FIG. 1

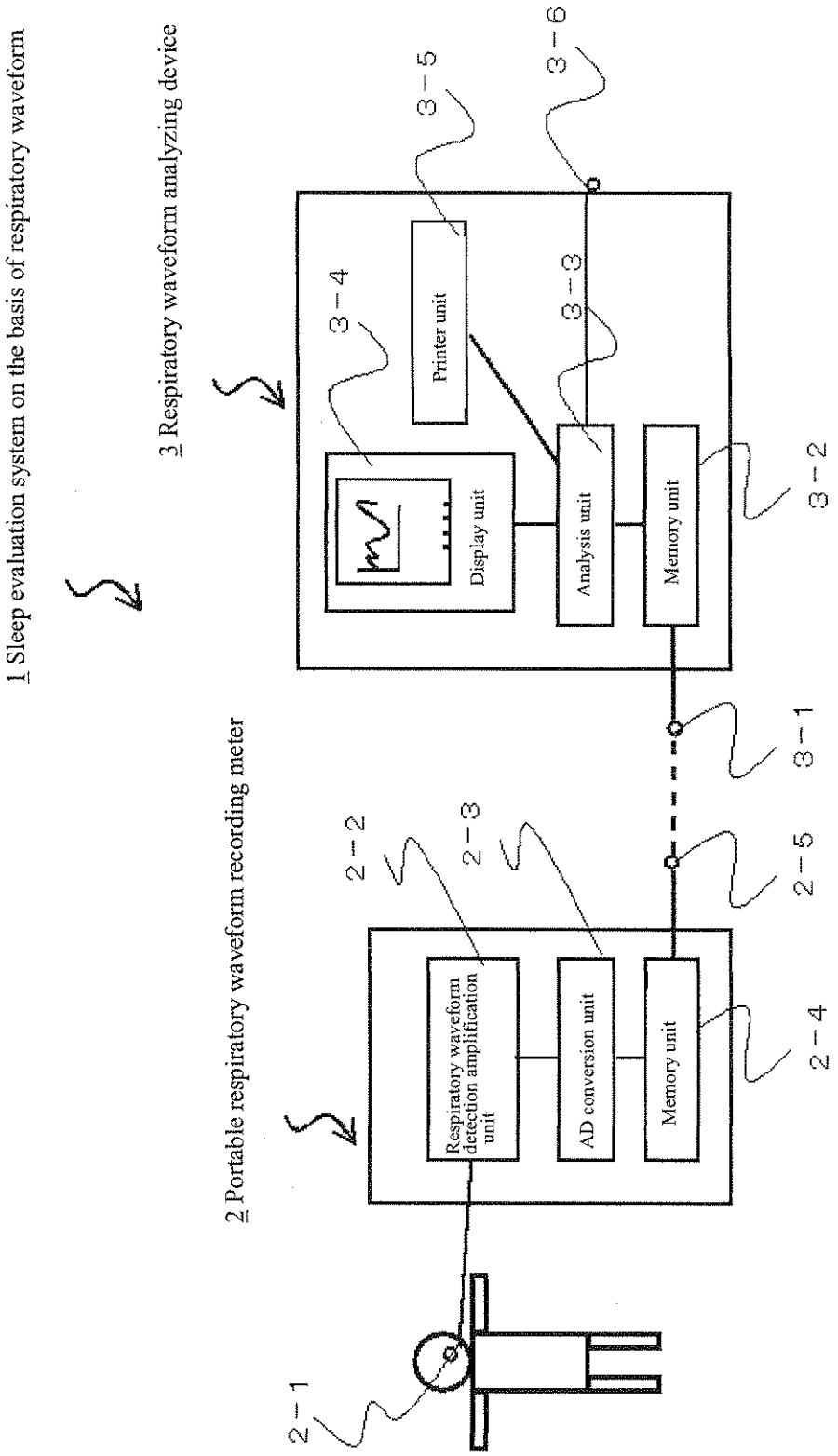
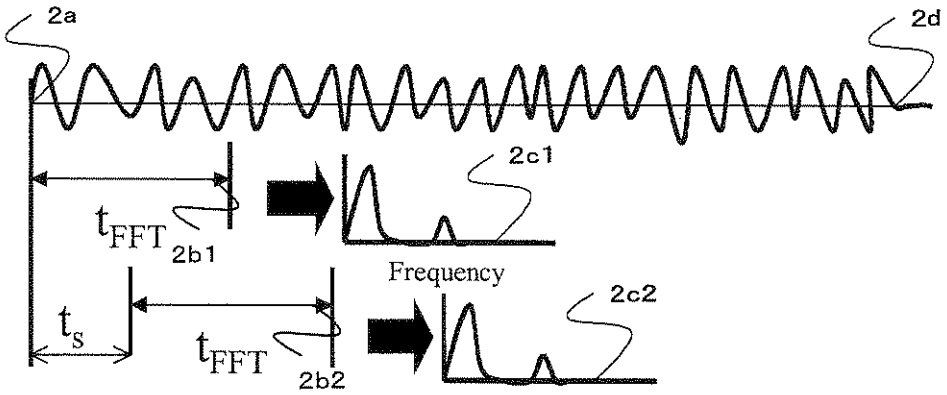

1 Sleep evaluation system on the basis of respiratory waveform
3 Respiratory waveform analyzing device
2 Portable respiratory waveform recording meter
Printer unit
Display unit
Analysis unit
Memory unit
Respiratory waveform detection amplification unit
AD conversion unit
Memory unit
3 – 1
3 – 2
3 – 3
3 – 4
3 – 5
3 – 6
2 – 1
2 – 2
2 – 3
2 – 4
2 – 5

FIG. 2

(A)


2a
2d
2c1
t_{FFT}
2b1
Frequency
t_s
t_{FFT}
2b2
2c2

(B)

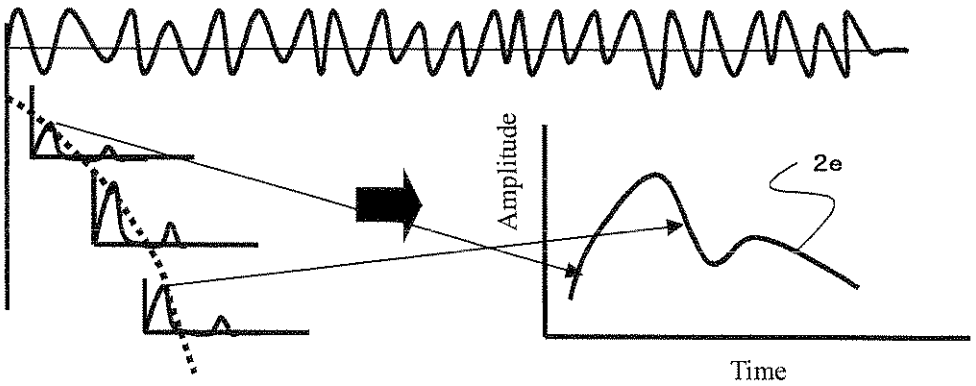
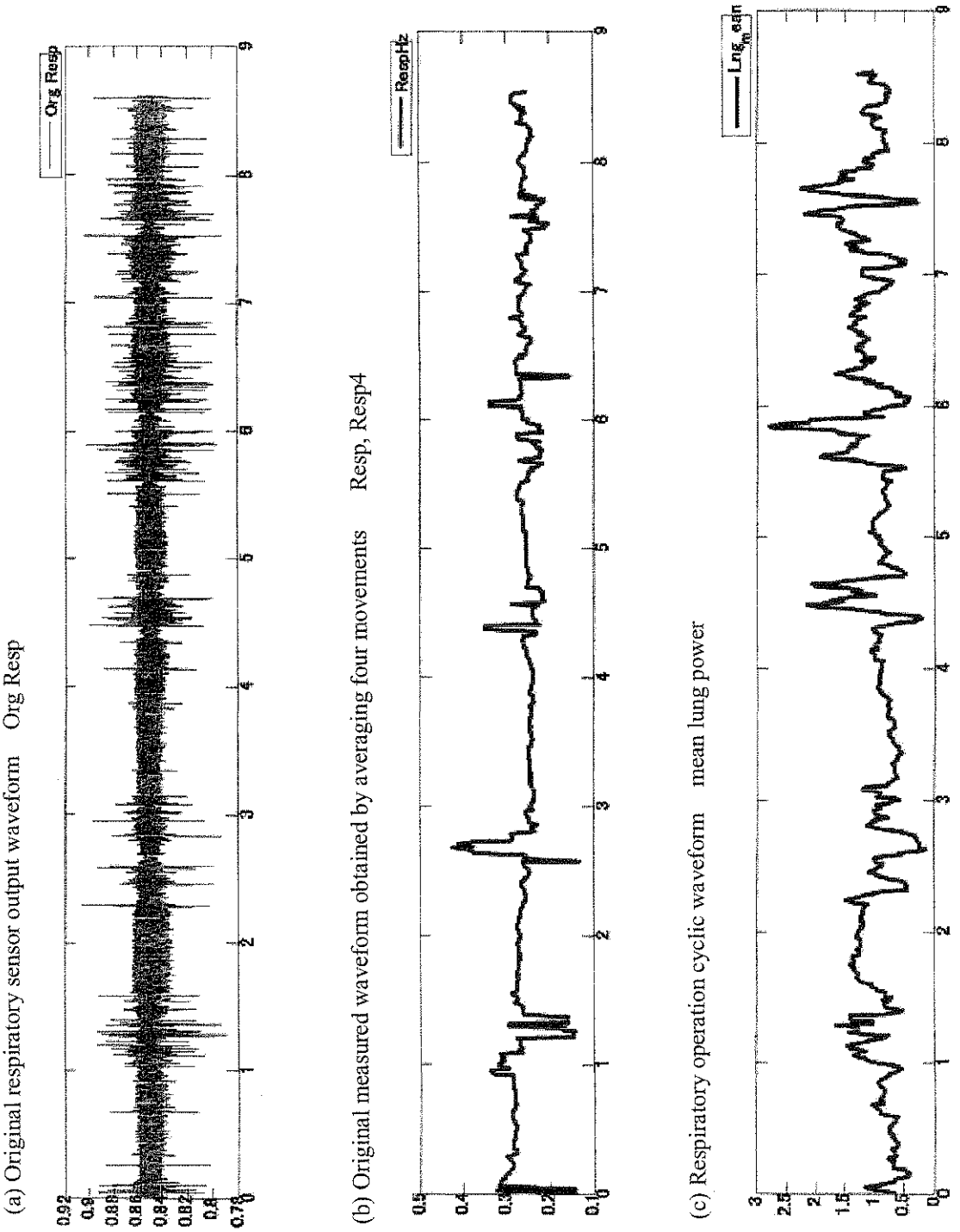

