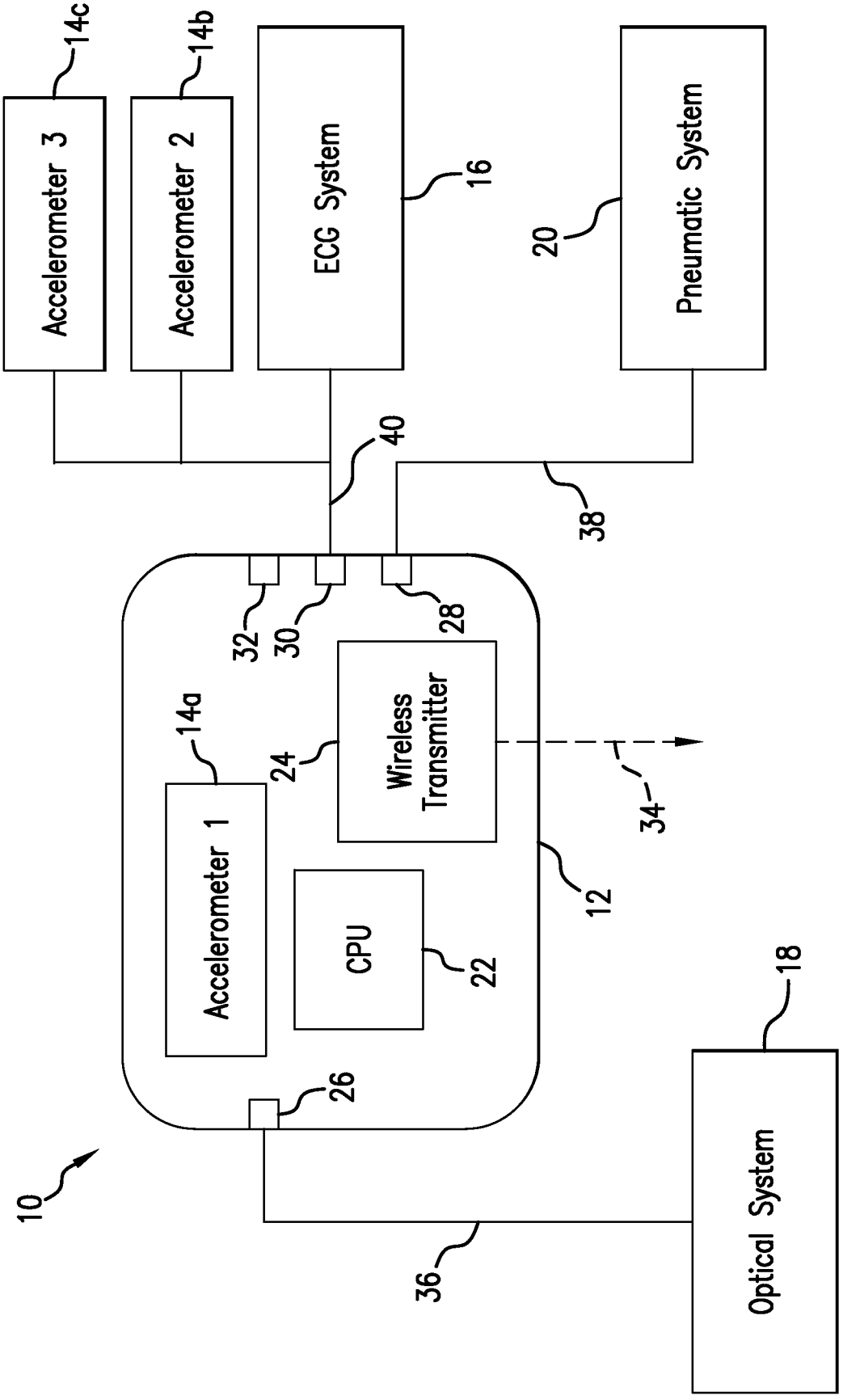

Accelerometer 3
14c
Accelerometer 2
14b
ECG System
16
Pneumatic System
20
40
38
32
30
28
14a
Accelerometer 1
24
Wireless Transmitter
34
CPU
22
12
26
10
18
Optical System
36

FIG. 1

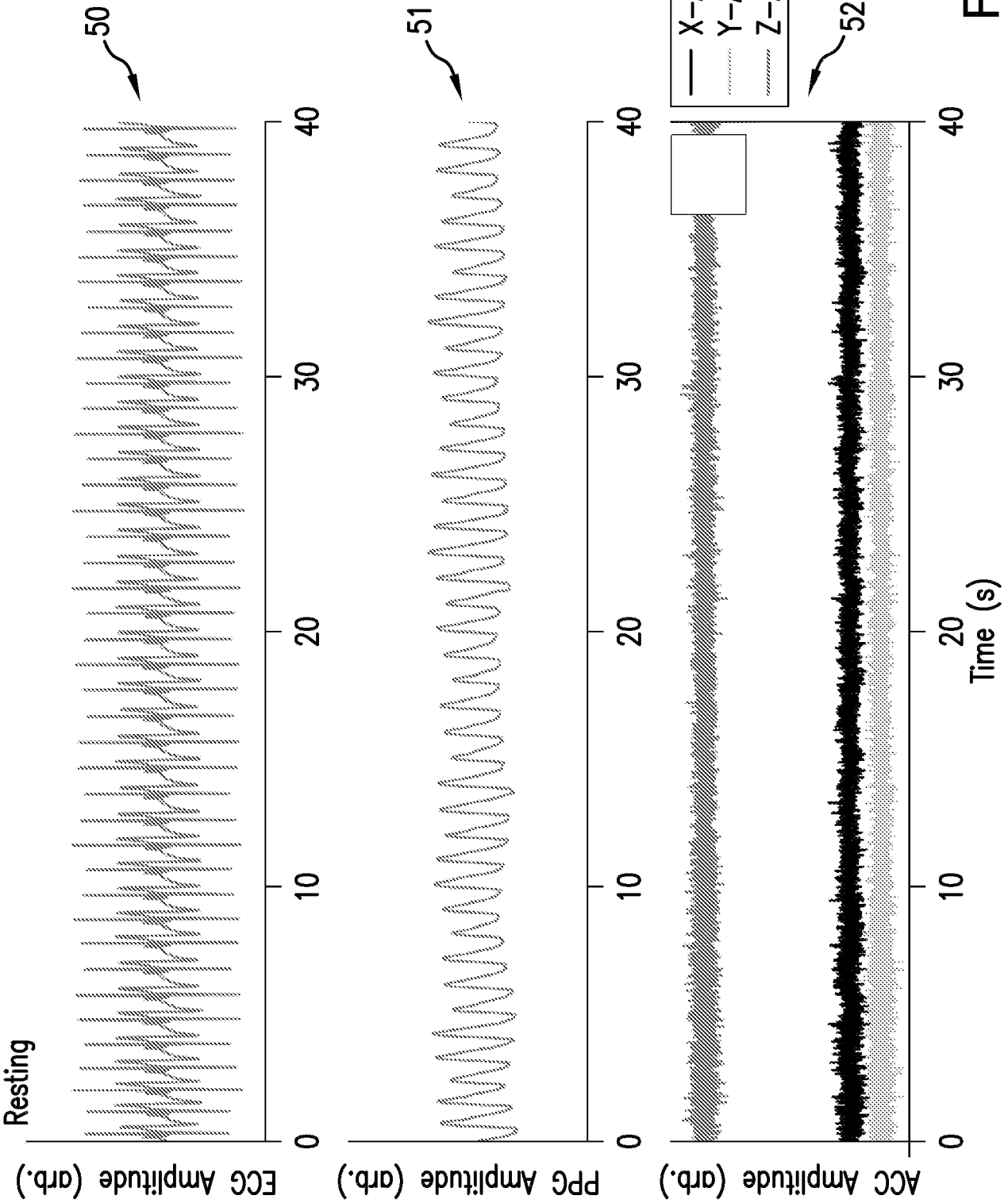

Resting
ECG Amplitude (arb.)
PPG Amplitude (arb.)
ACC Amplitude (arb.)
Time (s)
0
10
20
30
40
50
51
52
X-Axis
Y-Axis
Z-Axis

FIG.2

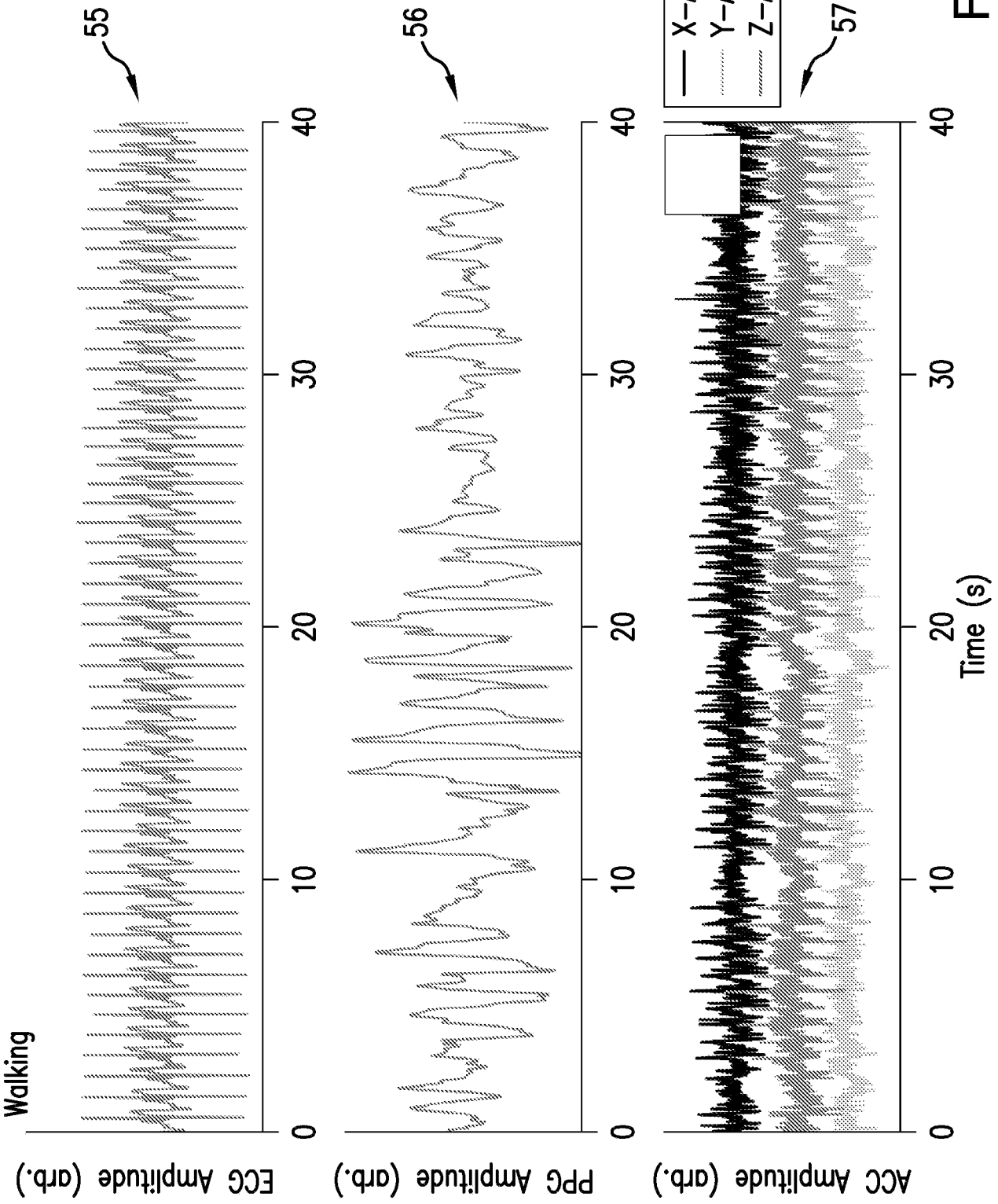

Walking
55
56
57
X-Axis
Y-Axis
Z-Axis
ECG Amplitude (arb.)
PPG Amplitude (arb.)
ACC Amplitude (arb.)
0
10
20
30
40
Time (s)

