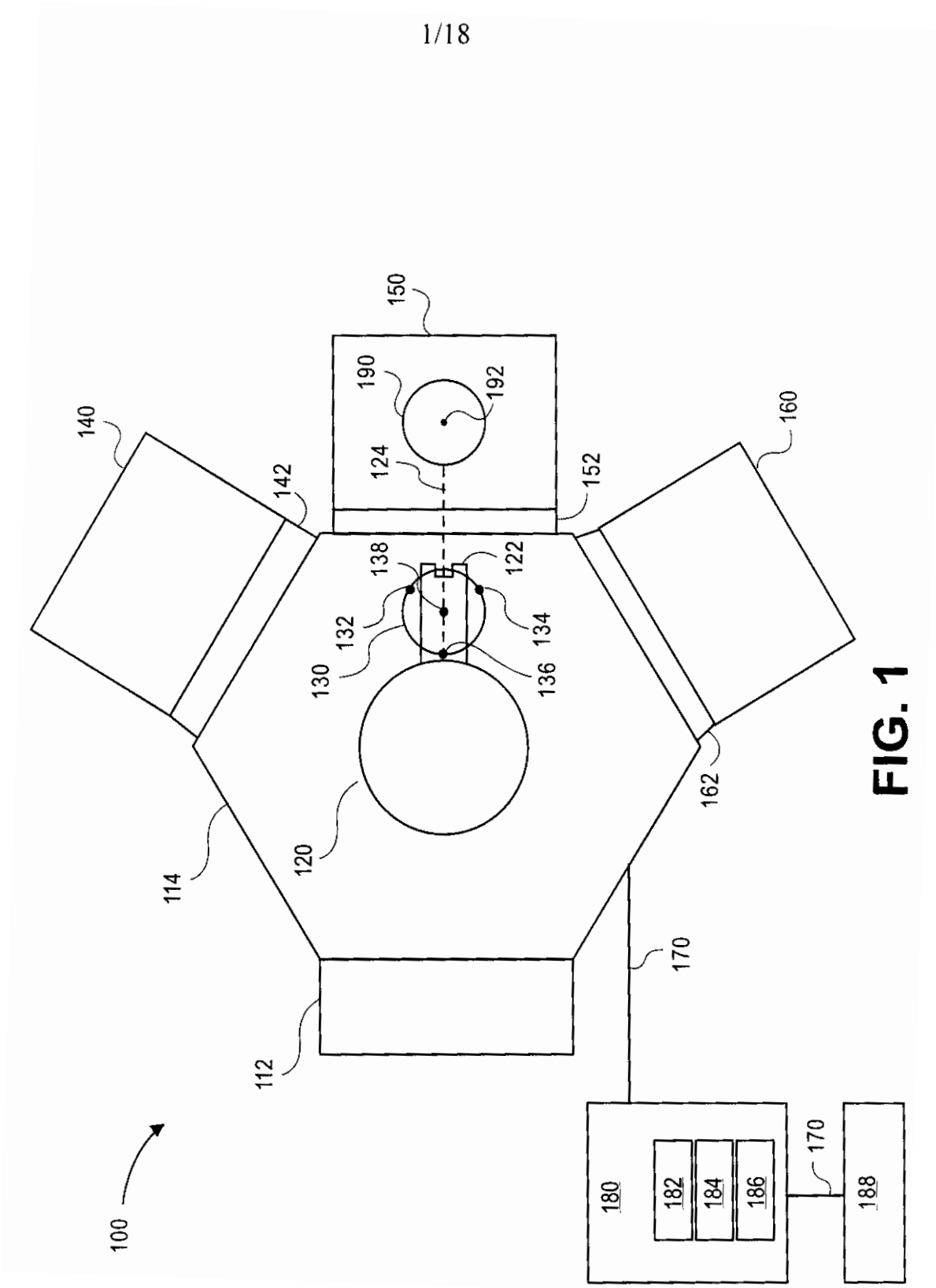

100
112
114
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192
122
124

FIG. 1

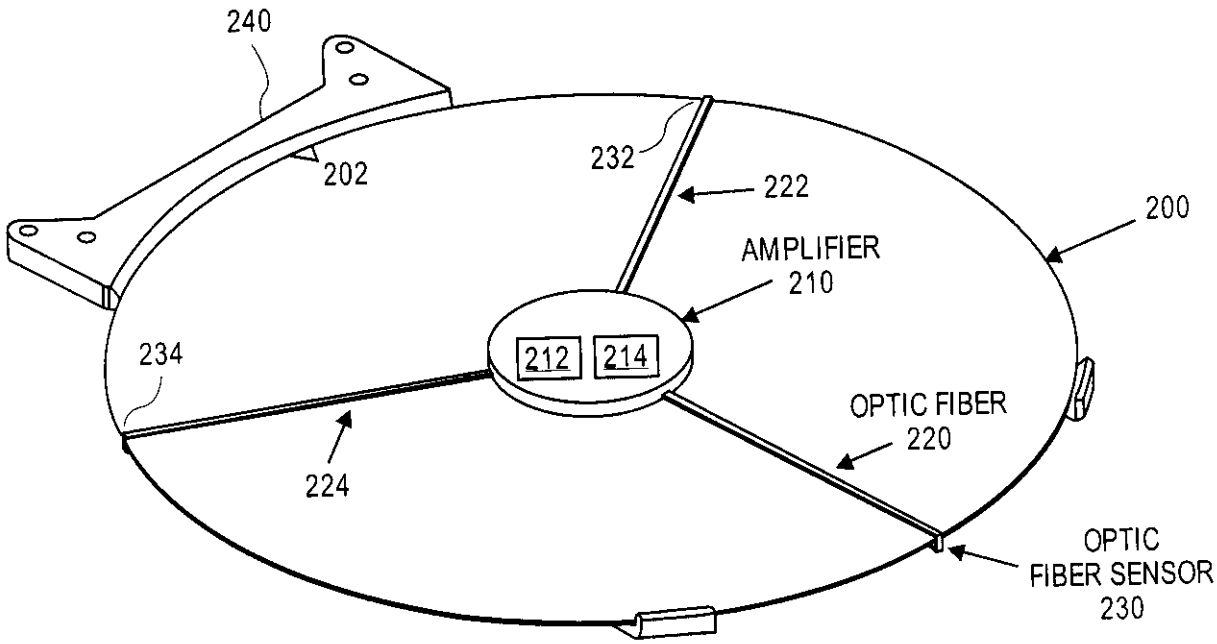

240
202
232
222
200
AMPLIFIER
210
212
214
234
OPTIC FIBER
220
224
OPTIC
FIBER SENSOR
230

FIG. 2A

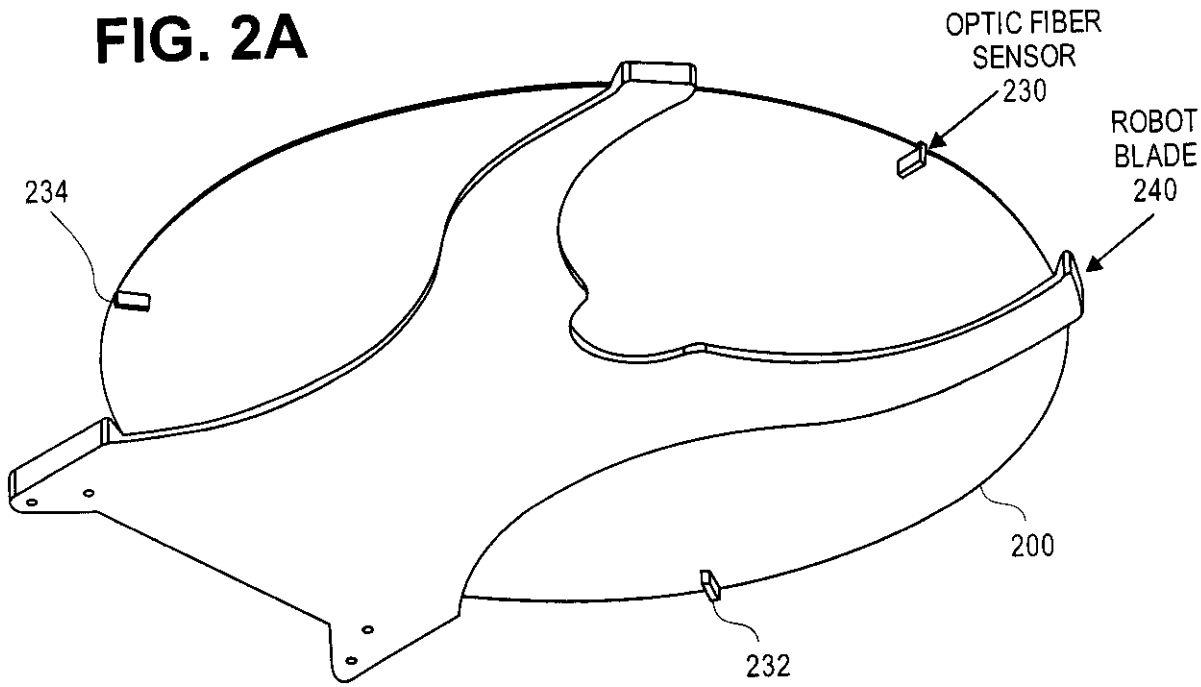

OPTIC FIBER
SENSOR
230
ROBOT
BLADE
240
234
200
232

FIG. 2B

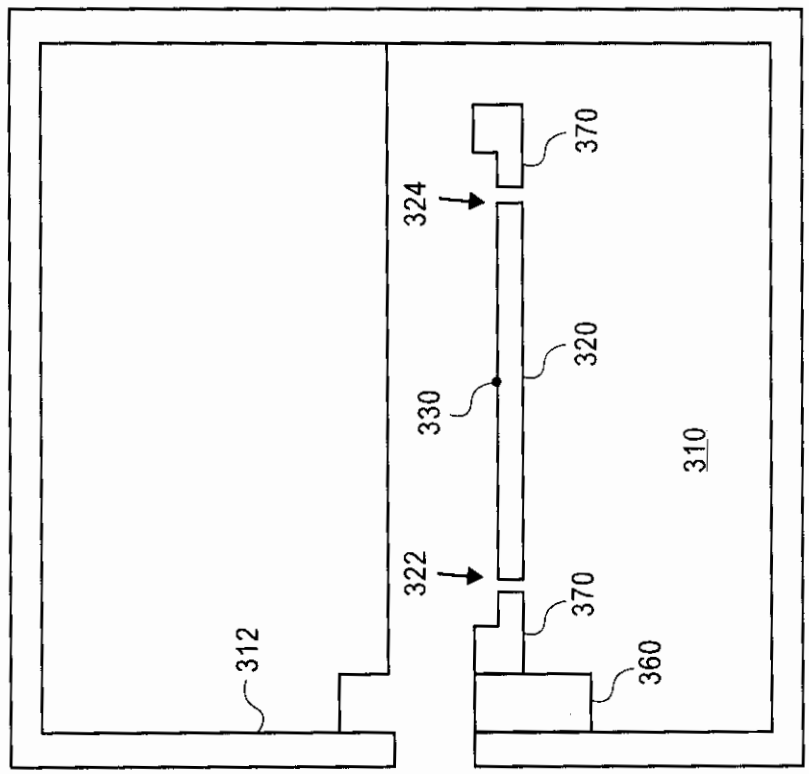
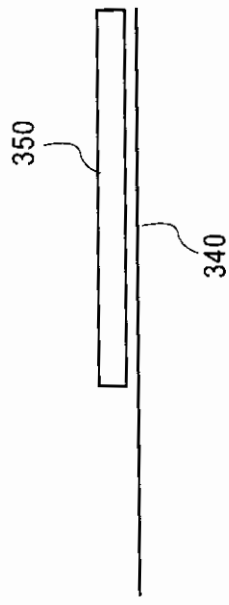


