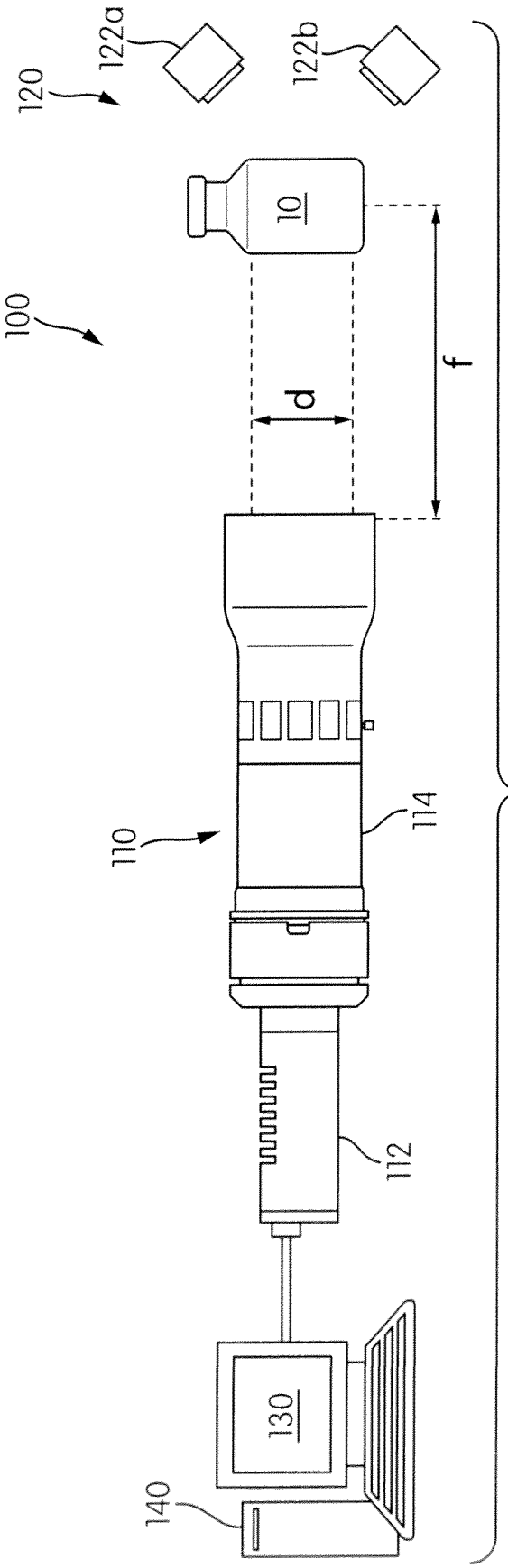


FIG. 1A

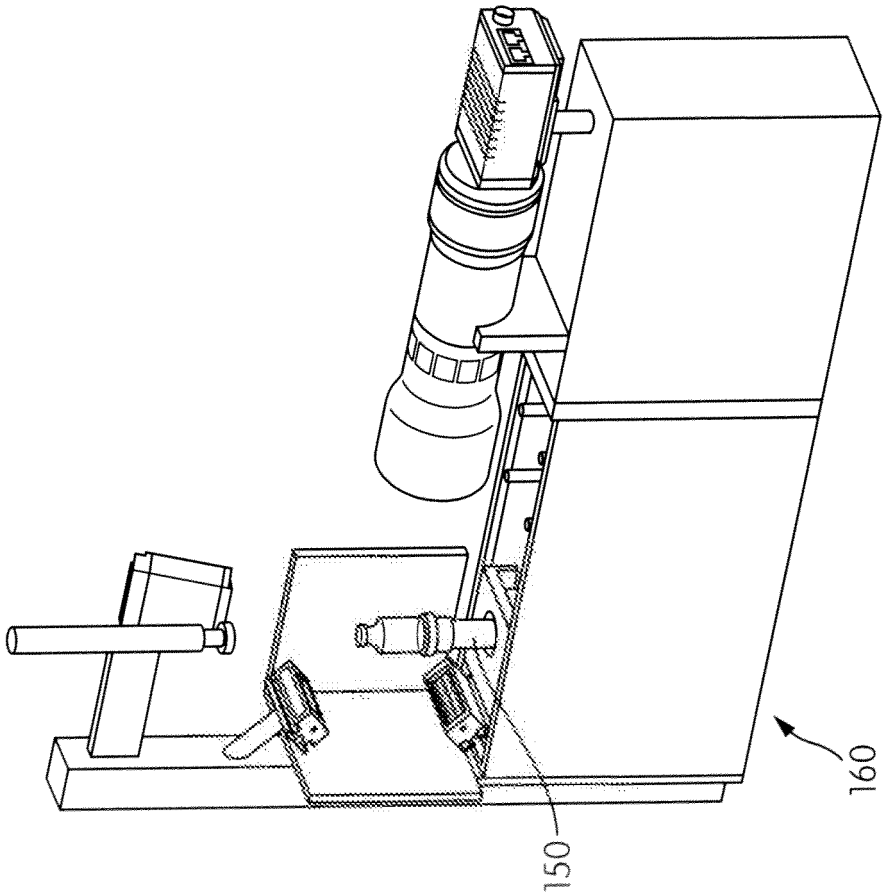


FIG. 1B

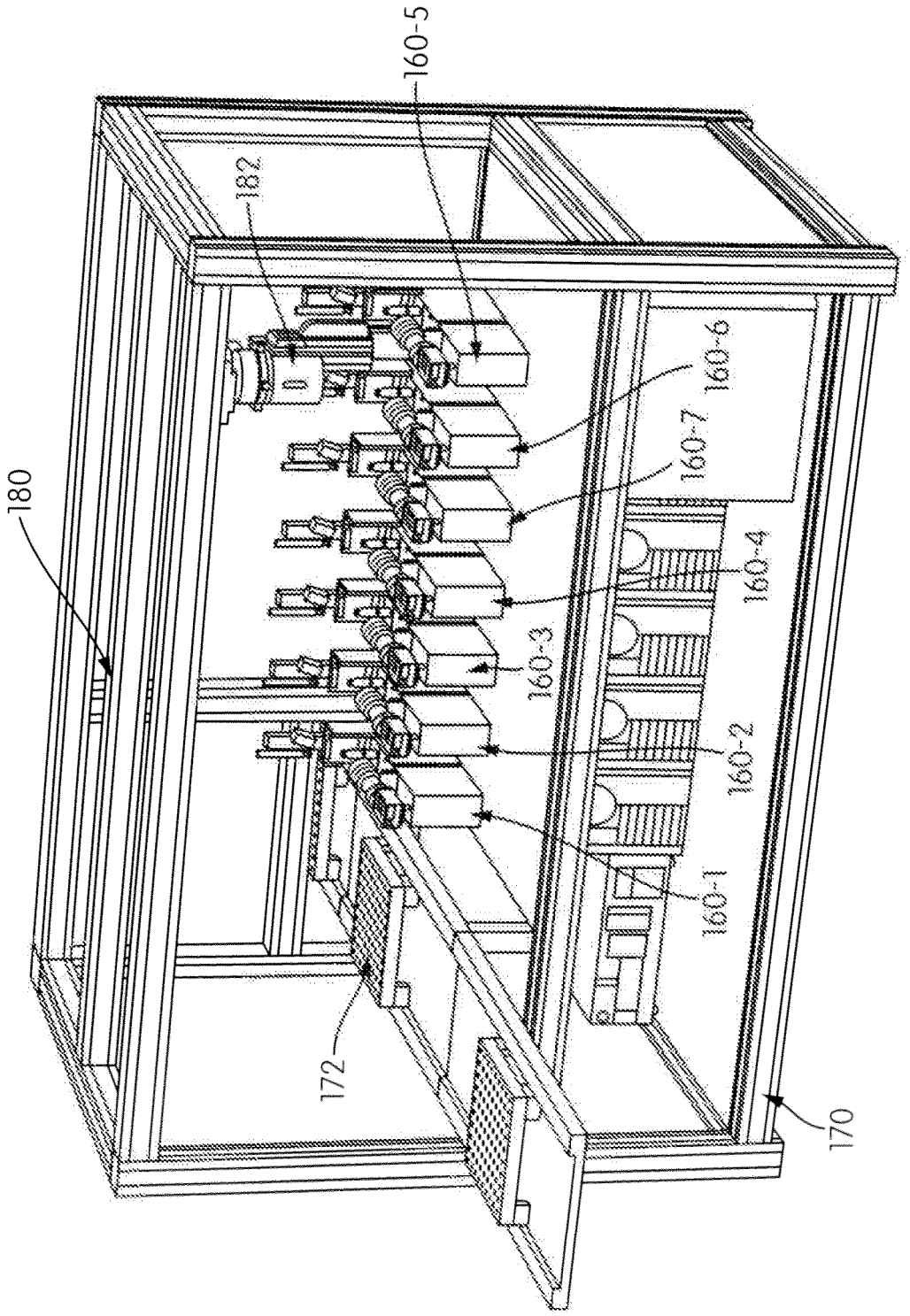


FIG. 1C

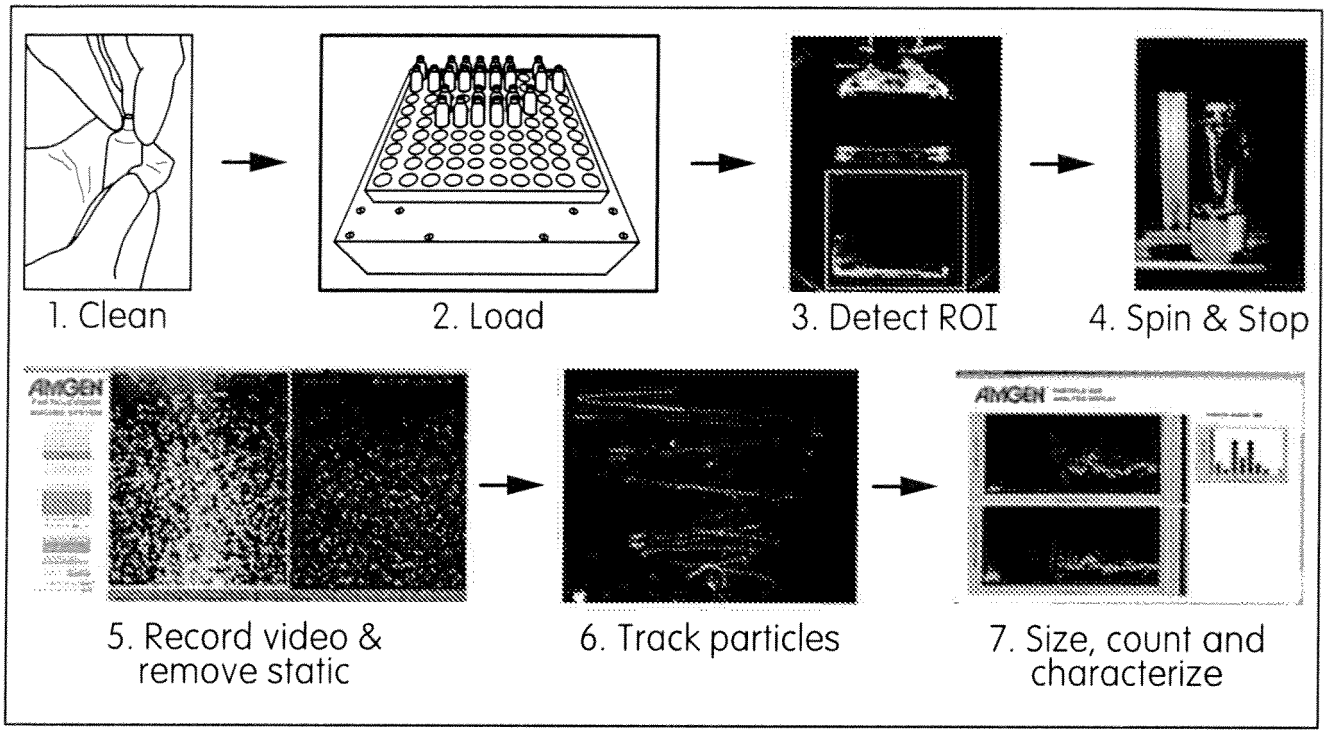

1. Clean
2. Load
3. Detect ROI
4. Spin & Stop
5. Record video & remove static
6. Track particles
7. Size, count and characterize

