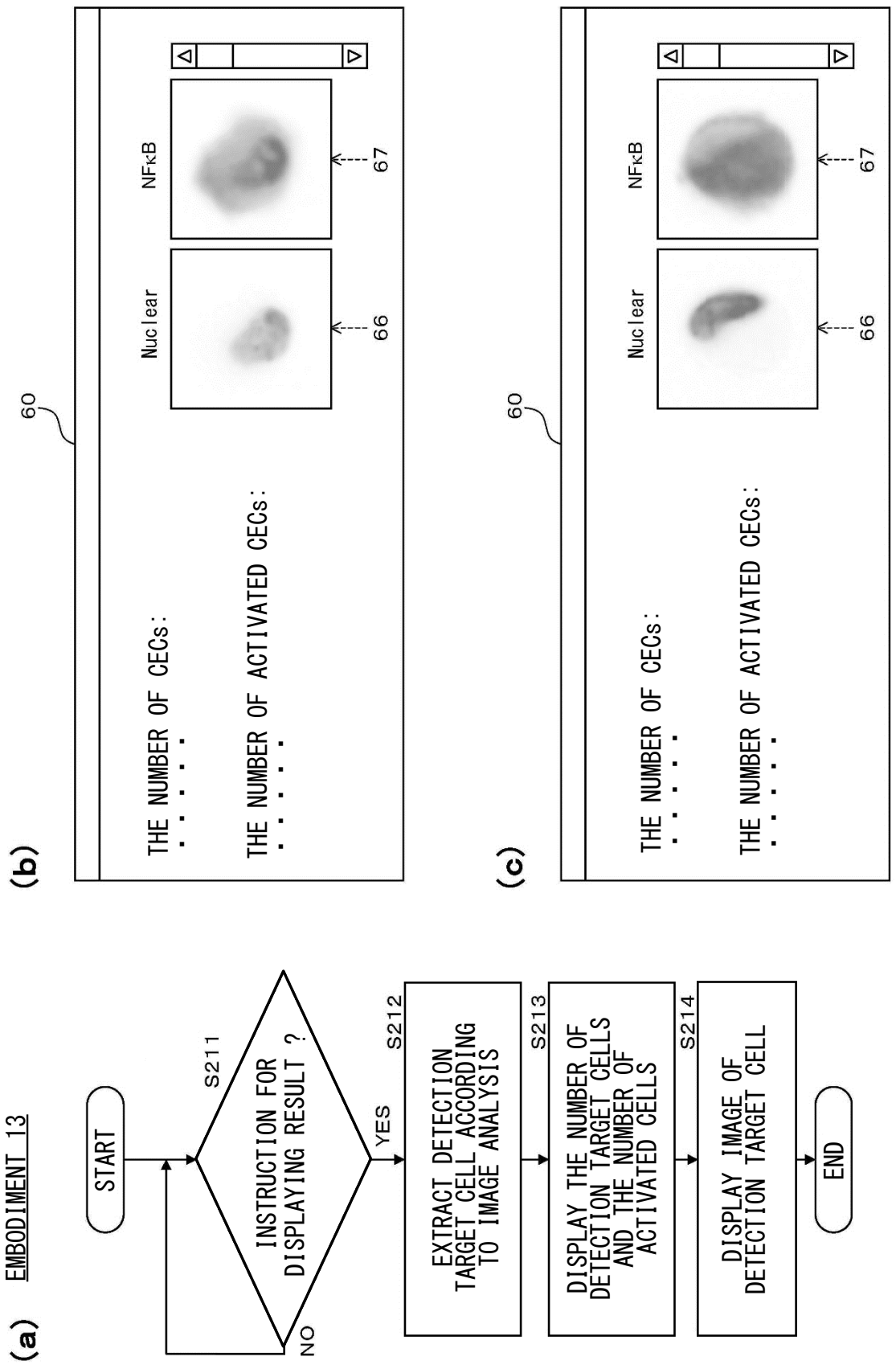

(a)
EMBODIMENT 13
START
S211
INSTRUCTION FOR DISPLAYING RESULT ?
YES
NO
S212
EXTRACT DETECTION TARGET CELL ACCORDING TO IMAGE ANALYSIS
S213
DISPLAY THE NUMBER OF DETECTION TARGET CELLS AND THE NUMBER OF ACTIVATED CELLS
S214
DISPLAY IMAGE OF DETECTION TARGET CELL
END
(b)
60
Nuclear
NFκB
66
67
THE NUMBER OF CECs:
THE NUMBER OF ACTIVATED CECs:
(c)
60
Nuclear
NFκB
66
67
THE NUMBER OF CECs:
THE NUMBER OF ACTIVATED CECs:

