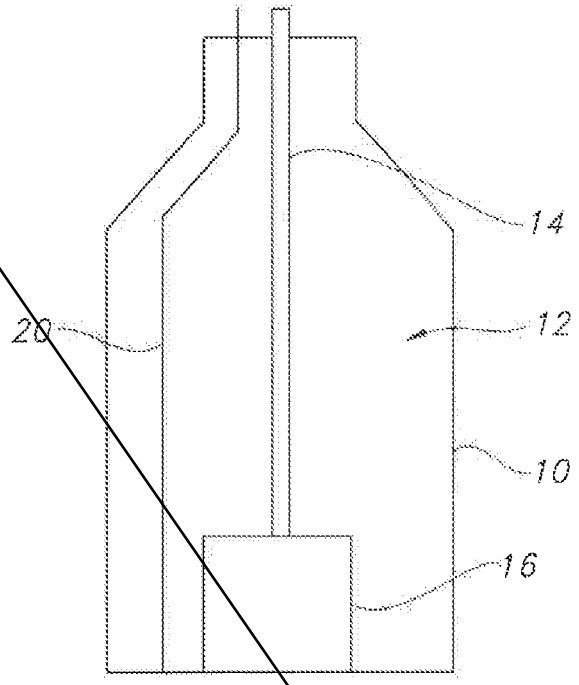


FIG. 1

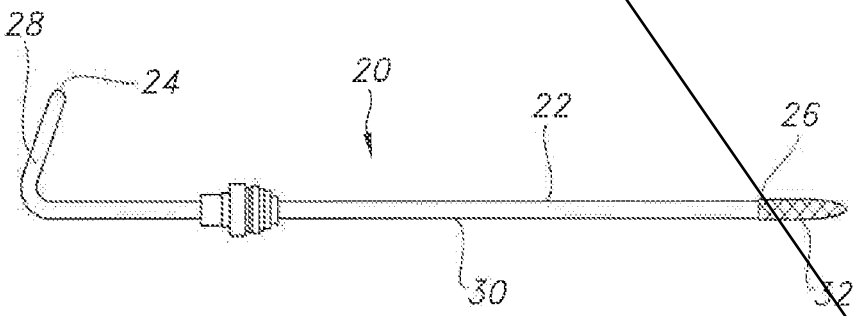


FIG. 2

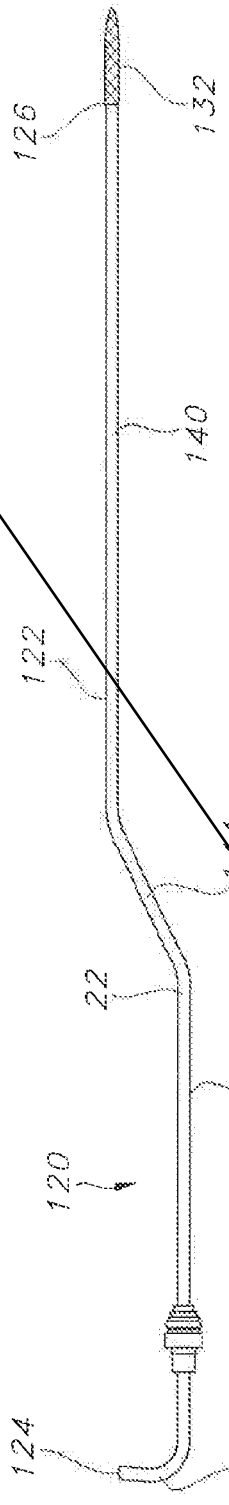


FIG. 3

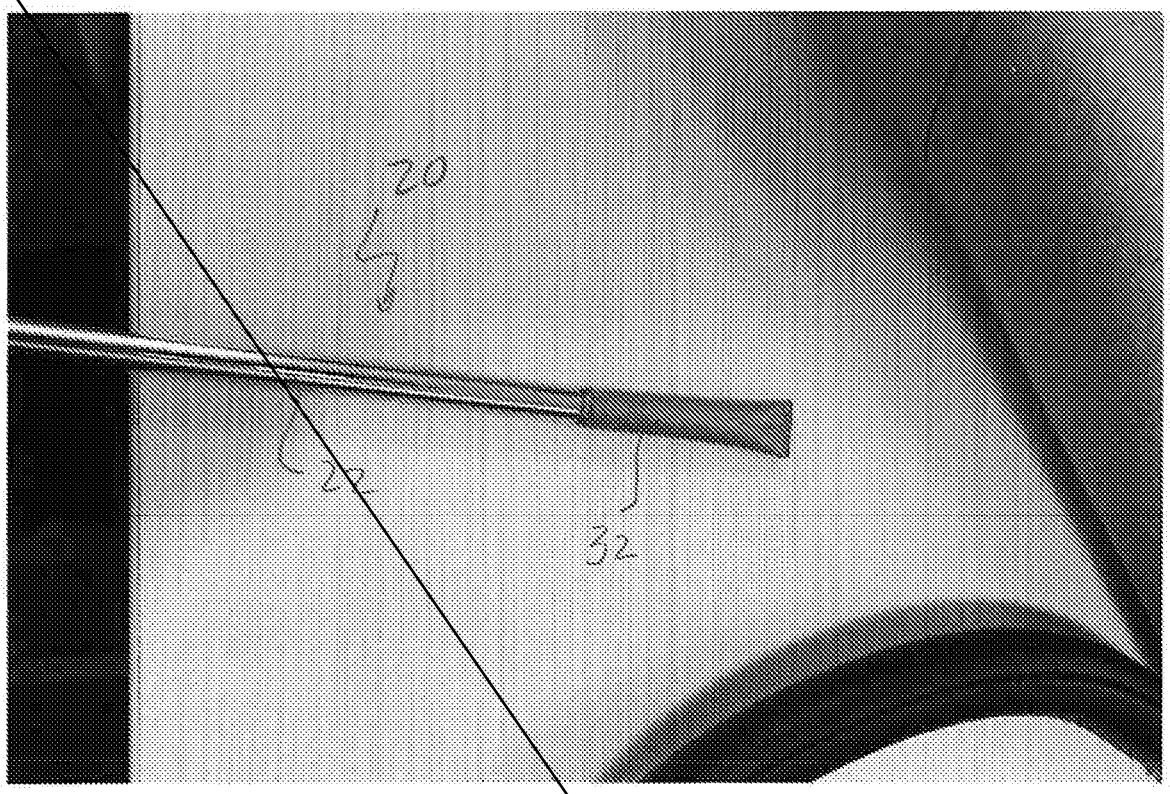


Fig. 4A

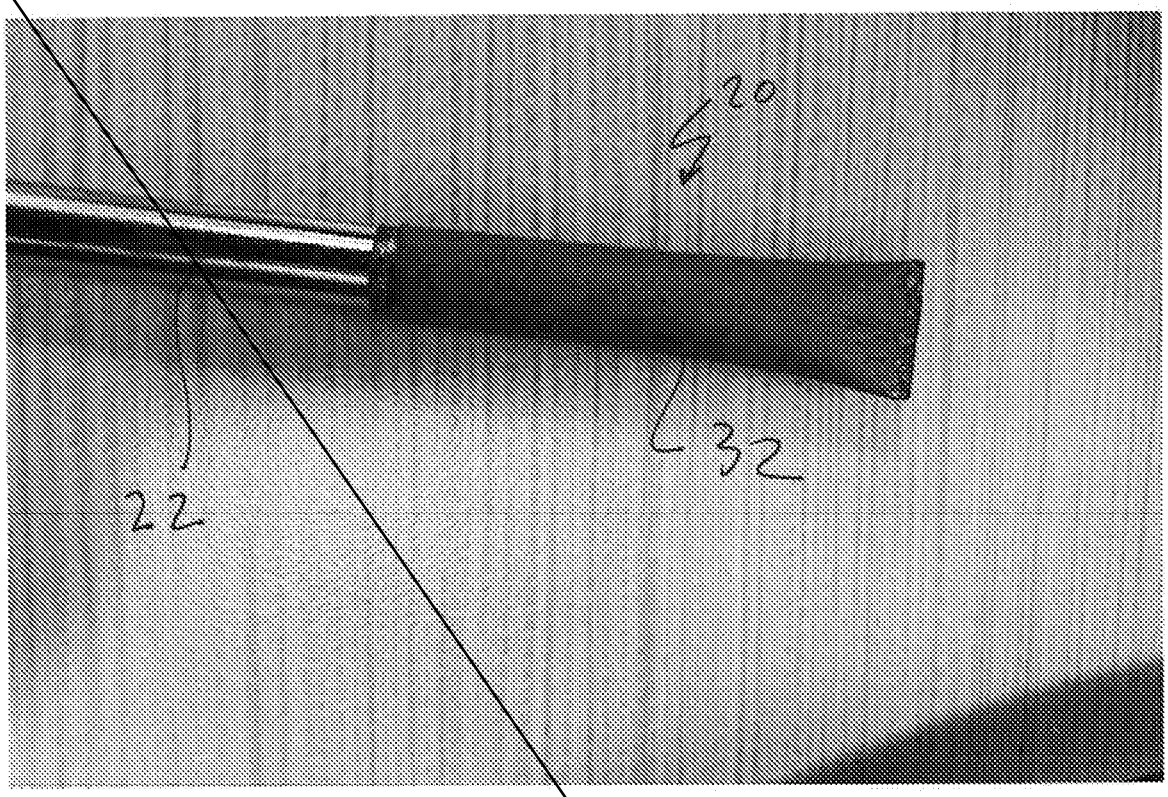


Fig. 4B

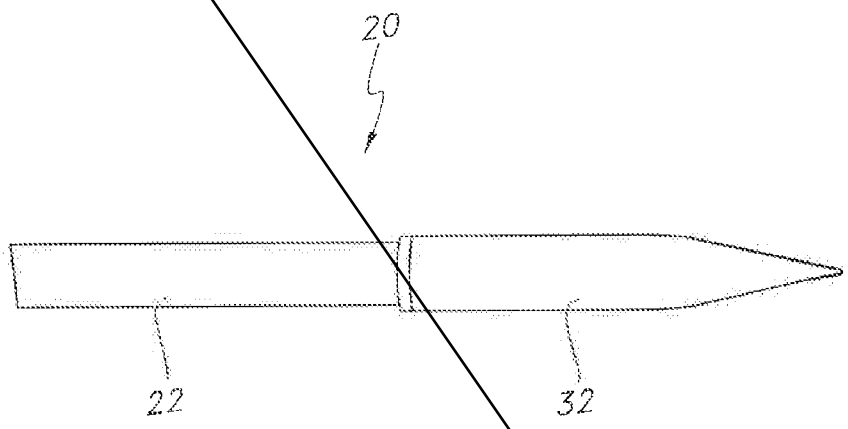


FIG. 4C

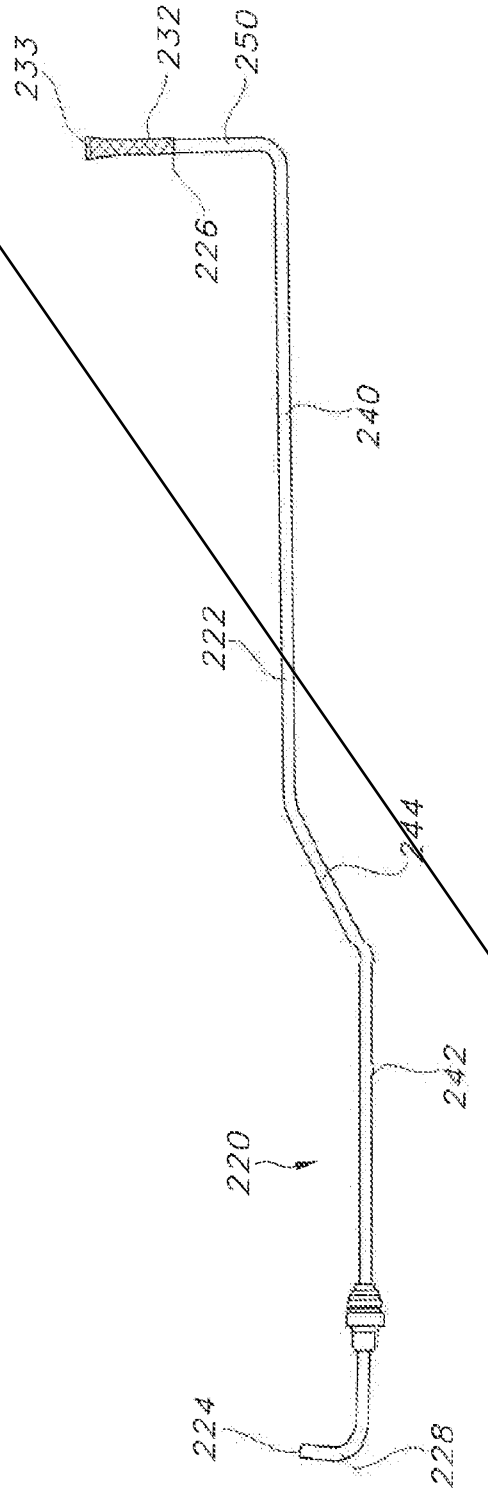


FIG. 5A

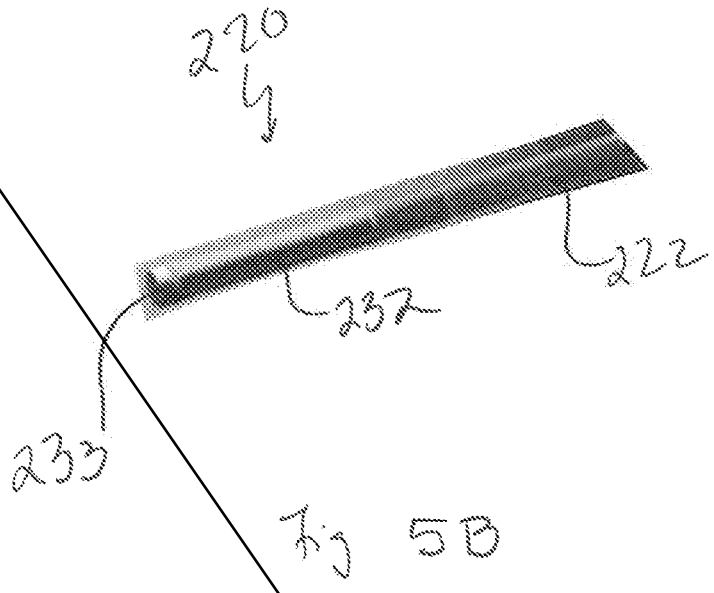


Fig 5B

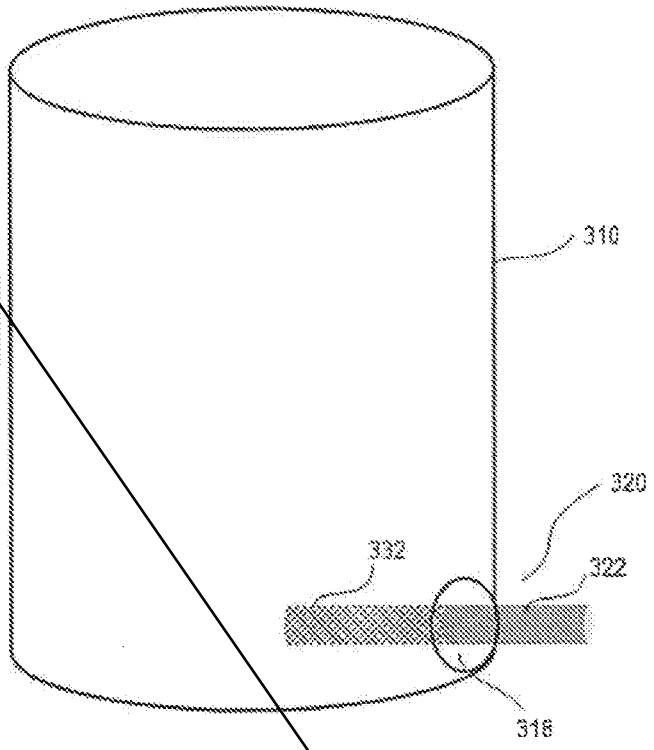


FIG. 6

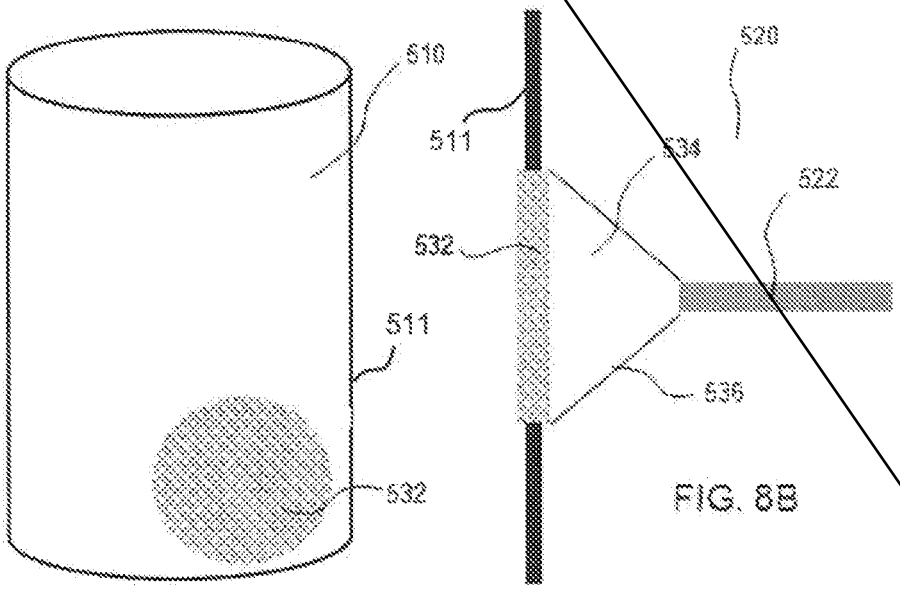


FIG. 8A

