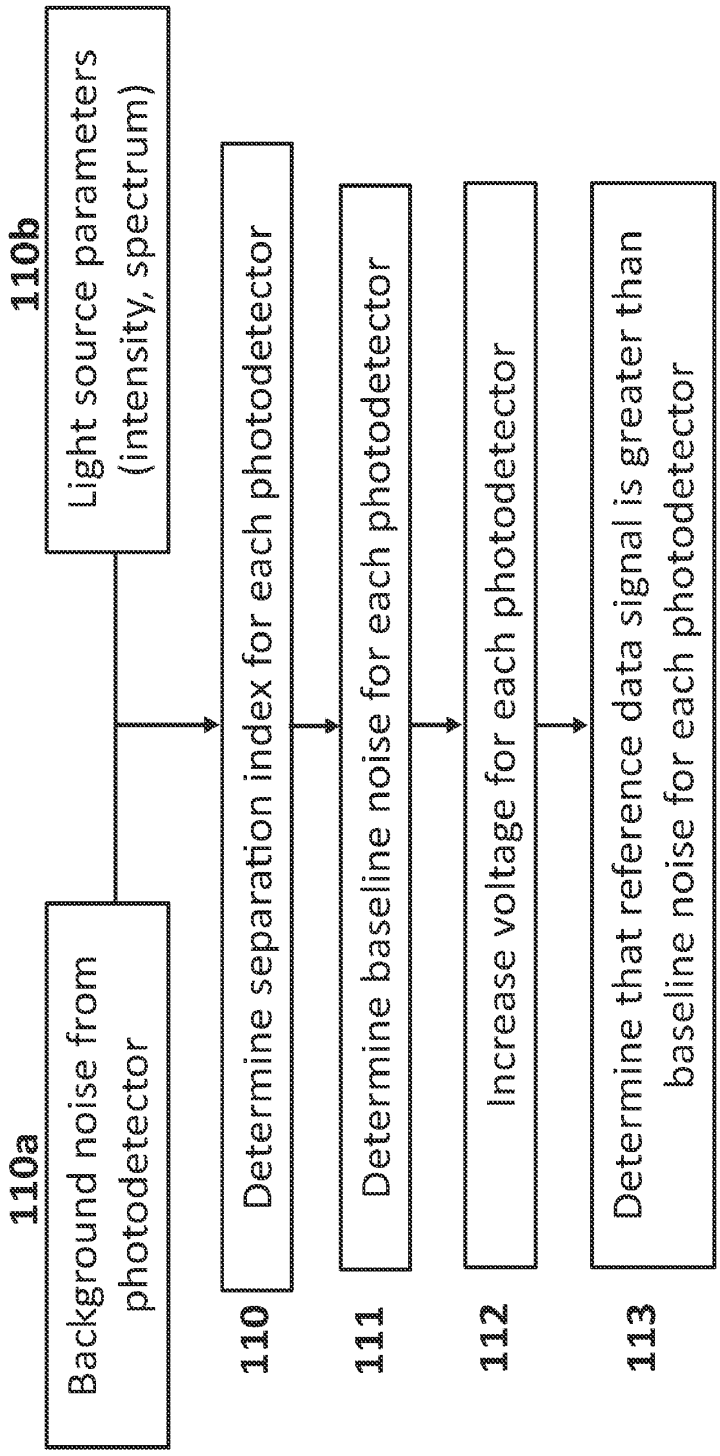

110a
Background noise from photodetector
110b
Light source parameters (intensity, spectrum)
110
Determine separation index for each photodetector
111
Determine baseline noise for each photodetector
112
Increase voltage for each photodetector
113
Determine that reference data signal is greater than baseline noise for each photodetector

