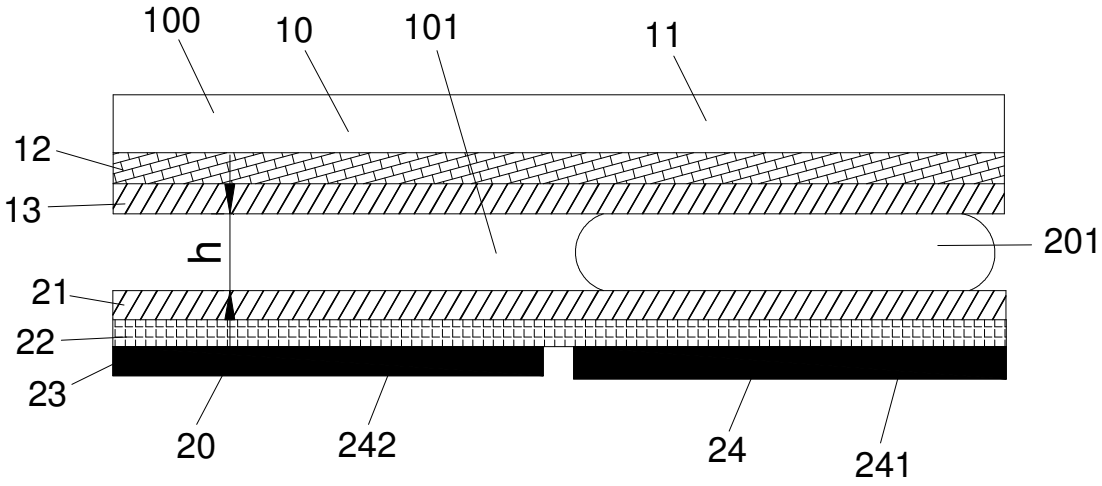


FIG. 1

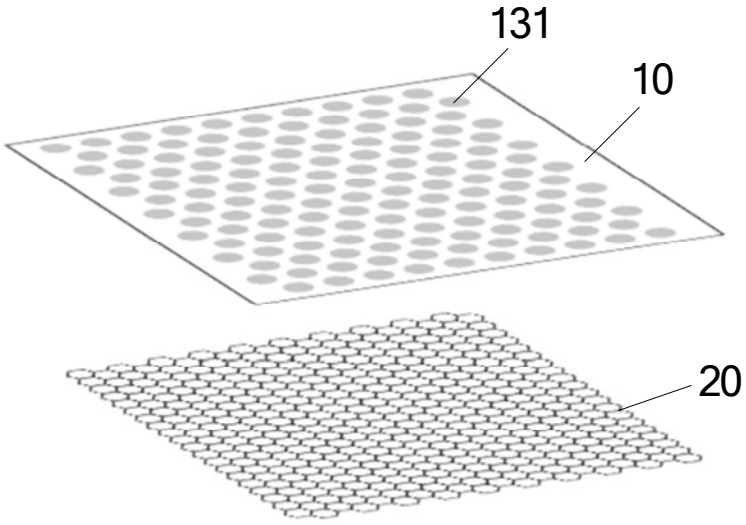


FIG. 2

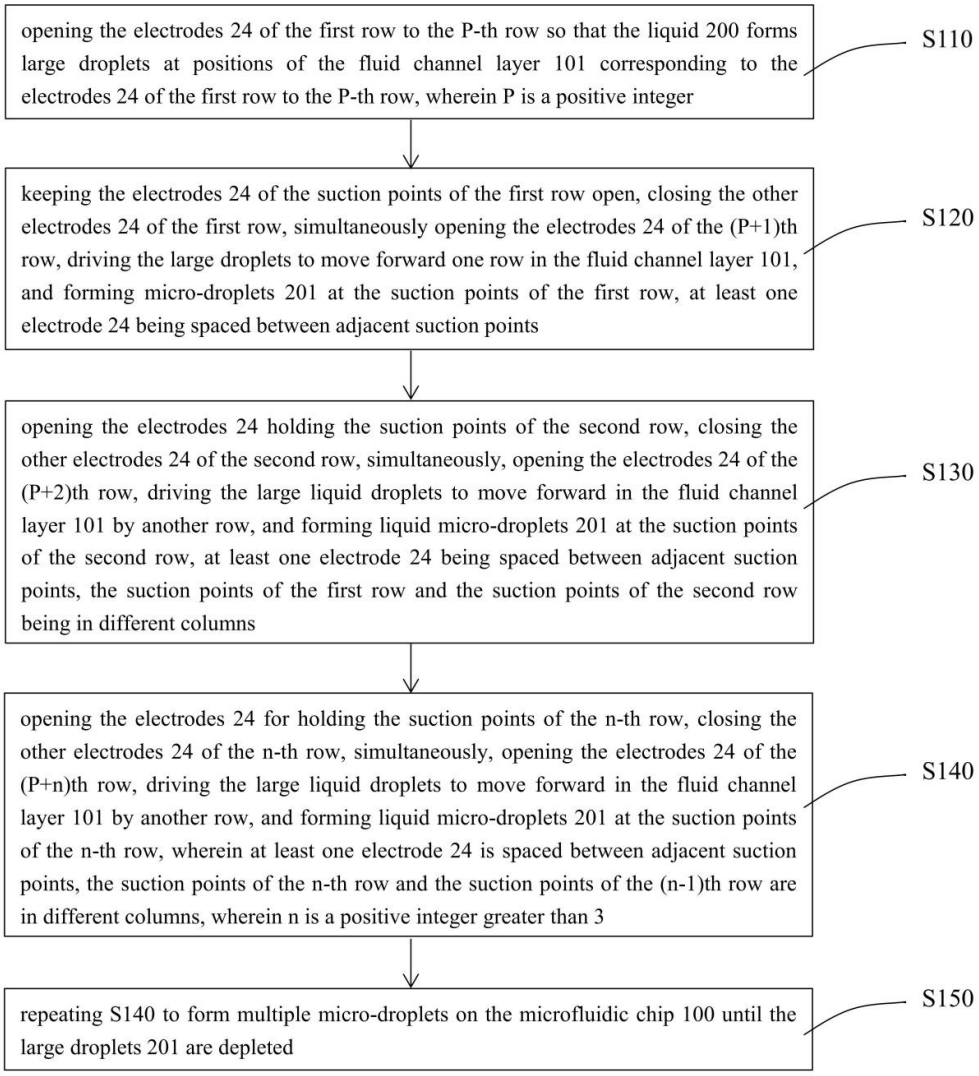

opening the electrodes 24 of the first row to the P-th row so that the liquid 200 forms large droplets at positions of the fluid channel layer 101 corresponding to the electrodes 24 of the first row to the P-th row, wherein P is a positive integer
S110
keeping the electrodes 24 of the suction points of the first row open, closing the other electrodes 24 of the first row, simultaneously opening the electrodes 24 of the (P+1)th row, driving the large droplets to move forward one row in the fluid channel layer 101, and forming micro-droplets 201 at the suction points of the first row, at least one electrode 24 being spaced between adjacent suction points
S120
opening the electrodes 24 holding the suction points of the second row, closing the other electrodes 24 of the second row, simultaneously, opening the electrodes 24 of the (P+2)th row, driving the large liquid droplets to move forward in the fluid channel layer 101 by another row, and forming liquid micro-droplets 201 at the suction points of the second row, at least one electrode 24 being spaced between adjacent suction points, the suction points of the first row and the suction points of the second row being in different columns
S130
opening the electrodes 24 for holding the suction points of the n-th row, closing the other electrodes 24 of the n-th row, simultaneously, opening the electrodes 24 of the (P+n)th row, driving the large liquid droplets to move forward in the fluid channel layer 101 by another row, and forming liquid micro-droplets 201 at the suction points of the n-th row, wherein at least one electrode 24 is spaced between adjacent suction points, the suction points of the n-th row and the suction points of the (n-1)th row are in different columns, wherein n is a positive integer greater than 3
S140
repeating S140 to form multiple micro-droplets on the microfluidic chip 100 until the large droplets 201 are depleted
S150