FIG. 8B

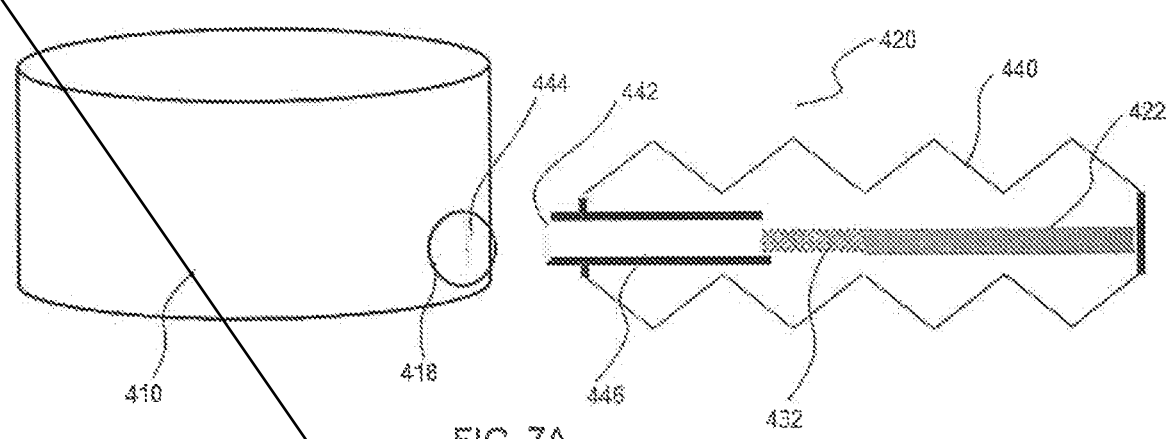


FIG. 7A

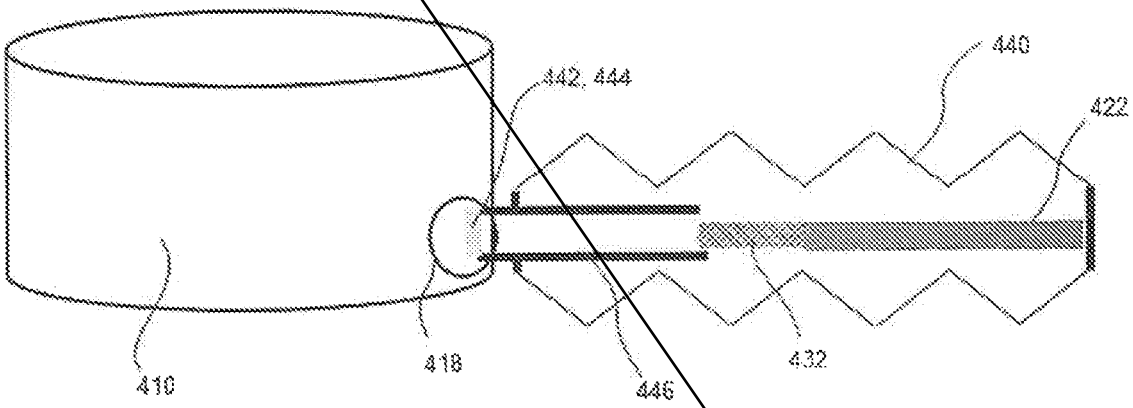


FIG. 7B

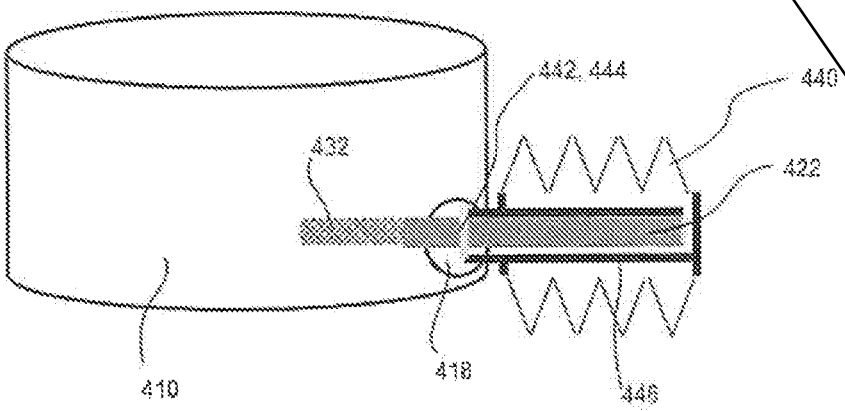


FIG. 7C

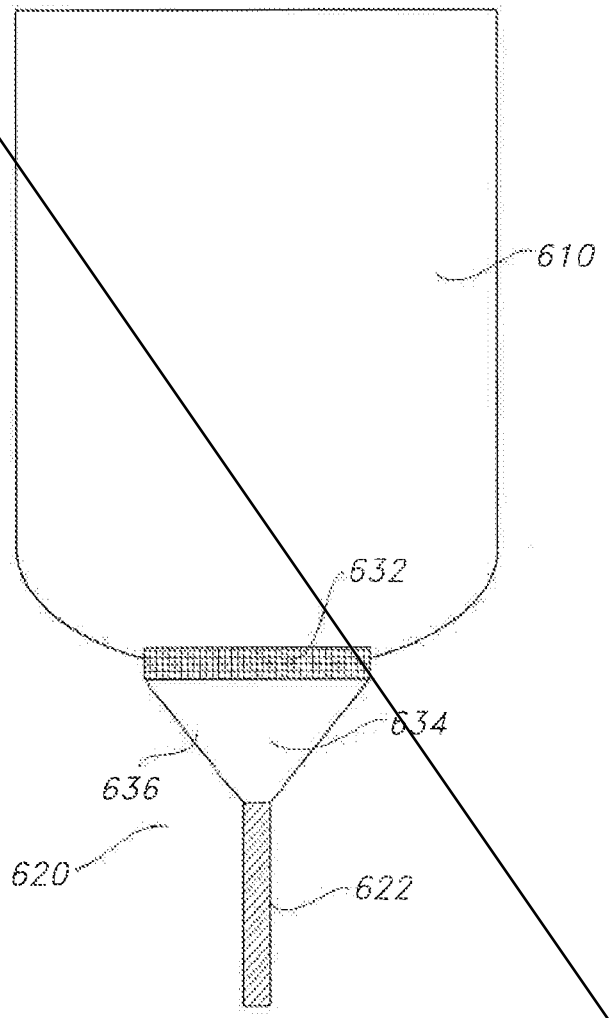


FIG. 9

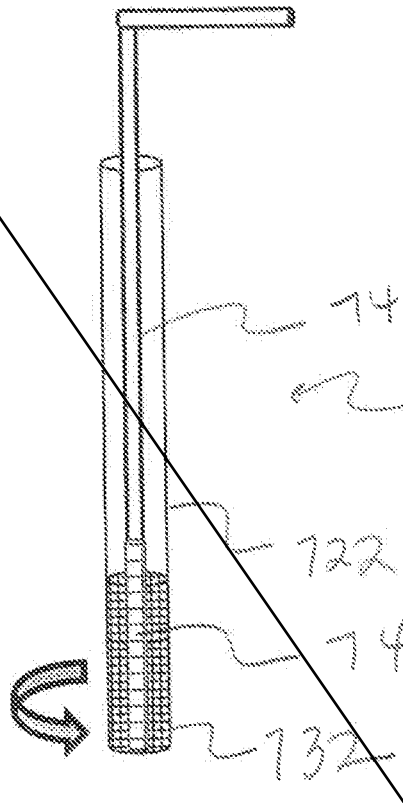


Fig. 10

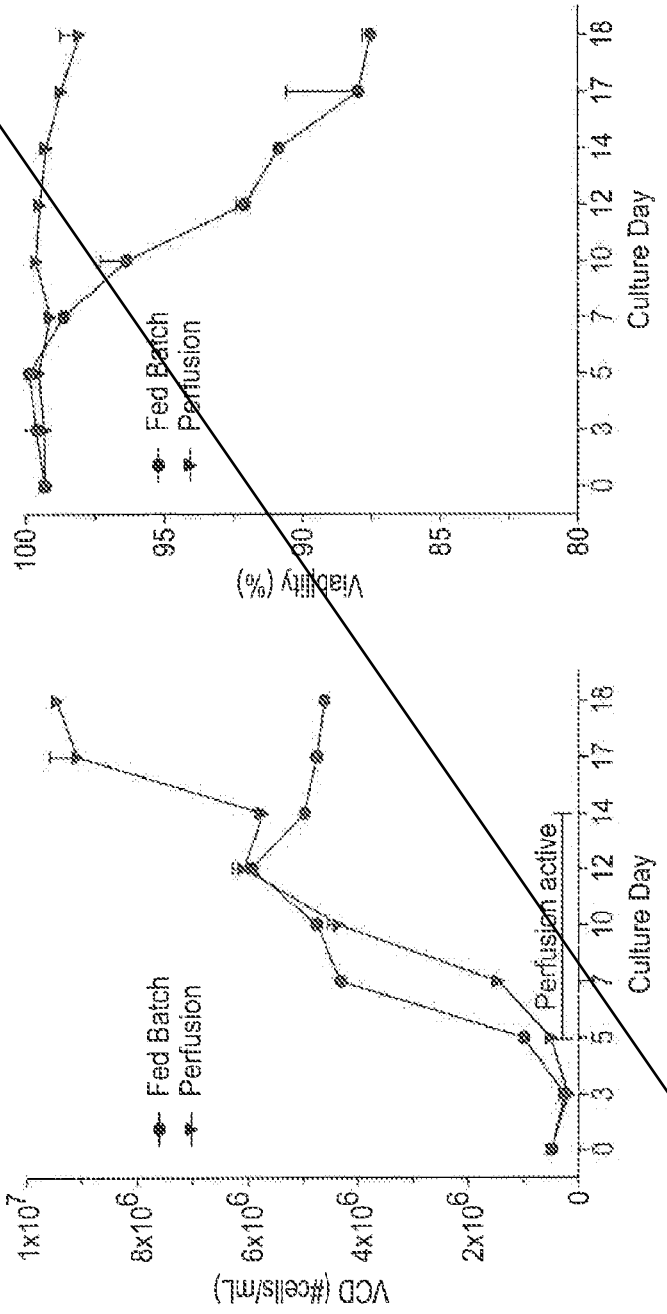

VCD (#cells/mL)
1x10^7
8x10^6
6x10^6
4x10^6
2x10^6
0
Fed Batch
Perfusion
Perfusion active
0 3 5 7 10 12 14 17 18
Culture Day
Viability (%)
100
95
90
85
80
Fed Batch
Perfusion
0 3 5 7 10 12 14 17 18
Culture Day

