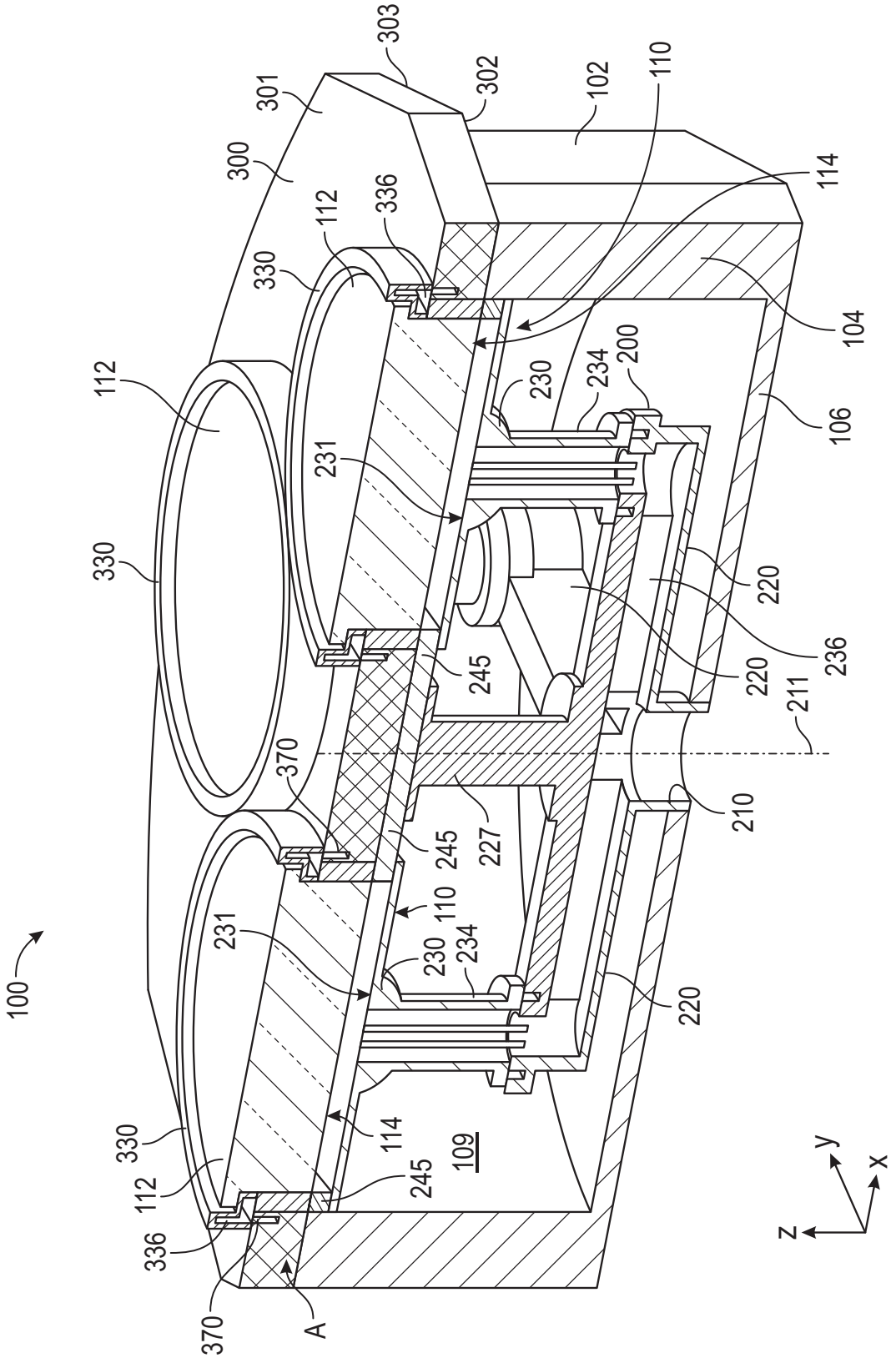

100
303
301
302
102
110
300
114
112
336
330
104
112
200
234
230
106
231
330
220
236
245
220
211
370
210
227
245
110
231
234
230
220
330
114
109
112
245
336
370
A
y
x
z

FIG. 1

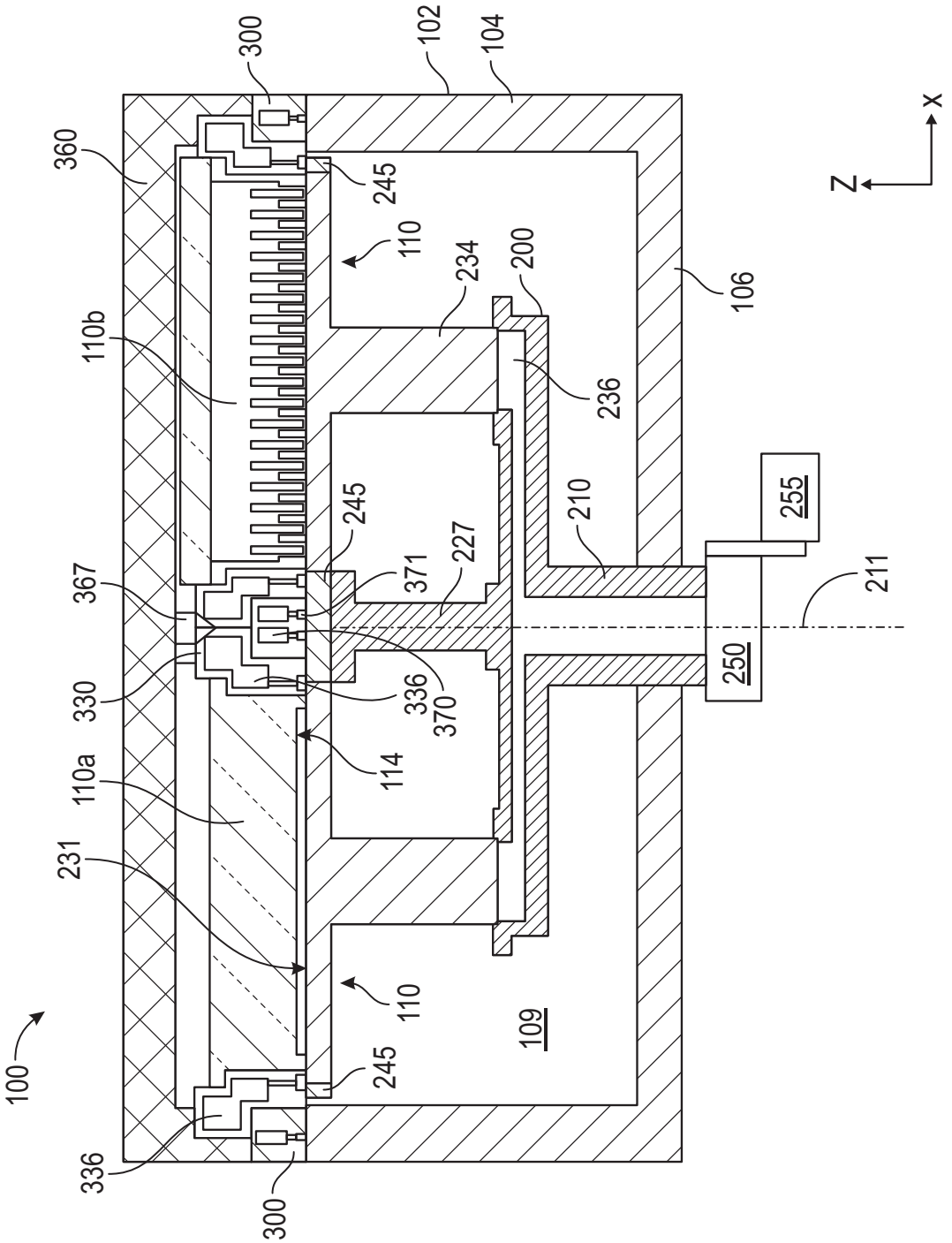

100
102
104
106
109
110
110a
110b
114
200
210
211
227
231
234
236
245
250
255
300
330
336
360
367
370
371
Z
X