FIG.3

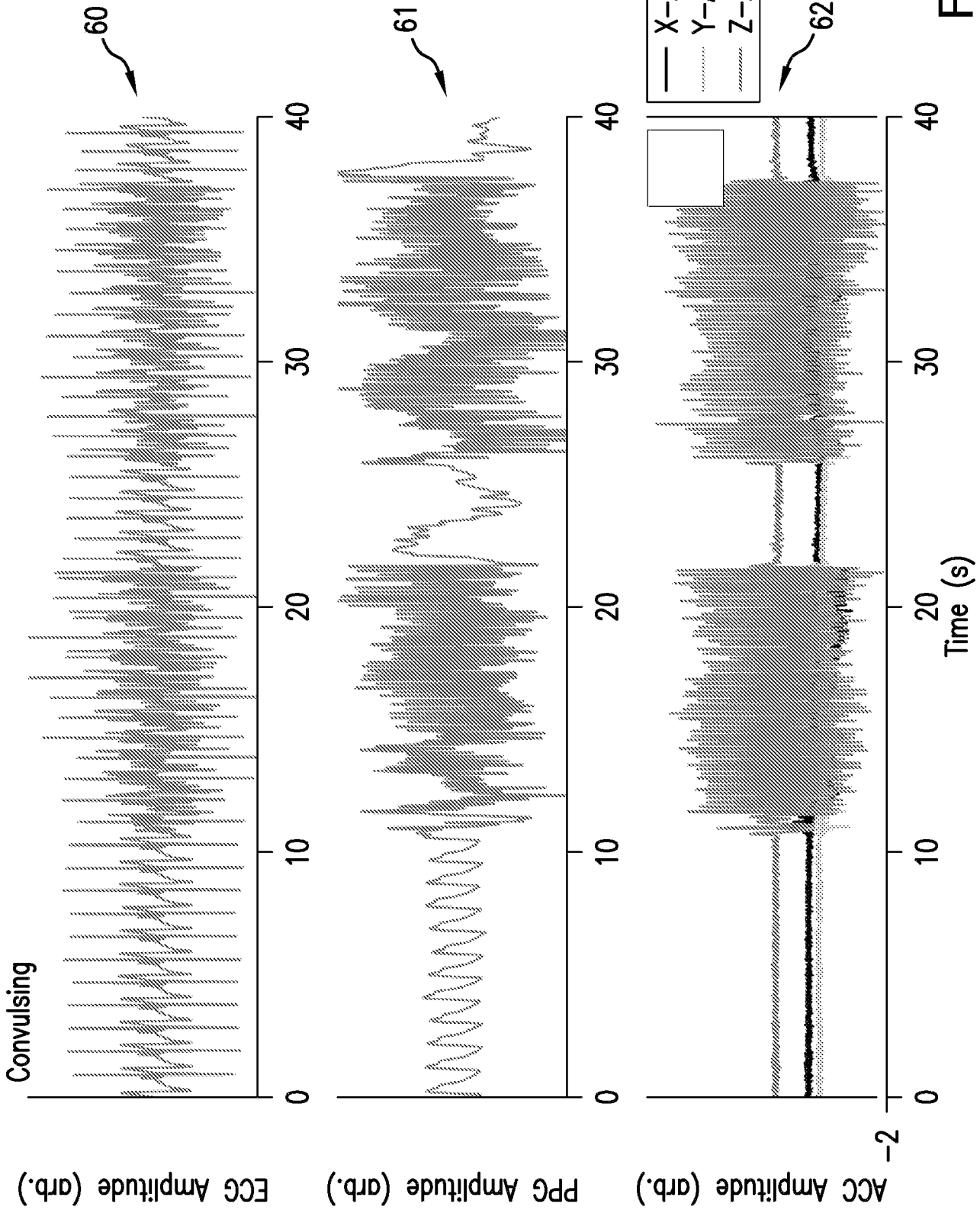

60
61
62
X-Axis
Y-Axis
Z-Axis
Convulsing
ECG Amplitude (arb.)
PPG Amplitude (arb.)
ACC Amplitude (arb.)
Time (s)
0
10
20
30
40
-2

FIG.4

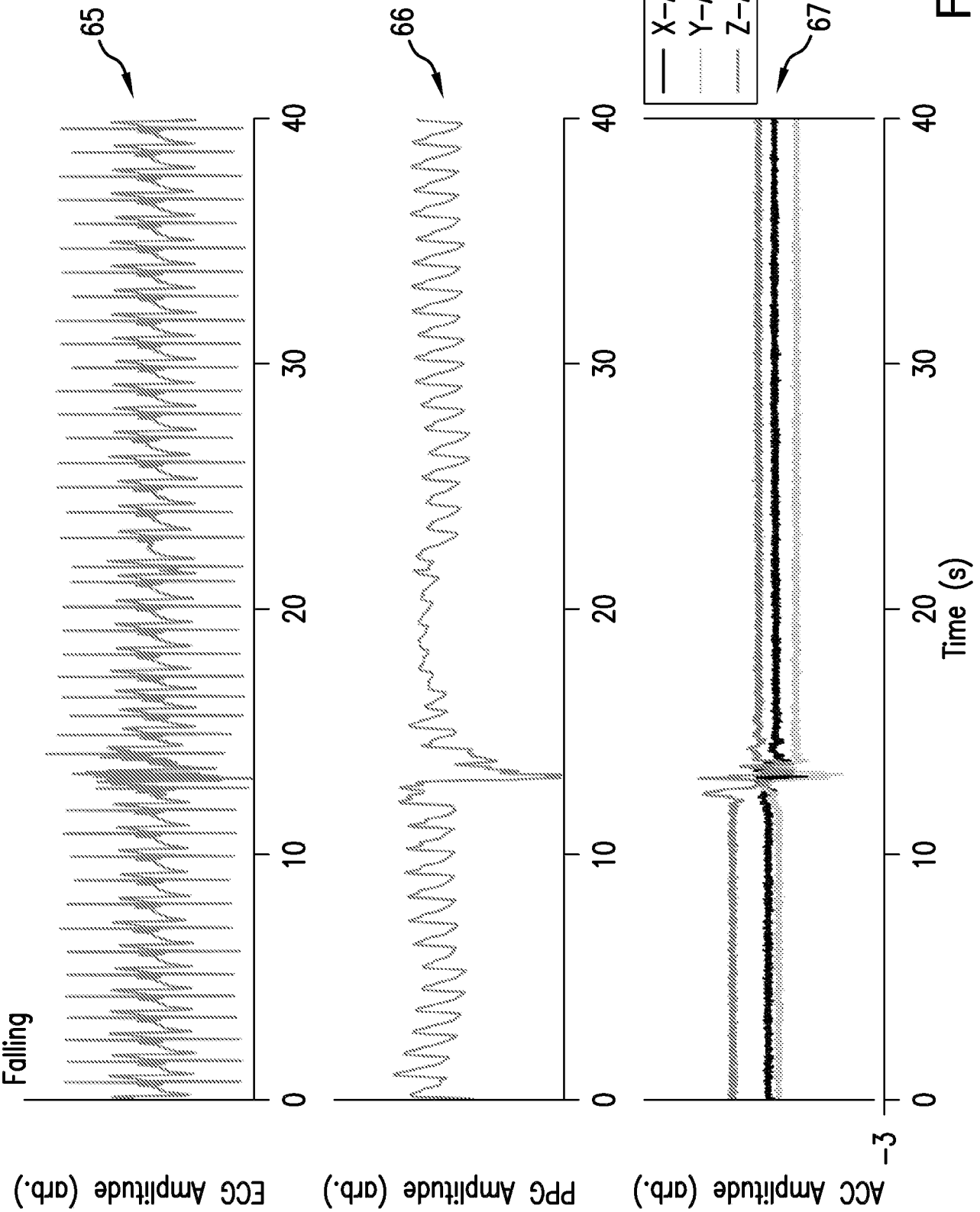

65
66
67
X-Axis
Y-Axis
Z-Axis
Falling
ECG Amplitude (arb.)
PPG Amplitude (arb.)
ACC Amplitude (arb.)
Time (s)
0
10
20
30
40
−3