FIG. 2A

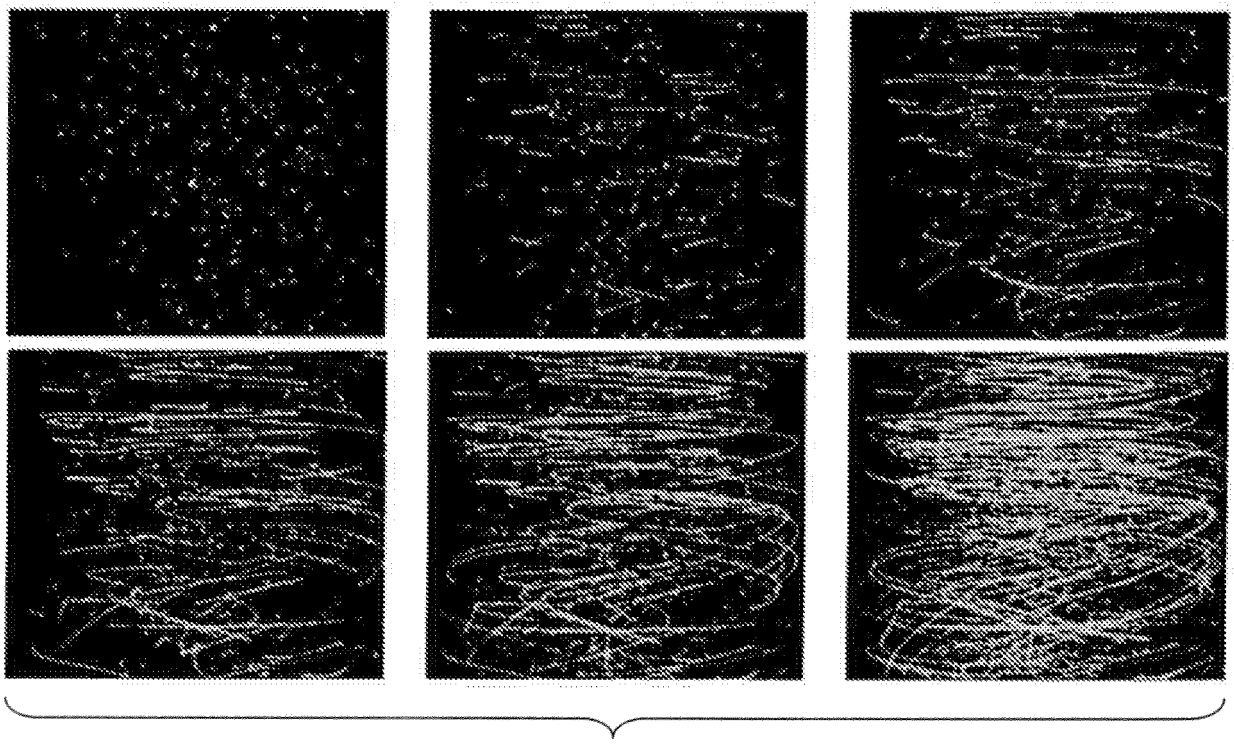


FIG. 2B

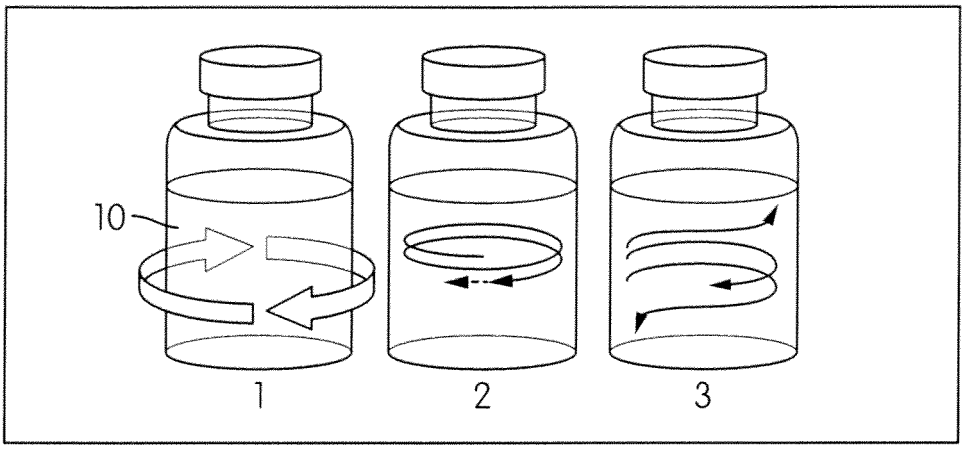


FIG. 3A

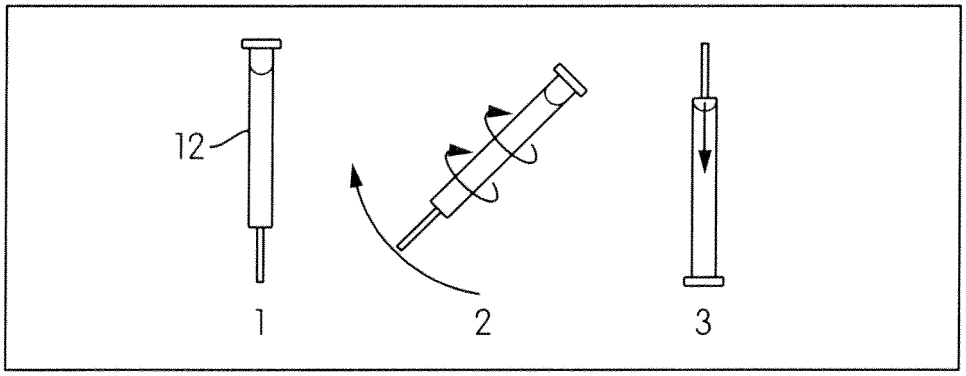


FIG. 3B

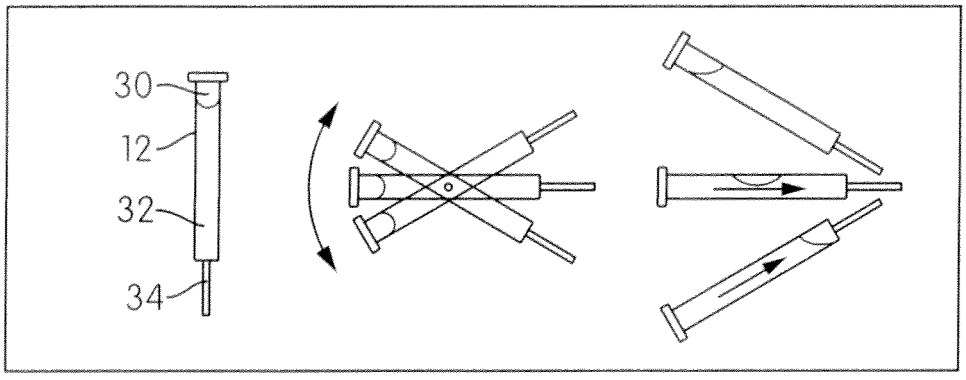


FIG. 3C

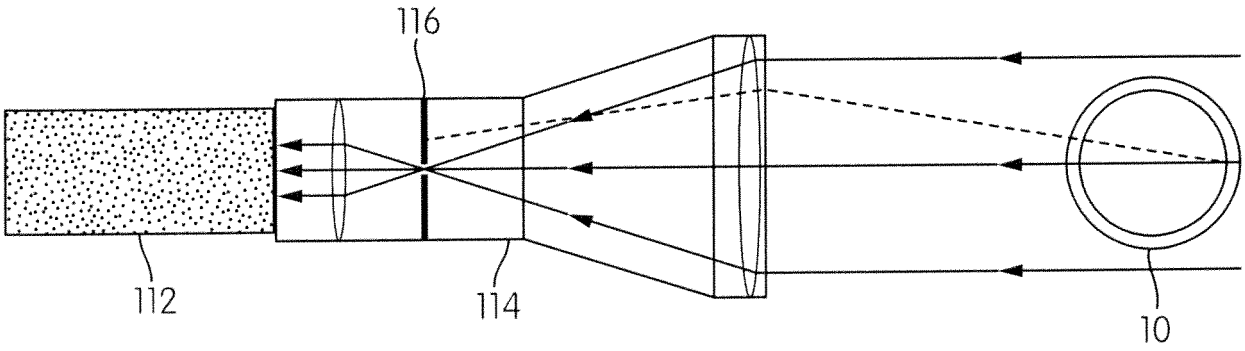


FIG. 4

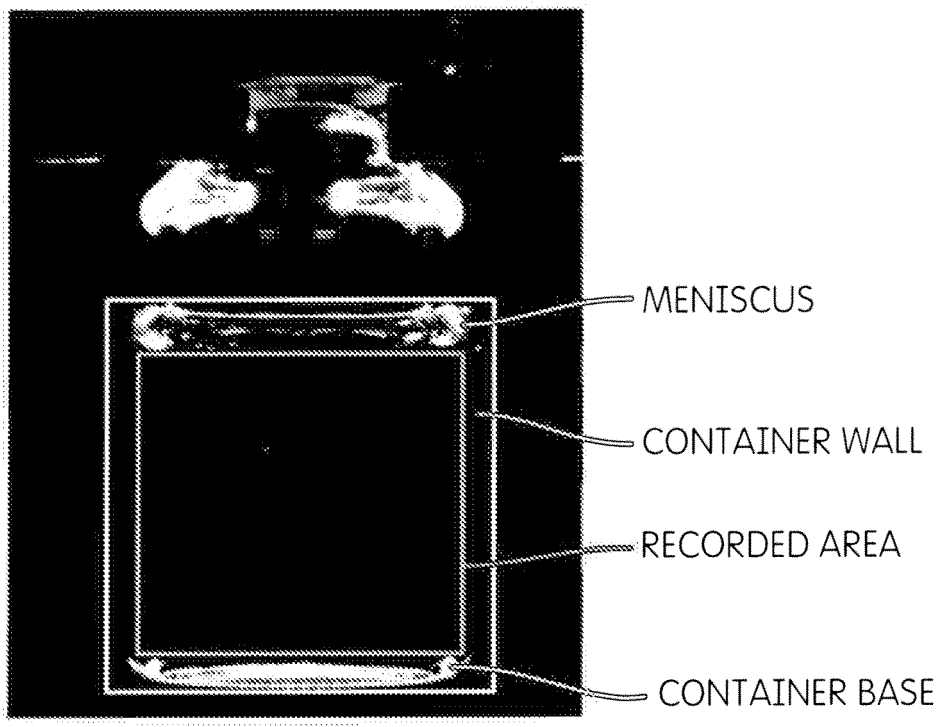

MENISCUS
CONTAINER WALL
RECORDED AREA
CONTAINER BASE

FIG. 5A

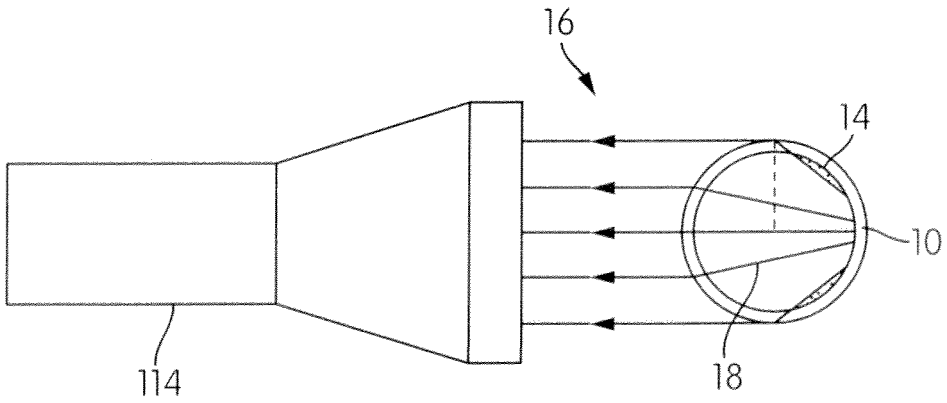

16
14
10
114
18

FIG. 5B

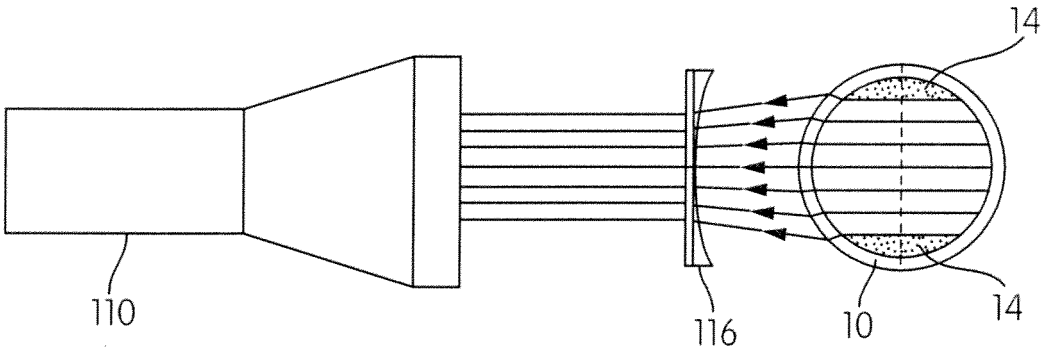


FIG. 5C

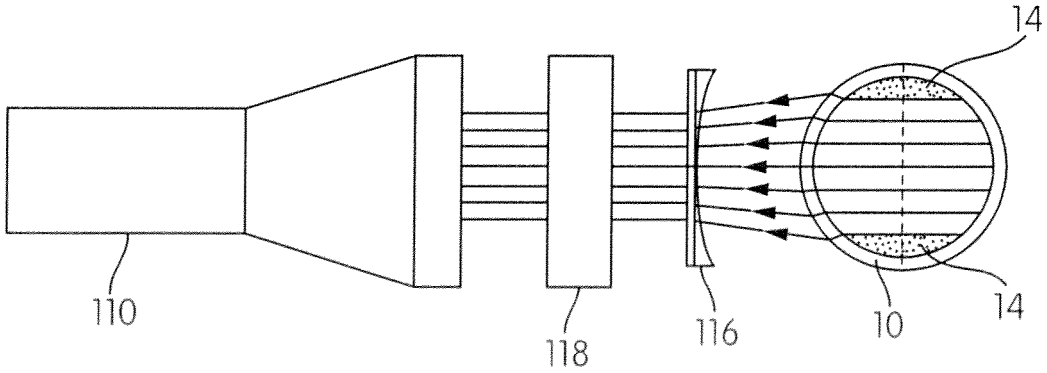


FIG. 5D

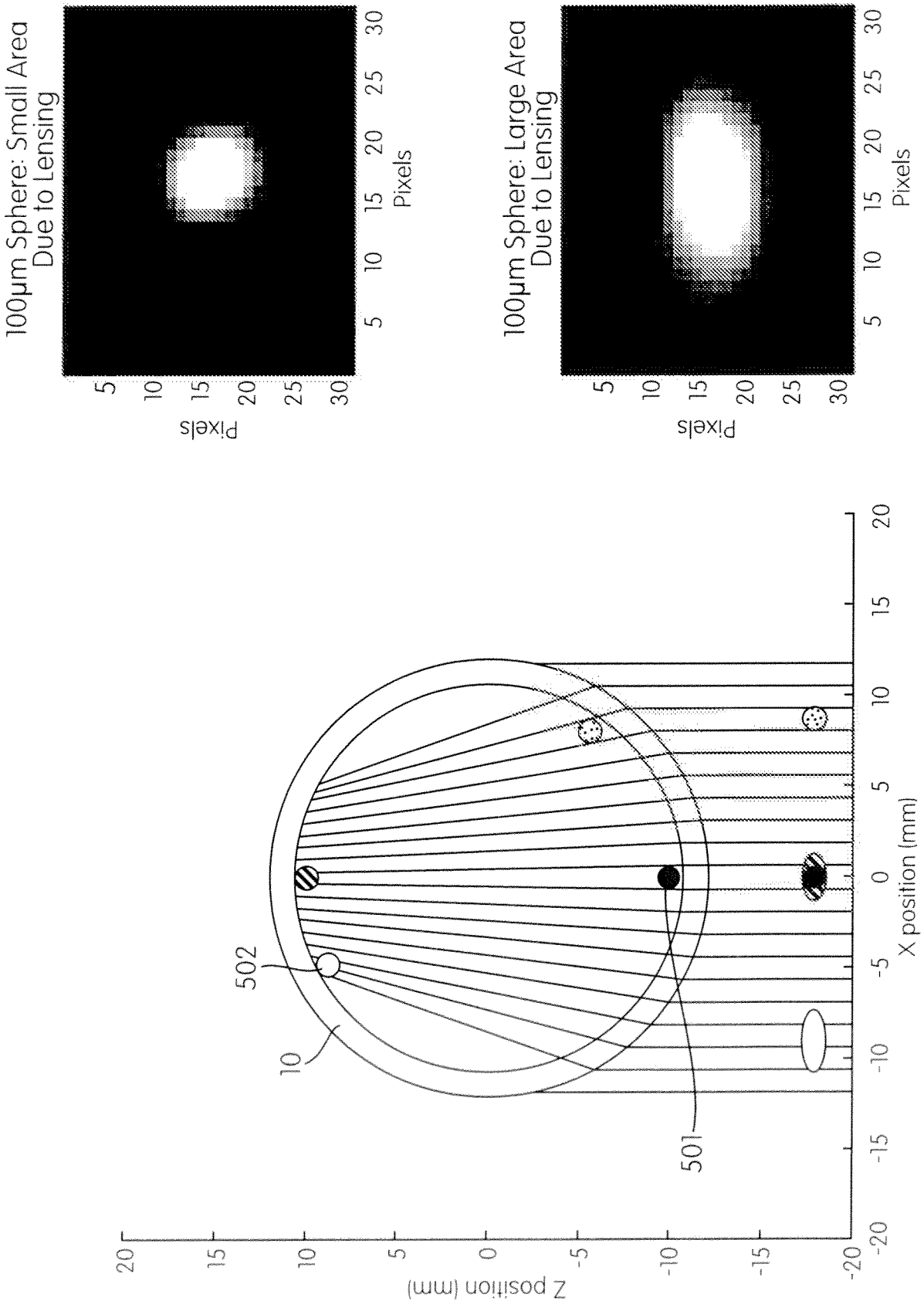

100µm Sphere: Small Area
Due to Lensing
Pixels
100µm Sphere: Large Area
Due to Lensing
Pixels
Z position (mm)
X position (mm)
502
10
501

FIG. 5E

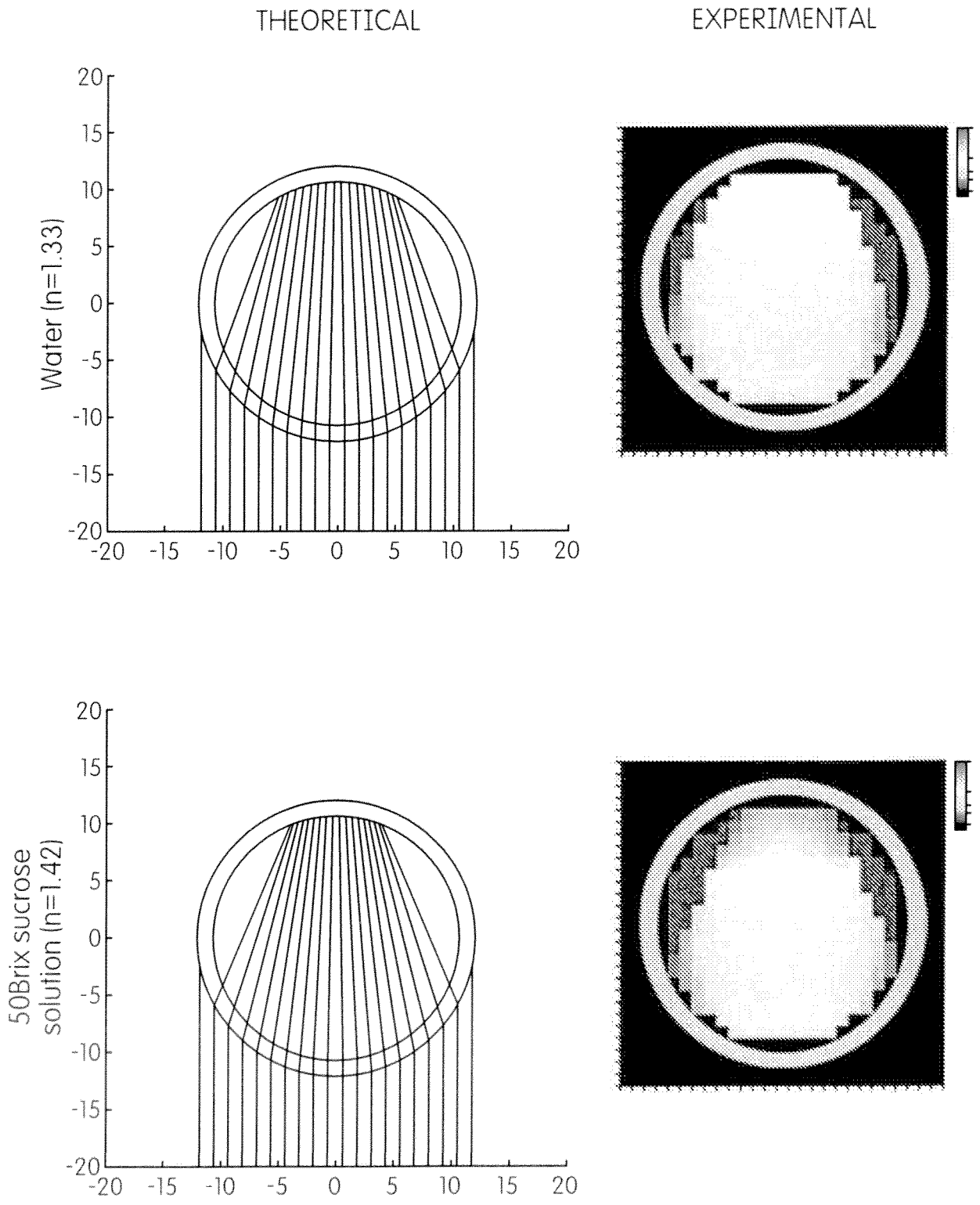

THEORETICAL
EXPERIMENTAL
Water (n=1.33)
50Brix sucrose solution (n=1.42)
20
15
10
5
0
-5
-10
-15
-20
-20 -15 -10 -5 0 5 10 15 20

FIG. 5F

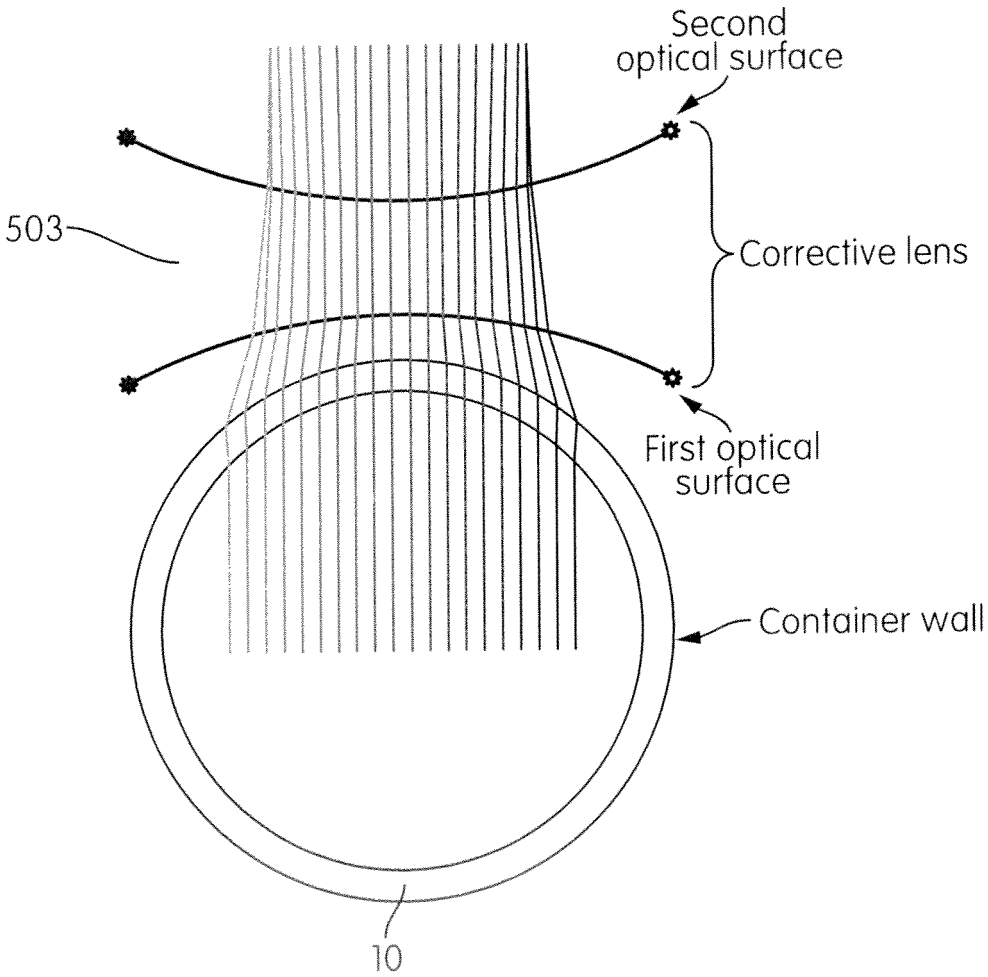

Second optical surface
503
Corrective lens
First optical surface
Container wall
10