FIG. 3A



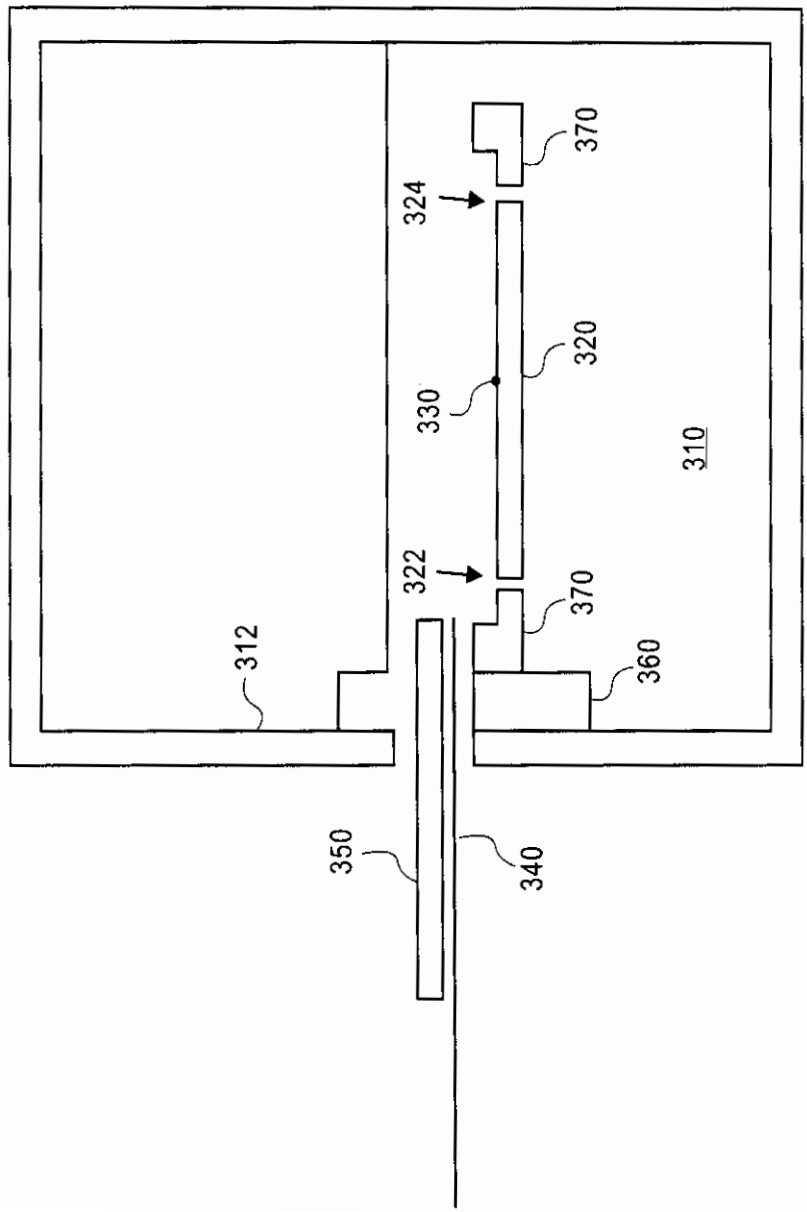


FIG. 3B

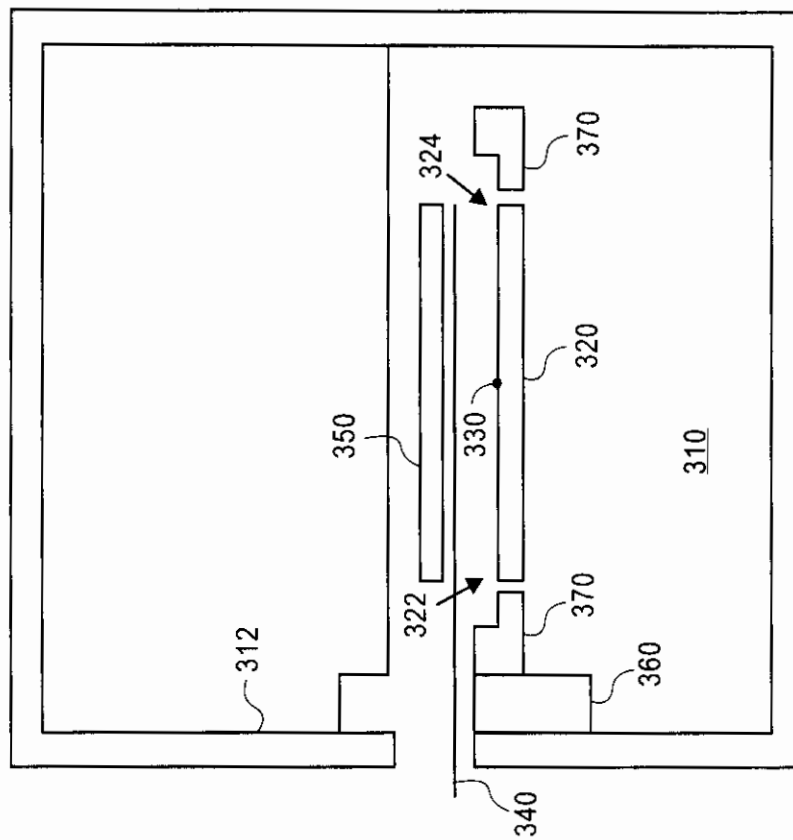


FIG. 3C

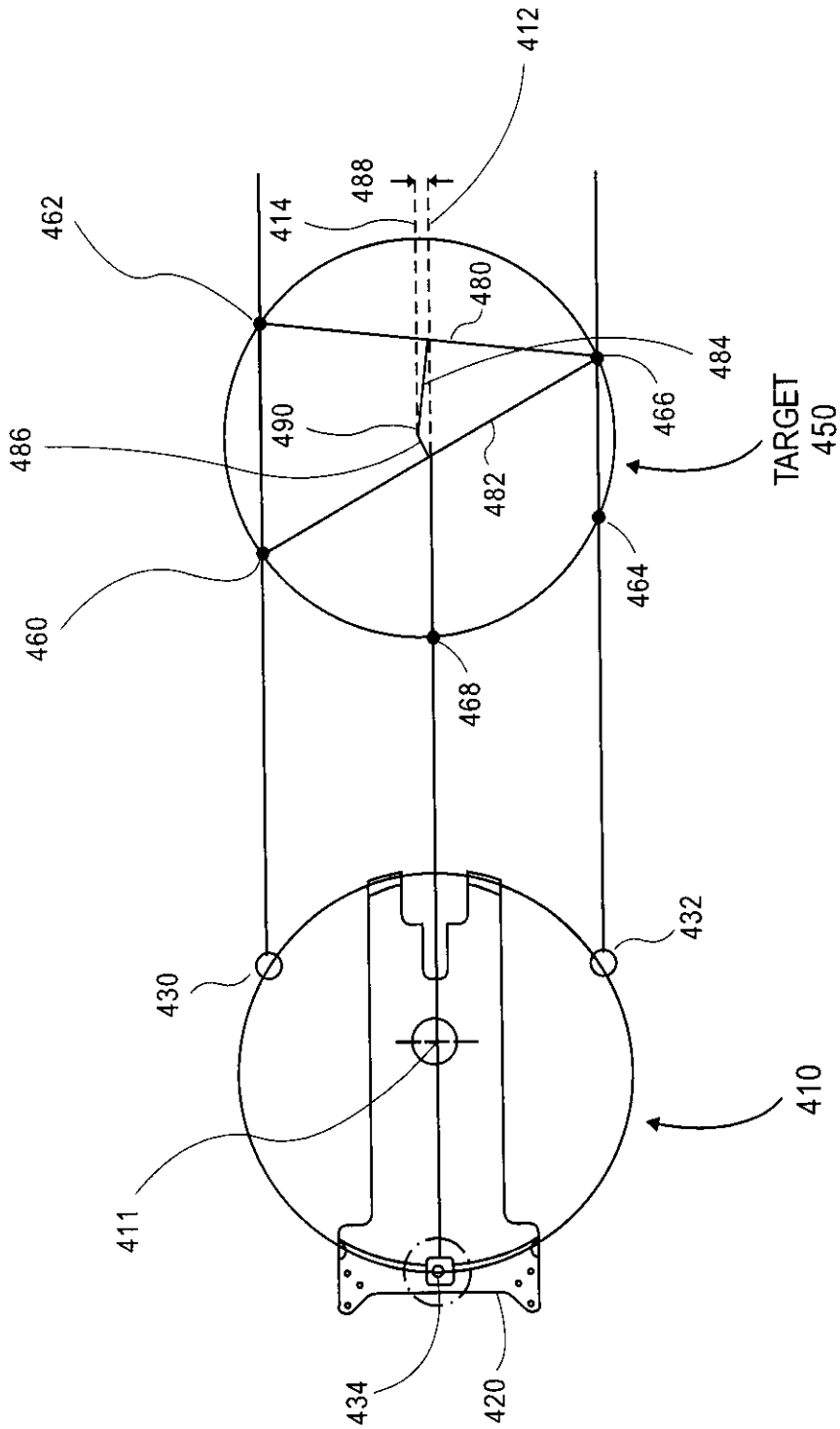

412
488
414
462
480
484
466
TARGET
450
486
490
482
460
464
468
432
430
410
411
434
420

FIG. 4A

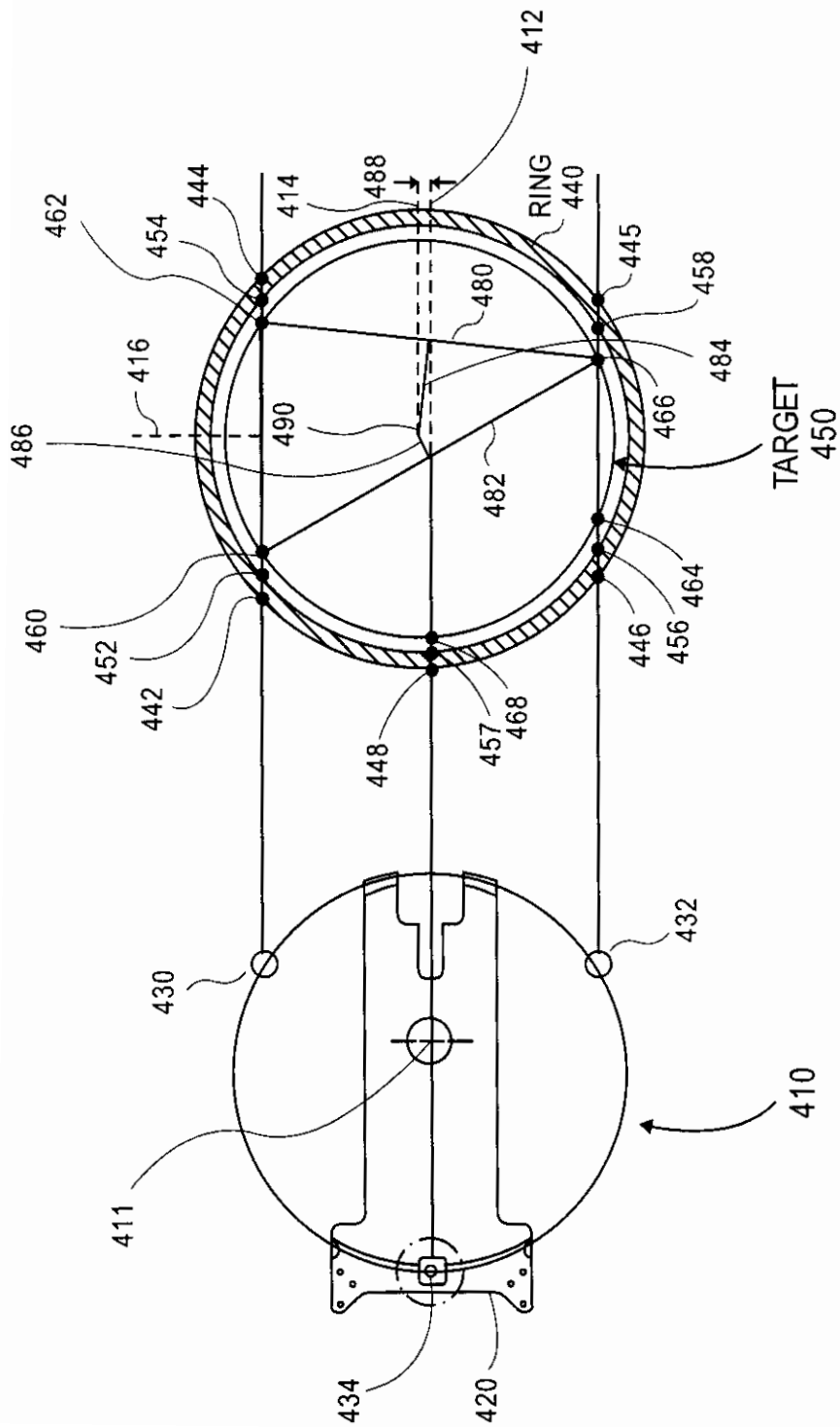

412
462
454
444
414
488
RING
440
445
458
480
484
416
466
486
490
482
TARGET
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460
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442
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434
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FIG. 4B