FIG. 5

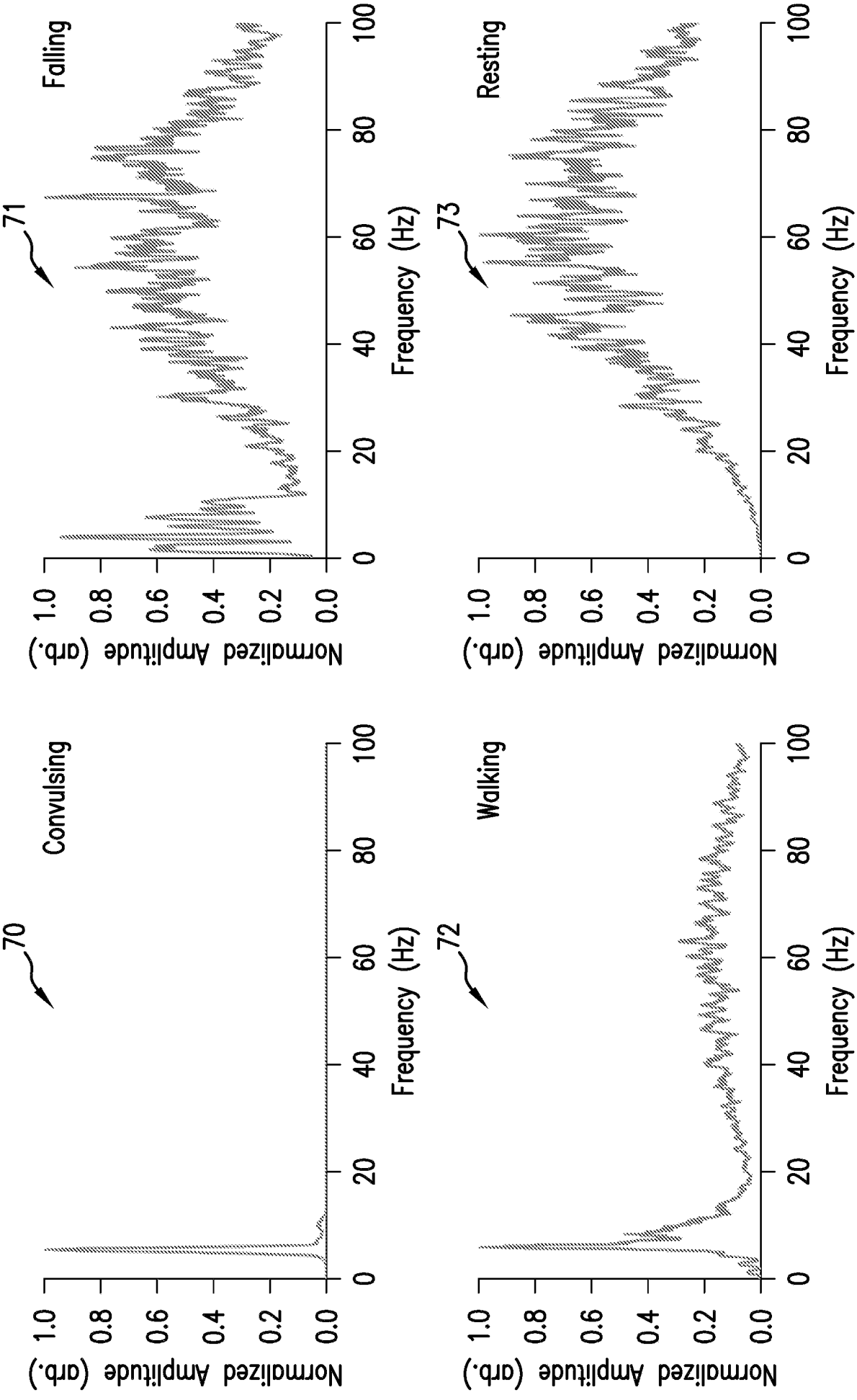

Falling
71
Normalized Amplitude (arb.)
Frequency (Hz)
Resting
73
Convulsing
70
Walking
72
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100

FIG.6

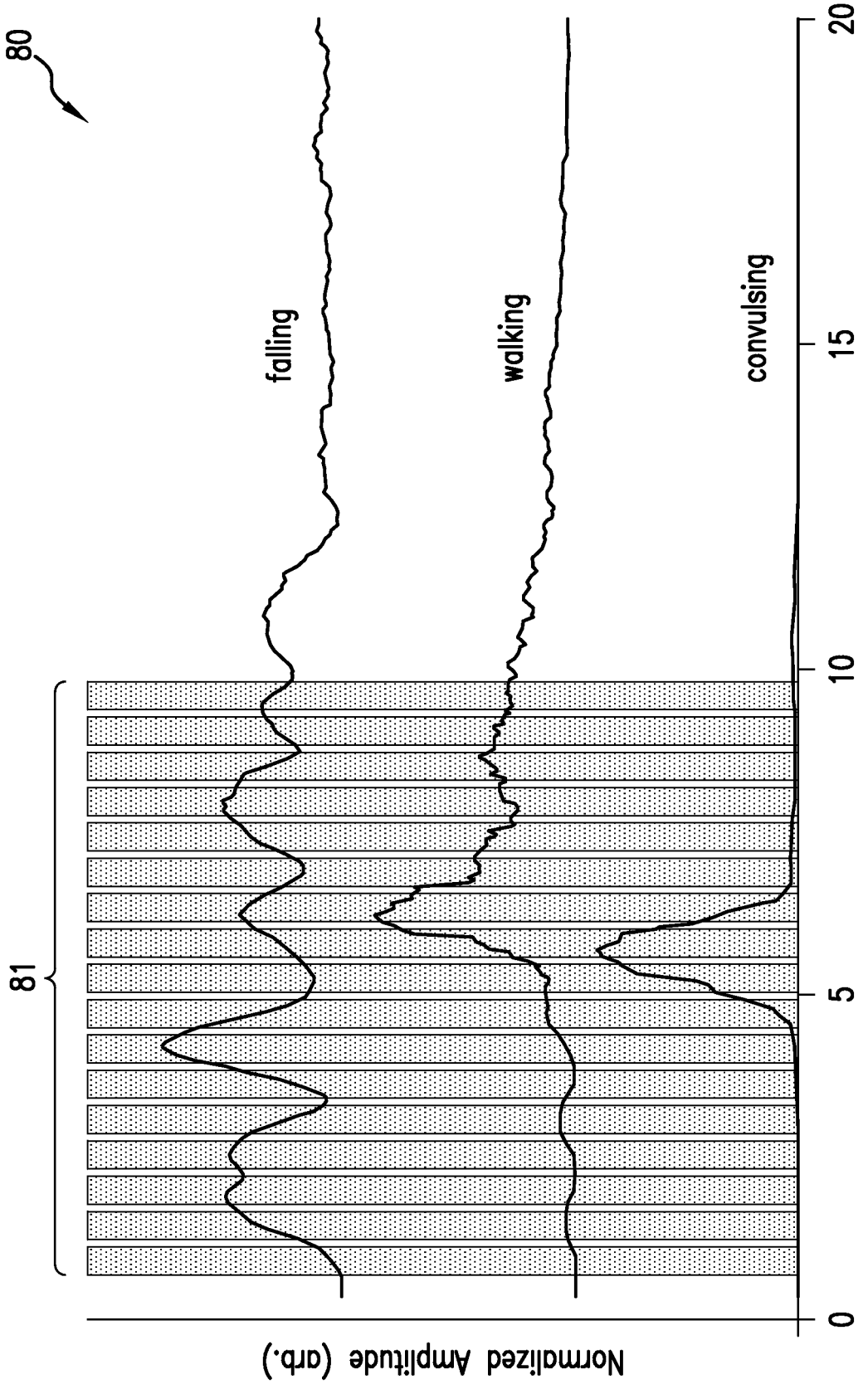

80
81
falling
walking
convulsing
Normalized Amplitude (arb.)
0
5
10
15
20
Frequency (Hz)

FIG. 7

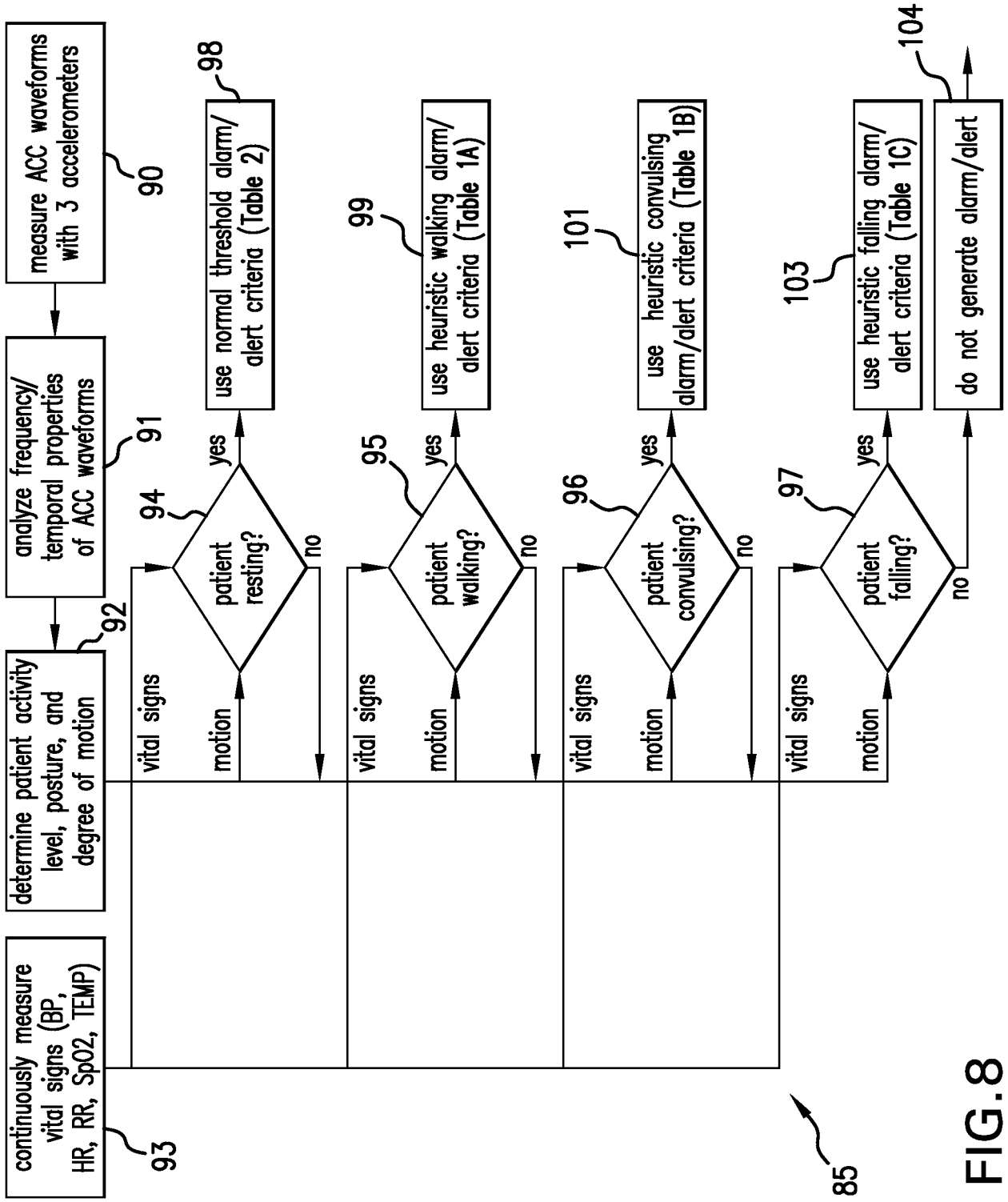

measure ACC waveforms with 3 accelerometers
90
analyze frequency/ temporal properties of ACC waveforms
91
determine patient activity level, posture, and degree of motion
92
continuously measure vital signs (BP, HR, RR, SpO2, TEMP)
93
vital signs
motion
patient resting?
94
yes
no
use normal threshold alarm/ alert criteria (Table 2)
98
patient walking?
95
use heuristic walking alarm/ alert criteria (Table 1A)
99
patient convulsing?
96
use heuristic convulsing alarm/alert criteria (Table 1B)
101
patient falling?
97
use heuristic falling alarm/ alert criteria (Table 1C)
103
do not generate alarm/alert
104
85