FIG. 5G

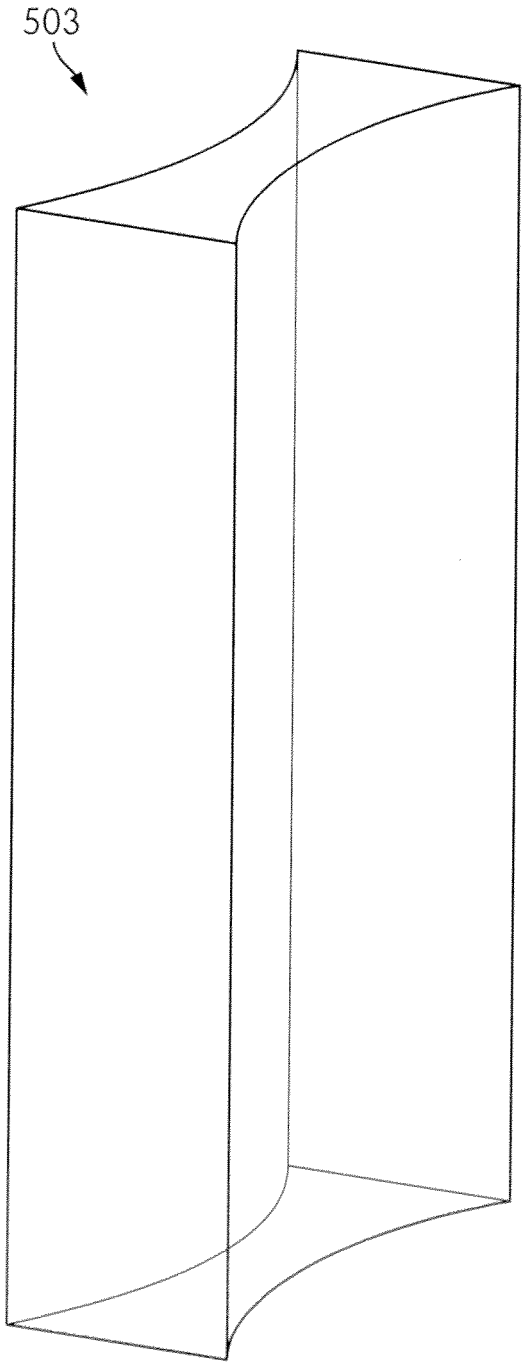


FIG. 5H

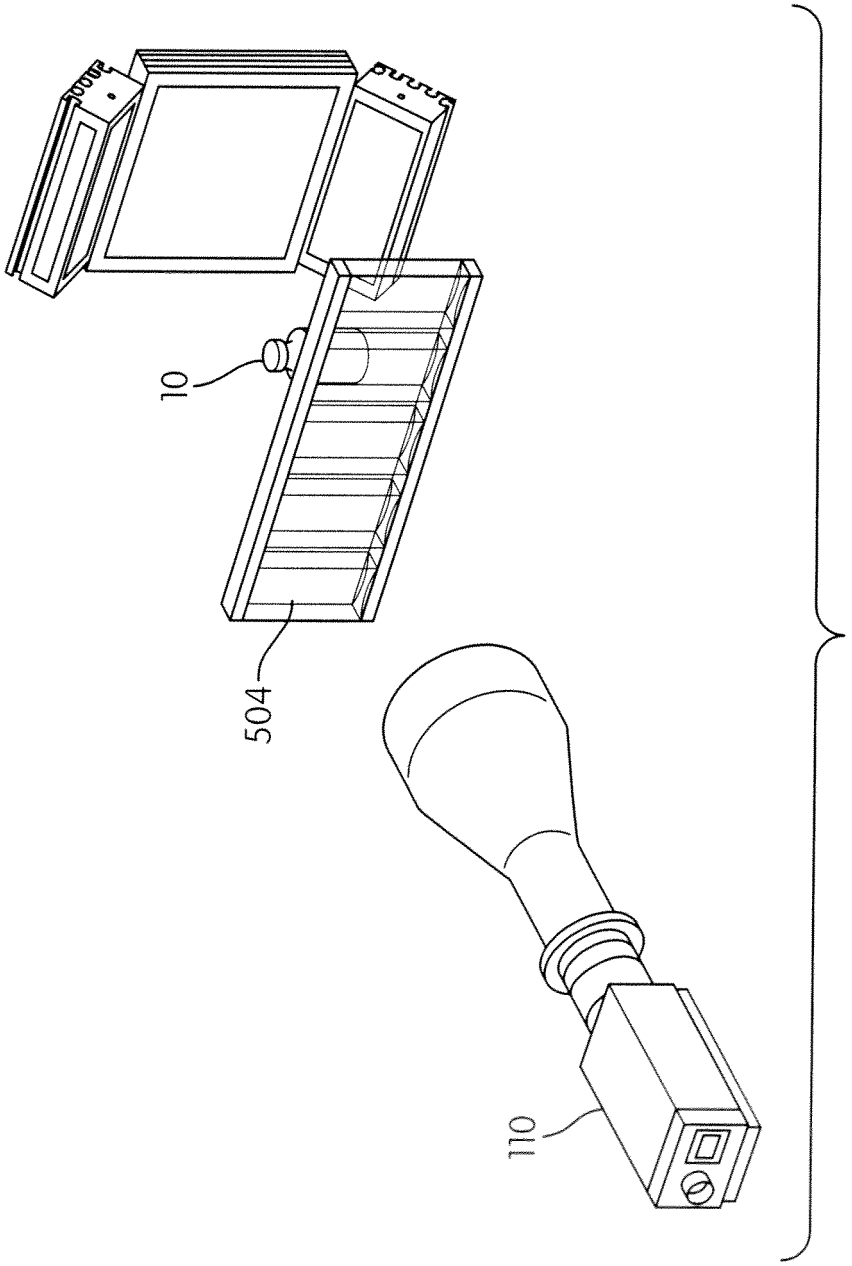


FIG. 5I

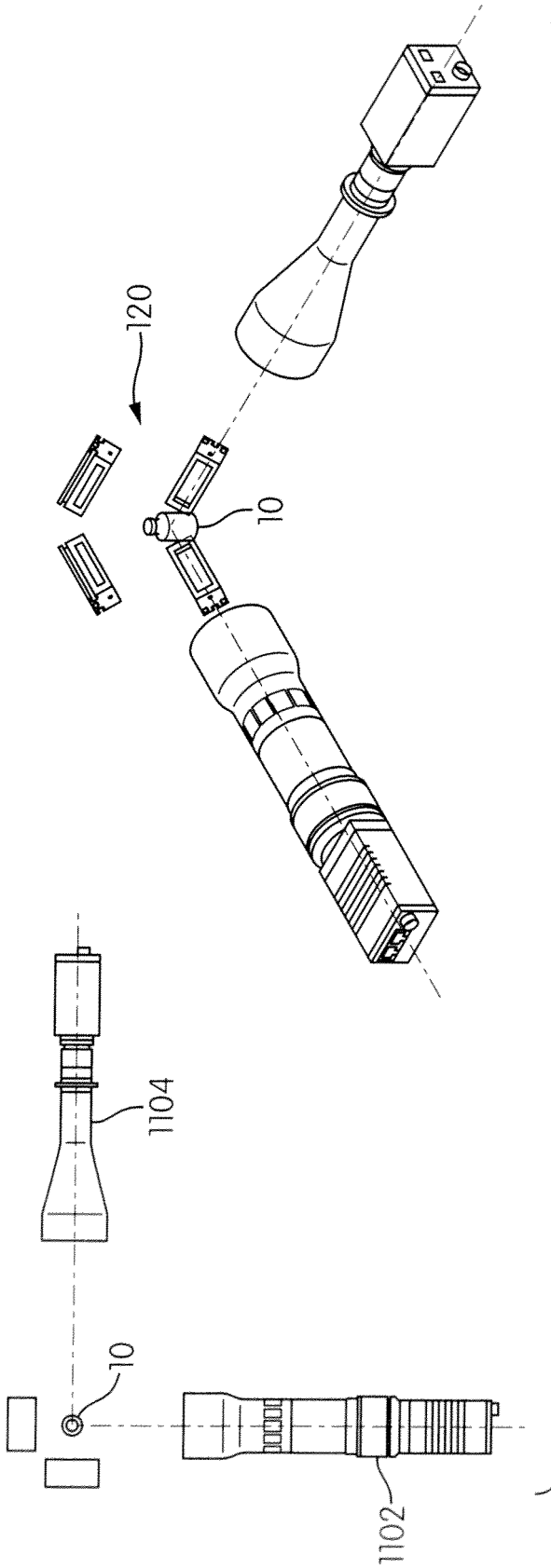


FIG. 6A

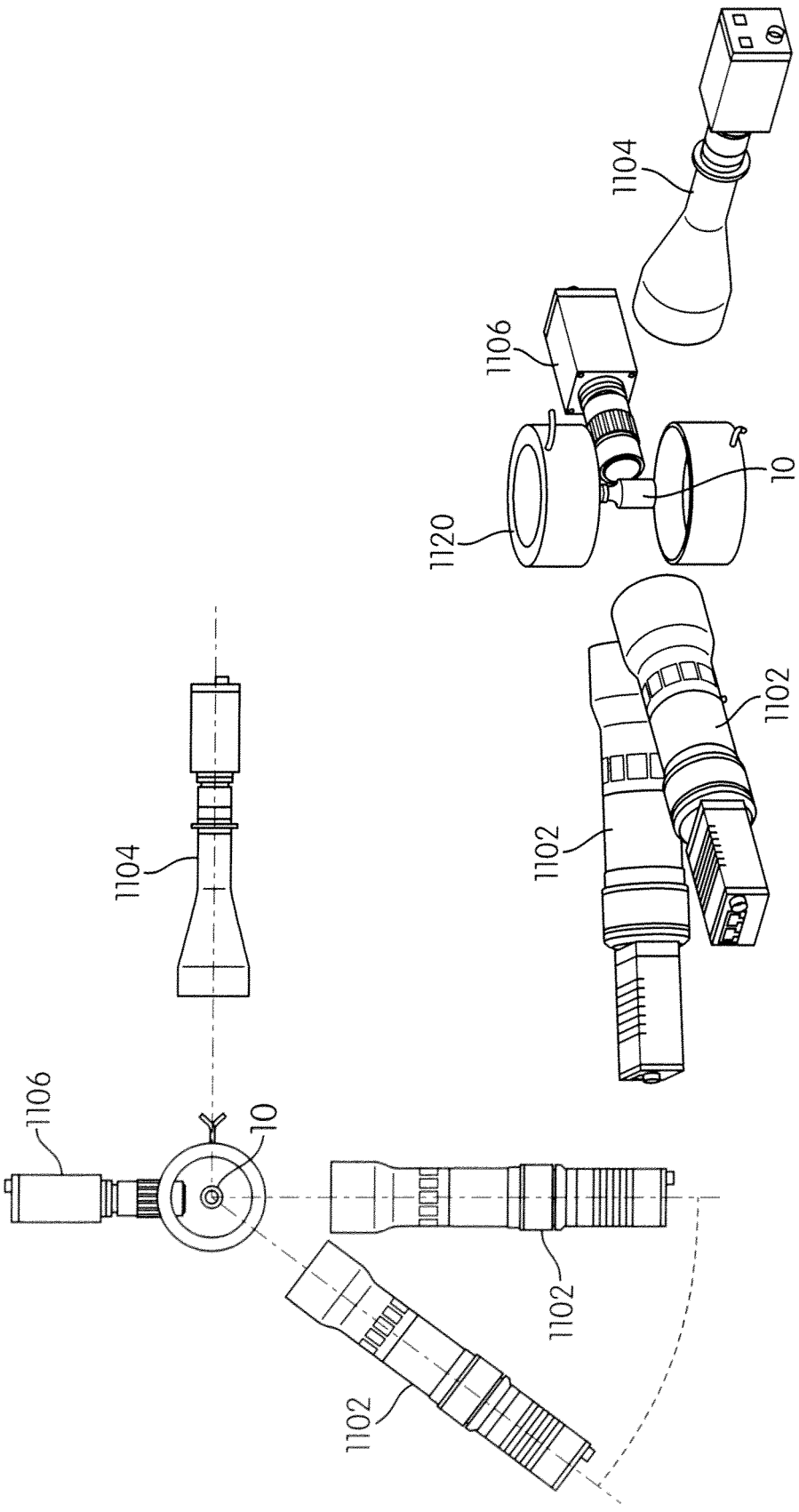


FIG. 6B

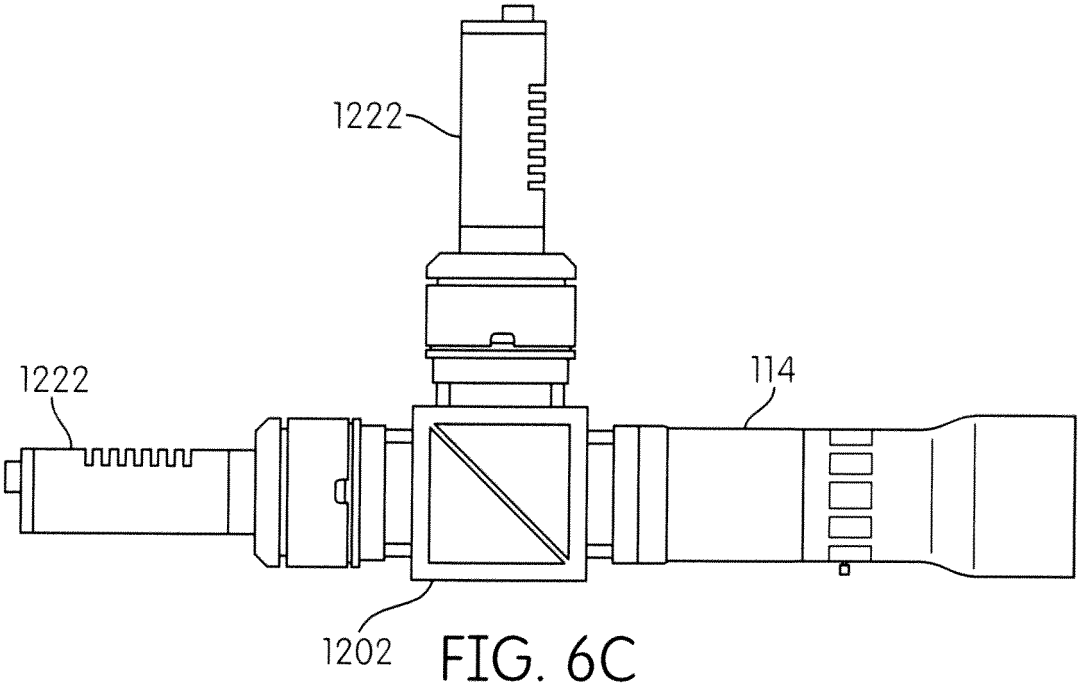


FIG. 6C

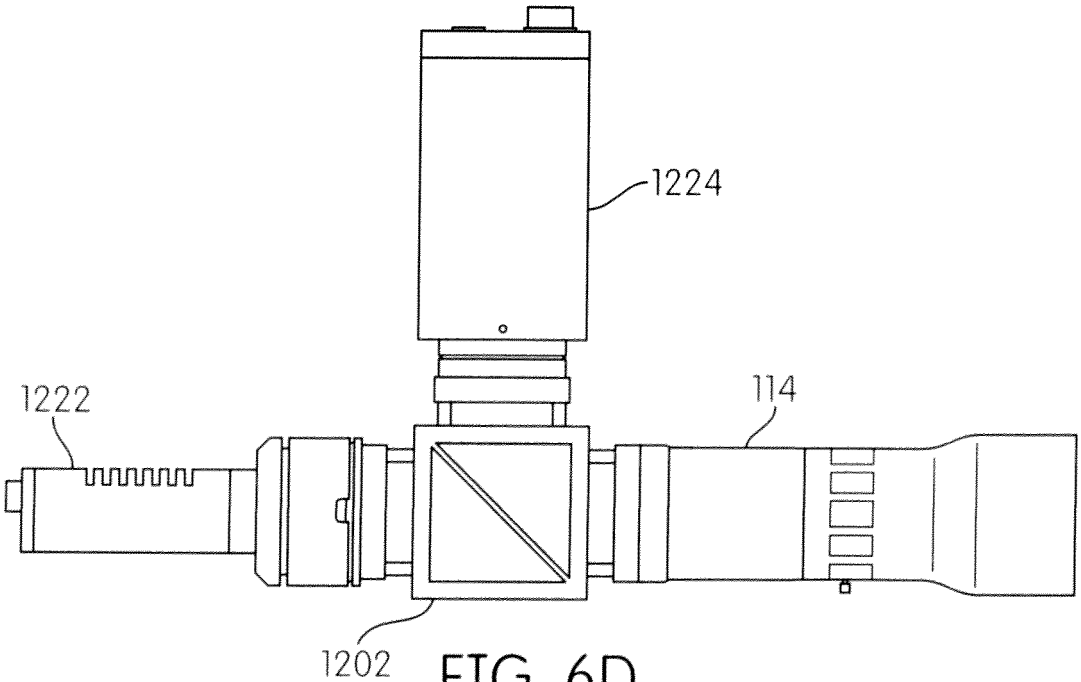


FIG. 6D

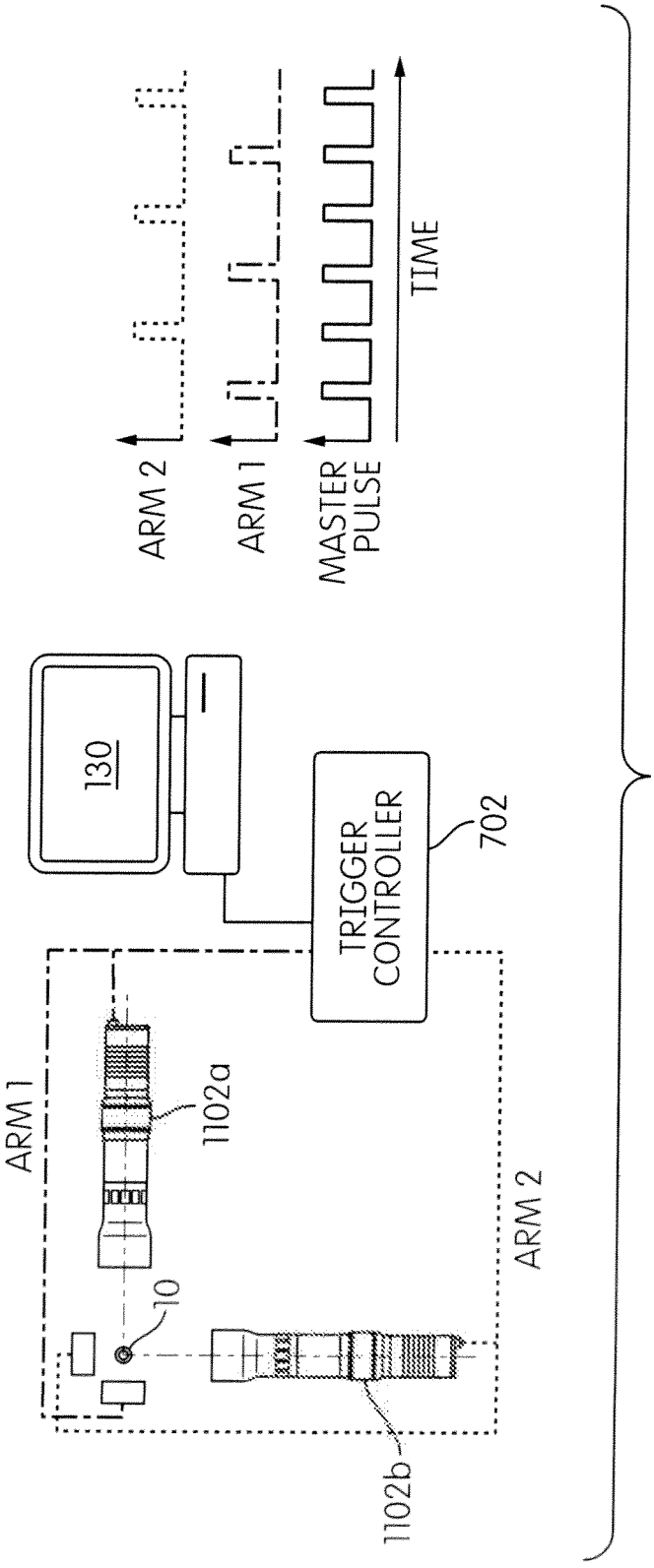

ARM 2
ARM 1
MASTER PULSE
TIME
130
TRIGGER CONTROLLER
702
ARM 1
1102a
10
ARM 2
1102b

FIG. 7A

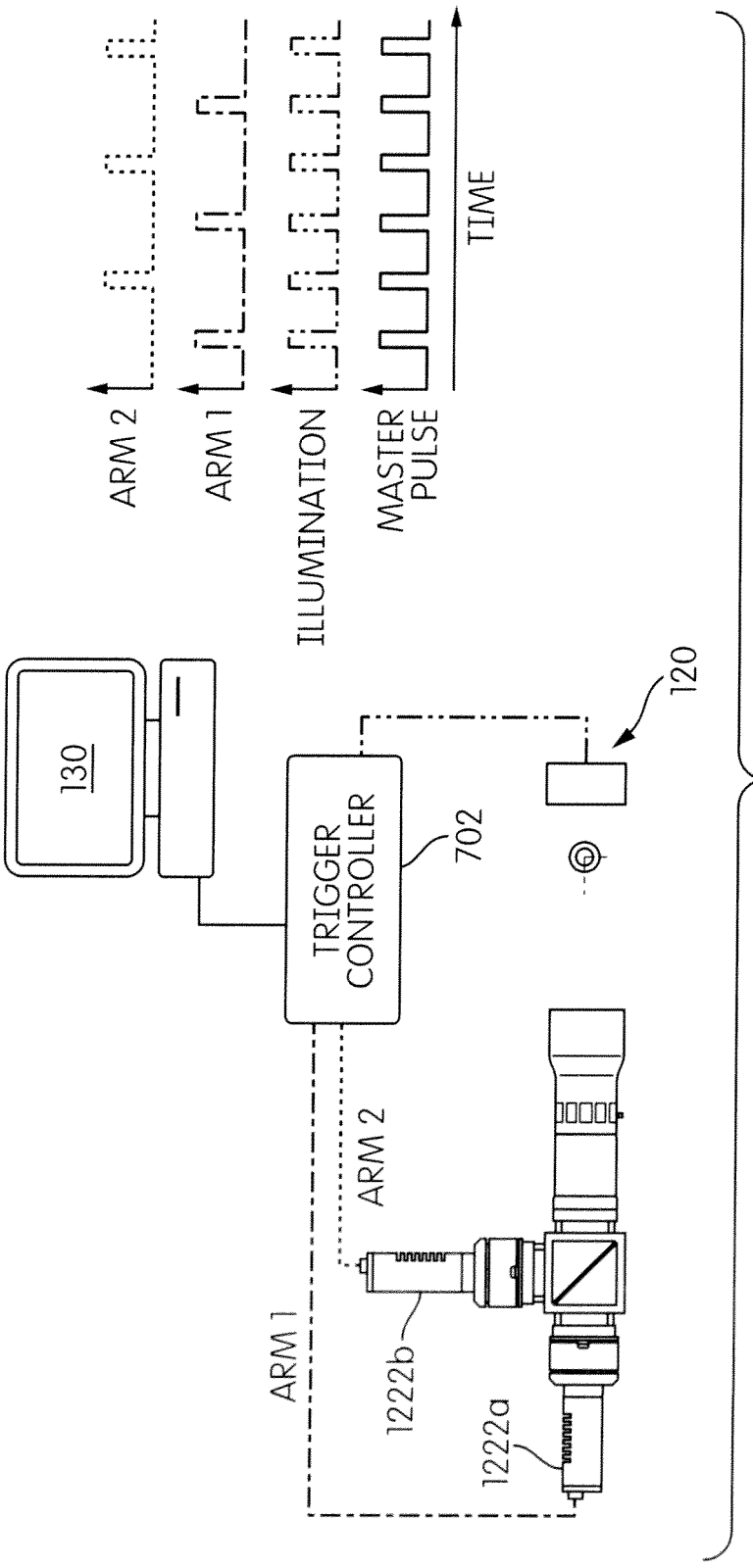

ARM 2
ARM 1
ILLUMINATION
MASTER PULSE
TIME
130
TRIGGER CONTROLLER
702
120
ARM 2
ARM 1
1222b
1222a

FIG. 7B

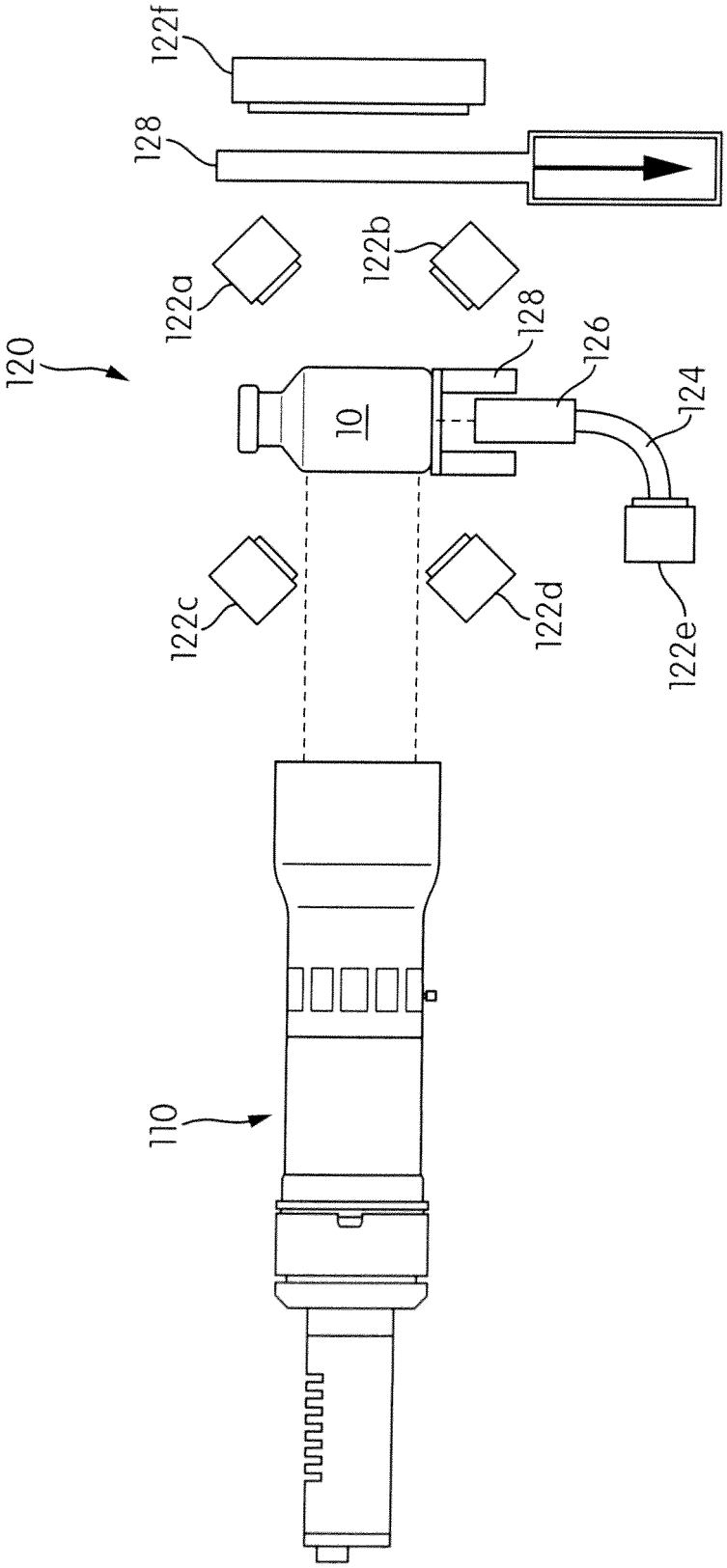


FIG. 8

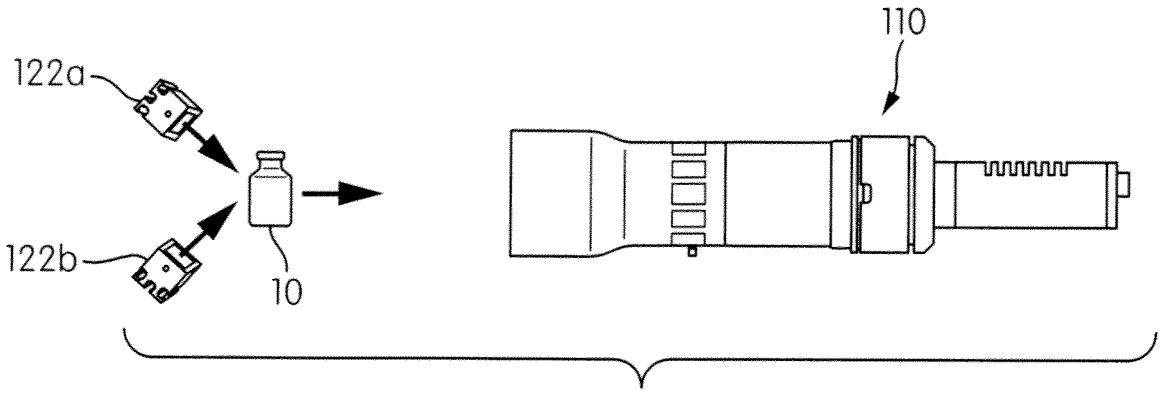


FIG. 9A

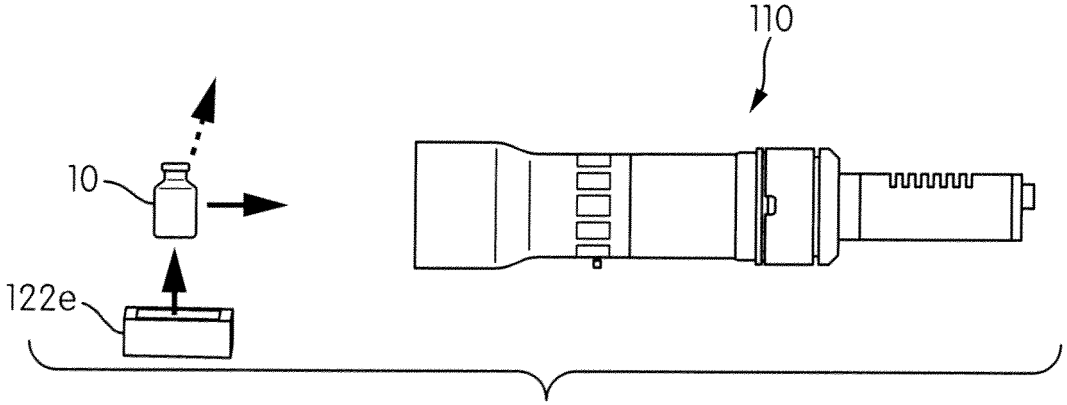


FIG. 9B

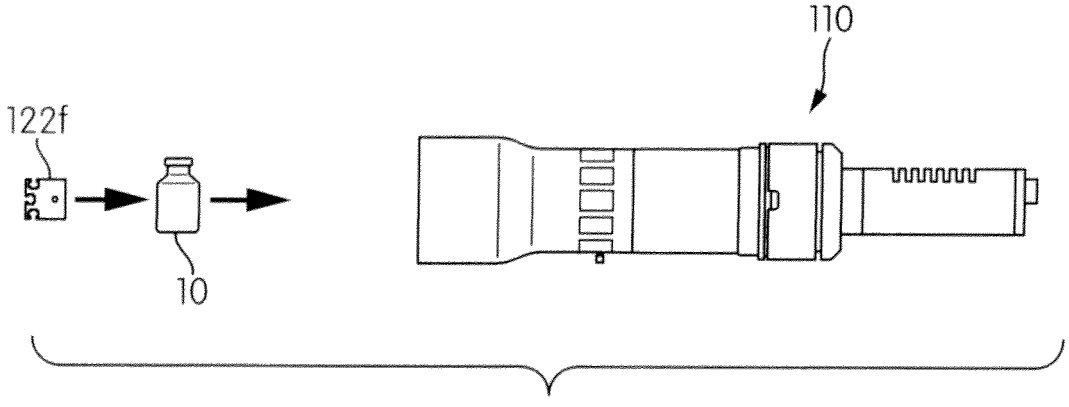


FIG. 9C

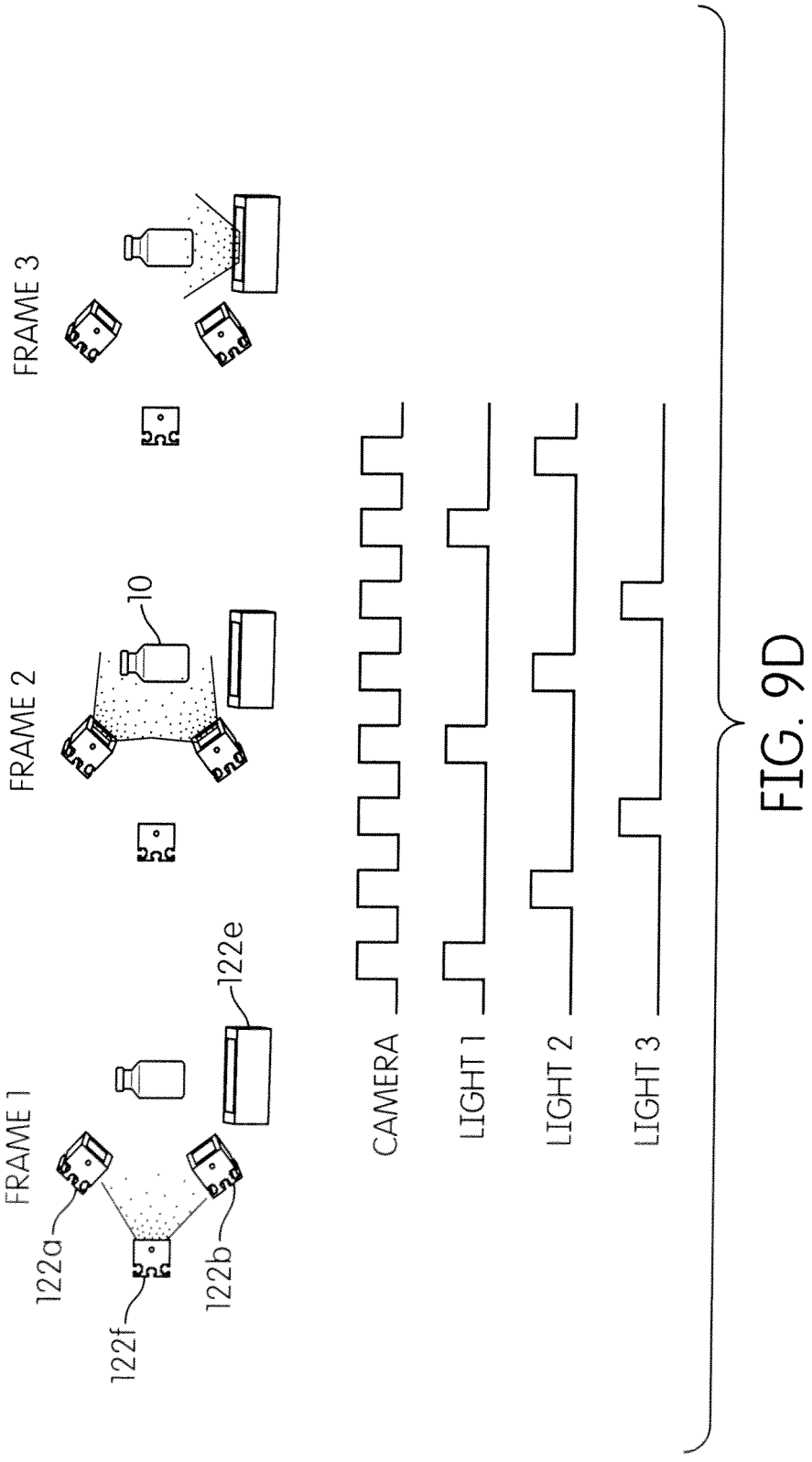

FRAME 1
FRAME 2
FRAME 3
10
122a
122b
122e
122f
CAMERA
LIGHT 1
LIGHT 2
LIGHT 3

FIG. 9D

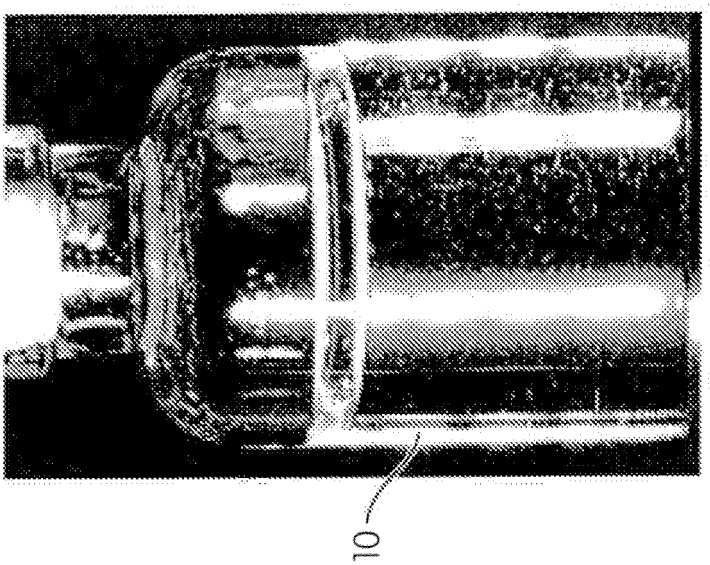


FIG. 10A

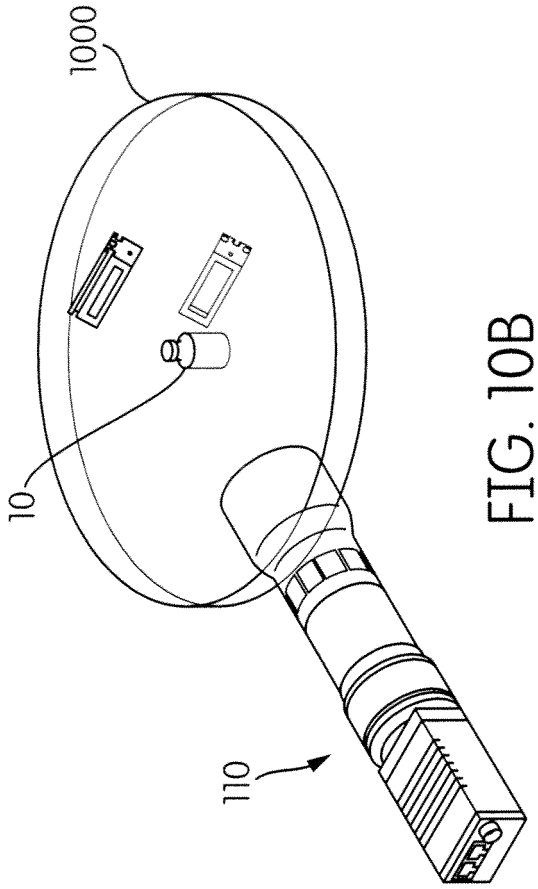


FIG. 10B

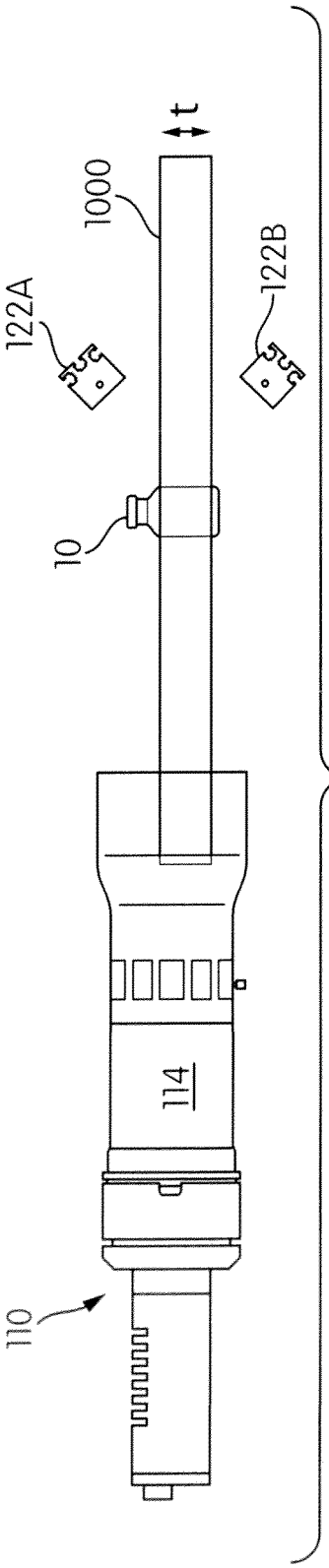