FIG. 3

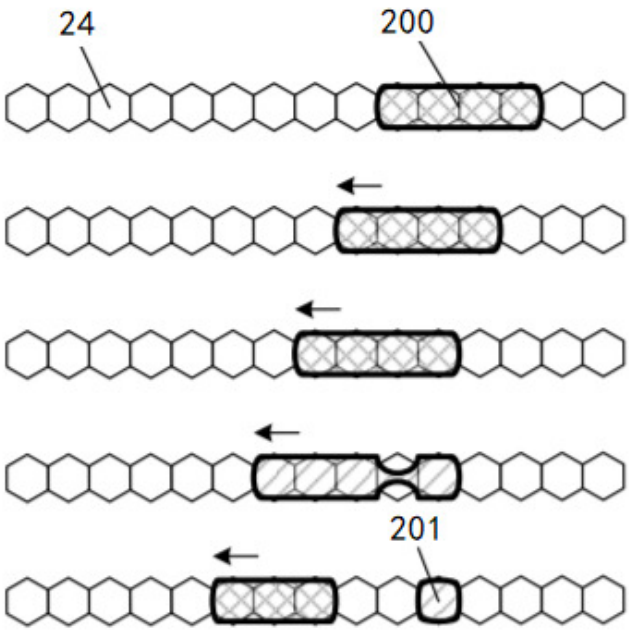


FIG. 4

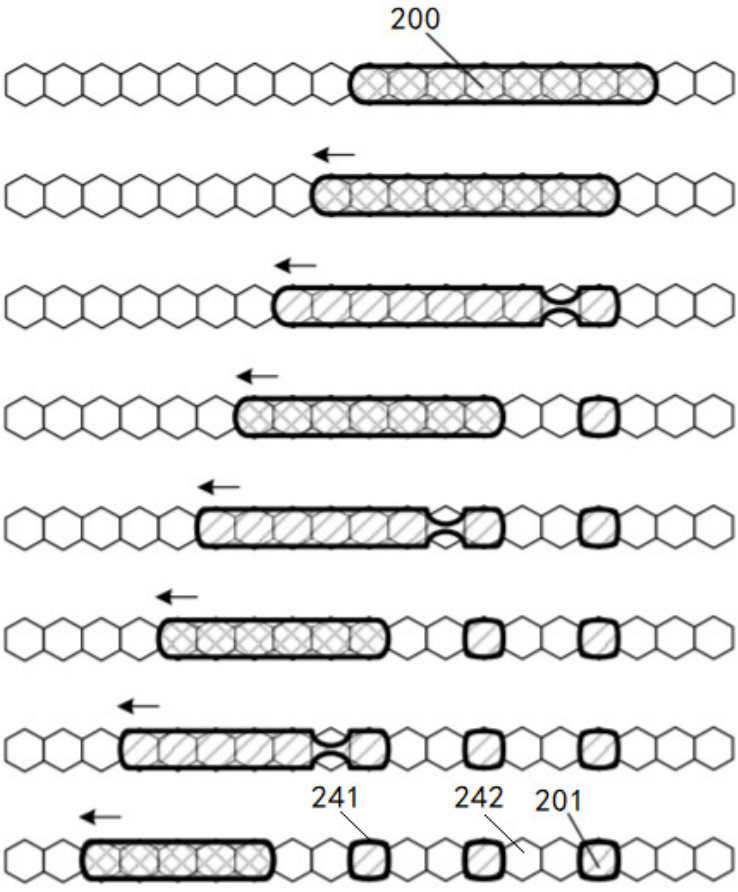


FIG. 5

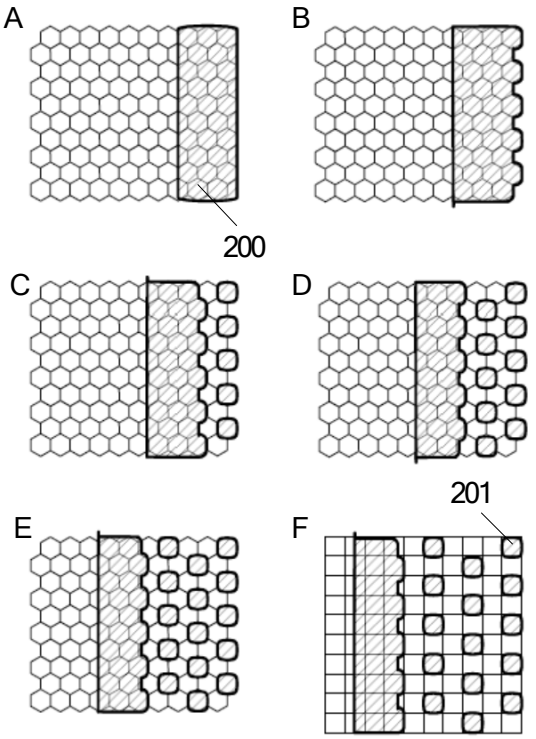


FIG. 6

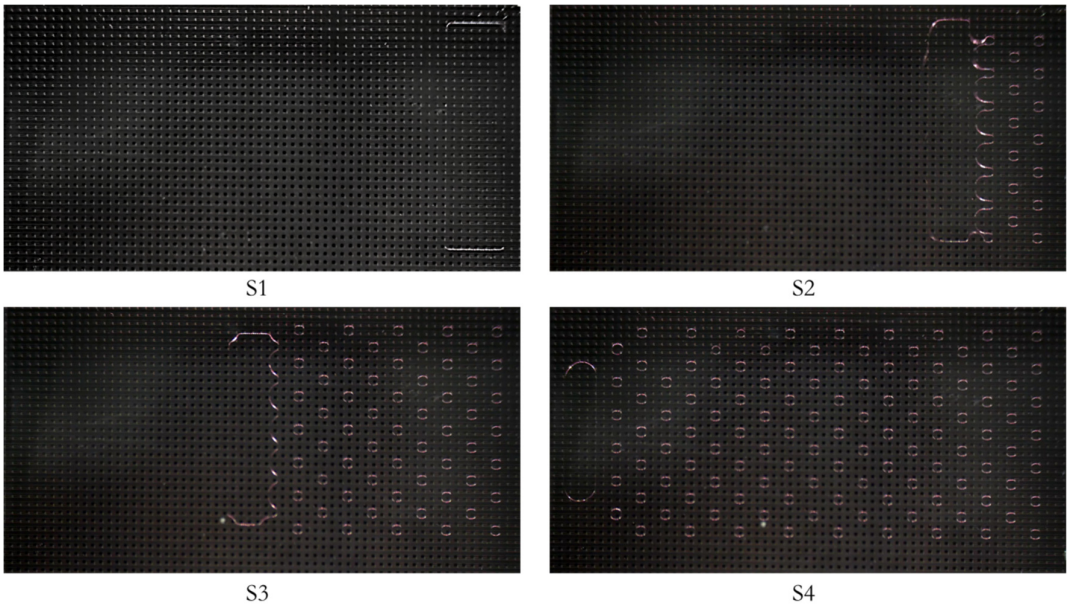


FIG. 7

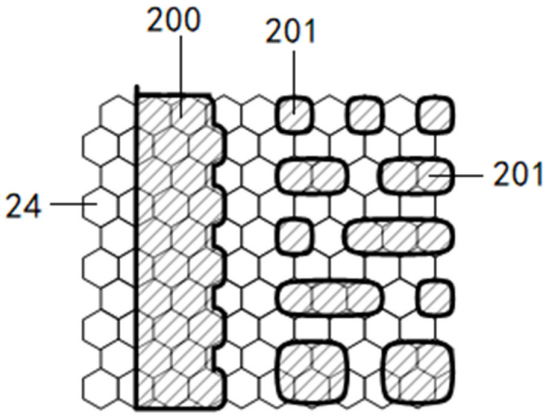

200
201
24
201

FIG. 8

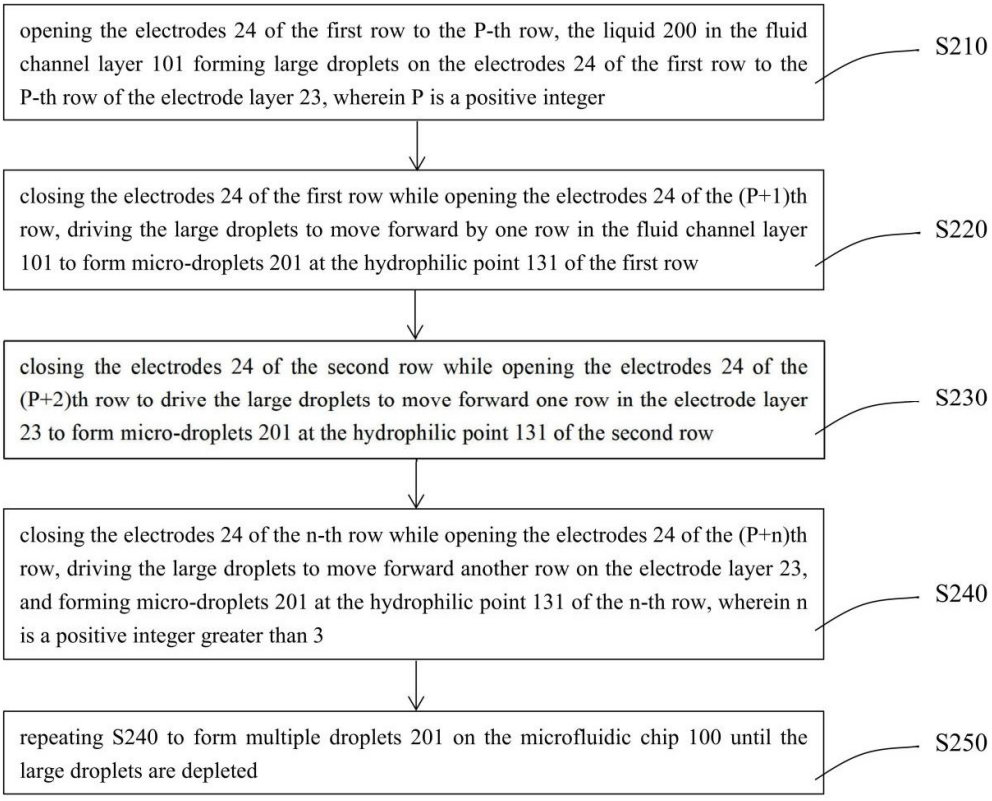

opening the electrodes 24 of the first row to the P-th row, the liquid 200 in the fluid channel layer 101 forming large droplets on the electrodes 24 of the first row to the P-th row of the electrode layer 23, wherein P is a positive integer
S210
closing the electrodes 24 of the first row while opening the electrodes 24 of the (P+1)th row, driving the large droplets to move forward by one row in the fluid channel layer 101 to form micro-droplets 201 at the hydrophilic point 131 of the first row
S220
closing the electrodes 24 of the second row while opening the electrodes 24 of the (P+2)th row to drive the large droplets to move forward one row in the electrode layer 23 to form micro-droplets 201 at the hydrophilic point 131 of the second row
S230
closing the electrodes 24 of the n-th row while opening the electrodes 24 of the (P+n)th row, driving the large droplets to move forward another row on the electrode layer 23, and forming micro-droplets 201 at the hydrophilic point 131 of the n-th row, wherein n is a positive integer greater than 3
S240
repeating S240 to form multiple droplets 201 on the microfluidic chip 100 until the large droplets are depleted
S250

FIG. 9

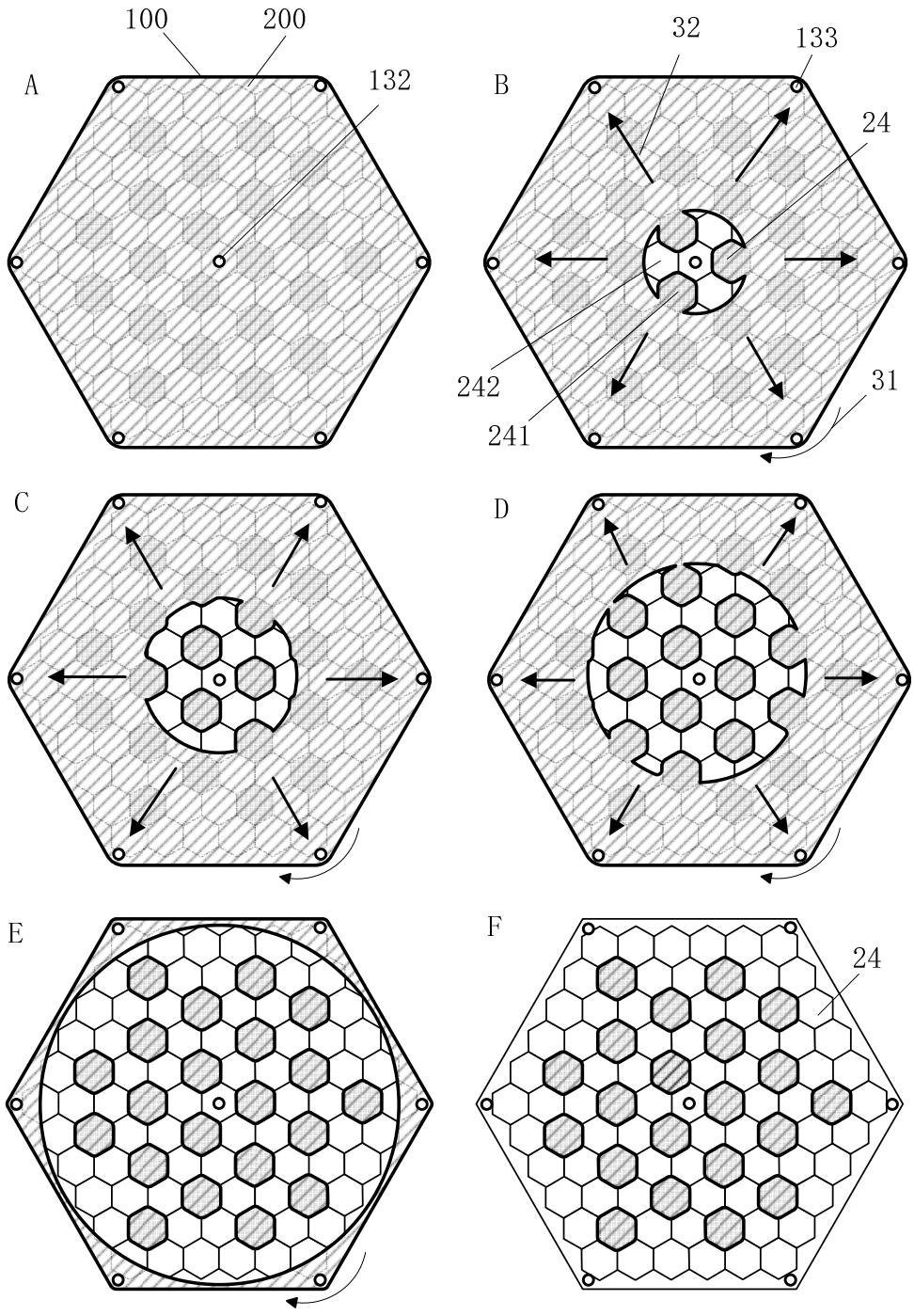


FIG. 10

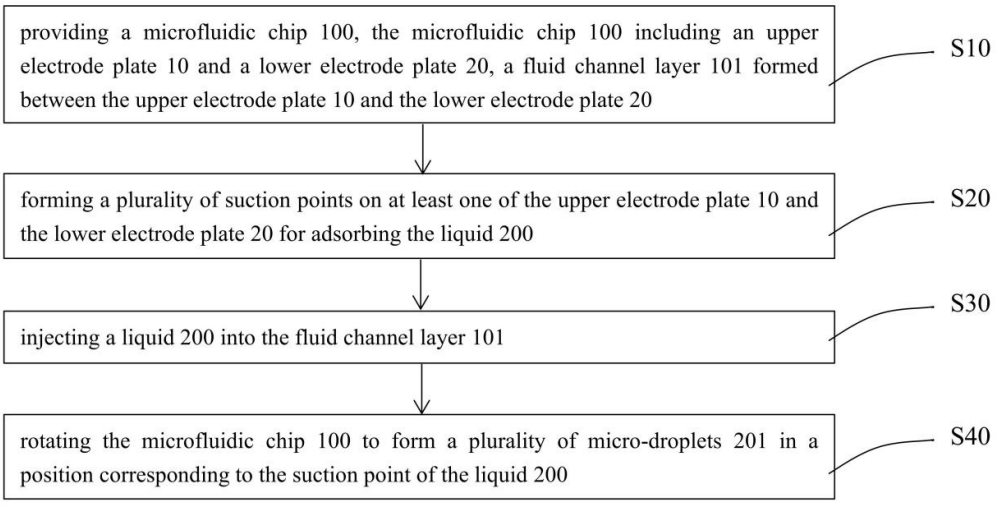

providing a microfluidic chip 100, the microfluidic chip 100 including an upper electrode plate 10 and a lower electrode plate 20, a fluid channel layer 101 formed between the upper electrode plate 10 and the lower electrode plate 20
S10
forming a plurality of suction points on at least one of the upper electrode plate 10 and the lower electrode plate 20 for adsorbing the liquid 200
S20
injecting a liquid 200 into the fluid channel layer 101
S30
rotating the microfluidic chip 100 to form a plurality of micro-droplets 201 in a position corresponding to the suction point of the liquid 200
S40