Amplitude
2e
Time

FIG. 3

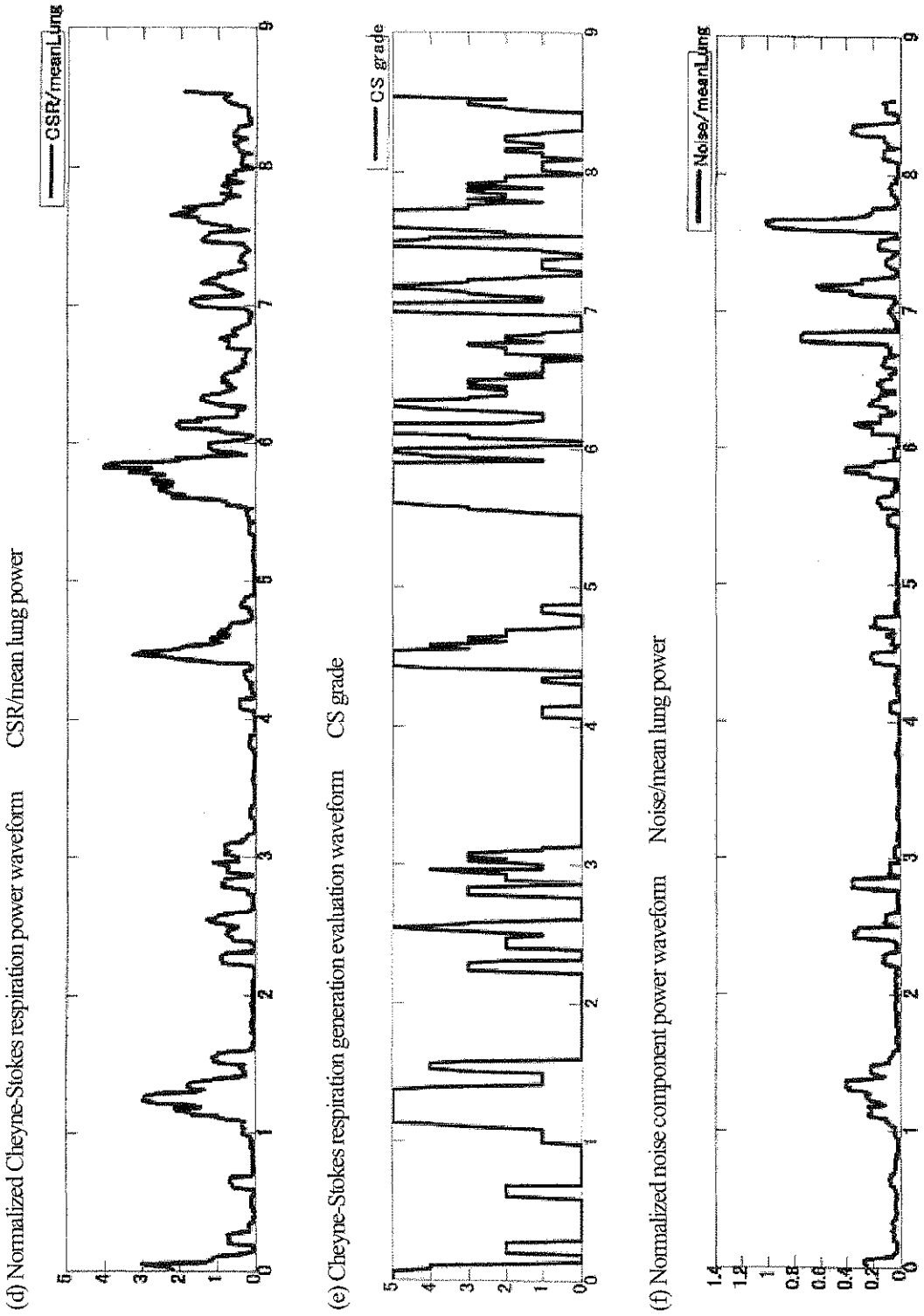


(a) Original respiratory sensor output waveform Org Resp

(b) Original measured waveform obtained by averaging four movements Resp, Resp4

(c) Respiratory operation cyclic waveform mean lung power

FIG. 4

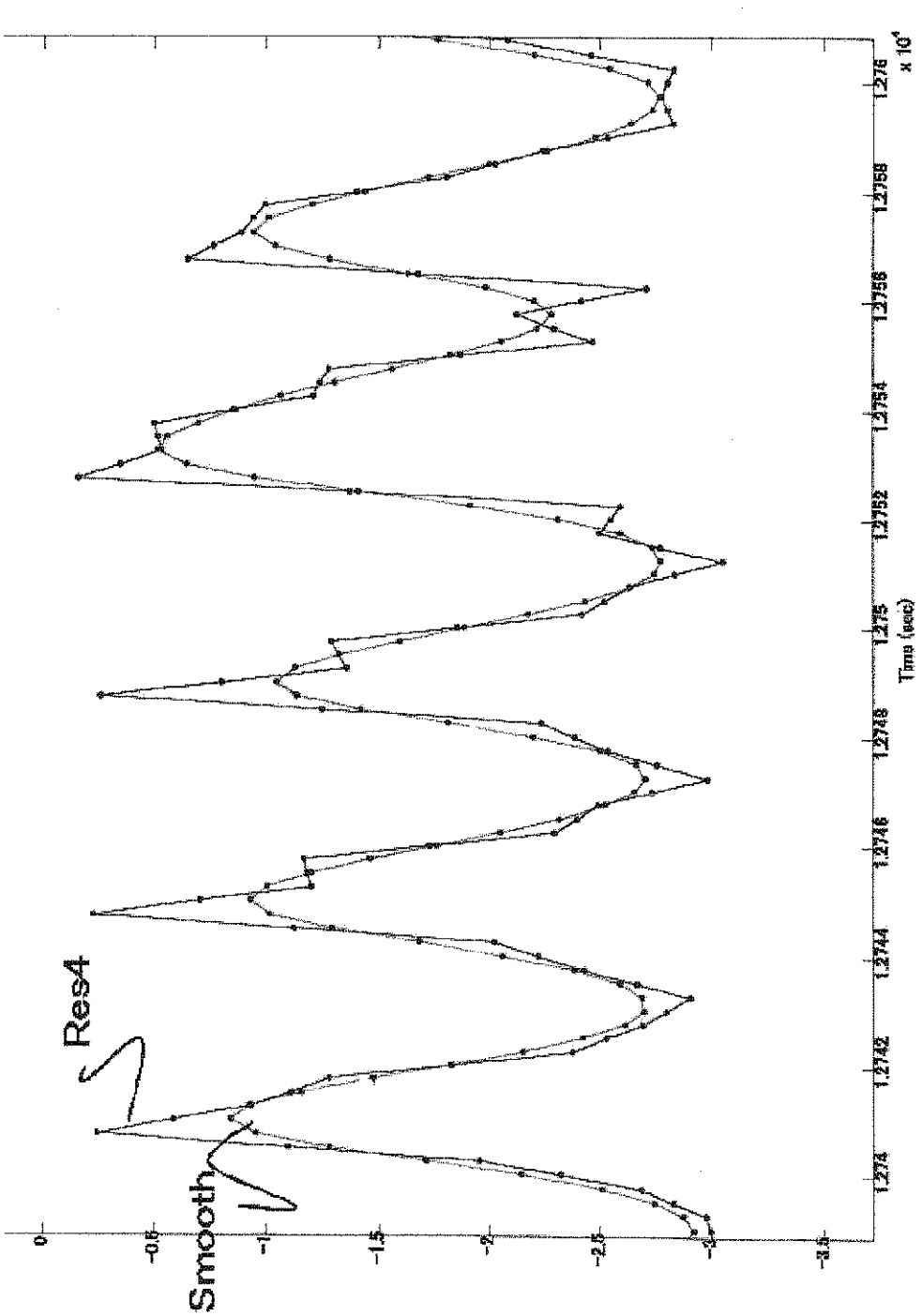


(d) Normalized Cheyne-Stokes respiration power waveform CSR/mean lung power

(e) Cheyne-Stokes respiration generation evaluation waveform CS grade

(f) Normalized noise component power waveform Noise/mean lung power

FIG. 5



Respiratory sensor output waveform obtained by averaging four measurements (resp4) and smoothing respiratory waveform obtained by moving average of past 5 seconds thereof (smooth)

FIG. 6

Noise waveform (noise) is created by subtracting smoothing respiratory waveform (smooth) from lower envelope (bottom) of respiratory sensor output waveform (resp4) obtained by moving average four measurements

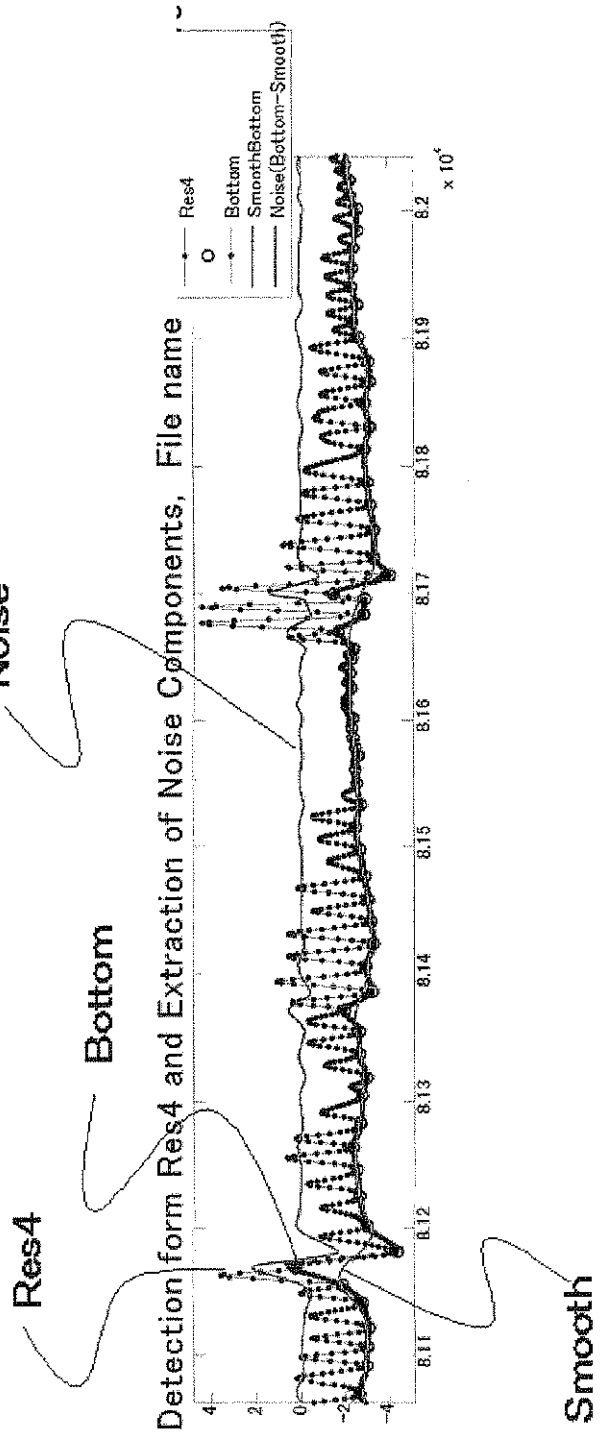
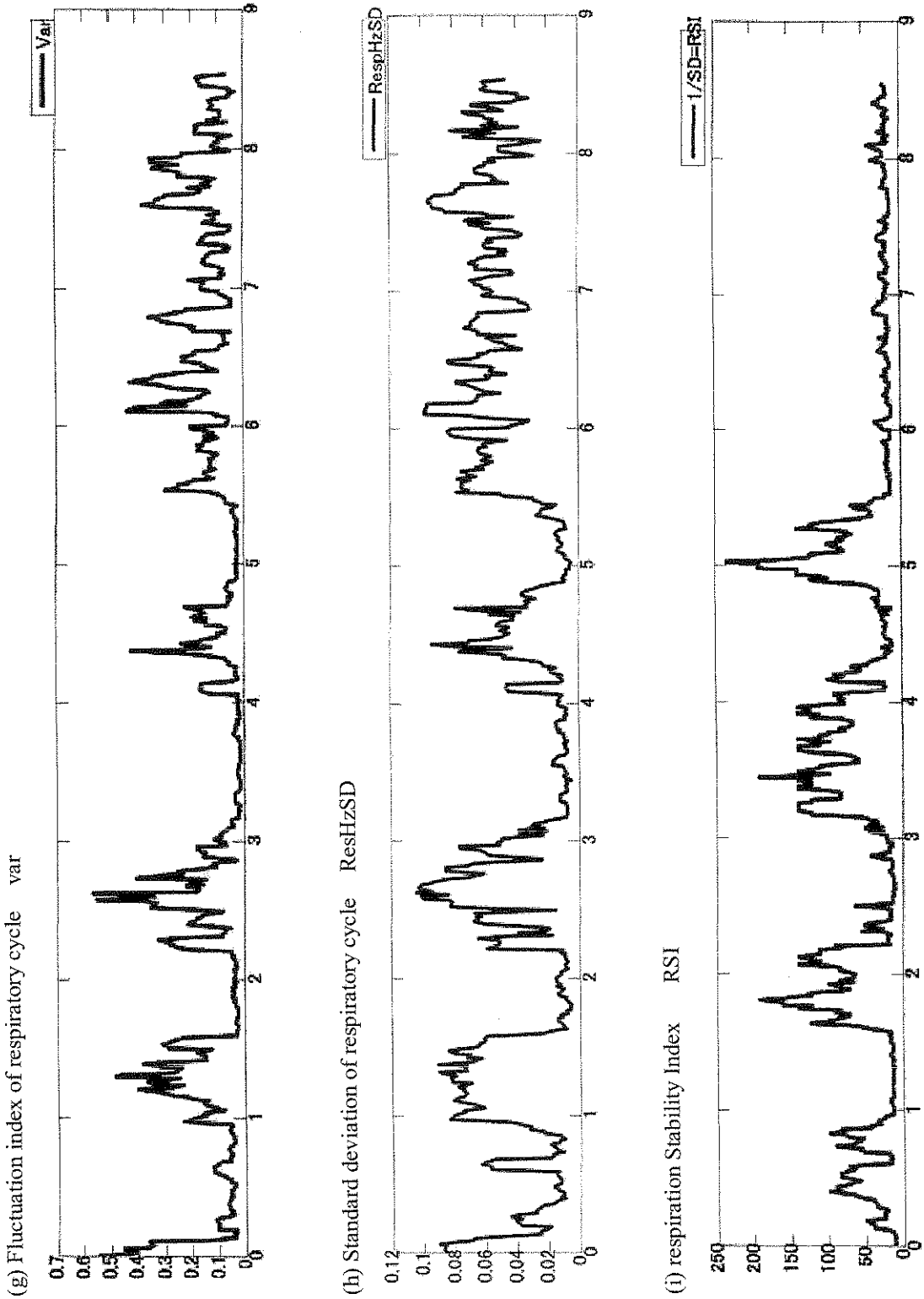