FIG. 2

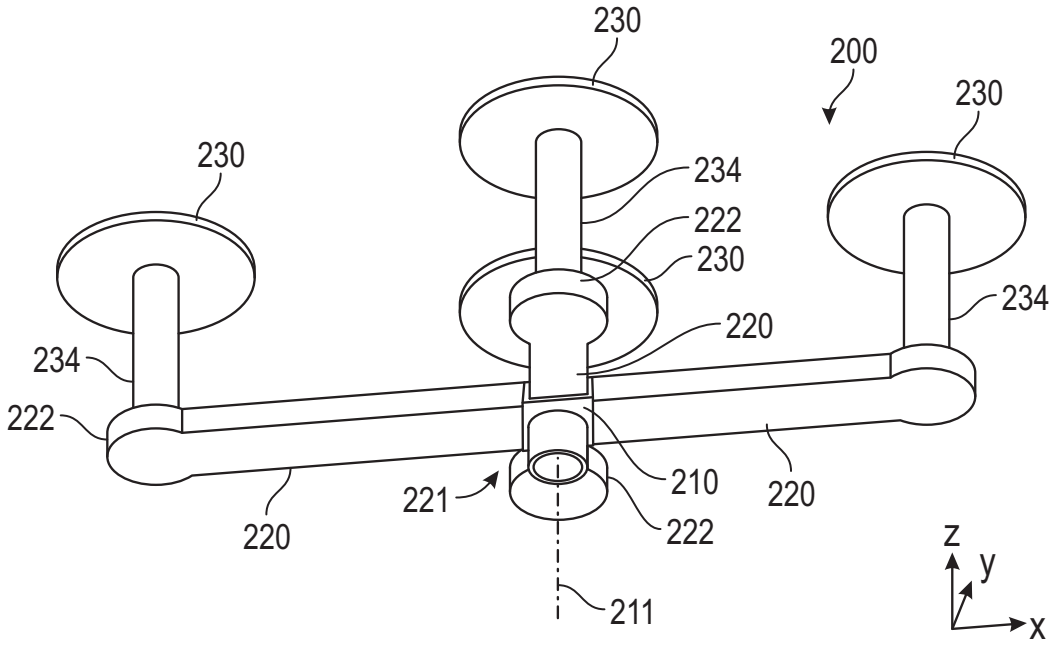

230
200
230
230
234
222
230
234
220
234
222
210
220
221
222
220
211
z
y
x

FIG. 3

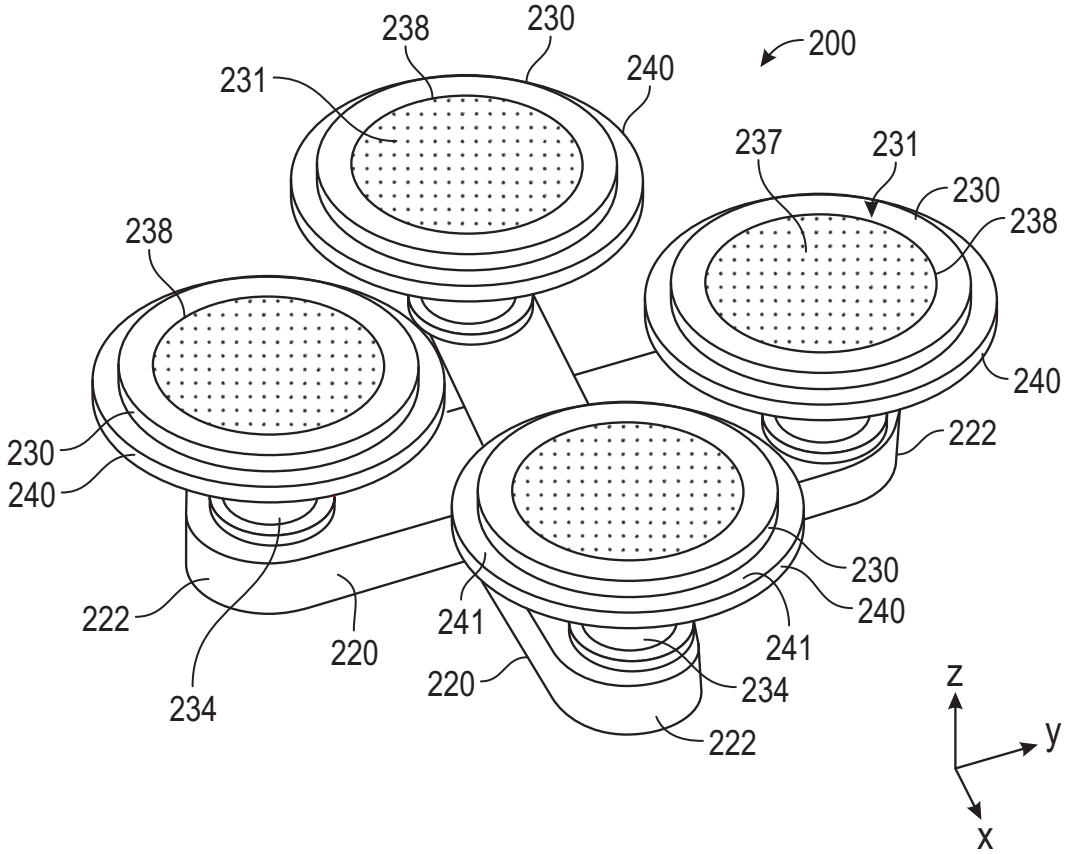

238
230
200
231
240
237
231
230
238
238
240
230
240
222
230
240
222
241
220
241
220
234
234
222
z
y
x

FIG. 4

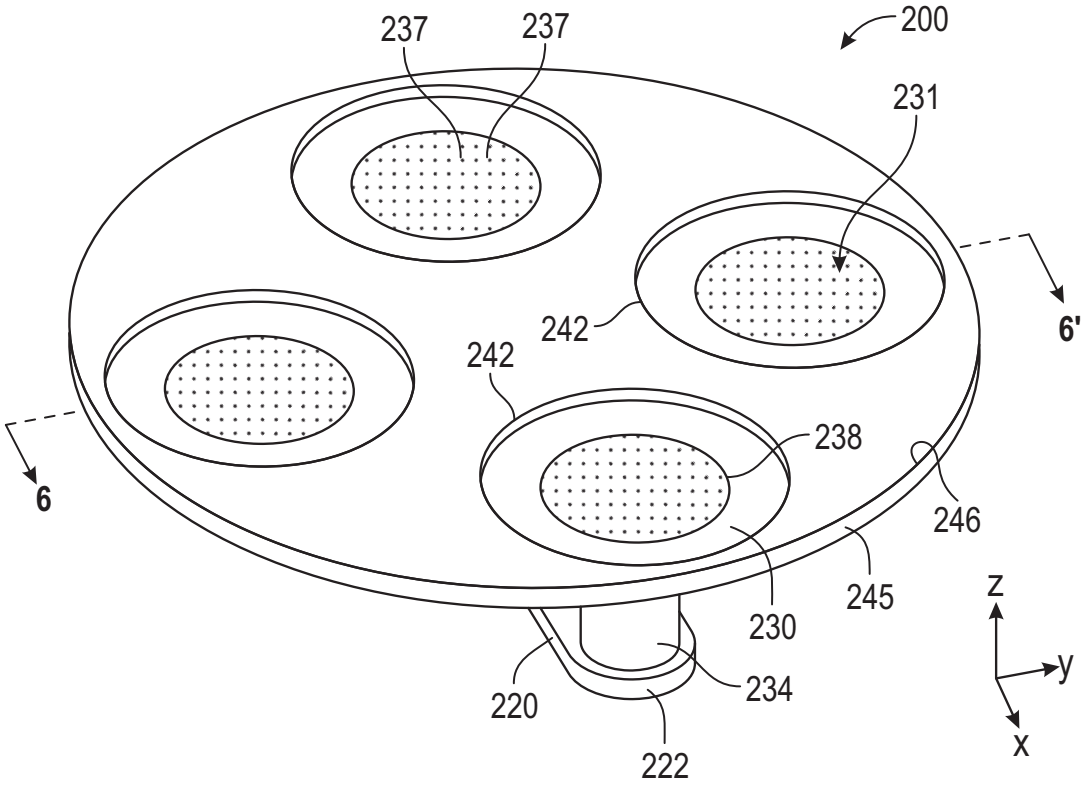

237
237
200
231
242
6'
242
238
6
246
245
230
234
220
222
z
y
x

FIG. 5

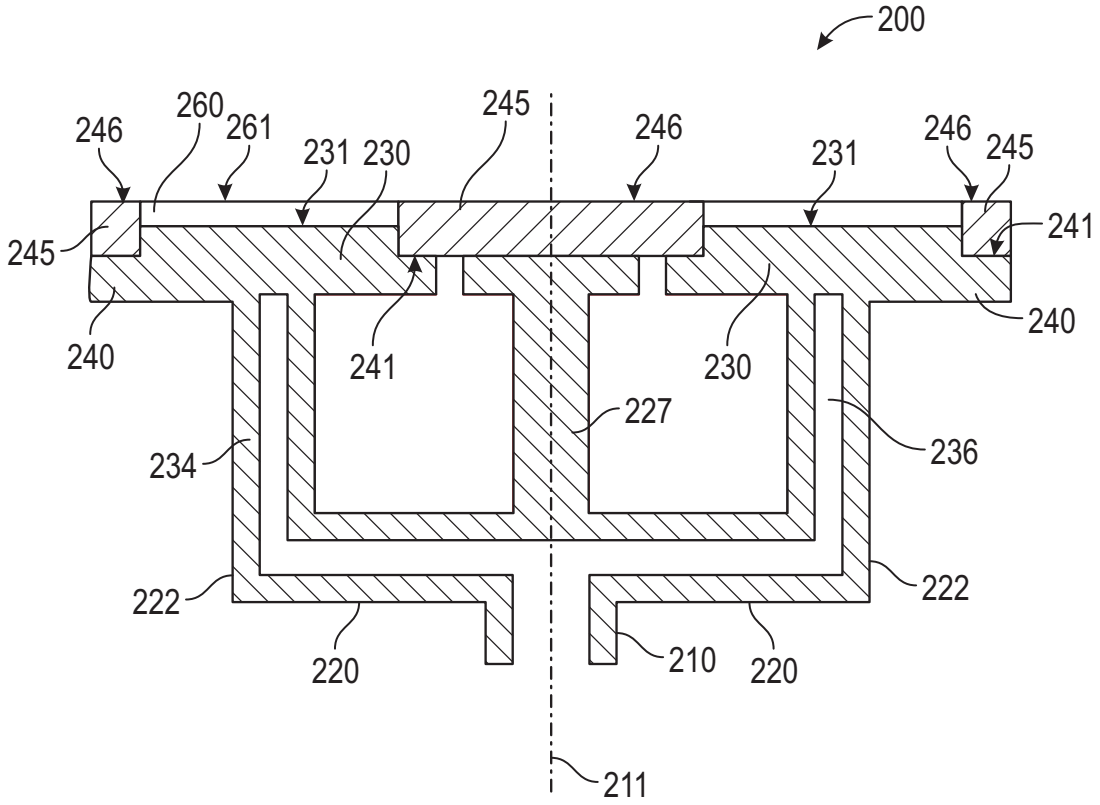

200
246
260
261
231
230
245
246
231
246
245
241
245
240
241
230
227
236
234
222
222
220
210
220
211