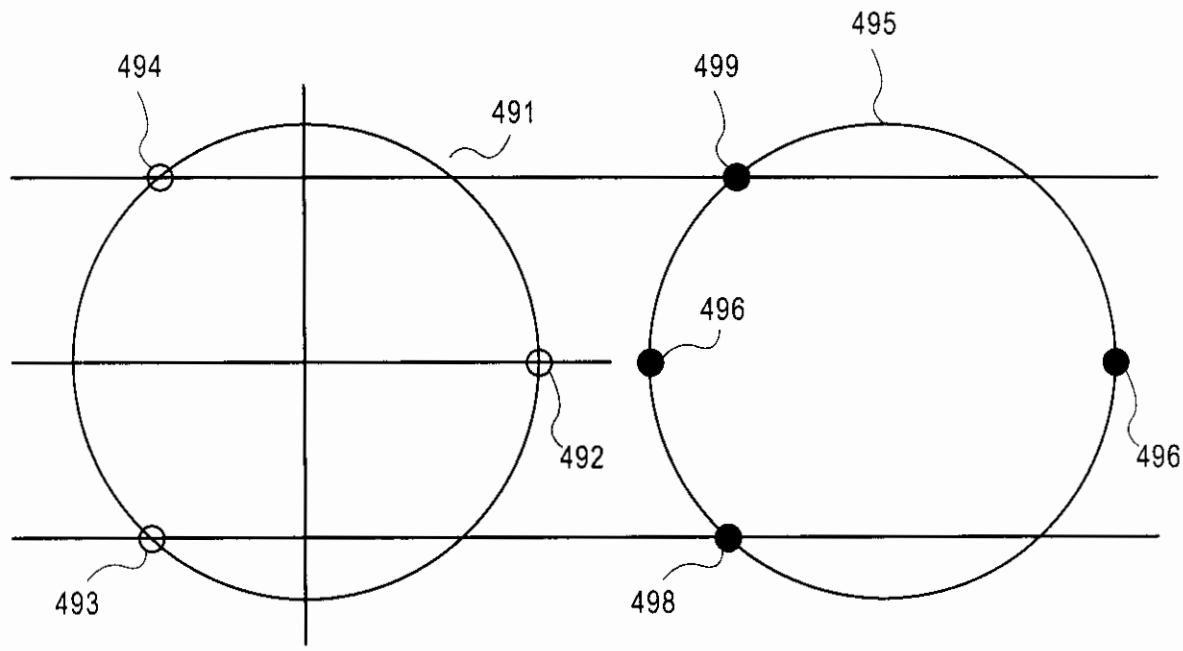


FIG. 4C

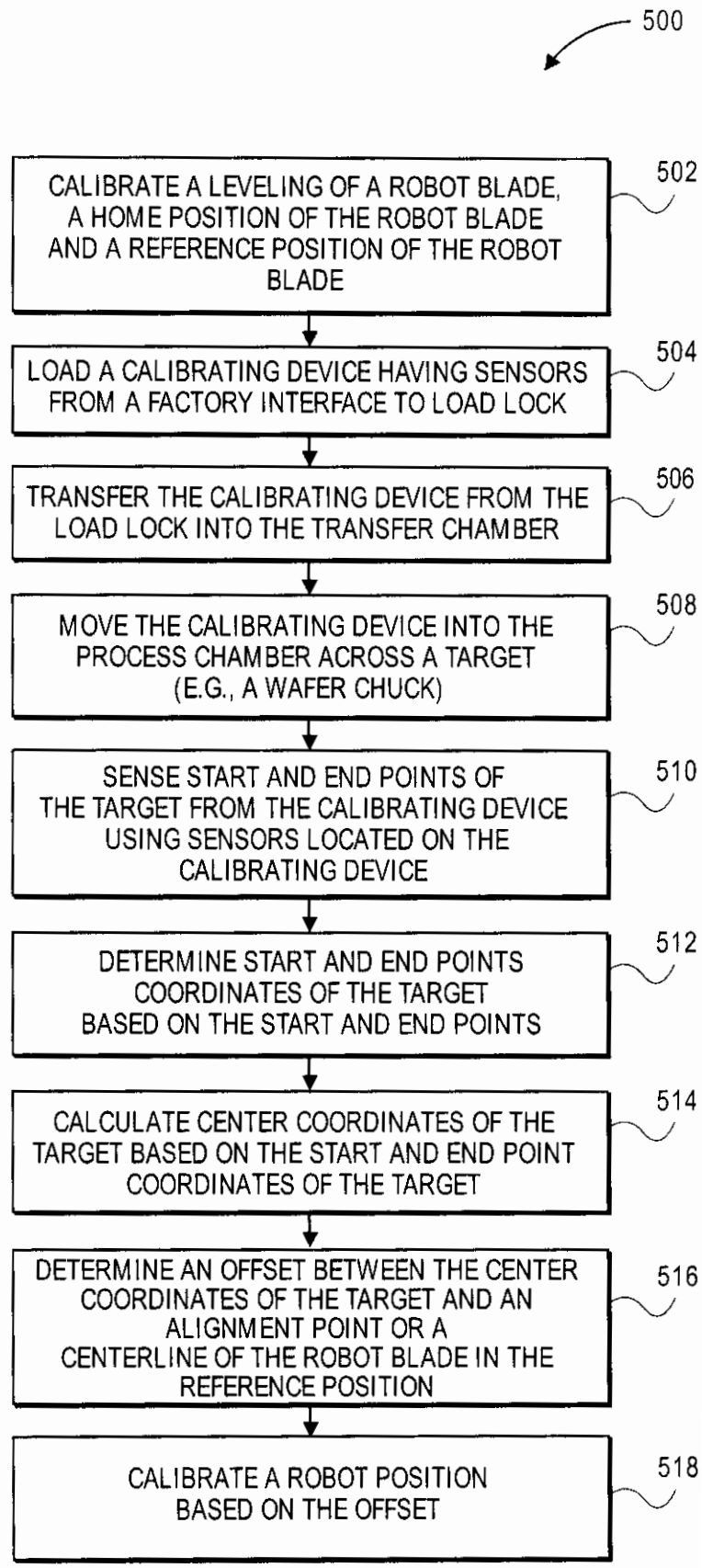

500
CALIBRATE A LEVELING OF A ROBOT BLADE, A HOME POSITION OF THE ROBOT BLADE AND A REFERENCE POSITION OF THE ROBOT BLADE
502
LOAD A CALIBRATING DEVICE HAVING SENSORS FROM A FACTORY INTERFACE TO LOAD LOCK
504
TRANSFER THE CALIBRATING DEVICE FROM THE LOAD LOCK INTO THE TRANSFER CHAMBER
506
MOVE THE CALIBRATING DEVICE INTO THE PROCESS CHAMBER ACROSS A TARGET (E.G., A WAFER CHUCK)
508
SENSE START AND END POINTS OF THE TARGET FROM THE CALIBRATING DEVICE USING SENSORS LOCATED ON THE CALIBRATING DEVICE
510
DETERMINE START AND END POINTS COORDINATES OF THE TARGET BASED ON THE START AND END POINTS
512
CALCULATE CENTER COORDINATES OF THE TARGET BASED ON THE START AND END POINT COORDINATES OF THE TARGET
514
DETERMINE AN OFFSET BETWEEN THE CENTER COORDINATES OF THE TARGET AND AN ALIGNMENT POINT OR A CENTERLINE OF THE ROBOT BLADE IN THE REFERENCE POSITION
516
CALIBRATE A ROBOT POSITION BASED ON THE OFFSET
518