FIG.8

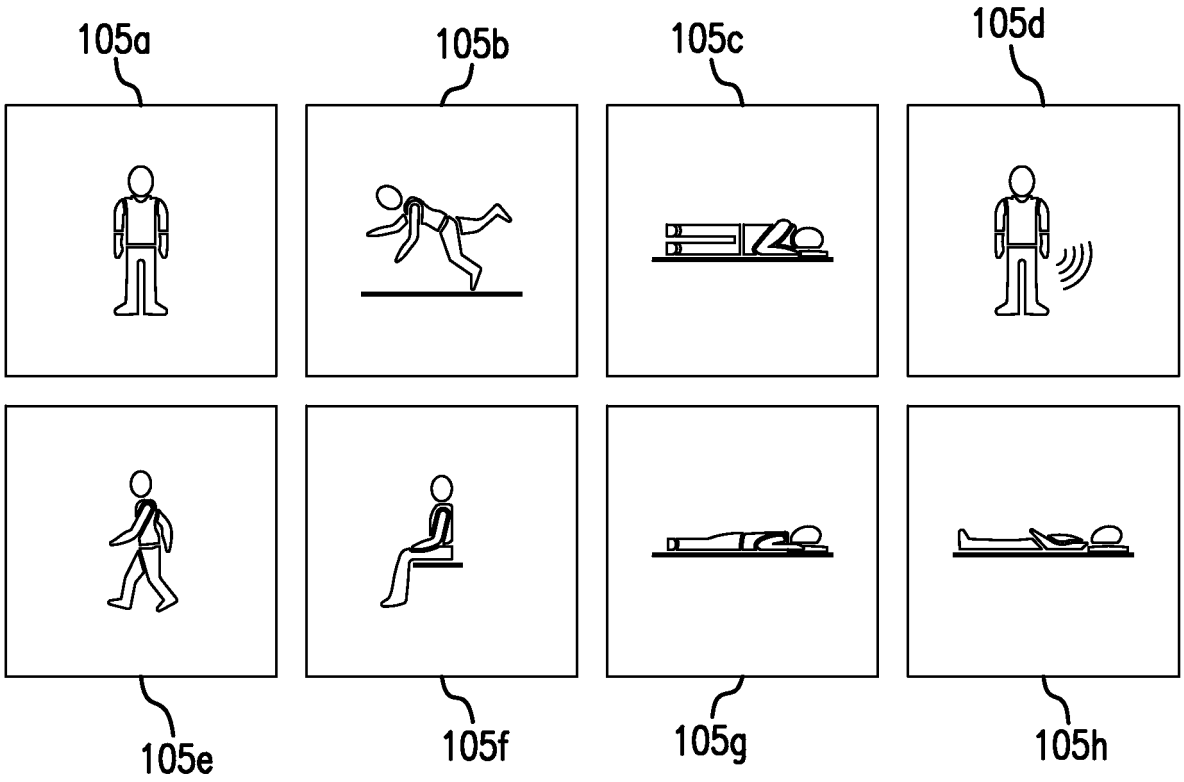


FIG.9

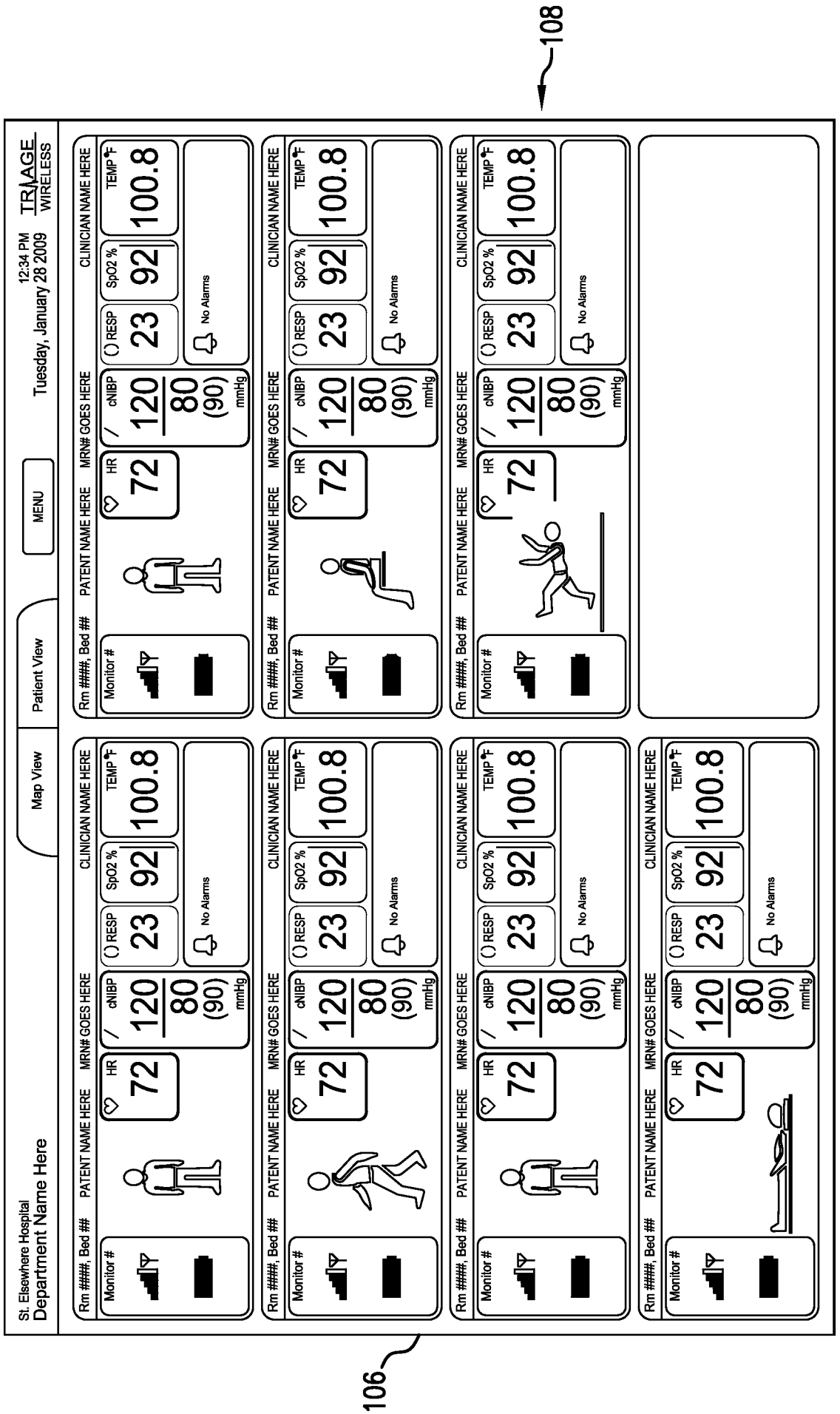

St. Elsewhere Hospital
Department Name Here
Map View
Patient View
MENU
12:34 PM
Tuesday, January 28 2009
TRIAGE
WIRELESS
Rm ####, Bed ##
PATENT NAME HERE
MRN# GOES HERE
CLINICIAN NAME HERE
Monitor #
HR
72
NIBP
120
80
(90)
mmHg
RESP
23
SpO2 %
92
TEMP
100.8
No Alarms
106
108

FIG. 10A

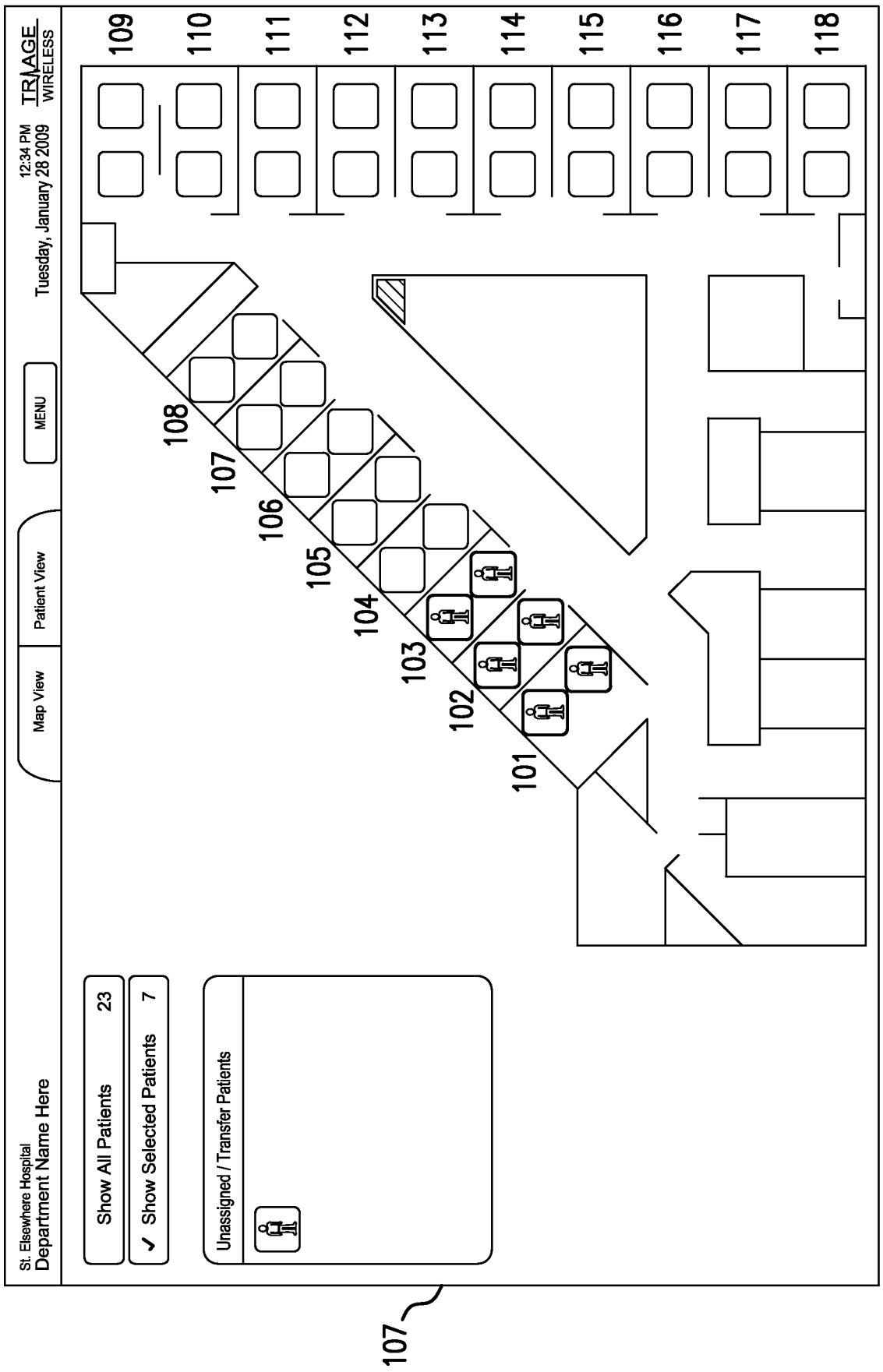

St. Elsewhere Hospital
Department Name Here
Map View
Patient View
MENU
12:34 PM
Tuesday, January 28 2009
TRIAGE
WIRELESS
Show All Patients 23
✓ Show Selected Patients 7
Unassigned / Transfer Patients
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
107