FIG. 1A

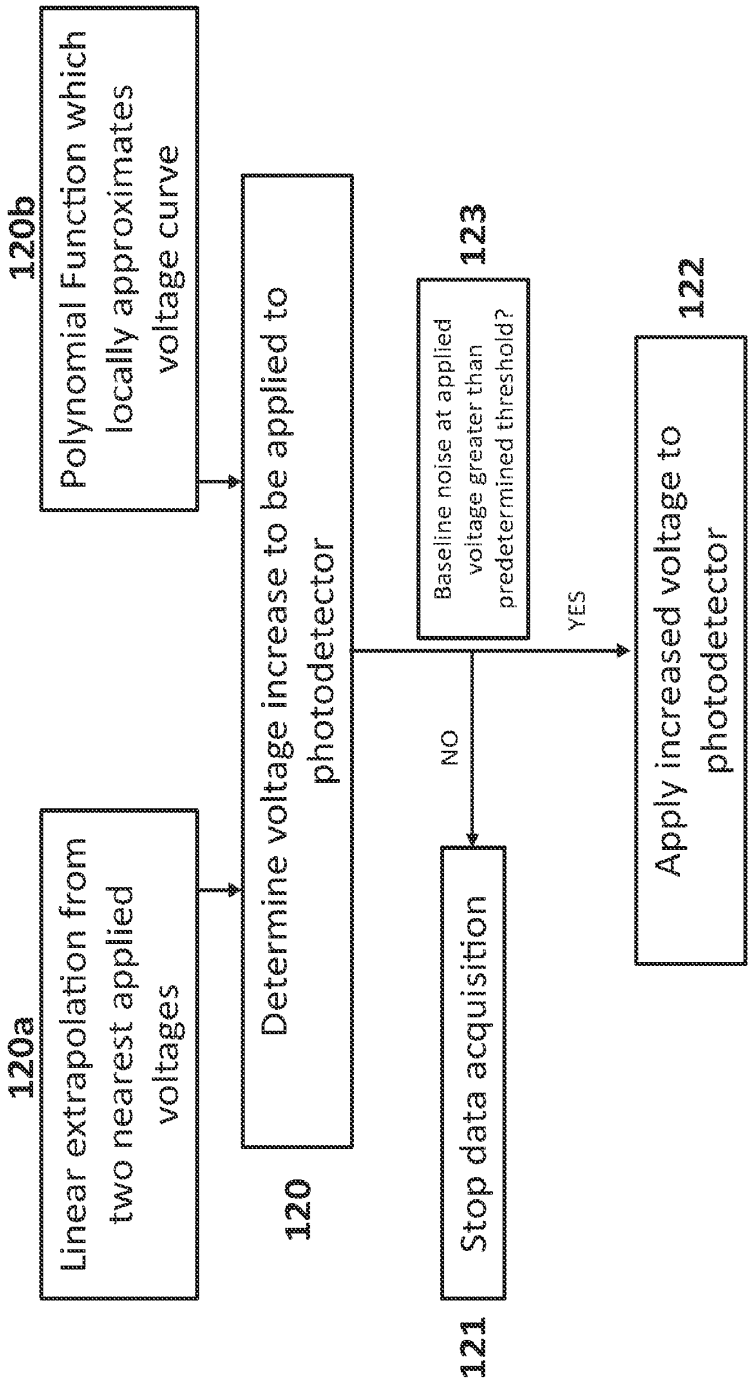

120b
Polynomial Function which locally approximates voltage curve
120a
Linear extrapolation from two nearest applied voltages
120
Determine voltage increase to be applied to photodetector
123
Baseline noise at applied voltage greater than predetermined threshold?
YES
NO
122
Apply increased voltage to photodetector
121
Stop data acquisition