FIG. 11

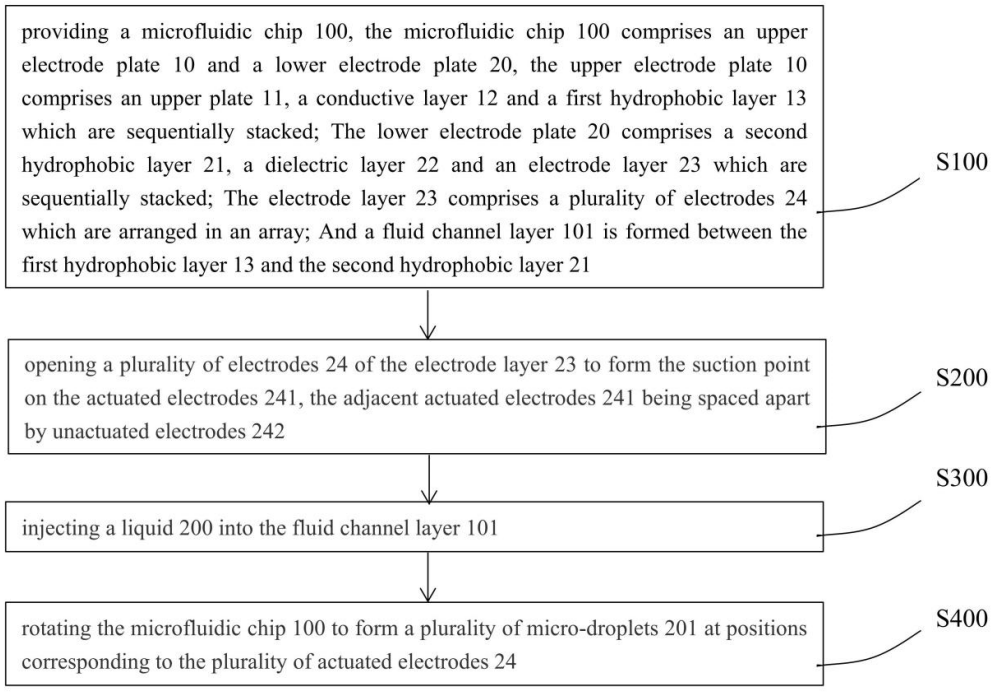

providing a microfluidic chip 100, the microfluidic chip 100 comprises an upper electrode plate 10 and a lower electrode plate 20, the upper electrode plate 10 comprises an upper plate 11, a conductive layer 12 and a first hydrophobic layer 13 which are sequentially stacked; The lower electrode plate 20 comprises a second hydrophobic layer 21, a dielectric layer 22 and an electrode layer 23 which are sequentially stacked; The electrode layer 23 comprises a plurality of electrodes 24 which are arranged in an array; And a fluid channel layer 101 is formed between the first hydrophobic layer 13 and the second hydrophobic layer 21
S100
opening a plurality of electrodes 24 of the electrode layer 23 to form the suction point on the actuated electrodes 241, the adjacent actuated electrodes 241 being spaced apart by unactuated electrodes 242
S200
injecting a liquid 200 into the fluid channel layer 101
S300
rotating the microfluidic chip 100 to form a plurality of micro-droplets 201 at positions corresponding to the plurality of actuated electrodes 24
S400

FIG. 12

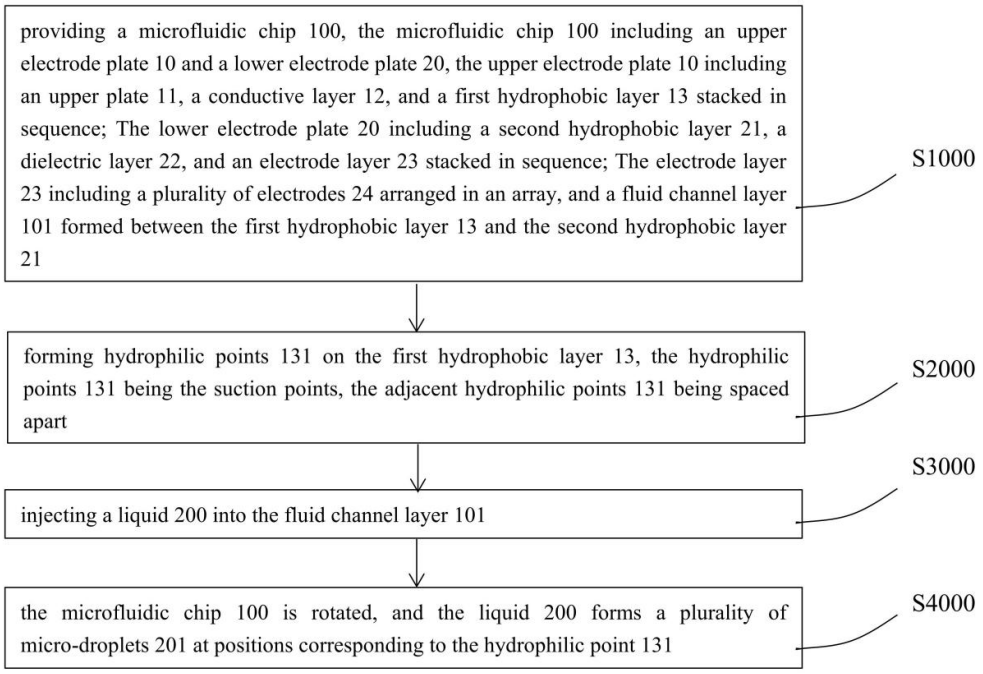

providing a microfluidic chip 100, the microfluidic chip 100 including an upper electrode plate 10 and a lower electrode plate 20, the upper electrode plate 10 including an upper plate 11, a conductive layer 12, and a first hydrophobic layer 13 stacked in sequence; The lower electrode plate 20 including a second hydrophobic layer 21, a dielectric layer 22, and an electrode layer 23 stacked in sequence; The electrode layer 23 including a plurality of electrodes 24 arranged in an array, and a fluid channel layer 101 formed between the first hydrophobic layer 13 and the second hydrophobic layer 21
S1000
forming hydrophilic points 131 on the first hydrophobic layer 13, the hydrophilic points 131 being the suction points, the adjacent hydrophilic points 131 being spaced apart
S2000
injecting a liquid 200 into the fluid channel layer 101
S3000
the microfluidic chip 100 is rotated, and the liquid 200 forms a plurality of micro-droplets 201 at positions corresponding to the hydrophilic point 131
S4000

