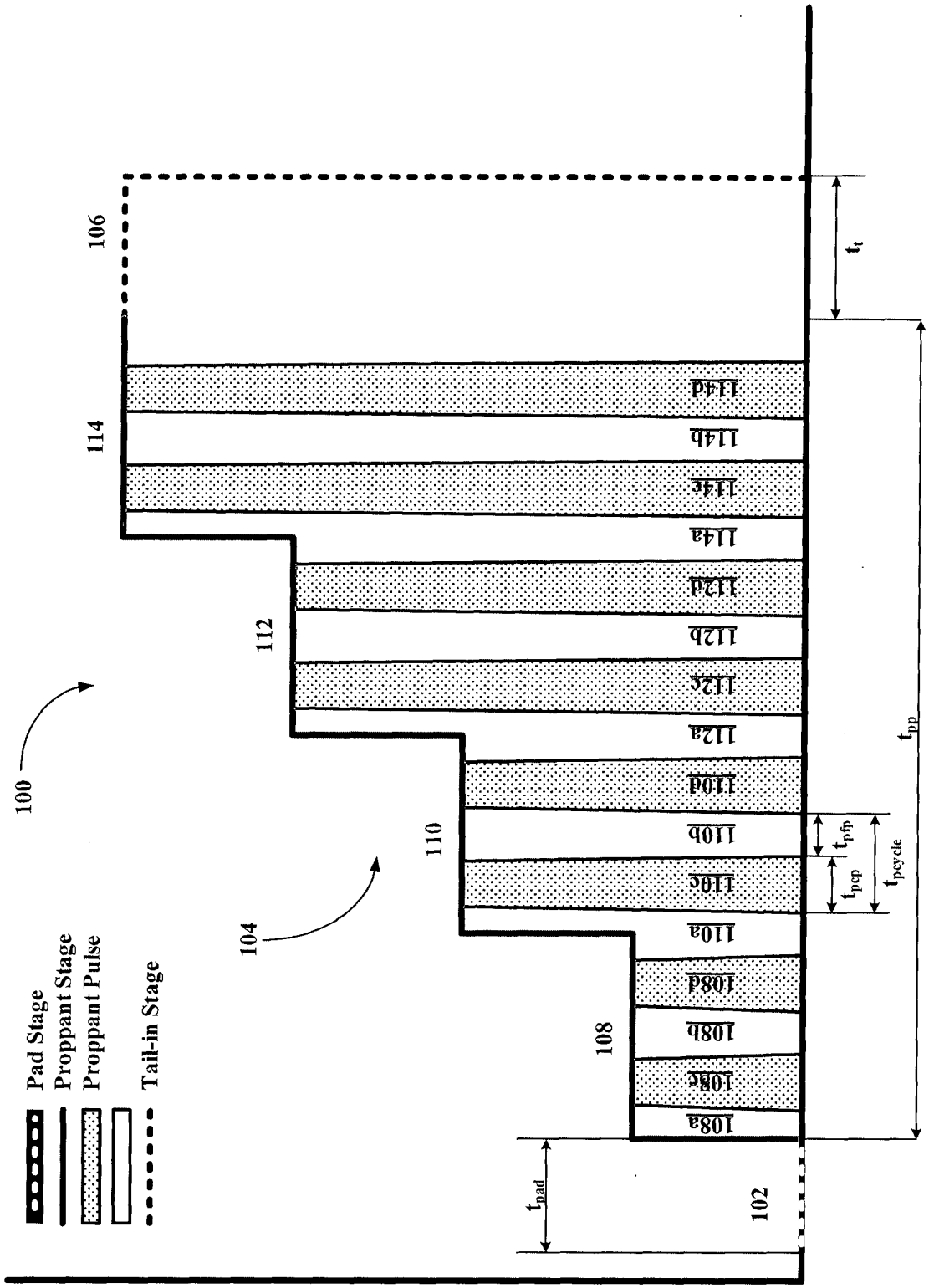

Pad Stage
Proppant Stage
Proppant Pulse
Tail-in Stage
100
102
104
106
108
108a
108b
108c
108d
110
110a
110b
110c
110d
112
112a
112b
112c
112d
114
114a
114b
114c
114d
t_{pad}
t_{pp}
t_{pfp}
t_{pcp}
t_{pcycle}
t_t

FIG. 1A

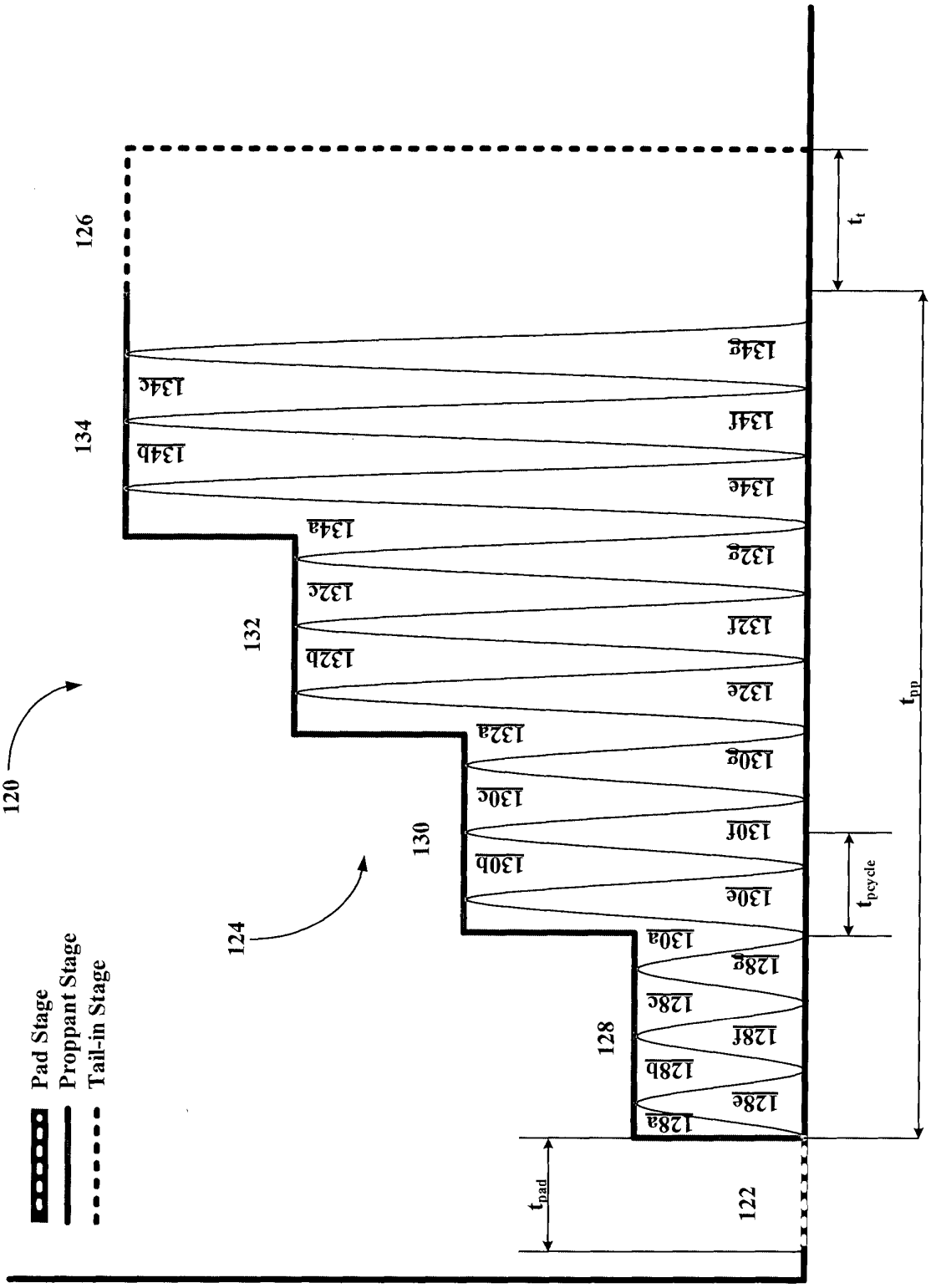

Pad Stage
Proppant Stage
Tail-in Stage
120
122
124
126
128
128a
128b
128c
128d
128e
128f
128g
130
130a
130b
130c
130d
130e
130f
130g
132
132a
132b
132c
132d
132e
132f
132g
134
134a
134b
134c
134d
134e
134f
134g
t_{pad}
t_{pcycle}
t_{pp}
t_t