FIG. 1B

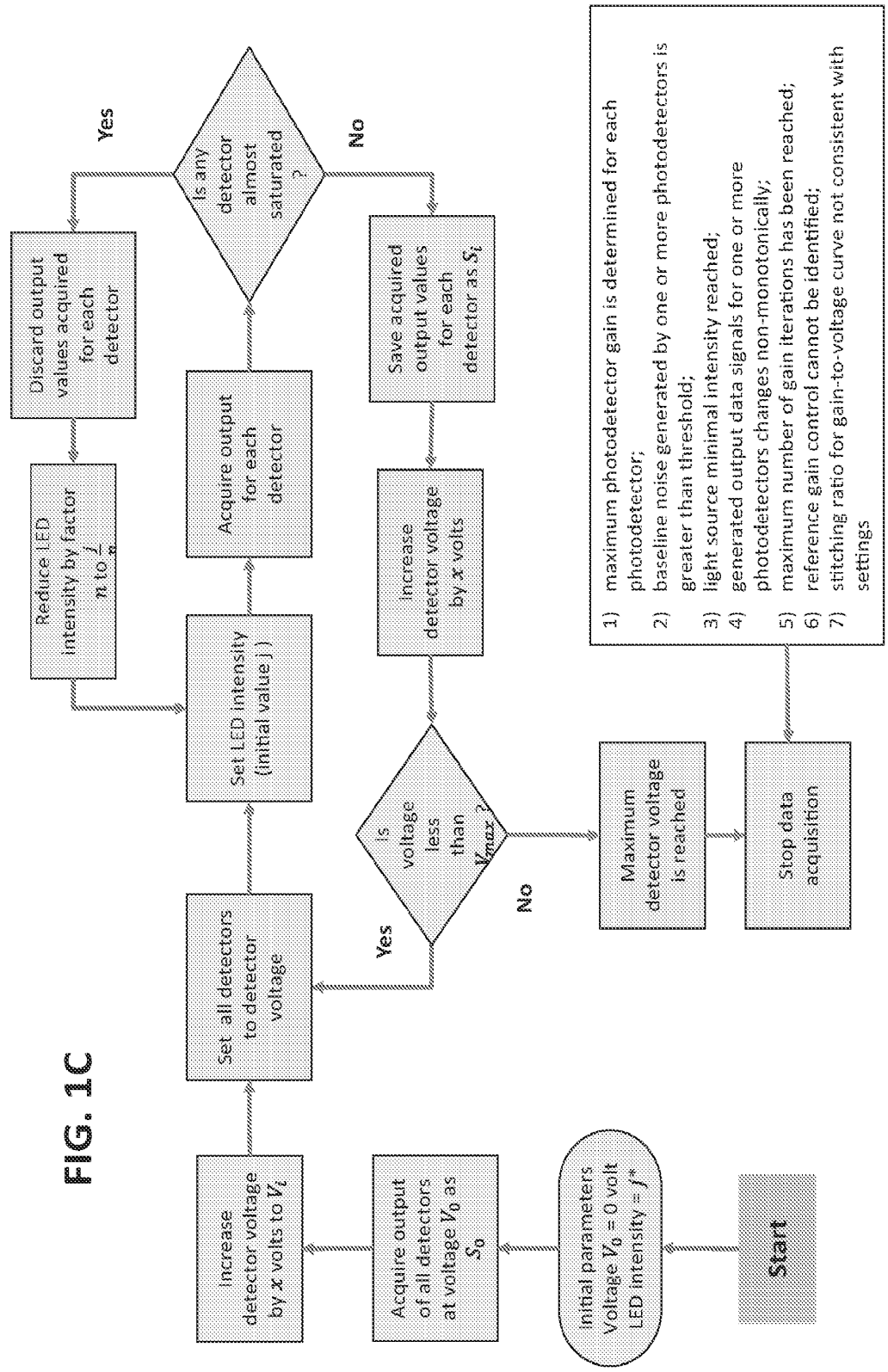

Start
initial parameters
Voltage V_0 = 0 volt
LED intensity = f^*
Acquire output of all detectors at voltage V_0 as S_0
Increase detector voltage by x volts to V_i
Set all detectors to detector voltage
Set LED intensity (initial value j)
Acquire output for each detector
Is any detector almost saturated ?
Yes
Discard output values acquired for each detector
Reduce LED intensity by factor n to $\frac{j}{n}$
No
Save acquired output values for each detector as S_i
Increase detector voltage by x volts
Is voltage less than V_{max} ?
Yes
No
Maximum detector voltage is reached
Stop data acquisition
1) maximum photodetector gain is determined for each photodetector;