FIG. 13

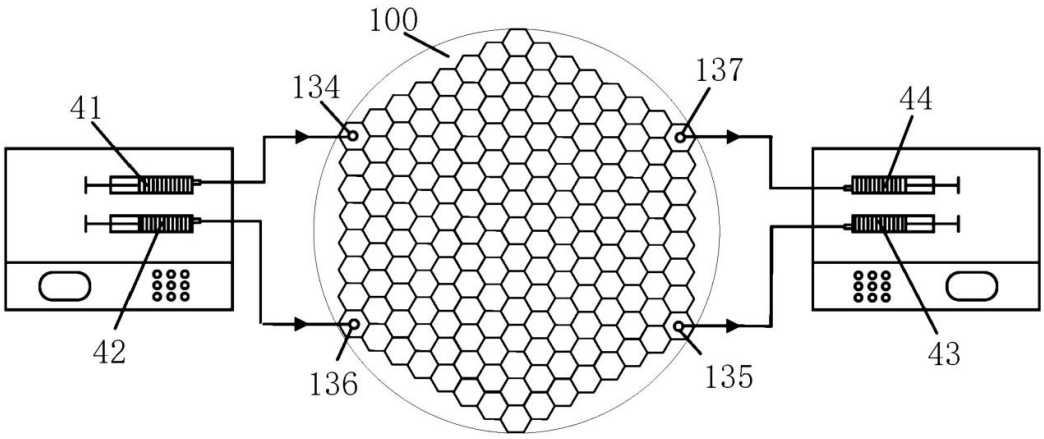

100
134
137
41
44
42
43
136
135

FIG. 14

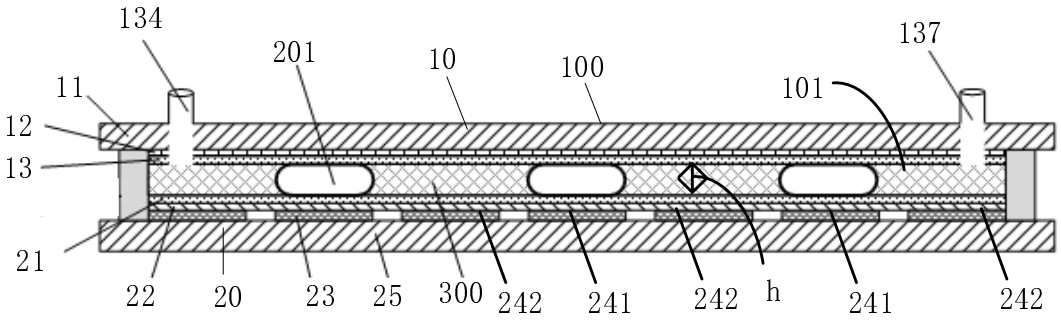

134
201
10
100
137
11
101
12
13
21
22
20
23
25
300
242
241
242
h
241
242

FIG. 15

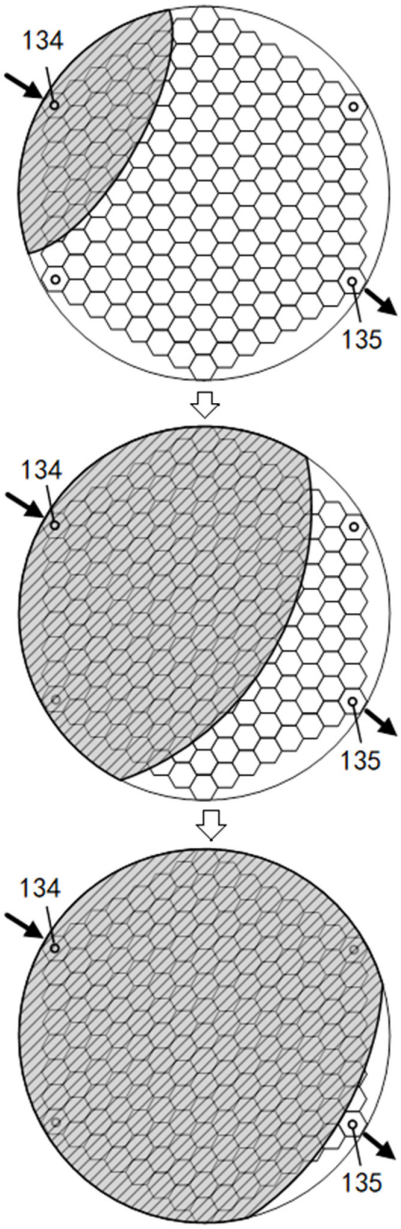

134
135
134
135
134
135

FIG. 16

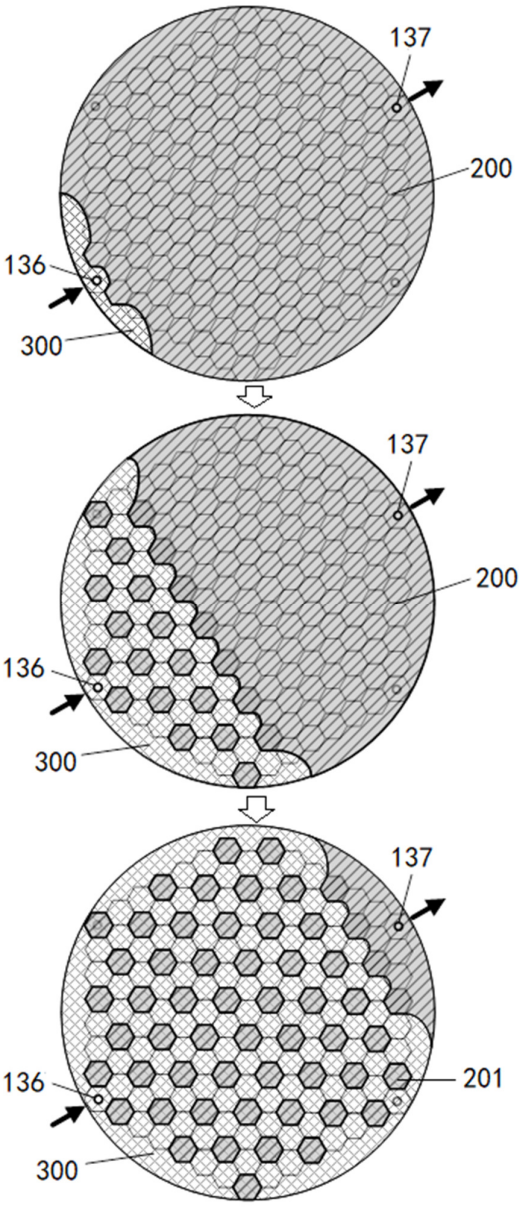

137
200
136
300
137
200
136
300
137
201
136
300

FIG. 17

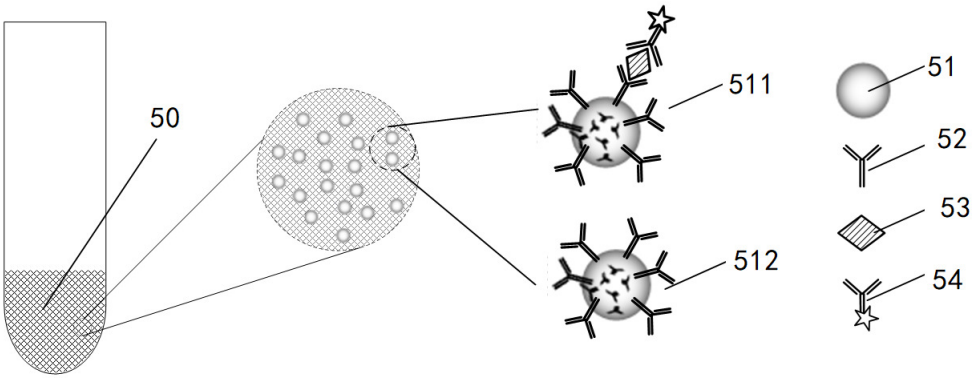

50
511
512
51
52
53
54

FIG. 18

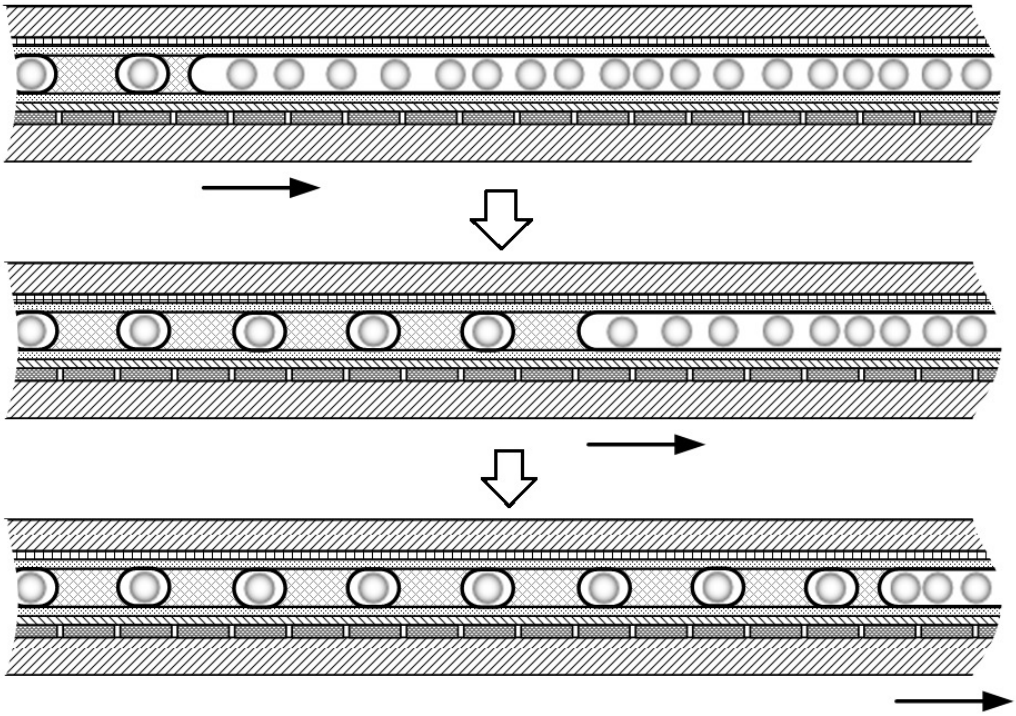


FIG. 19

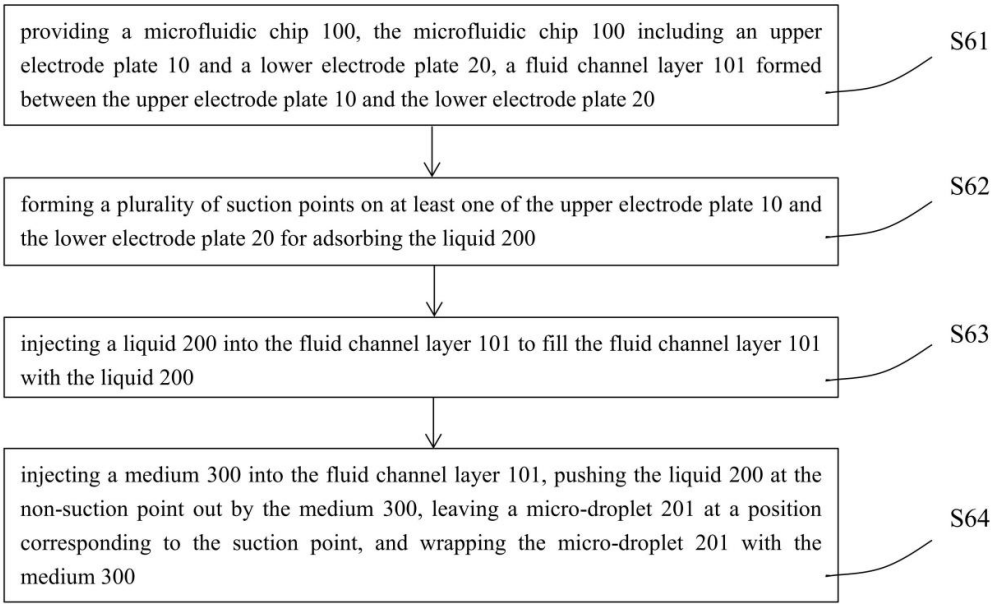

providing a microfluidic chip 100, the microfluidic chip 100 including an upper electrode plate 10 and a lower electrode plate 20, a fluid channel layer 101 formed between the upper electrode plate 10 and the lower electrode plate 20
S61
forming a plurality of suction points on at least one of the upper electrode plate 10 and the lower electrode plate 20 for adsorbing the liquid 200
S62
injecting a liquid 200 into the fluid channel layer 101 to fill the fluid channel layer 101 with the liquid 200
S63
injecting a medium 300 into the fluid channel layer 101, pushing the liquid 200 at the non-suction point out by the medium 300, leaving a micro-droplet 201 at a position corresponding to the suction point, and wrapping the micro-droplet 201 with the medium 300
S64

FIG. 20

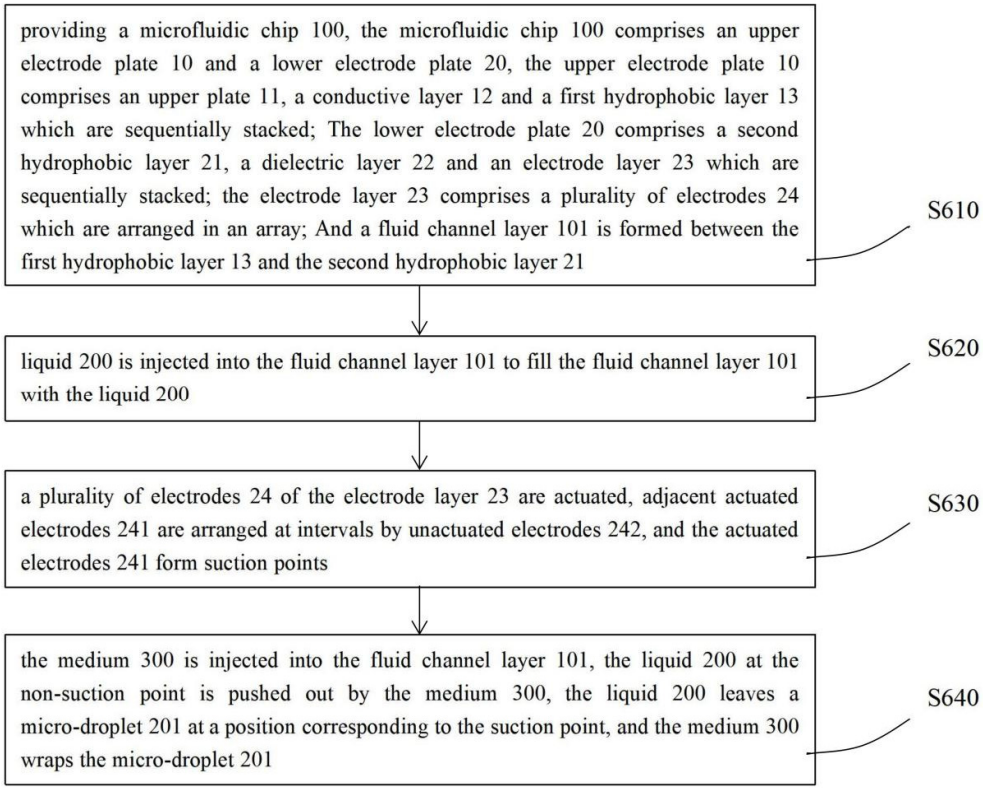

providing a microfluidic chip 100, the microfluidic chip 100 comprises an upper electrode plate 10 and a lower electrode plate 20, the upper electrode plate 10 comprises an upper plate 11, a conductive layer 12 and a first hydrophobic layer 13 which are sequentially stacked; The lower electrode plate 20 comprises a second hydrophobic layer 21, a dielectric layer 22 and an electrode layer 23 which are sequentially stacked; the electrode layer 23 comprises a plurality of electrodes 24 which are arranged in an array; And a fluid channel layer 101 is formed between the first hydrophobic layer 13 and the second hydrophobic layer 21
S610
liquid 200 is injected into the fluid channel layer 101 to fill the fluid channel layer 101 with the liquid 200
S620
a plurality of electrodes 24 of the electrode layer 23 are actuated, adjacent actuated electrodes 241 are arranged at intervals by unactuated electrodes 242, and the actuated electrodes 241 form suction points
S630
the medium 300 is injected into the fluid channel layer 101, the liquid 200 at the non-suction point is pushed out by the medium 300, the liquid 200 leaves a micro-droplet 201 at a position corresponding to the suction point, and the medium 300 wraps the micro-droplet 201
S640