FIG. 6

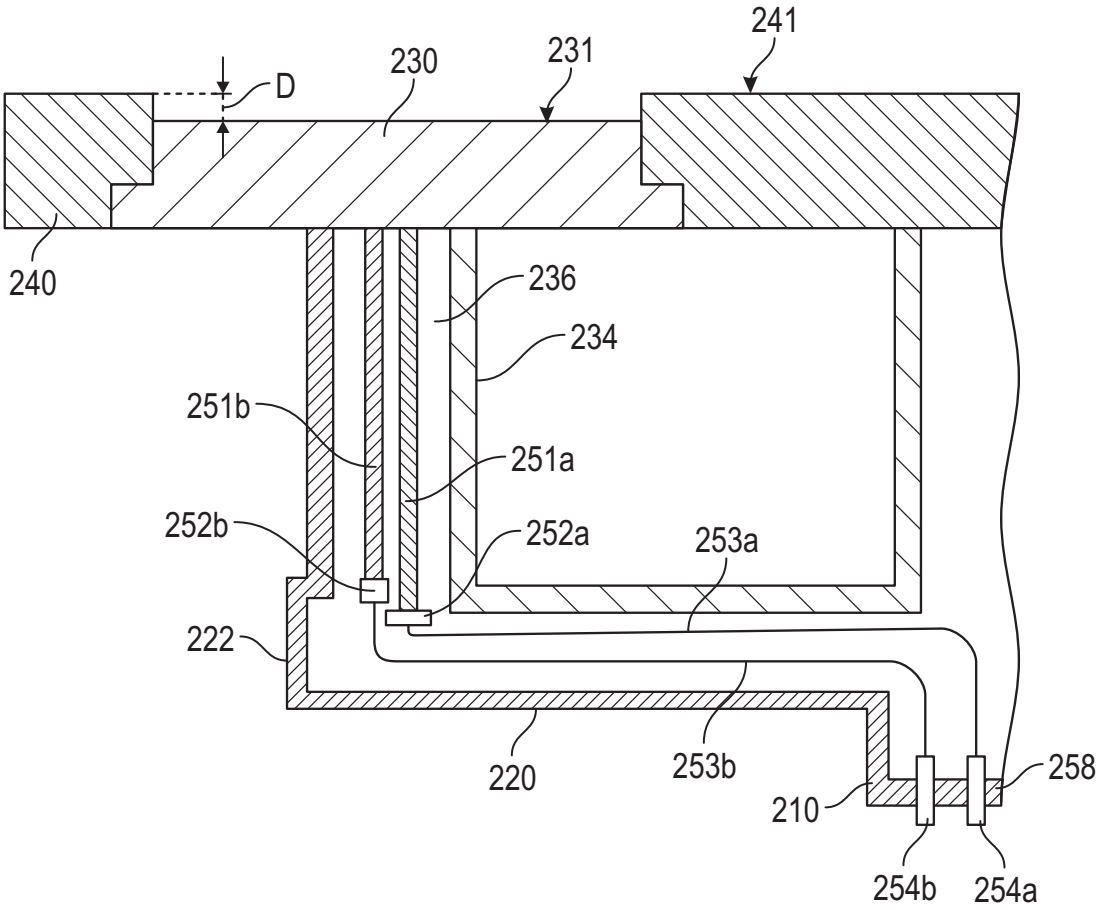

241
231
230
D
240
236
234
251b
251a
252b
252a
253a
222
220
253b
210
258
254b
254a