FIG. 5

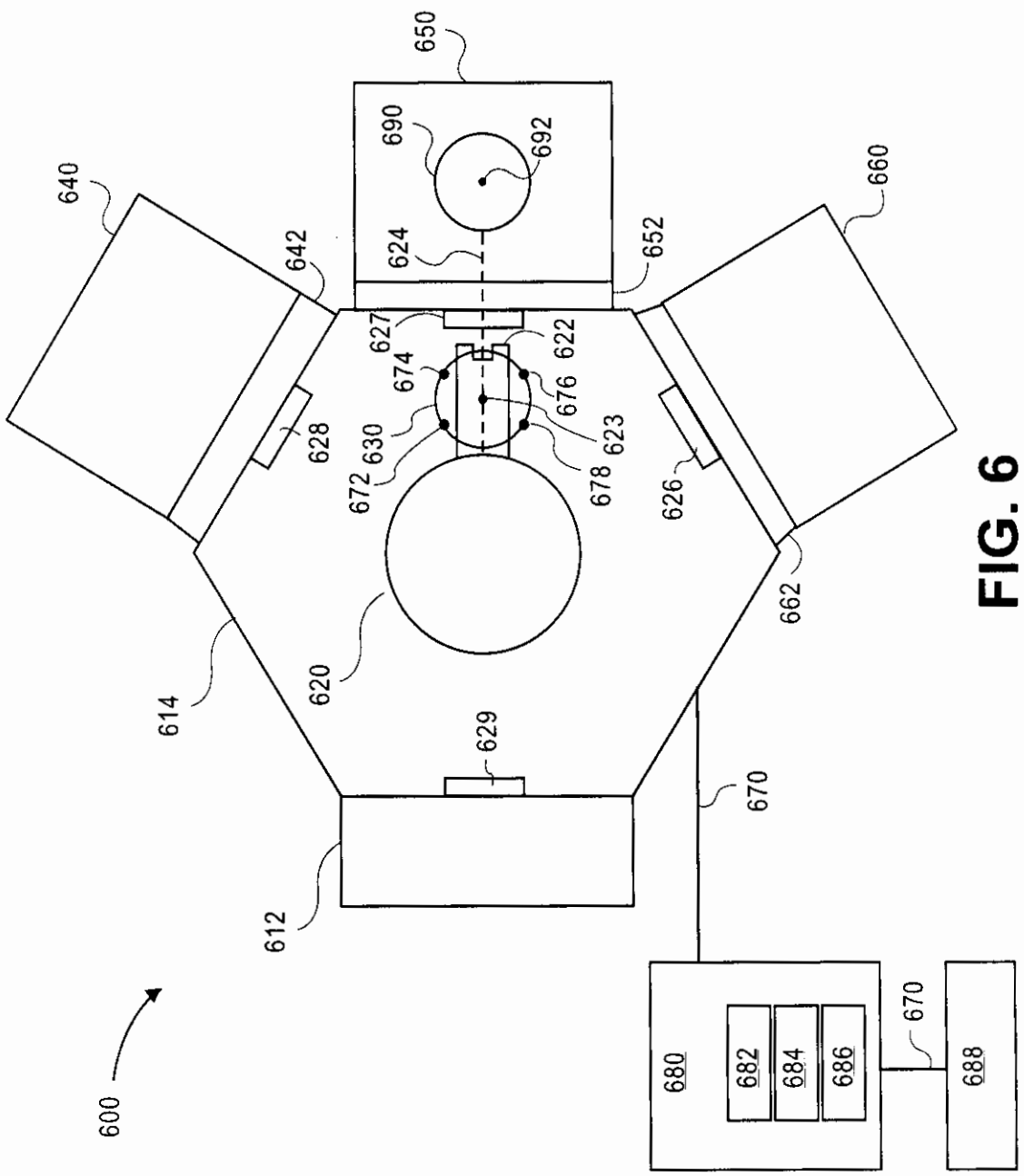

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FIG. 6

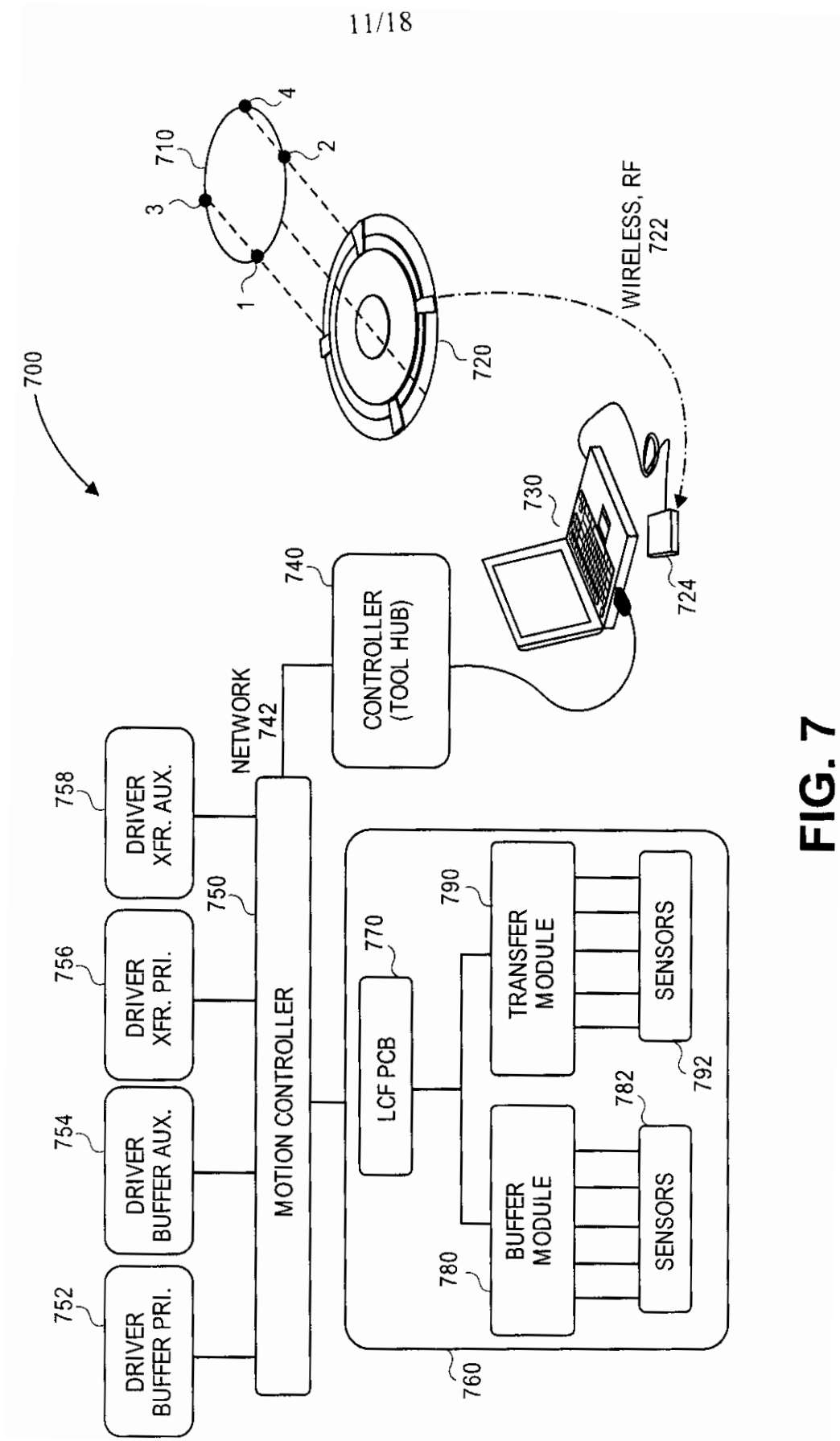

700
710
1
2
3
4
720
WIRELESS, RF
722
730
724
740
CONTROLLER
(TOOL HUB)
NETWORK
742
750
MOTION CONTROLLER
752
DRIVER
BUFFER PRI.
754
DRIVER
BUFFER AUX.
756
DRIVER
XFR. PRI.
758
DRIVER
XFR. AUX.
760
LCF PCB
770
780
BUFFER
MODULE
782
SENSORS
790
TRANSFER
MODULE
792
SENSORS