FIG. 7



(g) Fluctuation index of respiratory cycle var

(h) Standard deviation of respiratory cycle ResHzSD

(i) respiration Stability Index RSI

FIG. 8

Conceptual diagram of fluctuation index (var) of respiratory cycle

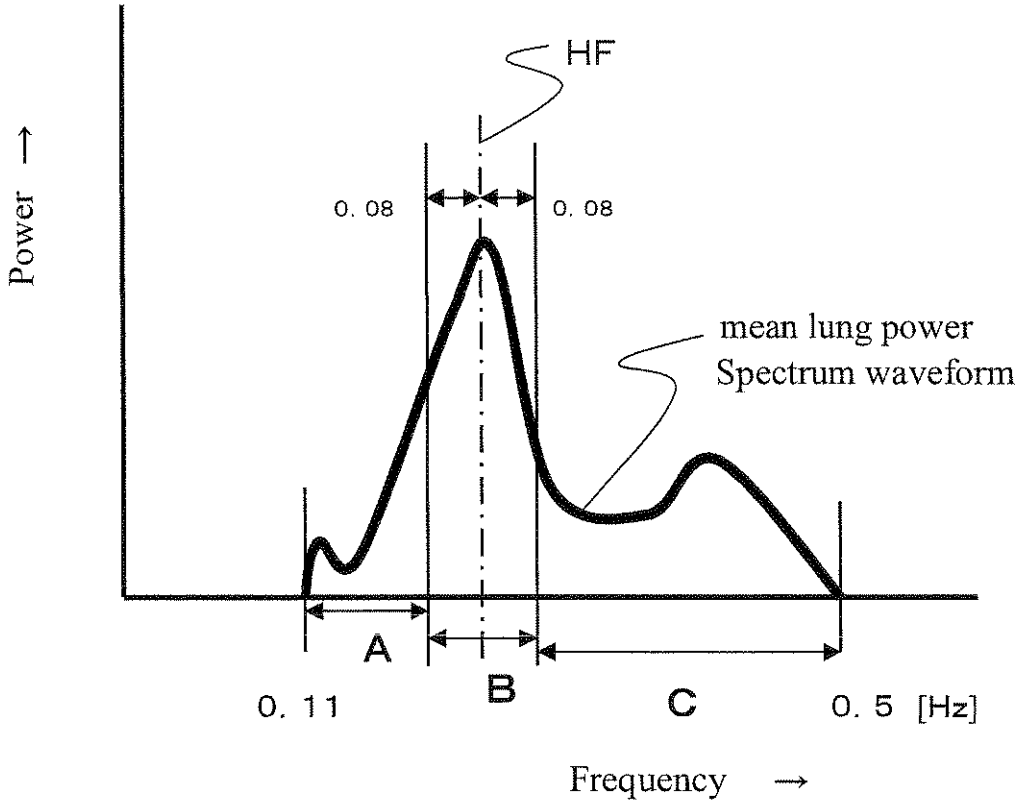


FIG. 9

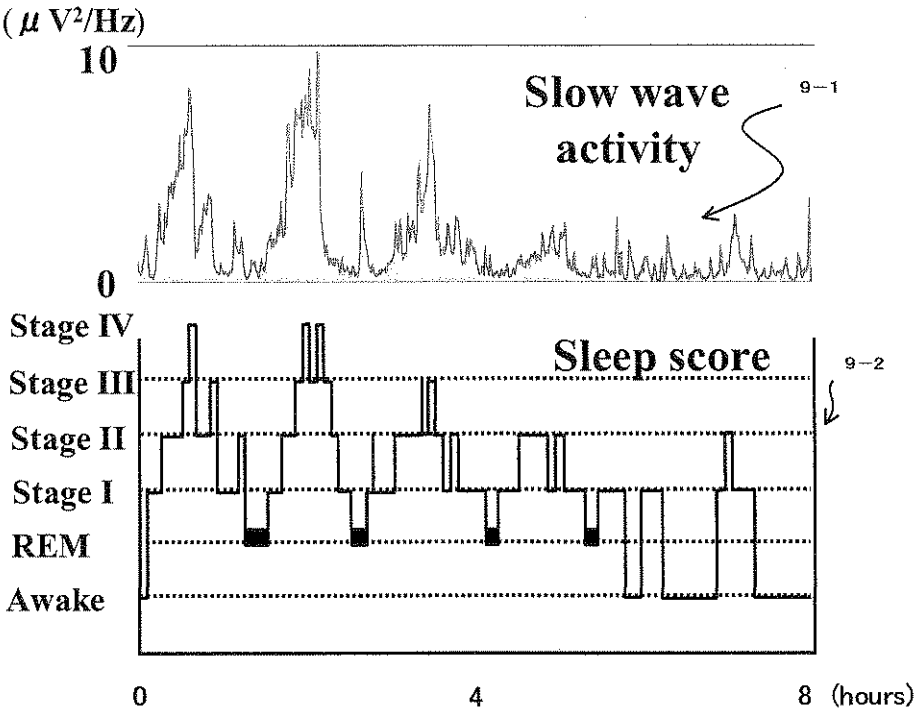

(μV²/Hz)
10
0
Slow wave activity
9-1
Stage IV
Stage III
Stage II
Stage I
REM
Awake
Sleep score
9-2
0
4
8 (hours)

FIG. 10

Conceptual standard deviation of respiratory cycle ResHzSD

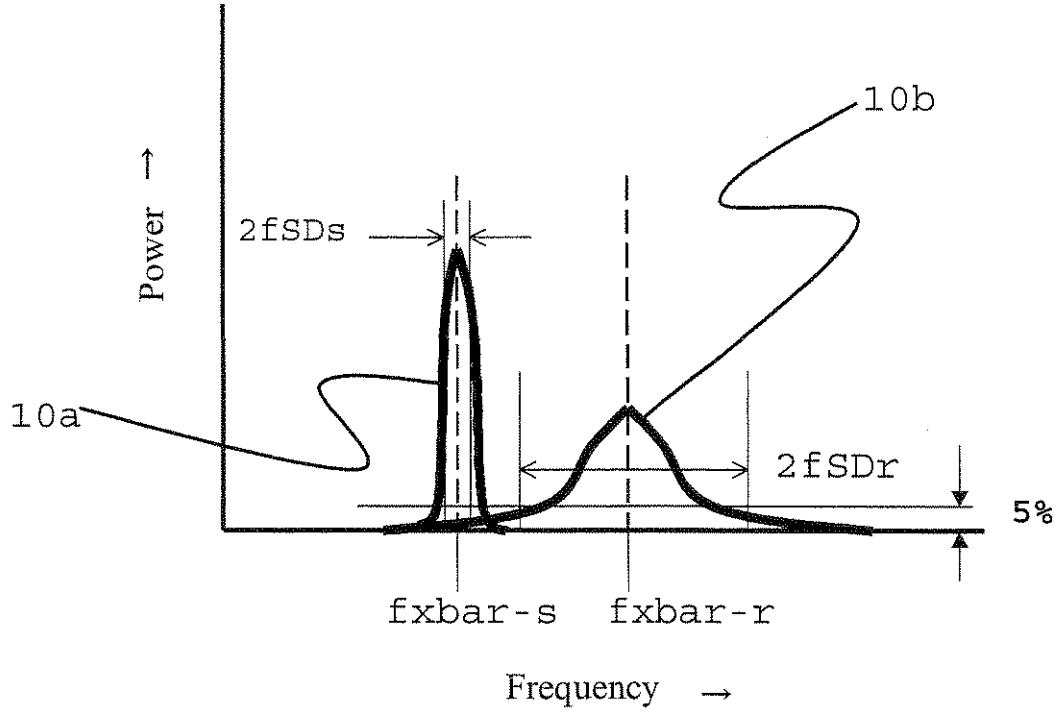
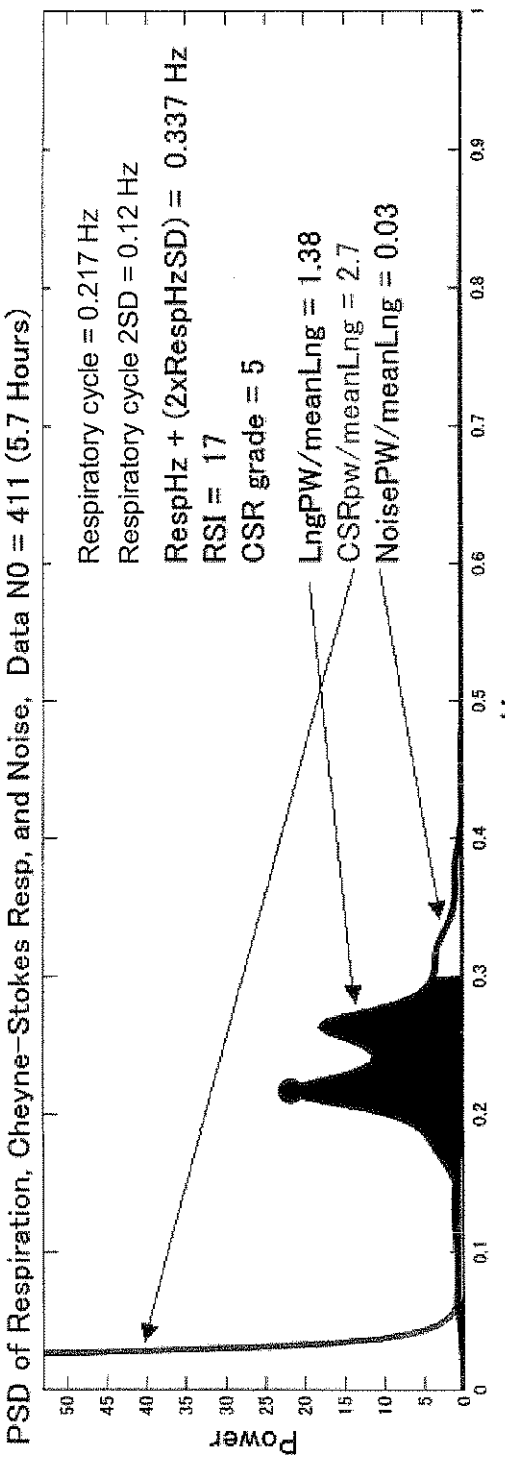


FIG. 11

(1) Waveform frequency spectrum graph in selected time domain



(2) Waveform graph enlarged in selected time domain

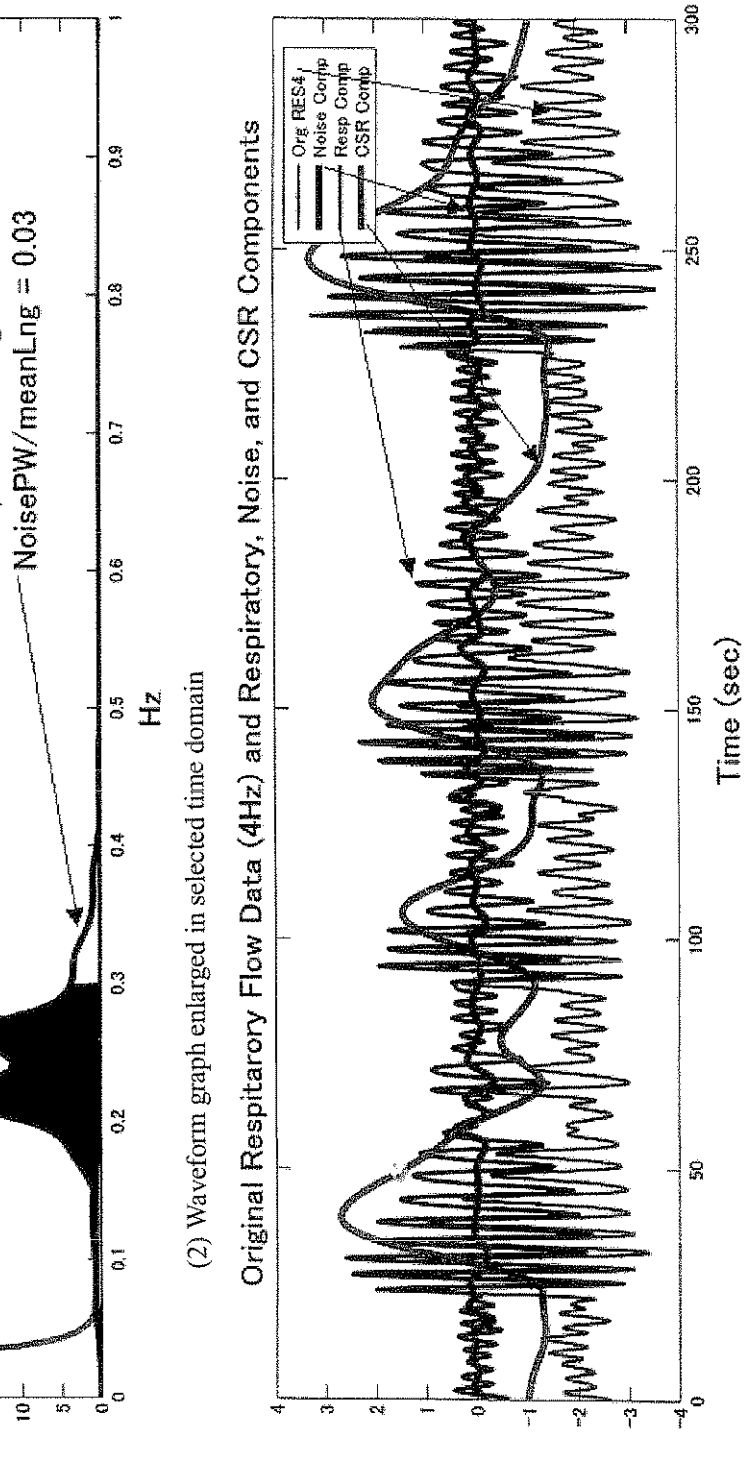
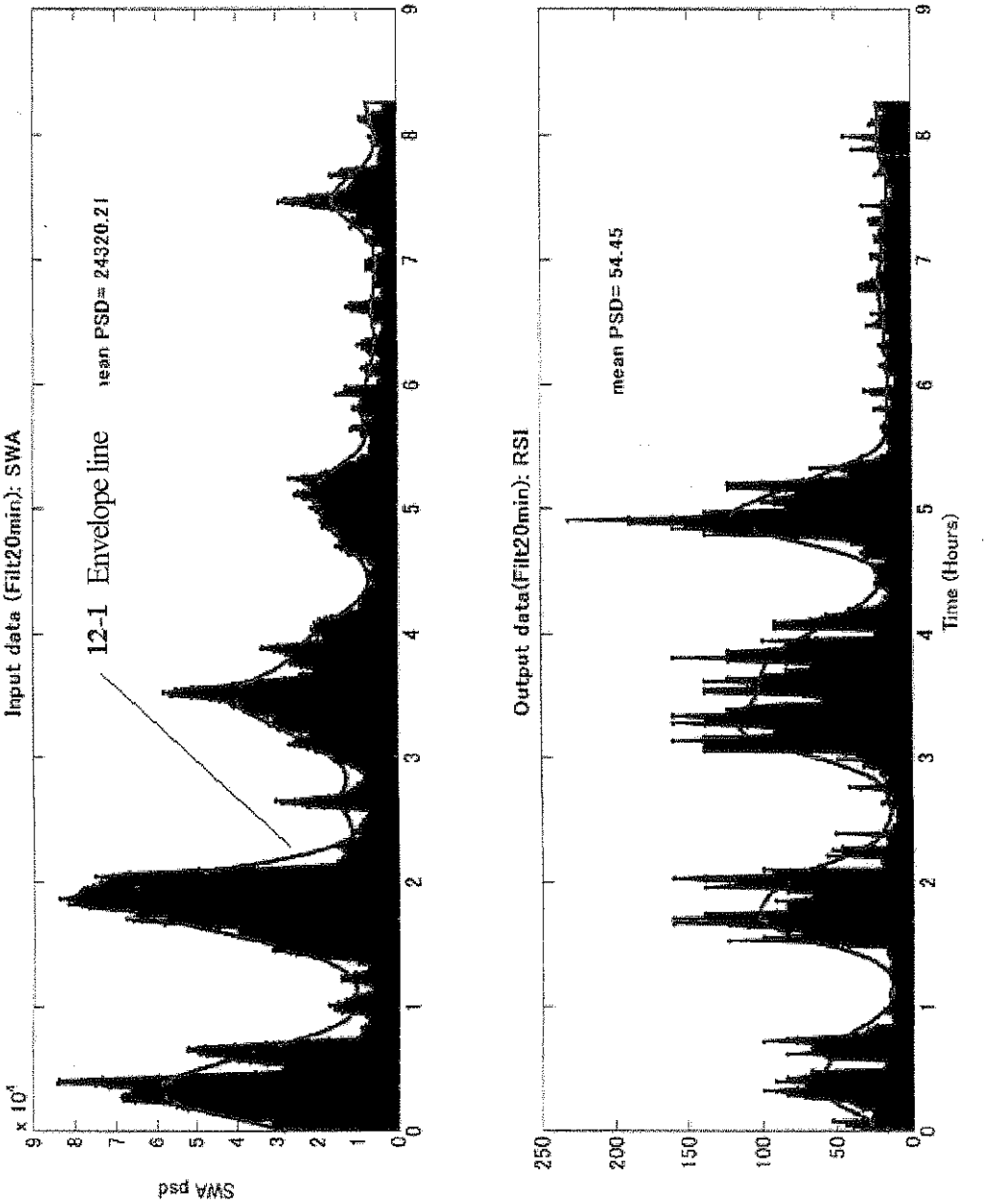