FIG. 18

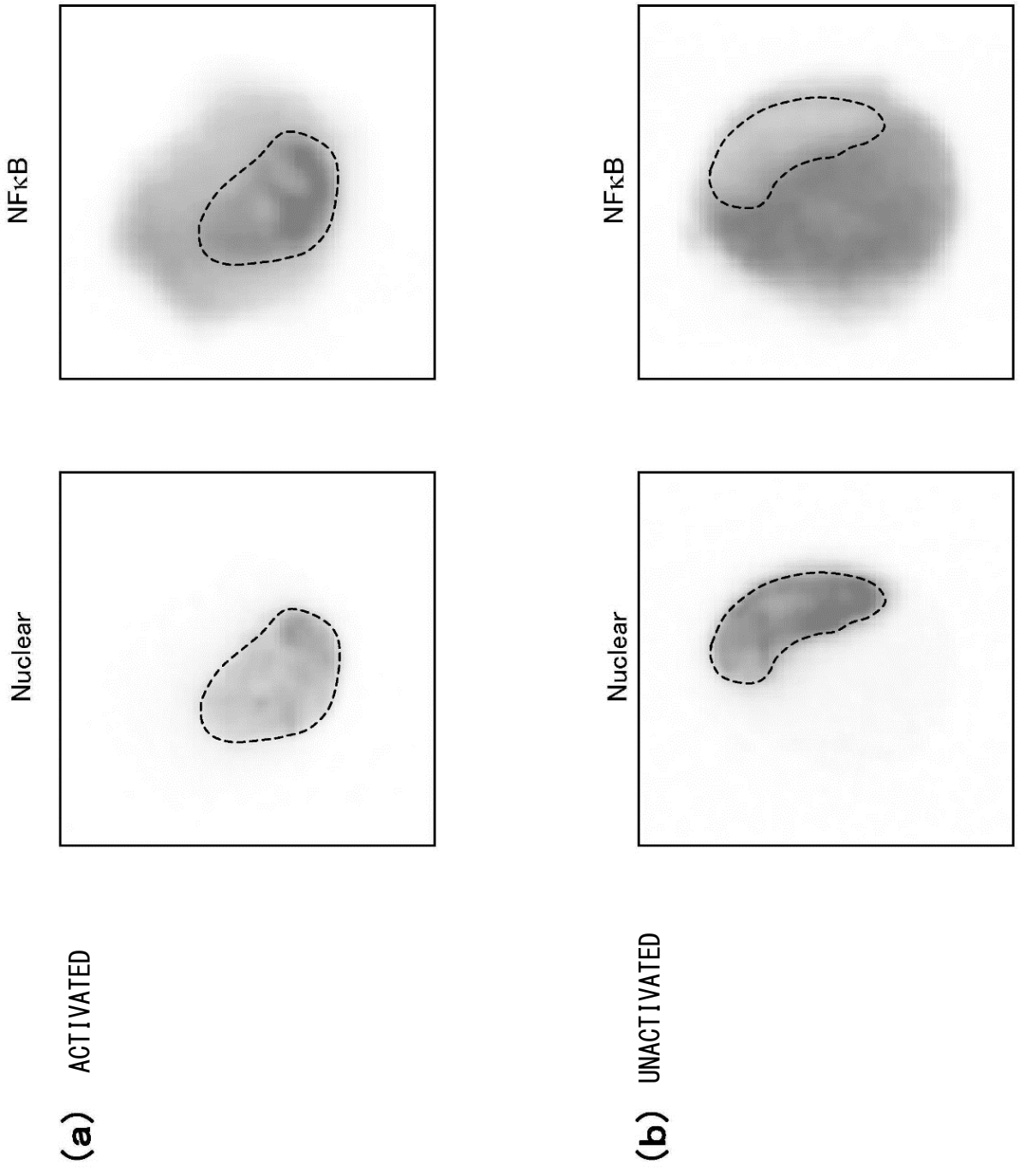


FIG. 19

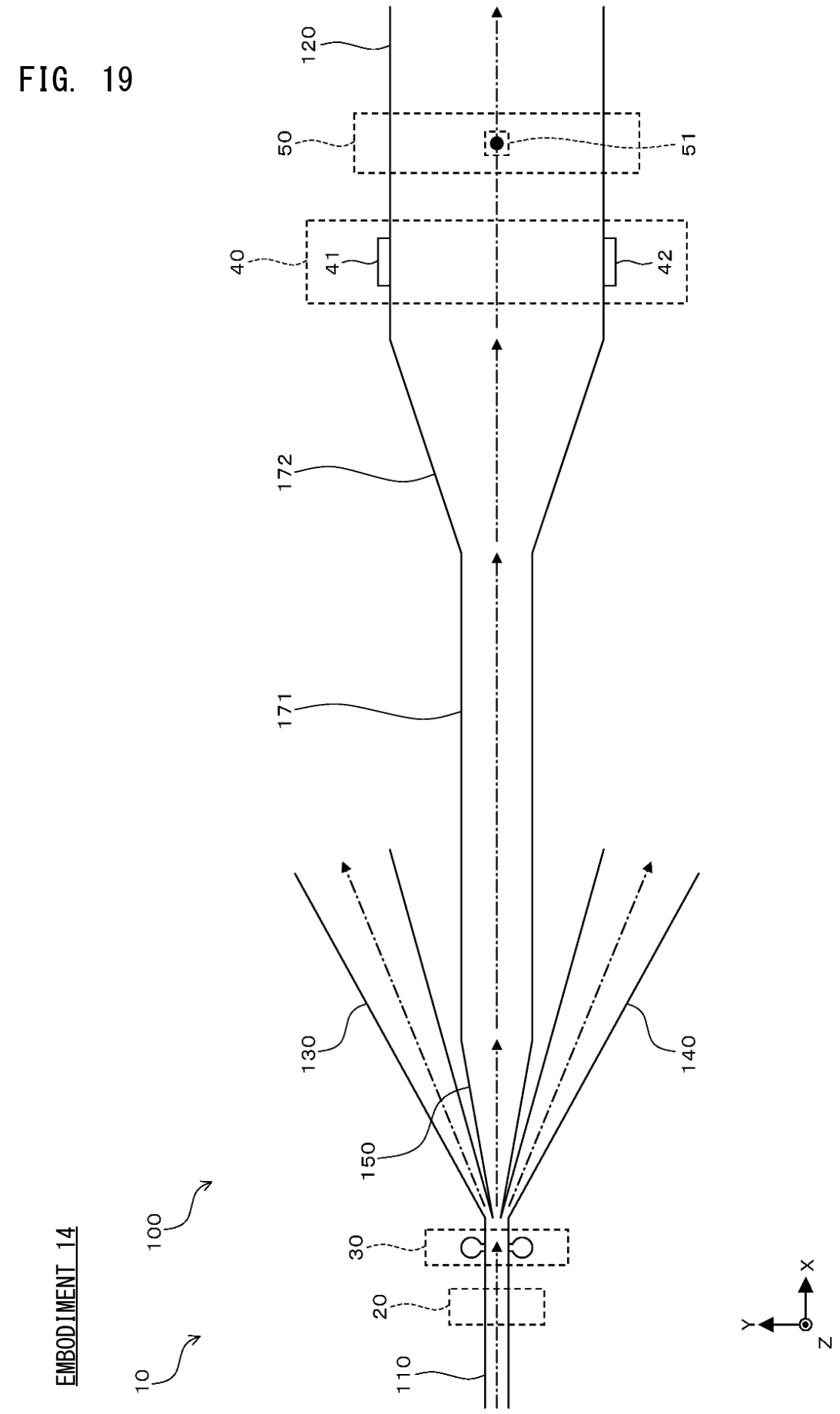

EMBODIMENT 14
10
100
110
120
130
140
150
171