FIG. 1B

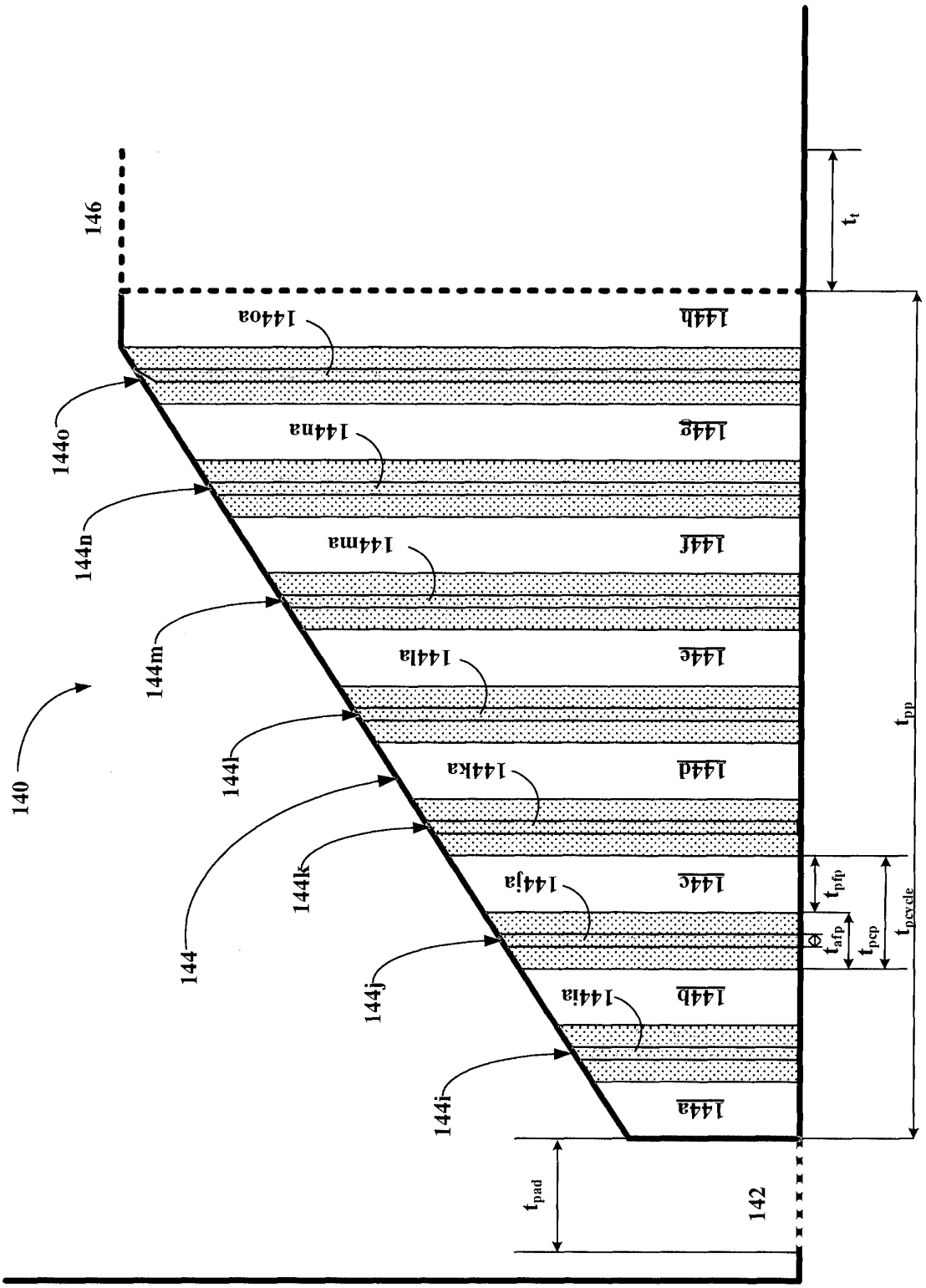

140
142
144
144a
144b
144c
144d
144e
144f
144g
144h
144i
144j
144k
144l
144m
144n
144o
144ia
144ja
144ka
144ma
144na
144oa
146
t_t
t_{pp}
t_{pfp}
t_{afp}
t_{pcp}
t_{pcycle}
t_{pad}

FIG. 1C

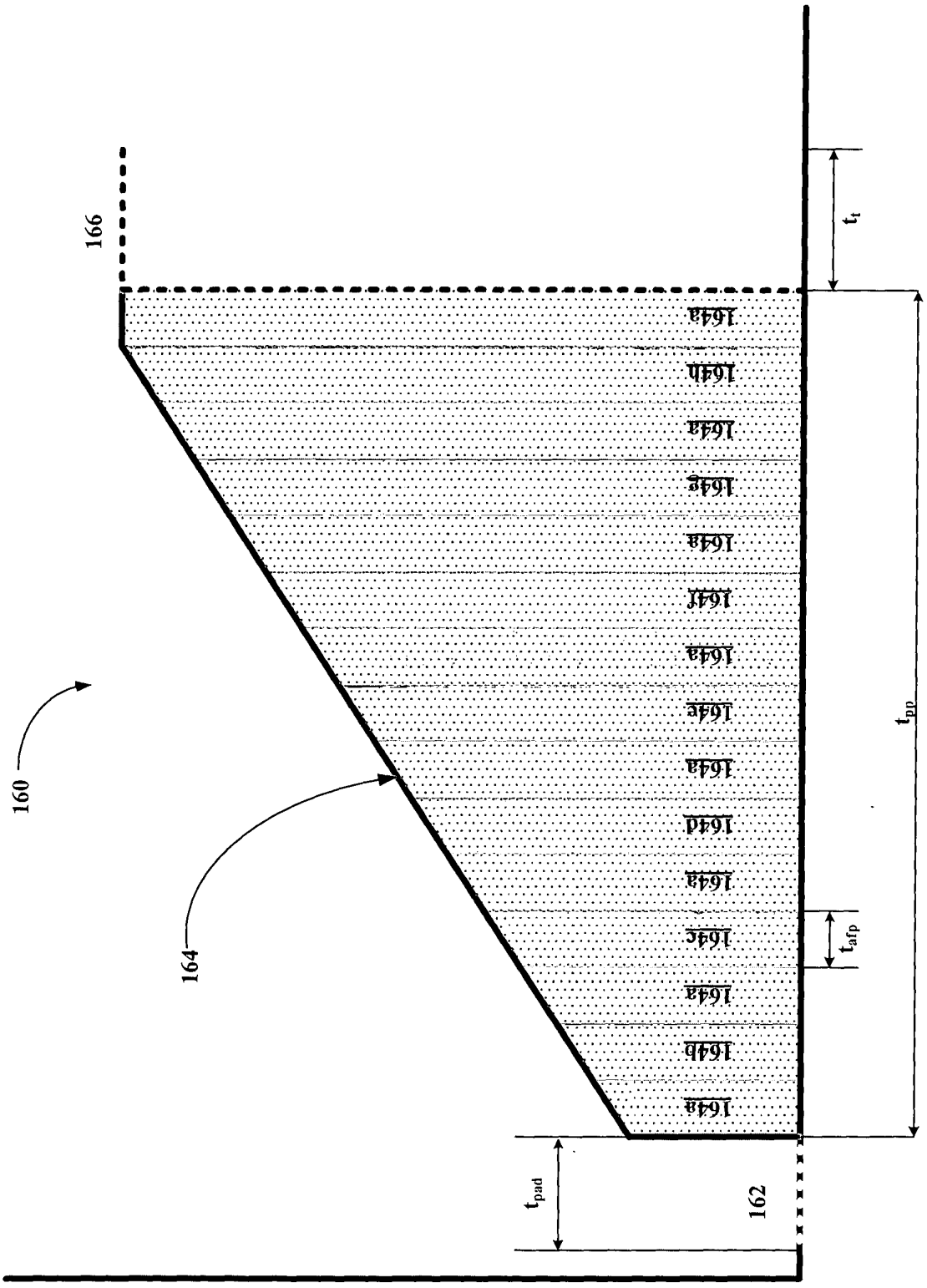

166
t_t
164a
164b
164a
164e
164a
164f
164a
164e
164a
164d
164a
164c
164a
164b
164a
t_{afp}
t_{pp}
160
164
t_{pad}
162