FIG. 12

First case (healthy person)

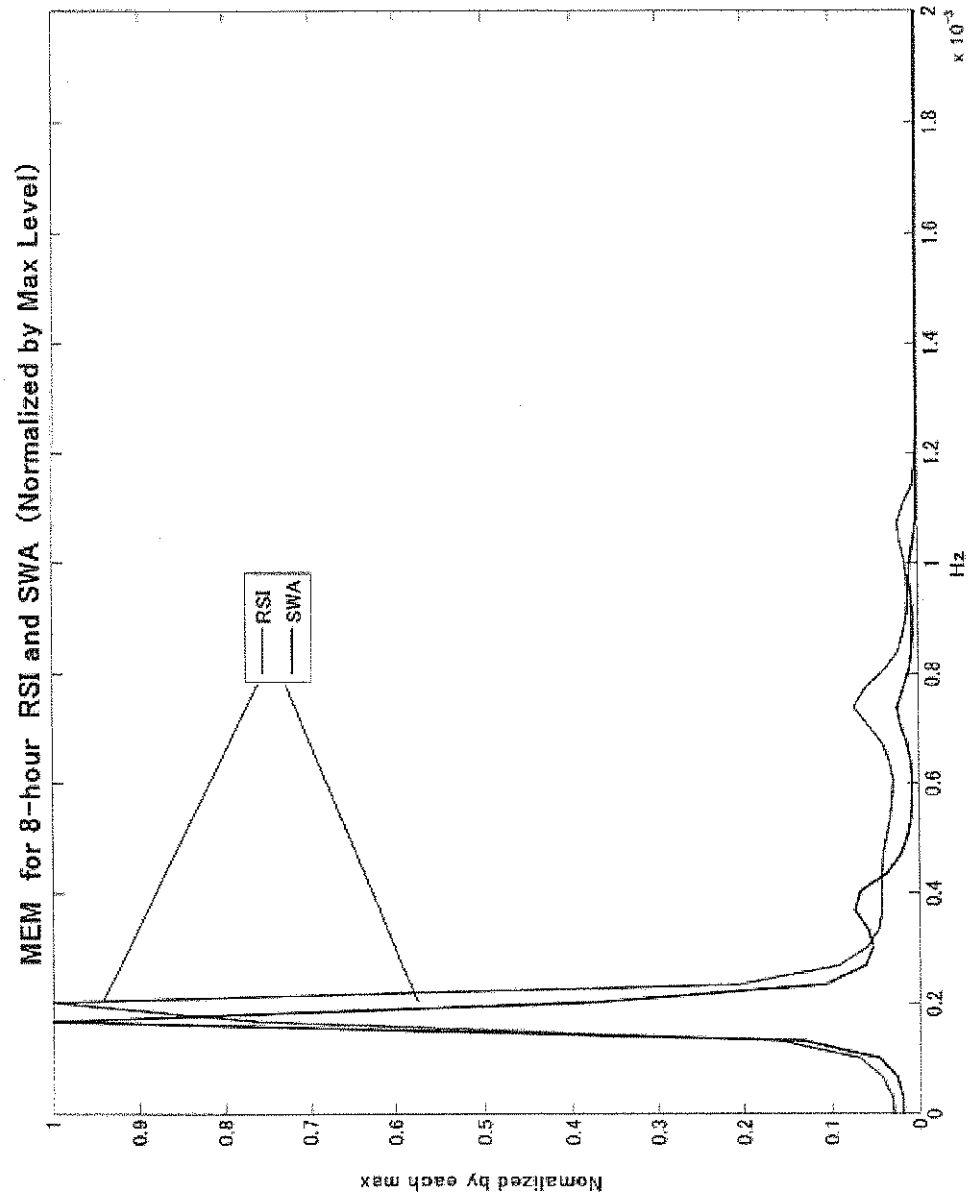


(i) Brain wave SWA trend

(ii) Respiratory cycle RSI trend

FIG. 13

First case (healthy person)

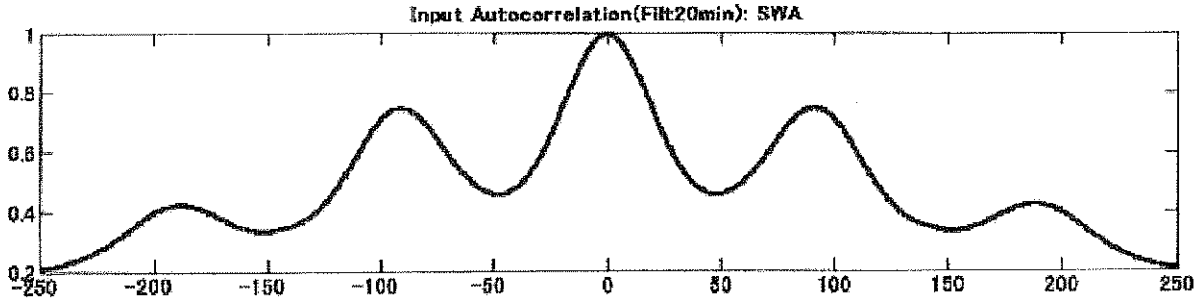


(iii) Frequency distribution of brain wave SWA and respiratory cycle RSI

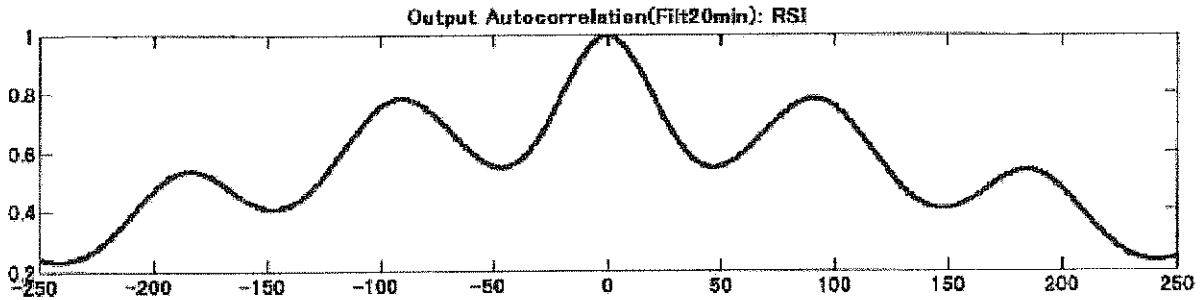
FIG. 14

First case (healthy person)

(iv) Brain wave SWA Autocorrelation function



(v) Respiratory cycle RSI autocorrelation function



(vi) Cross-correlation function of brain wave SWA and respiratory cycle RSI

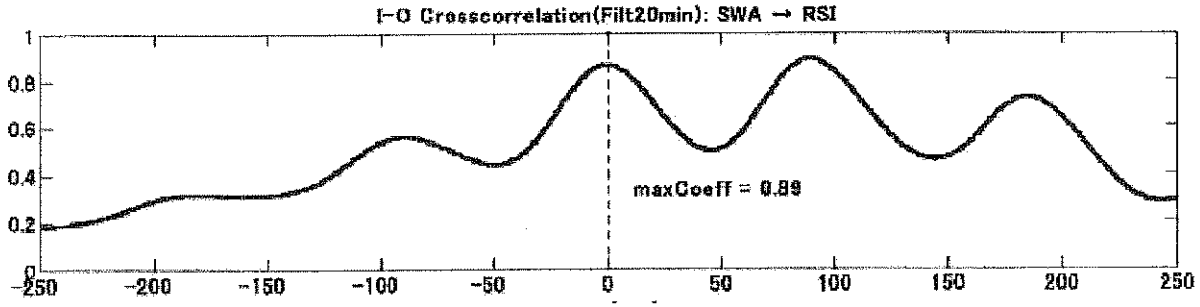
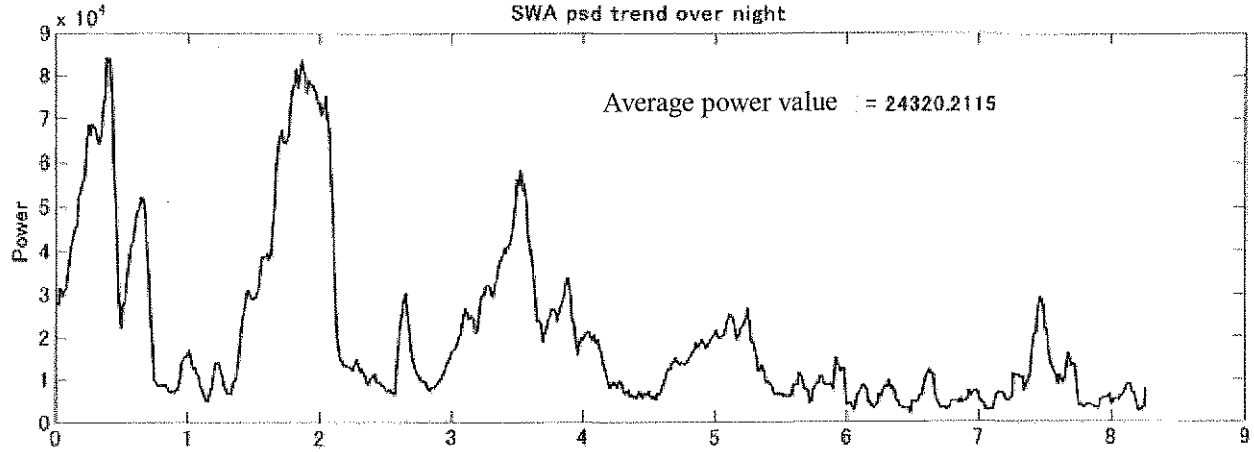


FIG. 15

First case (healthy person)

(vii) Brain wave swa trend



(viii) Trend of ultradian power included in brain wave SWA trend

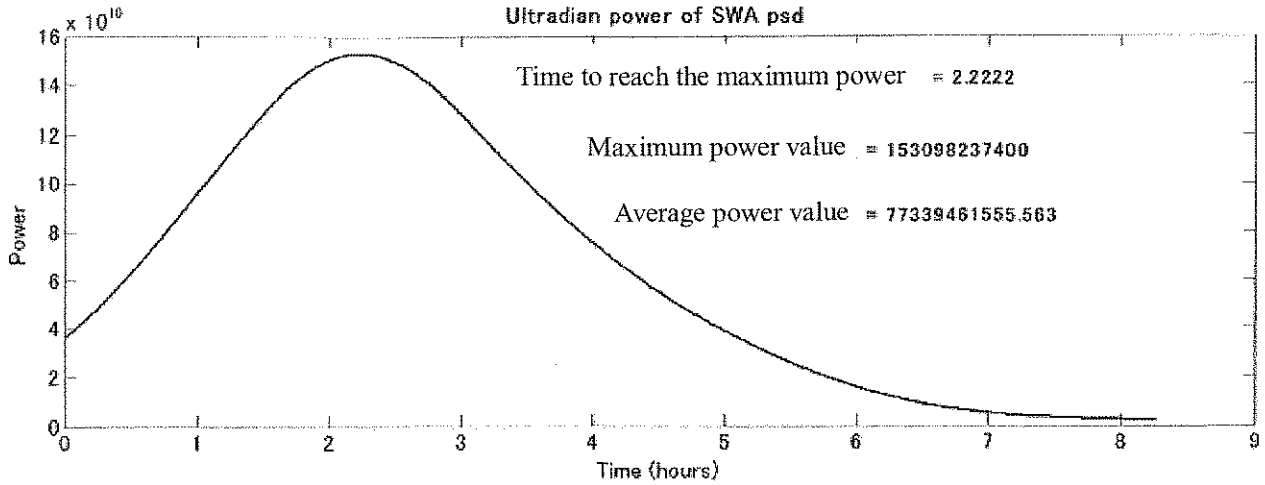
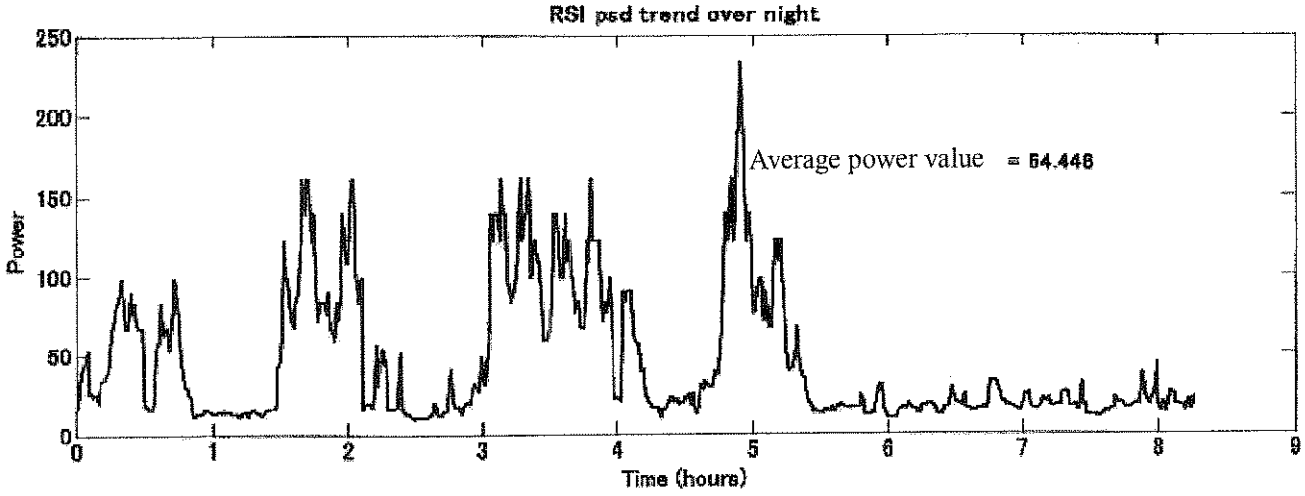