172
20
30
40
41
42
50
51
X
Y
Z

FIG. 20

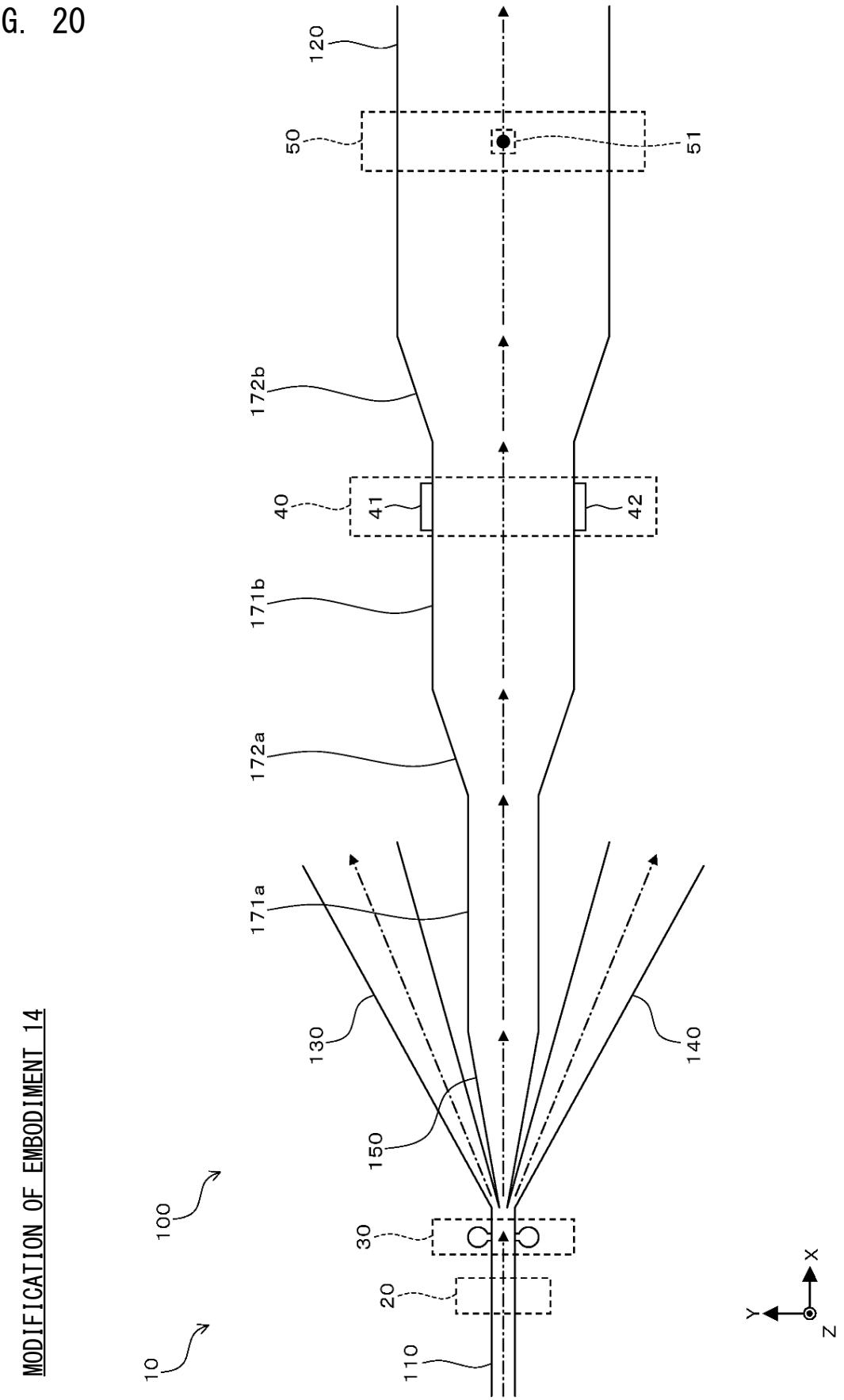

MODIFICATION OF EMBODIMENT 14
10
100
110
20
30
150
130
140
171a