FIG. 11

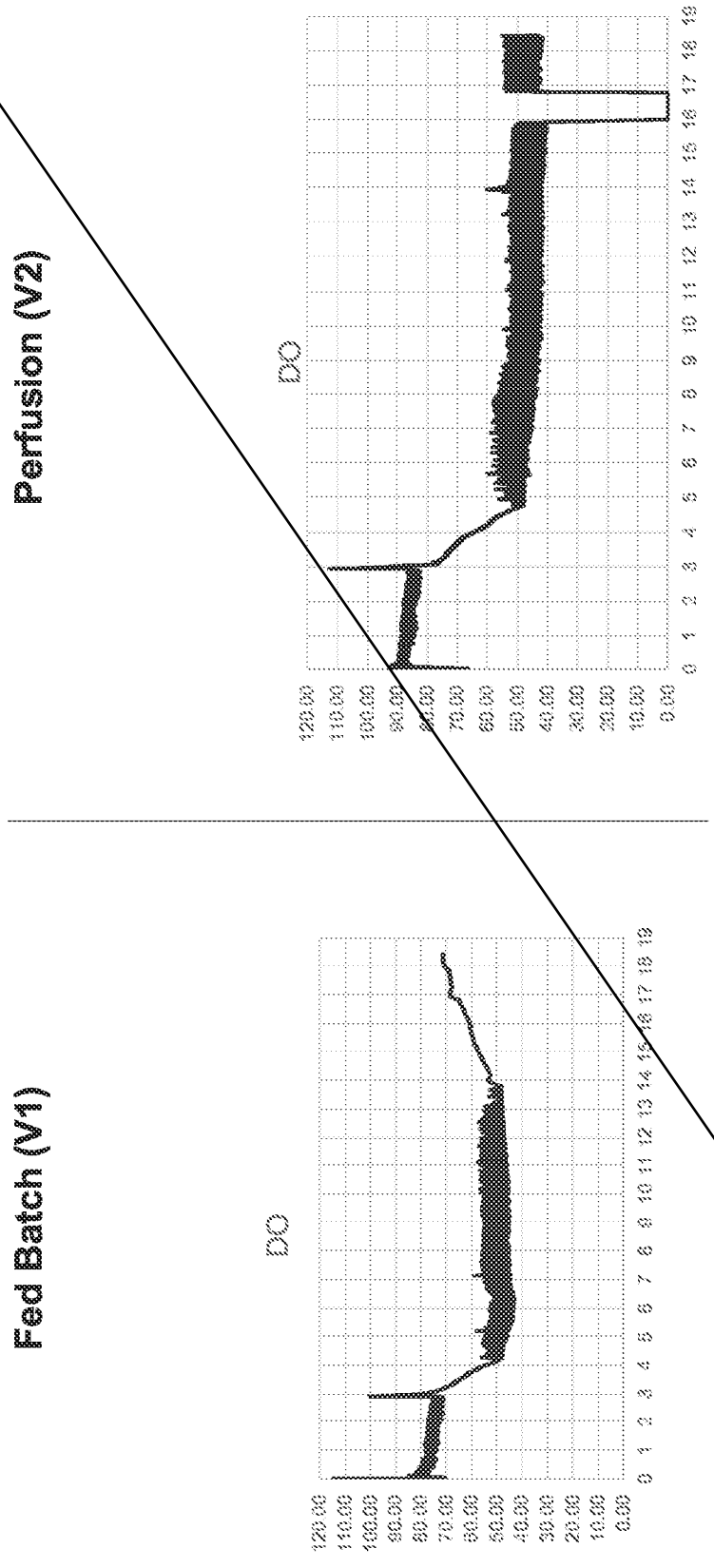

Perfusion (V2)
DO
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Fed Batch (V1)
DO
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

FIG.12

Glucose
Fed Batch
Perfusion
Perfusion active
Glucose (g/L)
Culture Day
Lactate
Fed Batch
Perfusion
Perfusion active
Lactate (g/L)
Culture Day
Ammonia
Fed Batch
Perfusion
Perfusion active
Ammonia (mmol/L)
Culture Day

FIG.13

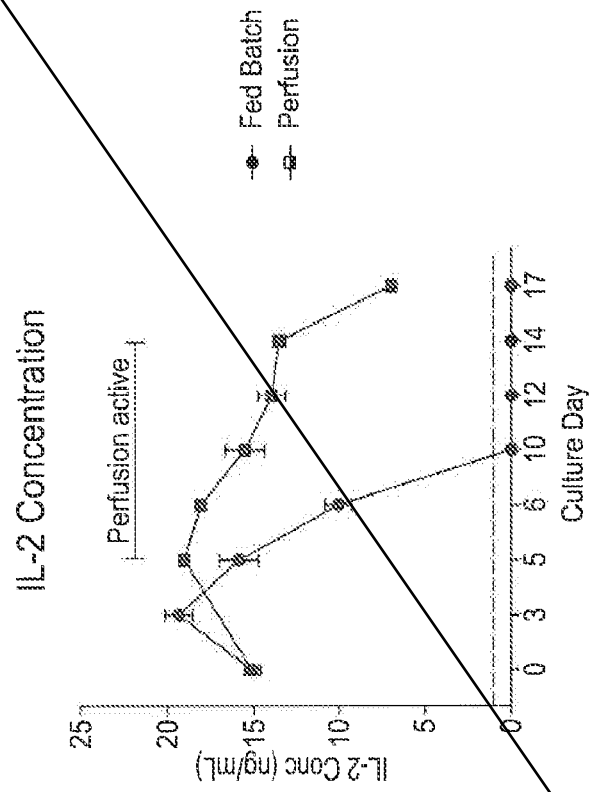

IL-2 Concentration
Fed Batch
Perfusion
Perfusion active
IL-2 Conc (ng/mL)
25
20
15
10
5
0
0
3
5
8
10
12
14
17
Culture Day

FIG. 14

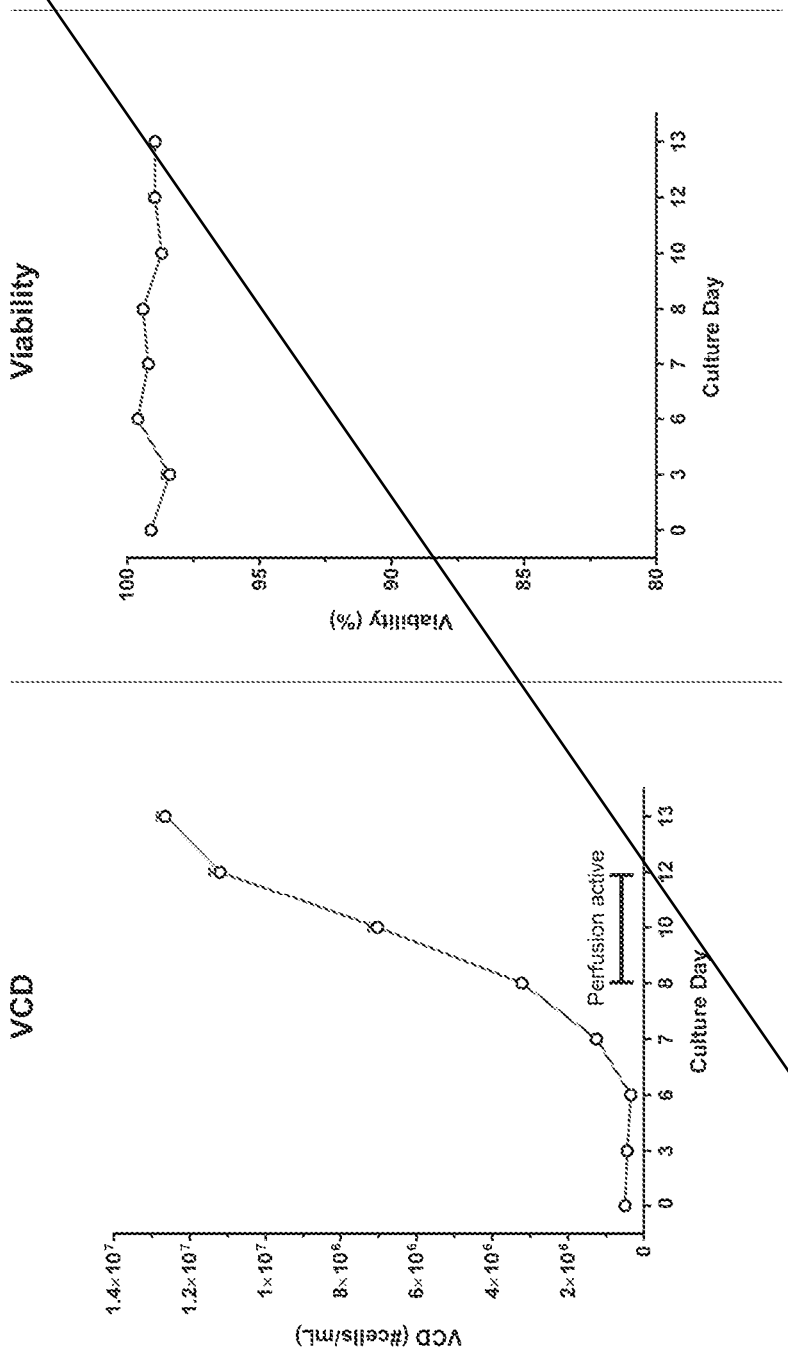

VCD
VCD (#cells/mL)
1.4x10^7
1.2x10^7
1x10^7
8x10^6
6x10^6
4x10^6
2x10^6
0
Perfusion active
0 3 6 7 8 10 12 13
Culture Day
Viability
Viability (%)
100
95
90
85
80
0 3 6 7 8 10 12 13
Culture Day

FIG. 15

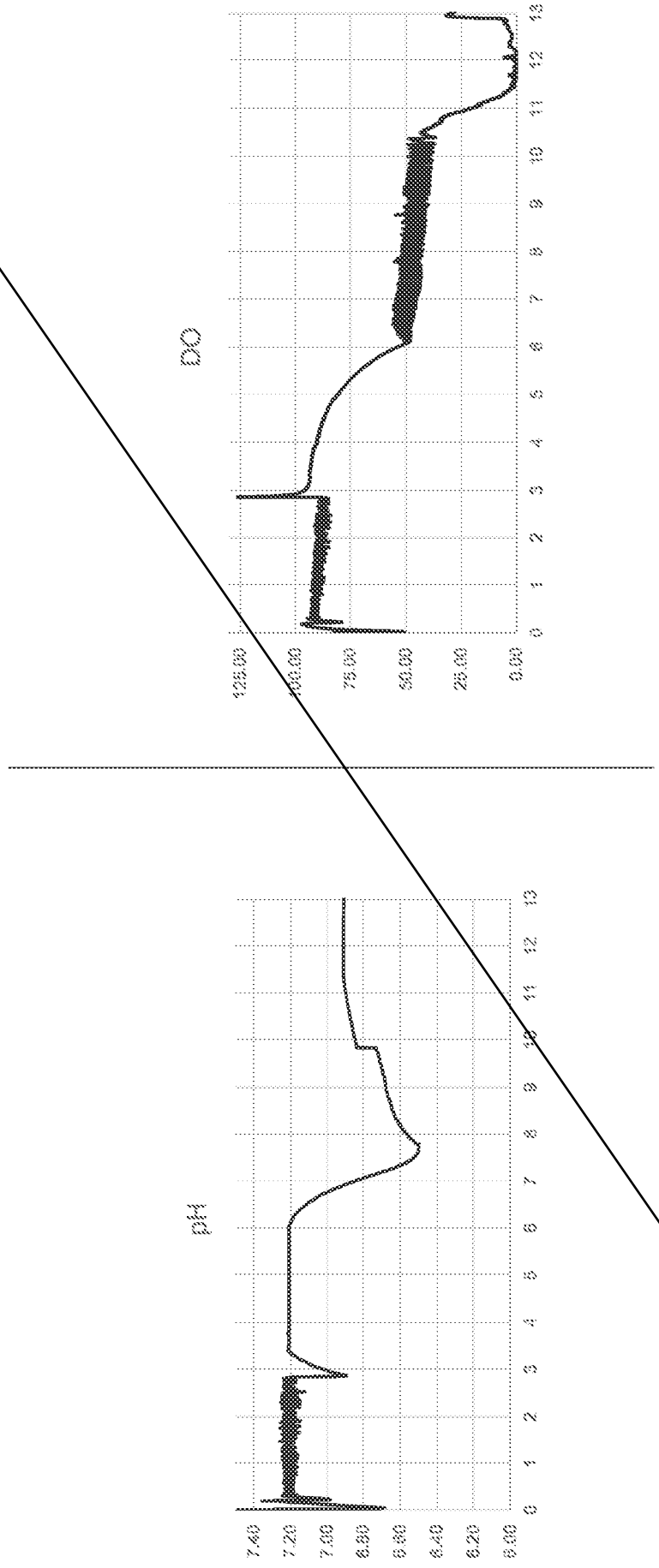

DO
128.00
102.00
76.00
50.00
25.00
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13
pH
7.40
7.20
7.00
6.80
6.60
6.40
6.20
6.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13

FIG. 16

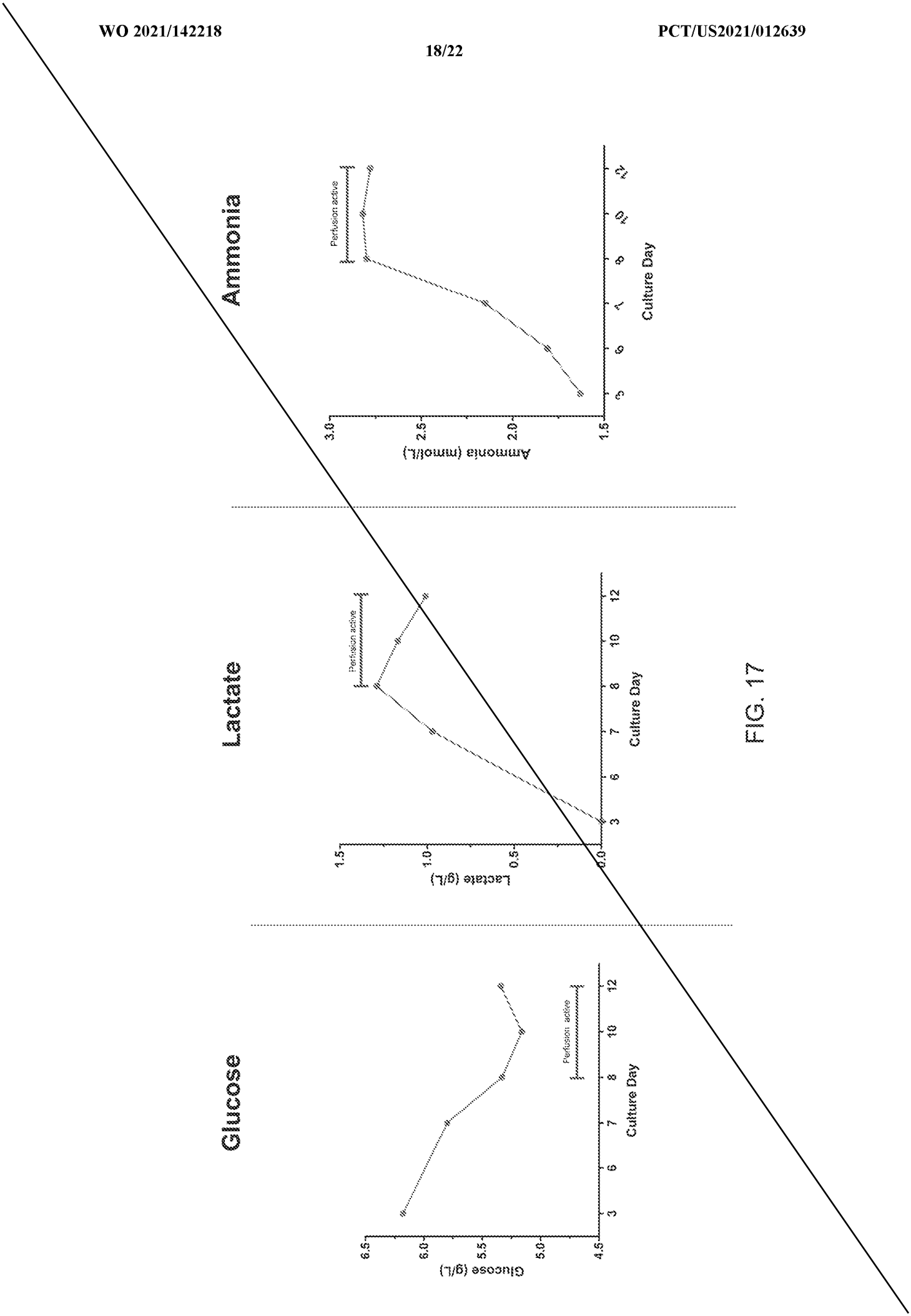

Glucose
Glucose (g/L)
6.5
6.0
5.5
5.0
4.5
3
6
7
8
10
12
Culture Day
Perfusion active
Lactate
Lactate (g/L)
1.5
1.0
0.5
0.0
3
6
7
8
10
12
Culture Day
Perfusion active
Ammonia
Ammonia (mmol/L)
3.0
2.5
2.0
1.5
3
6
7
8
10
12
Culture Day
Perfusion active