FIG. 10C

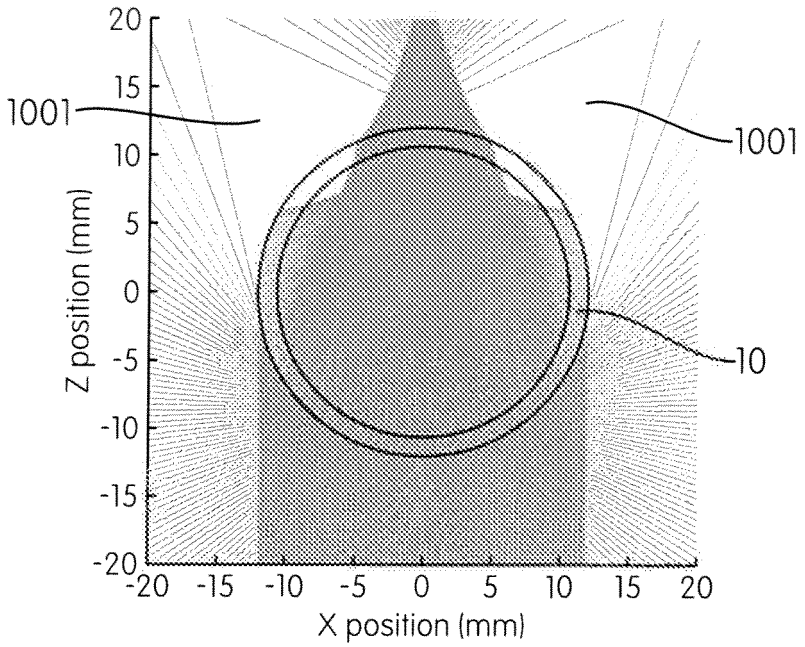


FIG. 10D

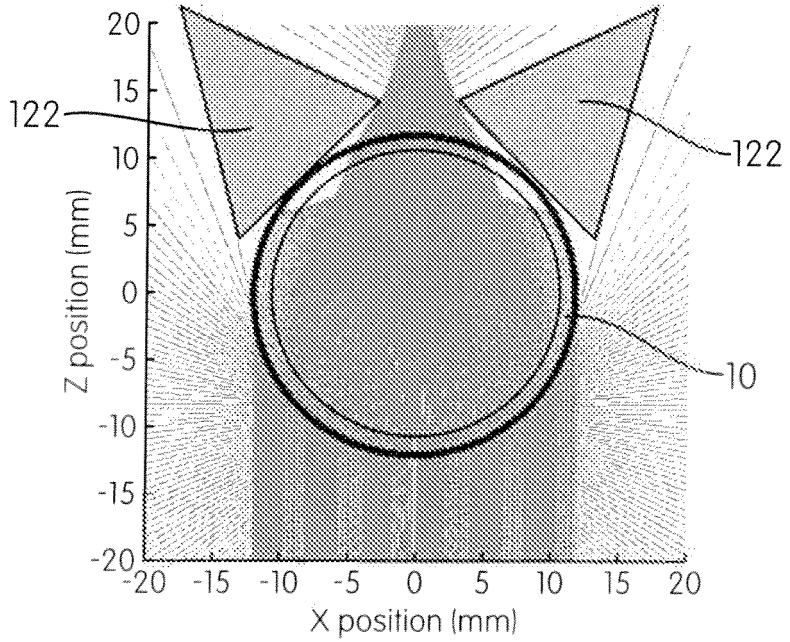


FIG. 10E

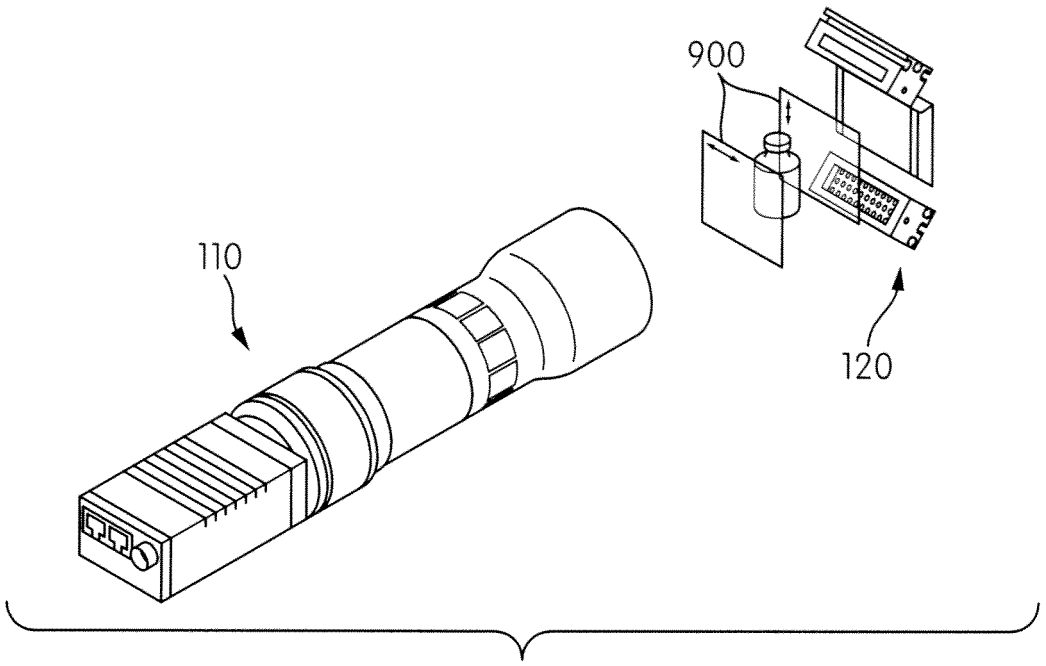


FIG. 11

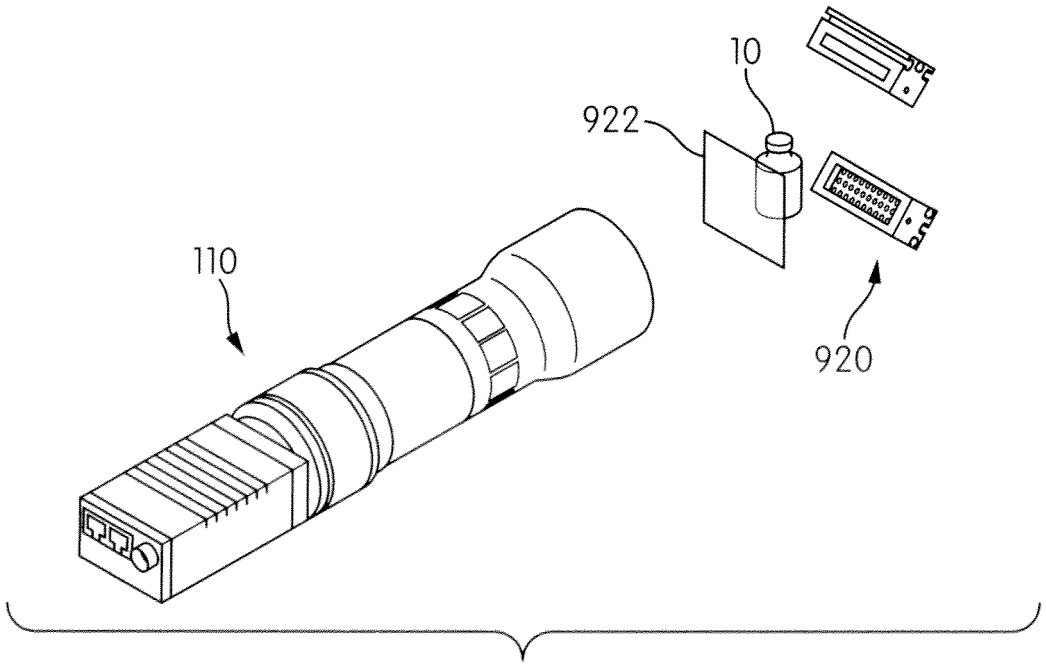


FIG. 12

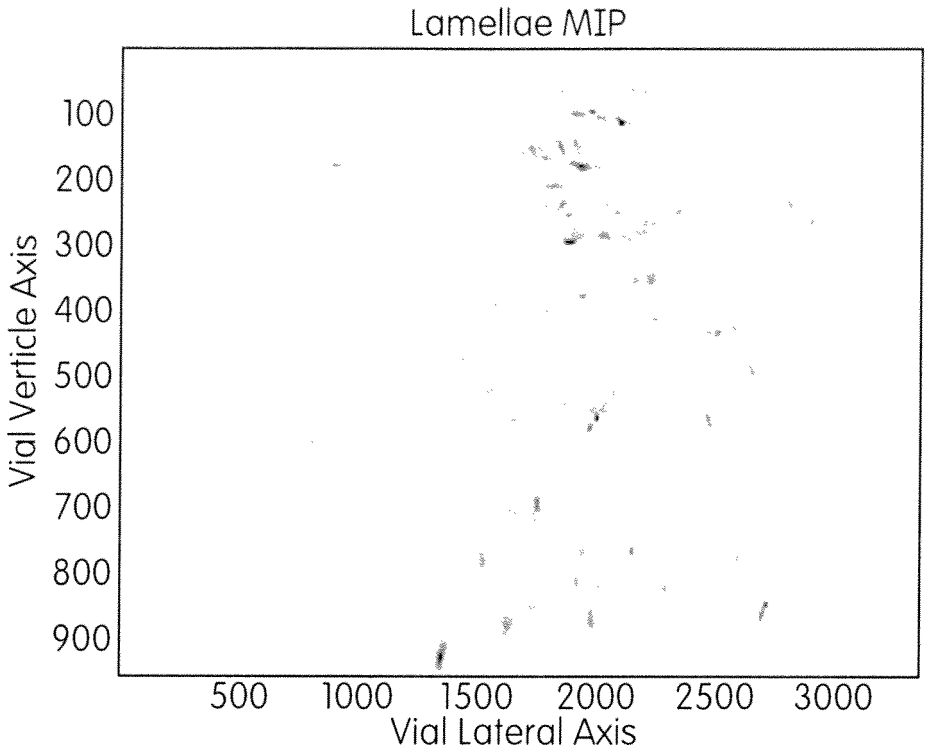


FIG. 13A

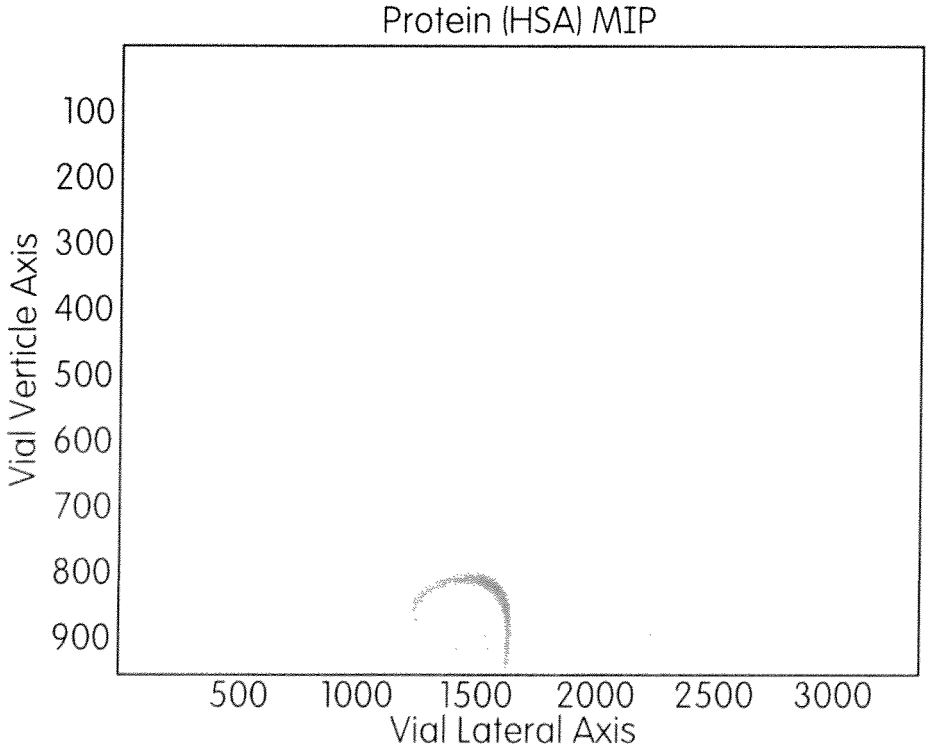


FIG. 13B

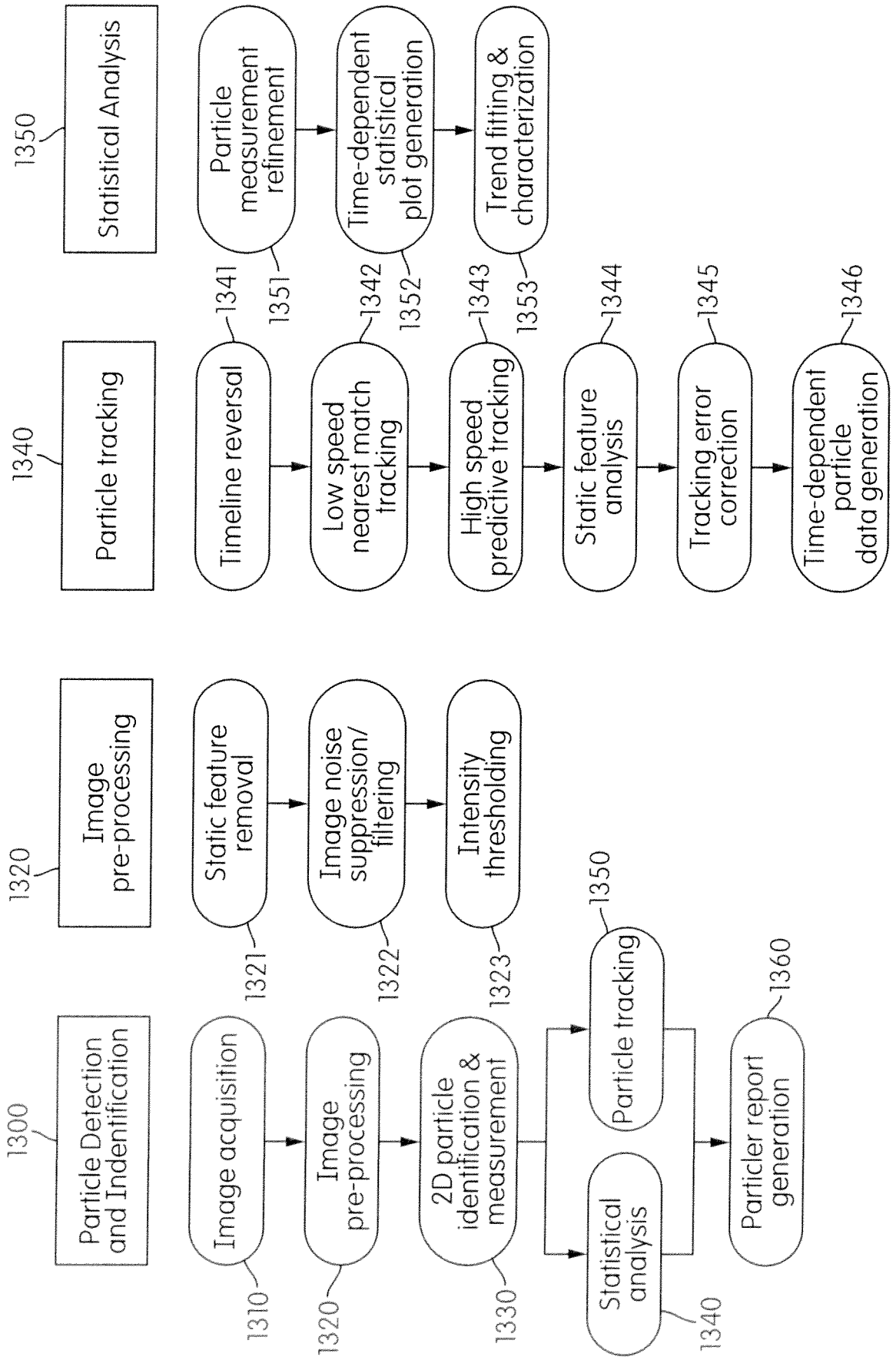

1300
Particle Detection and Indentification
1310
Image acquisition
1320
Image pre-processing
1330
2D particle identification & measurement
1340
Statistical analysis
1360
Particler report generation
1320
Image pre-processing
1321
Static feature removal
1322
Image noise suppression/ filtering
1323
Intensity thresholding
1340
Particle tracking
1341
Timeline reversal
1342
Low speed nearest match tracking
1343
High speed predictive tracking
1344
Static feature analysis
1345
Tracking error correction
1346
Time-dependent particle data generation
1350
Statistical Analysis
1351
Particle measurement refinement
1352
Time-dependent statistical plot generation
1353
Trend fitting & characterization