172a
171b
40
41
42
172b
50
51
120
X
Y
Z

FIG. 21

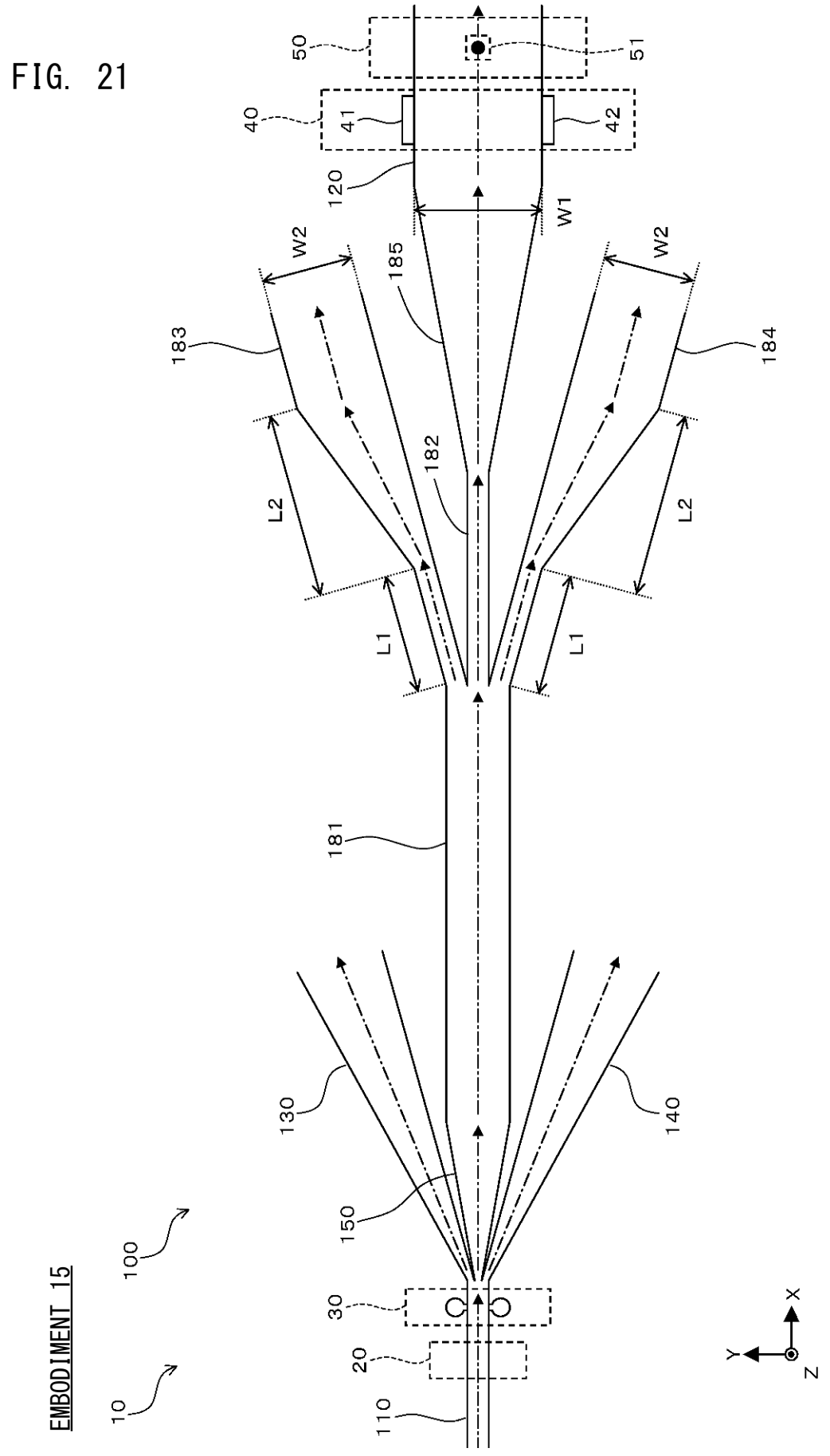

EMBODIMENT 15
10
100
110
20
30
150
130
140
181
182
183