FIG. 17

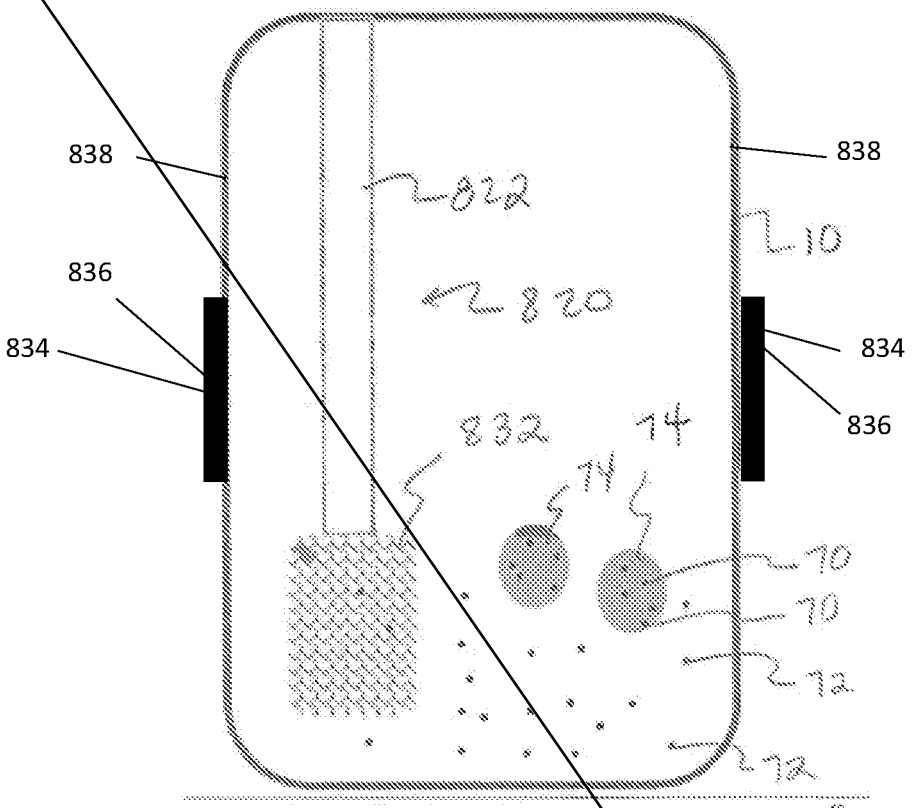


Fig. 18

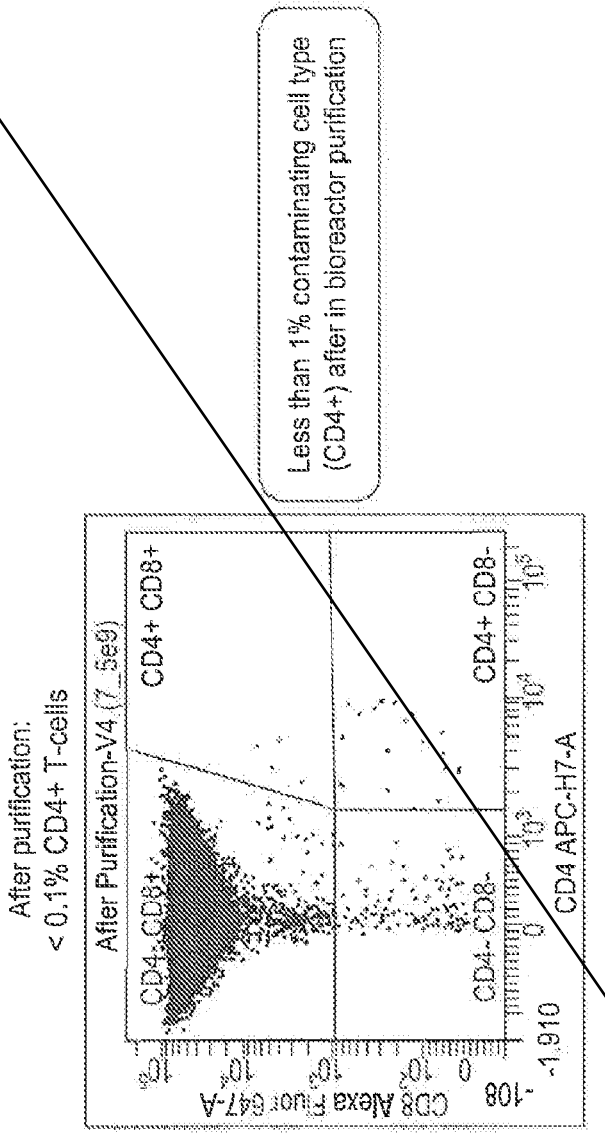


FIG. 19A

FIG. 19B

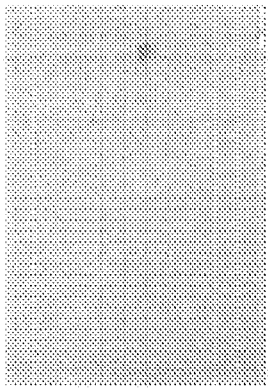


FIG. 19E

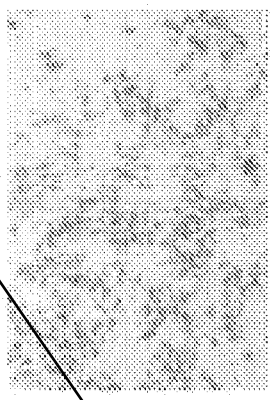


FIG. 19D

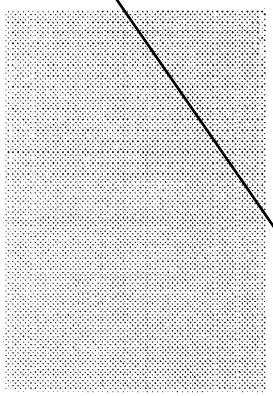


FIG. 19C

Beads remaining: <0.5 %

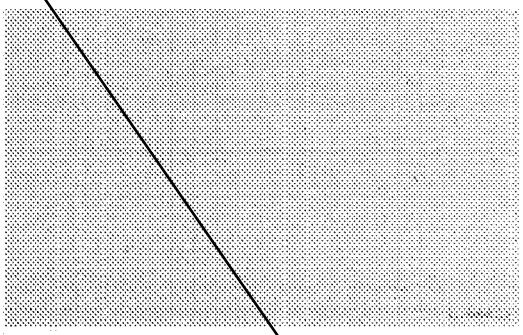


FIG. 20A

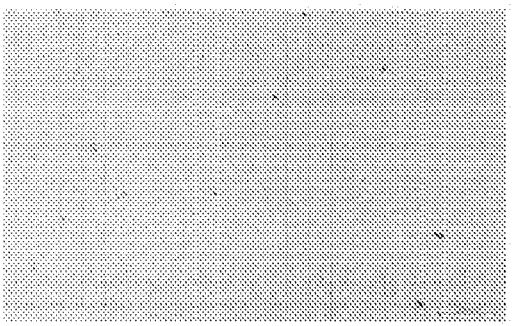


FIG. 20B



FIG. 20C

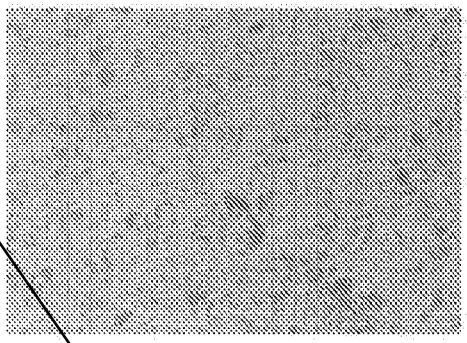


FIG. 20D

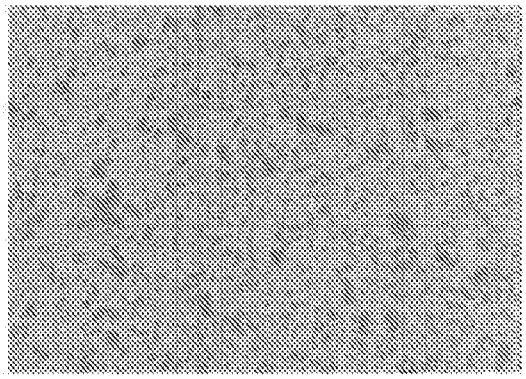


FIG. 20E

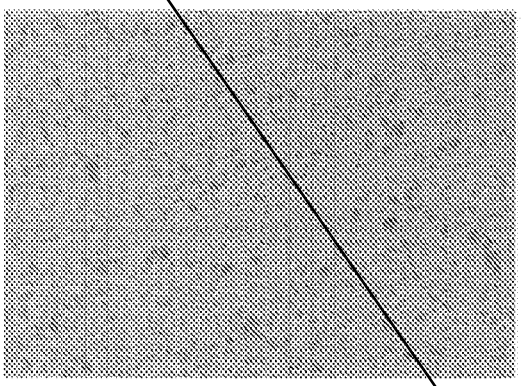


FIG. 20F

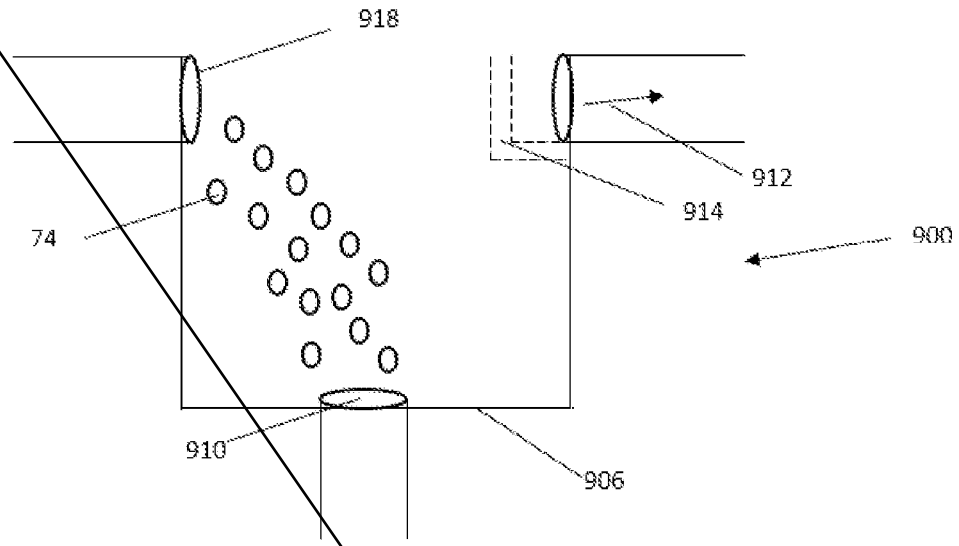


Fig. 21A