FIG. 14

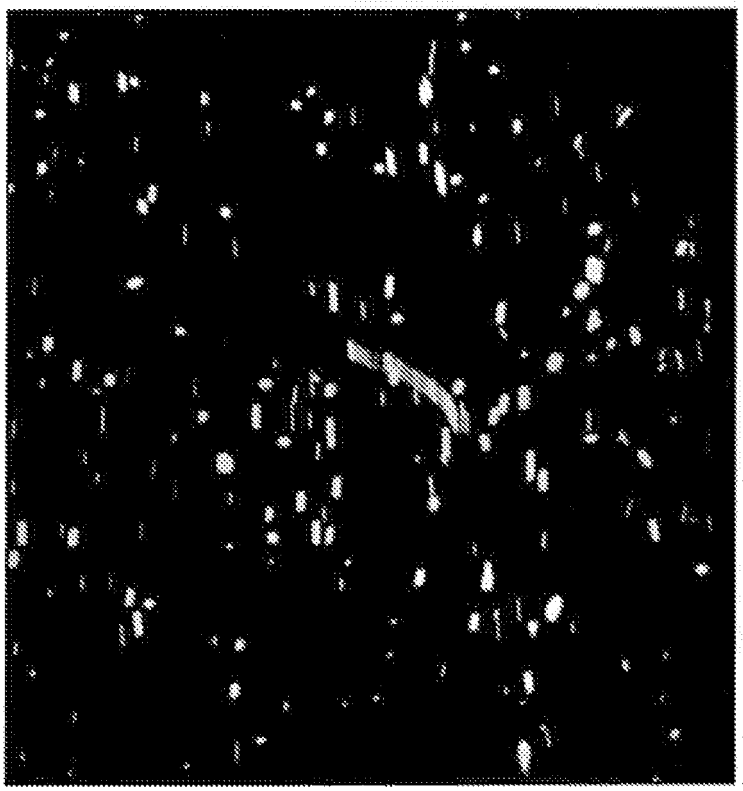


FIG. 15B



FIG. 15A

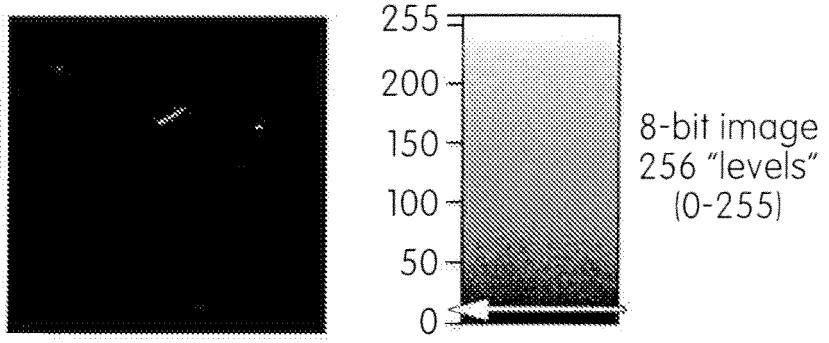


FIG. 16A

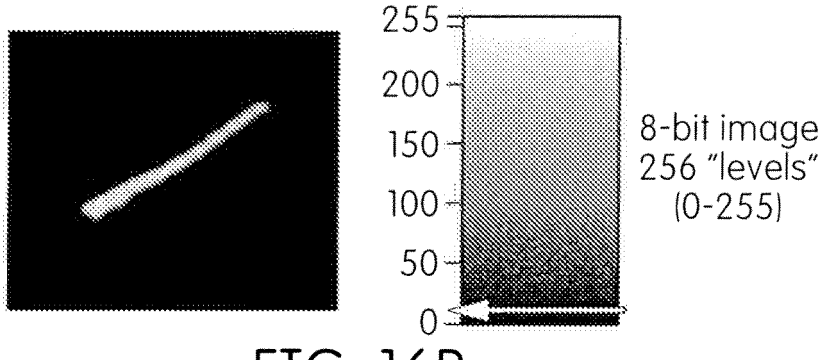


FIG. 16B

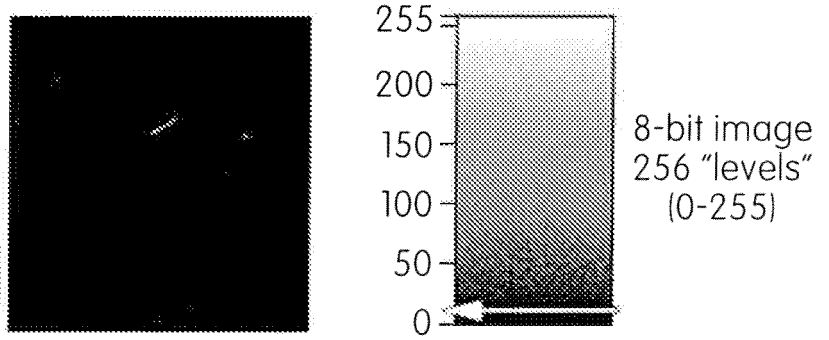


FIG. 16C

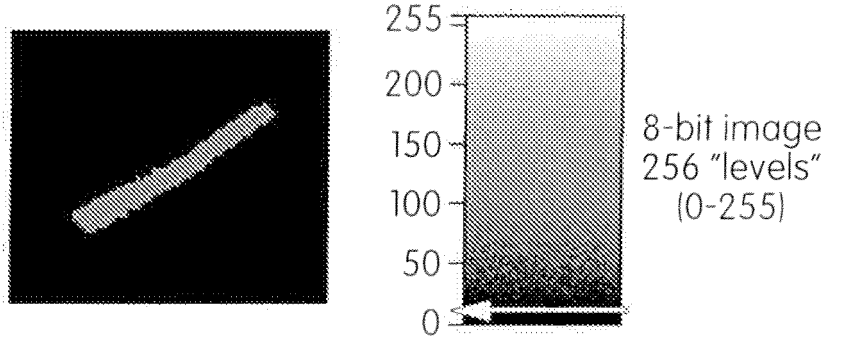


FIG. 16D

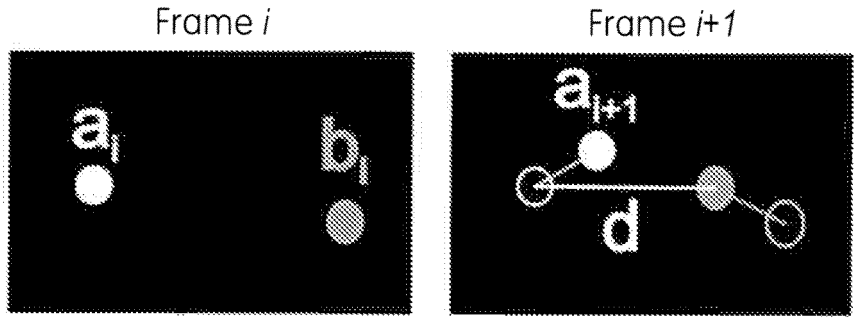


FIG. 17A

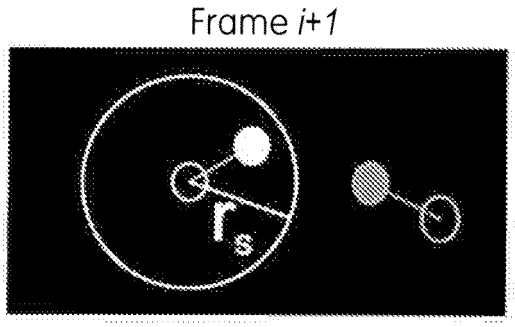


FIG. 17B

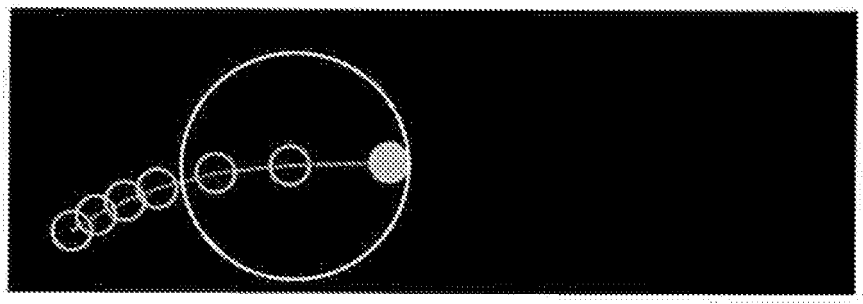


FIG. 17C

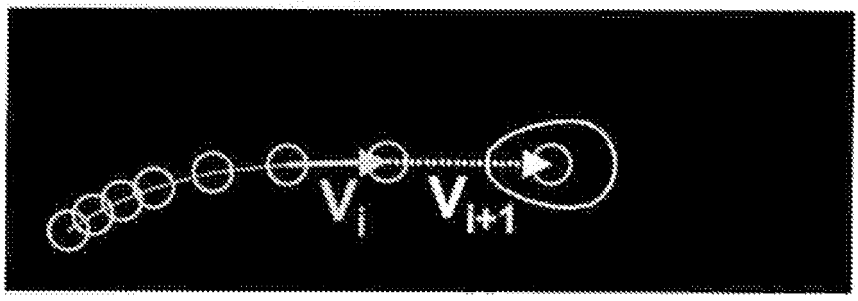


FIG. 17D

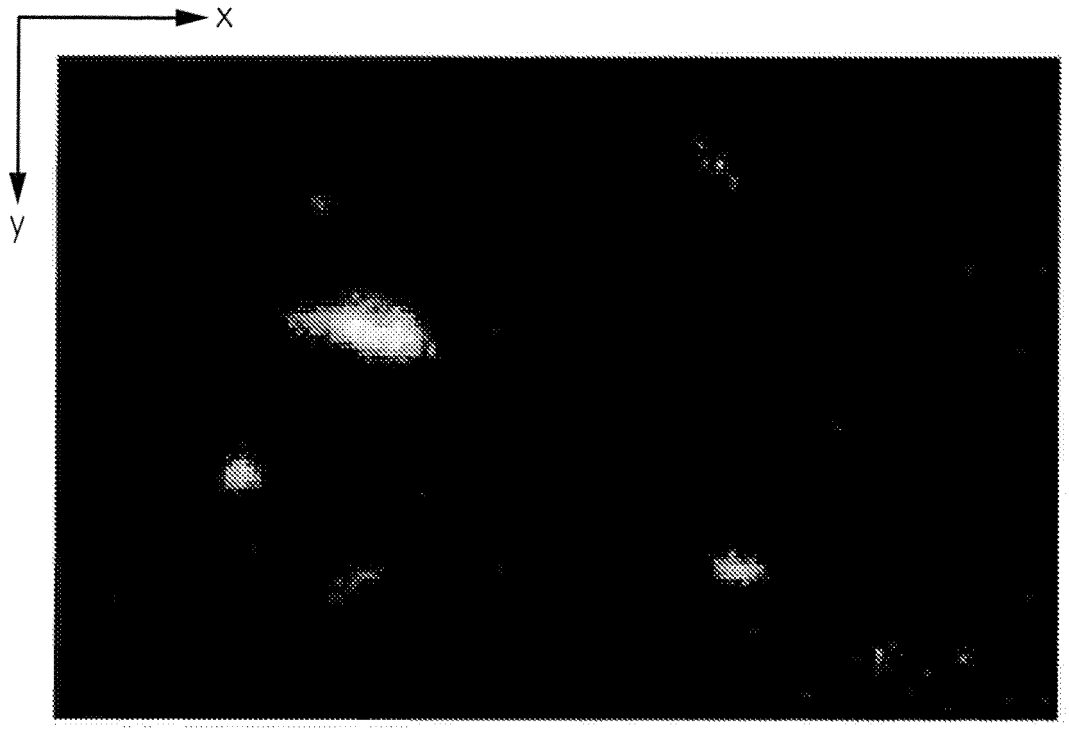


FIG. 18A

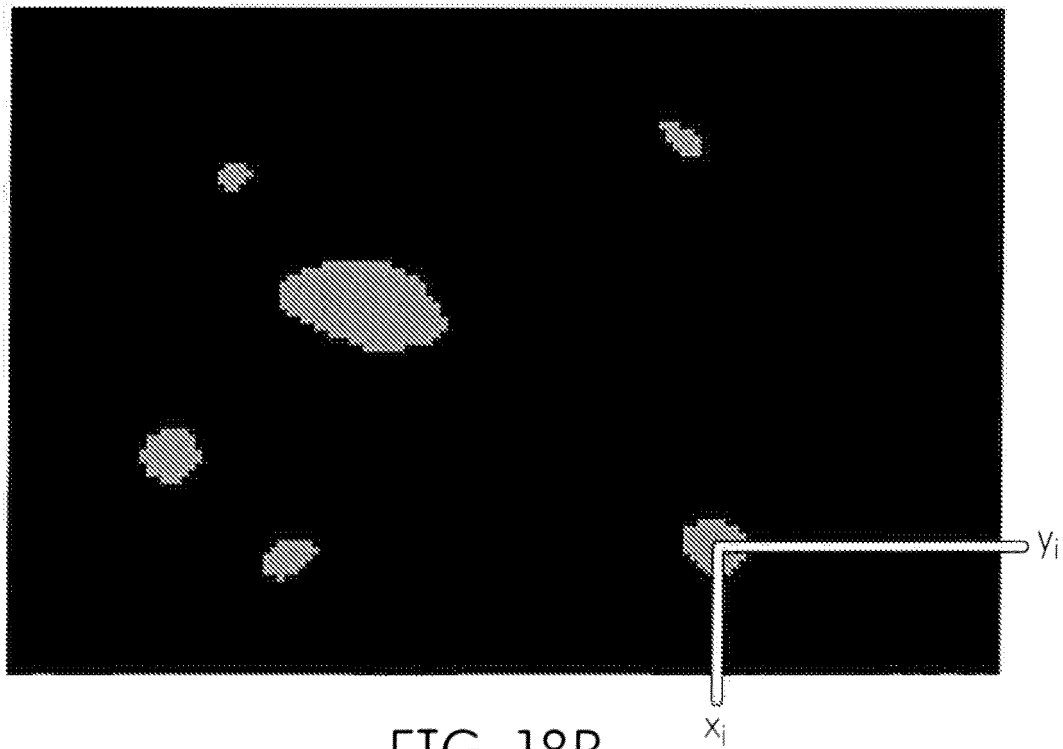


FIG. 18B

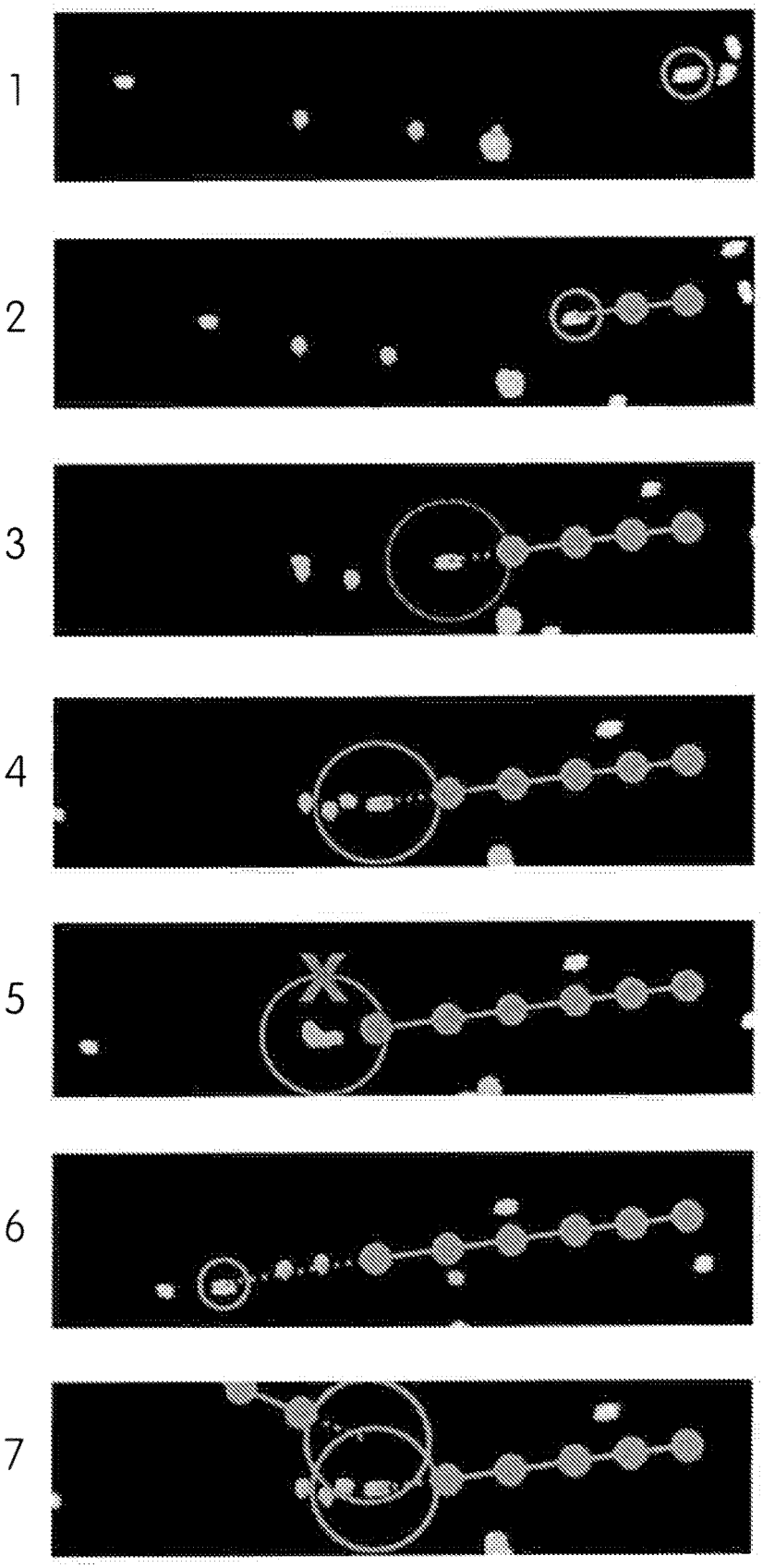


FIG. 19

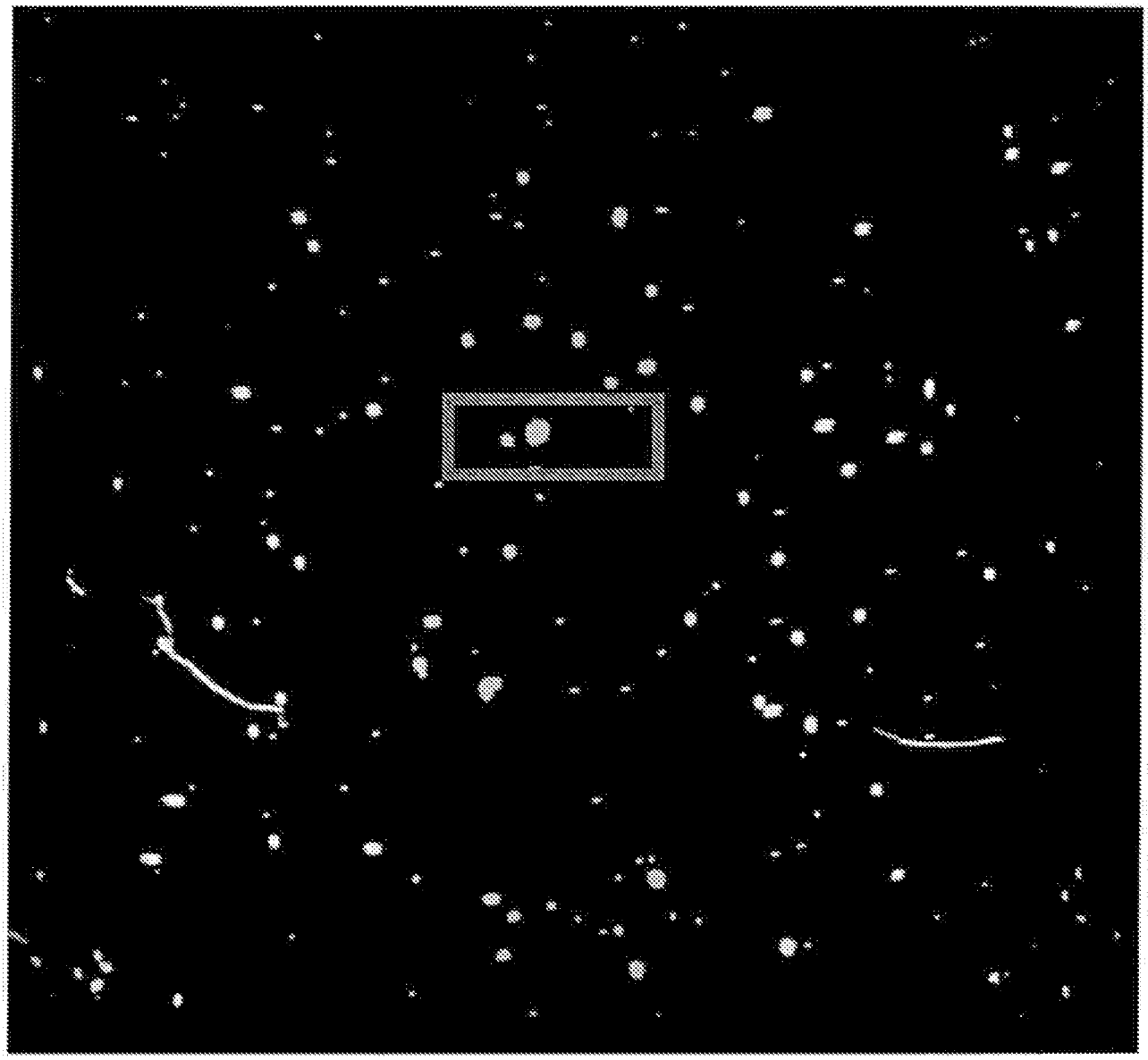


FIG. 20A



FIG. 20B



FIG. 20C

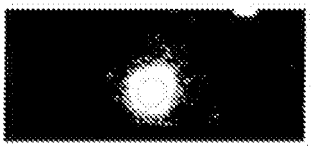


FIG. 20D

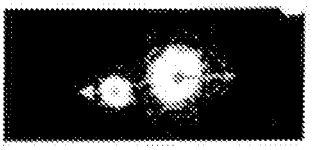


FIG. 20E

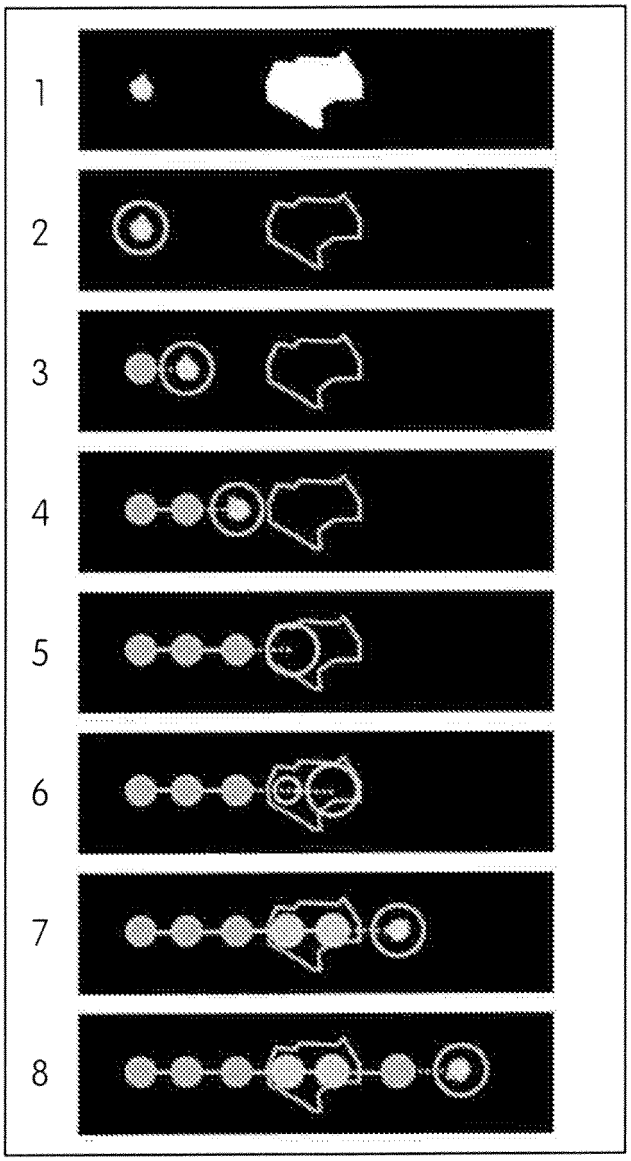


FIG. 21A

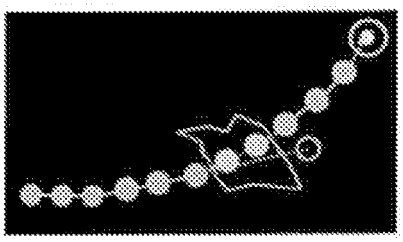


FIG. 21B

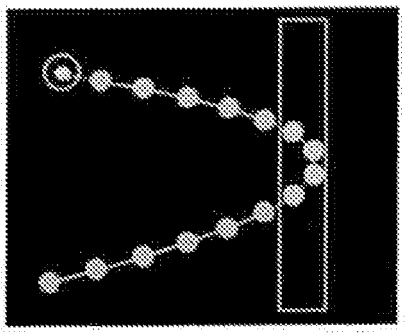


FIG. 21C

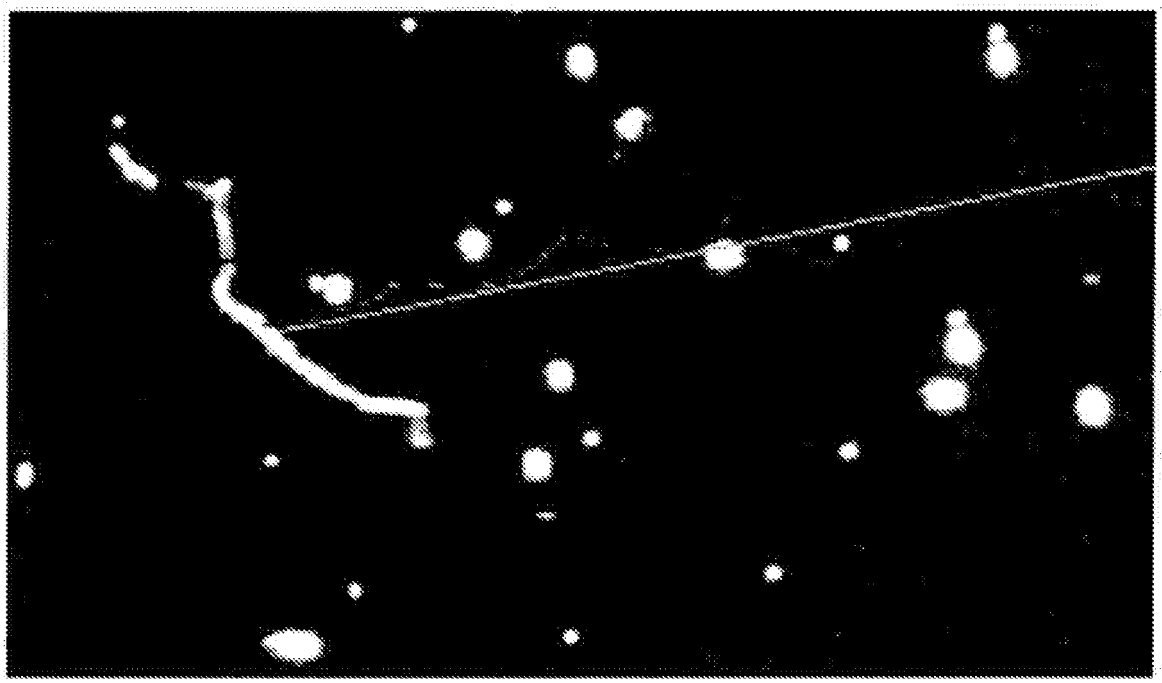


FIG. 22A

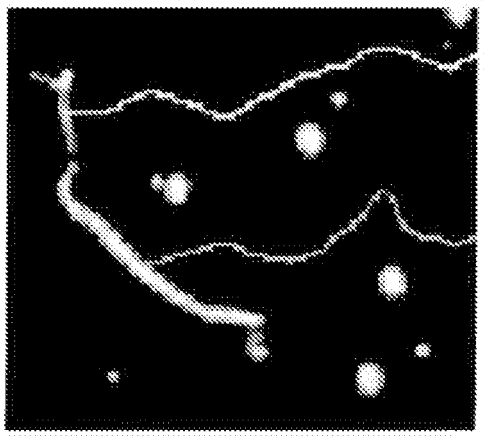


FIG. 22B

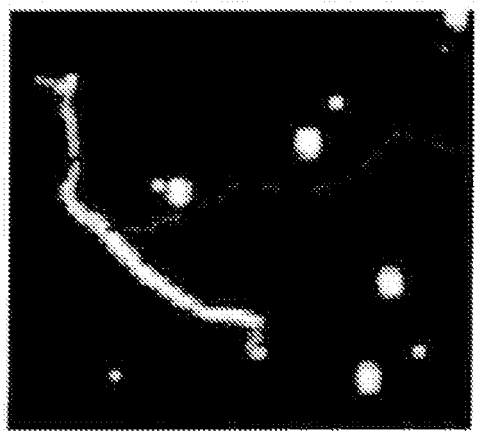


FIG. 22C

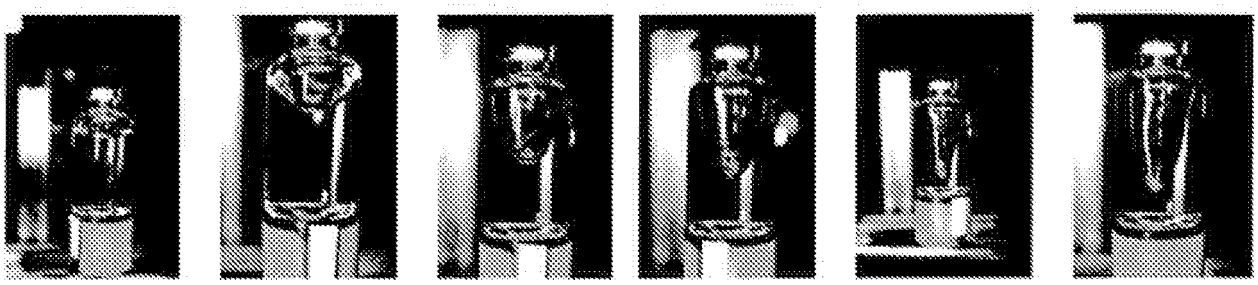


FIG. 23A

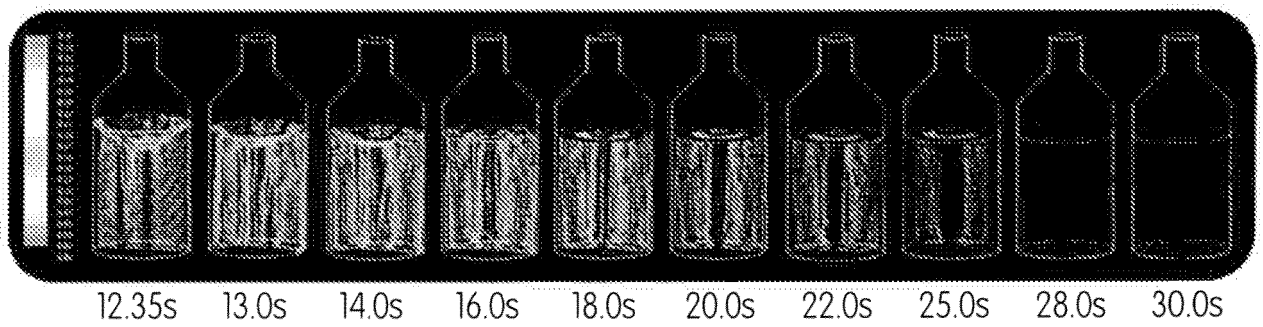


FIG. 23B

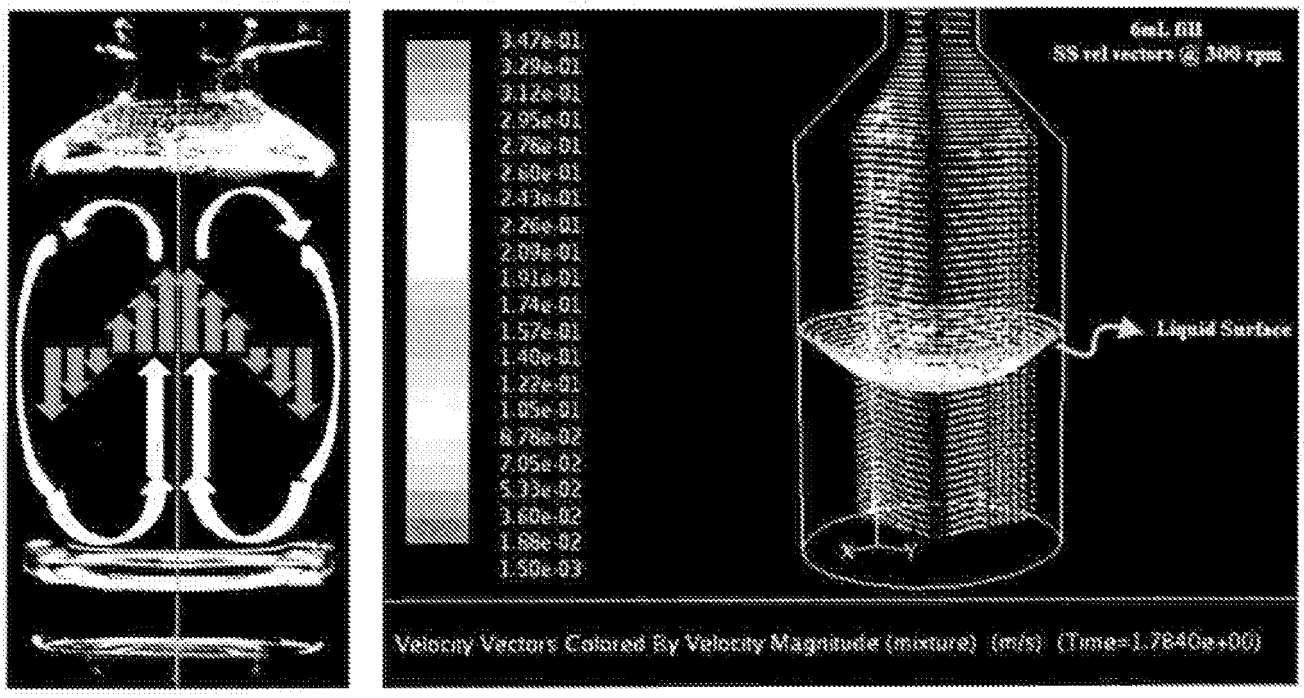


FIG. 23C