2) baseline noise generated by one or more photodetectors is greater than threshold;
3) light source minimal intensity reached;
4) generated output data signals for one or more photodetectors changes non-monotonically;
5) maximum number of gain iterations has been reached;
6) reference gain control cannot be identified;
7) stitching ratio for gain-to-voltage curve not consistent with settings

FIG. 1C

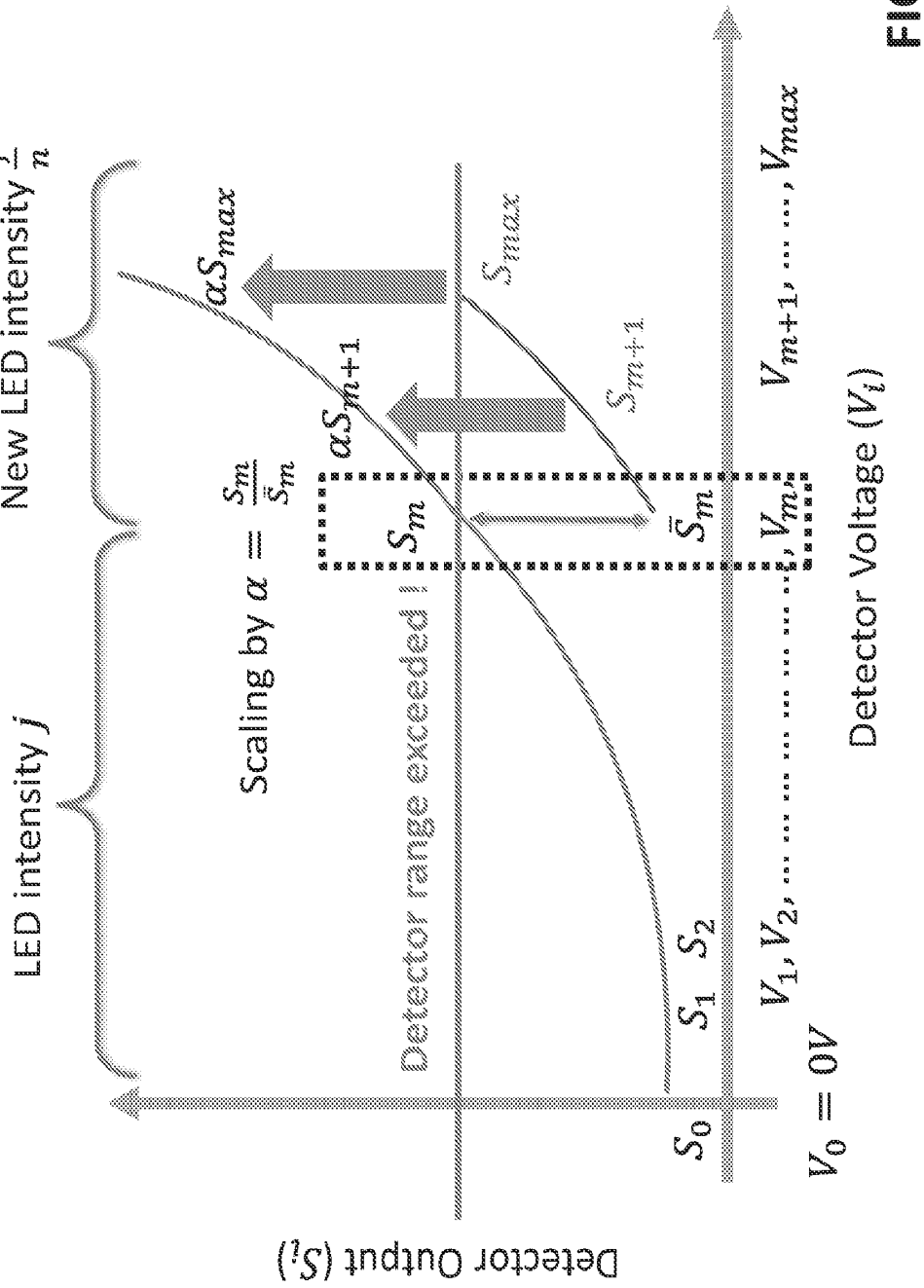

Detector Output (S_i)
$V_0 = 0V$
$V_1, V_2, \ldots, V_m, V_{m+1}, \ldots, V_{max}$
Detector Voltage (V_i)
S_0
S_1 S_2
S_m
$\bar{S}_m$
S_{max}
S_{m+1}
Detector range exceeded !
αS_m
αS_{m+1}
αS_{max}
Scaling by $\alpha = \frac{S_m}{\bar{S}_m}$
LED intensity j
New LED intensity $\frac{j}{n}$