FIG. 21

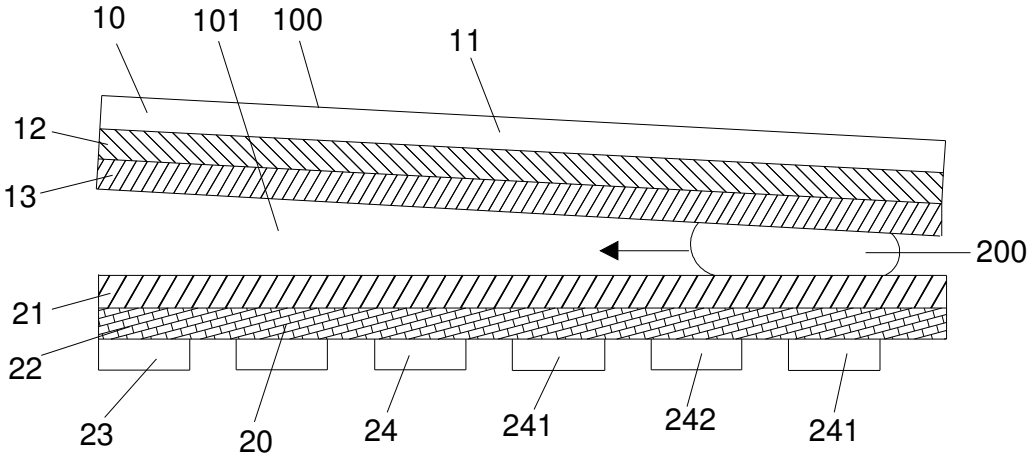

10
101
100
11
12
13
200
21
22
23
20
24
241
242
241

FIG. 22

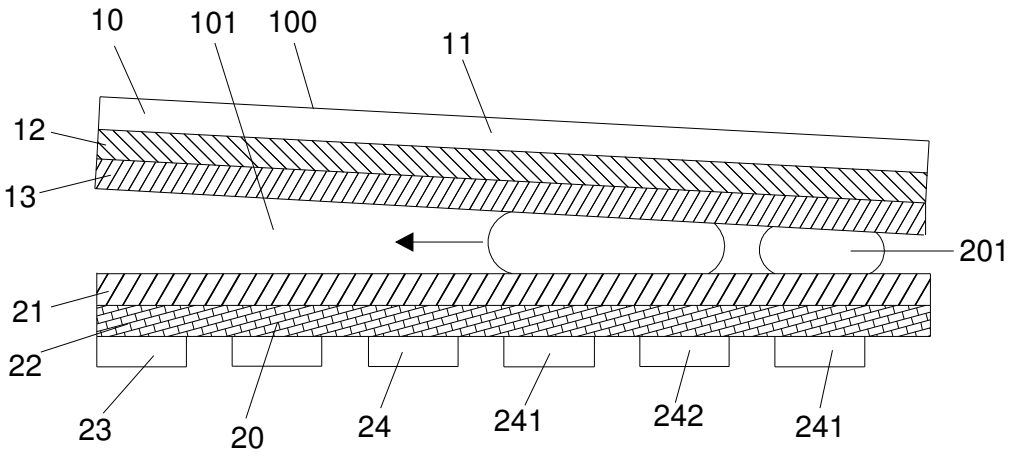

10
101
100
11
12
13
201
21
22
23
20
24
241
242
241

FIG. 23

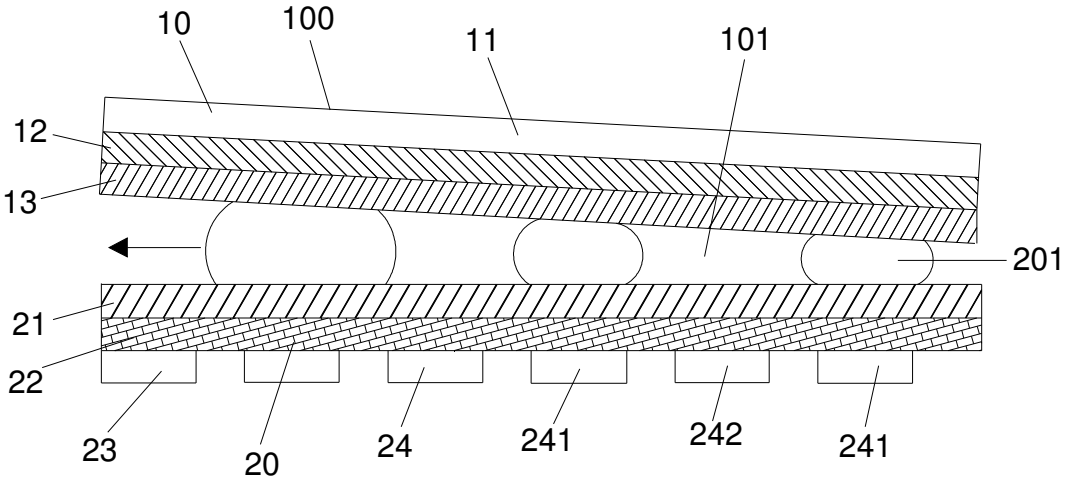

10
100
11
101
12
13
201
21
22
23
20
24
241
242
241

FIG. 24

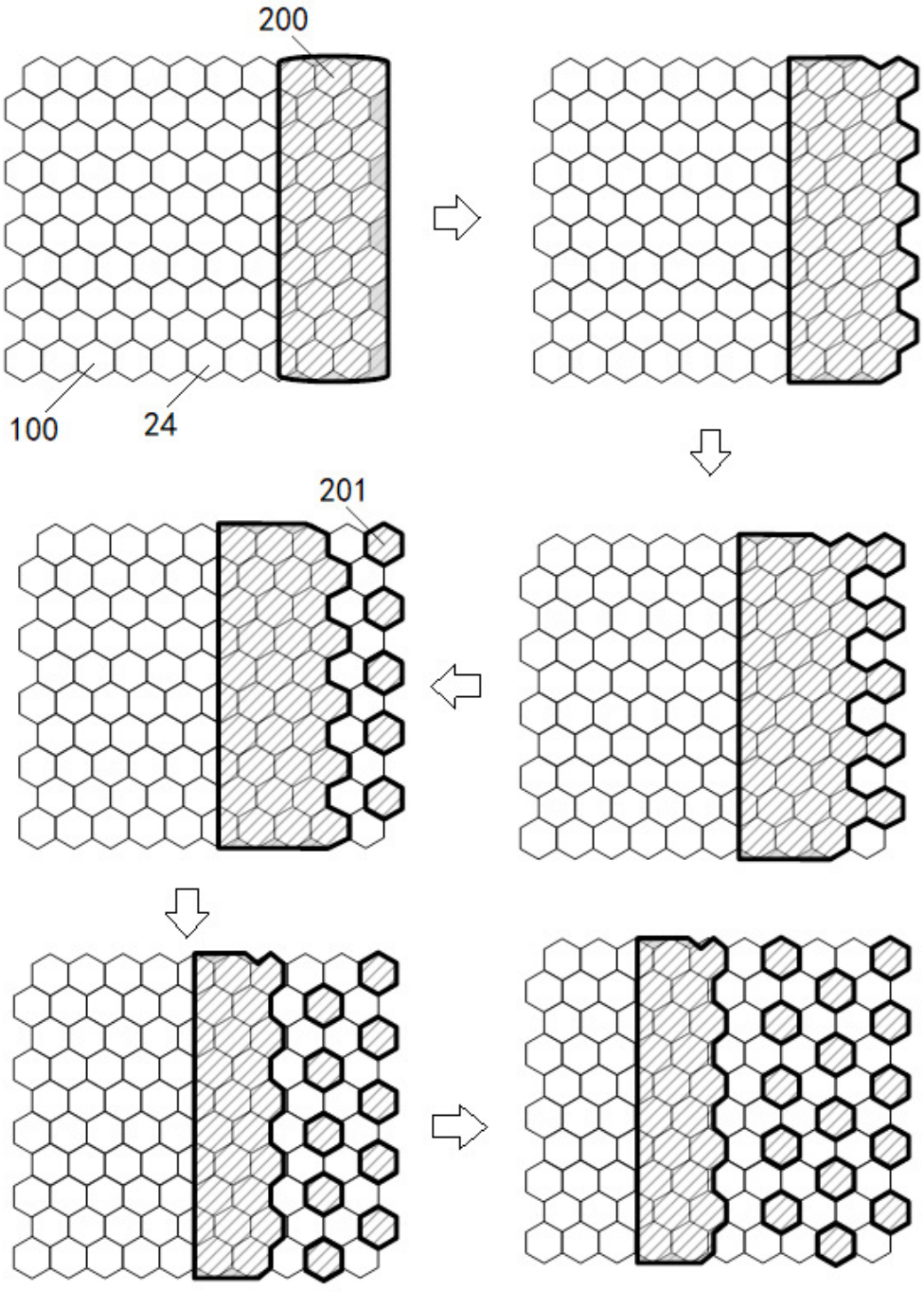


FIG. 25

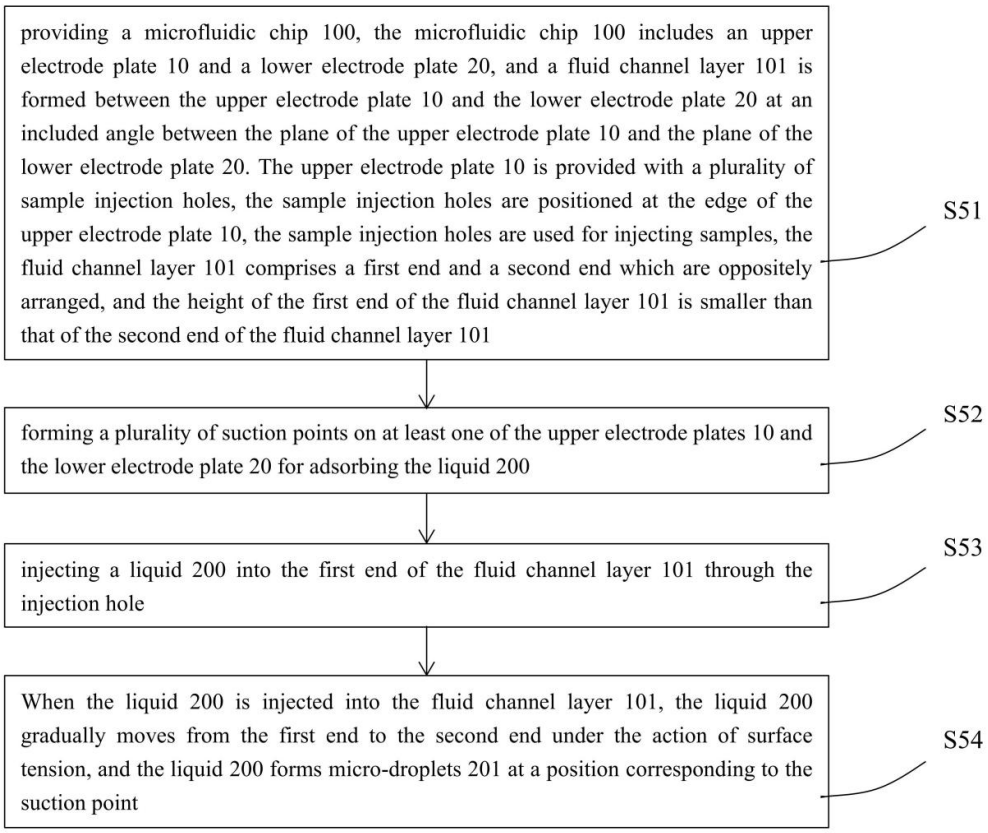

providing a microfluidic chip 100, the microfluidic chip 100 includes an upper electrode plate 10 and a lower electrode plate 20, and a fluid channel layer 101 is formed between the upper electrode plate 10 and the lower electrode plate 20 at an included angle between the plane of the upper electrode plate 10 and the plane of the lower electrode plate 20. The upper electrode plate 10 is provided with a plurality of sample injection holes, the sample injection holes are positioned at the edge of the upper electrode plate 10, the sample injection holes are used for injecting samples, the fluid channel layer 101 comprises a first end and a second end which are oppositely arranged, and the height of the first end of the fluid channel layer 101 is smaller than that of the second end of the fluid channel layer 101
S51
forming a plurality of suction points on at least one of the upper electrode plates 10 and the lower electrode plate 20 for adsorbing the liquid 200
S52
injecting a liquid 200 into the first end of the fluid channel layer 101 through the injection hole
S53
When the liquid 200 is injected into the fluid channel layer 101, the liquid 200 gradually moves from the first end to the second end under the action of surface tension, and the liquid 200 forms micro-droplets 201 at a position corresponding to the suction point
S54