FIG. 7

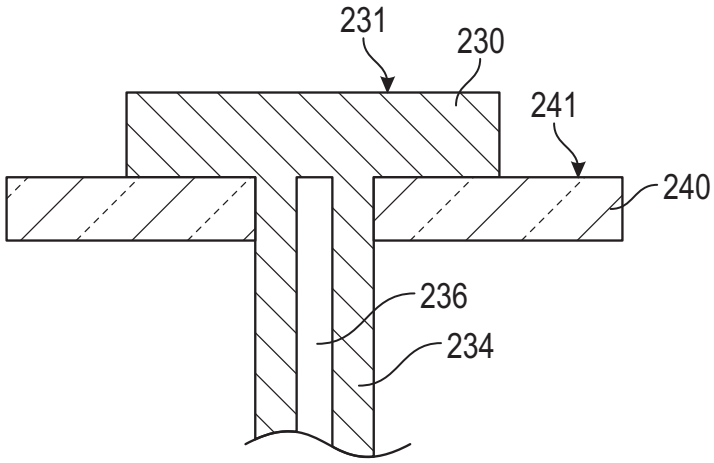

231
230
241
240
236
234

FIG. 8

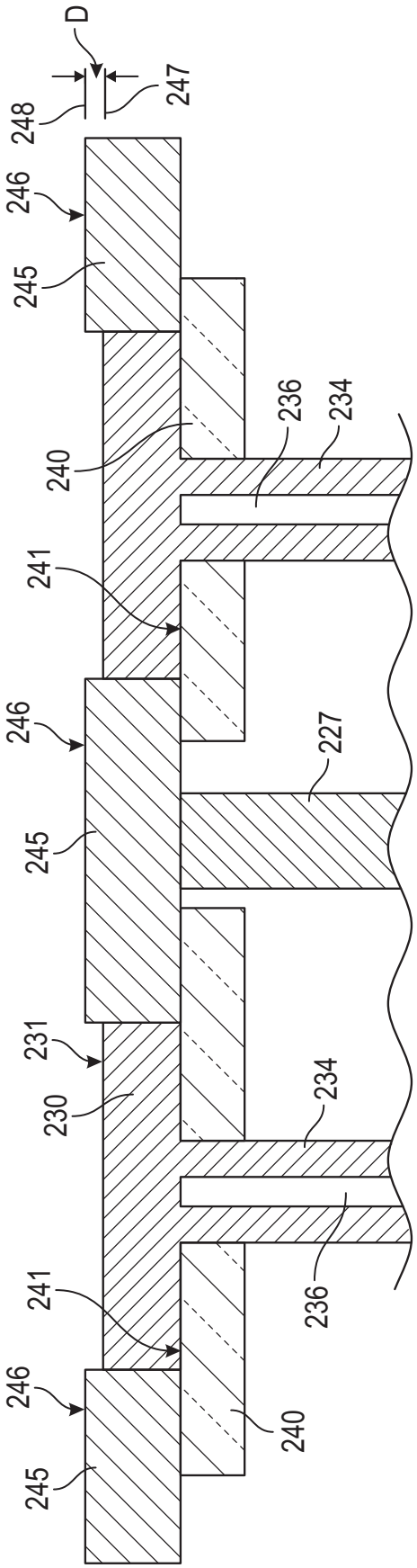

D
247
248
246
245
236
234
240
241
246
227
245
231
230
234
241
236
246
240
245

FIG. 9

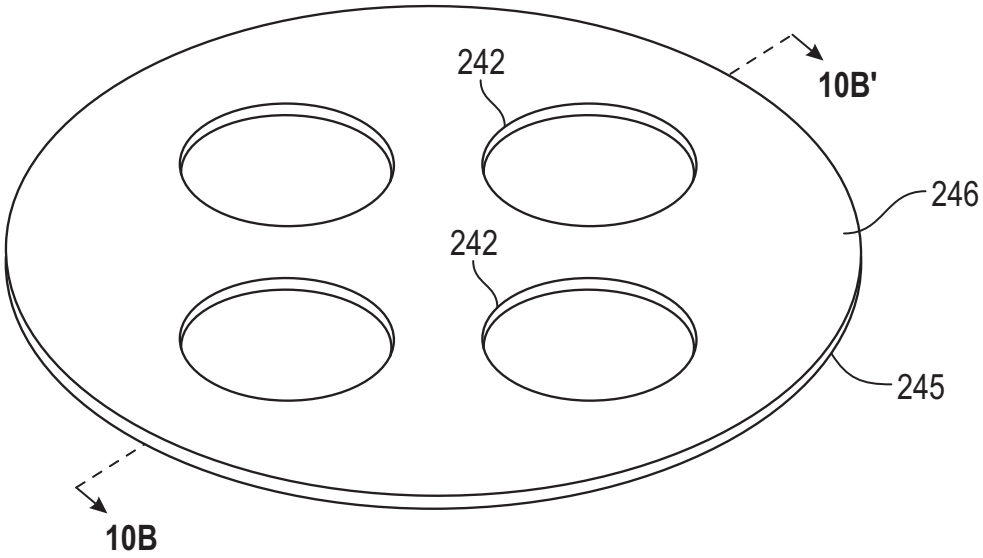


FIG. 10A

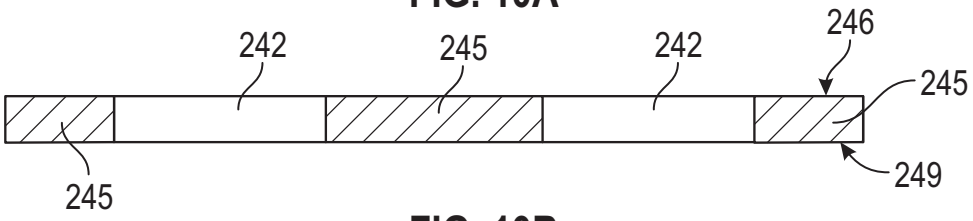


FIG. 10B

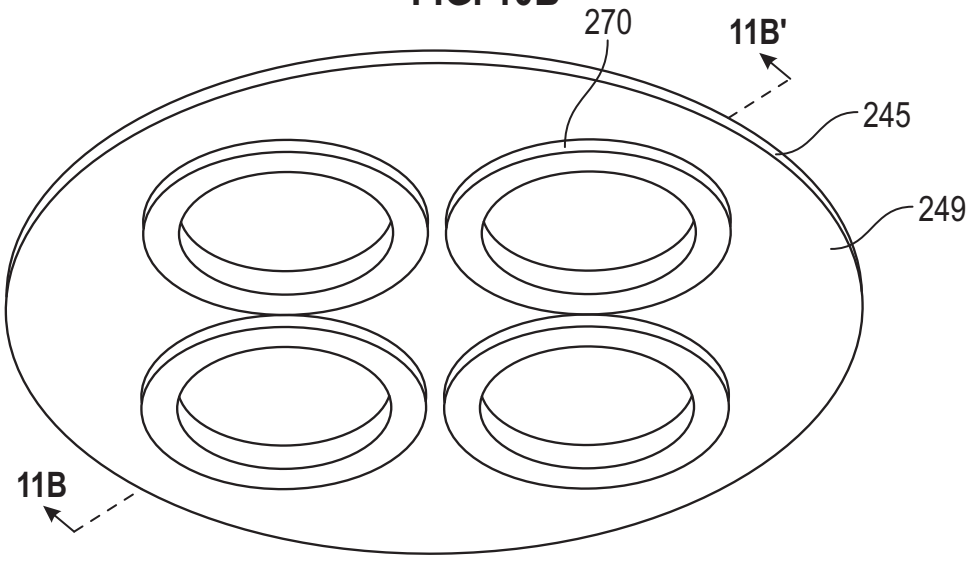


FIG. 11A

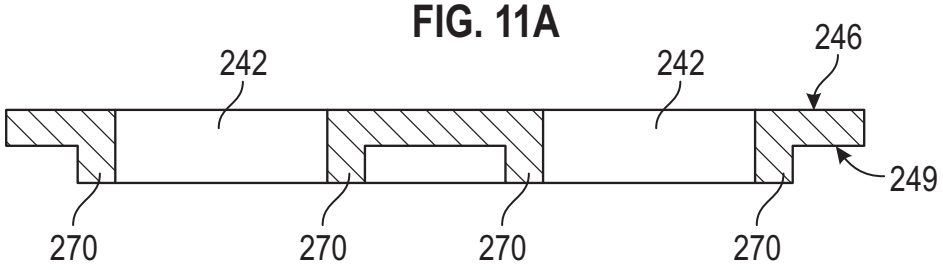


FIG. 11B

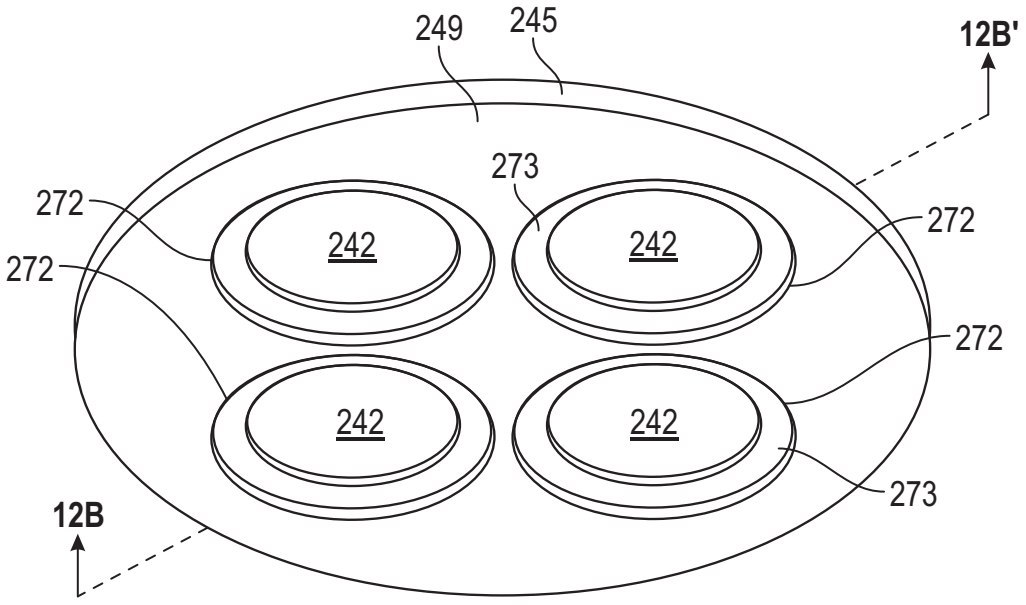


FIG. 12A

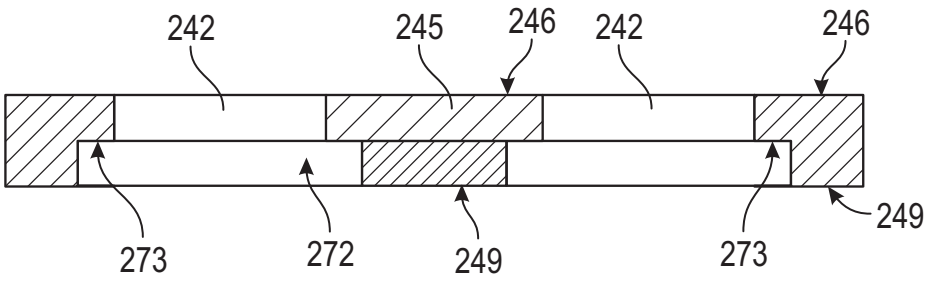


FIG. 12B

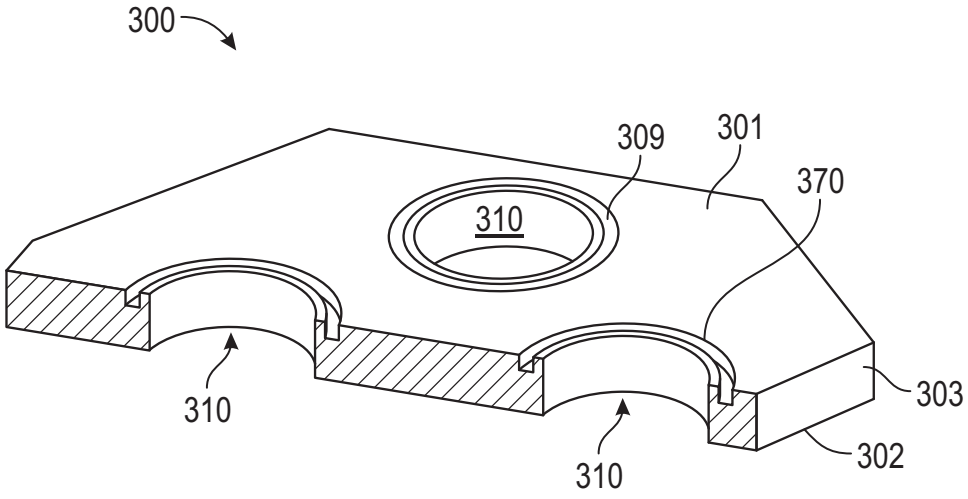


FIG. 13

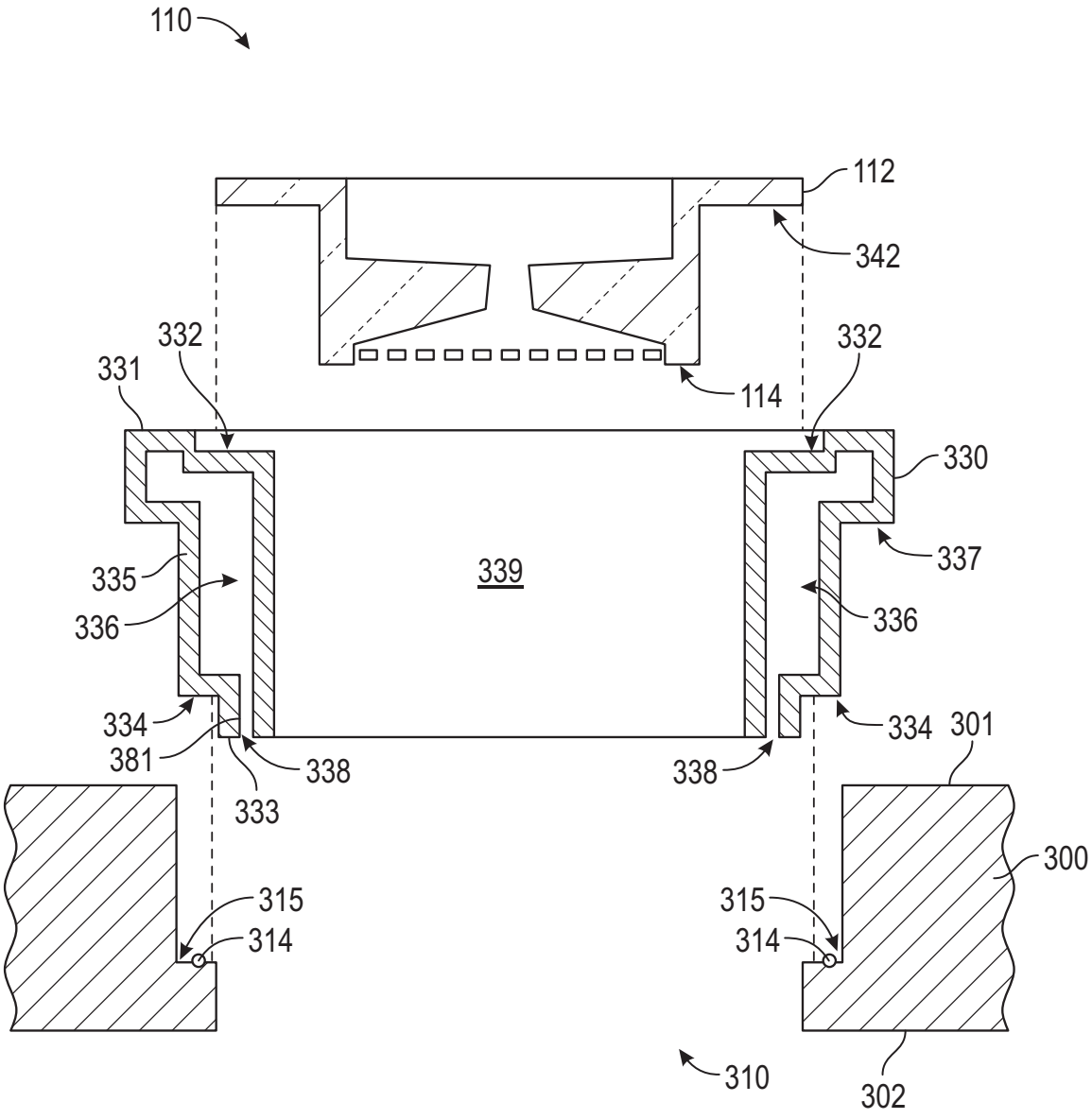

110
112
342
332
331
332
114
330
337
335
339
336
336
334
334
301
381
338
338
333
315
315
300
314
314
310
302