FIG. 2

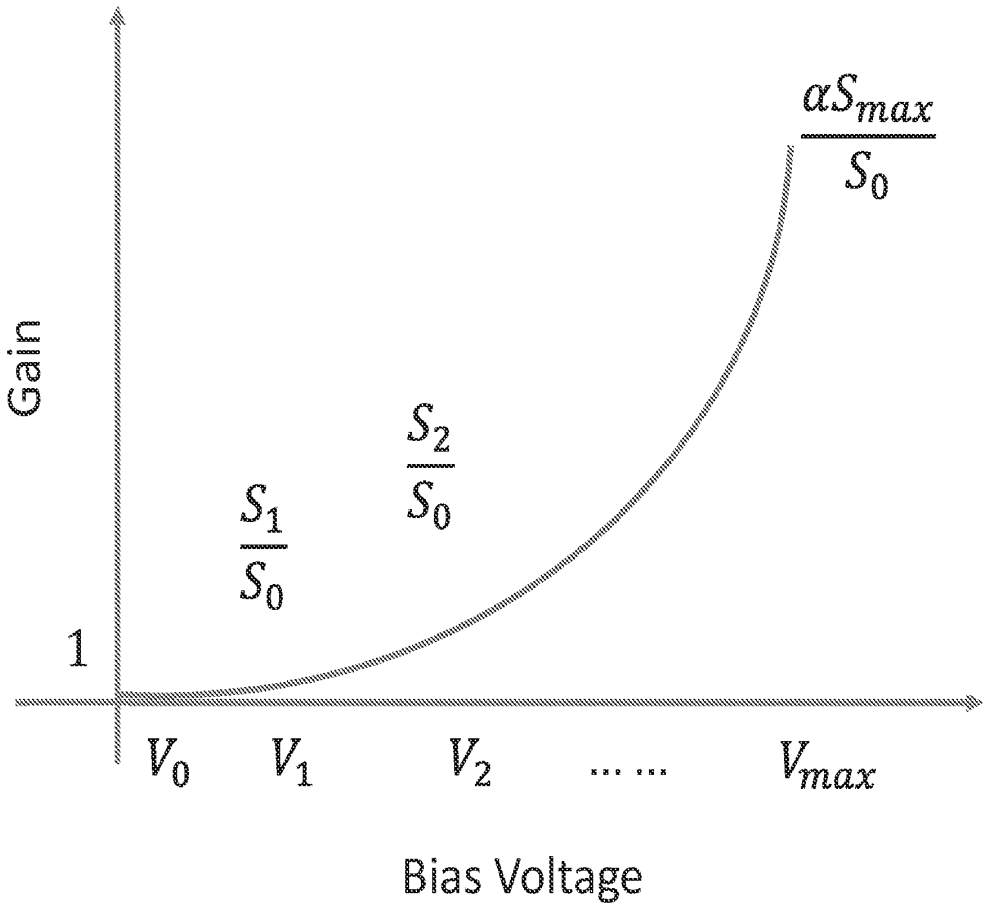
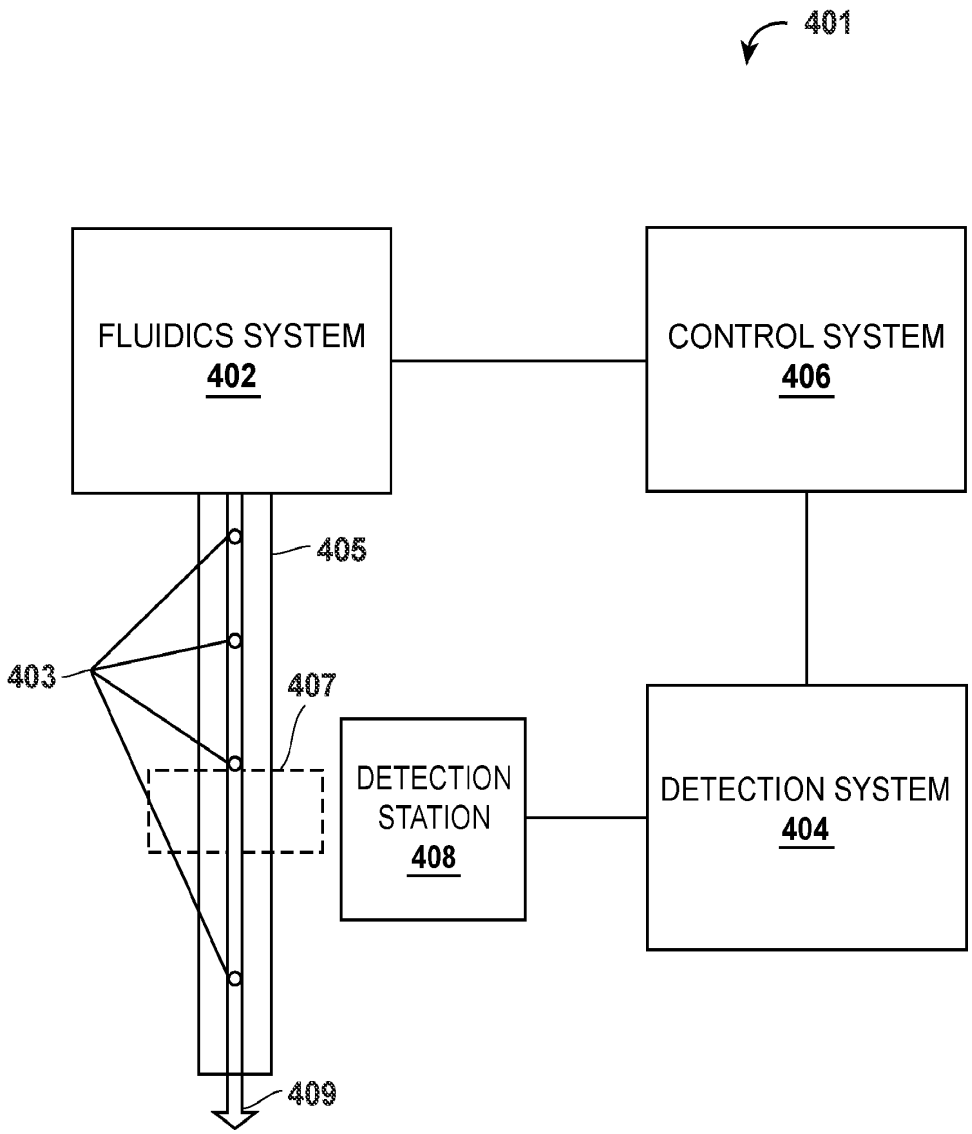