FIG. 16

First case (healthy person)

(ix) Respiratory cycle RSI trend



(x) Change of ultradian power included in respiratory cycle RSI trend

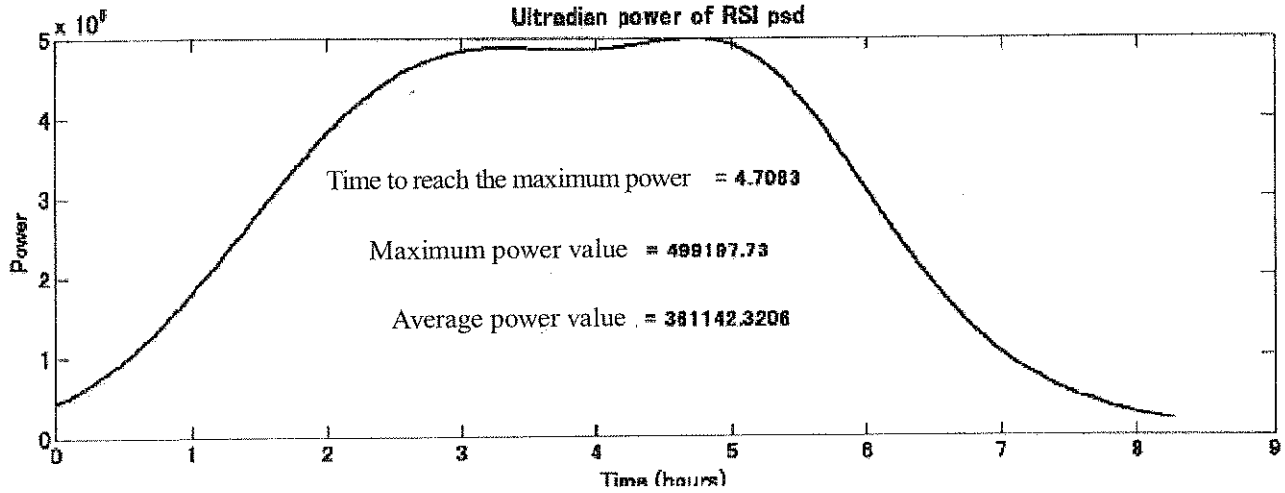
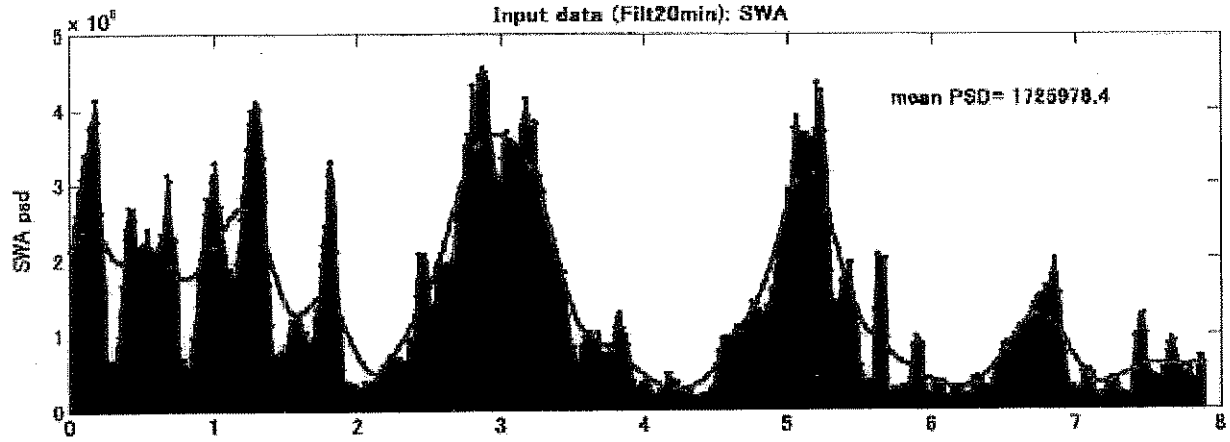


FIG. 17

Second case (NYHA Ⅰ、BNP=47)

(i) Brain wave SWA trend



(ii) Respiratory cycle RSI trend

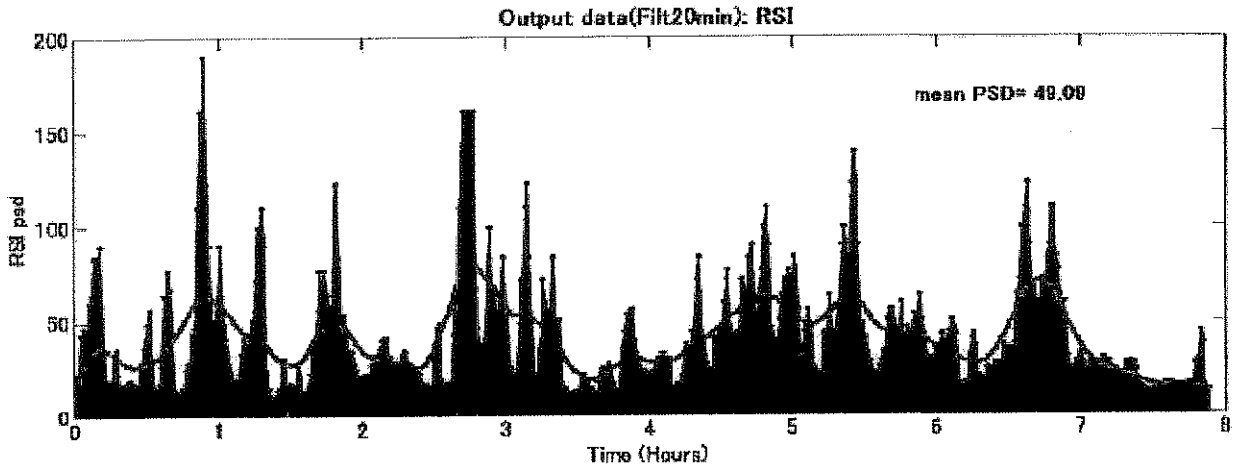
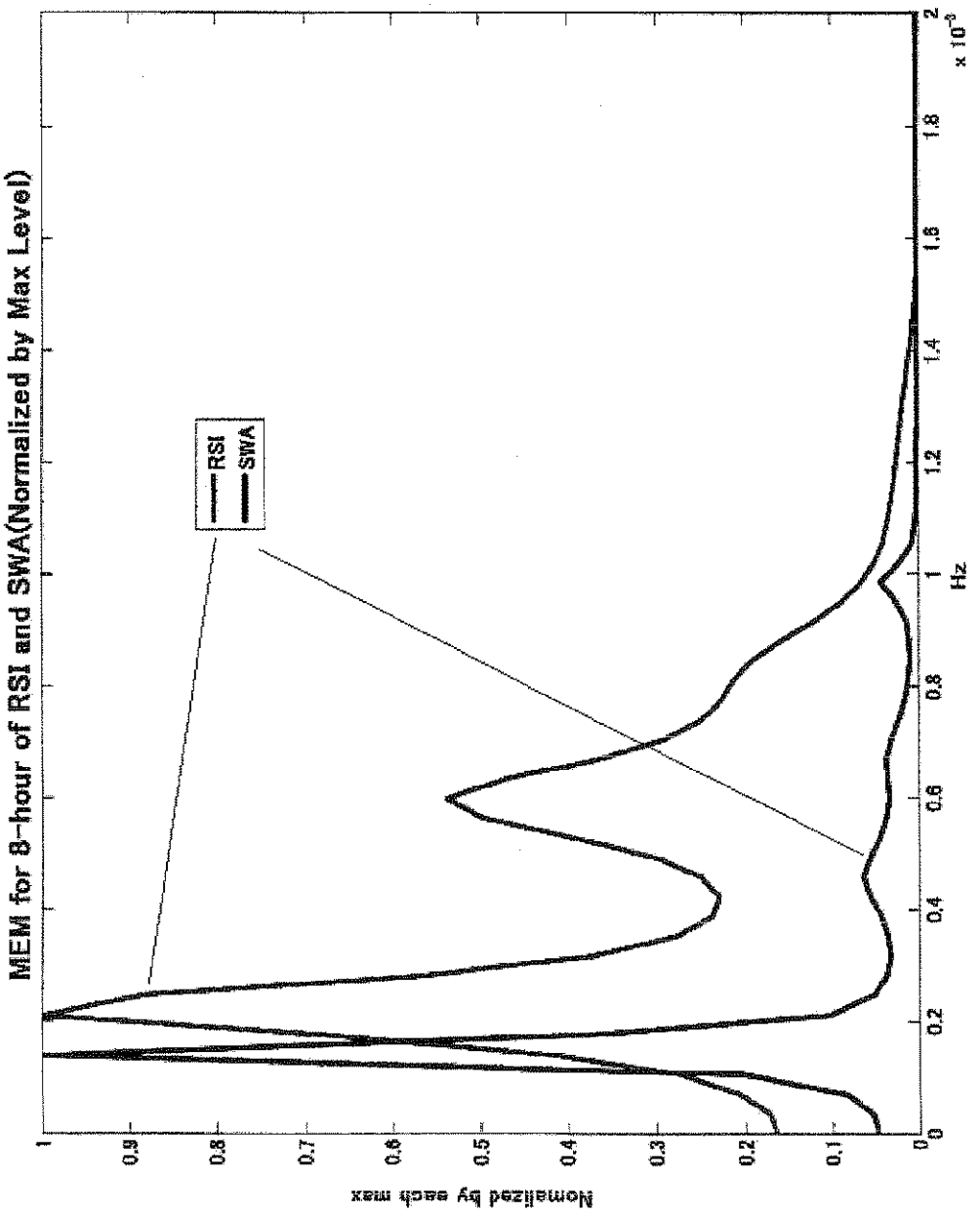


FIG. 18

Second case (NYHA Ⅰ、BNP=47)

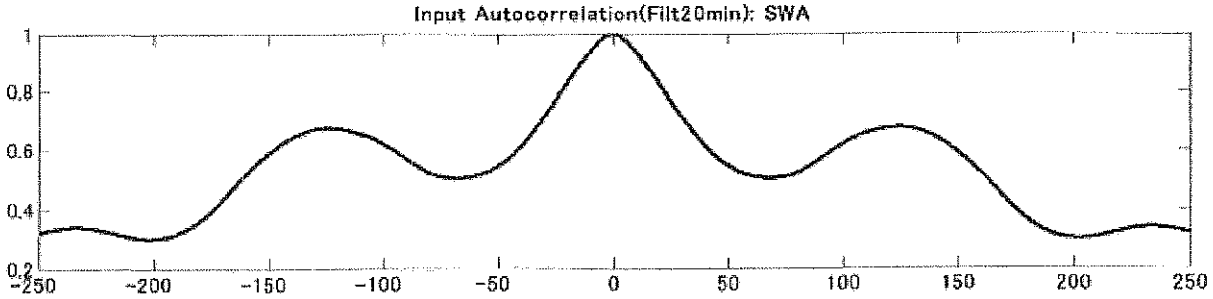


(iii) Frequency distribution of brain wave SWA and respiratory cycle RSI

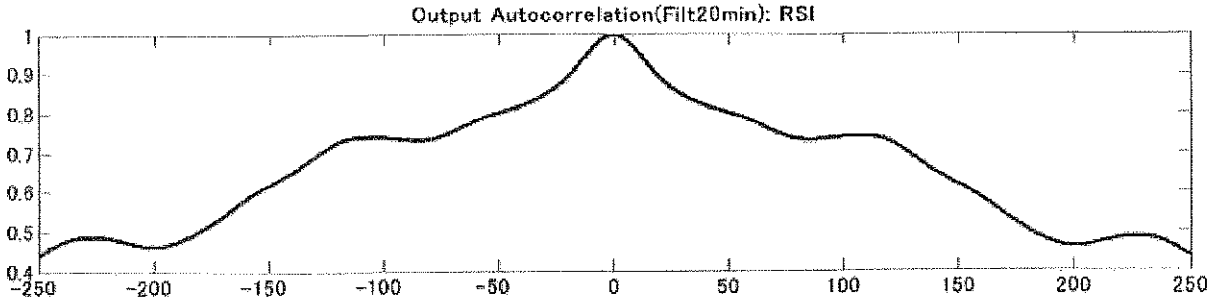
FIG. 19

Second case (NYHA Ⅰ、BNP=47)