FIG. 1D

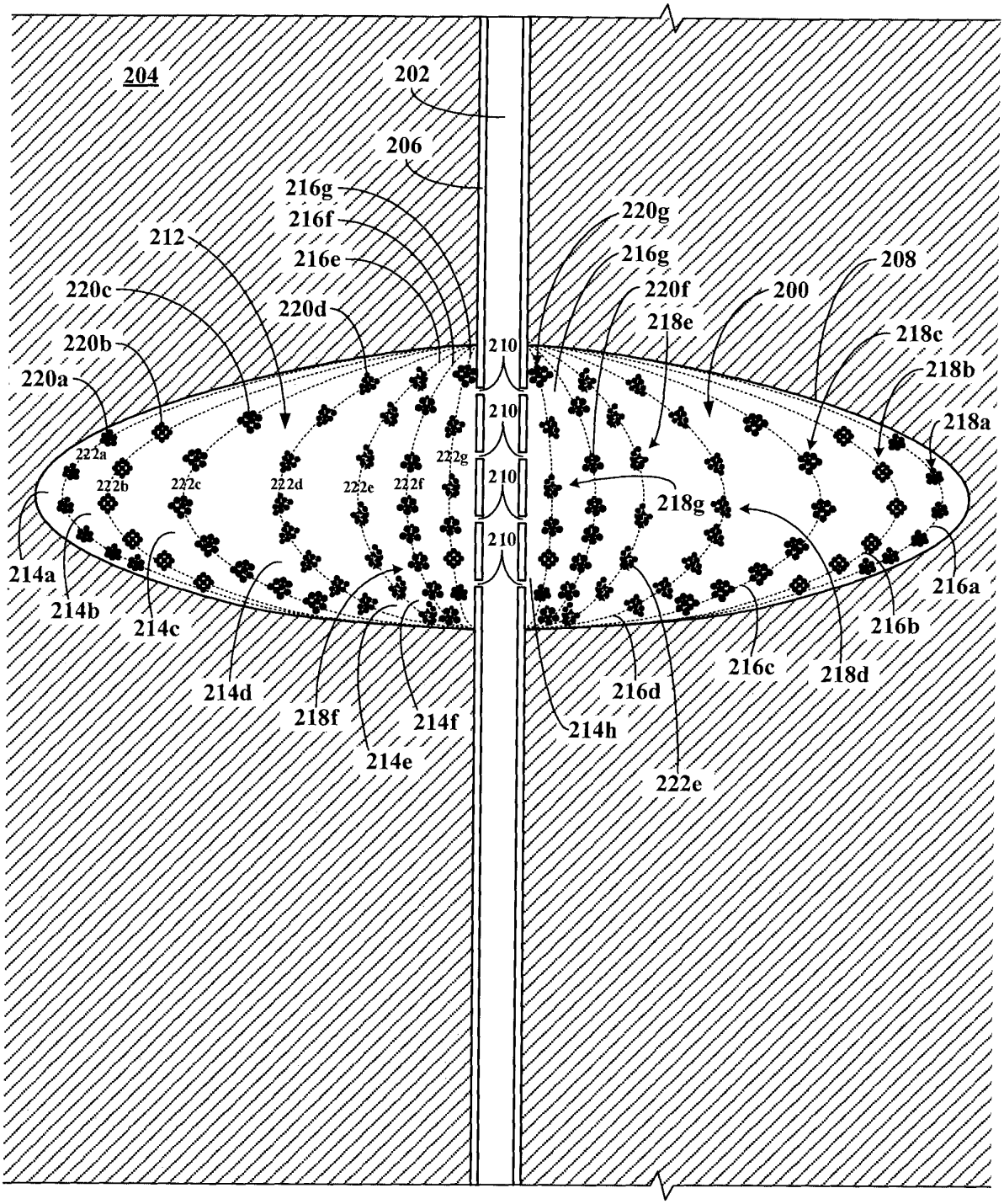

204
202
206
216g
216f
212
216e
220c
220d
220b
220a
222a
222b
222c
222d
222e
222f
222g
210
210
210
210
220g
216g
220f
218e
200
208
218c
218b
218a
218g
214a
214b
214c
214d
218f
214e
214f
214h
216d
222e
216c
218d
216b
216a

FIG. 2A

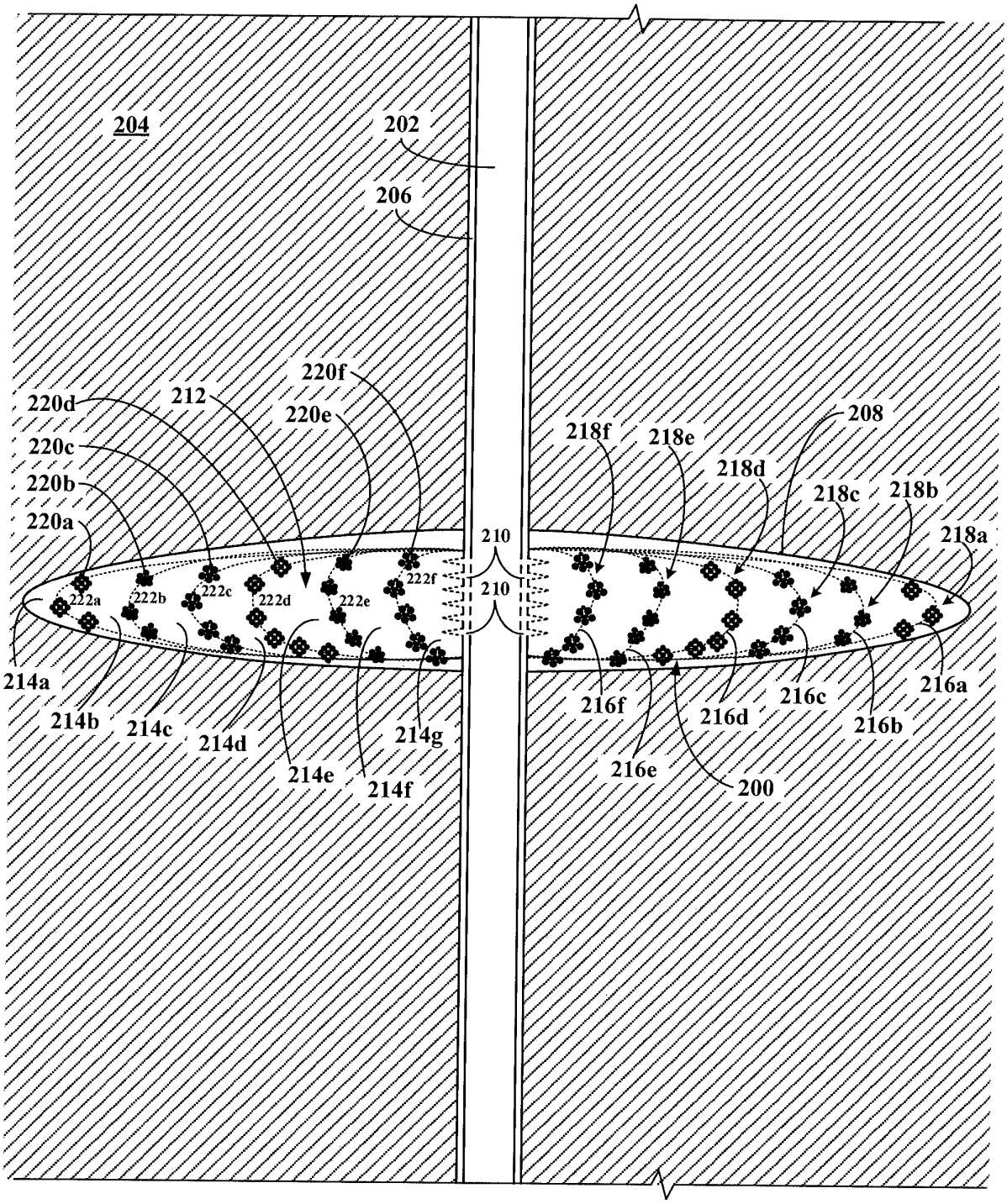

204
202
206
220f
220d
212
220e
208
218f
218e
220c
218d
220b
218c
218b
220a
210
218a
222a
222b
222c
222d
222e
222f
210
214a
214b
214c
214d
214e
214f
214g
216f
216d
216c
216b
216a
216e
200