FIG. 7

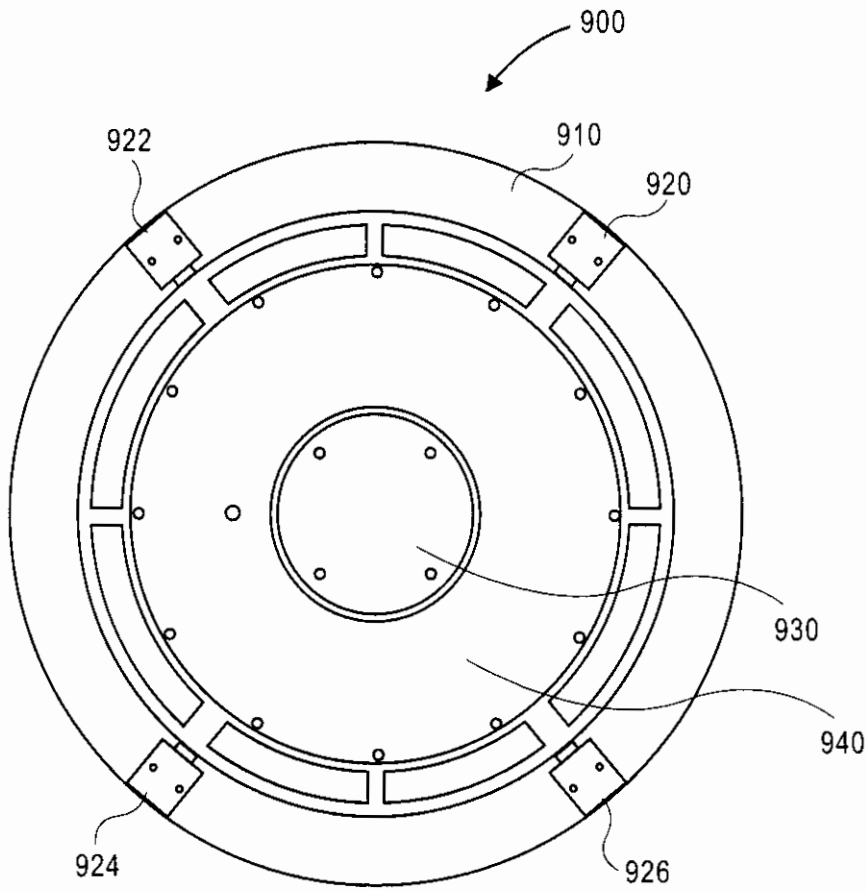


FIG. 9A

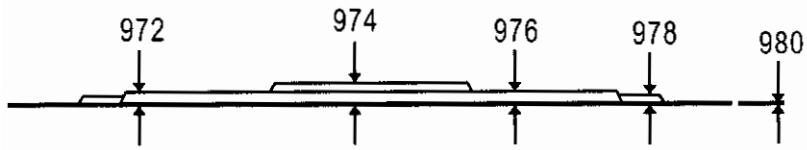


FIG. 9B

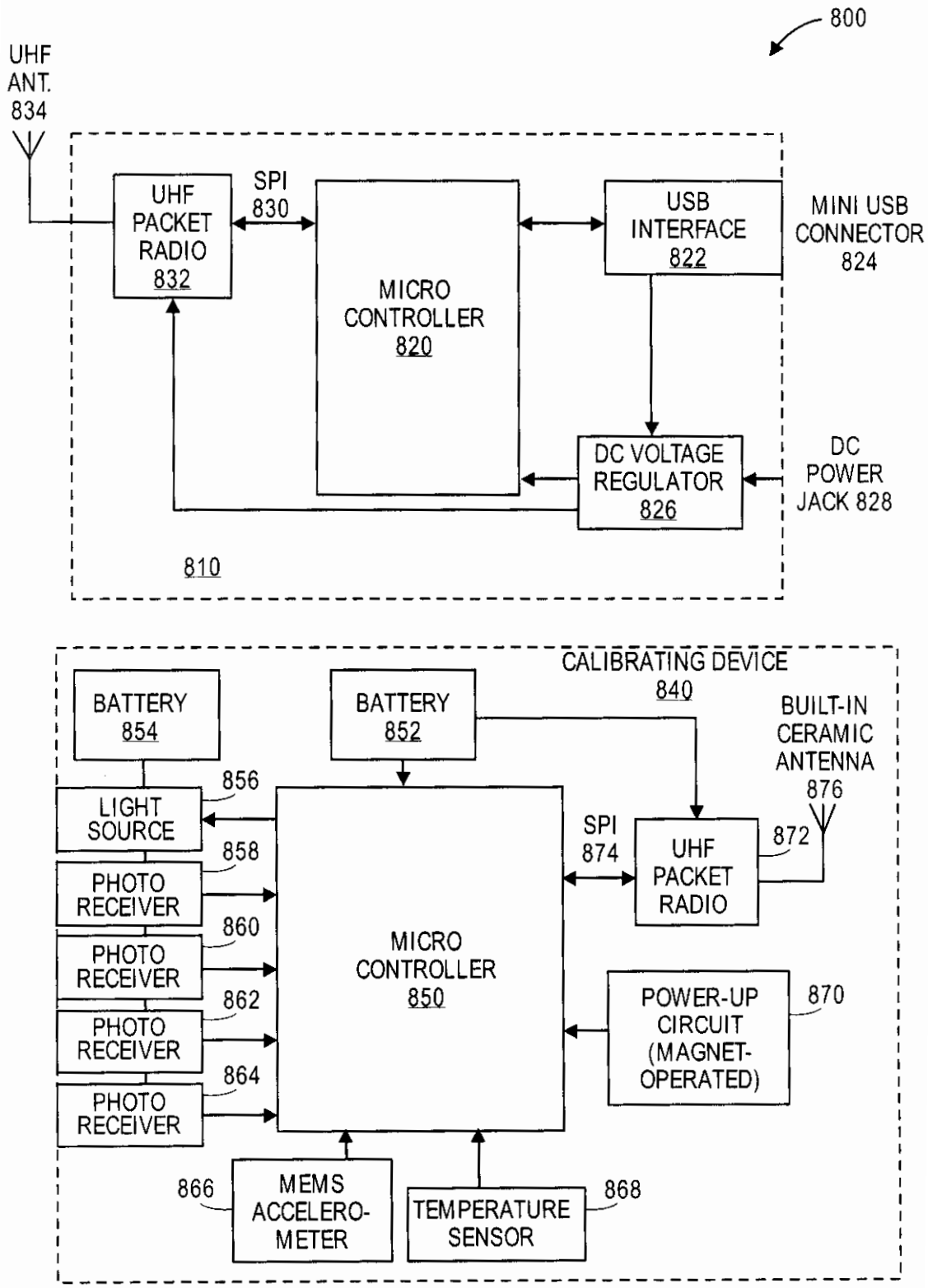

800
UHF ANT. 834
UHF PACKET RADIO 832
SPI 830
MICRO CONTROLLER 820
USB INTERFACE 822
MINI USB CONNECTOR 824
DC VOLTAGE REGULATOR 826
DC POWER JACK 828
810
CALIBRATING DEVICE 840
BATTERY 854
BATTERY 852
BUILT-IN CERAMIC ANTENNA 876
856
LIGHT SOURCE
858
PHOTO RECEIVER
860
PHOTO RECEIVER
862
PHOTO RECEIVER
864
PHOTO RECEIVER
MICRO CONTROLLER 850
SPI 874
UHF PACKET RADIO
872
POWER-UP CIRCUIT (MAGNET-OPERATED)
870
866
MEMS ACCELERO-METER
TEMPERATURE SENSOR
868