FIG.10B

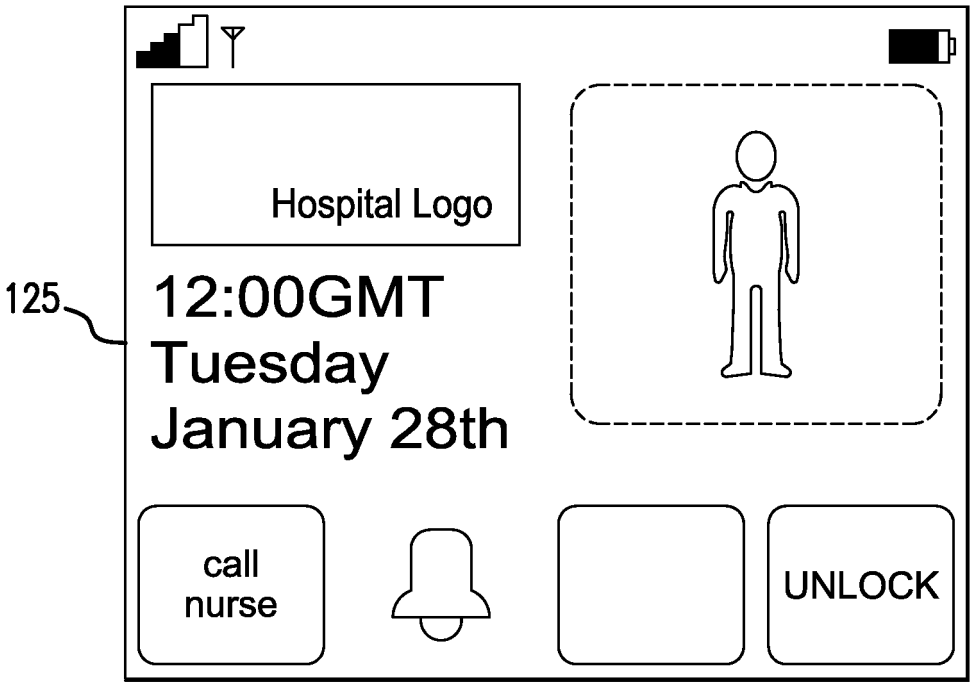


FIG.11A

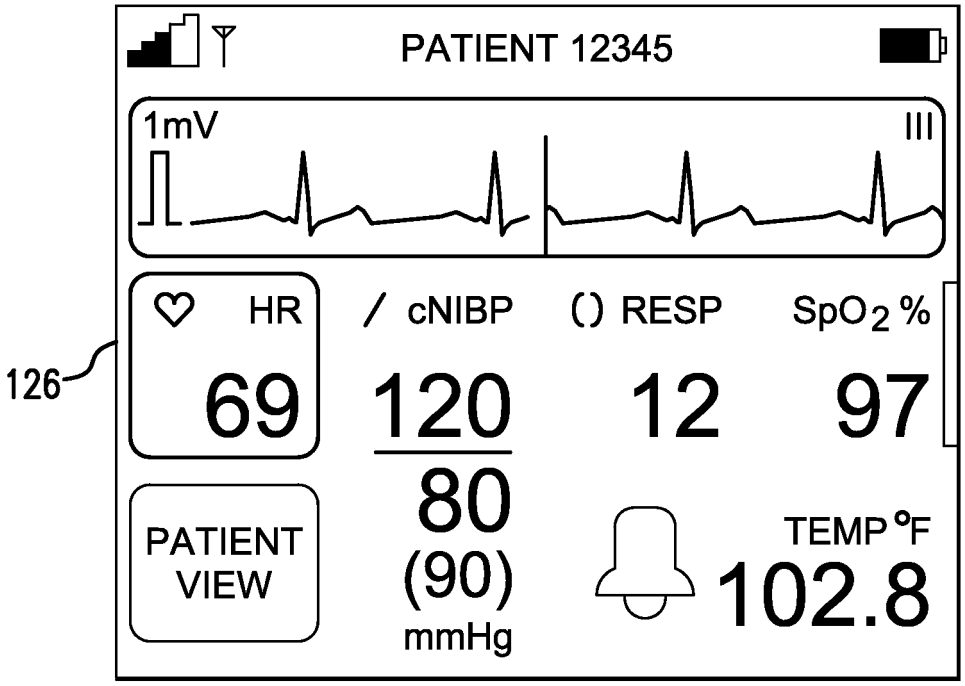


FIG.11B

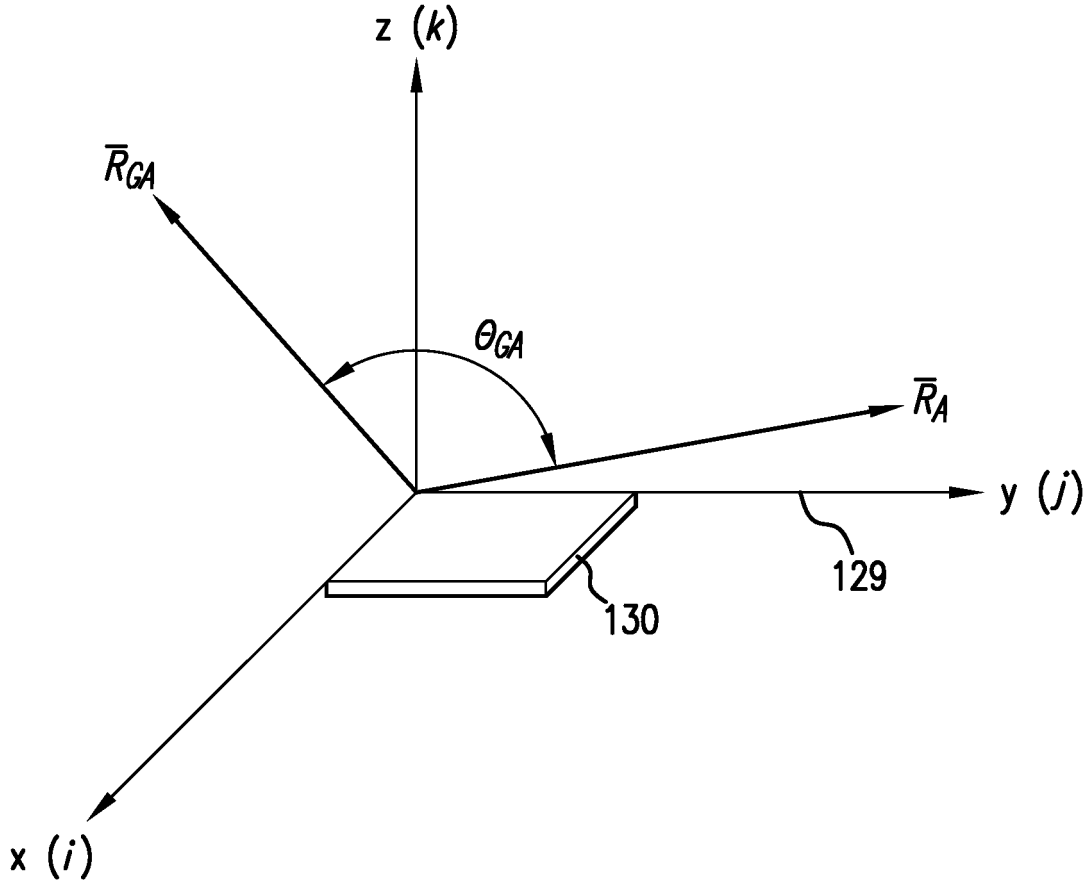


FIG.12

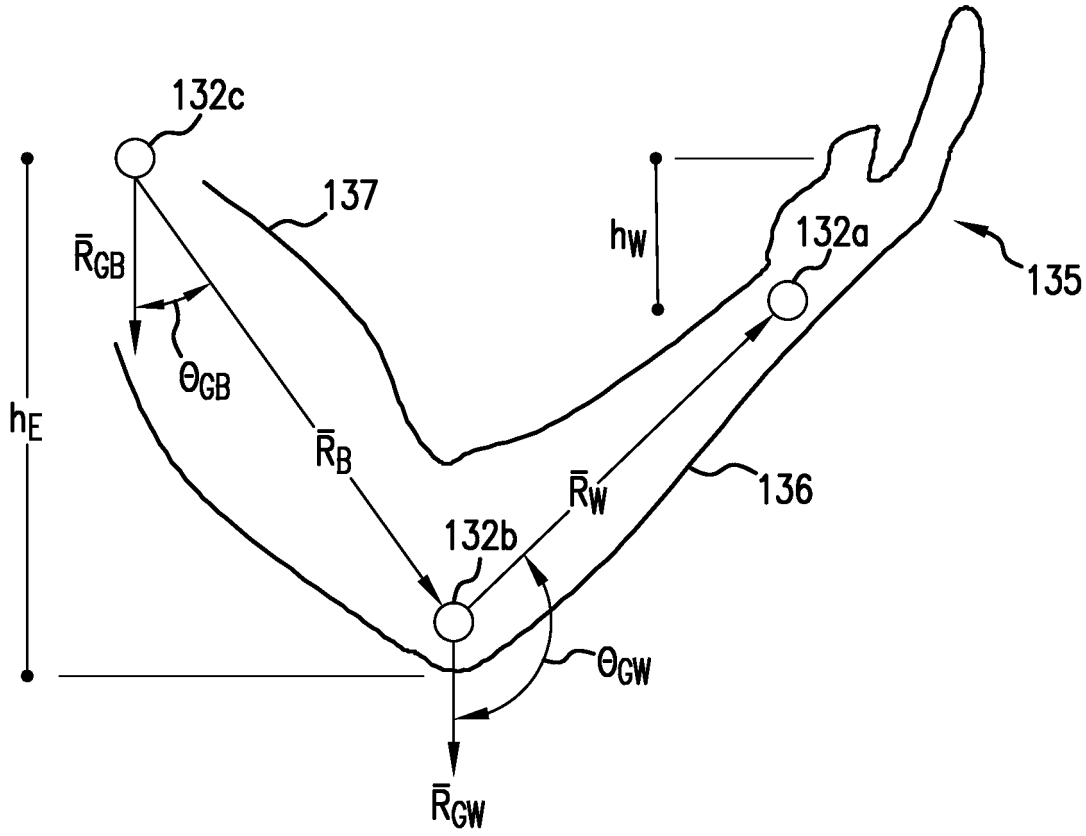

132c
137
$\bar{R}_{GB}$
θ_{GB}
h_E
$\bar{R}_B$
h_W
132a
135
$\bar{R}_W$
136
132b
θ_{GW}
$\bar{R}_{GW}$