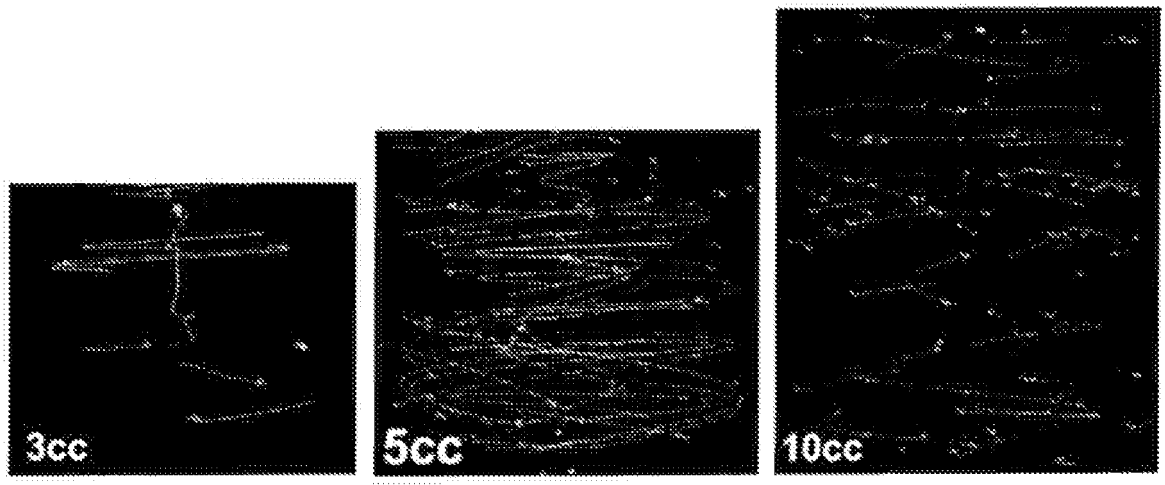


FIG. 23D



FIG. 24A

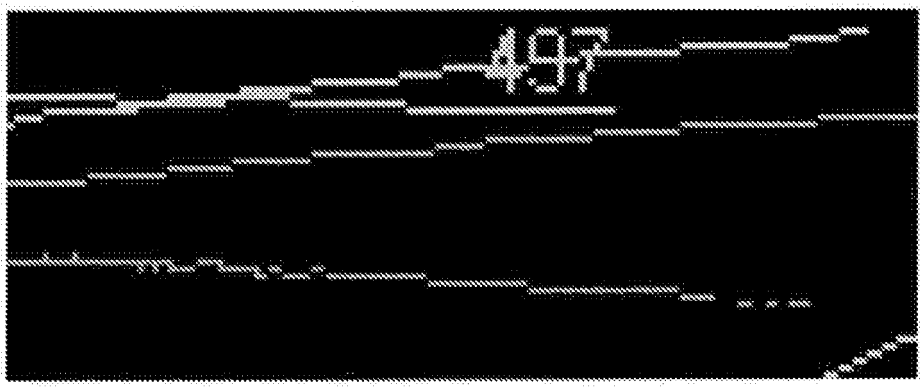


FIG. 24B

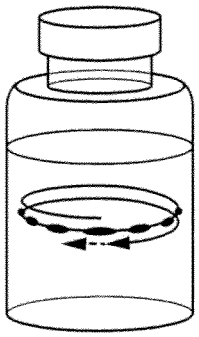


FIG. 25A

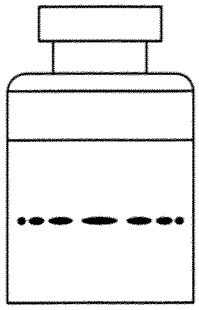


FIG. 25B

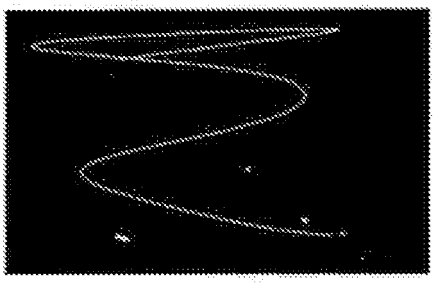


FIG. 25C

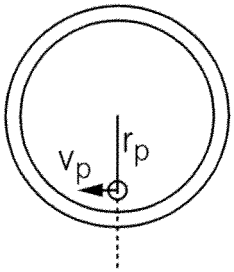


FIG. 25D

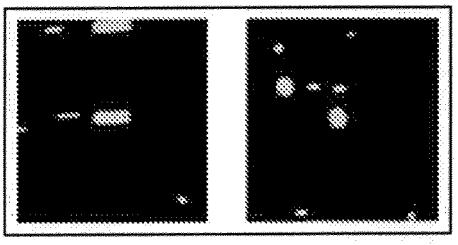


FIG. 25E

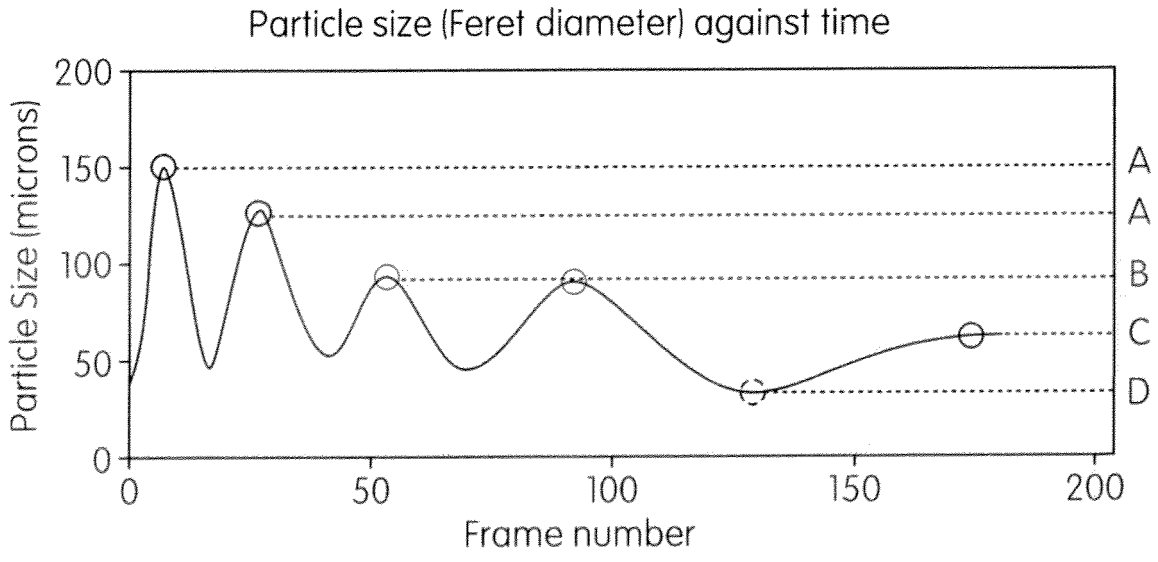


FIG. 25F

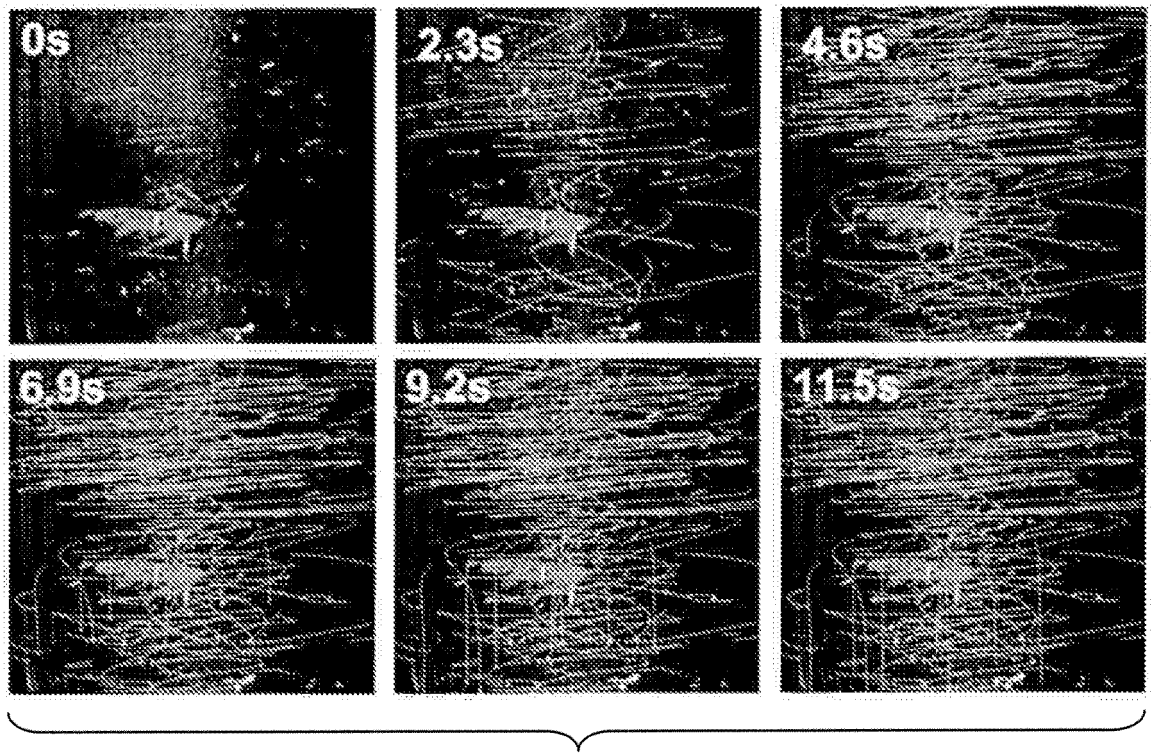


FIG. 26A

ordered0sp0.txt

	A	B	C	D	E	F	G	H	I	J	K
1	x position	y position	Partice ID	Status	Frame	Area	Angle	Speed	Elongation	Orientation	Max Feret
2	397.333	4.5	3131	1	44	6	1.55	5.918	2.5	170.662	5.385
3	403.25	4.375	3131	0	45	8	1.595	5.127	1.667	172.72	5.385
4	408.375	4.5	3131	0	46	8	1.553	6.472	2	162.641	6.708
5	414.846	4.385	3131	0	47	13	1.578	6.154	2.333	171.255	7.28
6	421	4.429	3131	0	48	14	1.547	5.078	1.75	171.359	7.071
7	426.077	4.308	3131	0	49	26	1.603	4.81	2	172.611	8.544
8	430.885	4.462	3131	0	50	26	1.508	5.054	2.25	2.76	9.22
9	435.929	4.143	3131	0	51	28	1.602	5.107	2.5	174.796	10.198
10	441.033	4.3	3131	0	52	30	1.499	4.567	2.5	173.983	10.44
11	445.588	3.971	3131	0	53	34	1.583	4.765	2	173.914	10.198
12	450.353	4.029	3131	0	54	34	1.507	4.485	2	172.375	10.198
13	454.829	3.743	3131	0	55	35	1.586	4.386	2	171.028	10.77