$\frac{\alpha S_{max}}{S_0}$
Gain
$\frac{S_2}{S_0}$
$\frac{S_1}{S_0}$
1
V_0
V_1
V_2
… …
V_{max}
Bias Voltage

FIG. 3

FIG. 4A


401
FLUIDICS SYSTEM
402
CONTROL SYSTEM
406
405
403
407
DETECTION
STATION
408
DETECTION SYSTEM
404
409

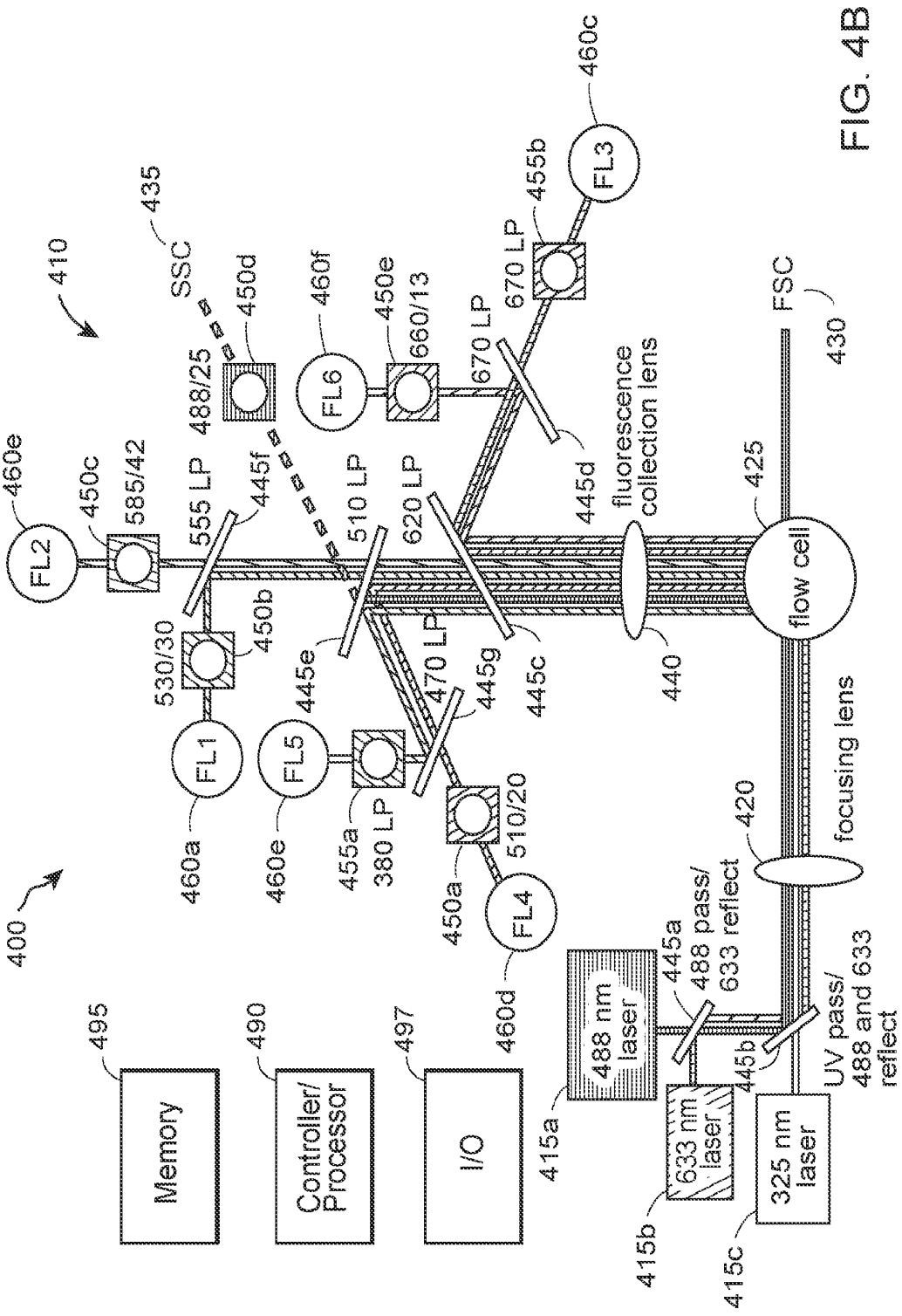

400
410
435
SSC
460e
FL2
450c
585/42
555 LP
445f
488/25
450d
460f
FL6
450e
660/13
670 LP
670 LP
455b
FL3
460c
530/30
450b
FL1
460a
FL5
460e
455a
380 LP
445e
510 LP
620 LP
470 LP
445g
445c
445d
fluorescence collection lens
440
425
flow cell
FSC
430
focusing lens
420
510/20
450a
FL4
460d
495
Memory
490
Controller/ Processor
497
I/O
415a
488 nm laser
445a
488 pass/ 633 reflect
445b
UV pass/ 488 and 633 reflect
633 nm laser
415b
325 nm laser
415c