FIG.13

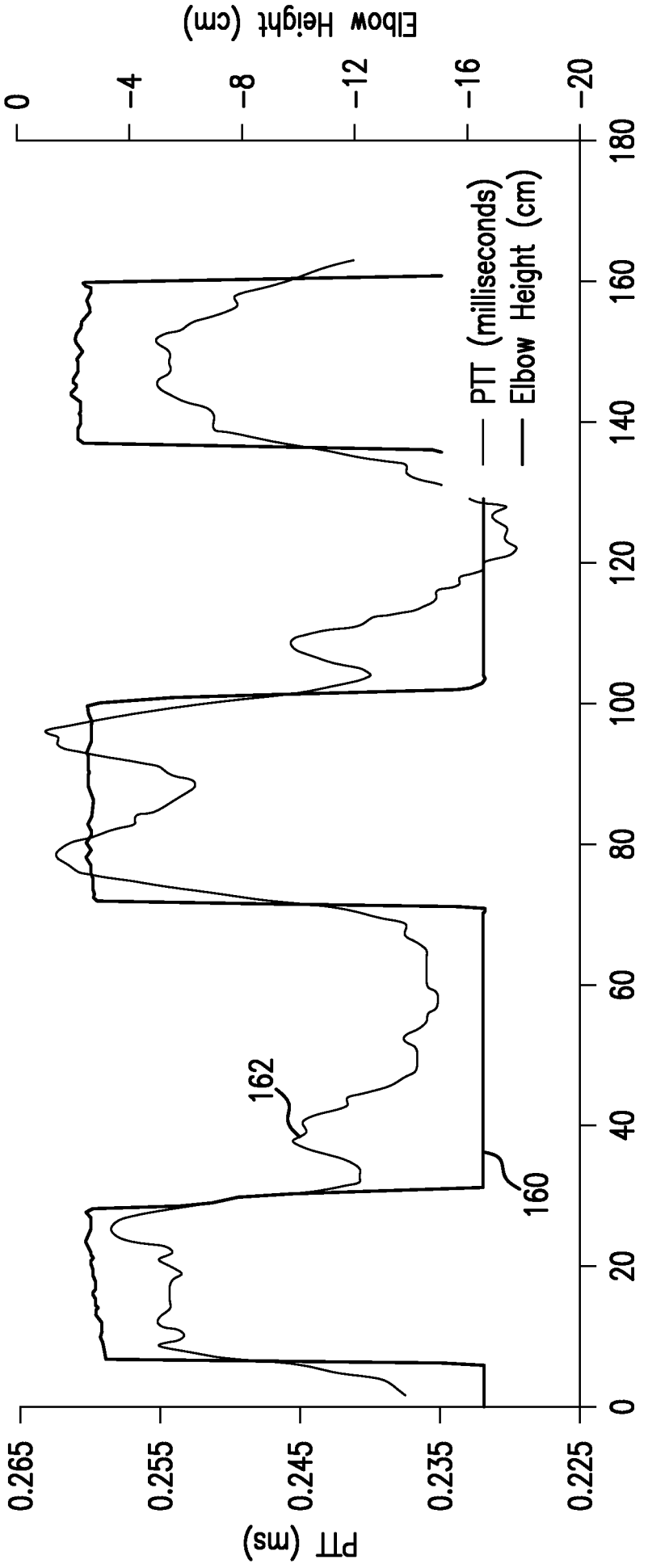

PTT (ms)
0.265
0.255
0.245
0.235
0.225
0
20
40
60
80
100
120
140
160
180
Time (arb.)
Elbow Height (cm)
0
−4
−8
−12
−16
−20
PTT (milliseconds)
Elbow Height (cm)
162
160

FIG.14

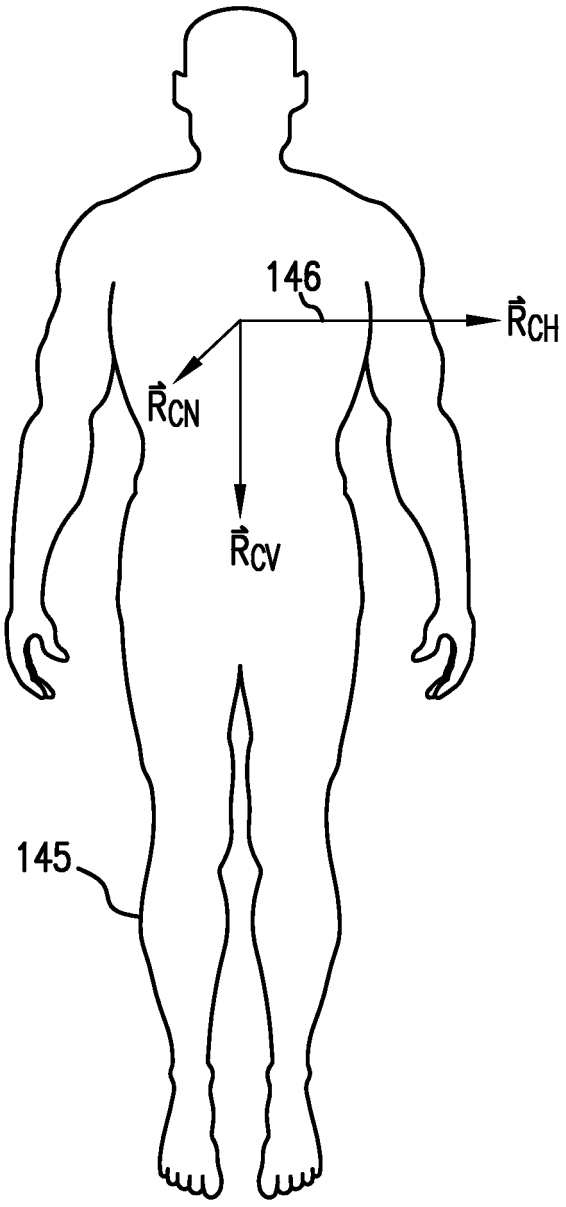


FIG.15

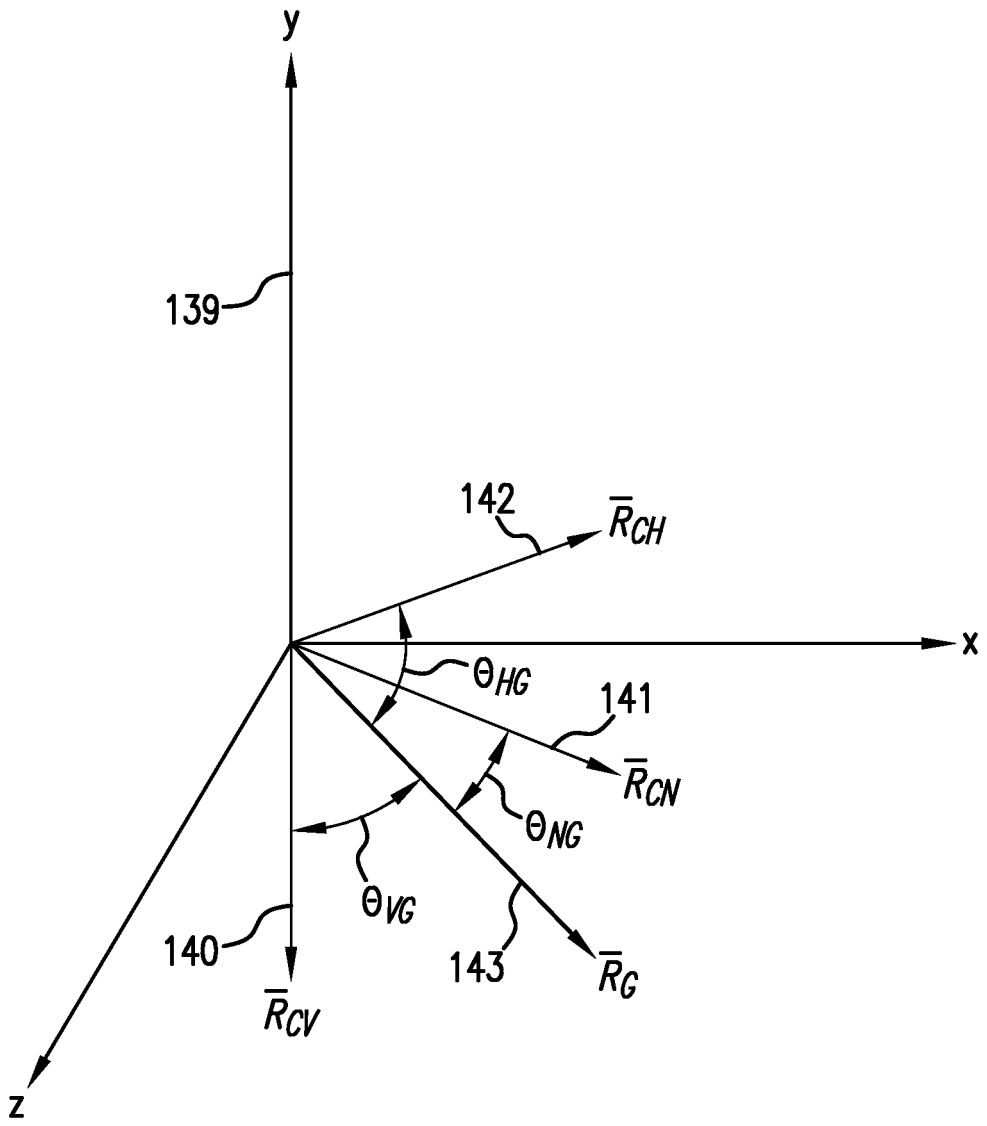

y
139
142
$\bar{R}_{CH}$
x
Θ_{HG}
141
$\bar{R}_{CN}$
Θ_{NG}
Θ_{VG}
140
143
$\bar{R}_G$
$\bar{R}_{CV}$
z