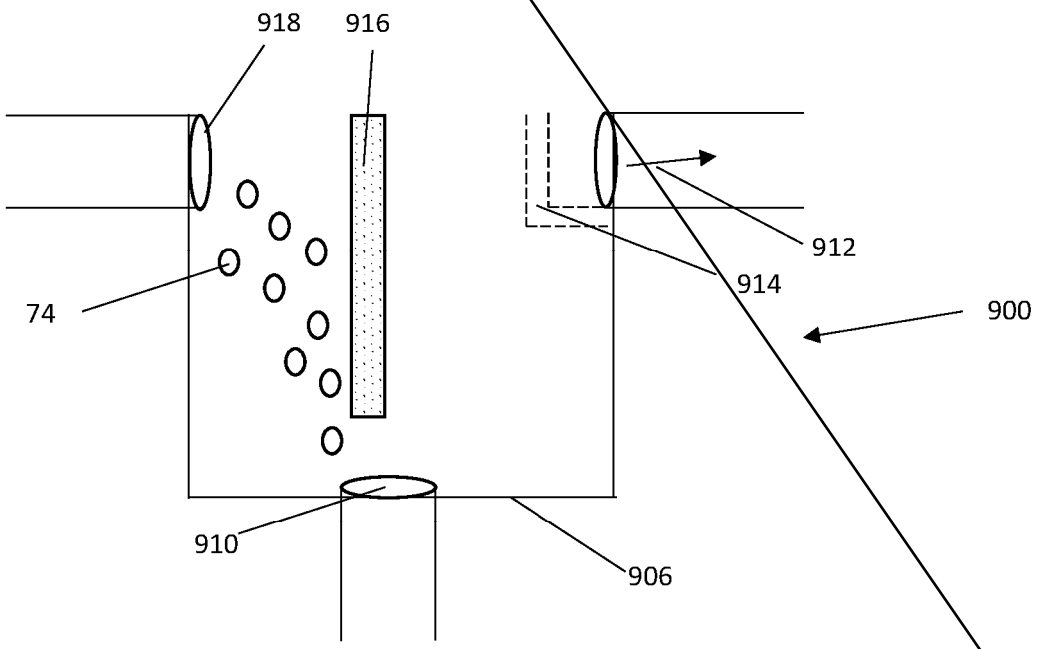


Fig. 21B

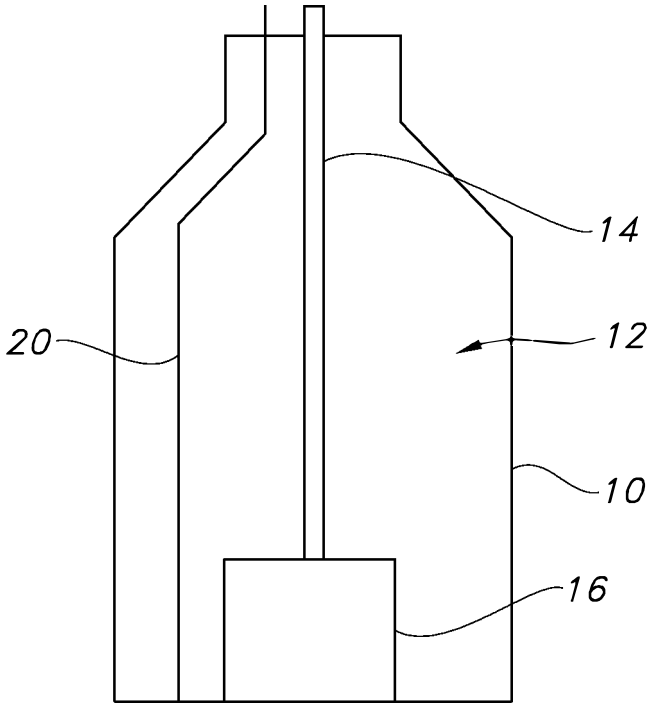


FIG. 1

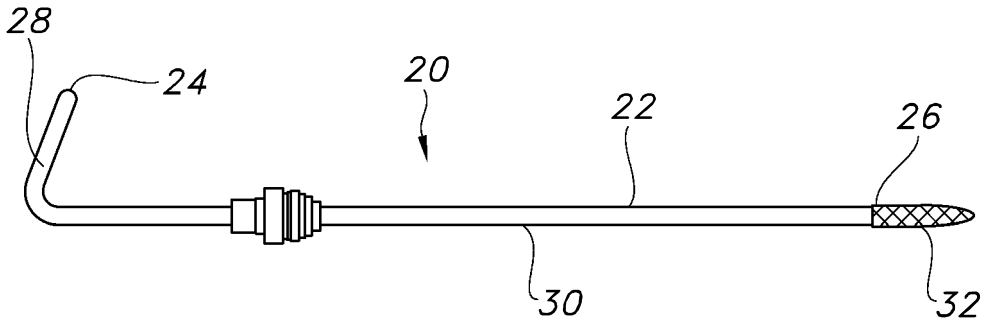


FIG. 2

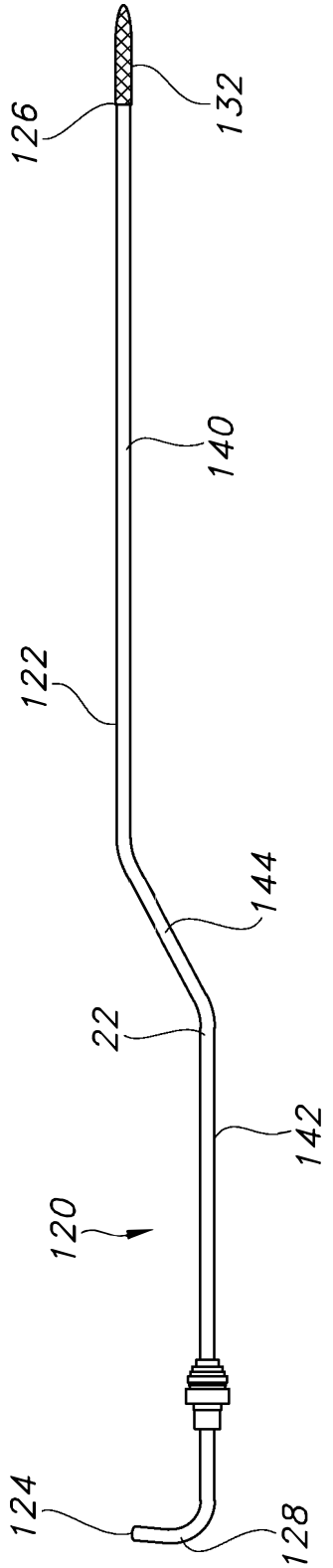


FIG. 3

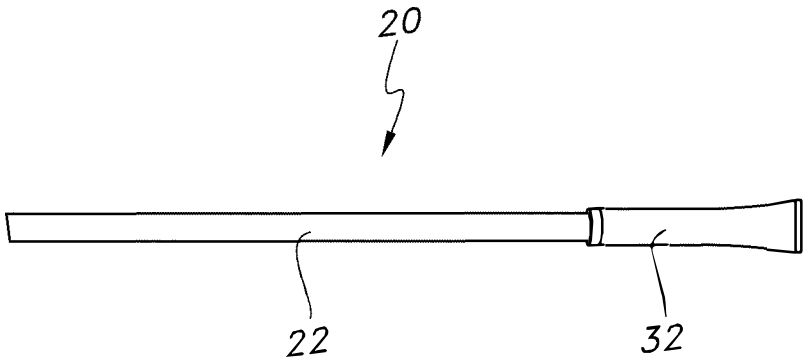


FIG. 4A

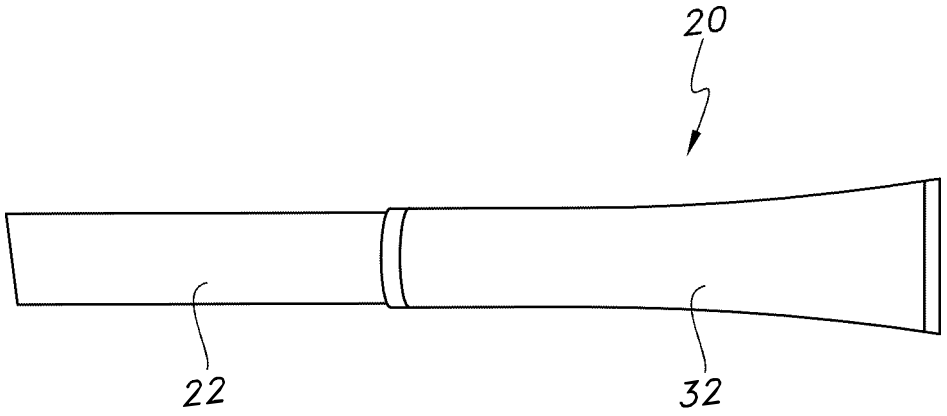


FIG. 4B

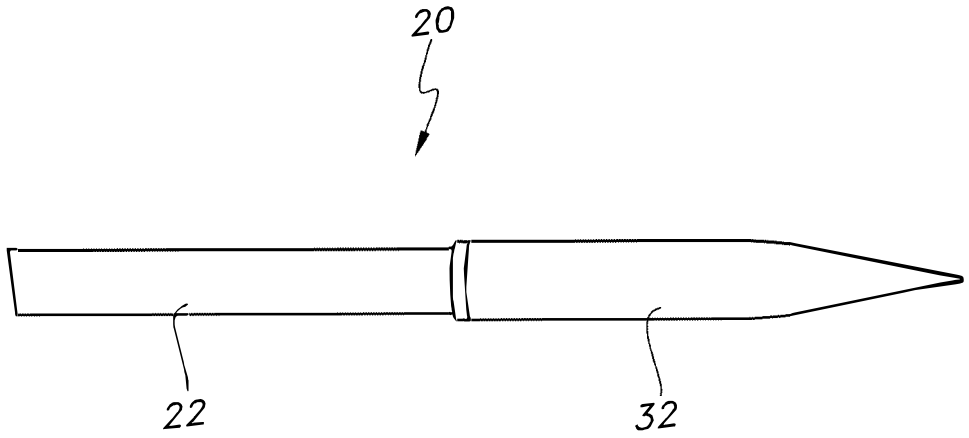


FIG. 4C

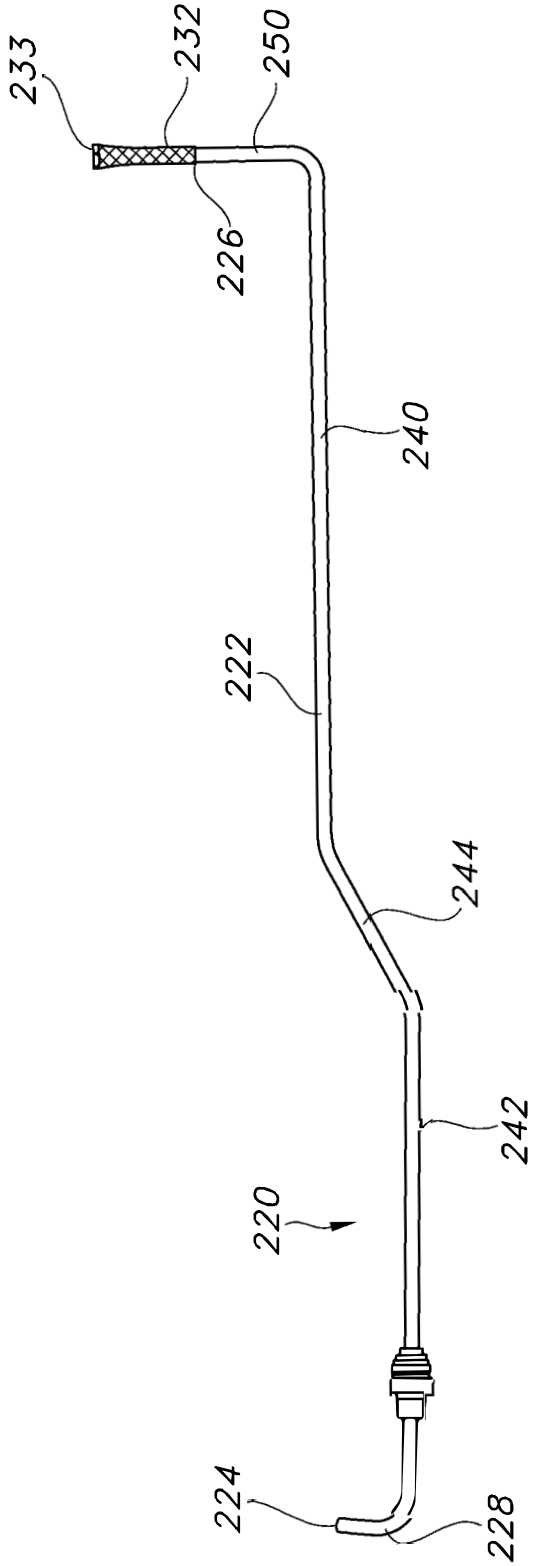


FIG. 5A

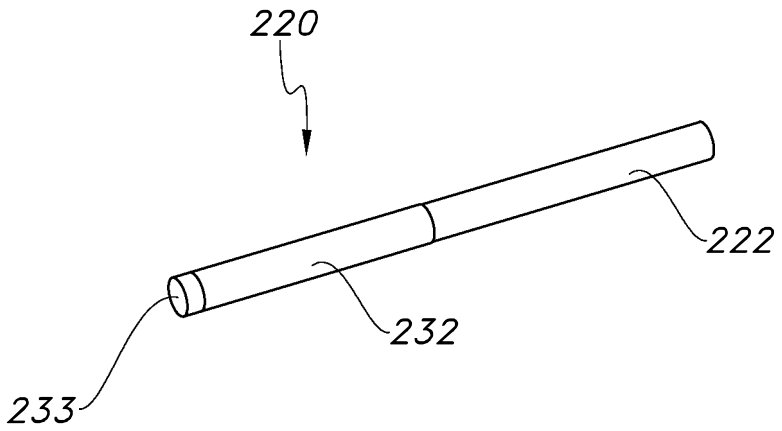


FIG. 5B

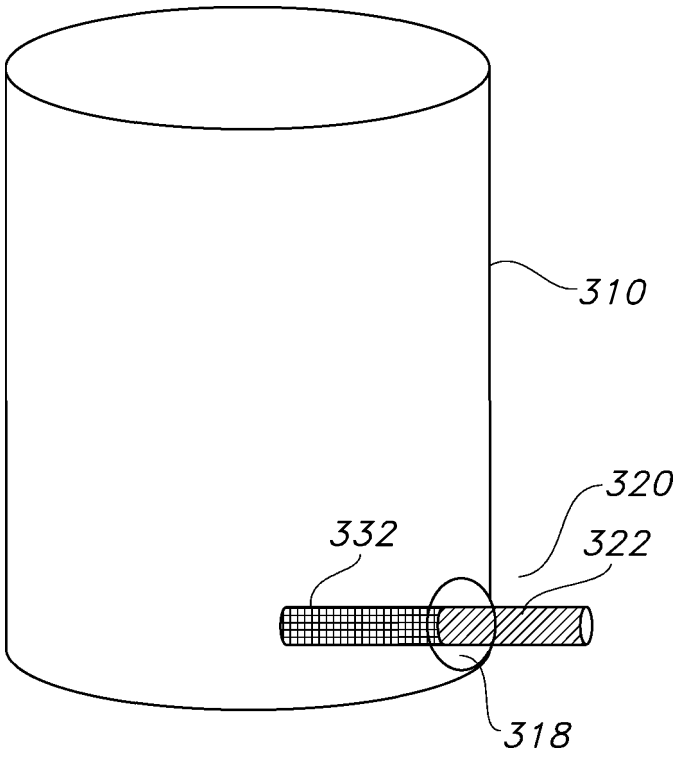


FIG. 6

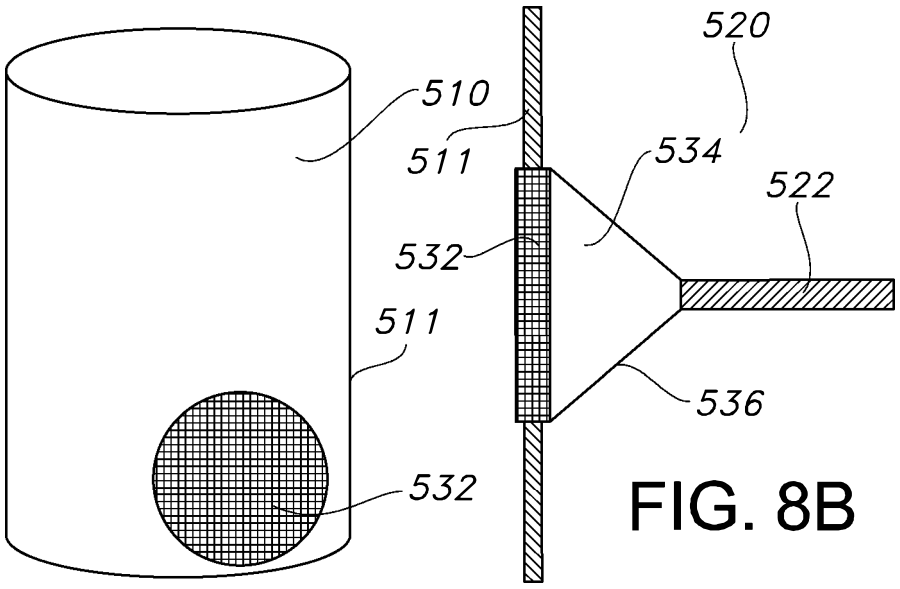


FIG. 8B

FIG. 8A

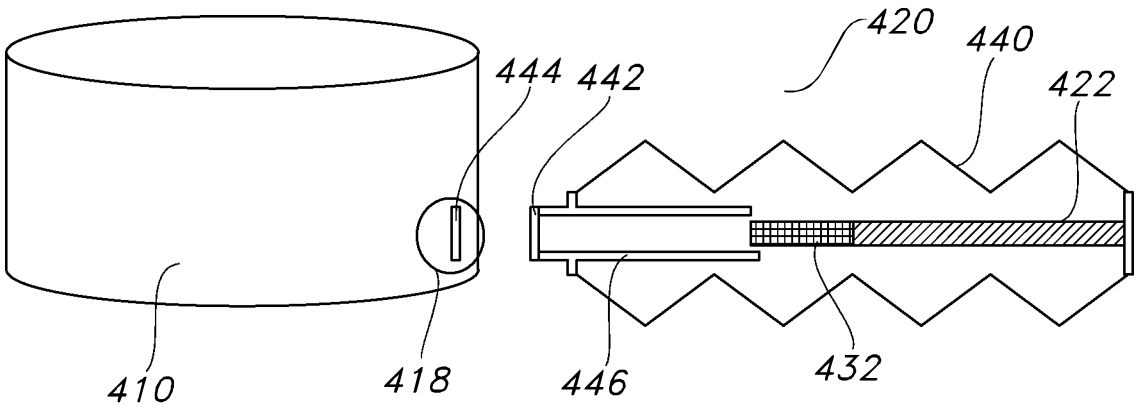


FIG. 7A