FIG. 14

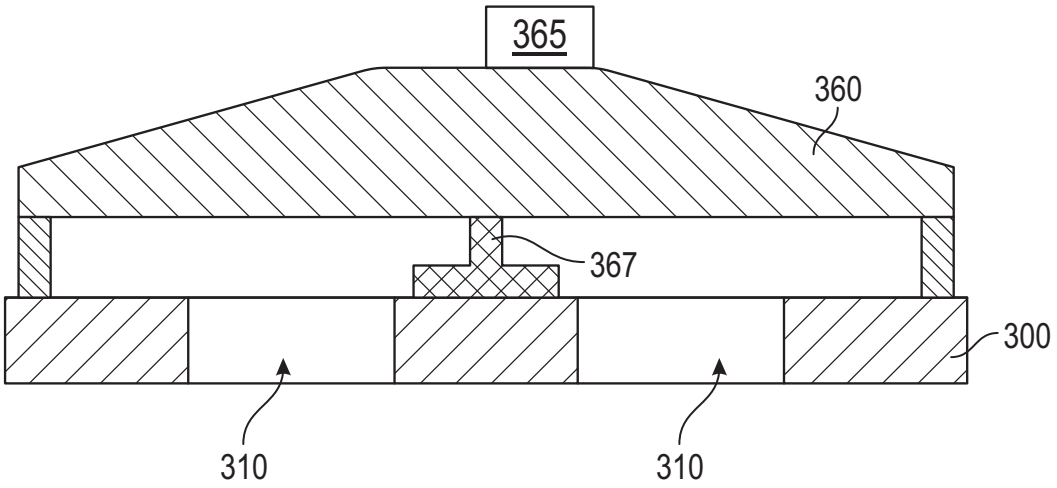

365
360
367
300
310
310

FIG. 15

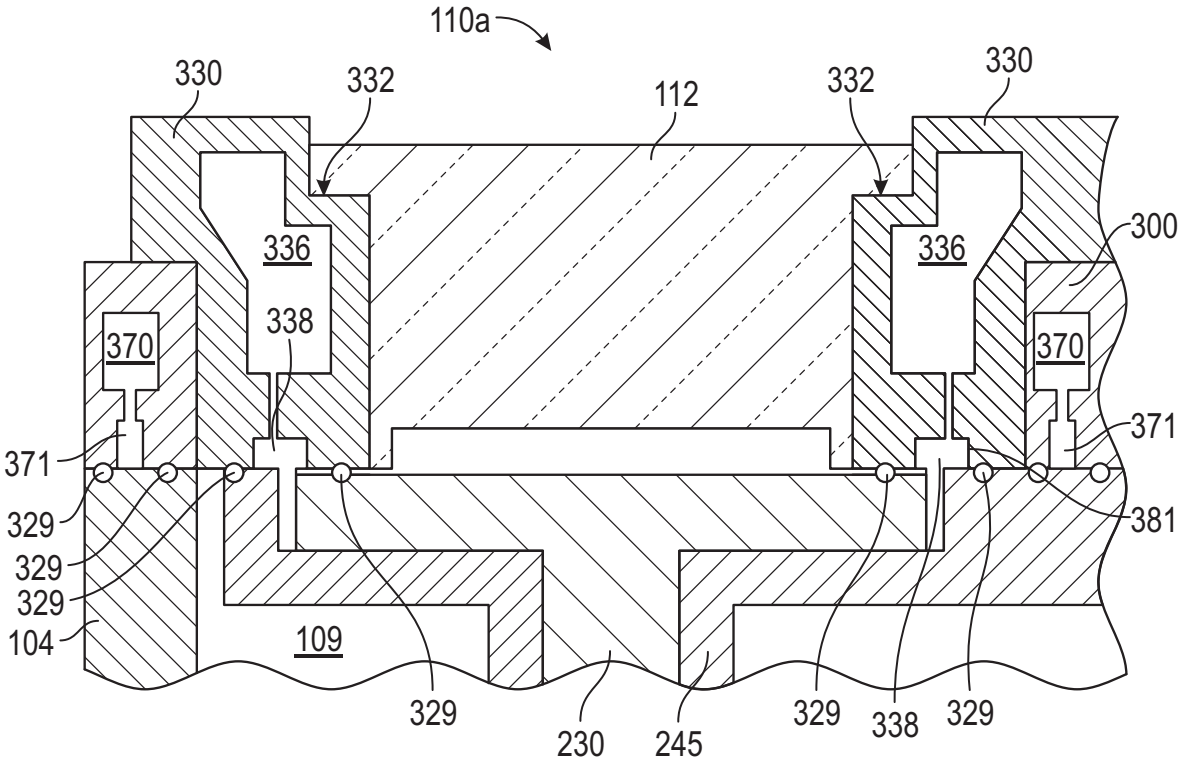

110a
330
332
112
332
330
336
336
300
338
370
370
371
371
329
329
329
381
104
109
329
230
245
329
338
329