FIG. 2B

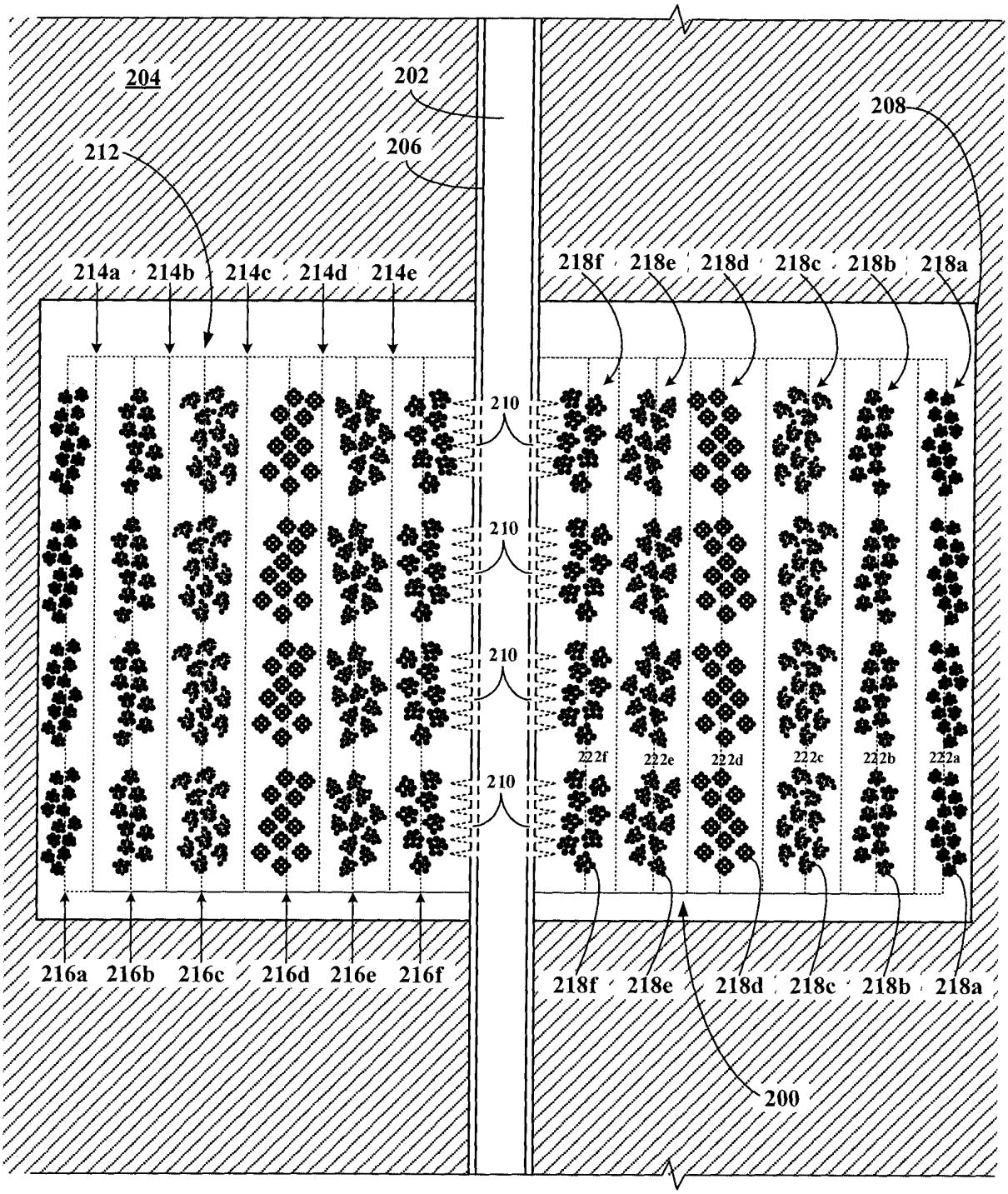

204
202
208
212
206
214a
214b
214c
214d
214e
218f
218e
218d
218c
218b
218a
210
210
210
210
222f
222e
222d
222c
222b
222a
216a
216b
216c
216d
216e
216f
218f
218e
218d
218c
218b
218a
200