FIG. 26

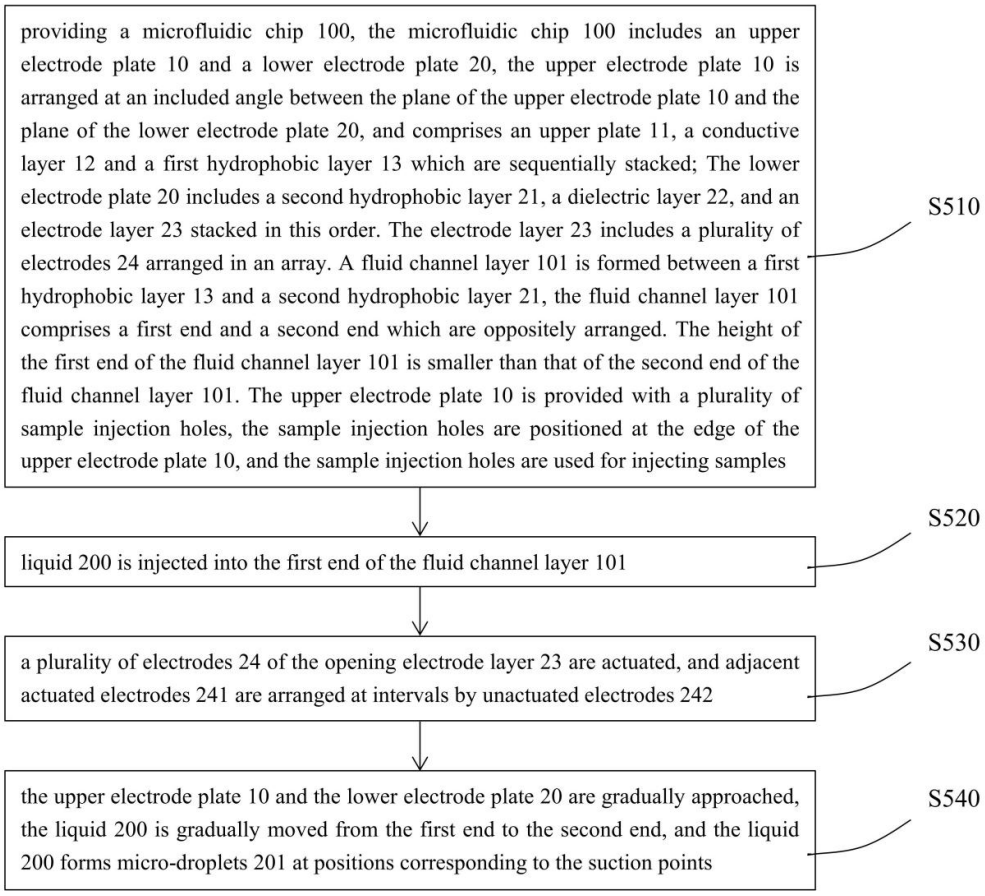

providing a microfluidic chip 100, the microfluidic chip 100 includes an upper electrode plate 10 and a lower electrode plate 20, the upper electrode plate 10 is arranged at an included angle between the plane of the upper electrode plate 10 and the plane of the lower electrode plate 20, and comprises an upper plate 11, a conductive layer 12 and a first hydrophobic layer 13 which are sequentially stacked; The lower electrode plate 20 includes a second hydrophobic layer 21, a dielectric layer 22, and an electrode layer 23 stacked in this order. The electrode layer 23 includes a plurality of electrodes 24 arranged in an array. A fluid channel layer 101 is formed between a first hydrophobic layer 13 and a second hydrophobic layer 21, the fluid channel layer 101 comprises a first end and a second end which are oppositely arranged. The height of the first end of the fluid channel layer 101 is smaller than that of the second end of the fluid channel layer 101. The upper electrode plate 10 is provided with a plurality of sample injection holes, the sample injection holes are positioned at the edge of the upper electrode plate 10, and the sample injection holes are used for injecting samples
S510
liquid 200 is injected into the first end of the fluid channel layer 101
S520
a plurality of electrodes 24 of the opening electrode layer 23 are actuated, and adjacent actuated electrodes 241 are arranged at intervals by unactuated electrodes 242
S530
the upper electrode plate 10 and the lower electrode plate 20 are gradually approached, the liquid 200 is gradually moved from the first end to the second end, and the liquid 200 forms micro-droplets 201 at positions corresponding to the suction points
S540