(iv) Brain wave SWA Autocorrelation function



(v) Respiratory cycle RSI autocorrelation function



(vi) Cross-correlation function of brain wave SWA and respiratory cycle RSI

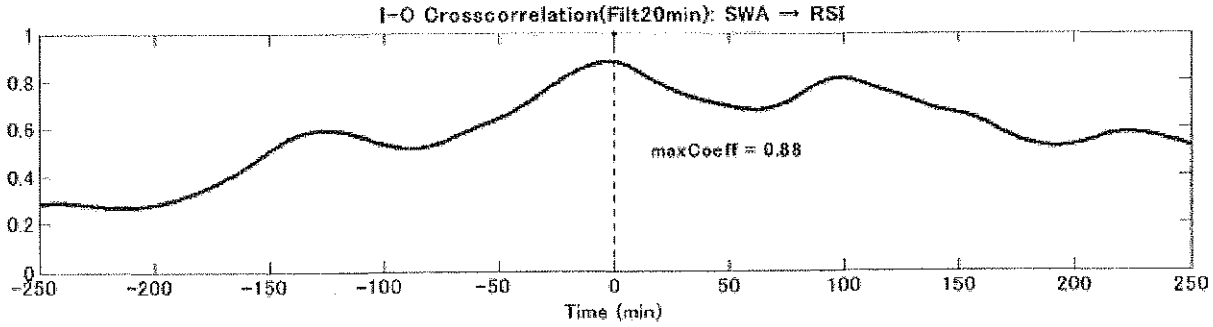
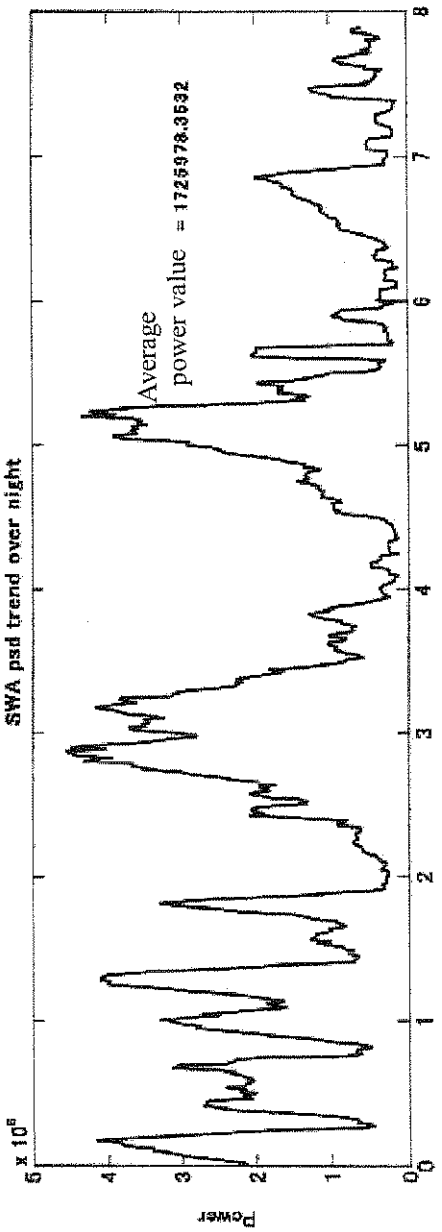
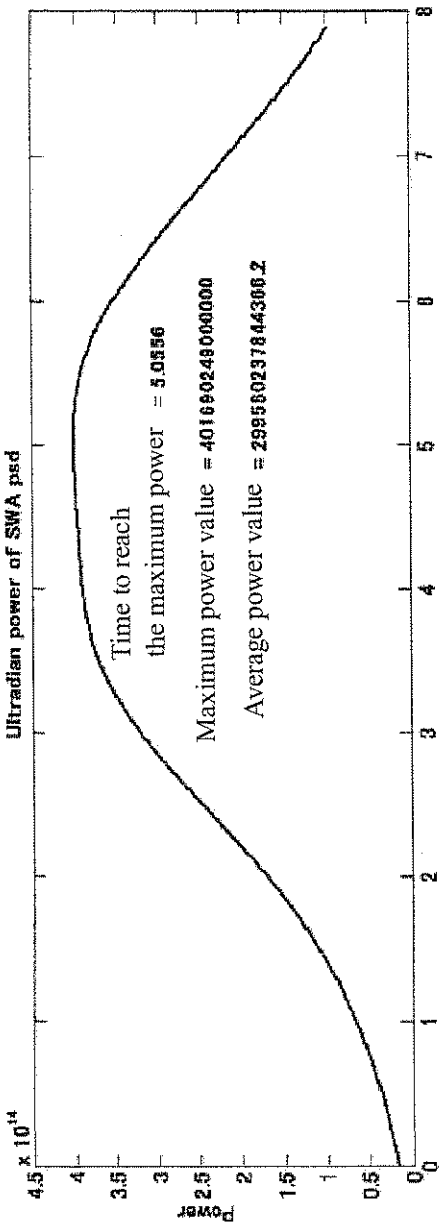


FIG. 20

Second case (NYHA I 、 BNP=47)



(vii) Brain wave SWA trend

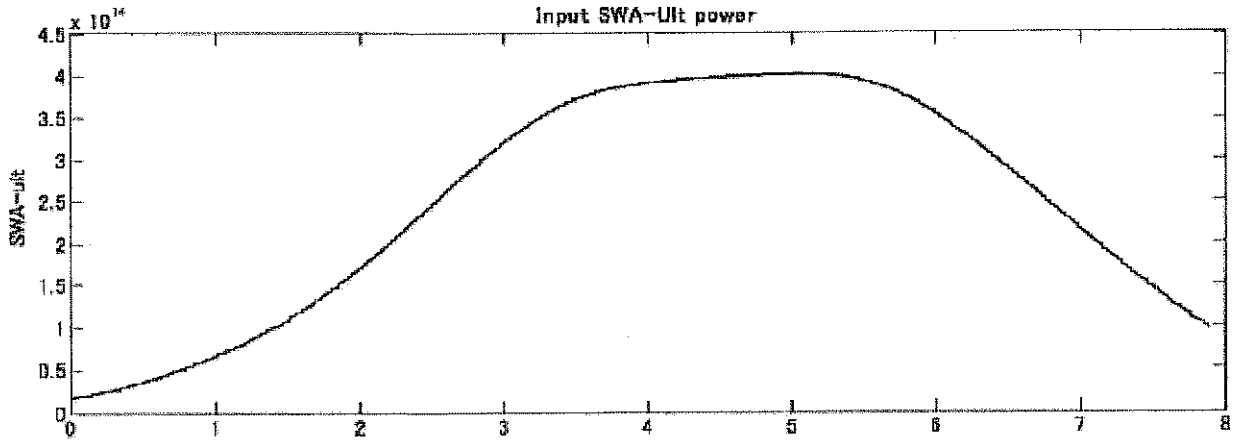


(viii) Trend of ultradian power included in brain wave SWA trend

FIG. 21

Second case (NYHA Ⅰ、BNP=47)

(xi) Change of ultradian power included in brain wave SWA trend



(xii) Change of ultradian power included in respiratory cycle RSI trend

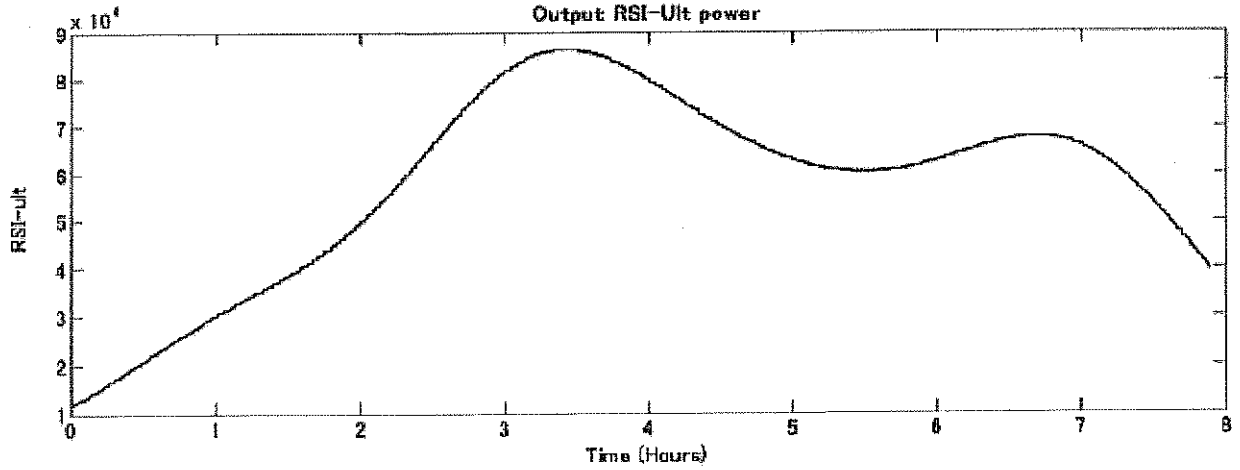
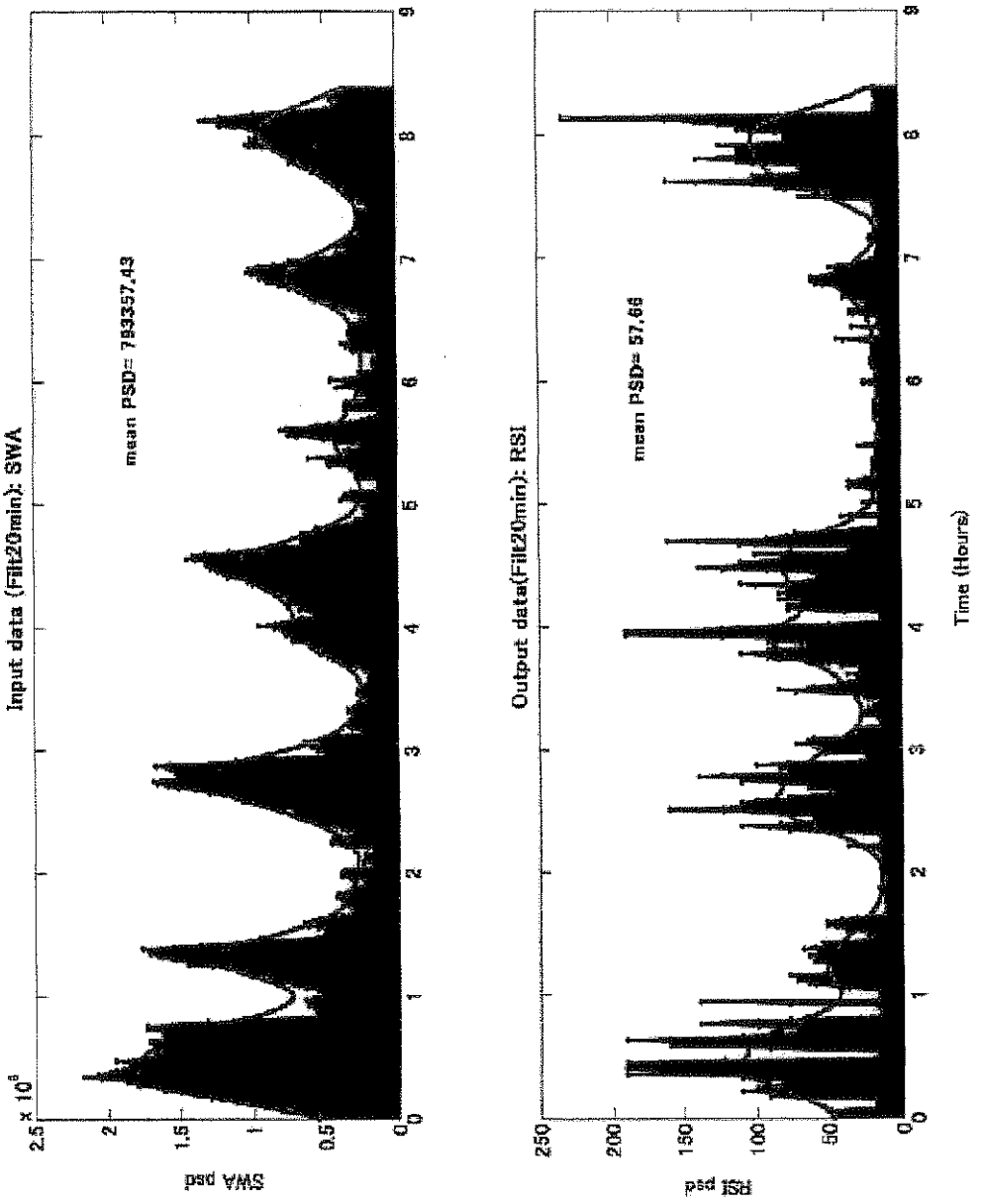


FIG. 22

Third case (NYHA II 、 BNP=115)

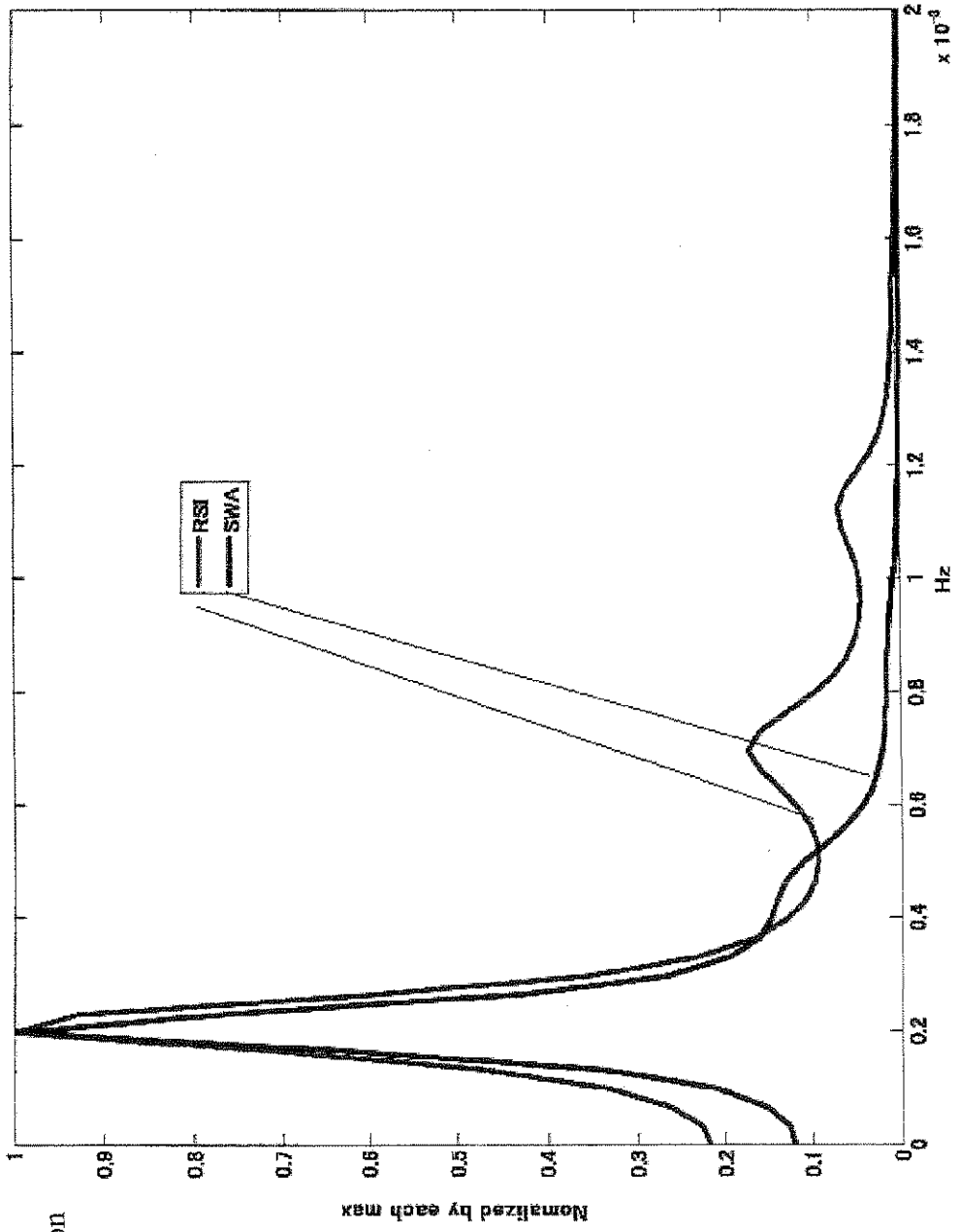


(i) Brain wave SWA trend

(ii) Respiratory cycle RSI trend

FIG. 23

Third case (NYHA II 、 BNP=115)