FIG. 4B

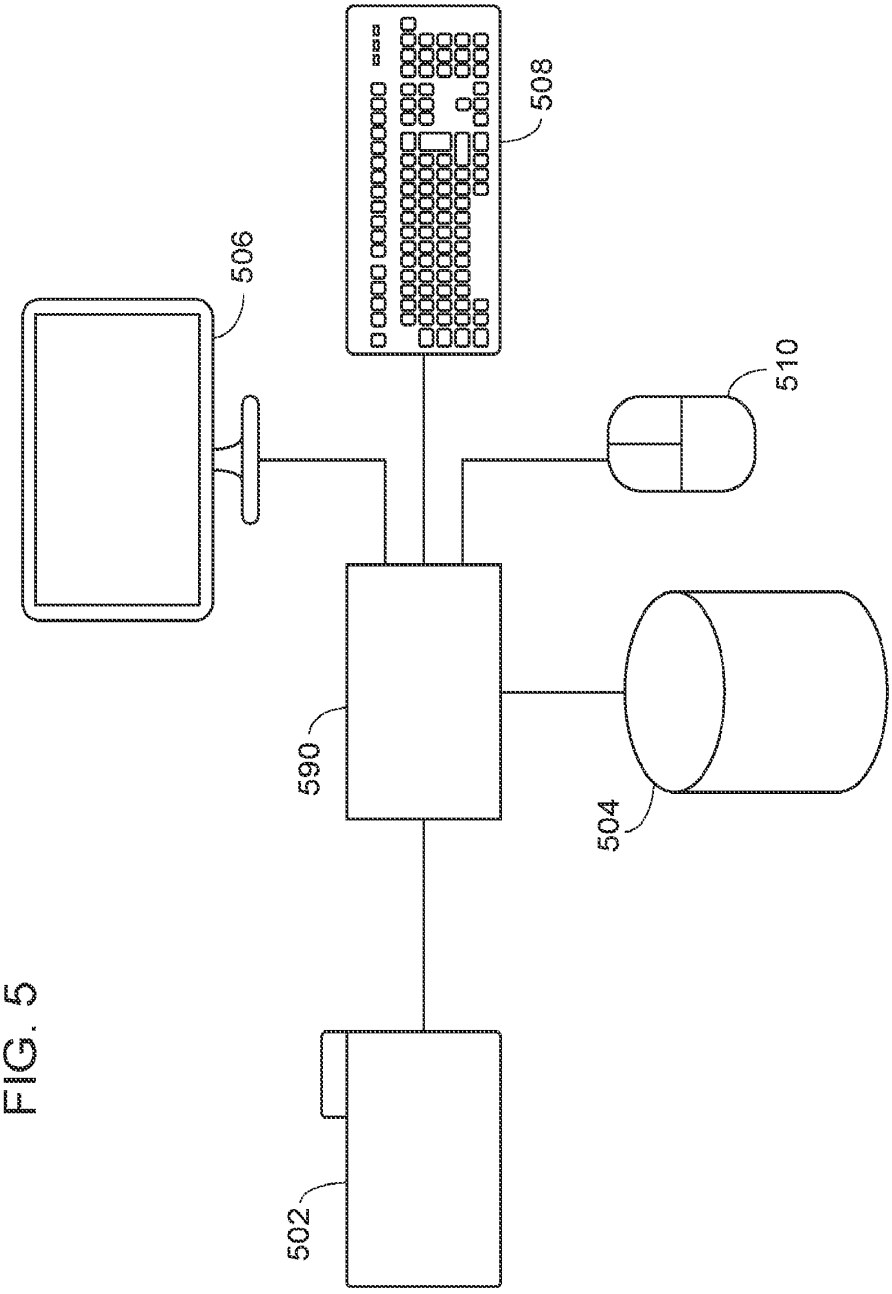


FIG. 5

FIG. 6A

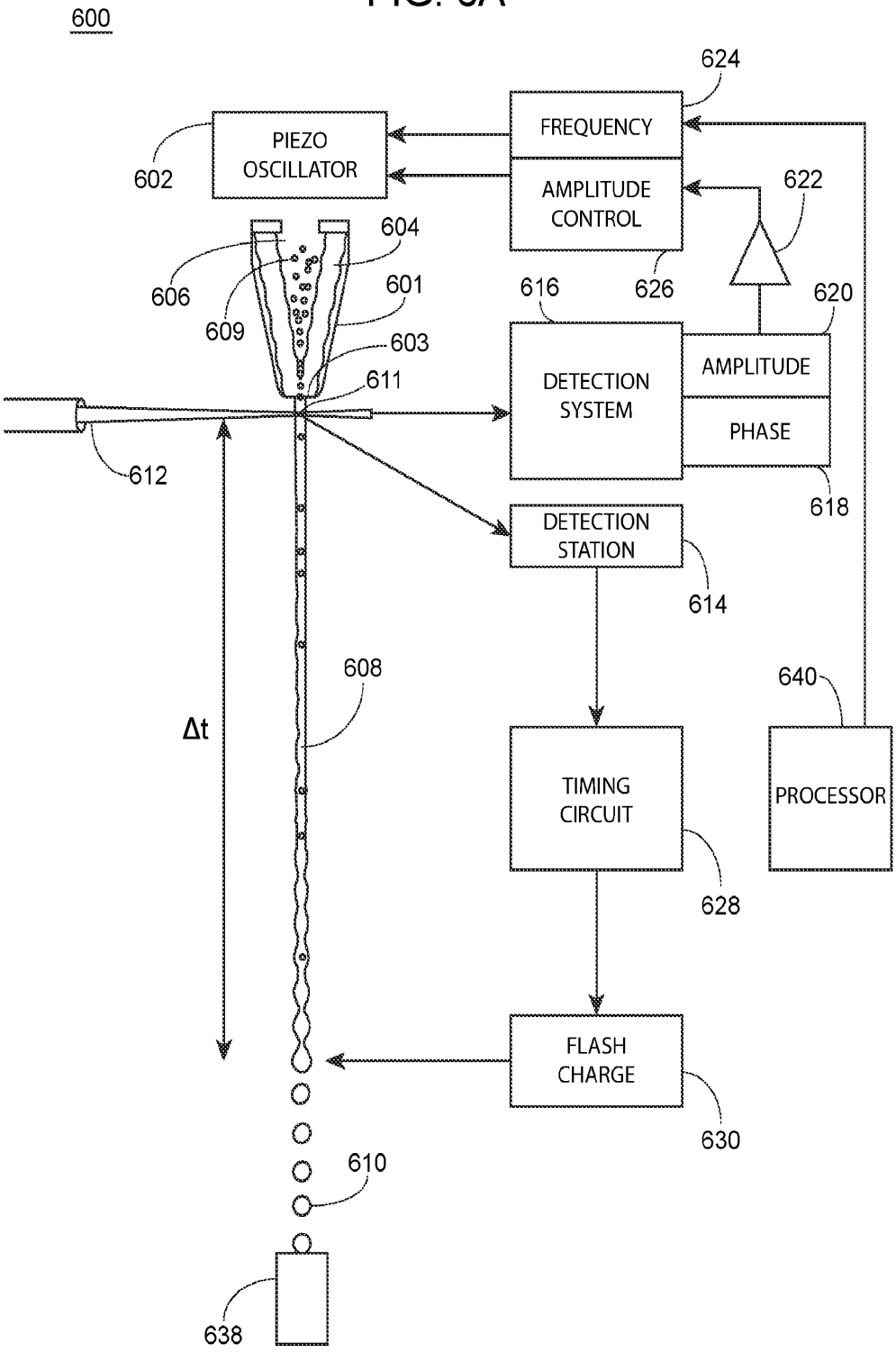

600
624
FREQUENCY
PIEZO OSCILLATOR
602
AMPLITUDE CONTROL
622
604
606
601
609
603
611
616
626
620
DETECTION SYSTEM
AMPLITUDE
PHASE
612
618
DETECTION STATION
614
608
640
Δt
TIMING CIRCUIT
PROCESSOR
628
FLASH CHARGE
630
610
638