FIG. 2C

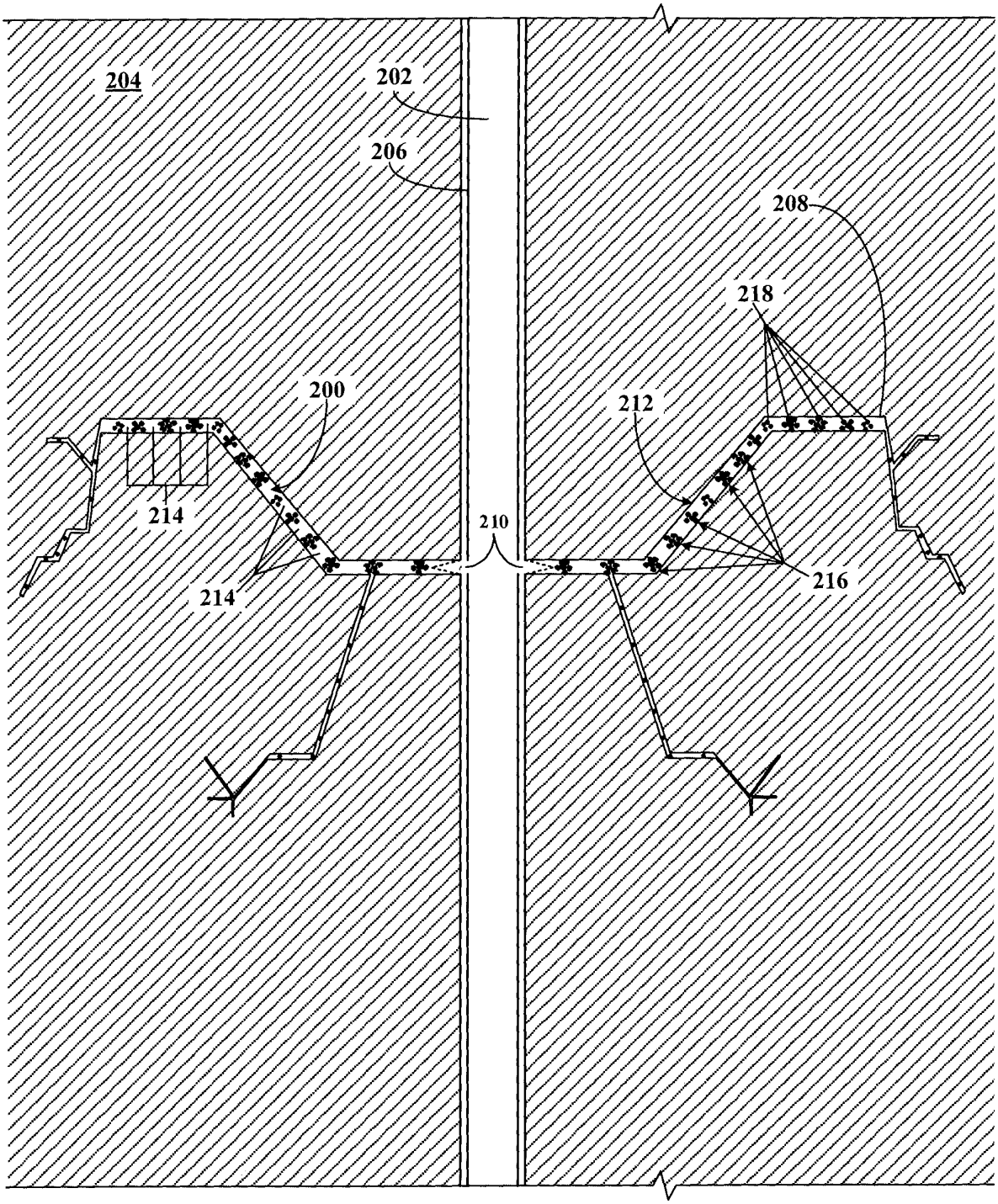


FIG. 2D

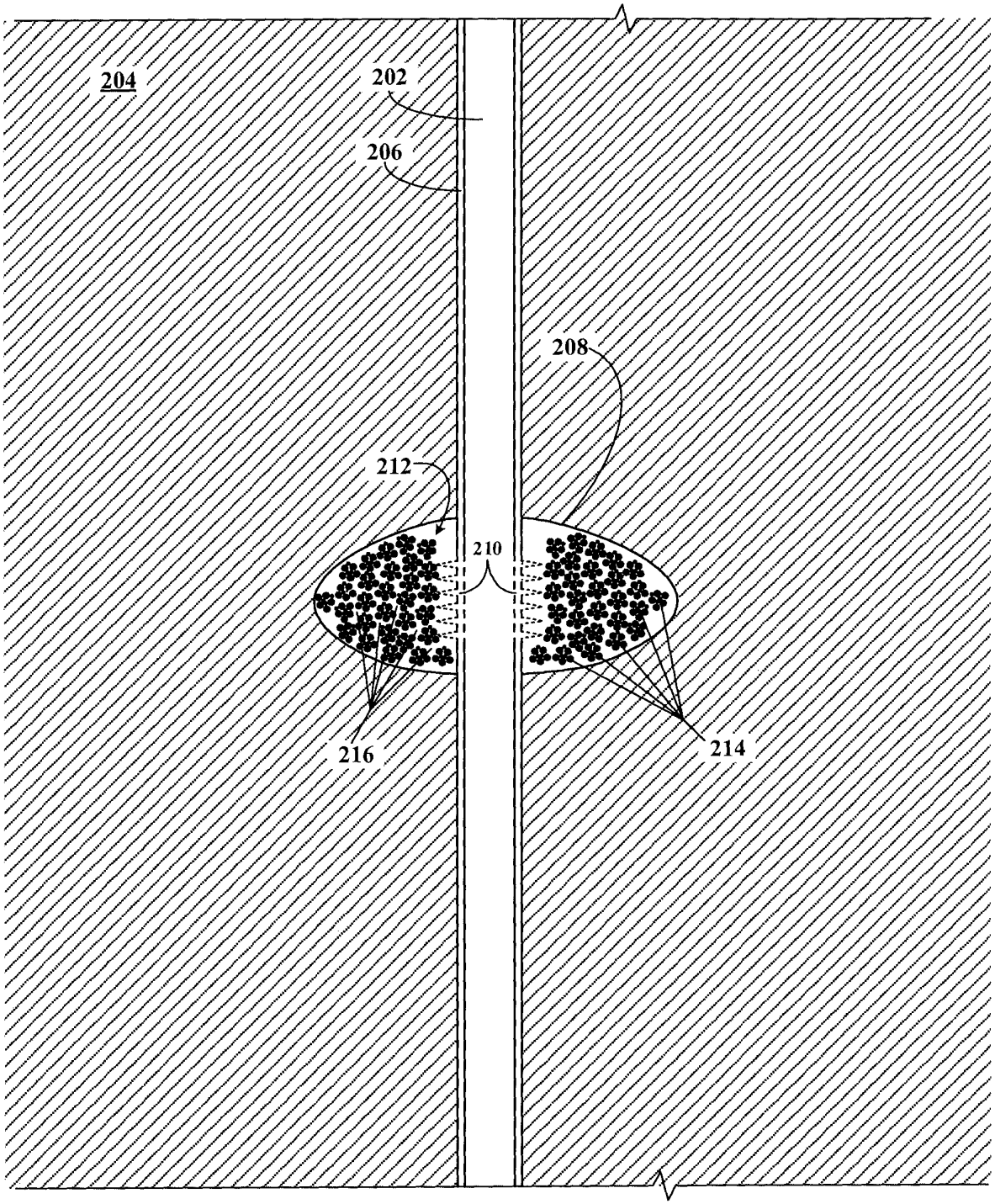


FIG. 2E

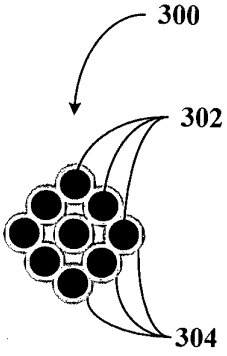


FIG. 3A

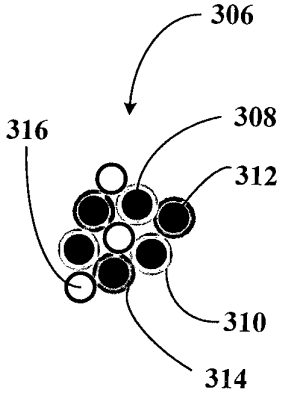


FIG. 3B

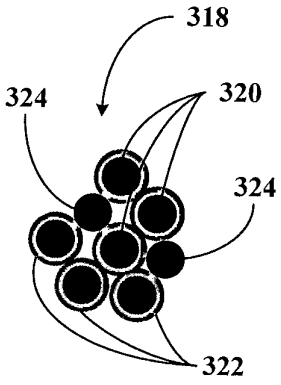


FIG. 3C

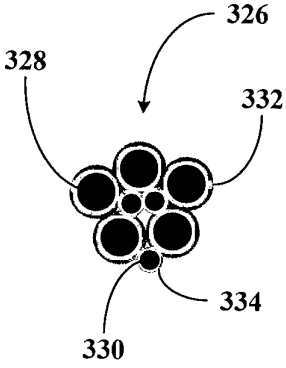


FIG. 3D

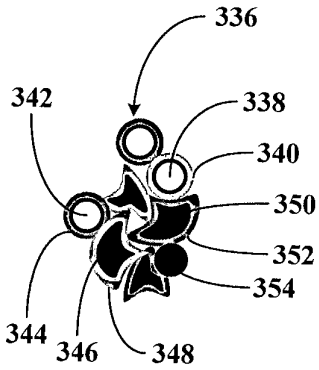


FIG. 3E

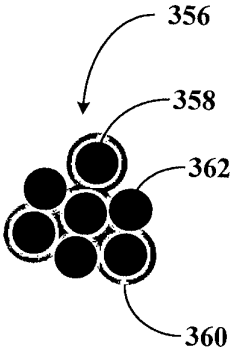


FIG. 3F

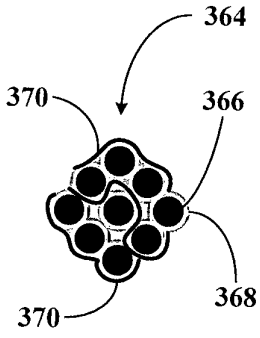


FIG. 3G

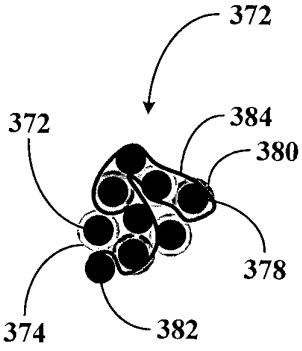


FIG. 3H

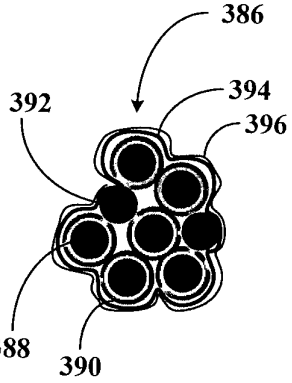


FIG. 3I