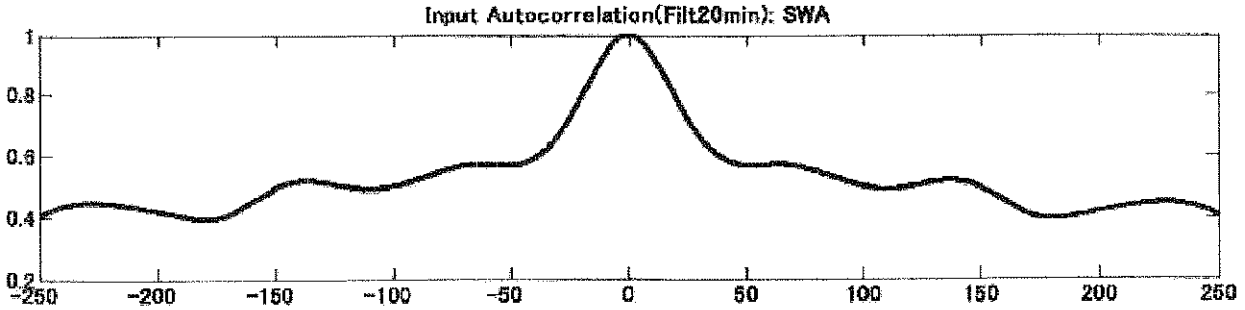


(iii) Frequency distribution of brain wave SWA and respiratory cycle RSI

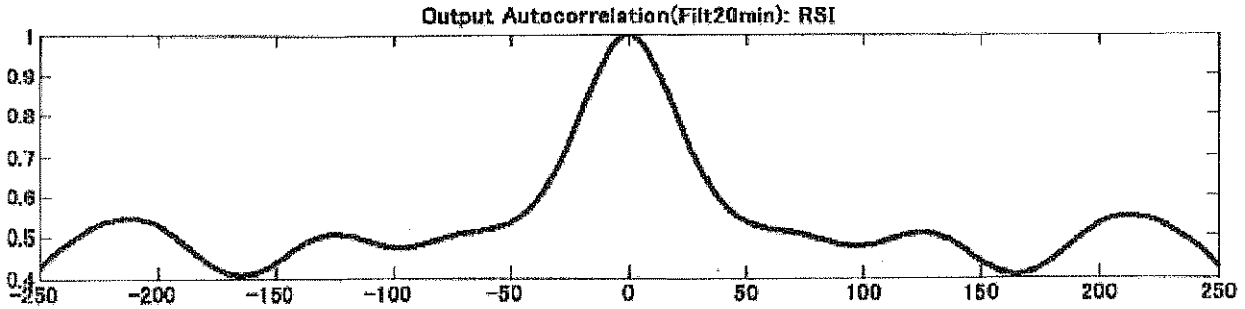
FIG. 24

Third case (NYHA II 、 BNP=115)

(iv) Brain wave SWA Autocorrelation function



(v) Respiratory cycle RSI autocorrelation function



(vi) Cross-correlation function of brain wave SWA and respiratory cycle RSI

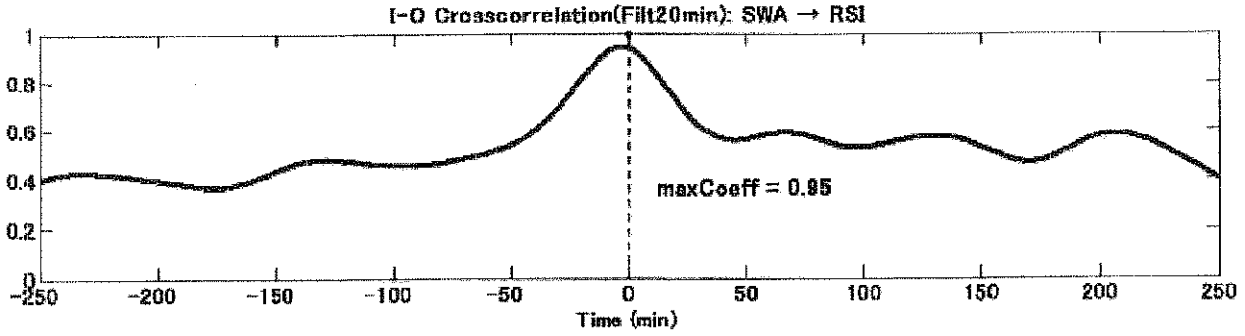
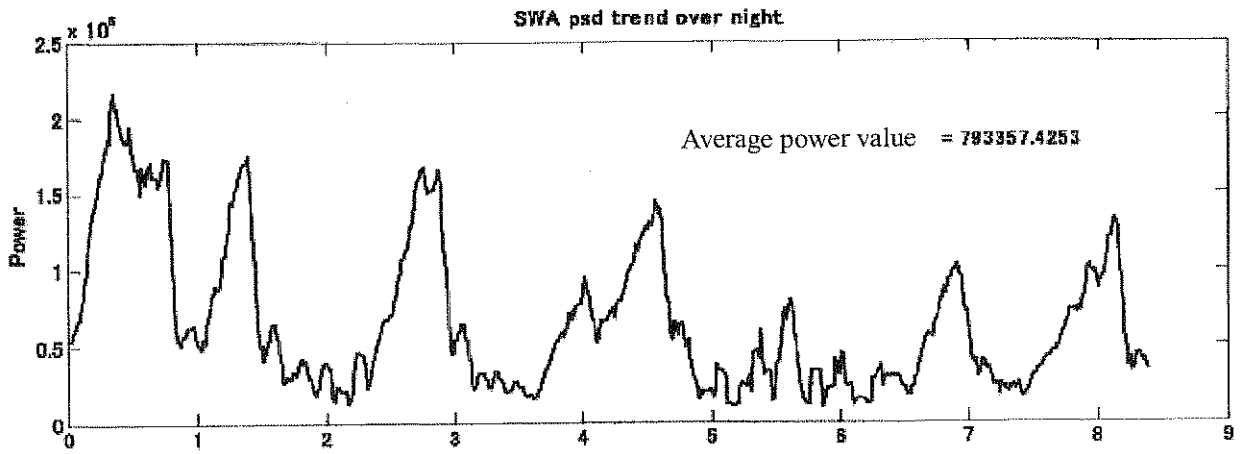


FIG. 25

Third case (NYHA II 、 BNP=115)

(vii) Brain wave SWA trend



(viii) Trend of ultradian power included in brain wave SWA trend

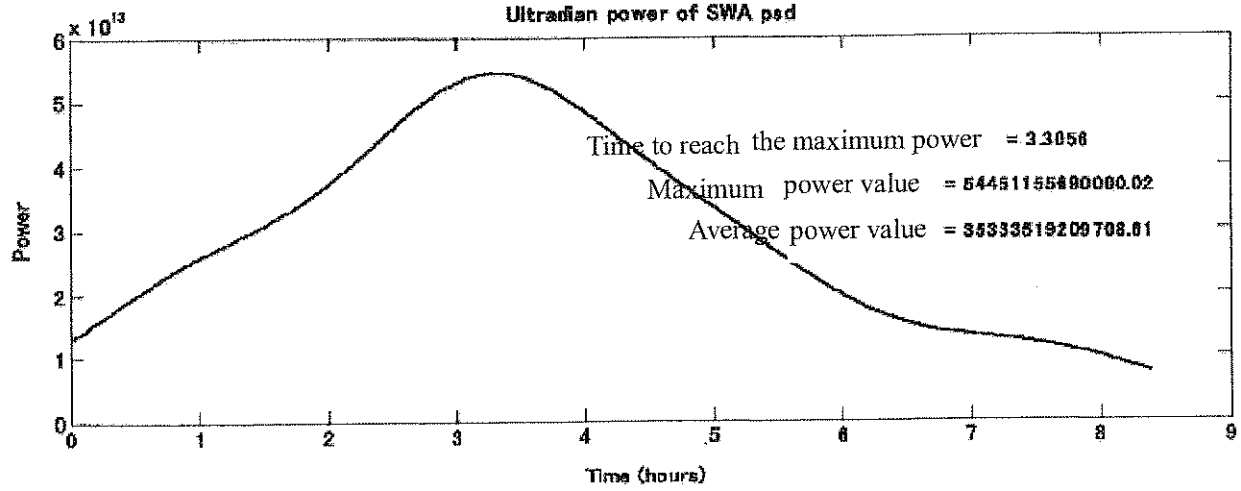
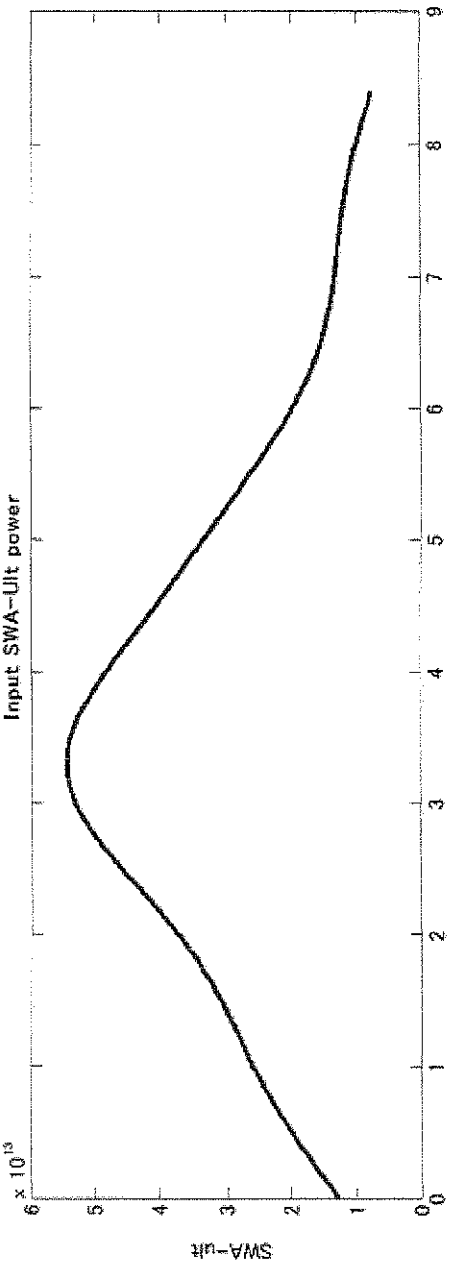
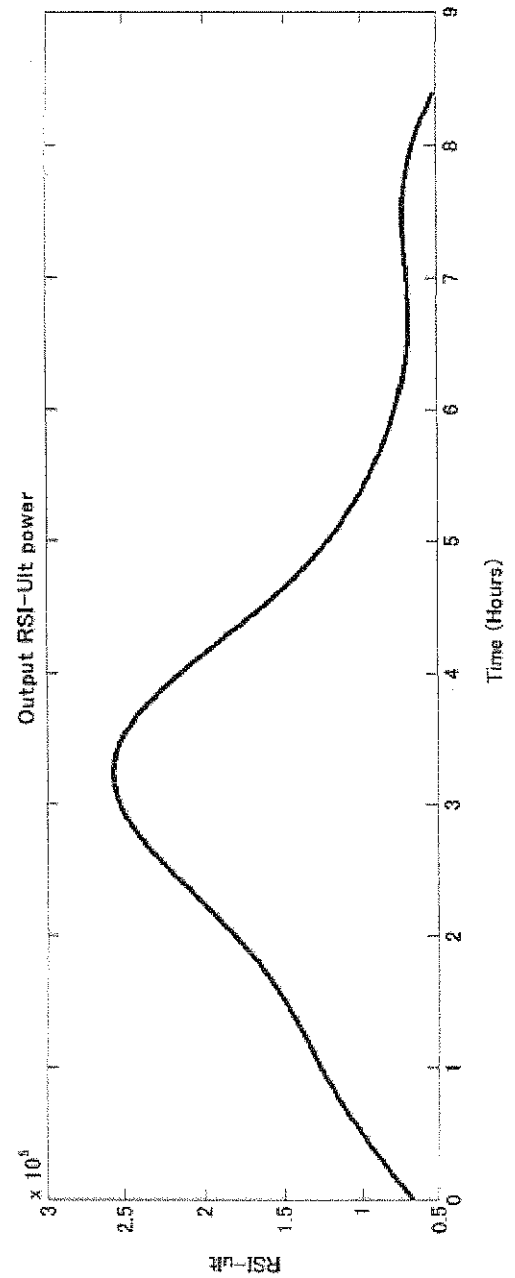


FIG. 26

Third case (NYHA II 、 BNP=115)