ordered0sp0

FIG. 26B



FIG. 27A

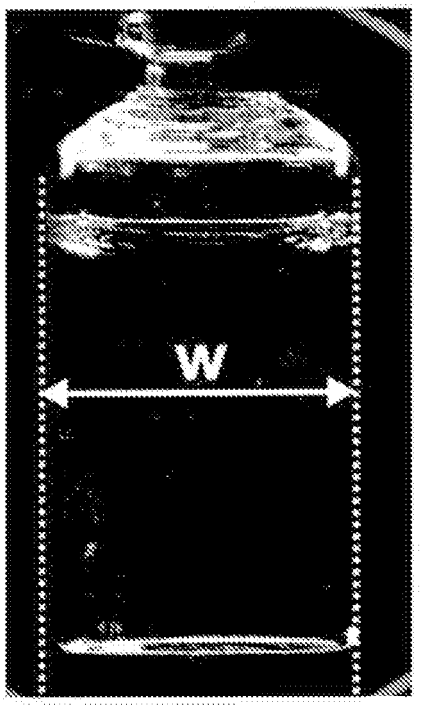


FIG. 27B



FIG. 27C

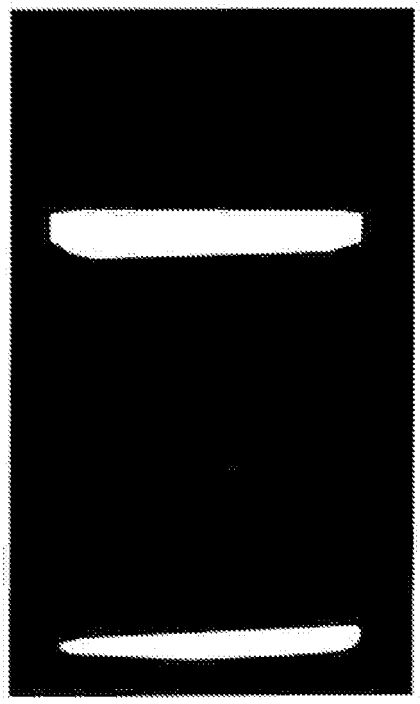


FIG. 27D

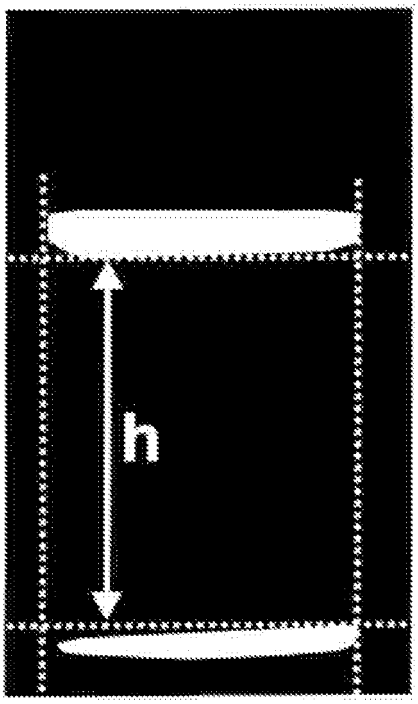


FIG. 27E



FIG. 27F

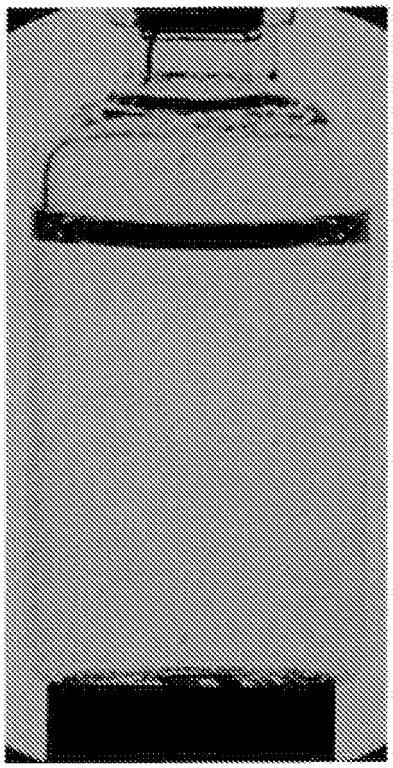


FIG. 28A

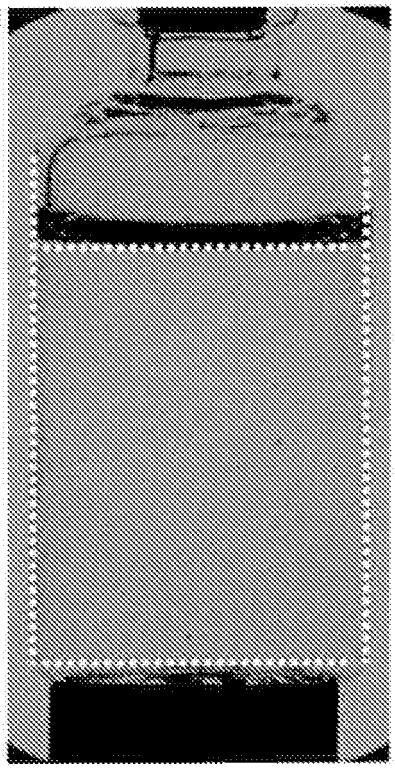


FIG. 28B

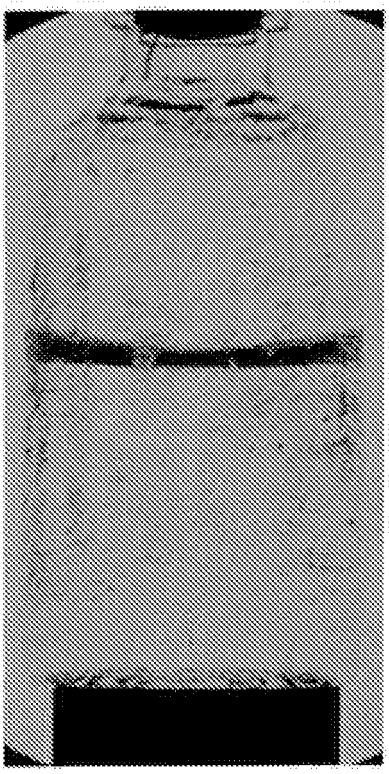


FIG. 28C

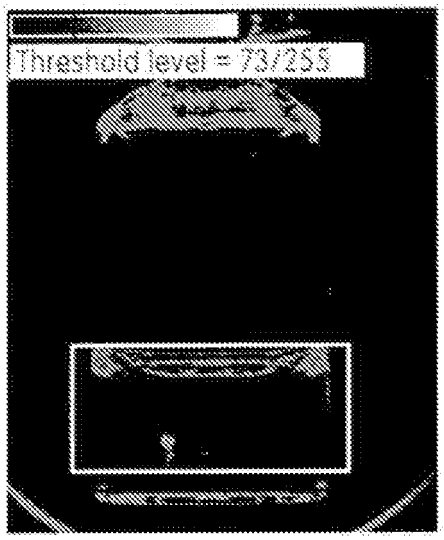


FIG. 29A

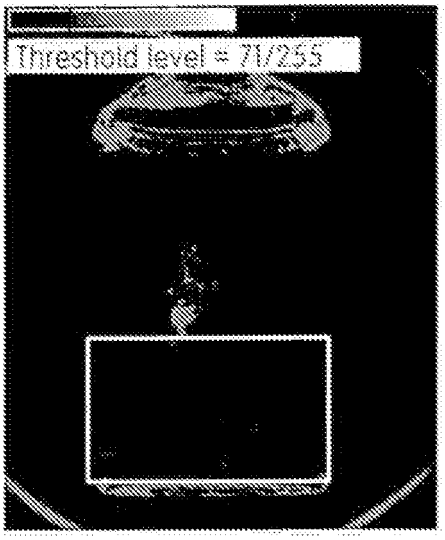


FIG. 29B

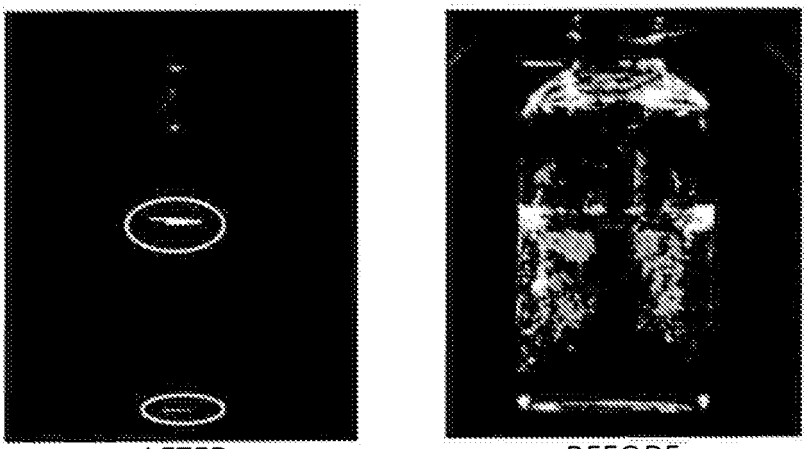


FIG. 29C

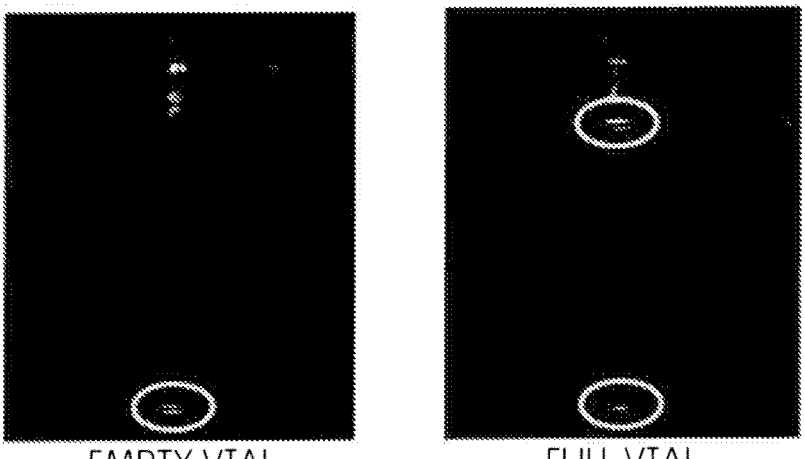


FIG. 29D

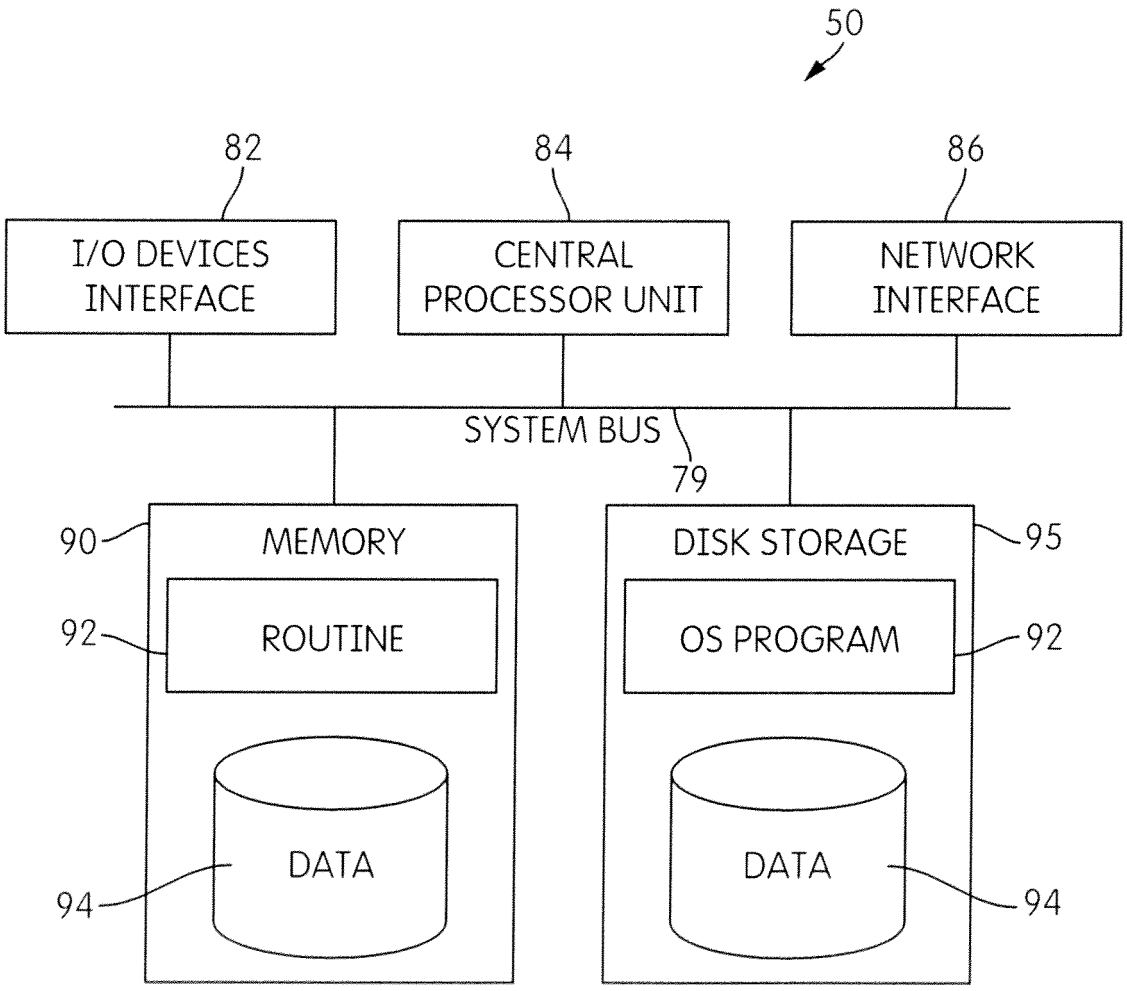

50
82
84
86
I/O DEVICES INTERFACE
CENTRAL PROCESSOR UNIT
NETWORK INTERFACE
SYSTEM BUS
79
90
MEMORY
95
DISK STORAGE
92
ROUTINE
92
OS PROGRAM
DATA
DATA
94
94

FIG. 30



FIG. 31A

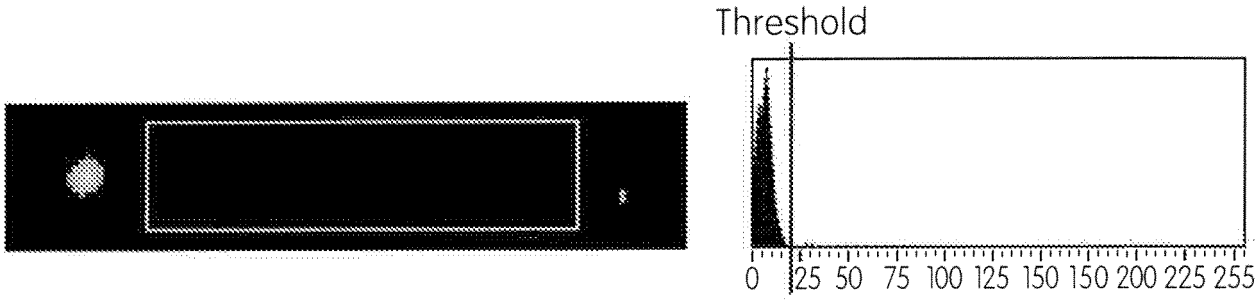


FIG. 31B

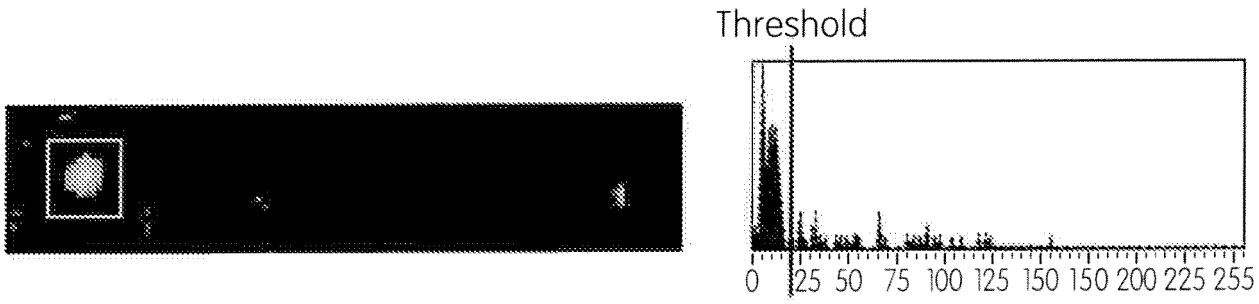


FIG. 31C

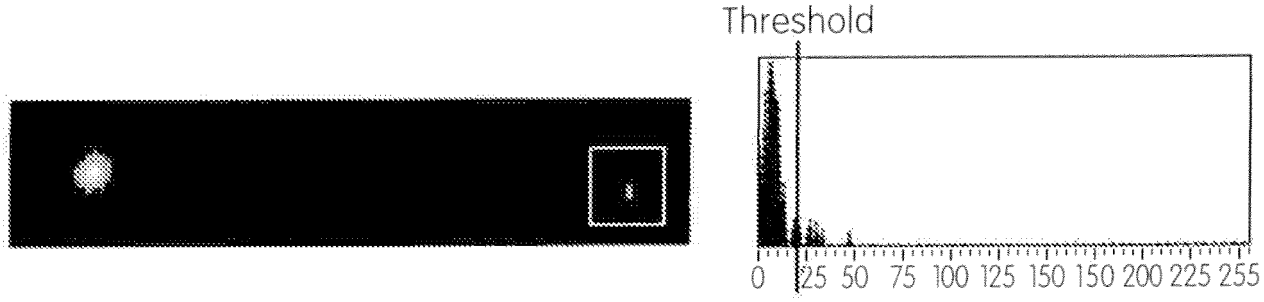


FIG. 31D

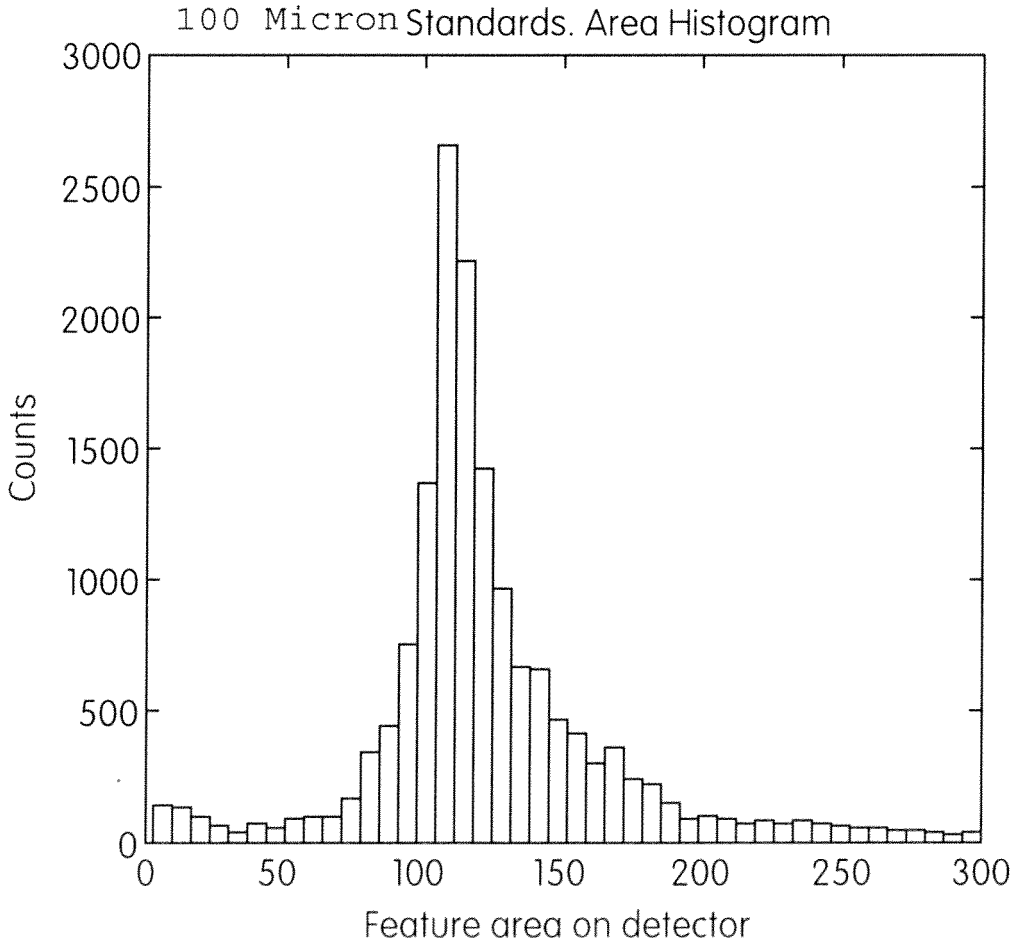

100 Micron Standards. Area Histogram
3000
2500
2000
1500
1000
500
0
Counts
0
50
100
150
200
250
300
Feature area on detector

FIG. 32

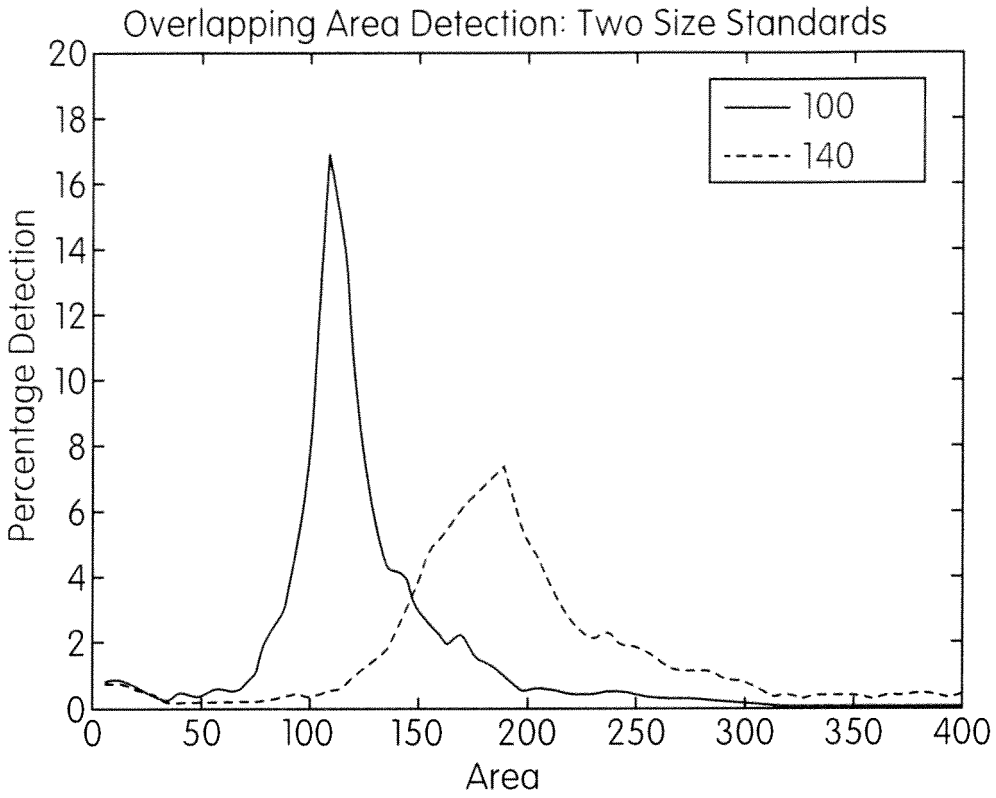

Overlapping Area Detection: Two Size Standards
Percentage Detection
Area
100
140
0
2
4
6
8
10
12
14
16
18
20
0
50
100
150
200
250
300
350
400

FIG. 33

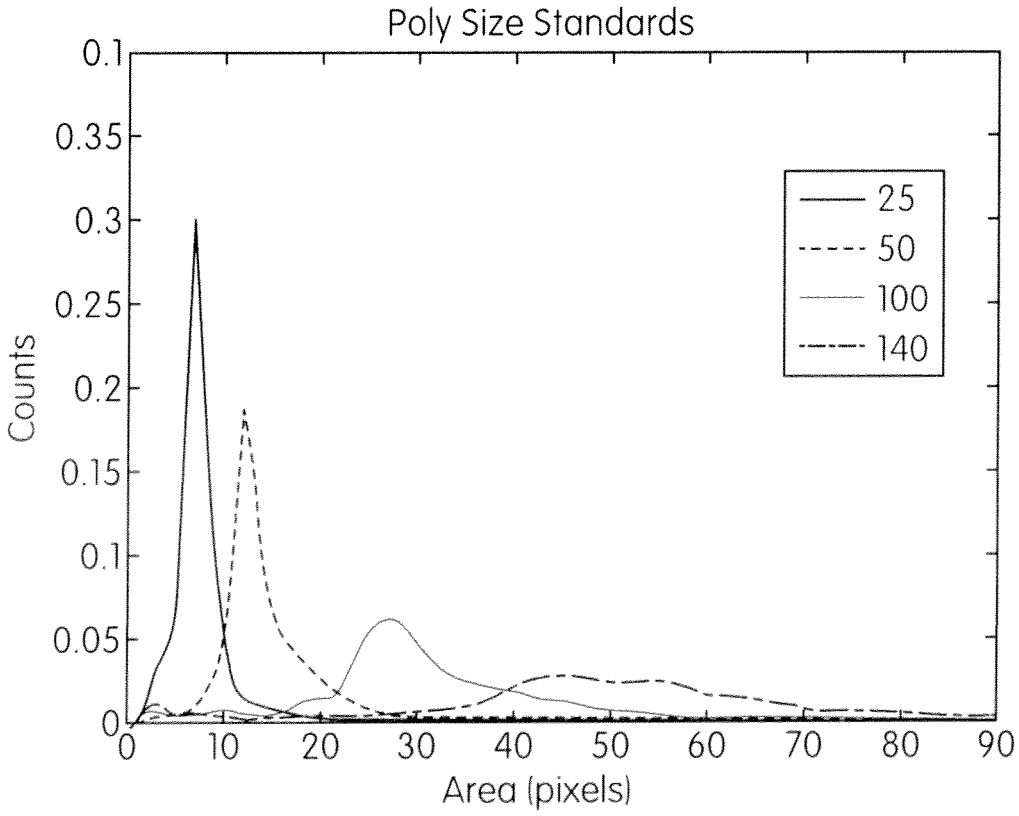

Poly Size Standards
Counts
Area (pixels)
25
50
100
140
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.1
0
10
20
30
40
50
60
70
80
90

FIG. 34

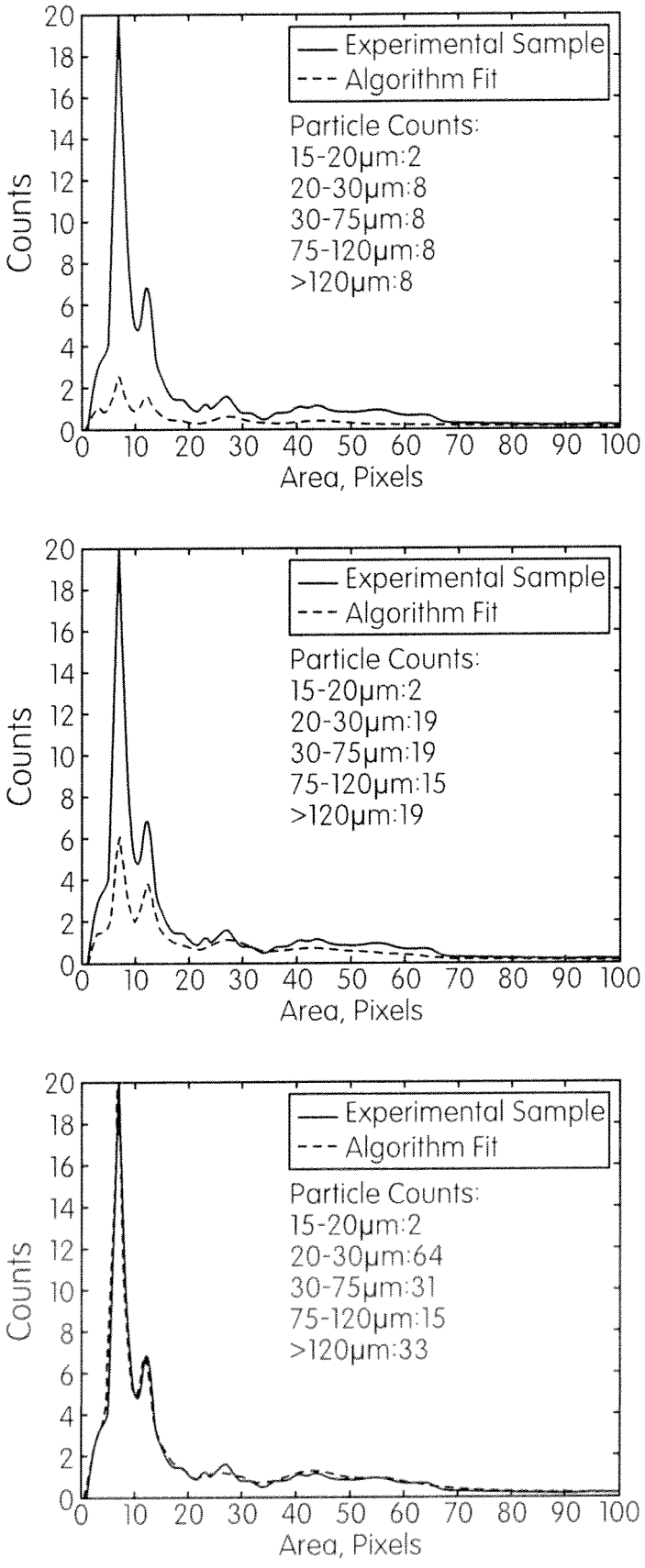

Experimental Sample
Algorithm Fit
Particle Counts:
15-20μm:2
20-30μm:8
30-75μm:8
75-120μm:8
>120μm:8
Counts
Area, Pixels
Experimental Sample
Algorithm Fit
Particle Counts:
15-20μm:2
20-30μm:19
30-75μm:19
75-120μm:15
>120μm:19
Counts
Area, Pixels
Experimental Sample
Algorithm Fit
Particle Counts:
15-20μm:2
20-30μm:64
30-75μm:31
75-120μm:15
>120μm:33
Counts
Area, Pixels

FIG. 35

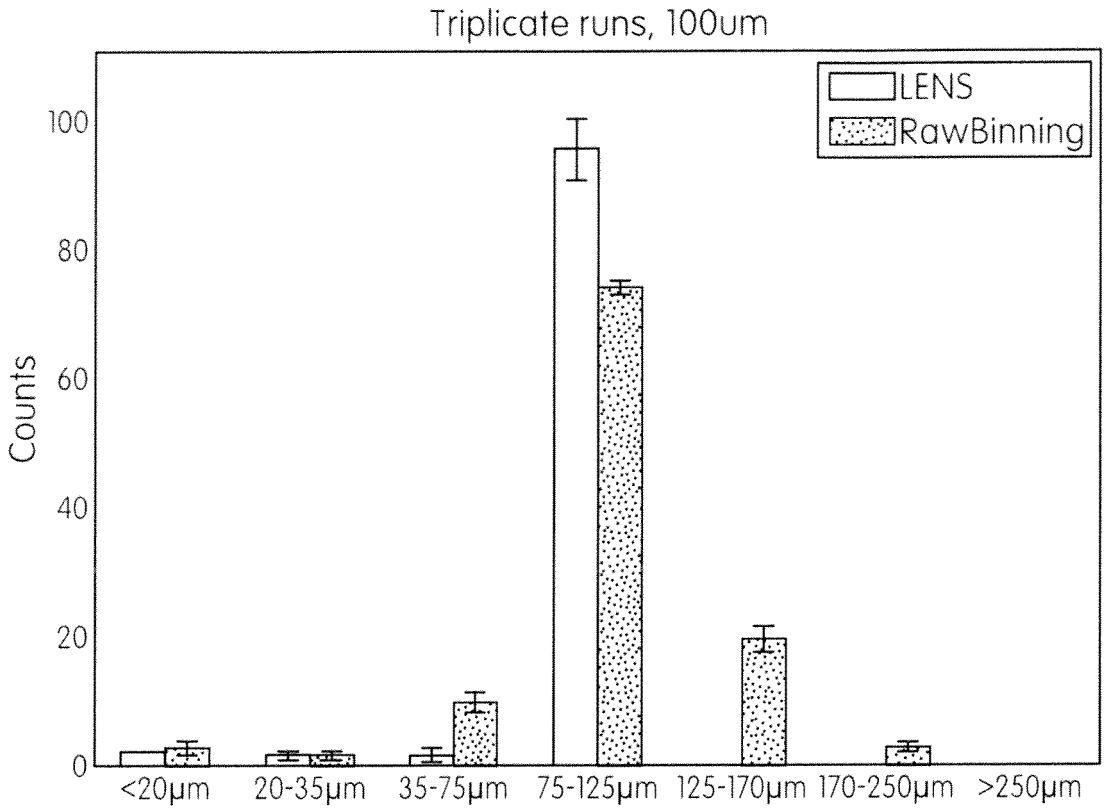

Triplicate runs, 100um
LENS
RawBinning
Counts
100
80
60
40
20
0
<20µm
20-35µm
35-75µm
75-125µm
125-170µm
170-250µm
>250µm