FIG. 27

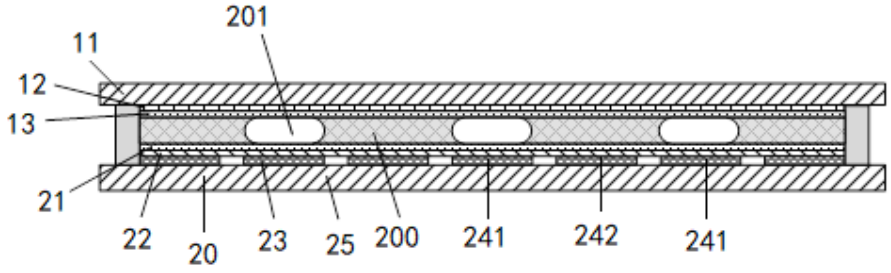

201
11
12
13
21
22
20
23
25
200
241
242
241

FIG. 28

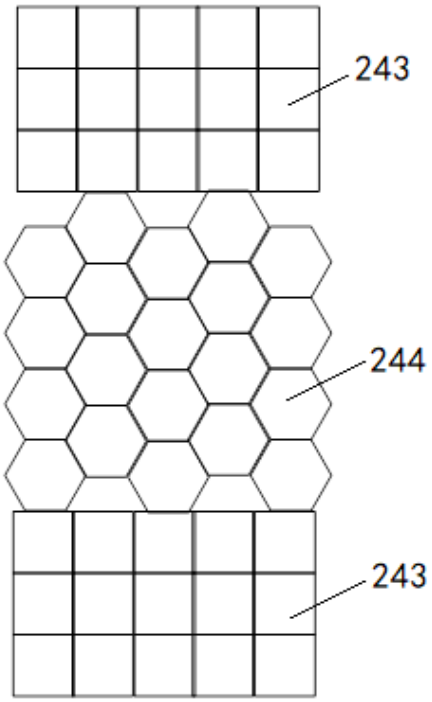


FIG. 29

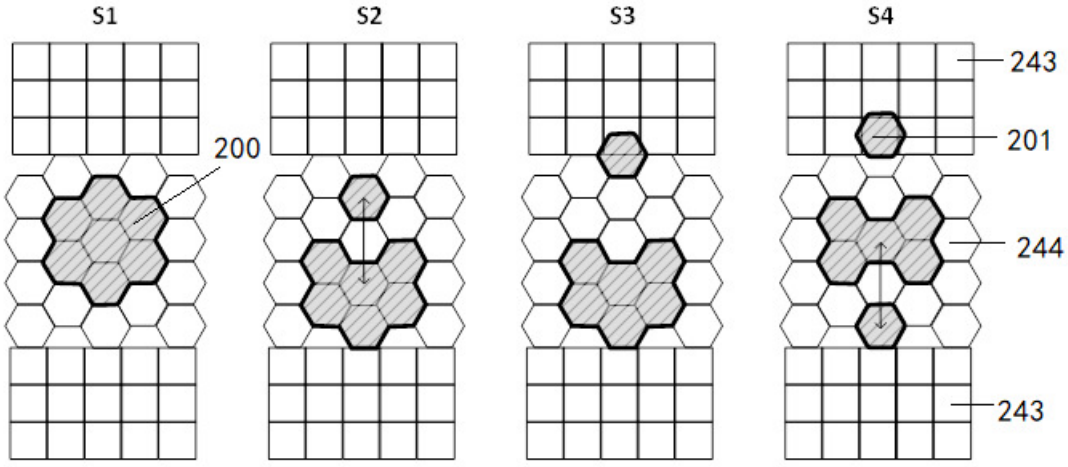


FIG.30

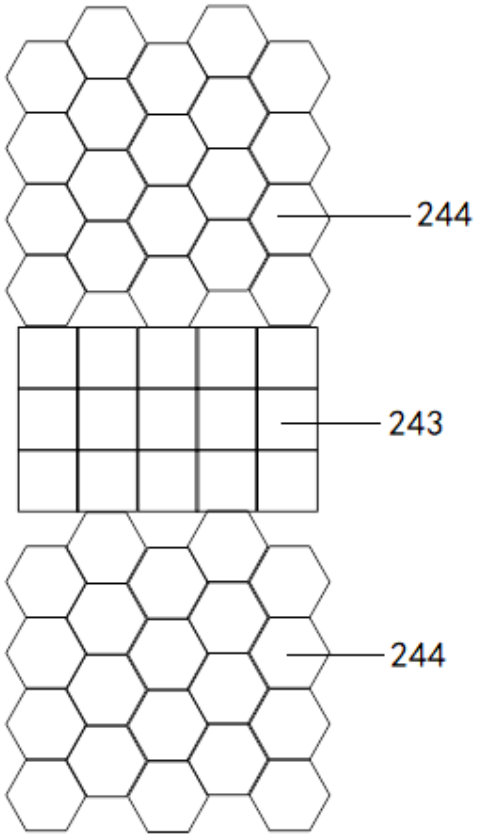


FIG.31

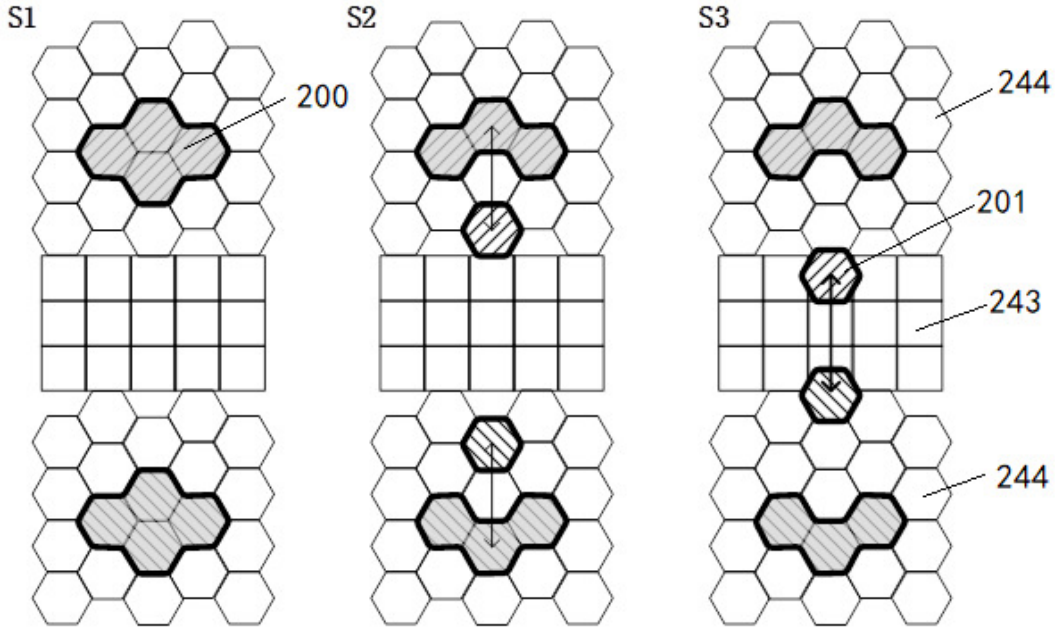


FIG.32

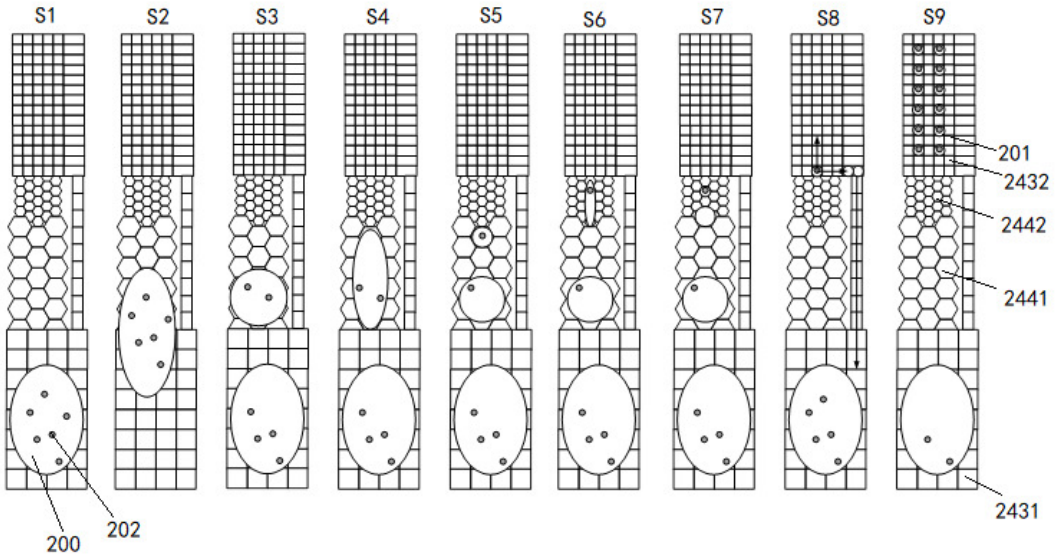


FIG.33

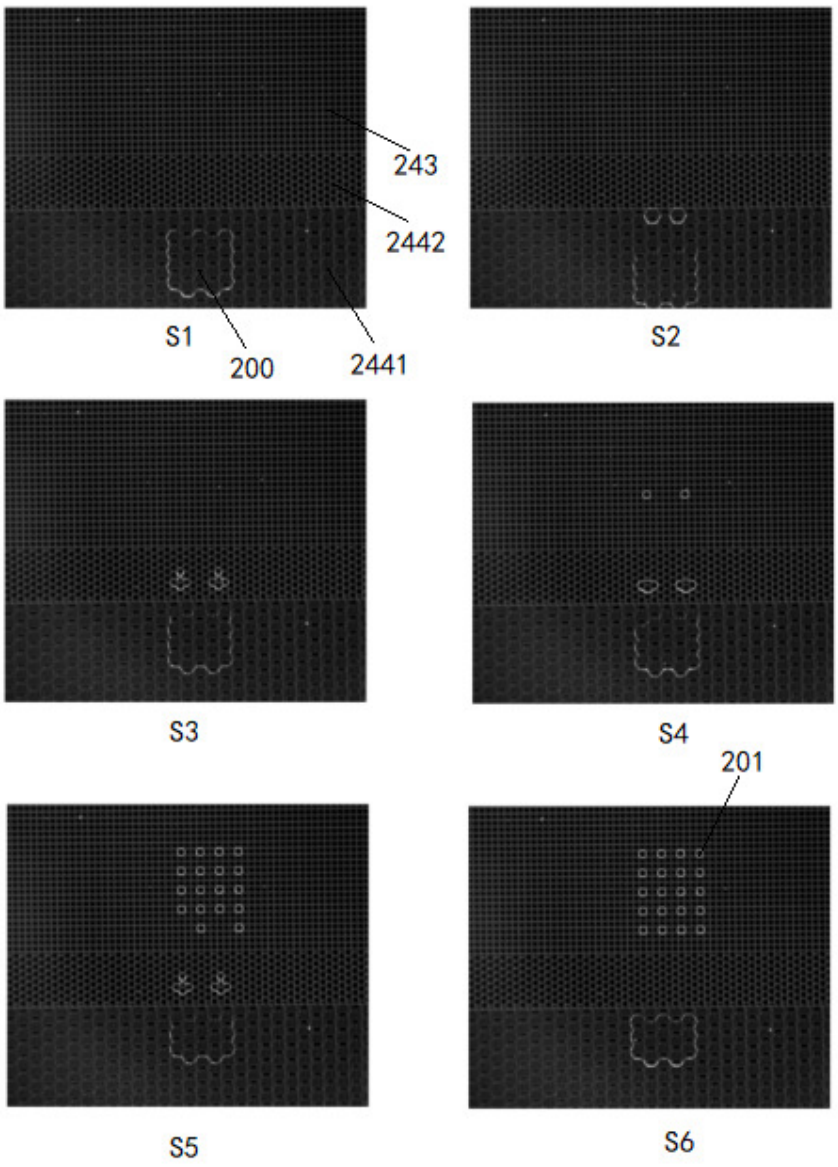


FIG.34

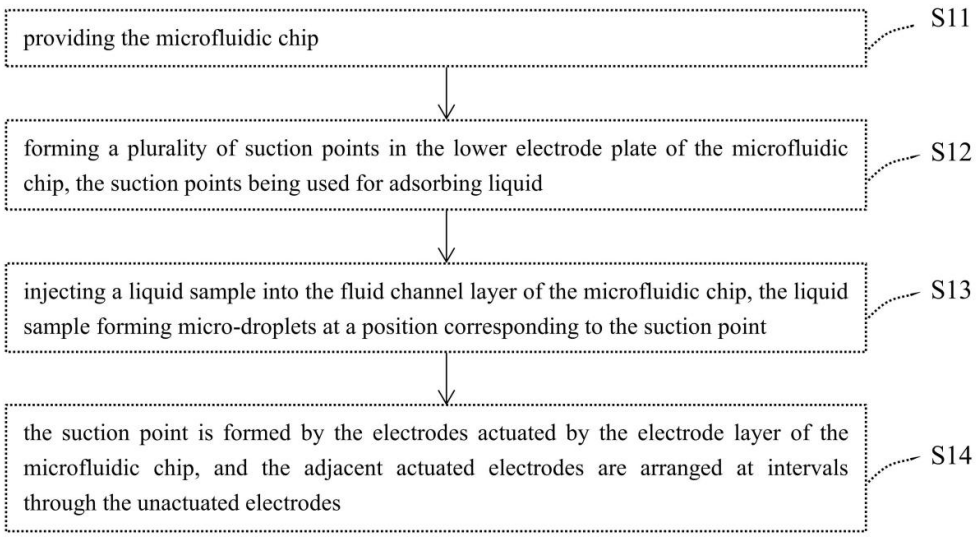

providing the microfluidic chip
S11
forming a plurality of suction points in the lower electrode plate of the microfluidic chip, the suction points being used for adsorbing liquid
S12
injecting a liquid sample into the fluid channel layer of the microfluidic chip, the liquid sample forming micro-droplets at a position corresponding to the suction point
S13
the suction point is formed by the electrodes actuated by the electrode layer of the microfluidic chip, and the adjacent actuated electrodes are arranged at intervals through the unactuated electrodes
S14

FIG.35

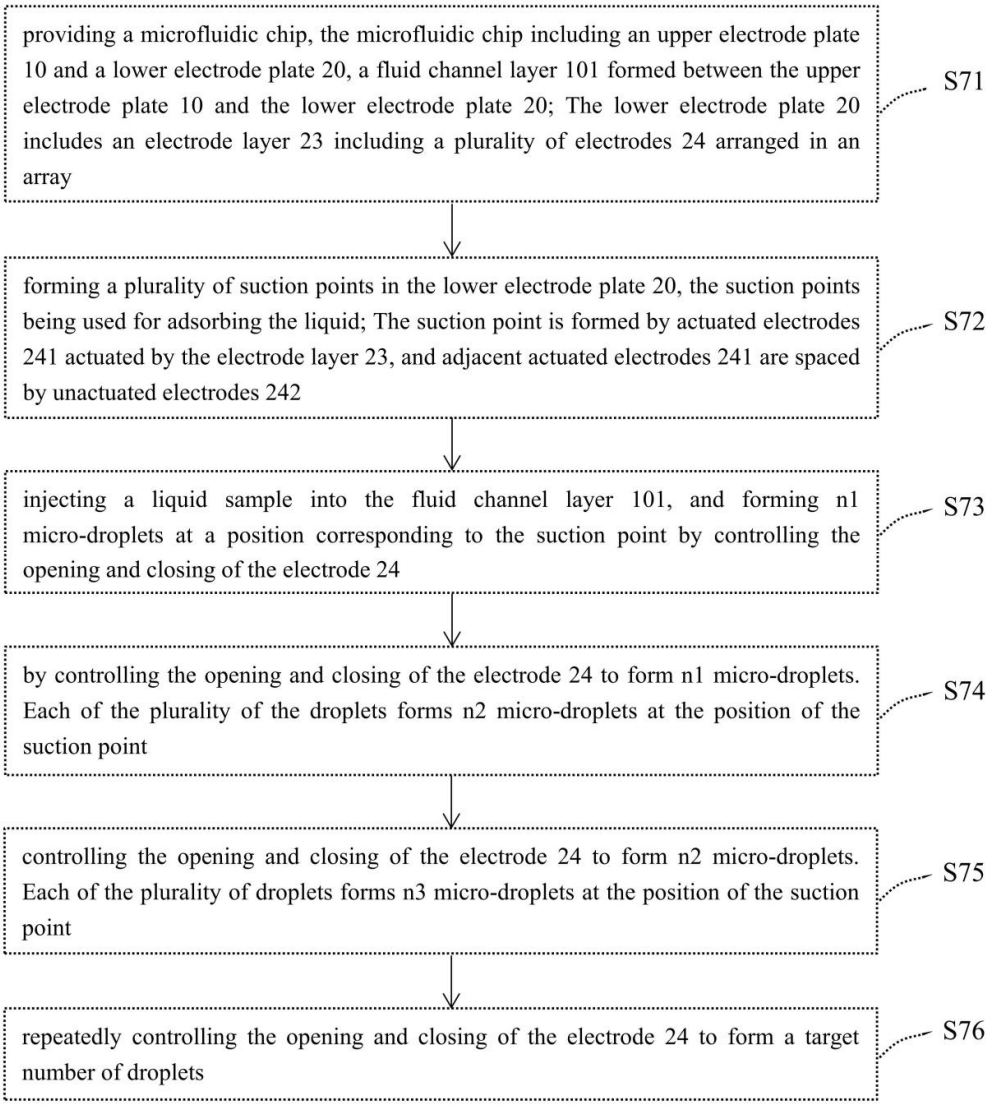

providing a microfluidic chip, the microfluidic chip including an upper electrode plate 10 and a lower electrode plate 20, a fluid channel layer 101 formed between the upper electrode plate 10 and the lower electrode plate 20; The lower electrode plate 20 includes an electrode layer 23 including a plurality of electrodes 24 arranged in an array
S71
forming a plurality of suction points in the lower electrode plate 20, the suction points being used for adsorbing the liquid; The suction point is formed by actuated electrodes 241 actuated by the electrode layer 23, and adjacent actuated electrodes 241 are spaced by unactuated electrodes 242
S72
injecting a liquid sample into the fluid channel layer 101, and forming n1 micro-droplets at a position corresponding to the suction point by controlling the opening and closing of the electrode 24
S73
by controlling the opening and closing of the electrode 24 to form n1 micro-droplets. Each of the plurality of the droplets forms n2 micro-droplets at the position of the suction point
S74
controlling the opening and closing of the electrode 24 to form n2 micro-droplets. Each of the plurality of droplets forms n3 micro-droplets at the position of the suction point
S75
repeatedly controlling the opening and closing of the electrode 24 to form a target number of droplets
S76