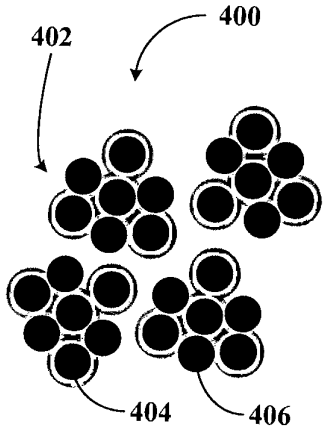


FIG. 4A

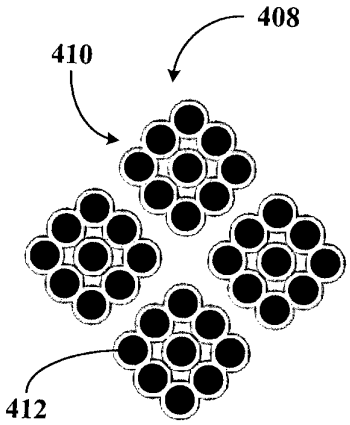


FIG. 4B

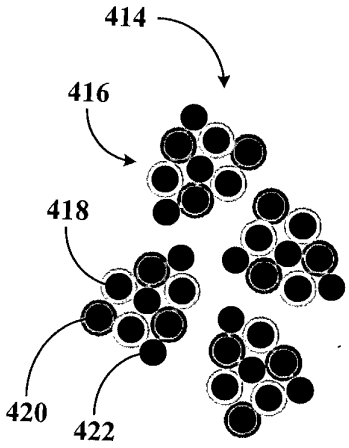


FIG. 4C

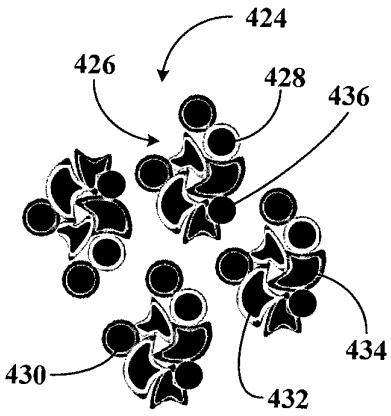


FIG. 4D

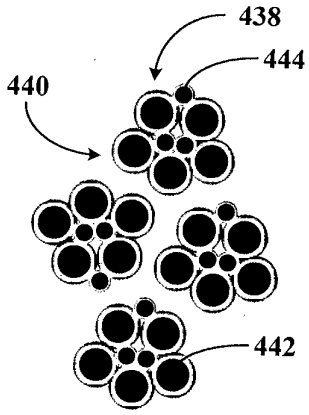


FIG. 4E

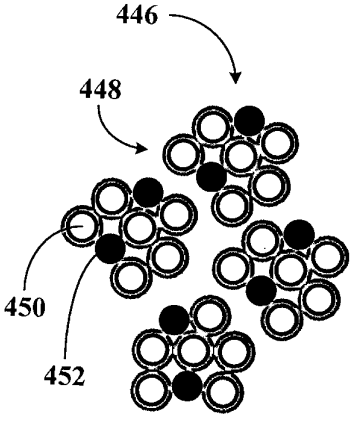


FIG. 4F

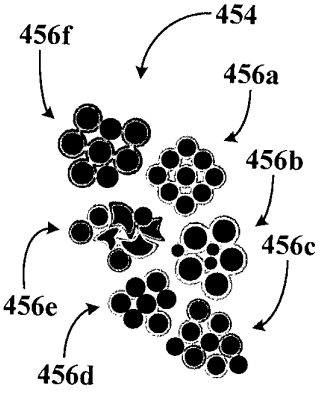


FIG. 4G

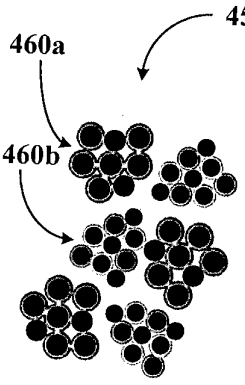


FIG. 4H

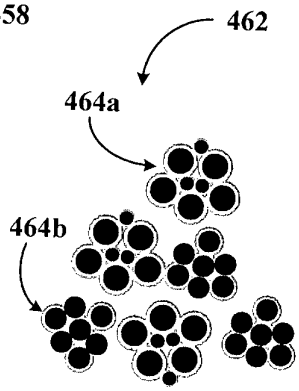


FIG. 4I

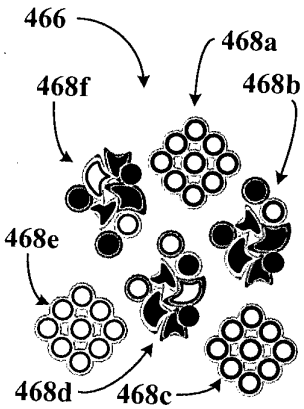


FIG. 4J

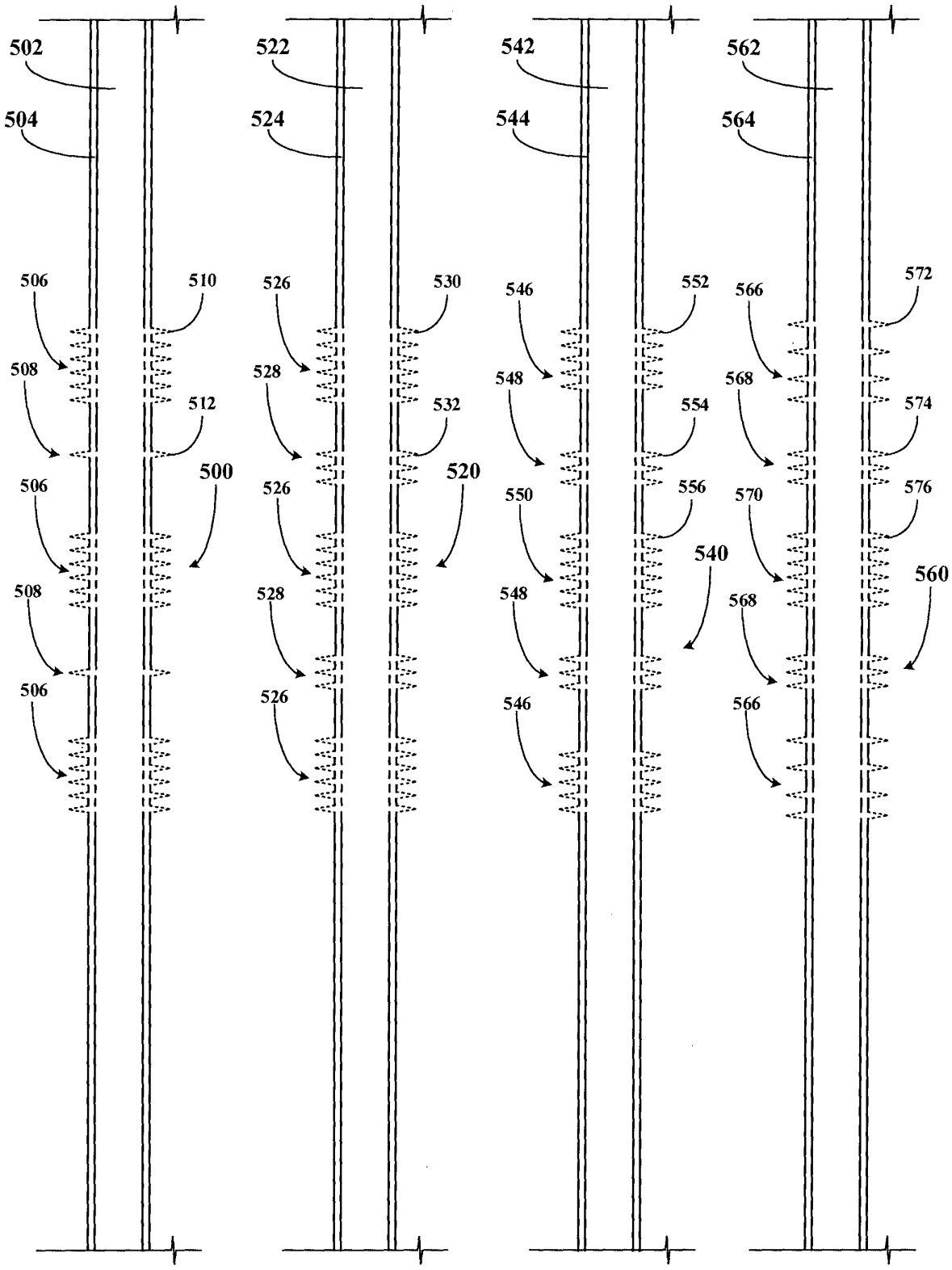
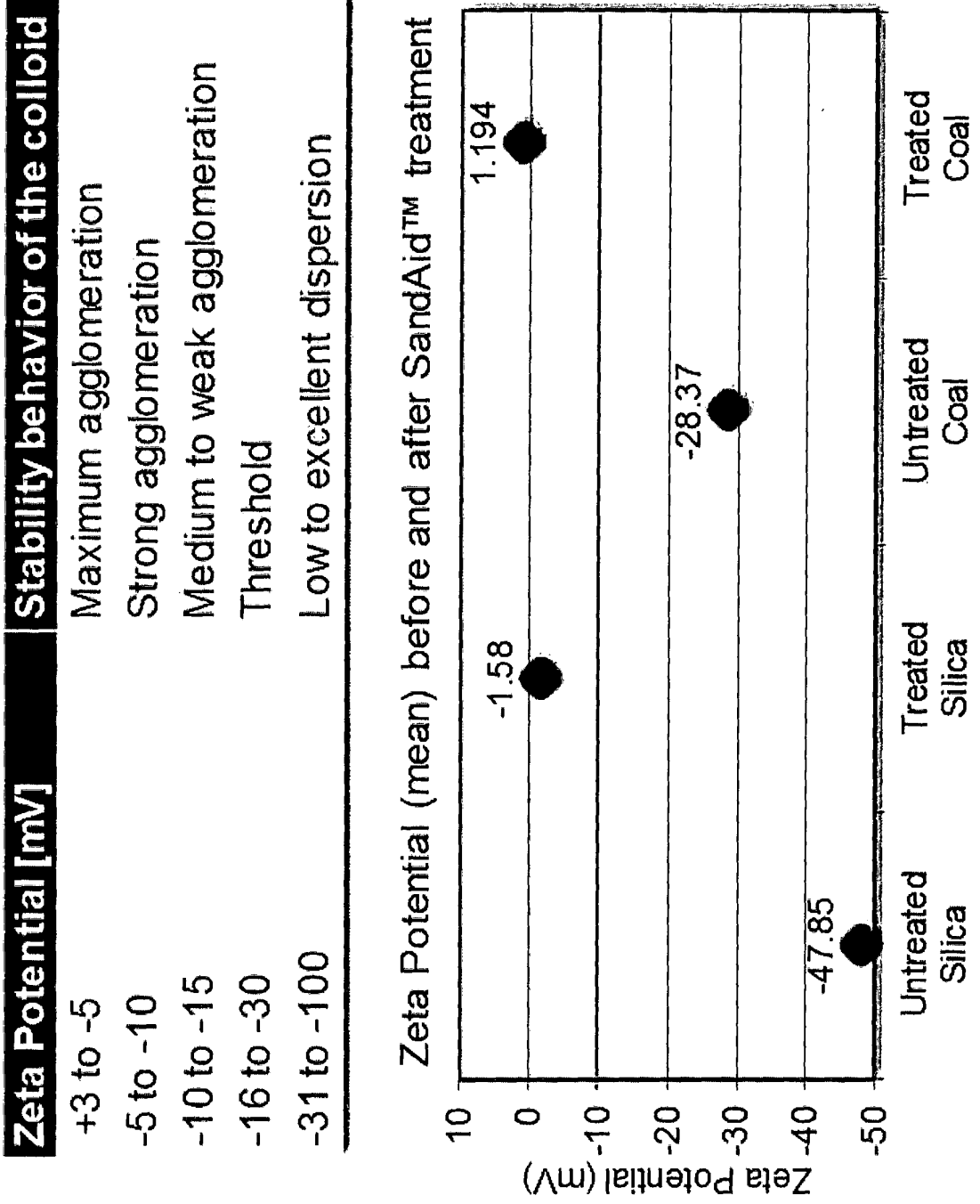