FIG. 6B

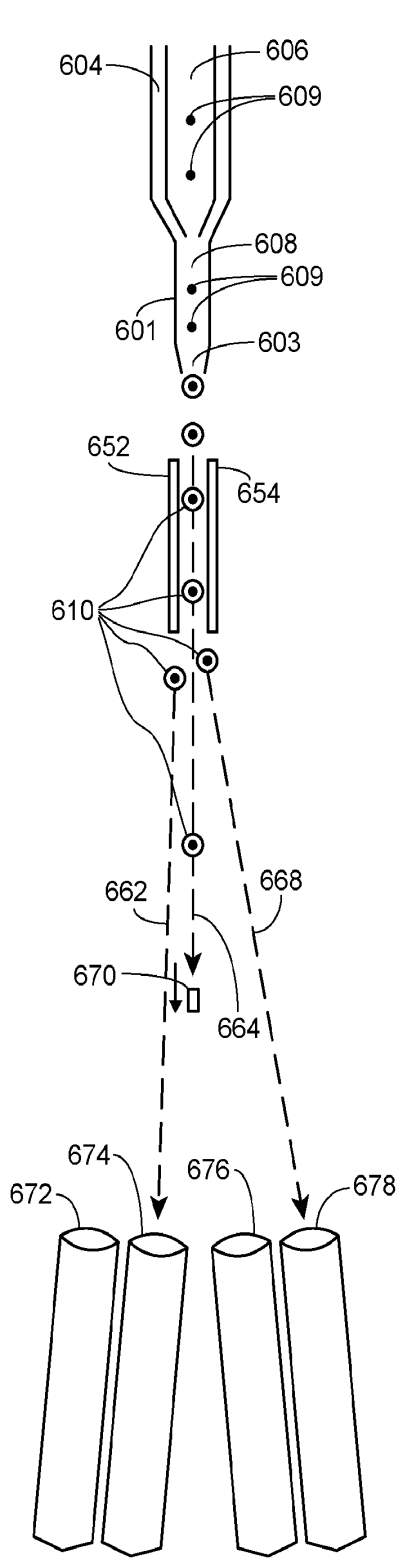
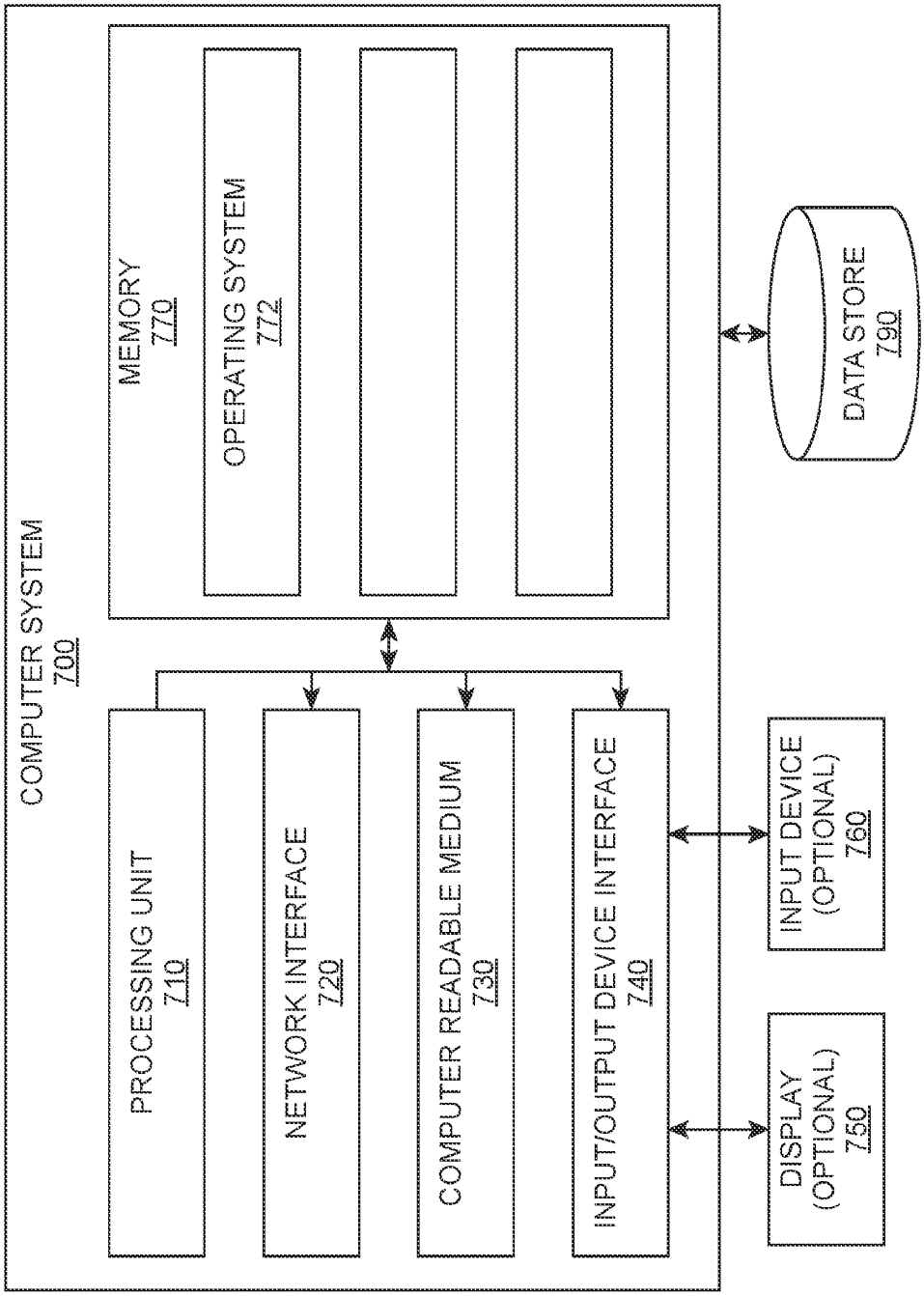

600
604
606
609
608
609
601
603
652
654
610
662
668
670
664
674
676
678
672

FIG. 7


COMPUTER SYSTEM
700
MEMORY
770
OPERATING SYSTEM
772
PROCESSING UNIT
710
NETWORK INTERFACE
720
COMPUTER READABLE MEDIUM
730
INPUT/OUTPUT DEVICE INTERFACE
740
DATA STORE
790
INPUT DEVICE
(OPTIONAL)
760
DISPLAY
(OPTIONAL)
750