FIG. 16

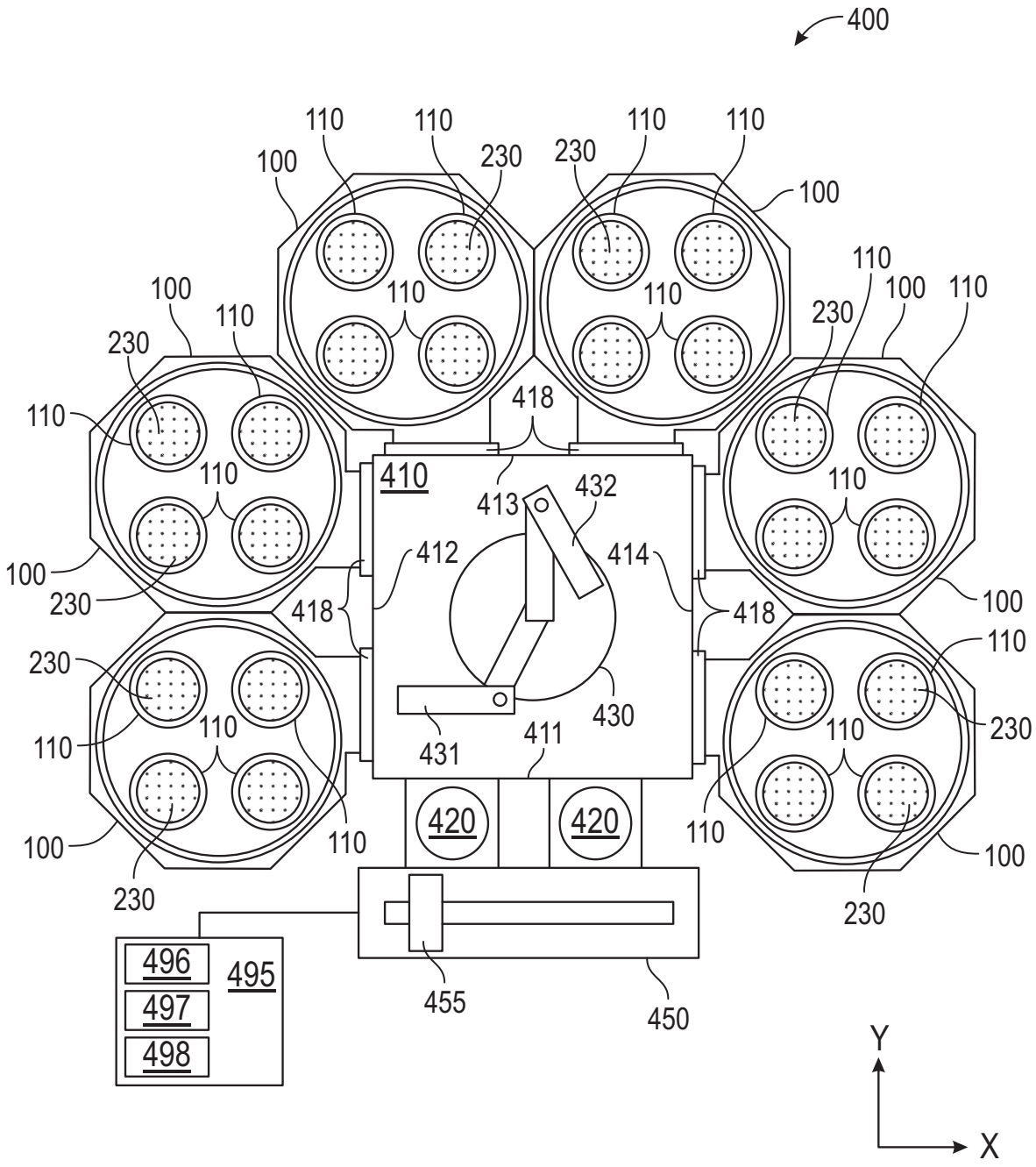

400
110
100
230
418
410
413
432
412
414
430
431
411
420
496
497
498
495
455
450
Y
X

FIG. 17

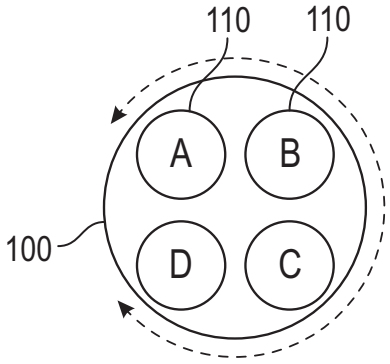


FIG. 18A

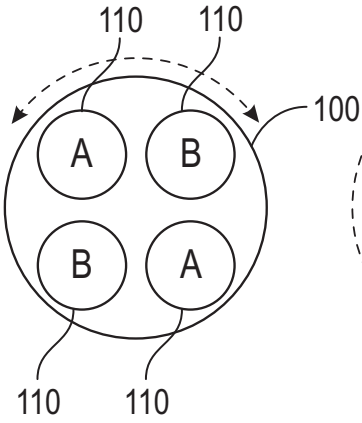


FIG. 18B

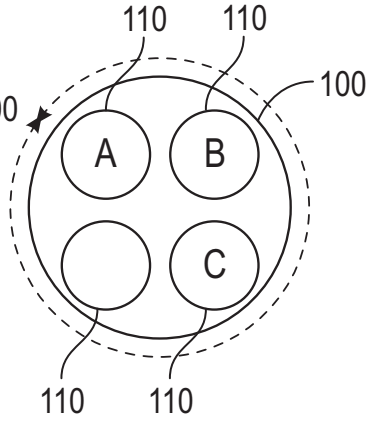


FIG. 18C

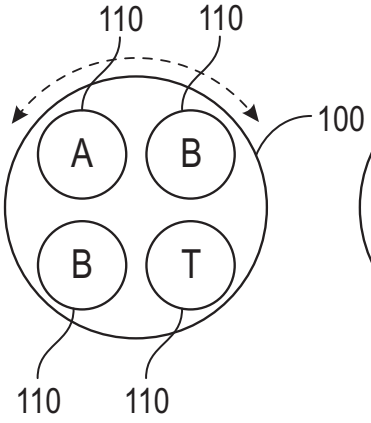


FIG. 18D

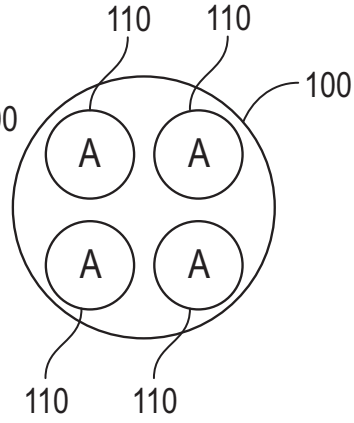


FIG. 18E

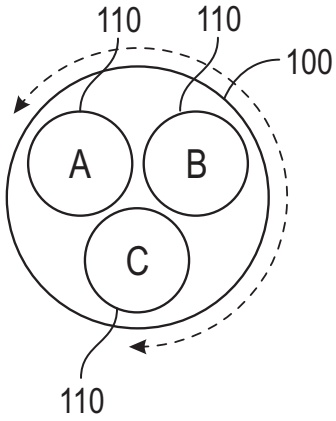


FIG. 18F

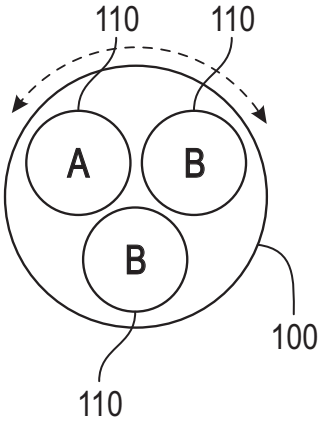


FIG. 18G

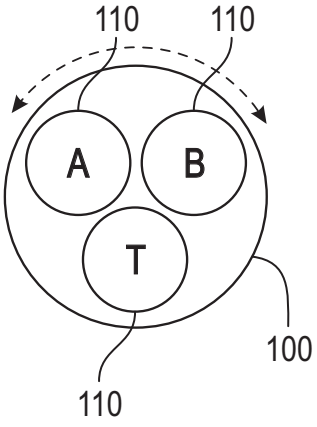


FIG. 18H

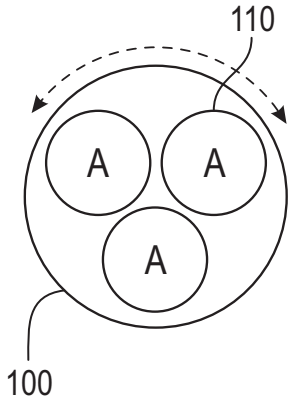


FIG. 18I

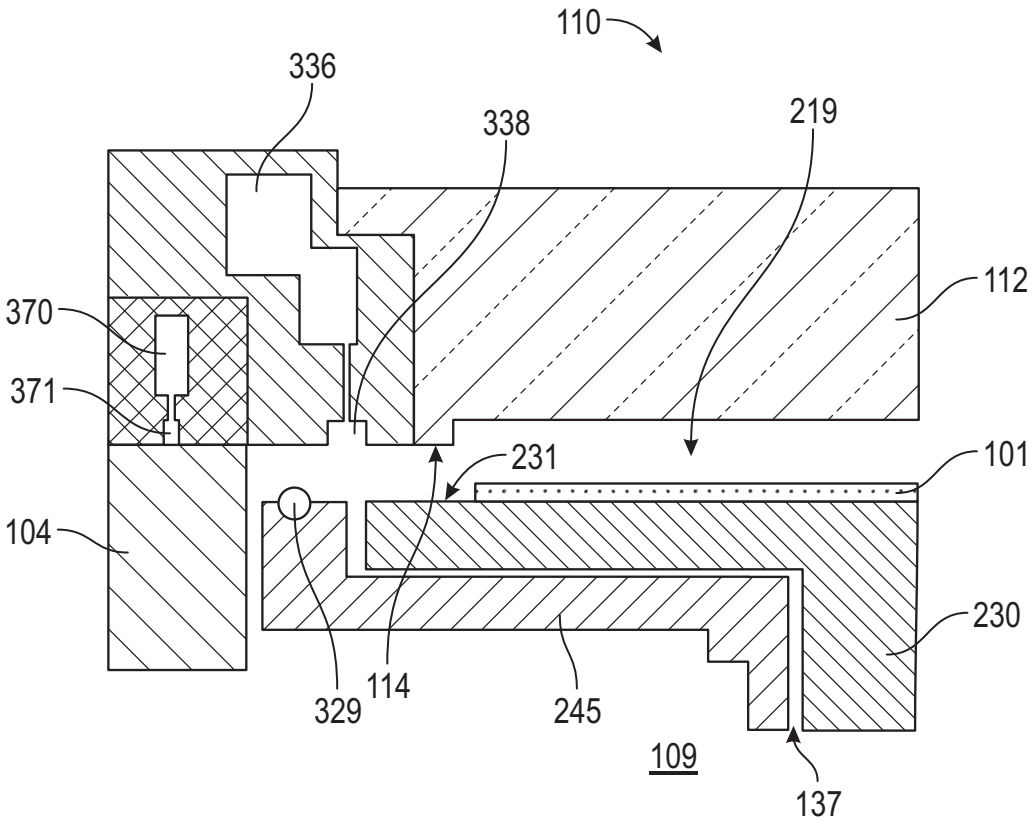


FIG. 19A