FIG.16

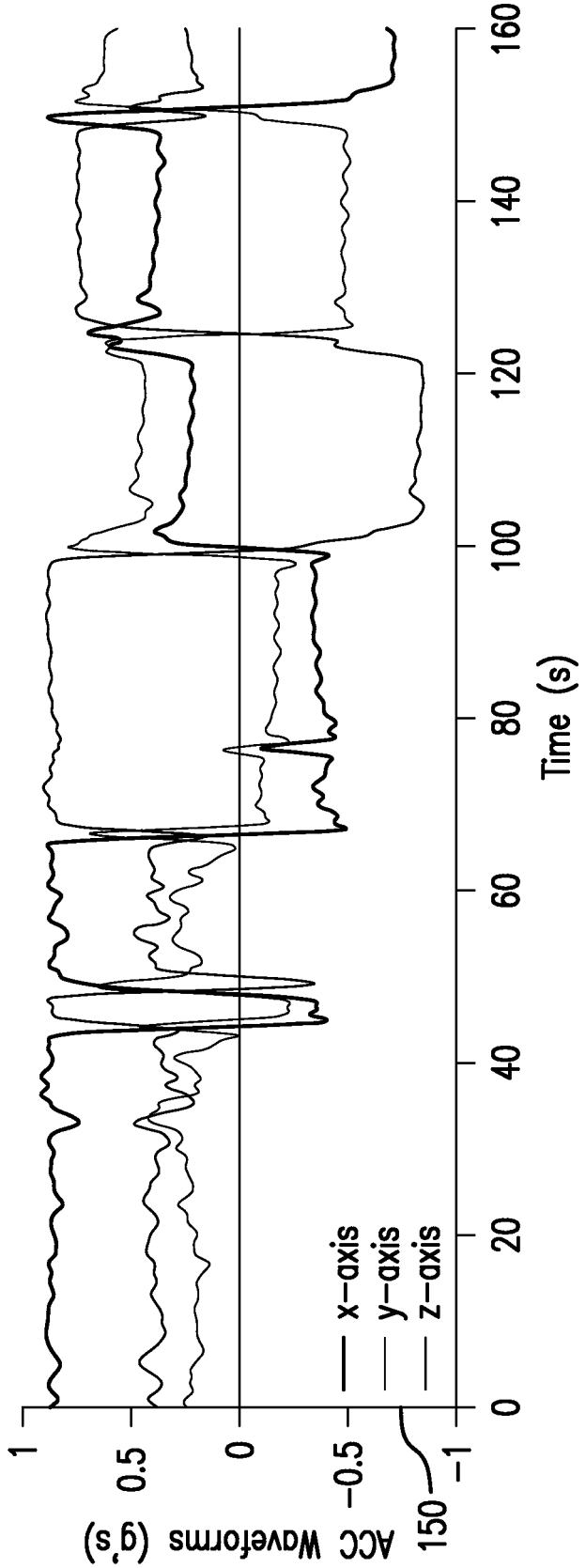


FIG.17A

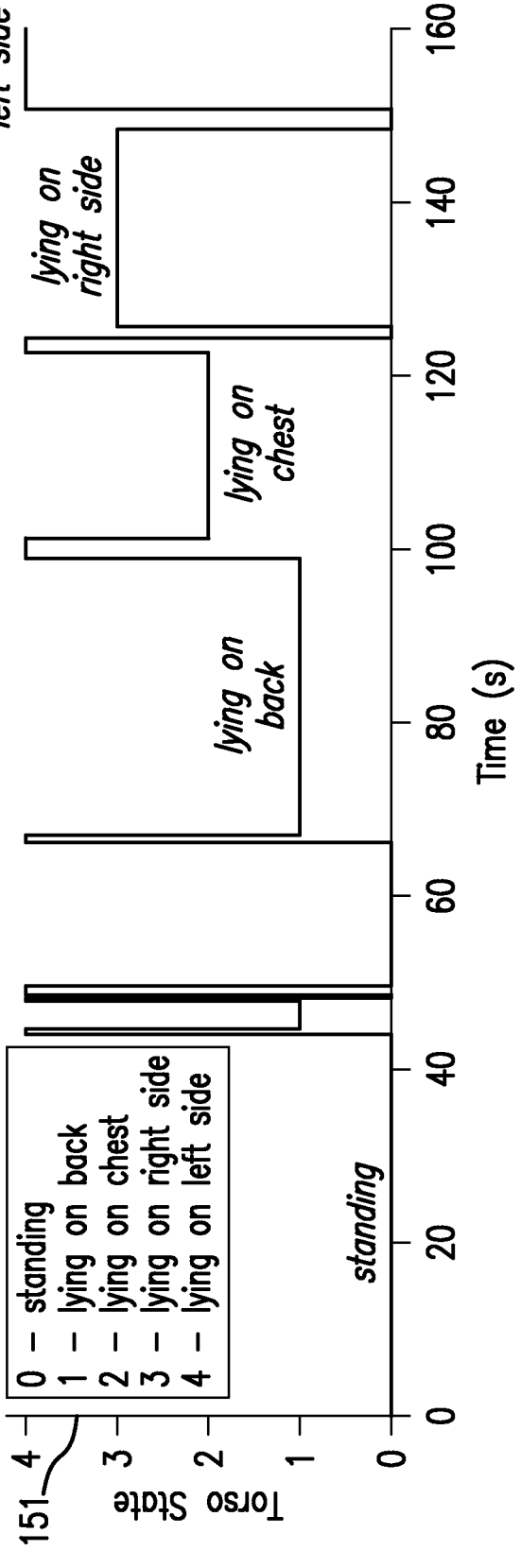


FIG.17B

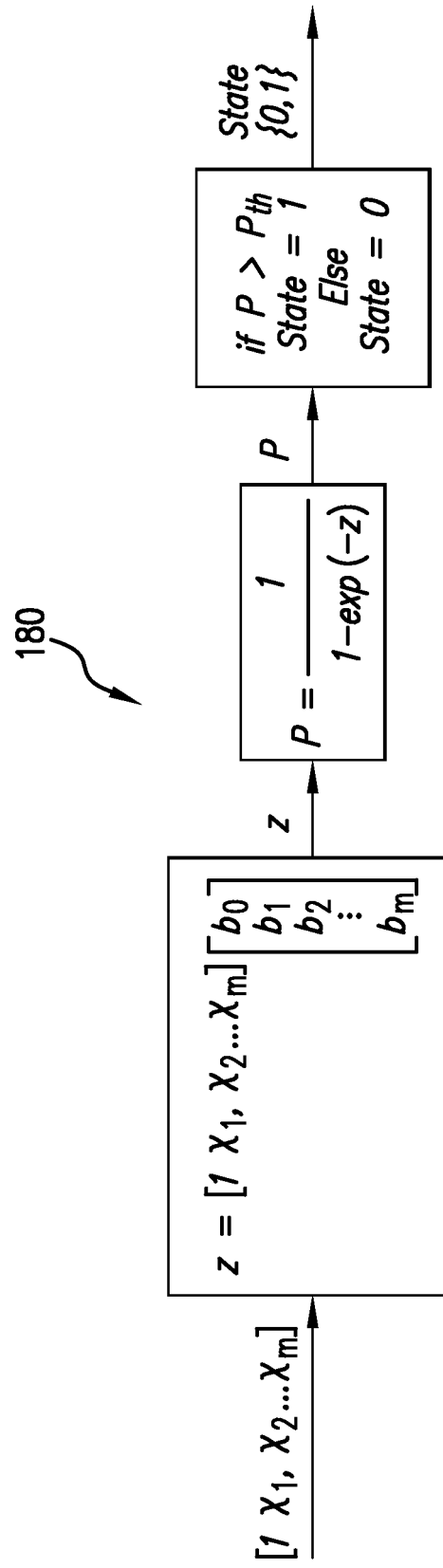

180
[1 x_1, x_2...x_m]
$z = [1\ x_1, x_2 ... x_m] \begin{bmatrix} b_0 \\ b_1 \\ b_2 \\ \vdots \\ b_m \end{bmatrix}$
z
$P = \frac{1}{1-exp(-z)}$
P
if $P > P_{th}$
State = 1
Else
State = 0
State
{0,1}