FIG. 8

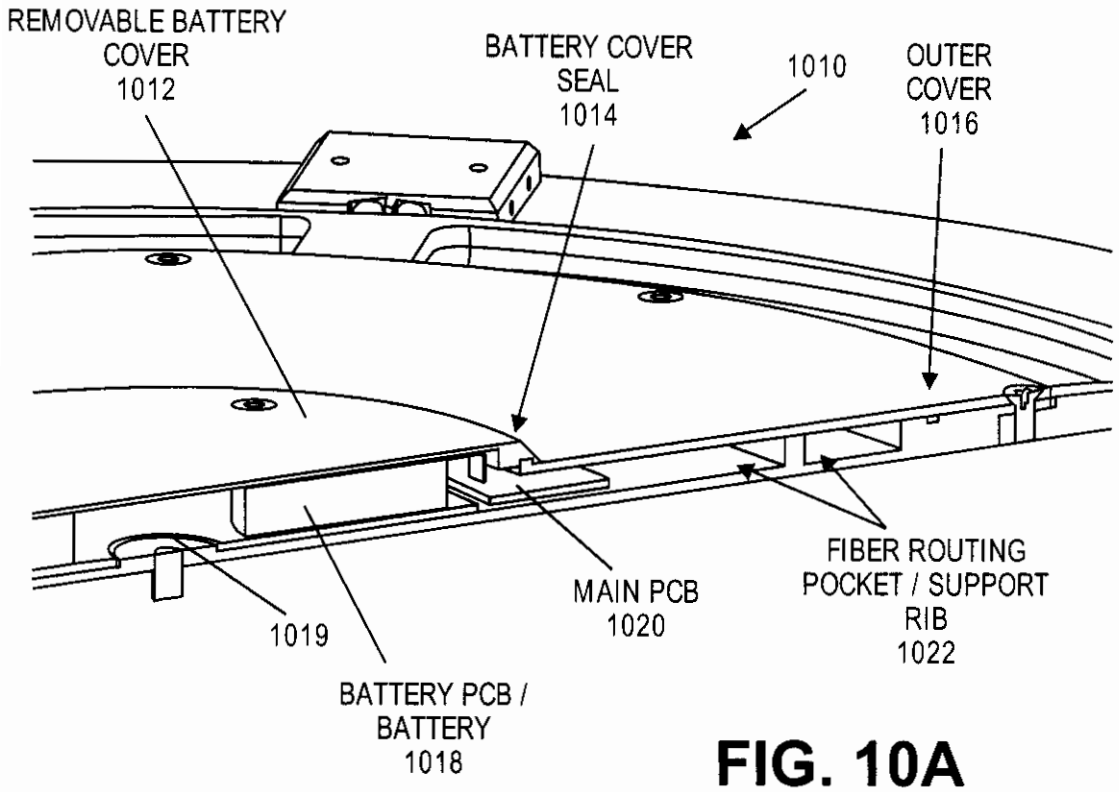


FIG. 10A

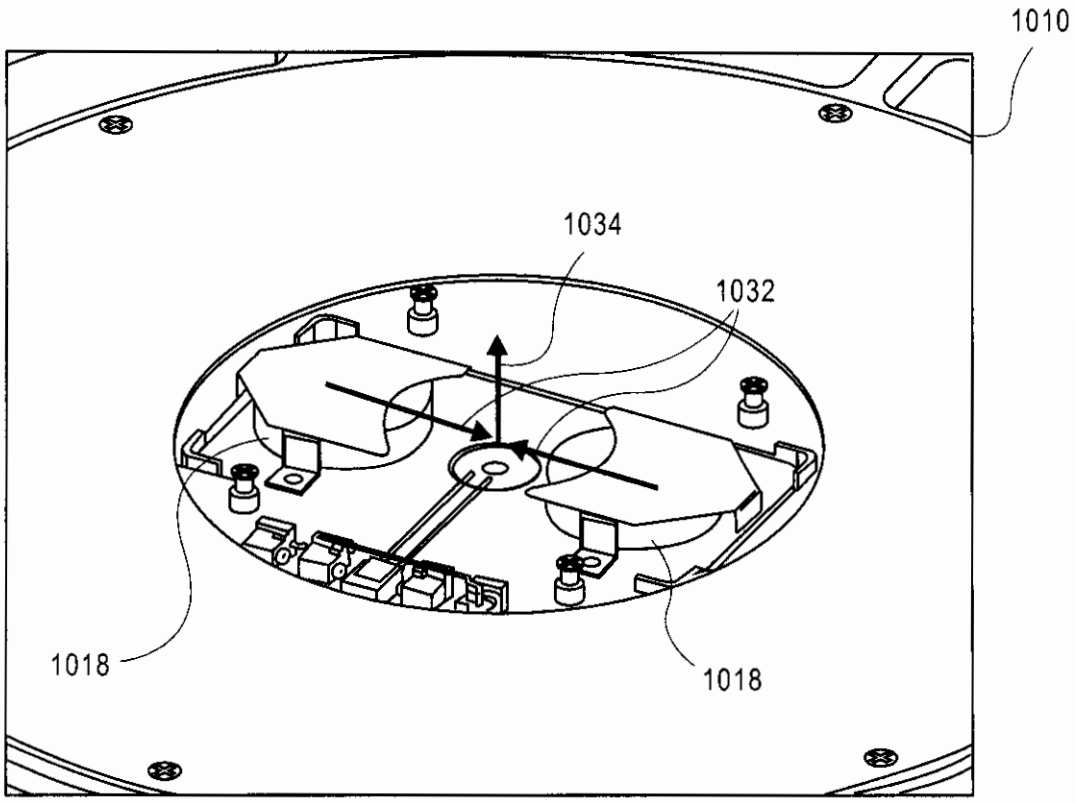


FIG. 10B

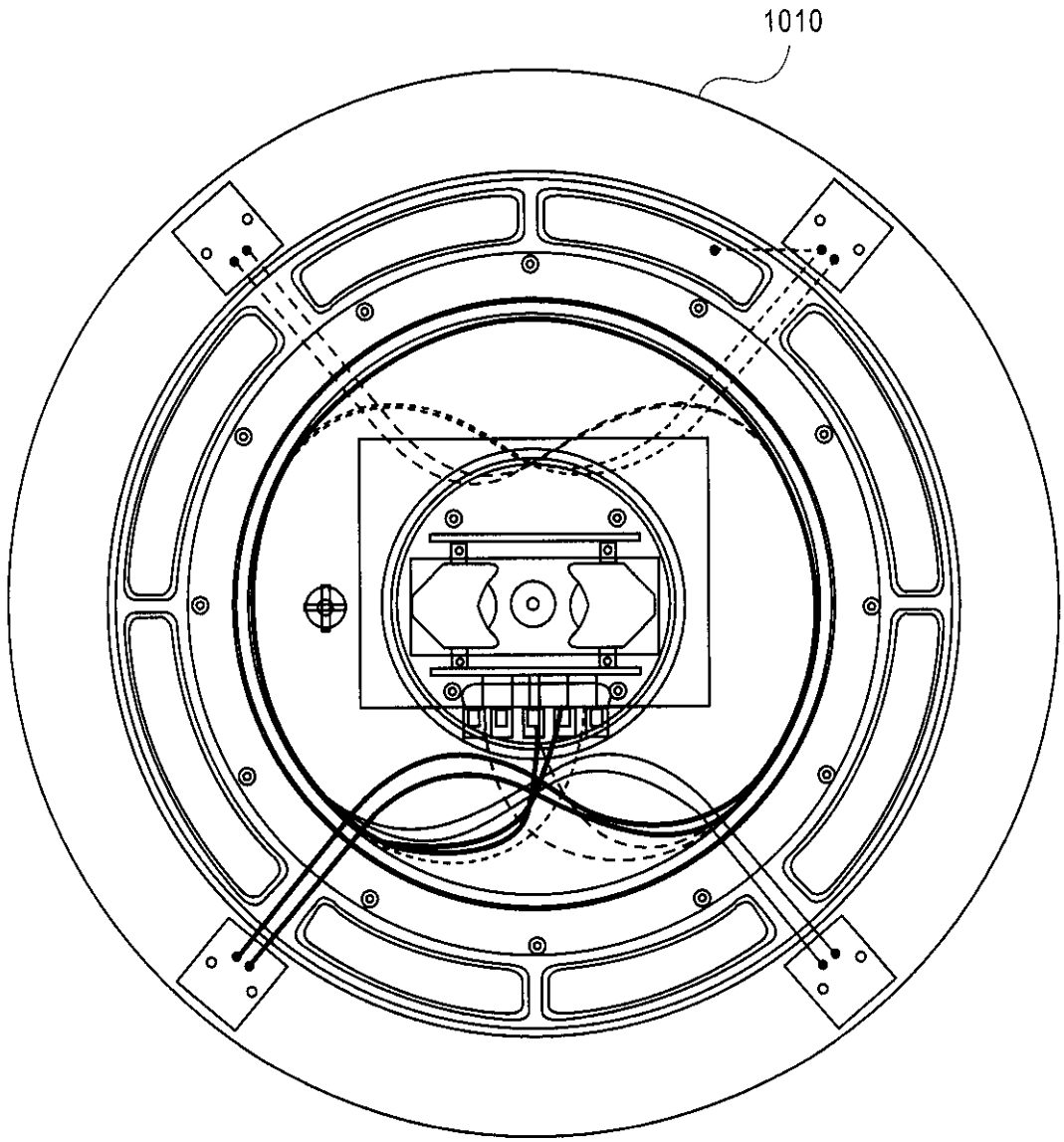


FIG. 10C

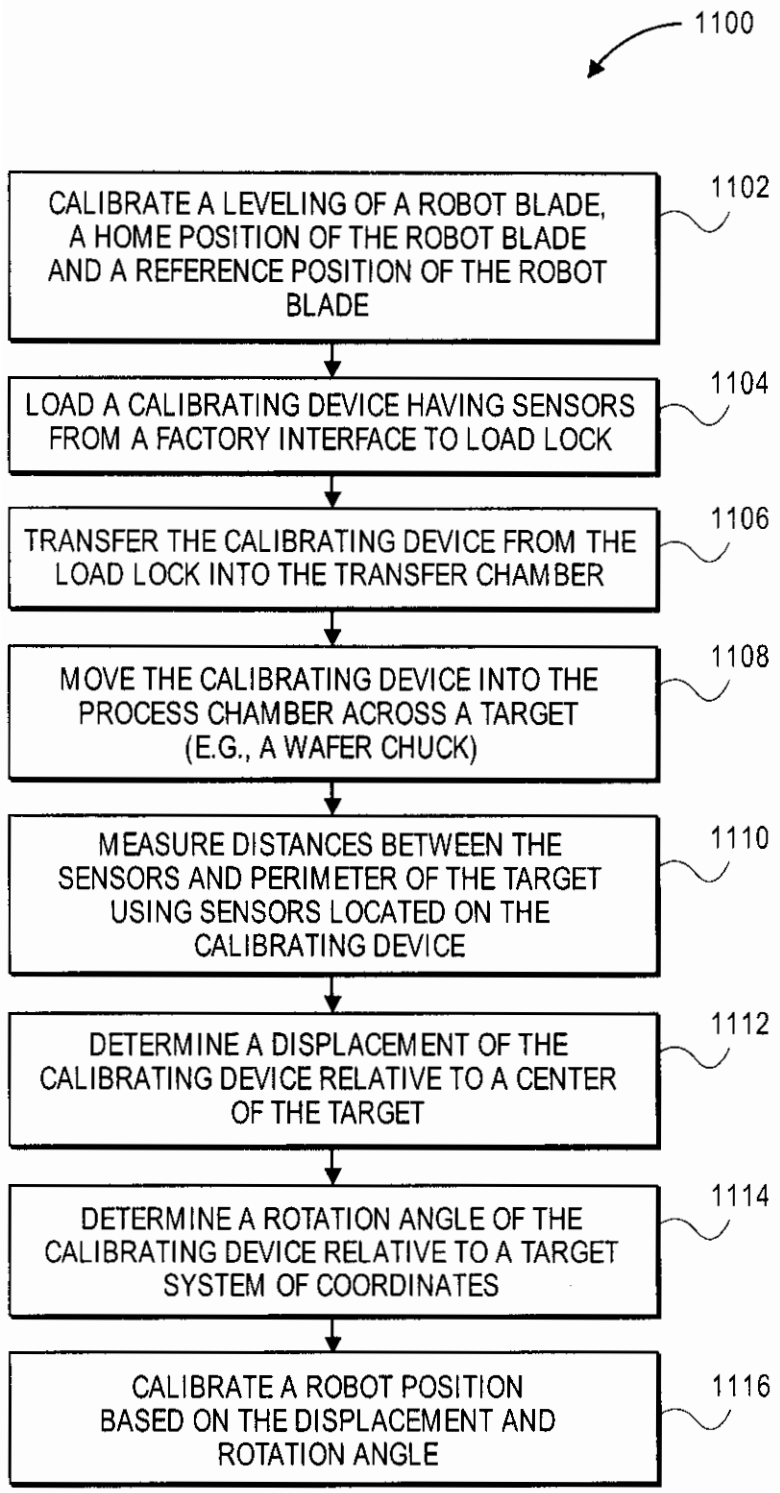

1100
CALIBRATE A LEVELING OF A ROBOT BLADE, A HOME POSITION OF THE ROBOT BLADE AND A REFERENCE POSITION OF THE ROBOT BLADE
1102
LOAD A CALIBRATING DEVICE HAVING SENSORS FROM A FACTORY INTERFACE TO LOAD LOCK
1104
TRANSFER THE CALIBRATING DEVICE FROM THE LOAD LOCK INTO THE TRANSFER CHAMBER
1106
MOVE THE CALIBRATING DEVICE INTO THE PROCESS CHAMBER ACROSS A TARGET (E.G., A WAFER CHUCK)
1108
MEASURE DISTANCES BETWEEN THE SENSORS AND PERIMETER OF THE TARGET USING SENSORS LOCATED ON THE CALIBRATING DEVICE
1110
DETERMINE A DISPLACEMENT OF THE CALIBRATING DEVICE RELATIVE TO A CENTER OF THE TARGET
1112
DETERMINE A ROTATION ANGLE OF THE CALIBRATING DEVICE RELATIVE TO A TARGET SYSTEM OF COORDINATES
1114
CALIBRATE A ROBOT POSITION BASED ON THE DISPLACEMENT AND ROTATION ANGLE
1116