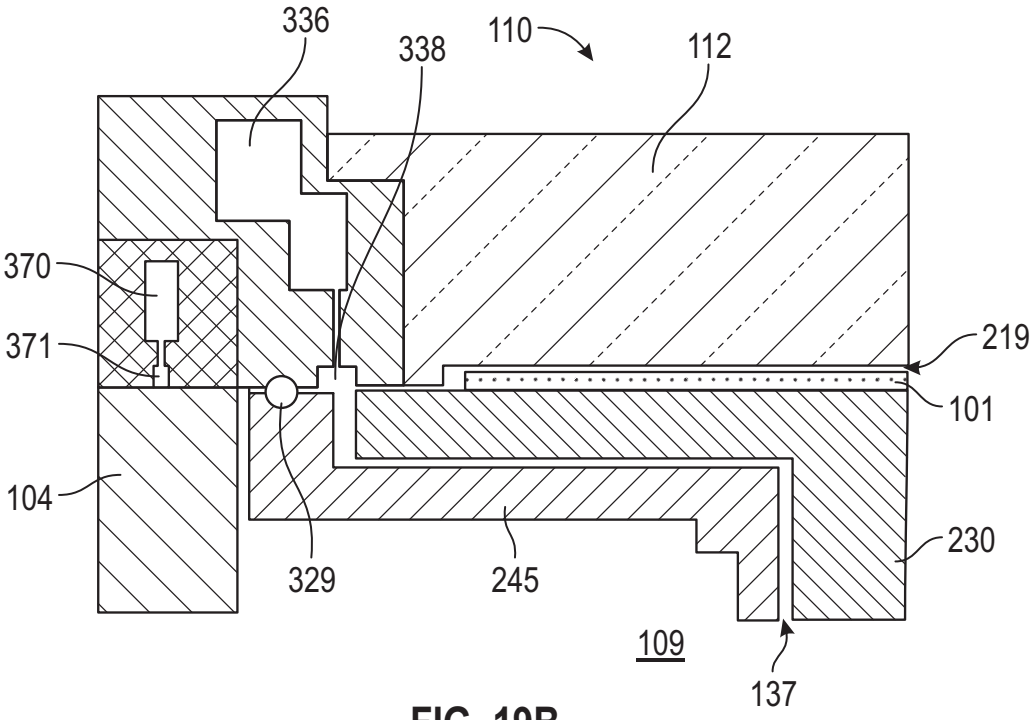


FIG. 19B

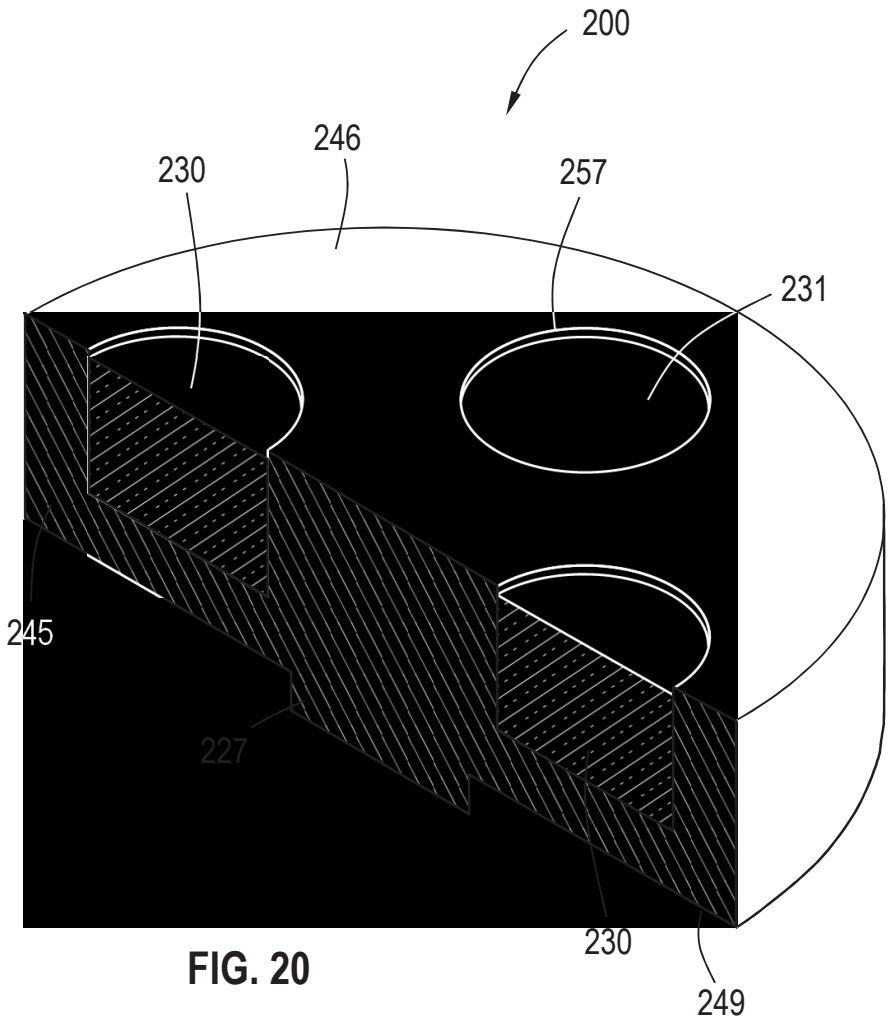


FIG. 20

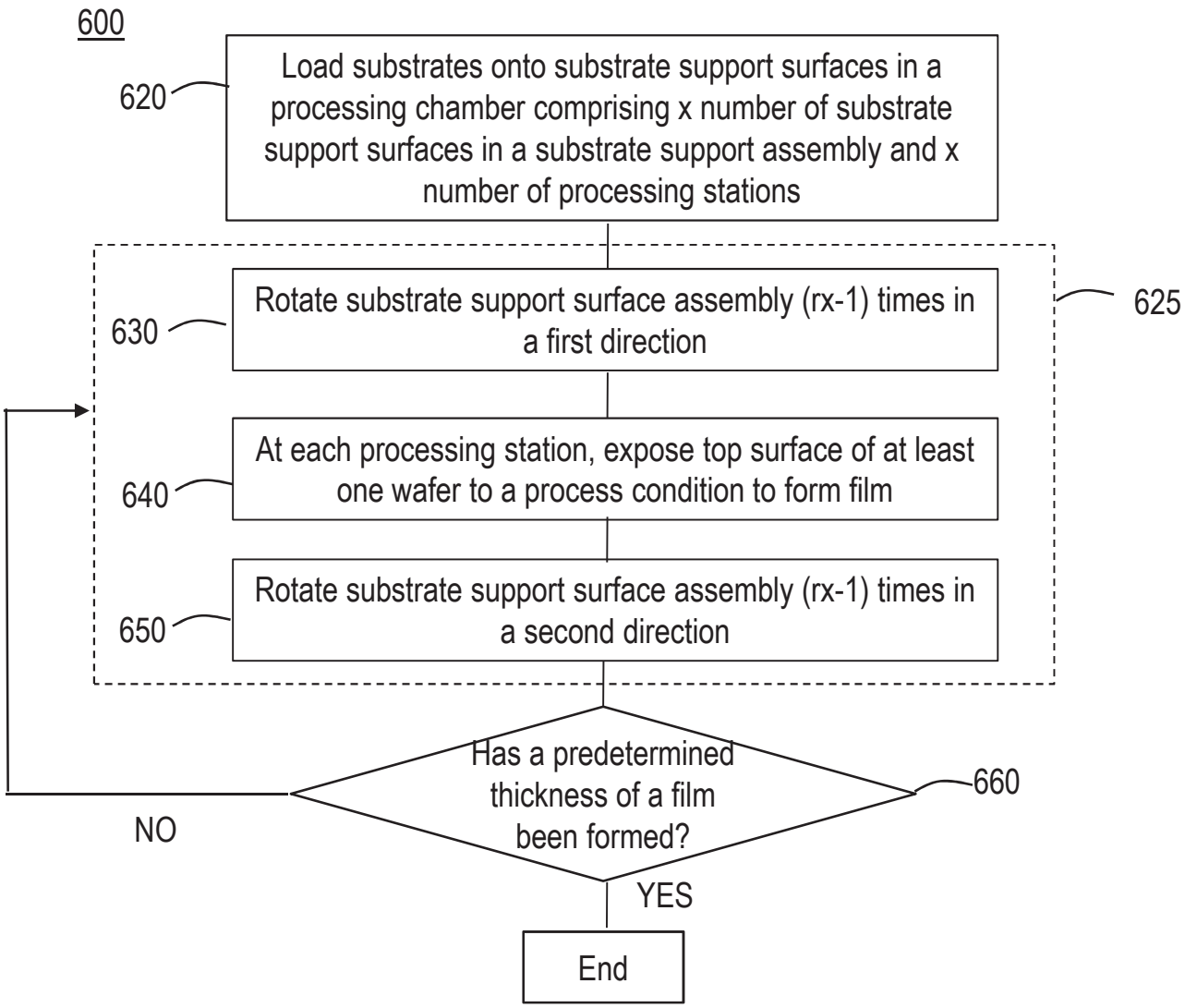

600
620
Load substrates onto substrate support surfaces in a processing chamber comprising x number of substrate support surfaces in a substrate support assembly and x number of processing stations
625
630
Rotate substrate support surface assembly (rx-1) times in a first direction
640
At each processing station, expose top surface of at least one wafer to a process condition to form film
650
Rotate substrate support surface assembly (rx-1) times in a second direction
660
Has a predetermined thickness of a film been formed?
NO
YES
End