184
185
120
40
41
42
50
51
W1
W2
W2
L1
L1
L2
L2
X
Y
Z

FIG. 22

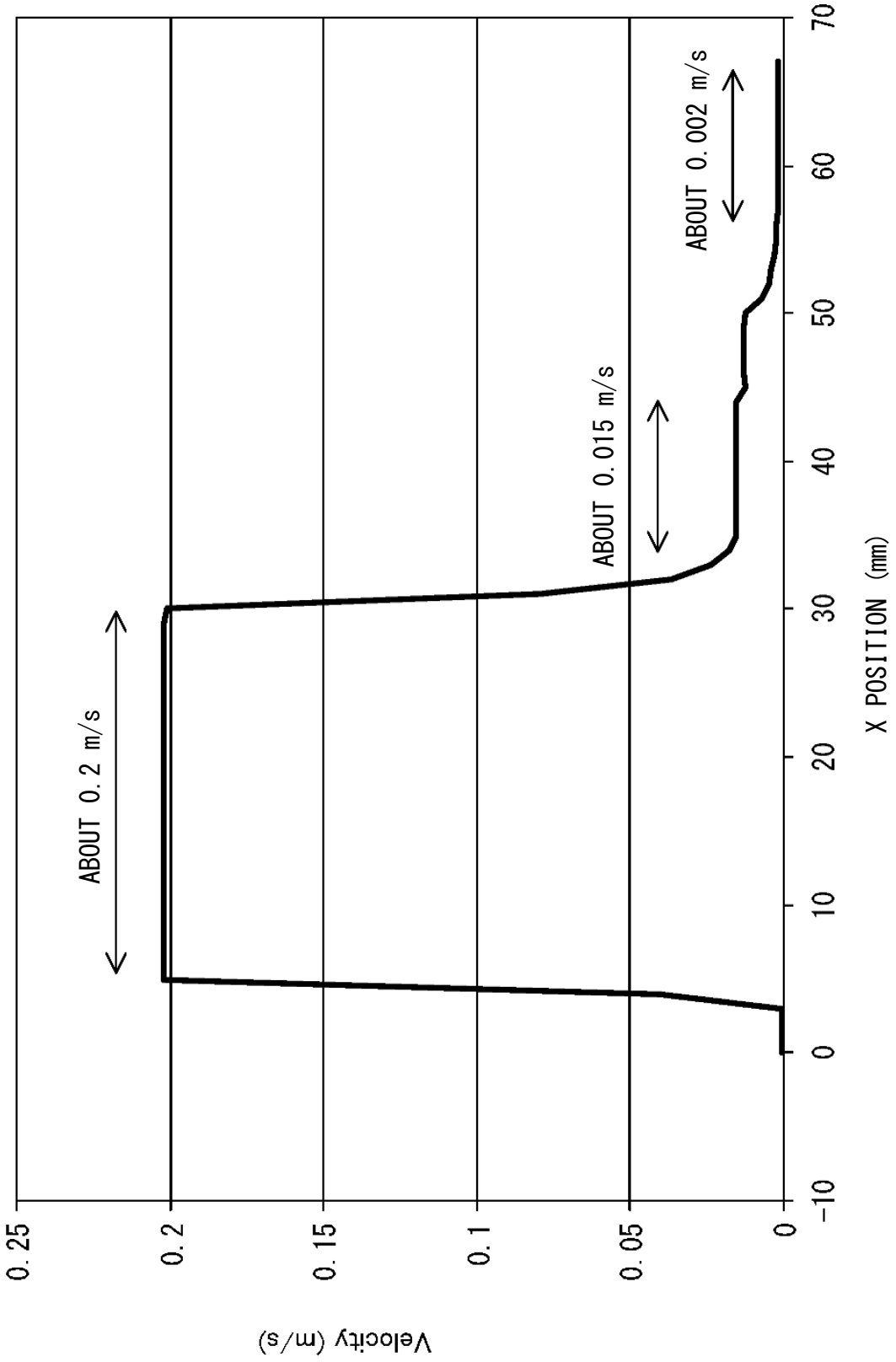
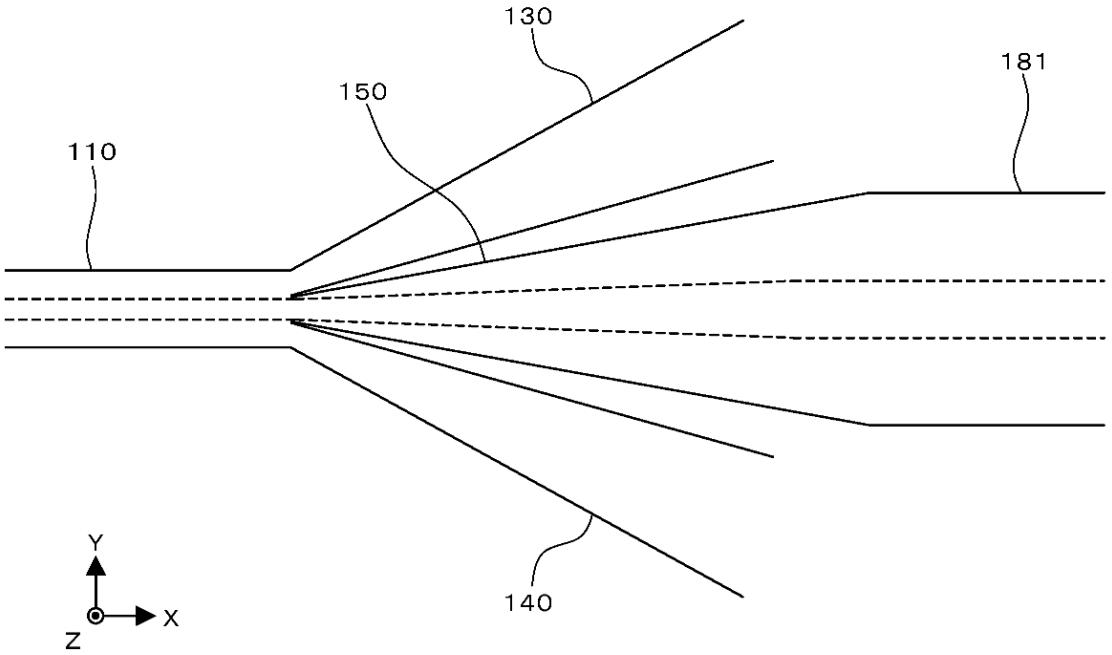

Velocity (m/s)
0.25
0.2
0.15
0.1
0.05
0
−10
0
10
20
30
40
50
60
70
X POSITION (mm)
ABOUT 0.2 m/s
ABOUT 0.015 m/s
ABOUT 0.002 m/s

FIG. 23

(a)



(b)