FIG. 5A FIG. 5B FIG. 5C FIG. 5D

Zeta Potential [mV]	Stability behavior of the colloid
+3 to -5	Maximum agglomeration
-5 to -10	Strong agglomeration
-10 to -15	Medium to weak agglomeration
-16 to -30	Threshold
-31 to -100	Low to excellent dispersion



Zeta Potential (mean) before and after SandAid™ treatment

FIG. 6

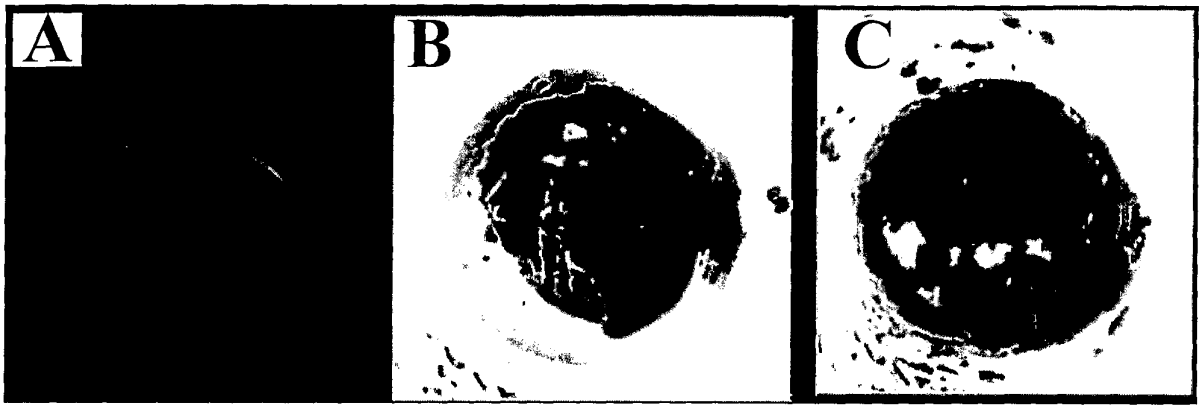


FIG. 7A-C



FIG. 8A

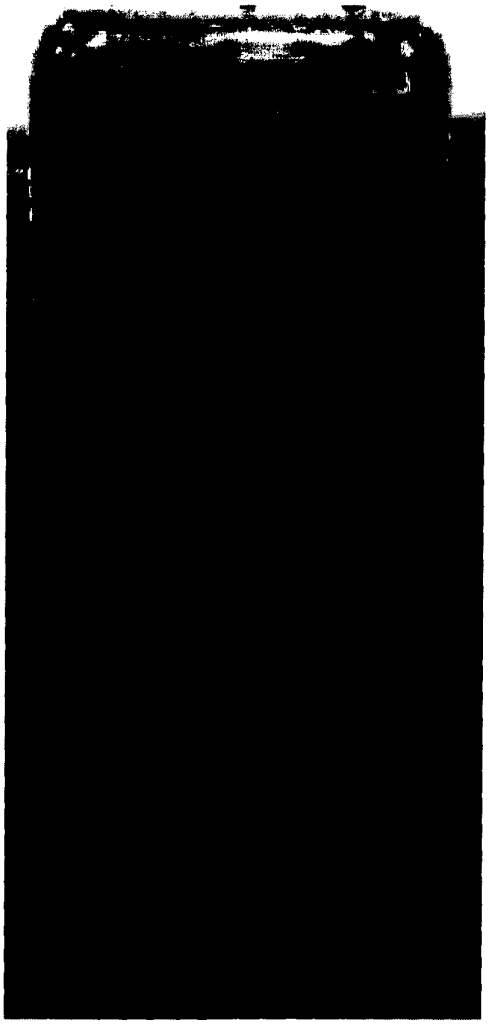