FIG. 36

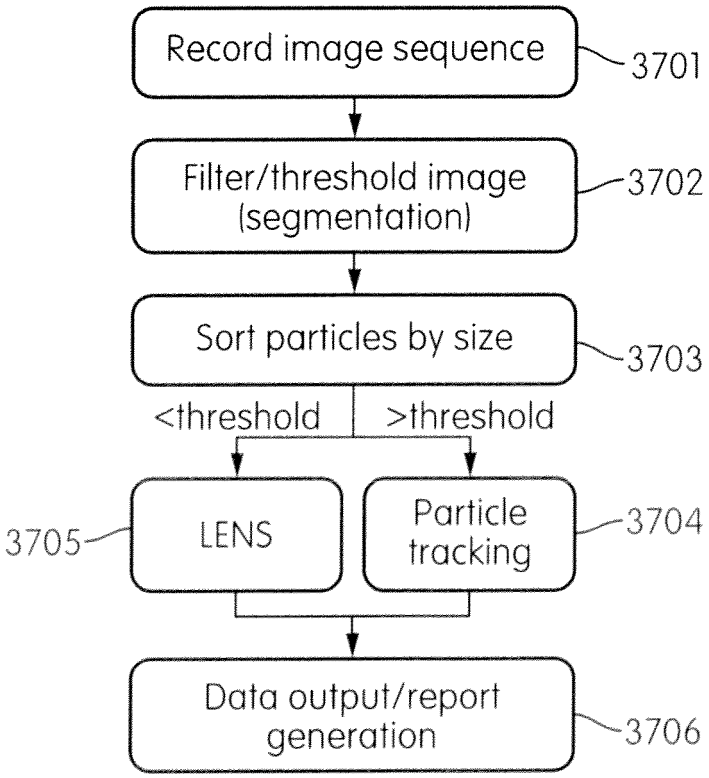

Record image sequence
3701
Filter/threshold image (segmentation)
3702
Sort particles by size
3703
<threshold
>threshold
3705
LENS
Particle tracking
3704
Data output/report generation
3706

FIG. 37

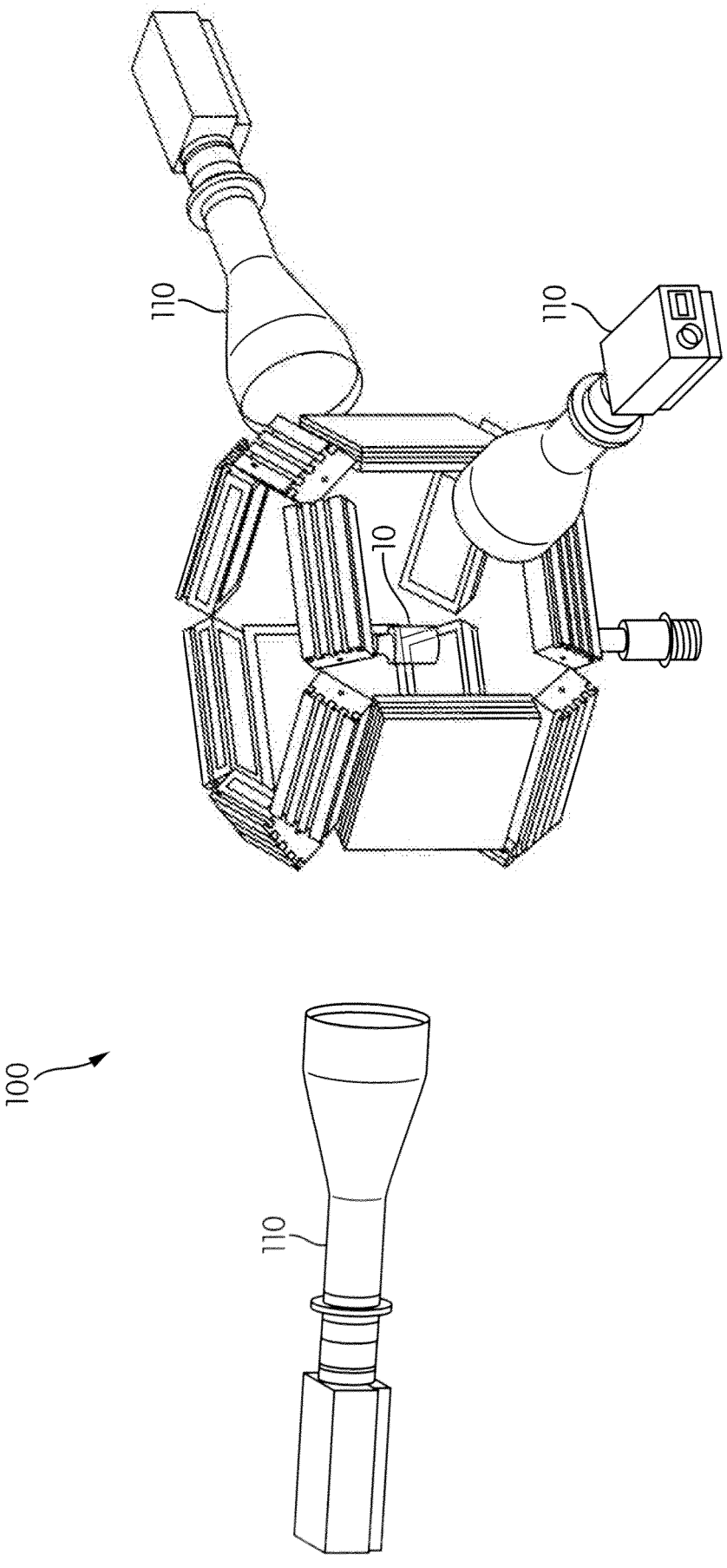


FIG. 38A

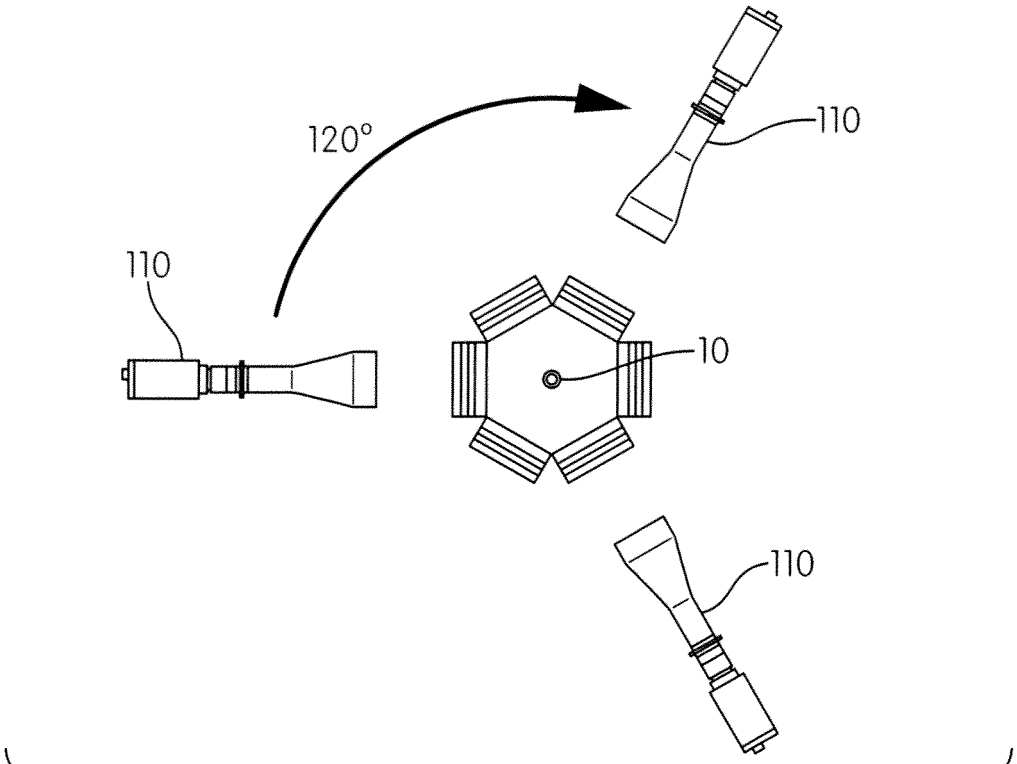


FIG. 38B

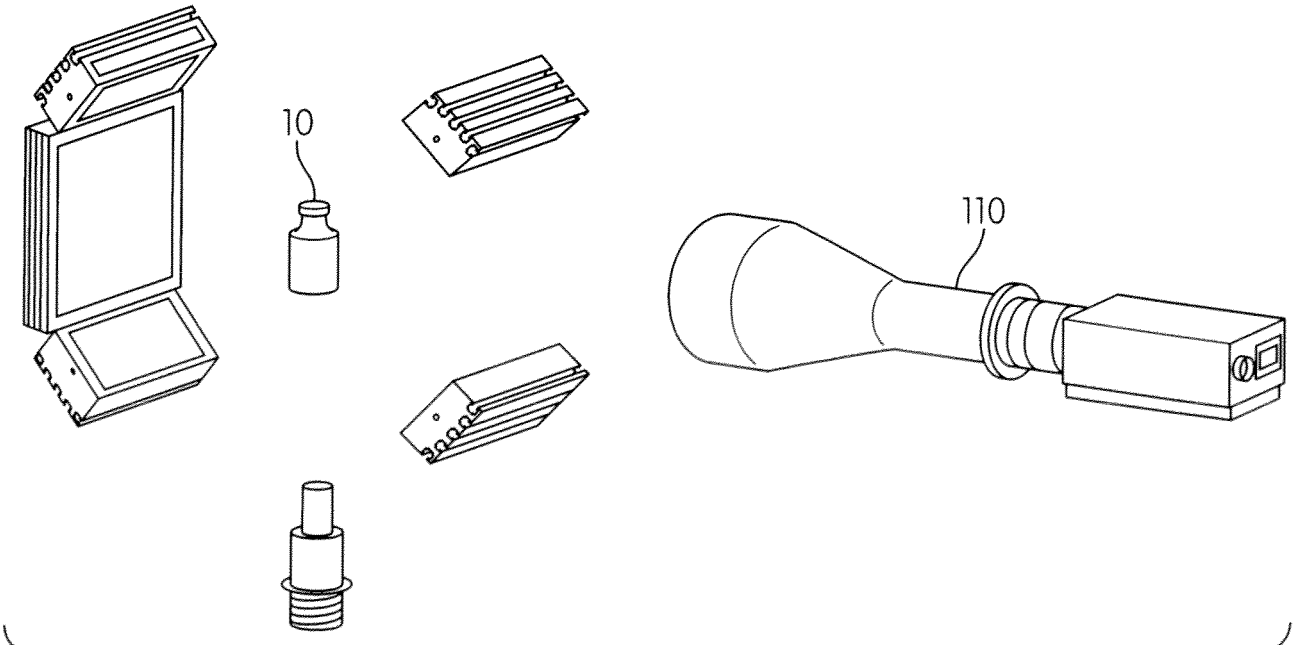


FIG. 38C

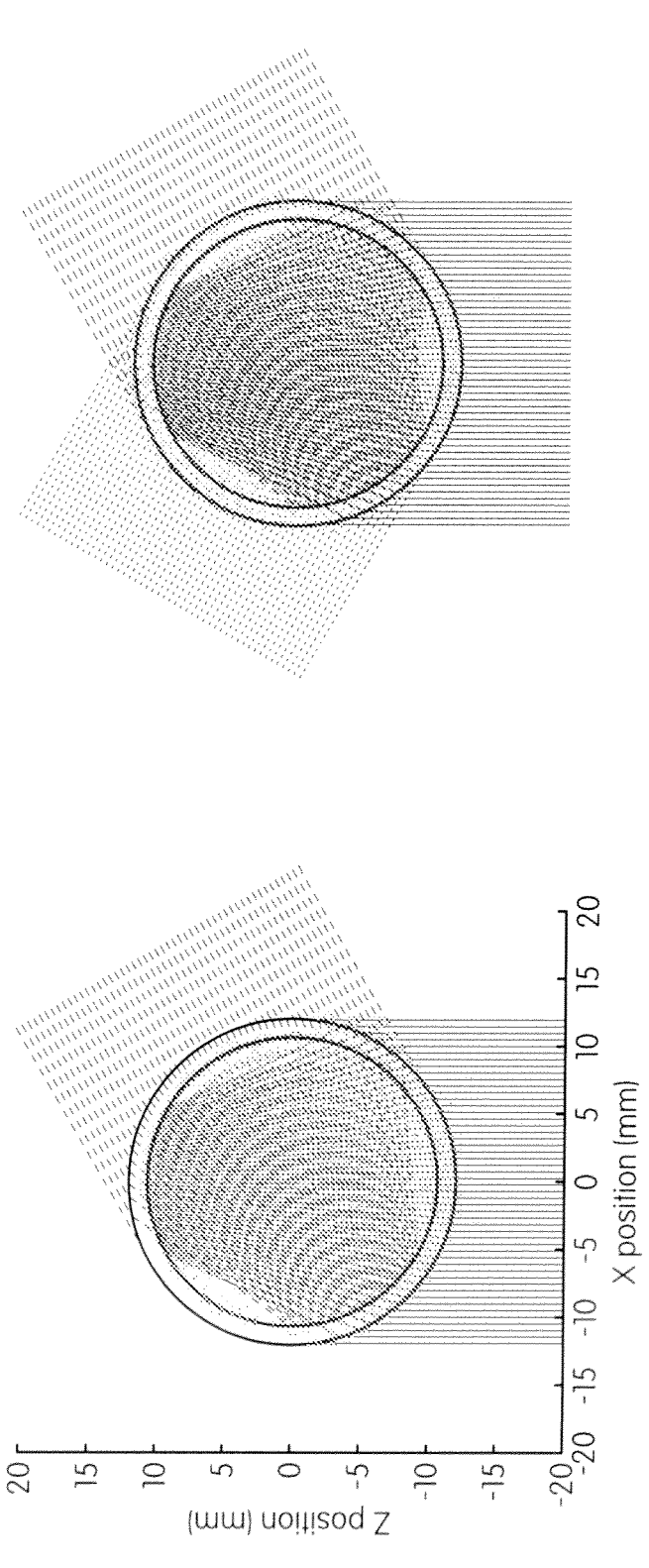

Z position (mm)
20
15
10
5
0
-5
-10
-15
-20
X position (mm)
-20
-15
-10
-5
0
5
10
15
20

FIG. 39

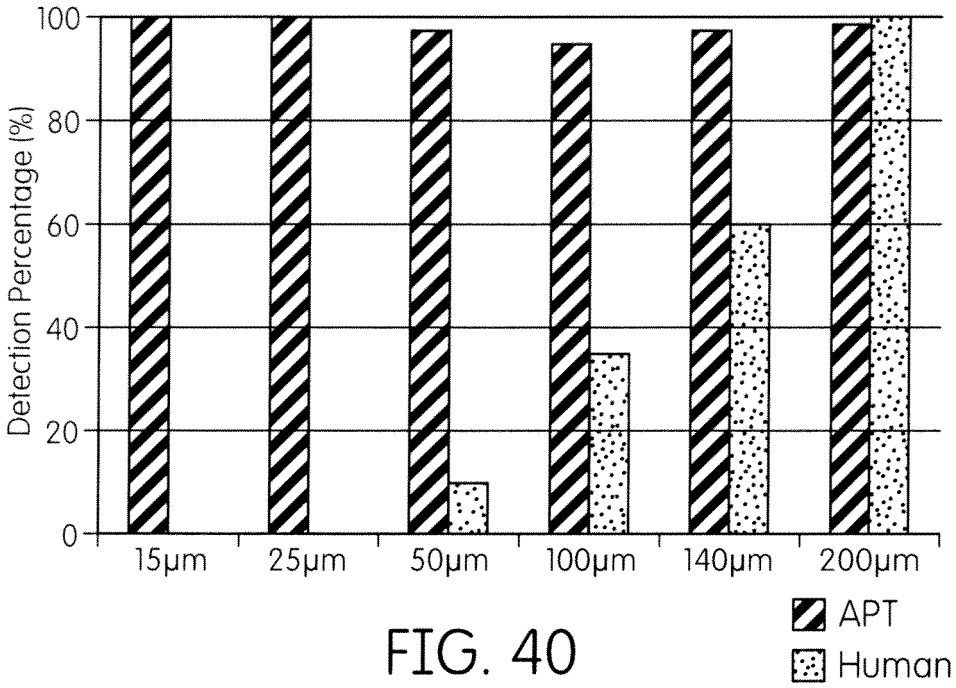

100
80
60
40
20
0
Detection Percentage (%)
15μm
25μm
50μm
100μm
140μm
200μm
APT
Human

FIG. 40

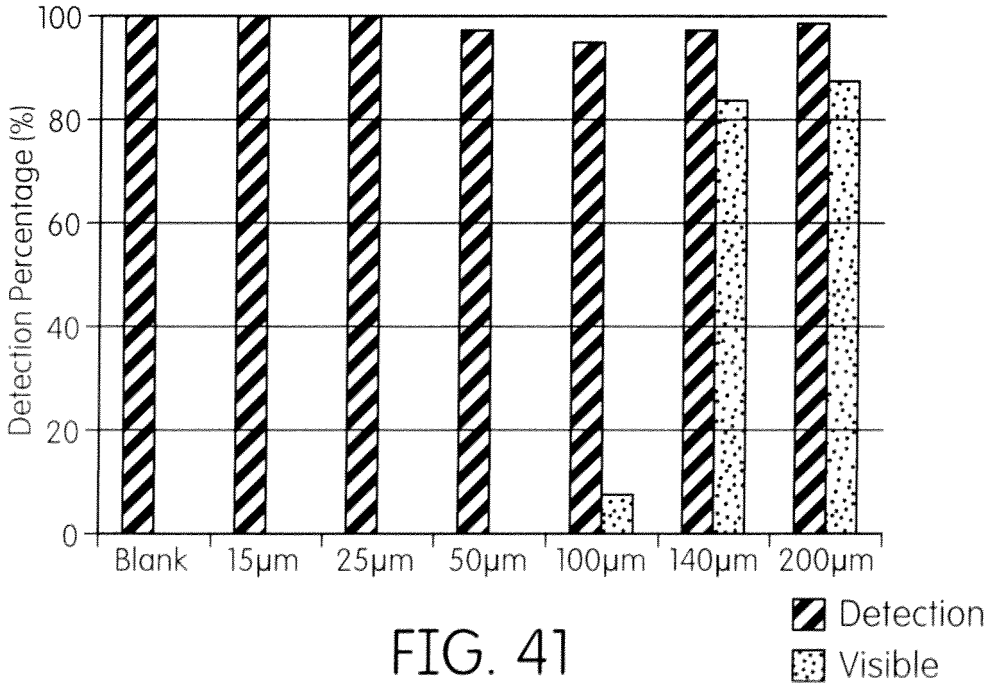

100
80
60
40
20
0
Detection Percentage (%)
Blank
15μm
25μm
50μm
100μm
140μm
200μm
Detection
Visible

FIG. 41

Size (μm)	R^2
15	0.995
50	0.993
100	0.995
140	0.957
200	0.985

FIG. 42

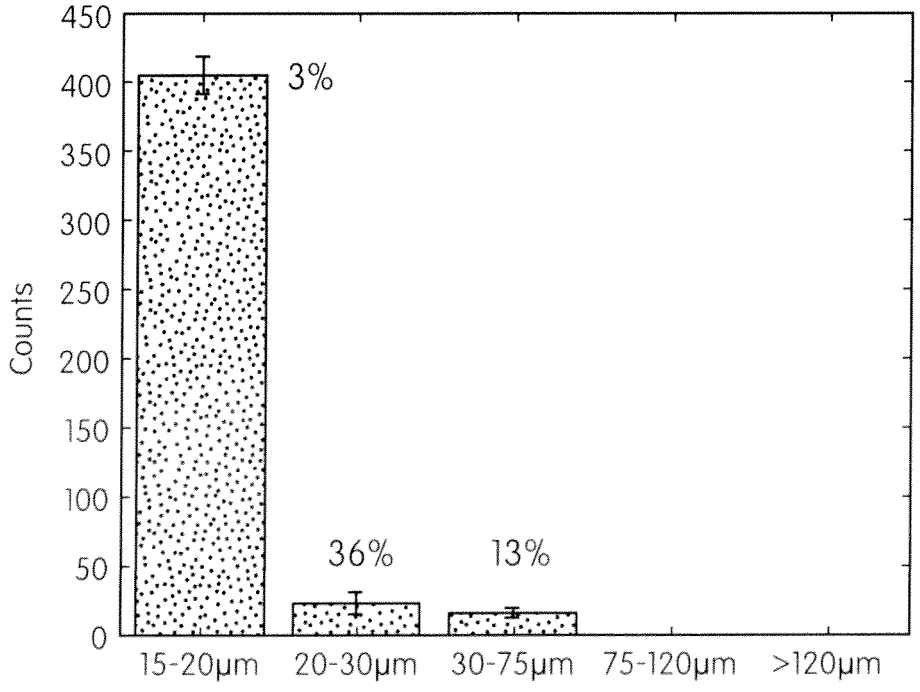


FIG. 43

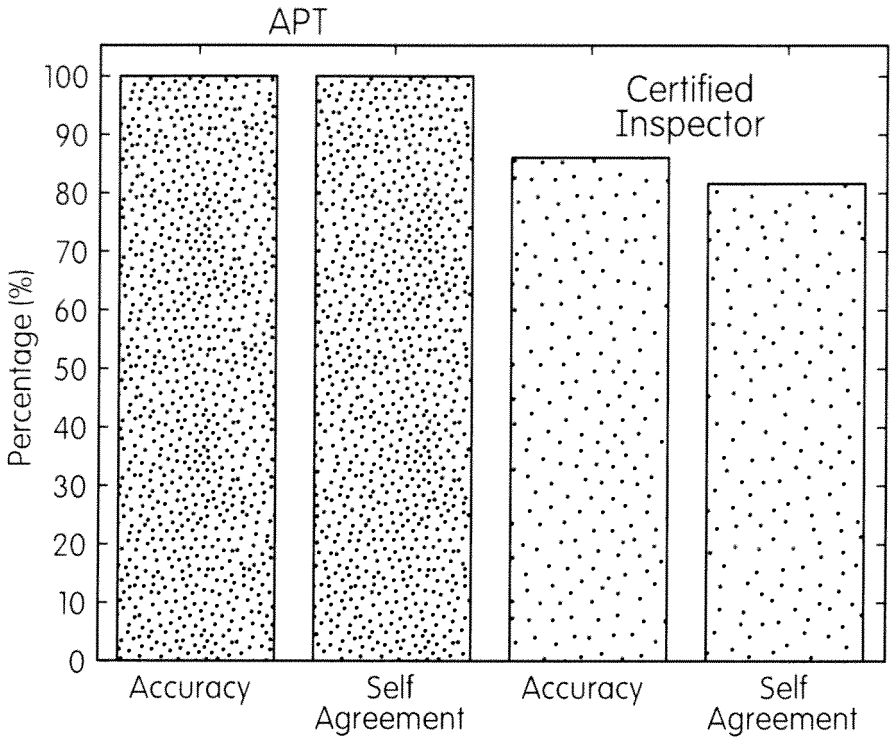

APT
Certified Inspector
Percentage (%)
100
90
80
70
60
50
40
30
20
10
0
Accuracy
Self Agreement
Accuracy
Self Agreement

FIG. 44

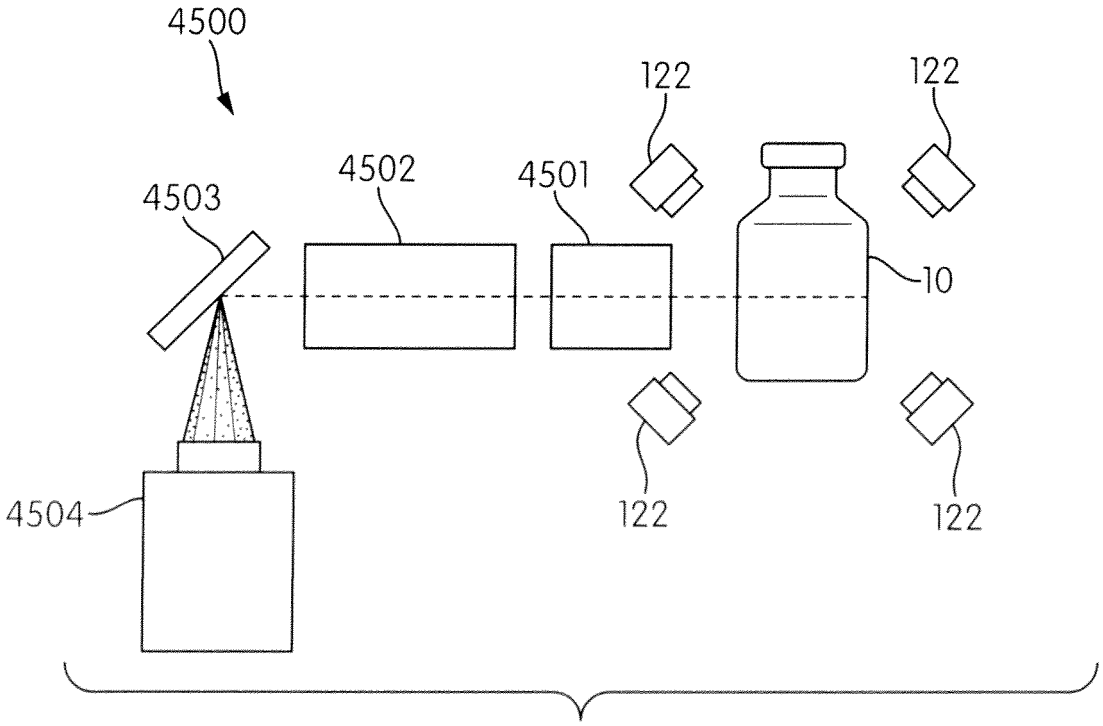

4500
4503
4502
4501
122
122
10
4504
122
122

FIG. 45