FIG. 18

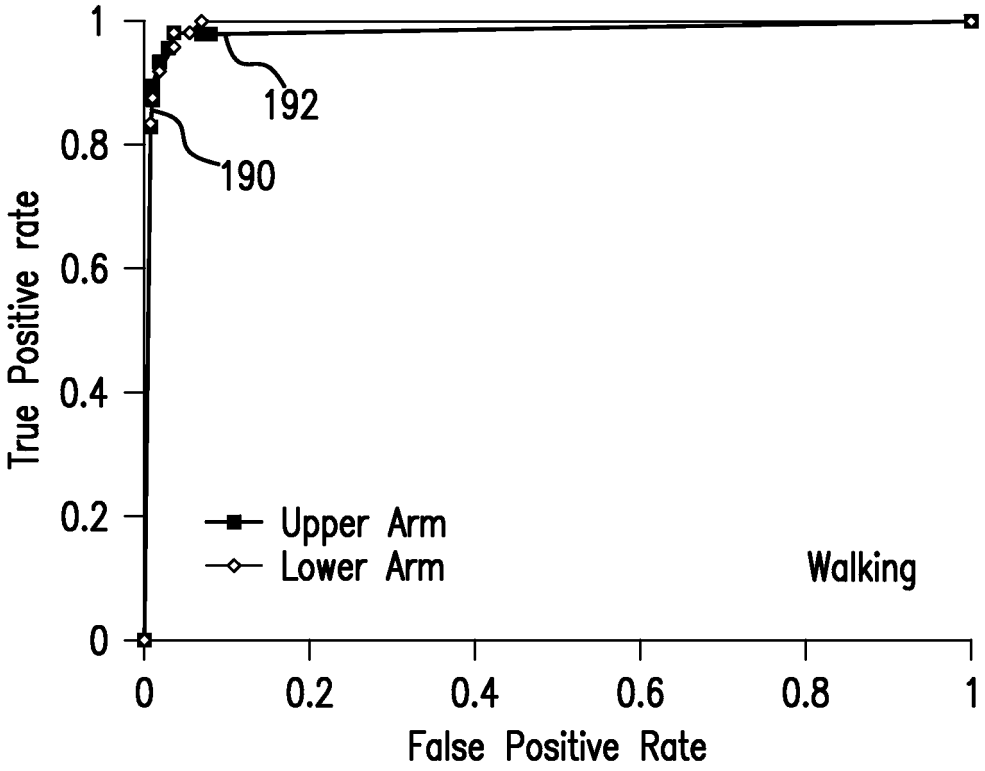


FIG.19A

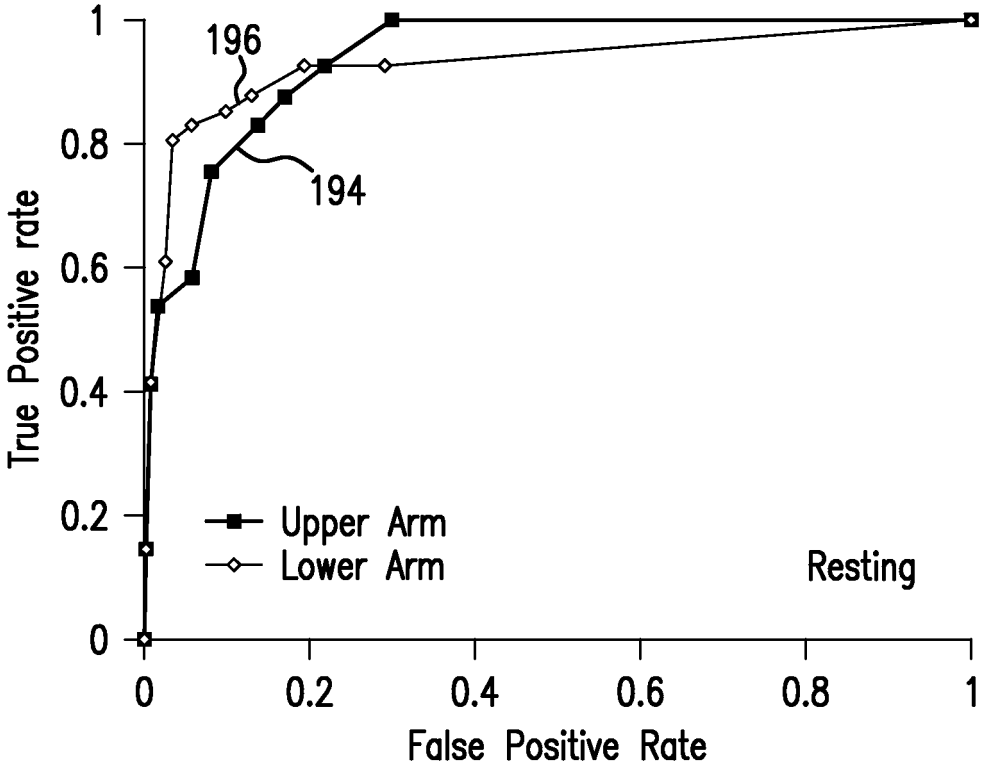


FIG.19B

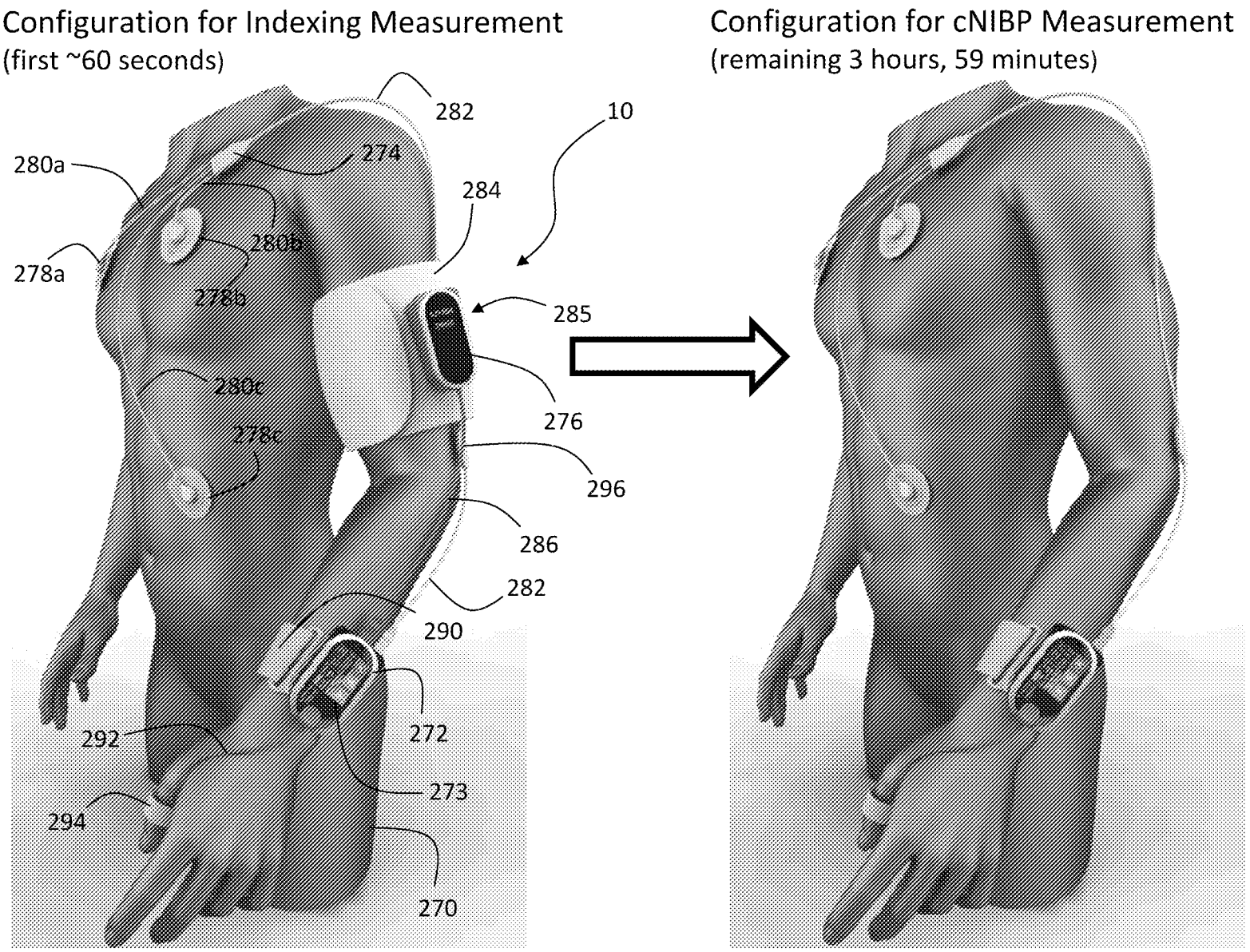


FIG.20A FIG.20B

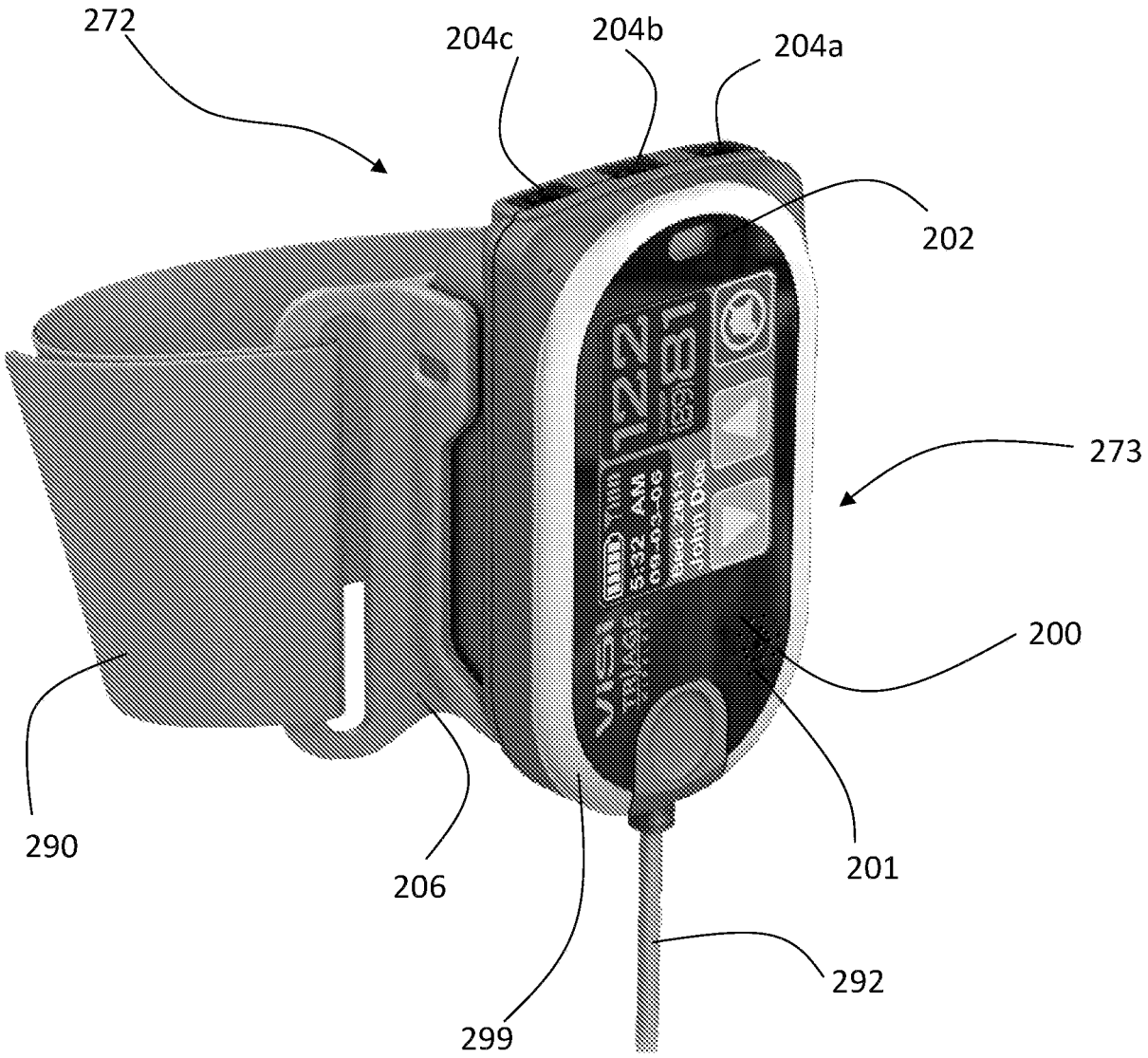


FIG.21