FIG. 8C

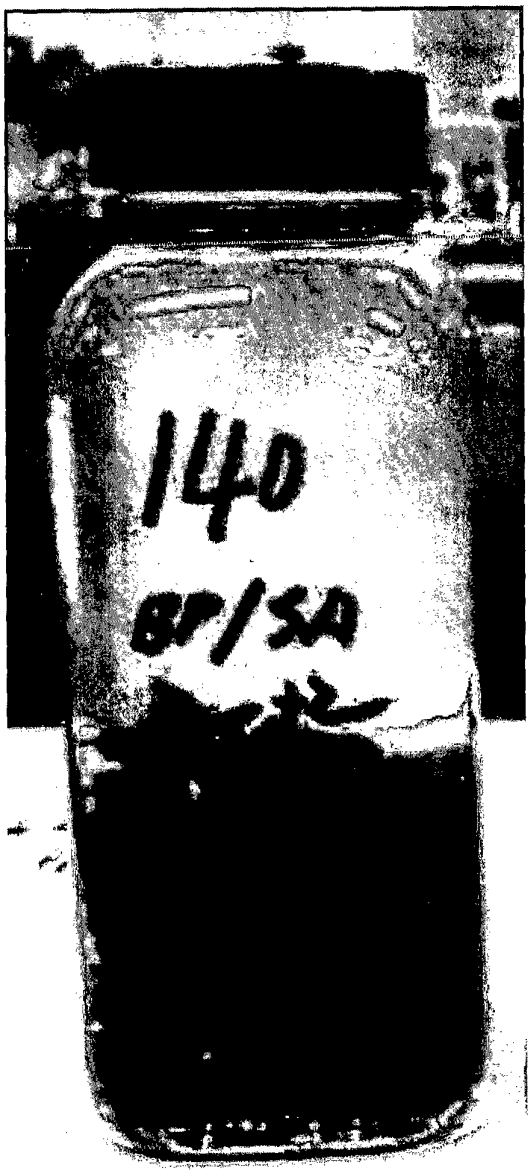


FIG. 8B

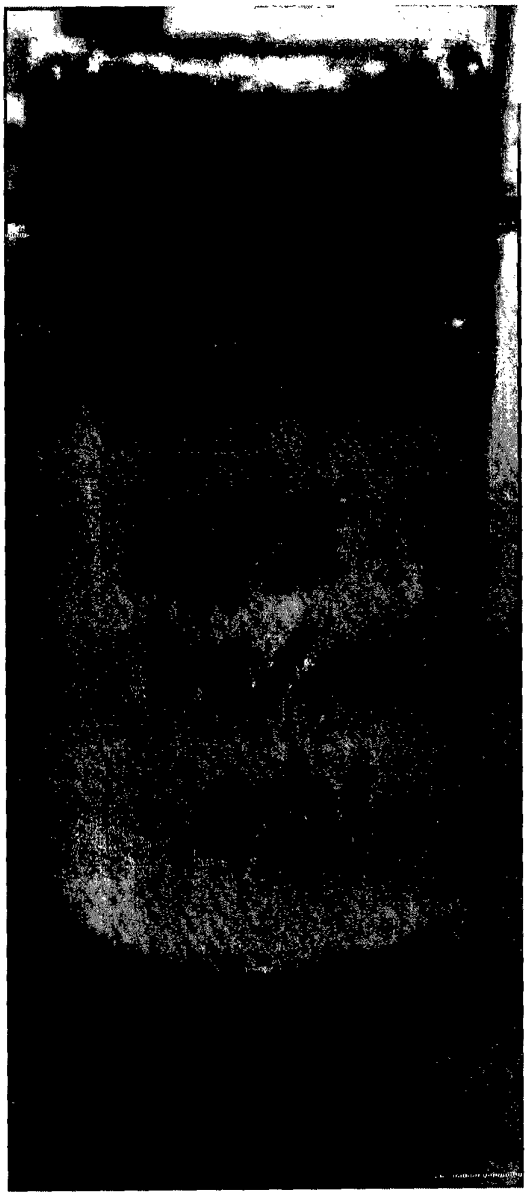


FIG. 8D

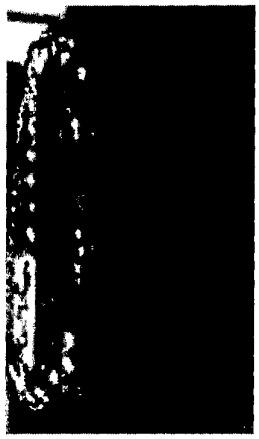


FIG. 9B

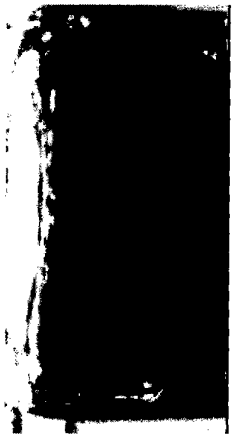


FIG. 9D

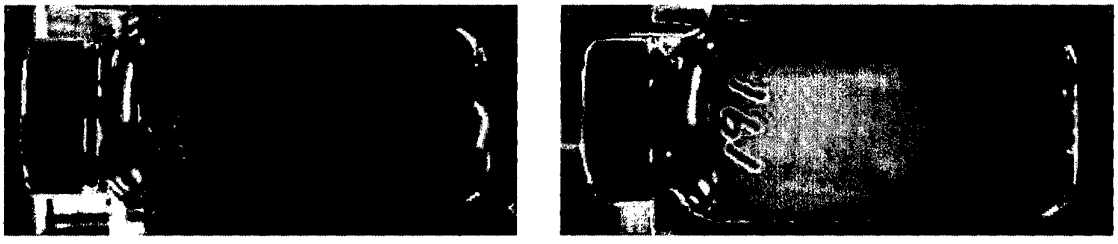




FIG. 9A



FIG. 9C



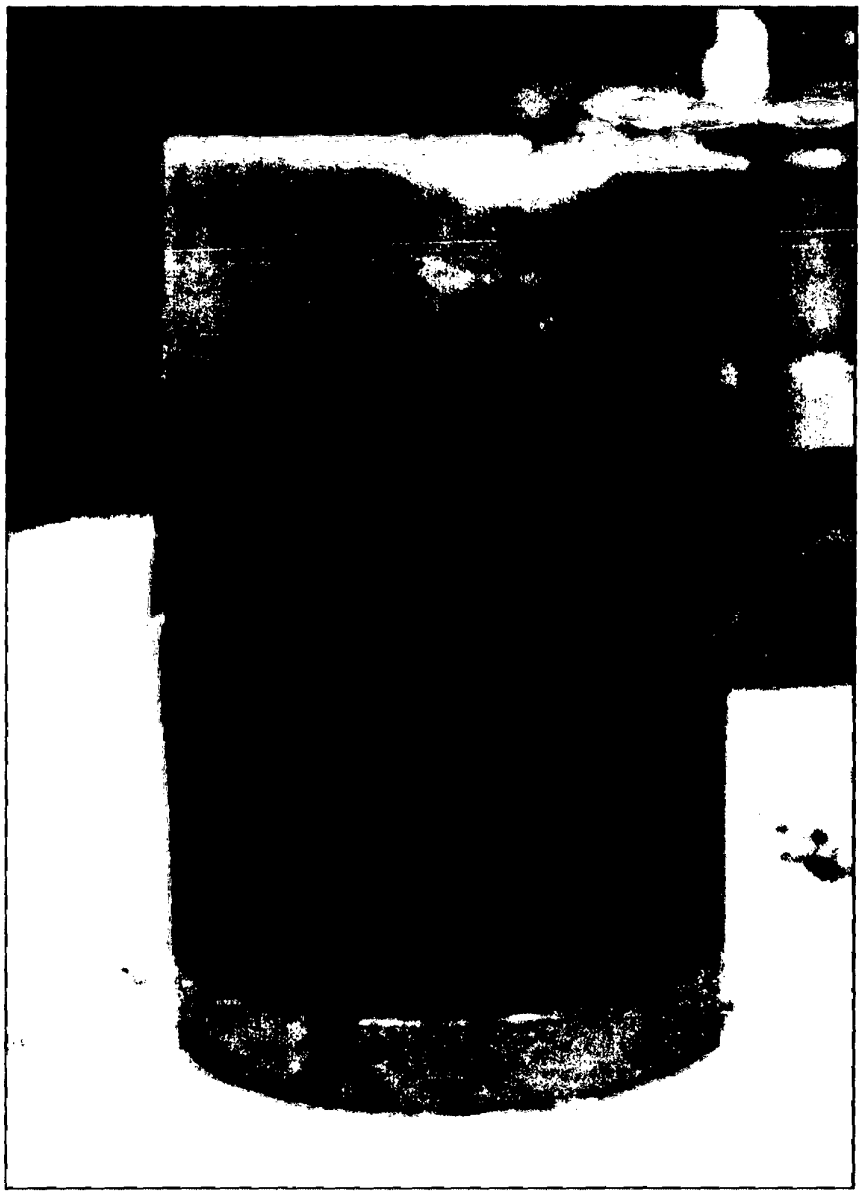


FIG. 10

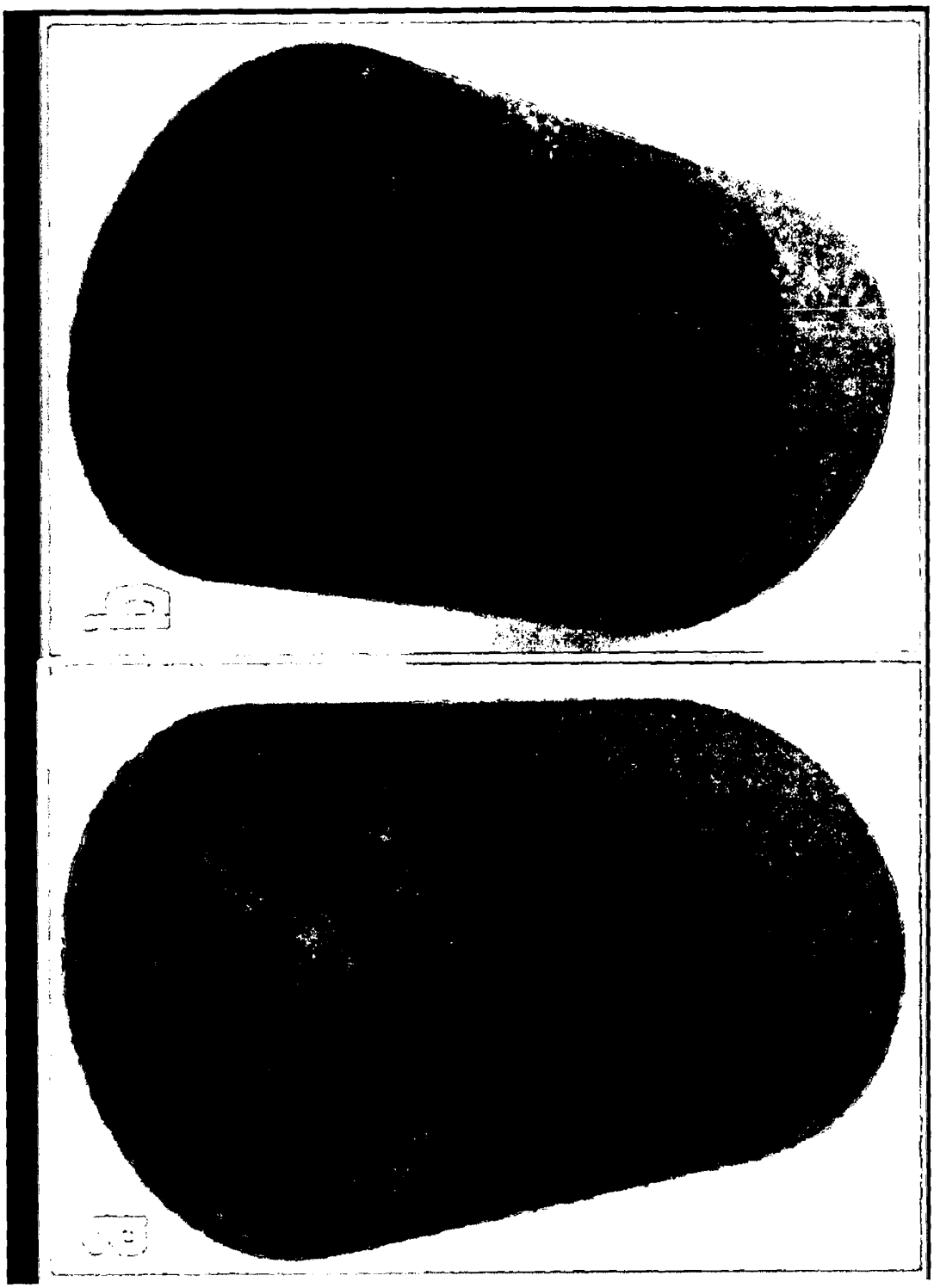


FIG. 11B

FIG. 11A