FIG. 21

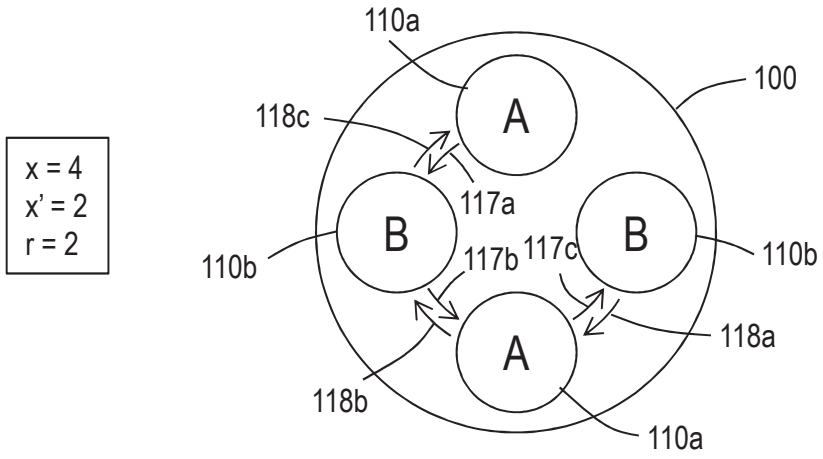

x = 4
x' = 2
r = 2
110a
100
118c
A
117a
B
B
110b
117b
117c
110b
118a
A
118b
110a

FIG. 22

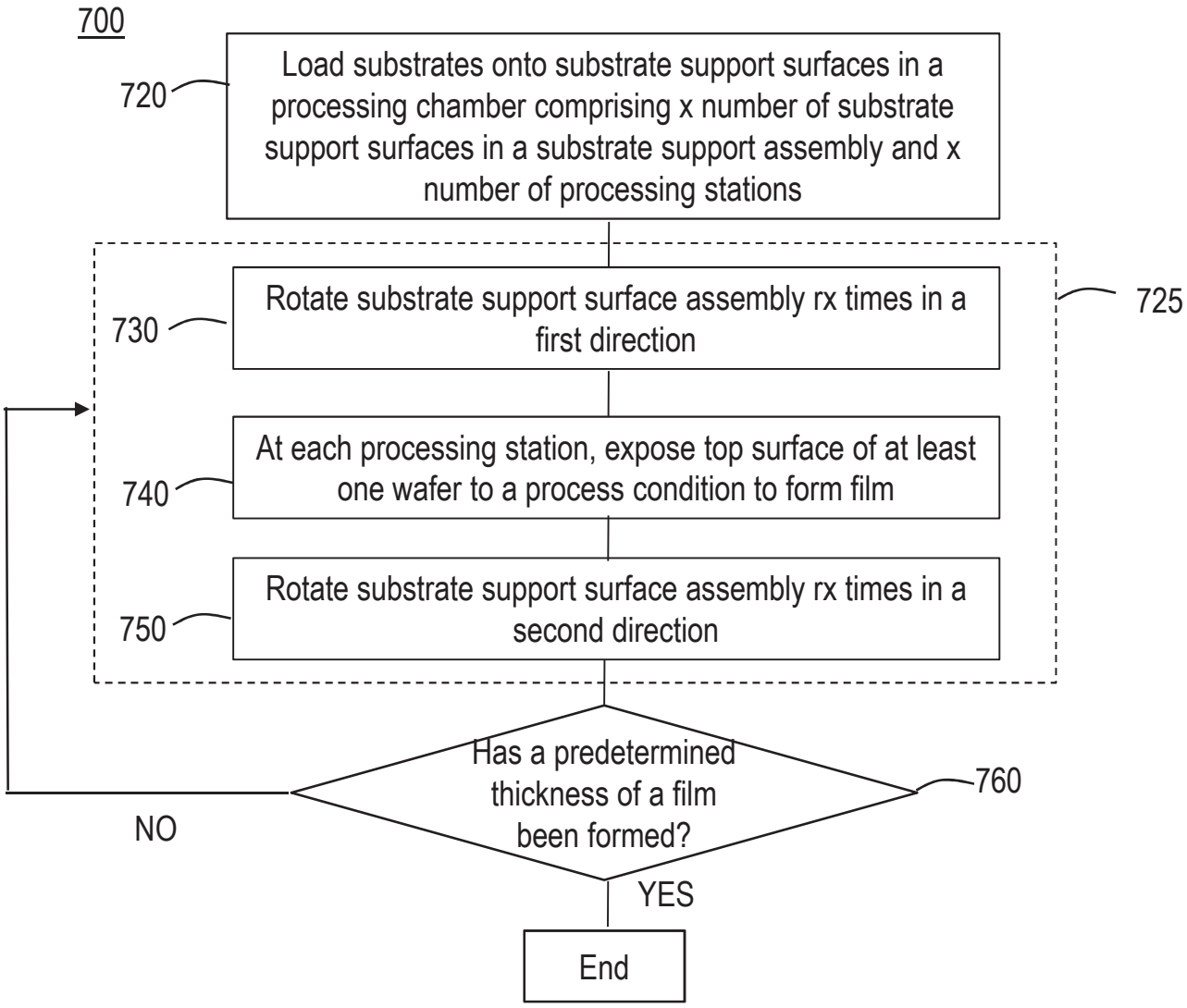

700
720
Load substrates onto substrate support surfaces in a processing chamber comprising x number of substrate support surfaces in a substrate support assembly and x number of processing stations
725
730
Rotate substrate support surface assembly rx times in a first direction
740
At each processing station, expose top surface of at least one wafer to a process condition to form film
750
Rotate substrate support surface assembly rx times in a second direction
760
Has a predetermined thickness of a film been formed?
NO
YES
End

FIG. 23

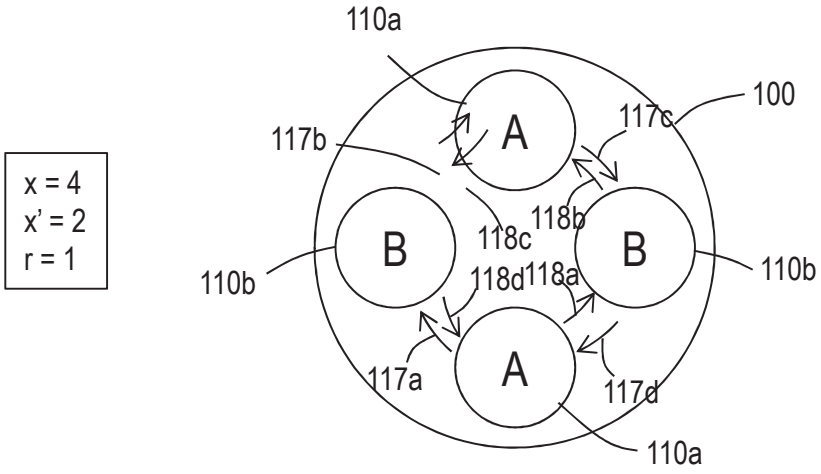

x = 4
x' = 2
r = 1
110a
100
117b
117c
A
B
B
118b
118c
118d
118a
110b
110b
117a
A
117d
110a

FIG. 24

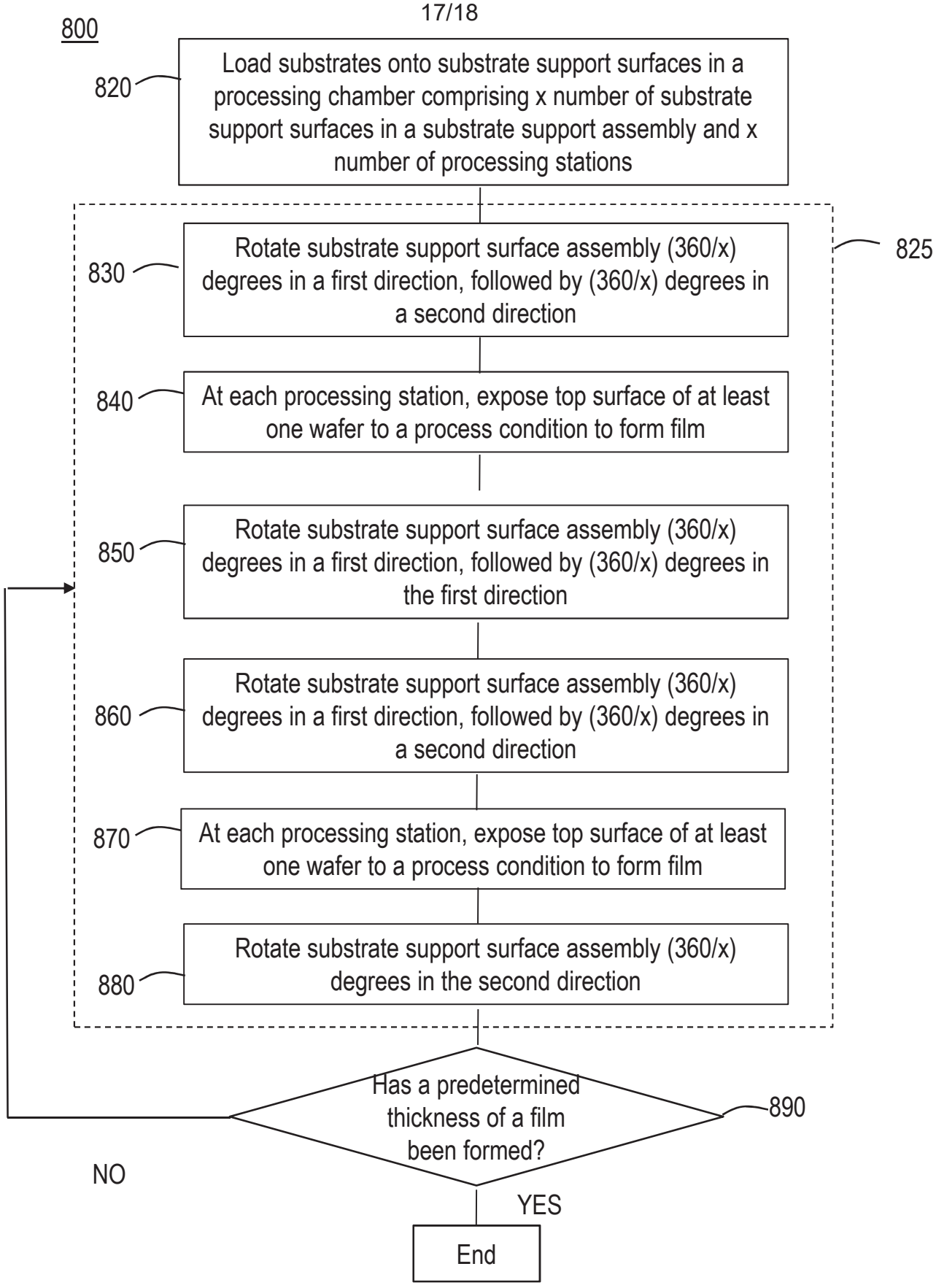

800
820
Load substrates onto substrate support surfaces in a processing chamber comprising x number of substrate support surfaces in a substrate support assembly and x number of processing stations
825
830
Rotate substrate support surface assembly (360/x) degrees in a first direction, followed by (360/x) degrees in a second direction
840
At each processing station, expose top surface of at least one wafer to a process condition to form film
850
Rotate substrate support surface assembly (360/x) degrees in a first direction, followed by (360/x) degrees in the first direction
860
Rotate substrate support surface assembly (360/x) degrees in a first direction, followed by (360/x) degrees in a second direction
870
At each processing station, expose top surface of at least one wafer to a process condition to form film
880
Rotate substrate support surface assembly (360/x) degrees in the second direction
Has a predetermined thickness of a film been formed?
890
NO
YES
End

FIG. 25

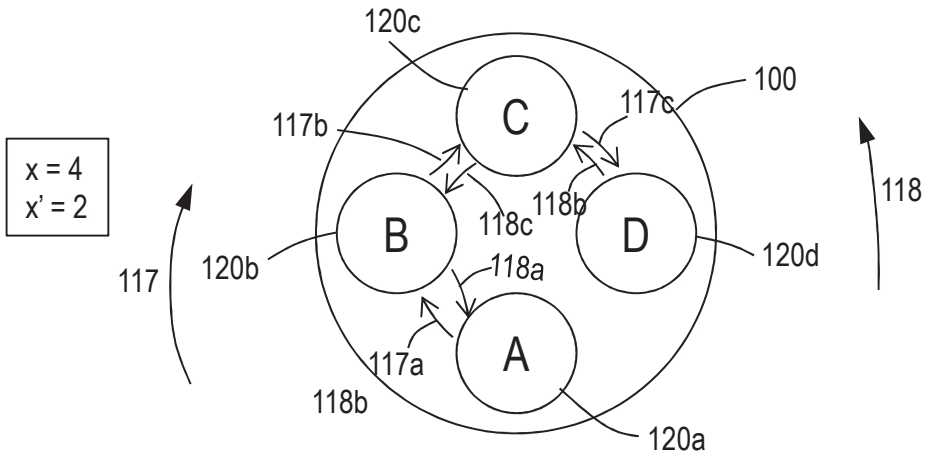

x = 4
x' = 2
120c
100
117b
C
117c
118
B
118c
118b
D
120d
117
120b
118a
117a
A
118b
120a

FIG. 26