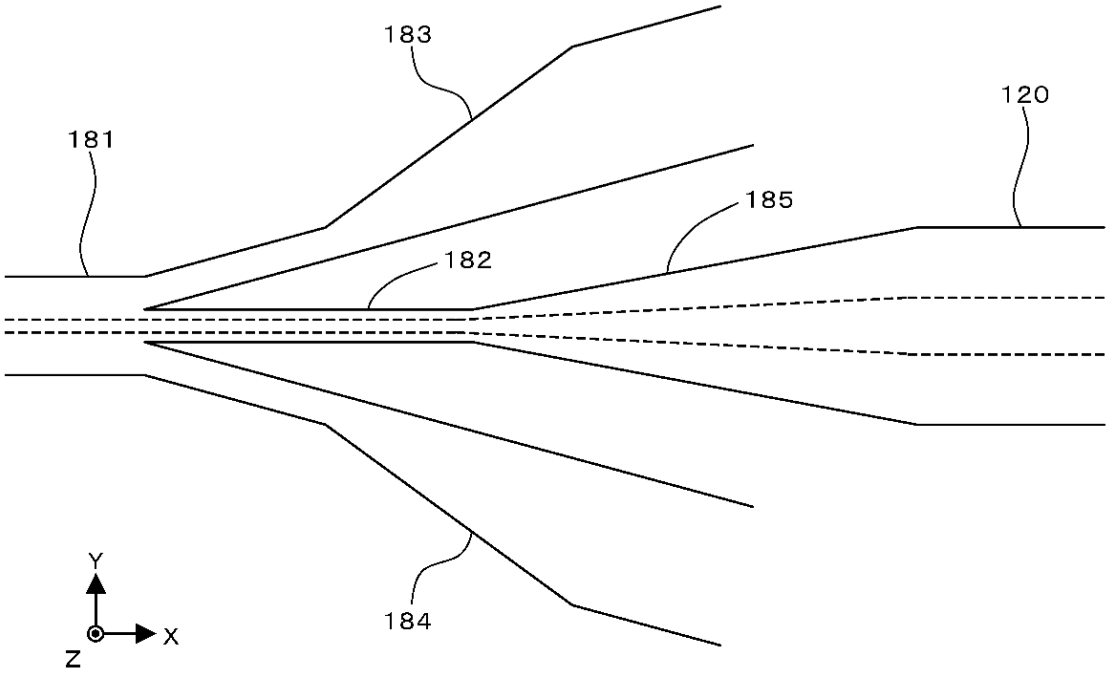


FIG. 24

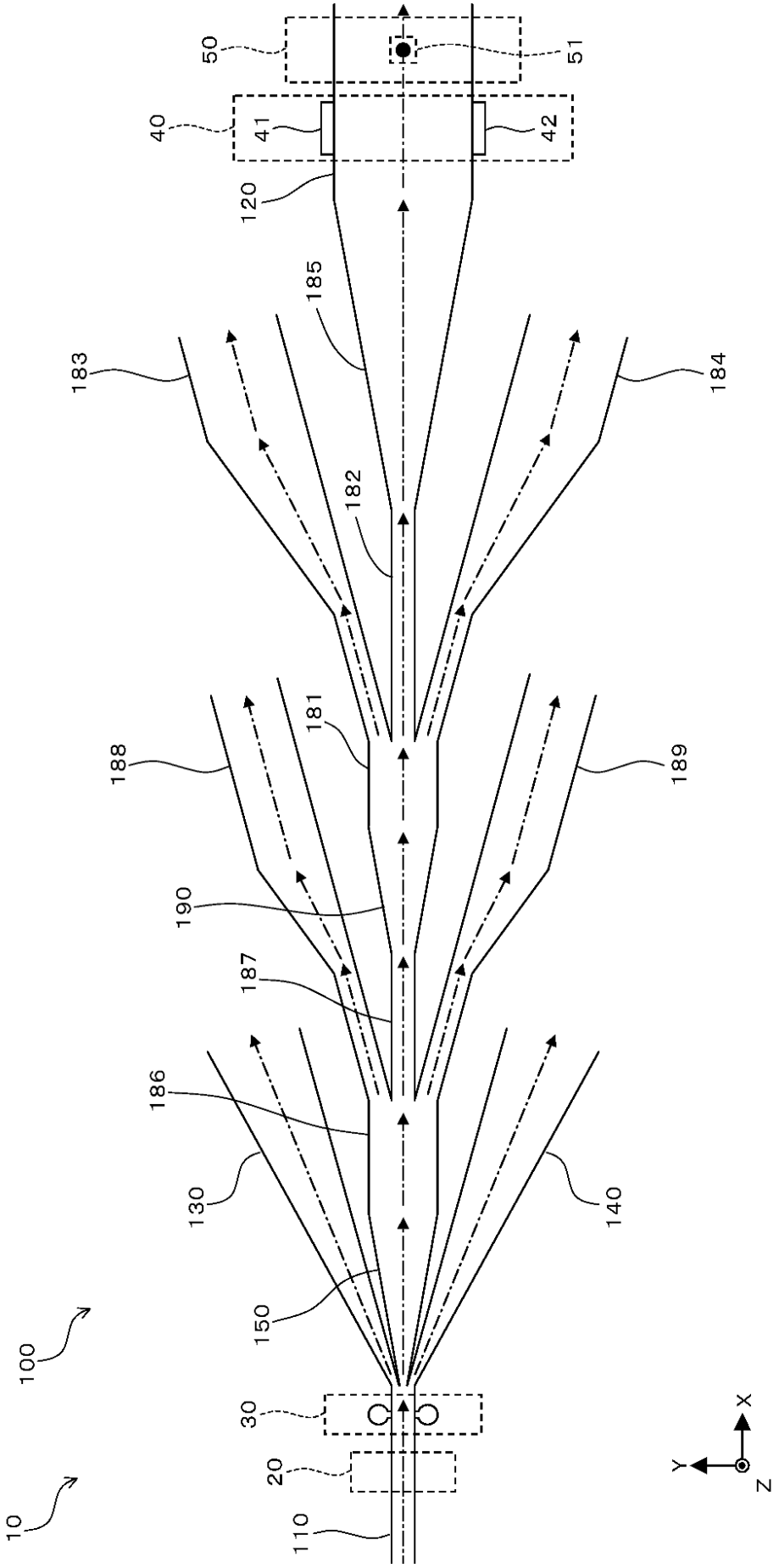
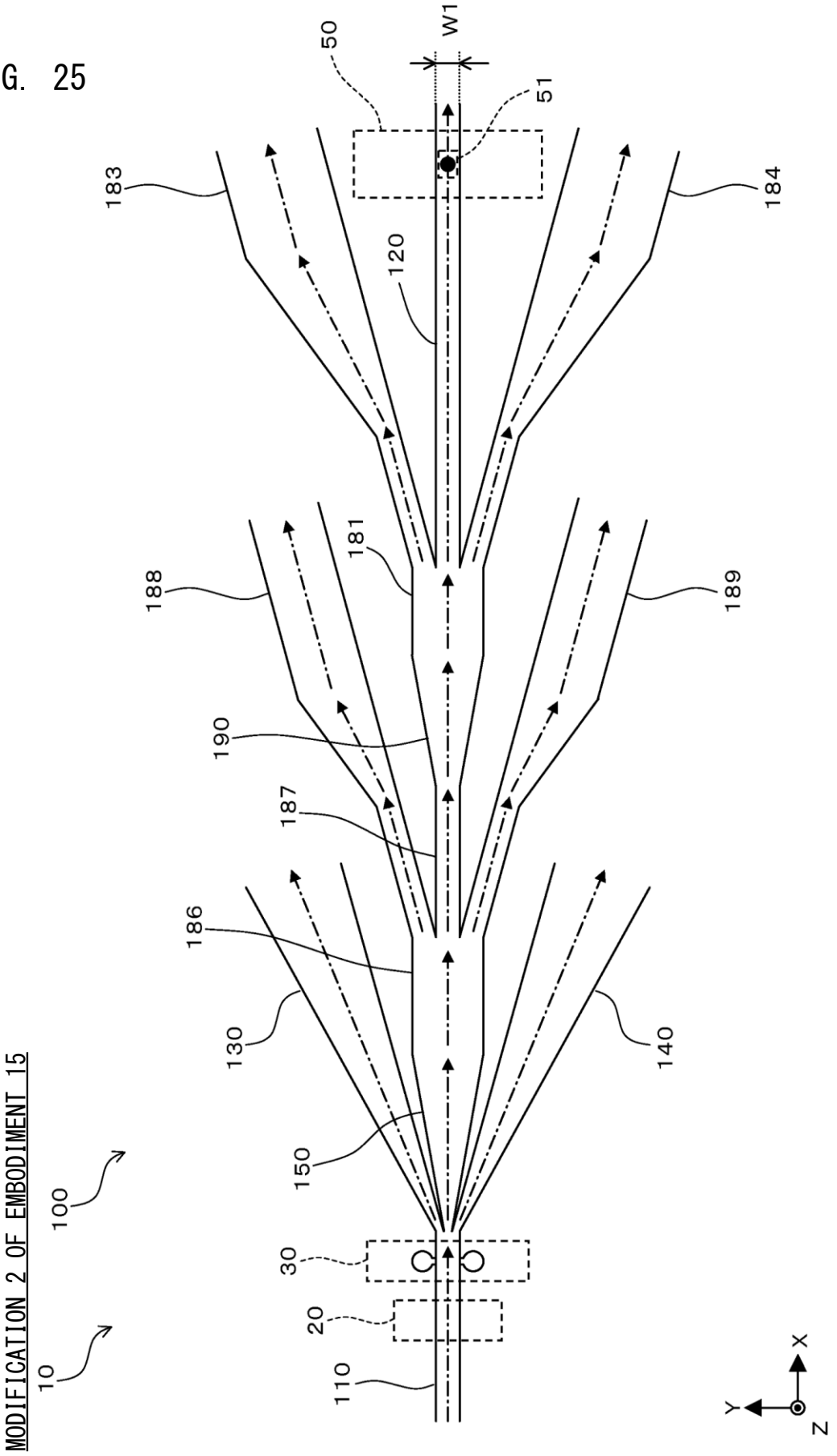

MODIFICATION 1 OF EMBODIMENT 15
10
100
110
20
30
40
41
42
50
51
120
130
140
150
181
182
183
184
185
186
187
188
189
190
X
Y
Z

FIG. 25


MODIFICATION 2 OF EMBODIMENT 15
10
100
110
20
30
150
130
186
187
190
188
181
183
120
50
W1
51
184
189
140
X
Y
Z