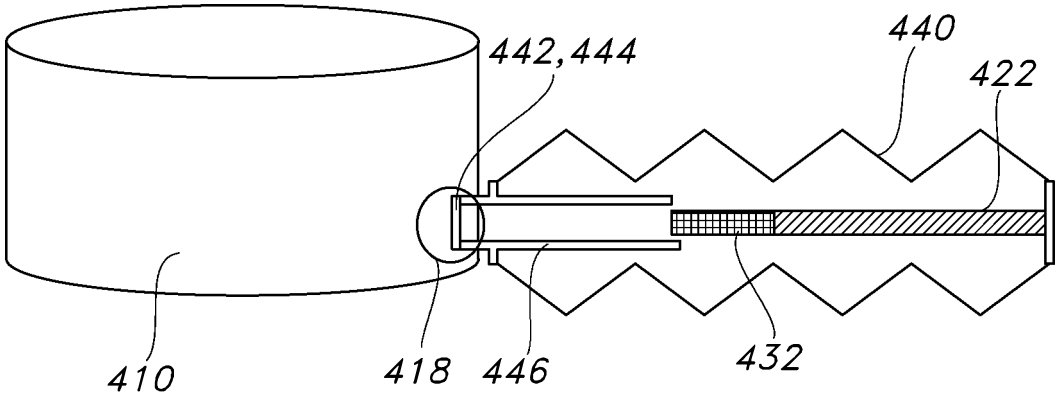


FIG. 7B

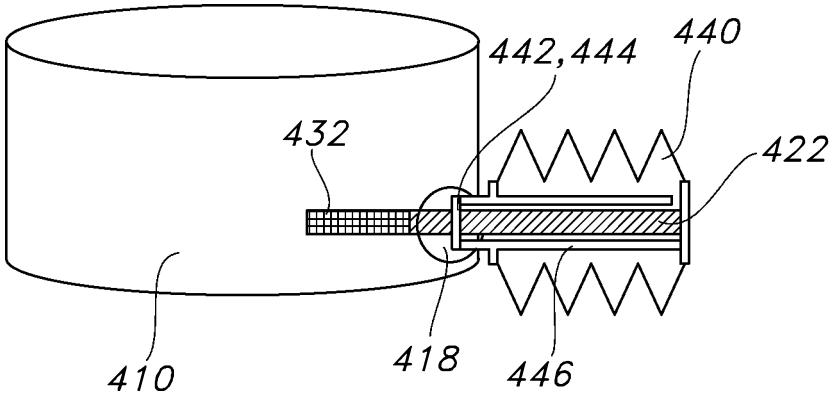


FIG. 7C

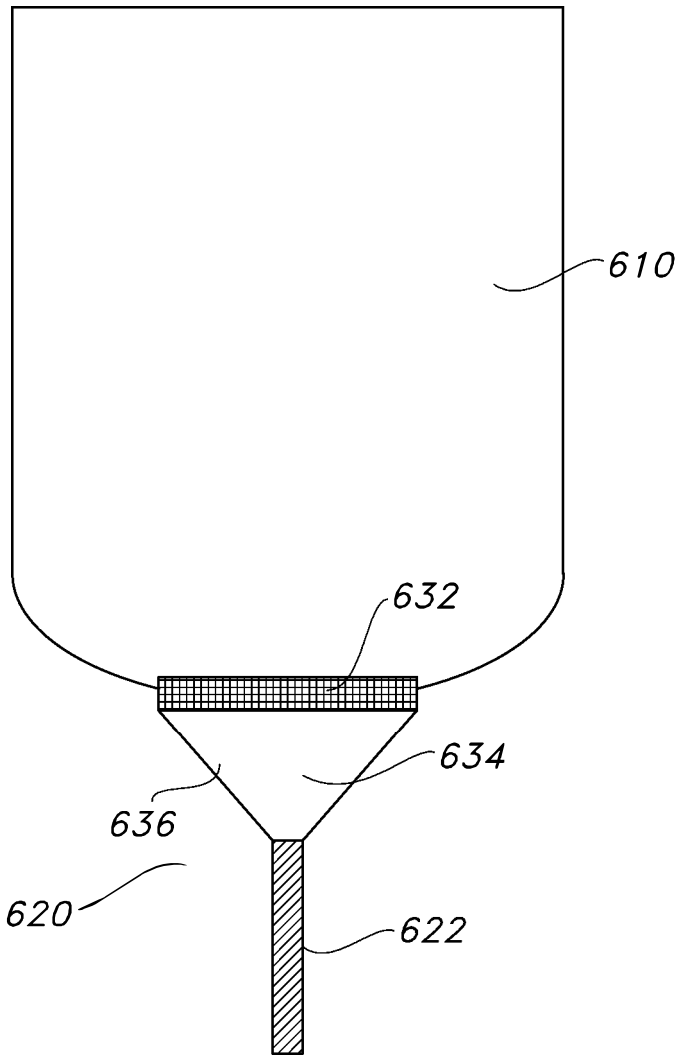


FIG. 9

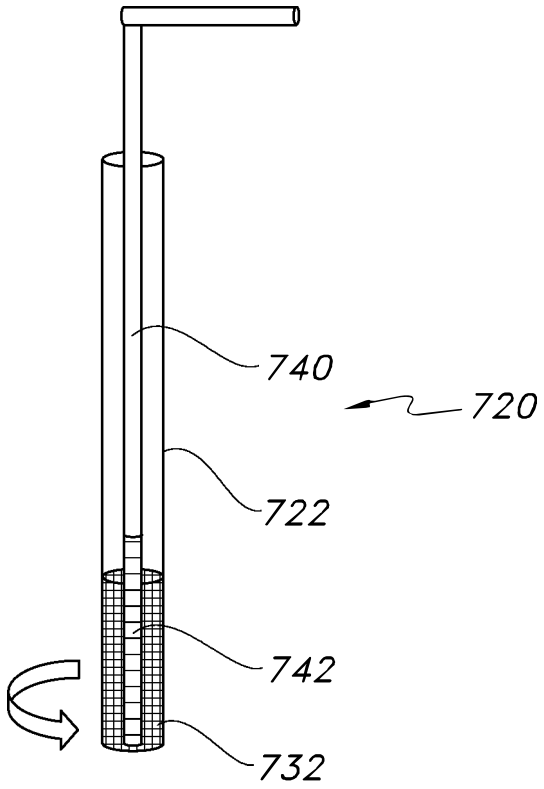


FIG. 10

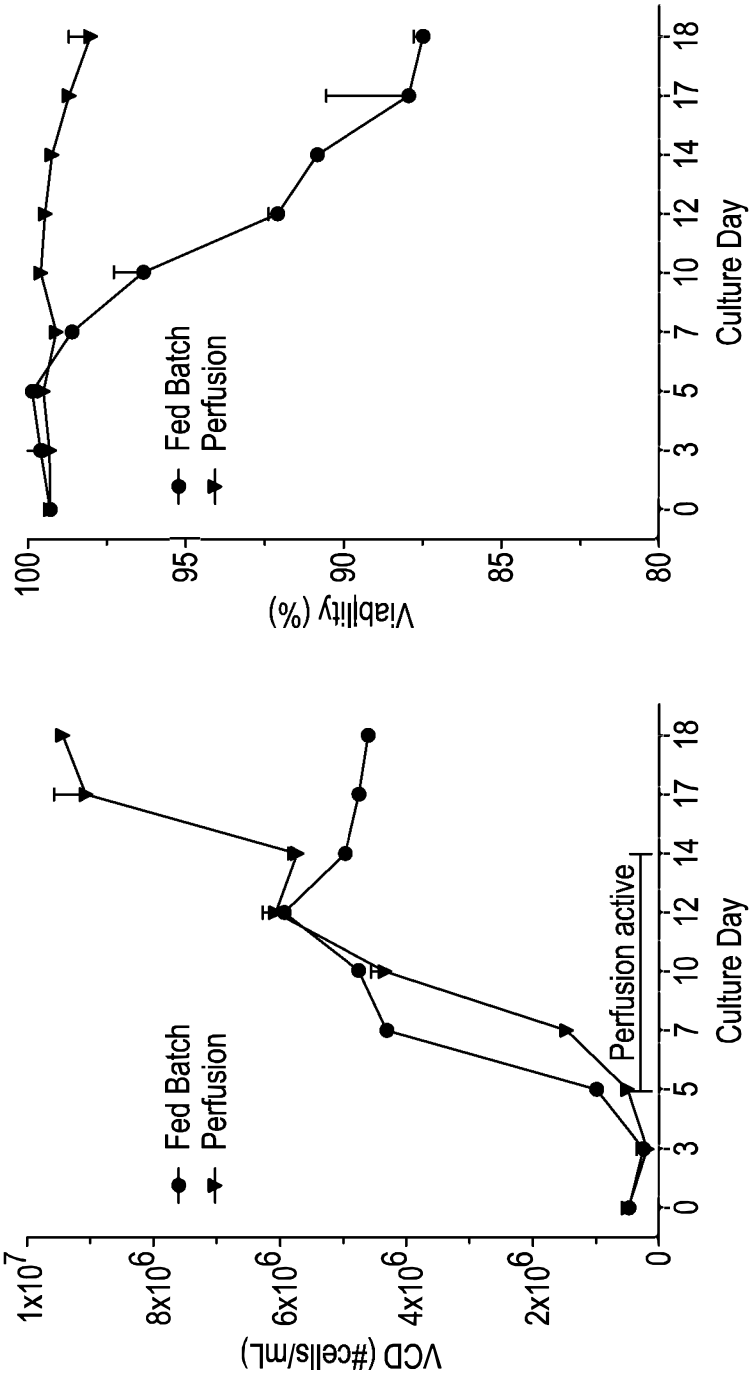

VCD (#cells/mL)
1x10^7
8x10^6
6x10^6
4x10^6
2x10^6
0
Fed Batch
Perfusion
Perfusion active
0 3 5 7 10 12 14 17 18
Culture Day
Viability (%)
100
95
90
85
80
Fed Batch
Perfusion
0 3 5 7 10 12 14 17 18
Culture Day

FIG. 11

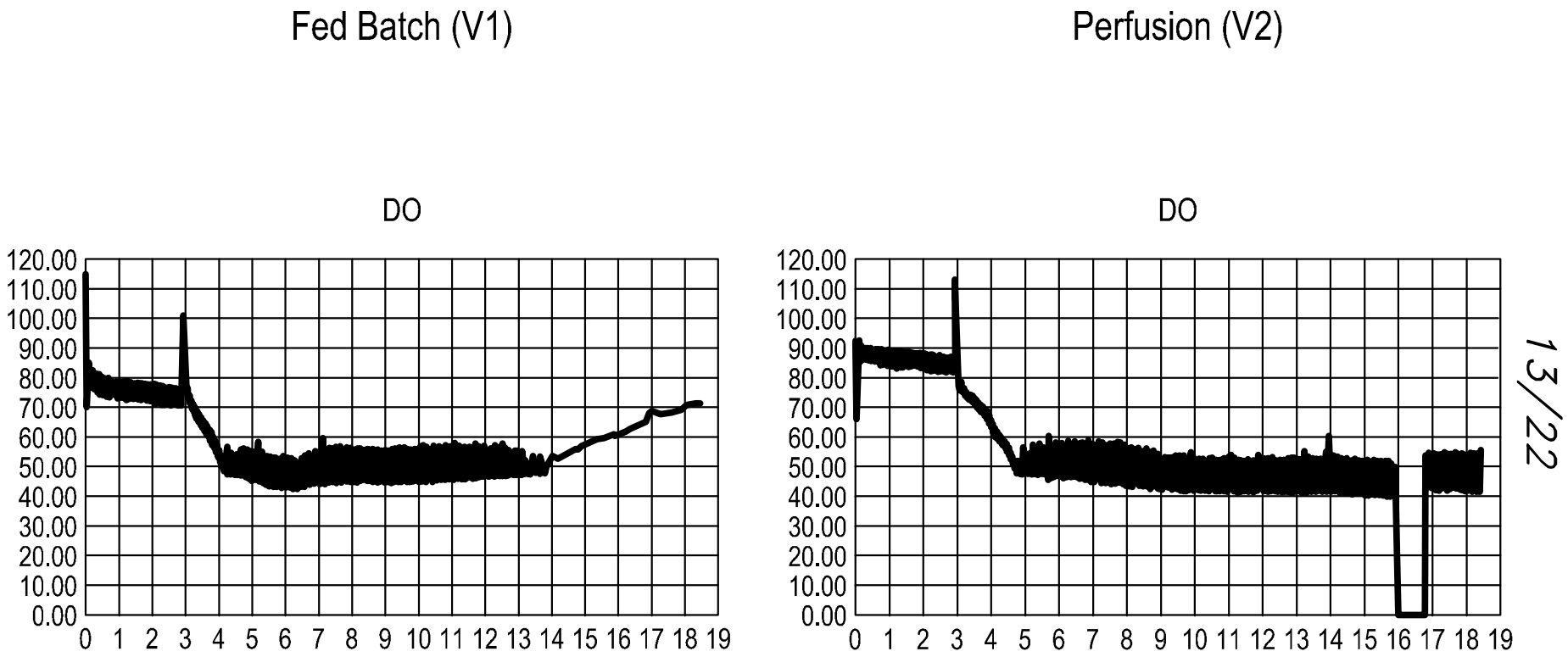

Fed Batch (V1)
DO
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Perfusion (V2)
DO
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