FIG. 11

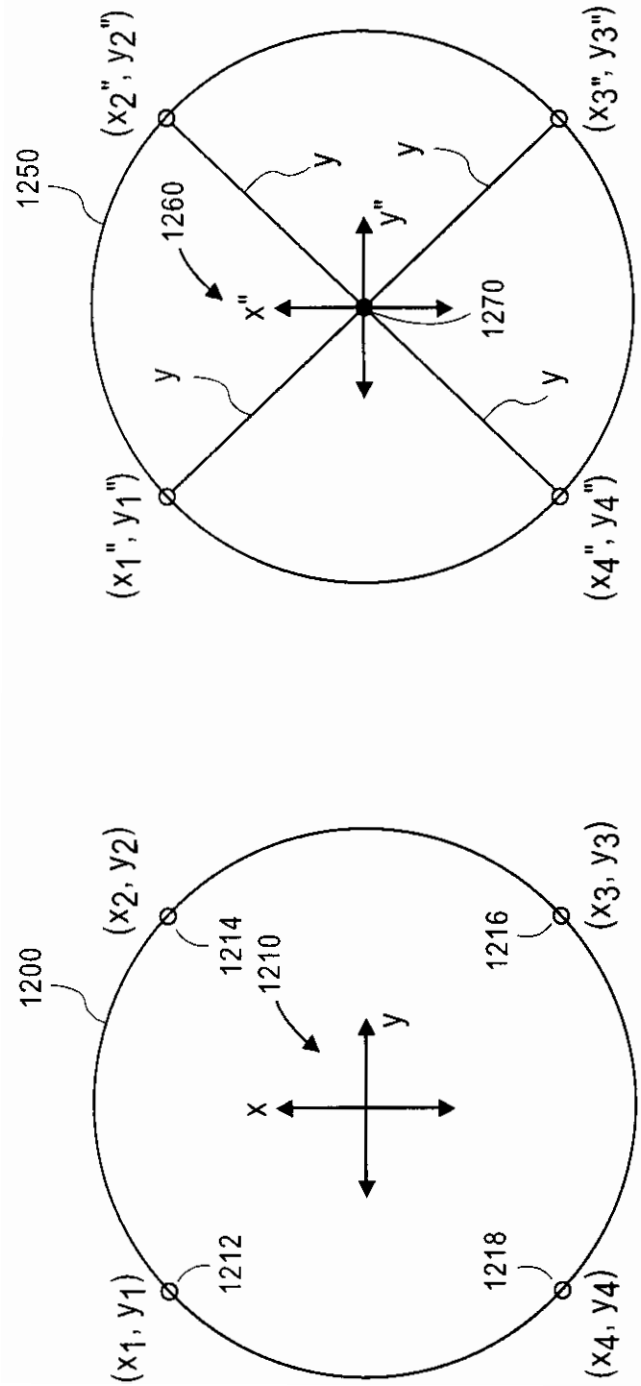


FIG. 12A

FIG. 12B

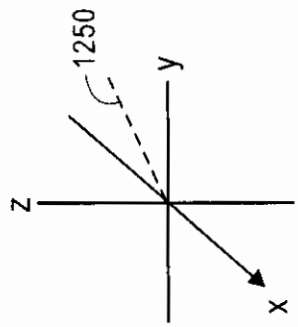


FIG. 12C

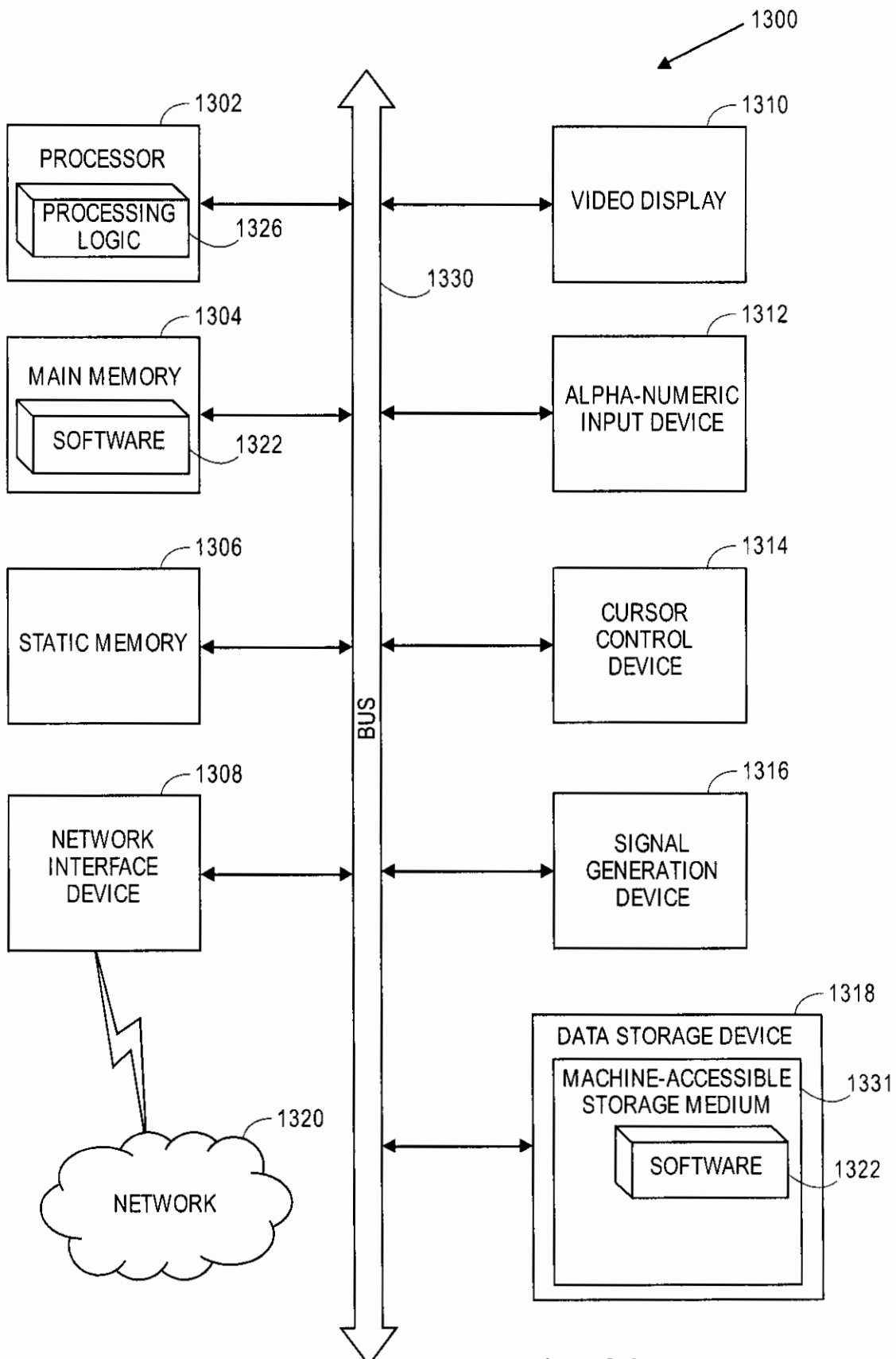

1300
1302
PROCESSOR
PROCESSING LOGIC
1326
1304
MAIN MEMORY
SOFTWARE
1322
1306
STATIC MEMORY
1308
NETWORK INTERFACE DEVICE
1320
NETWORK
BUS
1330
1310
VIDEO DISPLAY
1312
ALPHA-NUMERIC INPUT DEVICE
1314
CURSOR CONTROL DEVICE
1316
SIGNAL GENERATION DEVICE
1318
DATA STORAGE DEVICE
MACHINE-ACCESSIBLE STORAGE MEDIUM
1331
SOFTWARE
1322

FIG. 13