FIG.36

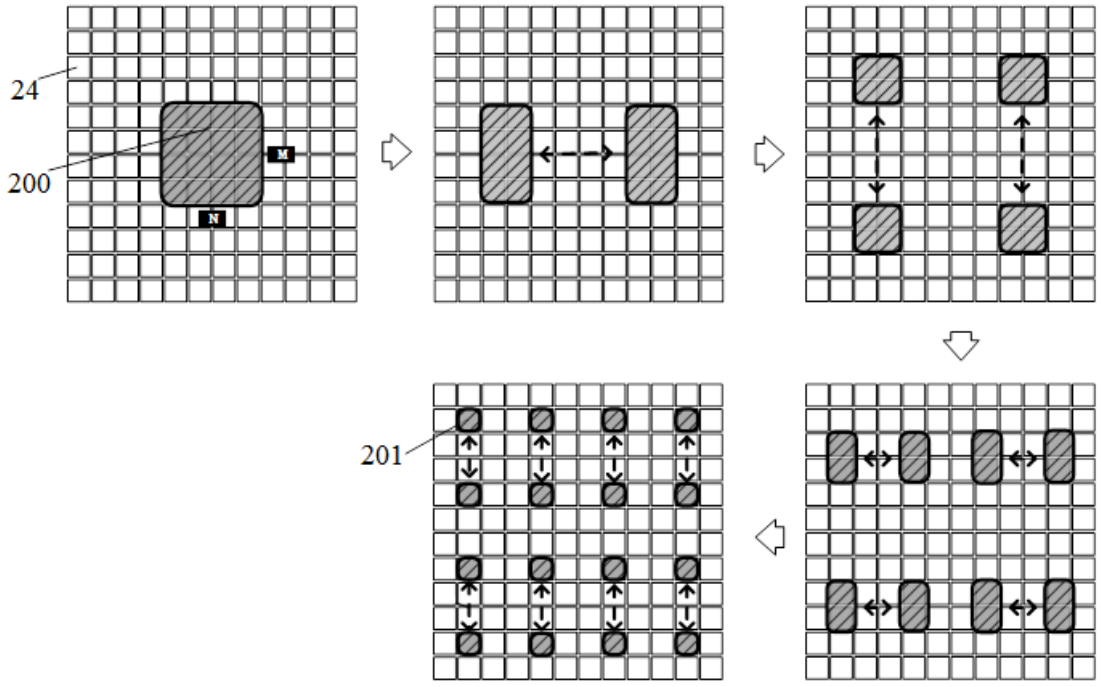


FIG.37

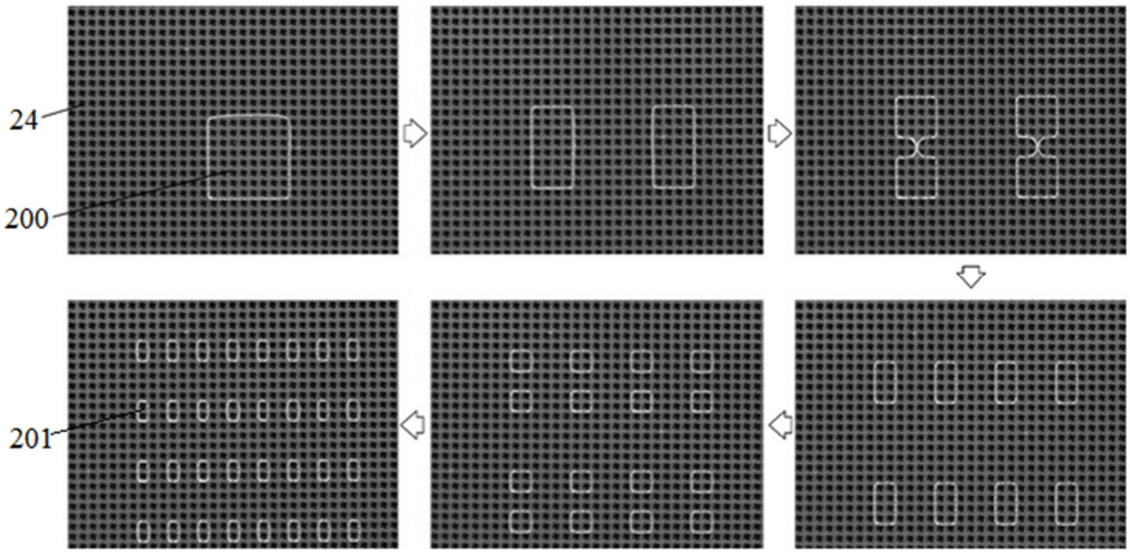


FIG.38

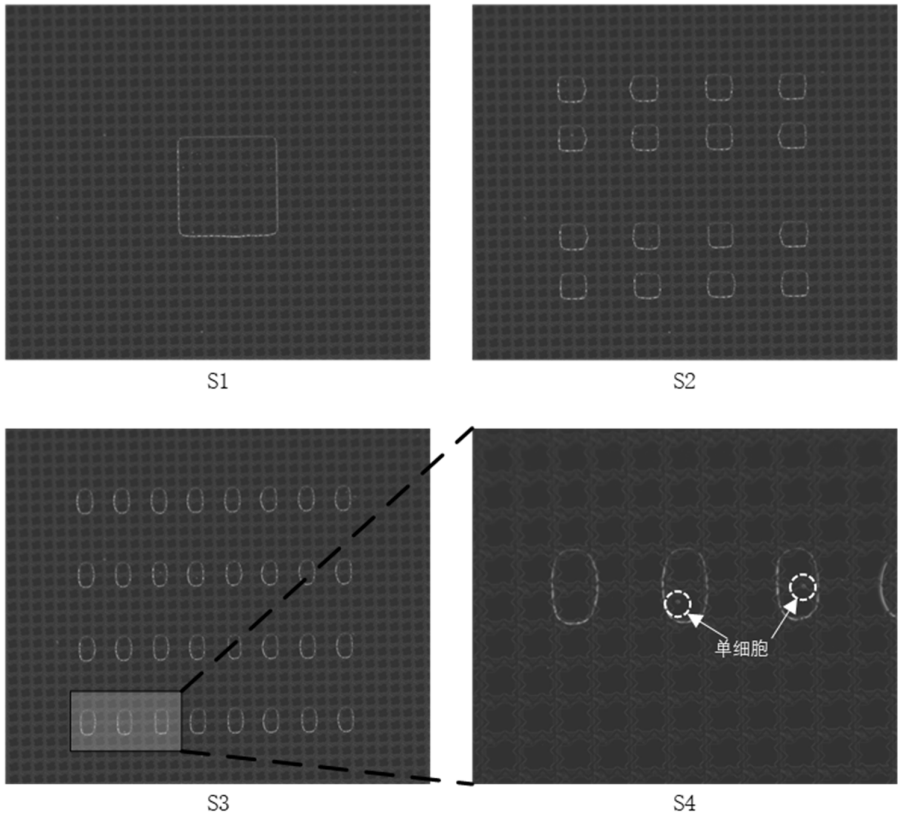


FIG.39

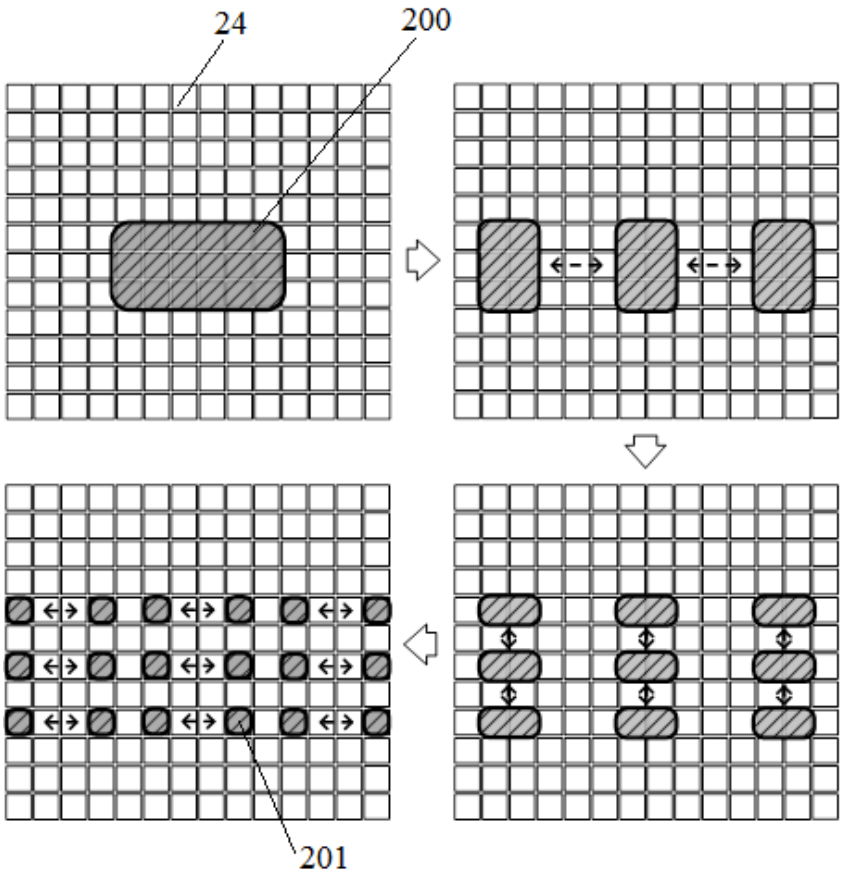


FIG.40

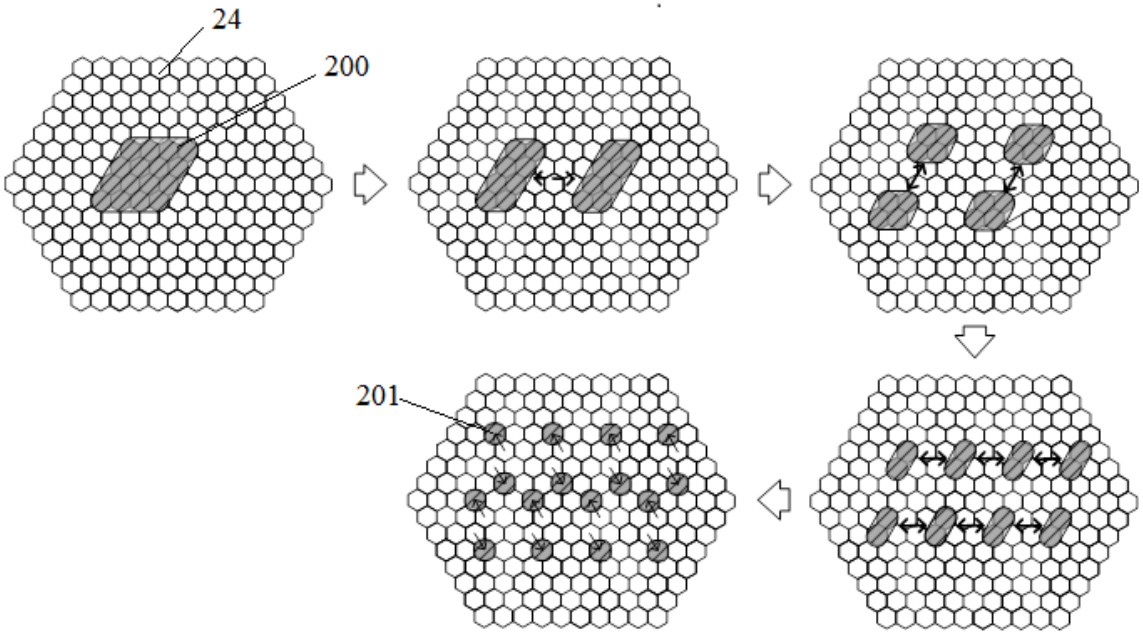


FIG.41

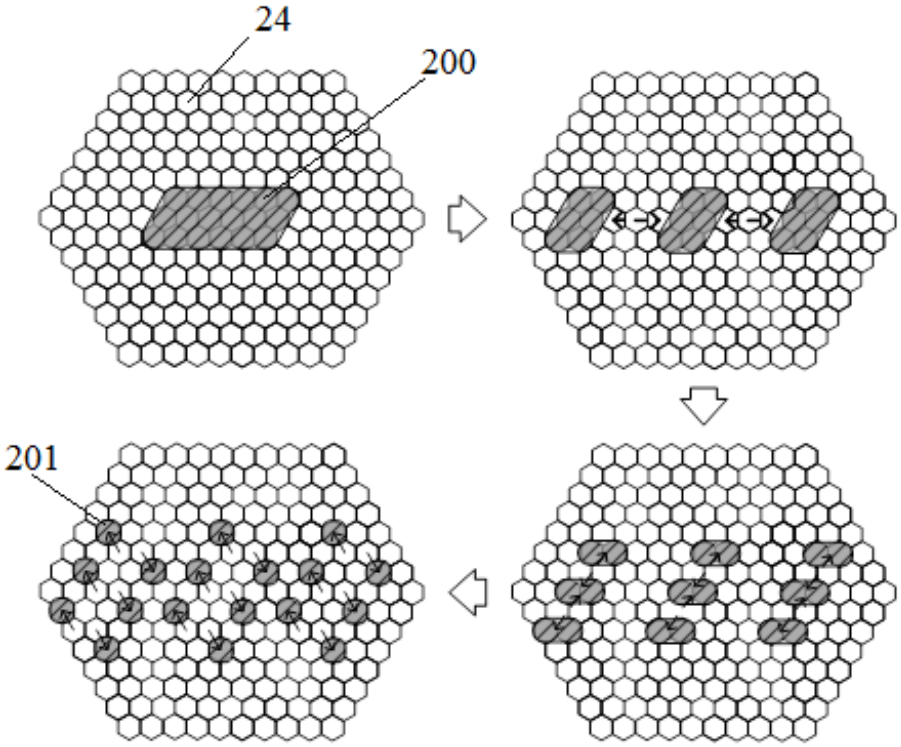


FIG.42