FIG. 12

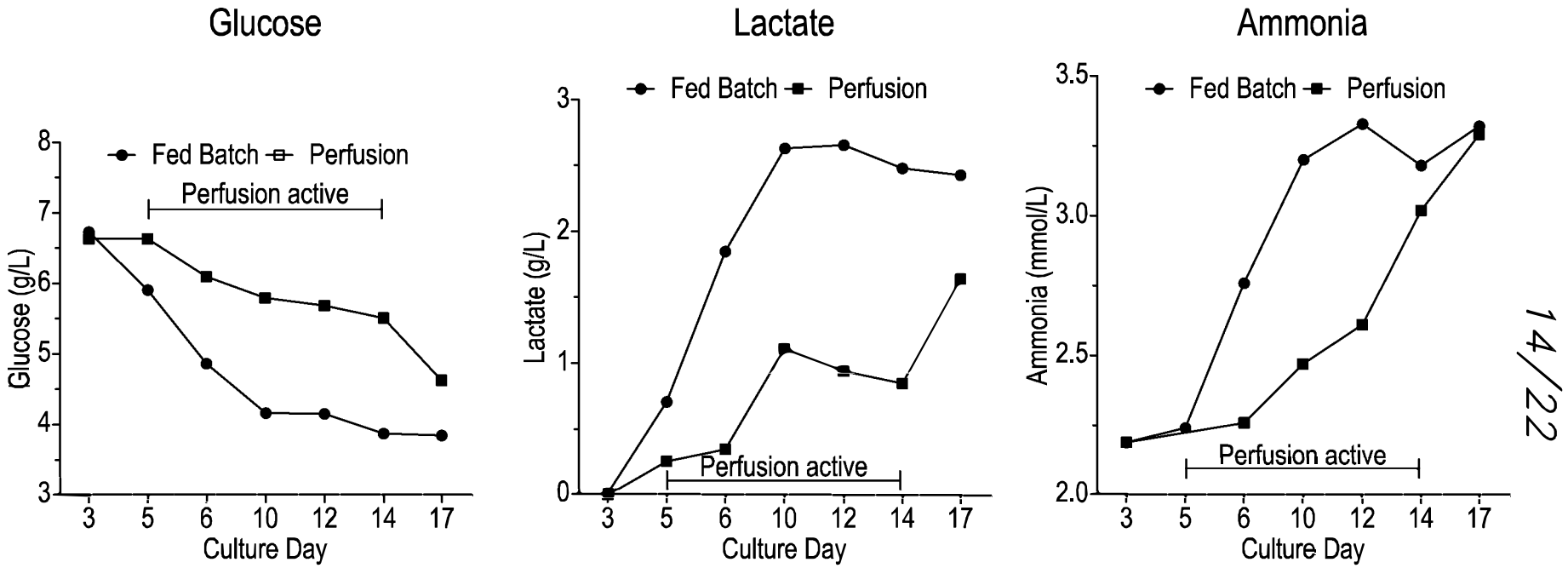

Glucose
Fed Batch
Perfusion
Perfusion active
Glucose (g/L)
8
7
6
5
4
3
3
5
6
10
12
14
17
Culture Day
Lactate
Fed Batch
Perfusion
Perfusion active
Lactate (g/L)
3
2
1
0
3
5
6
10
12
14
17
Culture Day
Ammonia
Fed Batch
Perfusion
Perfusion active
Ammonia (mmol/L)
3.5
3.0
2.5
2.0
3
5
6
10
12
14
17
Culture Day

FIG. 13

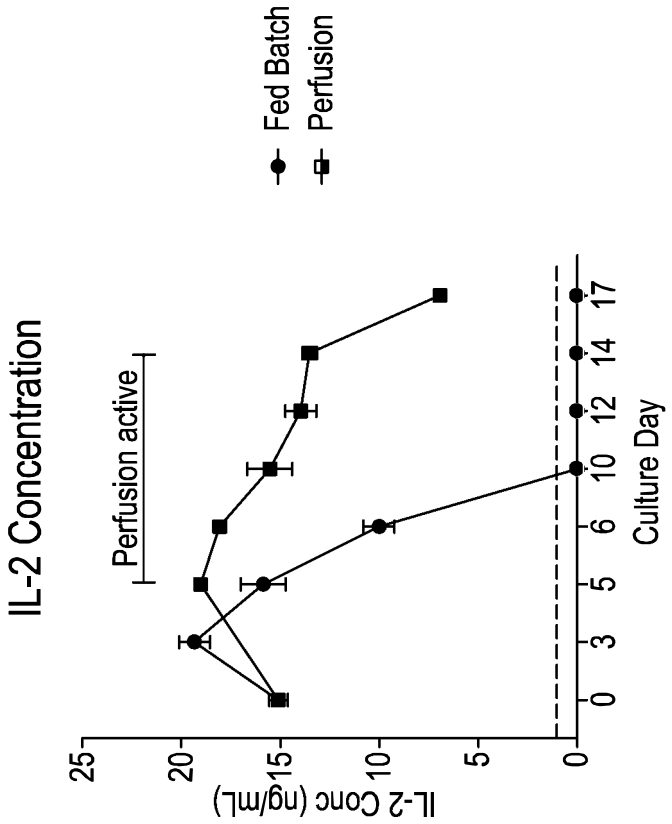

IL-2 Concentration
Perfusion active
Fed Batch
Perfusion
IL-2 Conc (ng/mL)
25
20
15
10
5
0
0
3
5
6
10
12
14
17
Culture Day

FIG. 14

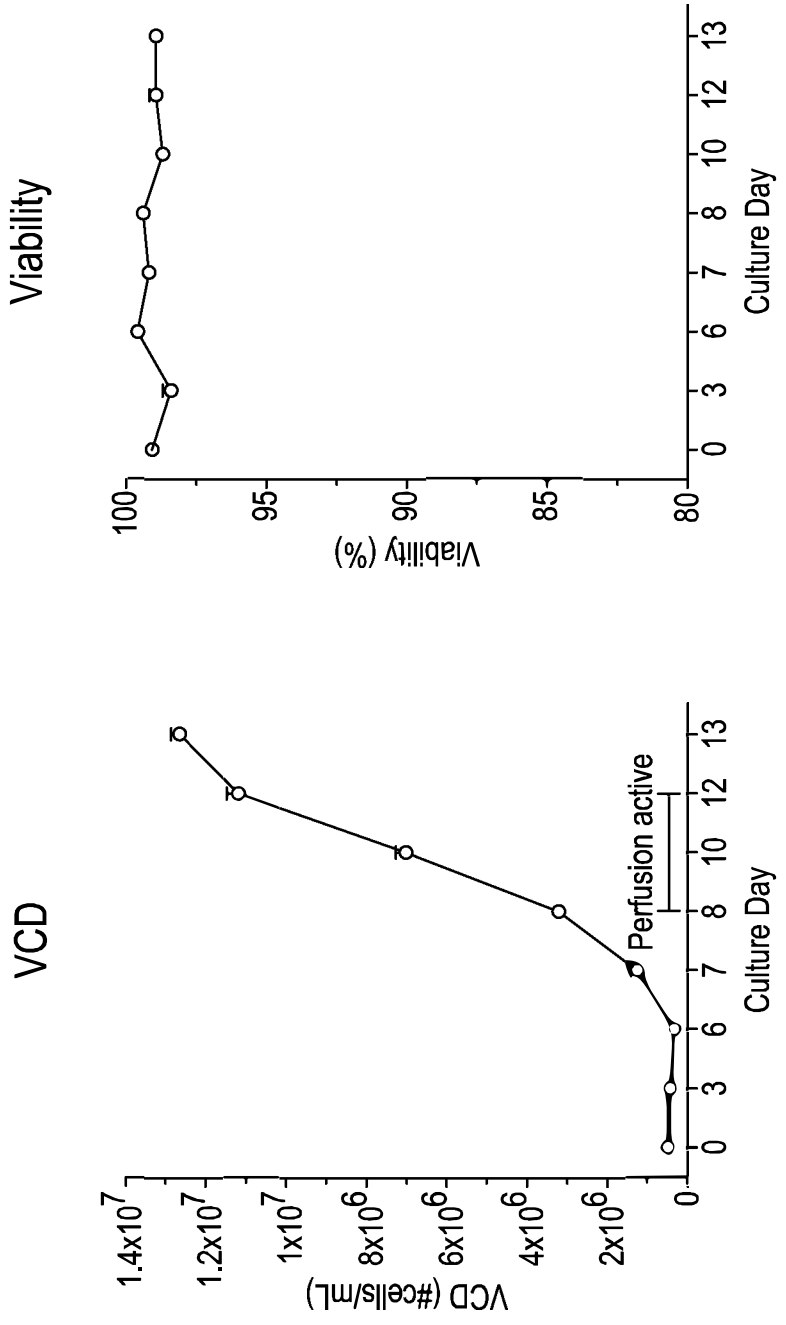

Viability
Viability (%)
100
95
90
85
80
0
3
6
7
8
10
12
13
Culture Day
VCD
VCD (#cells/mL)
1.4x10^7
1.2x10^7
1x10^7
8x10^6
6x10^6
4x10^6
2x10^6
0
Perfusion active
Culture Day

FIG. 15

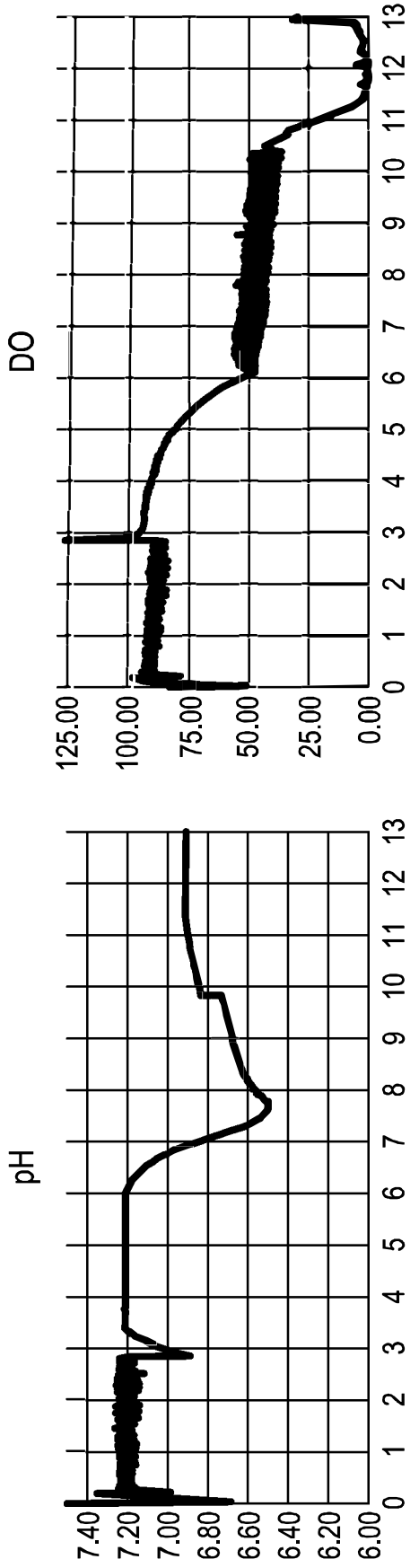

DO
125.00
100.00
75.00
50.00
25.00
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13
pH
7.40
7.20
7.00
6.80
6.60
6.40
6.20
6.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13

FIG. 16

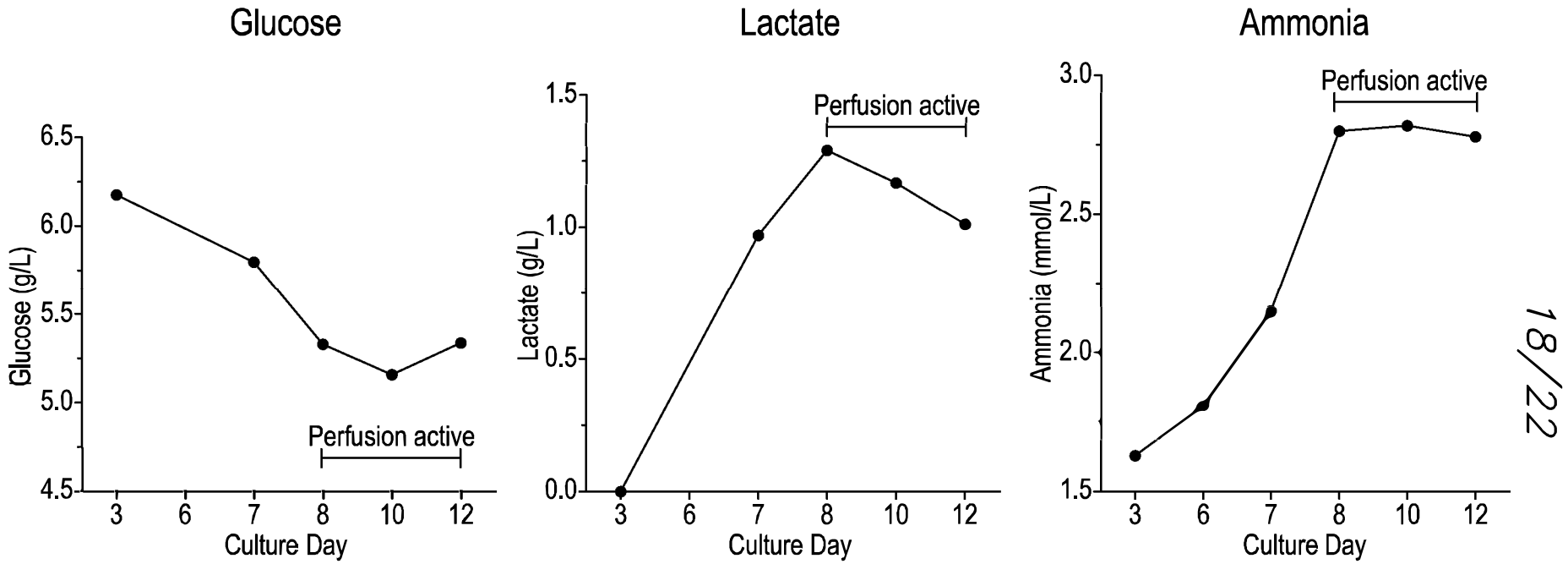

Glucose
Glucose (g/L)
6.5
6.0
5.5
5.0
4.5
Perfusion active
3
6
7
8
10
12
Culture Day
Lactate
Lactate (g/L)
1.5
1.0
0.5
0.0
Perfusion active
3
6
7
8
10
12
Culture Day
Ammonia
Ammonia (mmol/L)
3.0
2.5
2.0
1.5
Perfusion active
3
6
7
8
10
12
Culture Day

FIG. 17

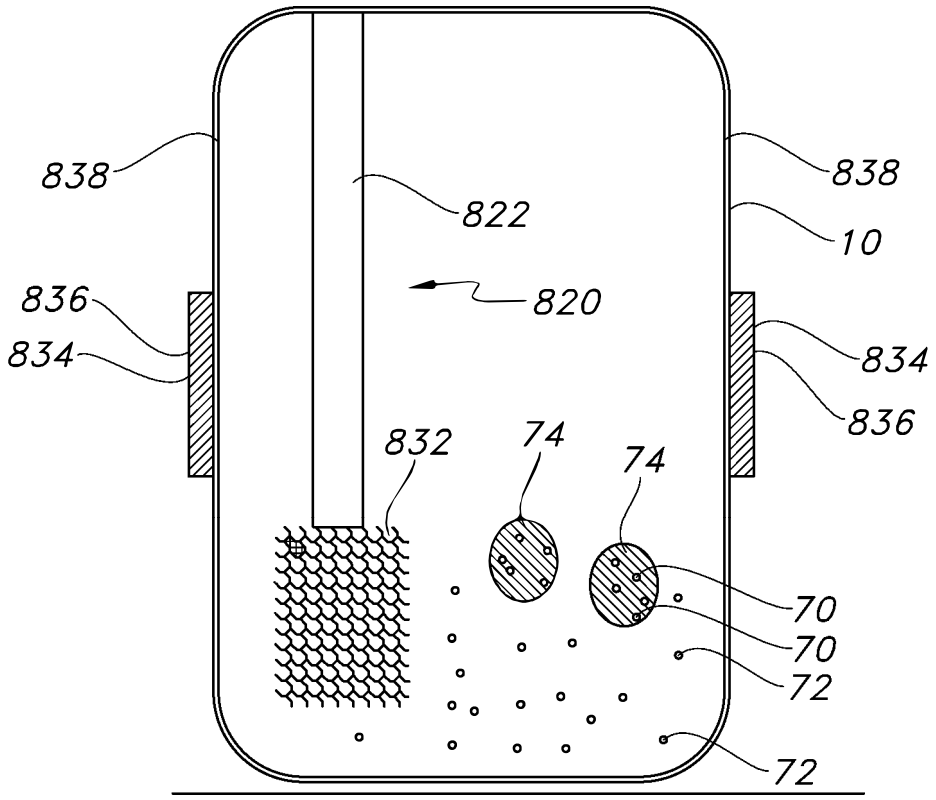


FIG. 18

Before purification:
≈20% CD4+ T-cells

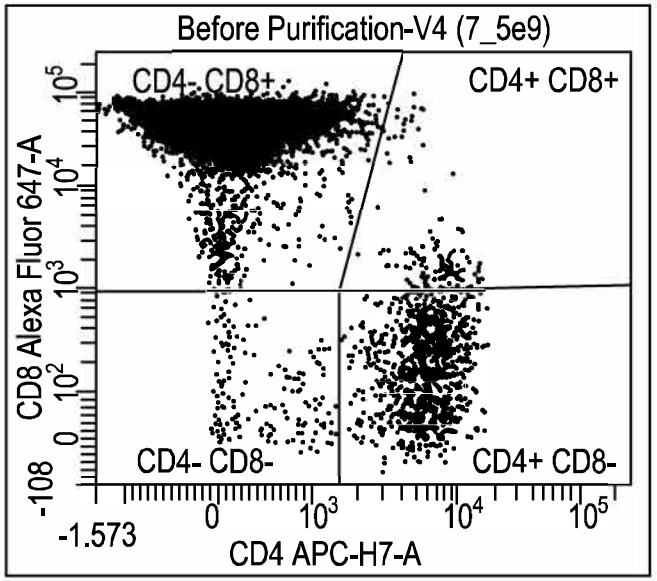


FIG. 19A

After purification:
< 0.1% CD4+ T-cells

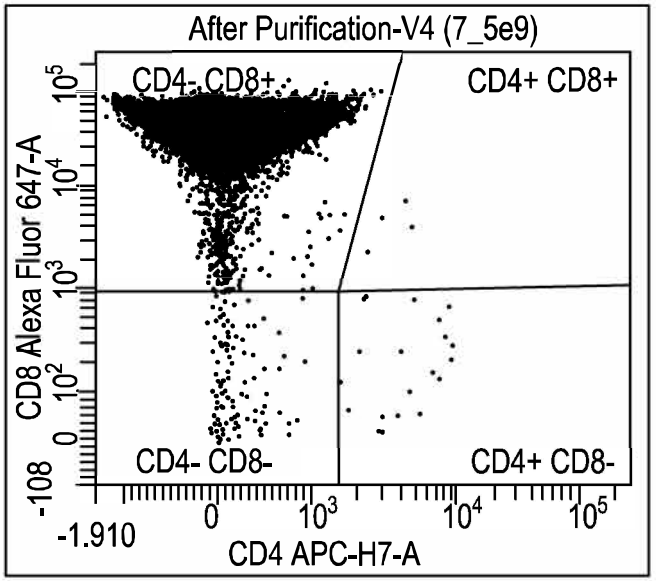


FIG. 19B

Less than 1% contaminating cell type (CD4+) after in bioreactor purification

Before magnetic beads

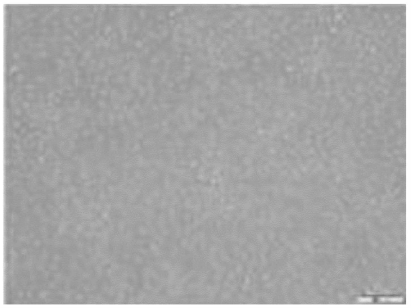


FIG. 19C

After magnetic beads added

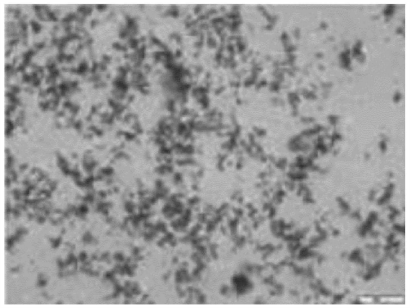


FIG. 19D

After Purification

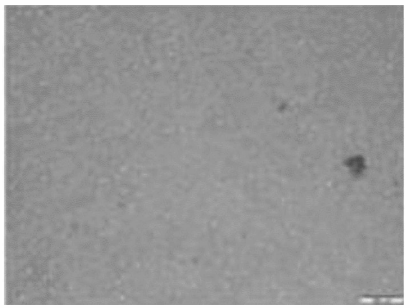


FIG. 19E

Beads remaining: <0.5 %

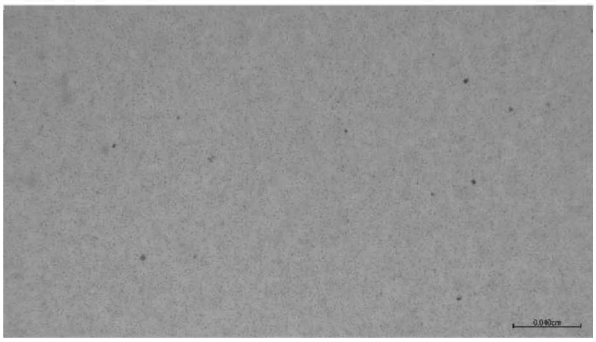


FIG. 20A

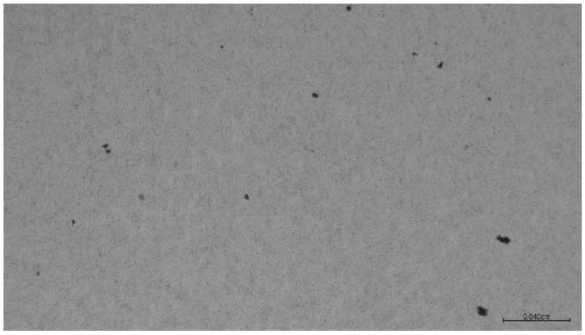


FIG. 20B

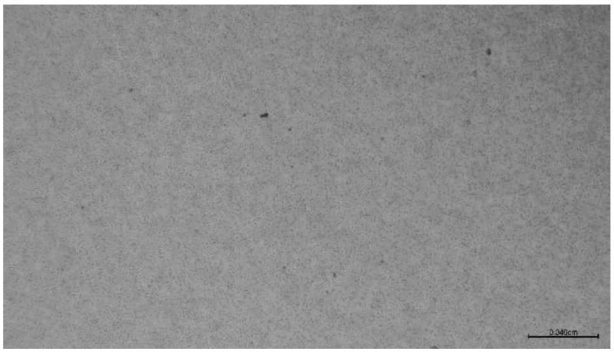


FIG. 20C

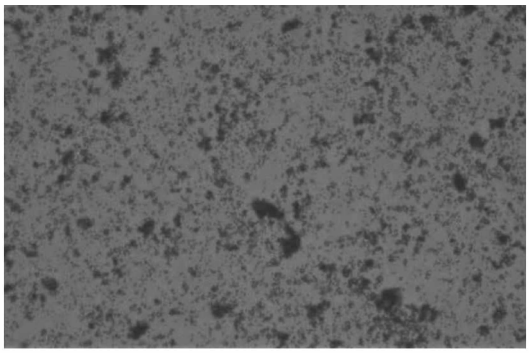


FIG. 20D

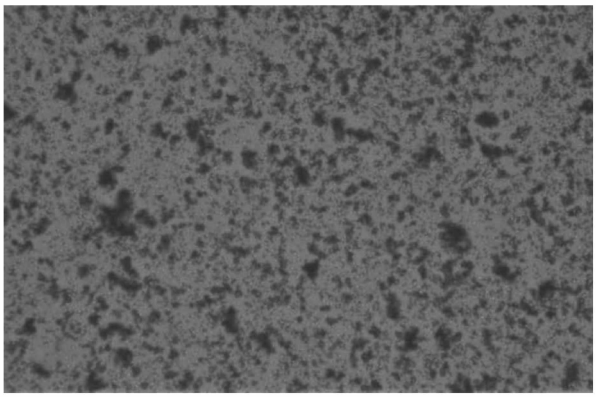


FIG. 20E

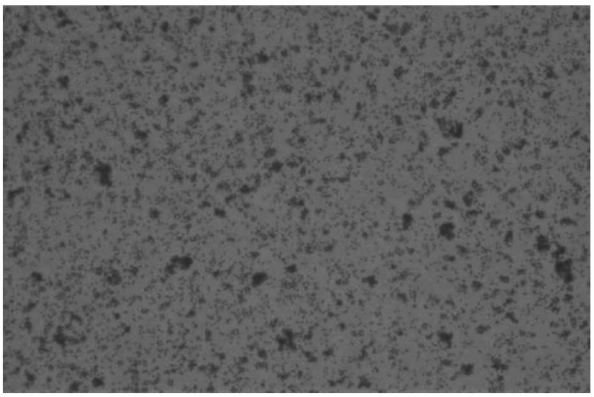


FIG. 20F

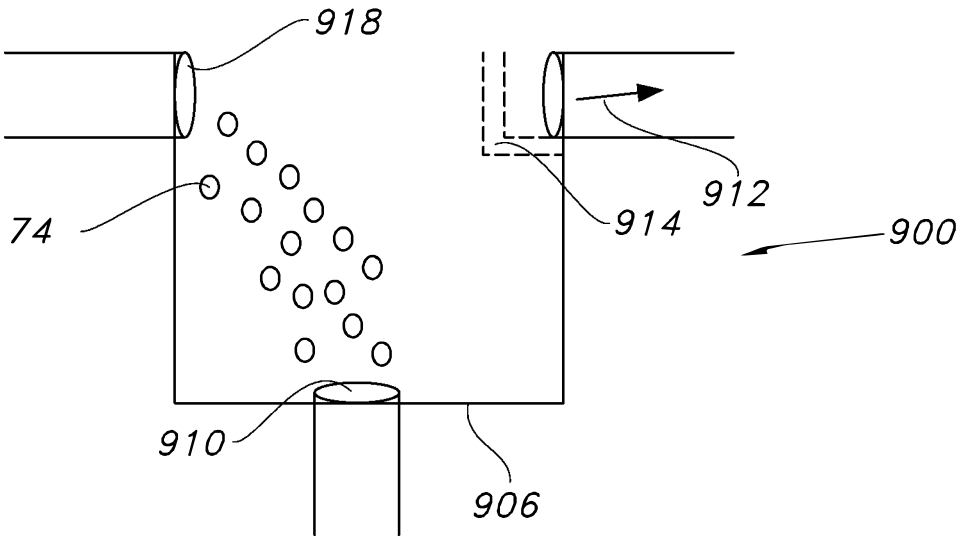


FIG. 21A

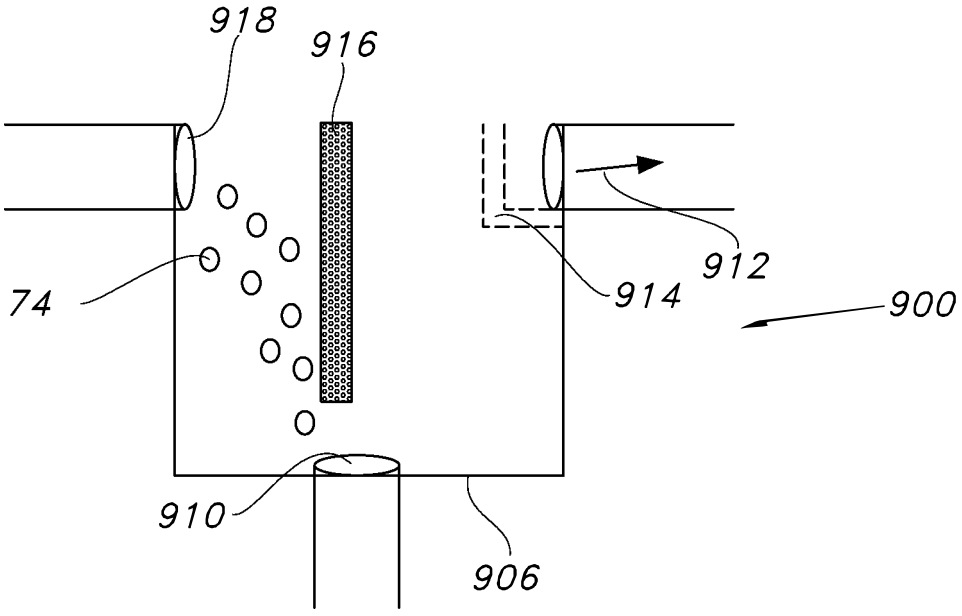


FIG. 21B