(xi) Change of ultradian power included in brain wave SWA trend

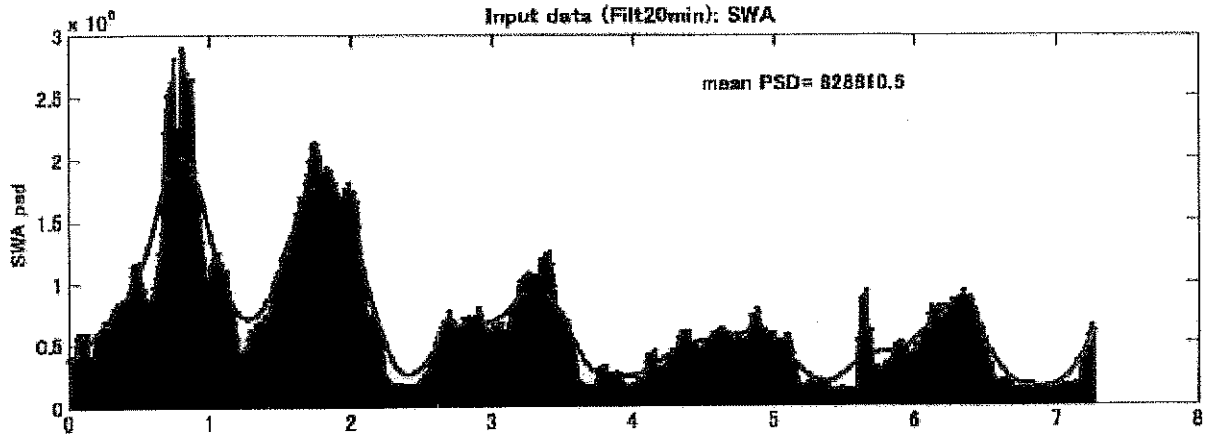


(xii) Change of ultradian power included in respiratory cycle RSI trend

FIG. 27

Fourth case (NYHA III 、 BNP=1000)

(i) Brain wave SWA trend



(ii) Respiratory cycle RSI trend

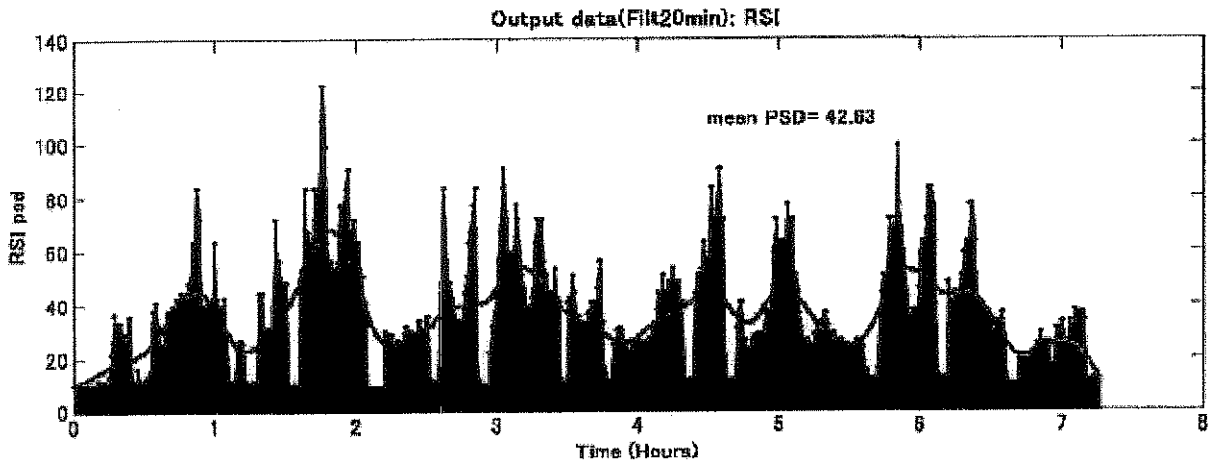


FIG. 28

Fourth case (NYHA III 、 BNP=1000)

(iii) Frequency distribution of brain wave SWA and respiratory cycle RSI

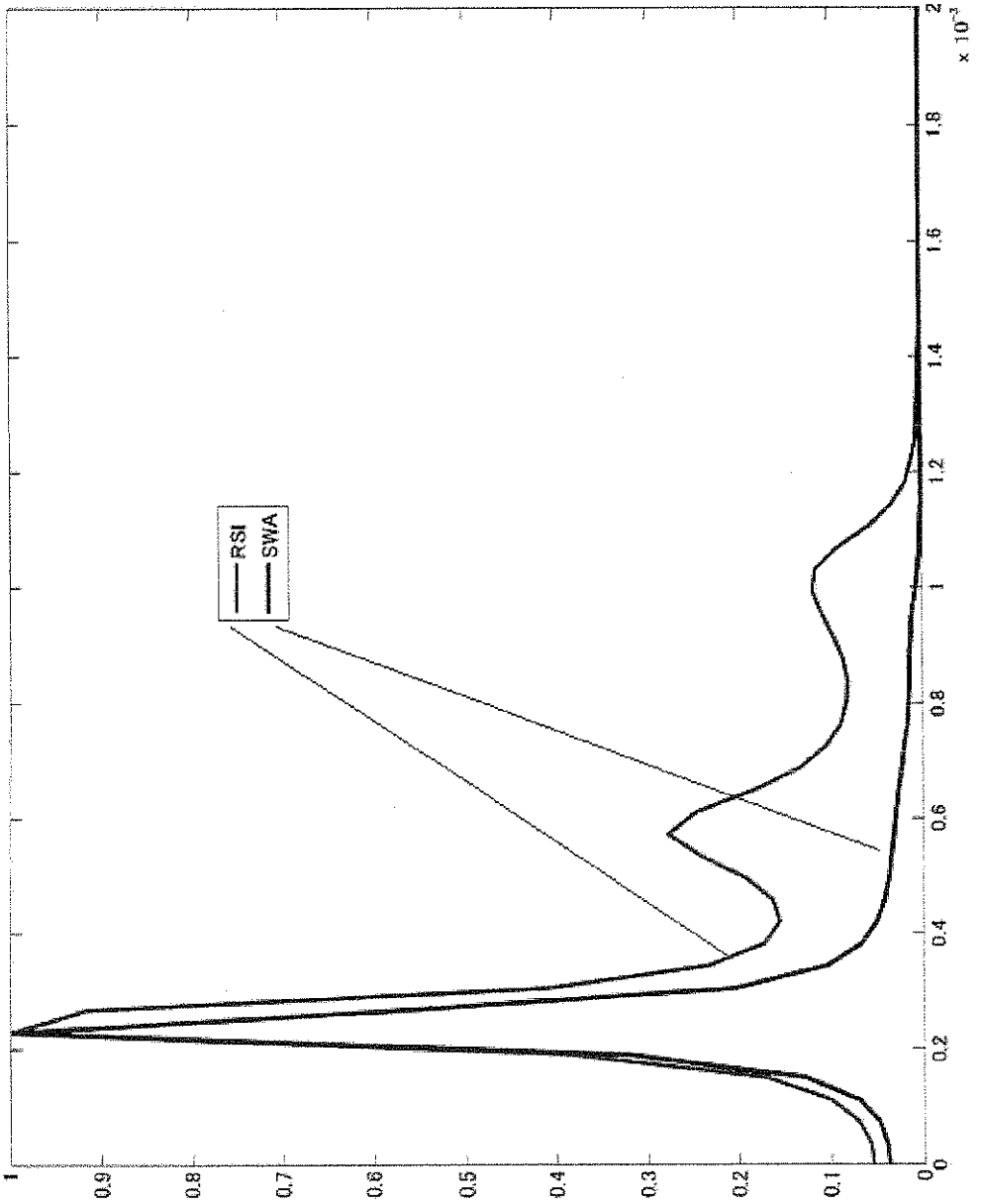
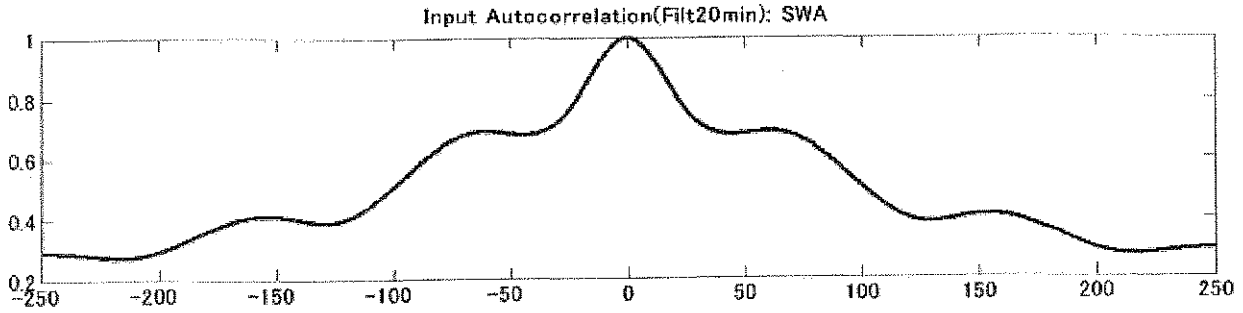


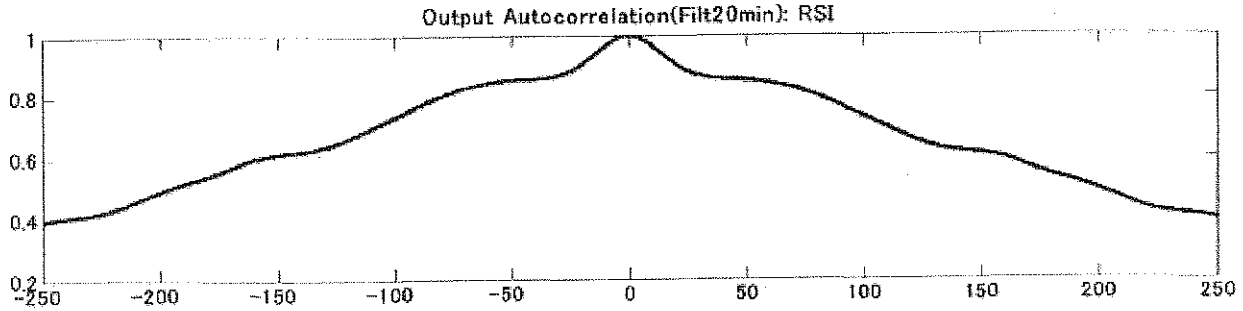
FIG. 29

Fourth case （NYHA Ⅲ 、 BNP=1000）

(iv) Brain wave SWA Autocorrelation function



(v) Respiratory cycle RSI autocorrelation function



(vi) Cross-correlation function of brain wave SWA and respiratory cycle RSI

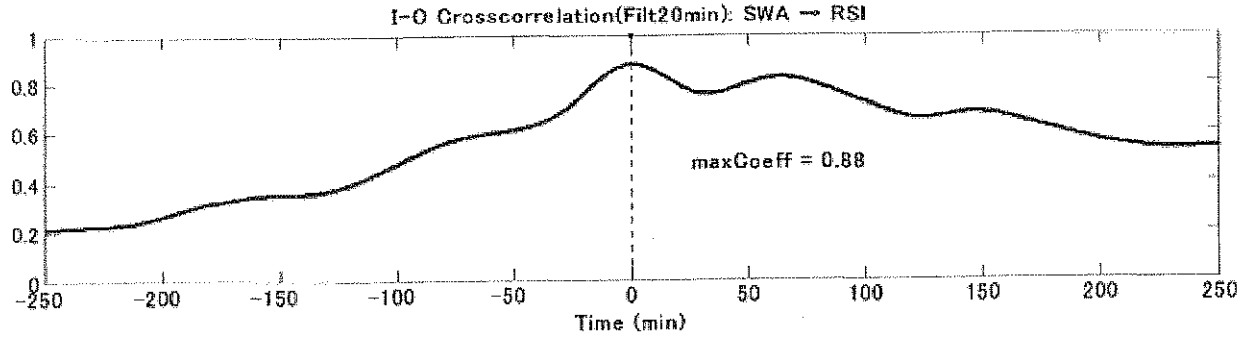
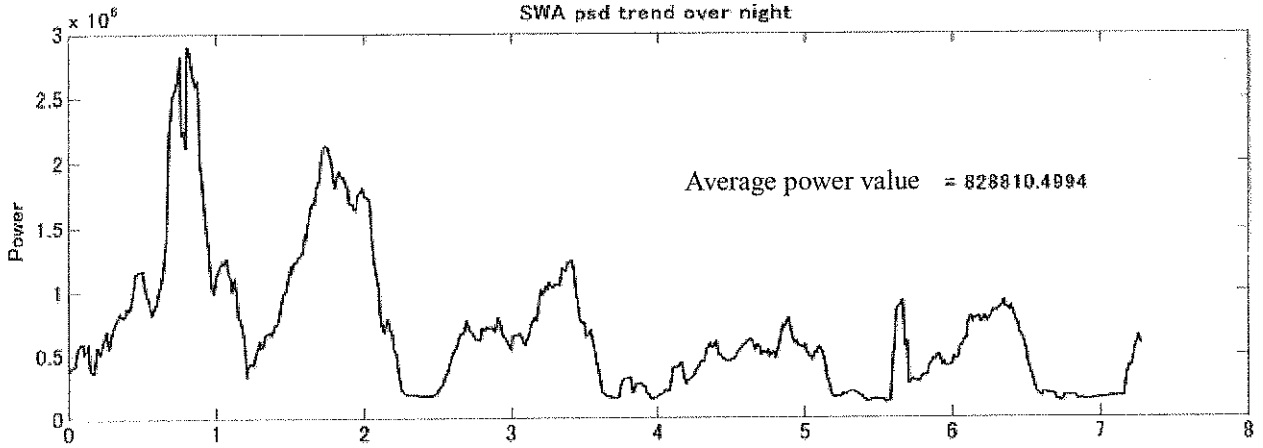


FIG. 30

Fourth case (NYHA III 、 BNP=1000)

(vii) Brain wave SWA trend



(viii) Trend of ultradian power included in brain wave SWA trend

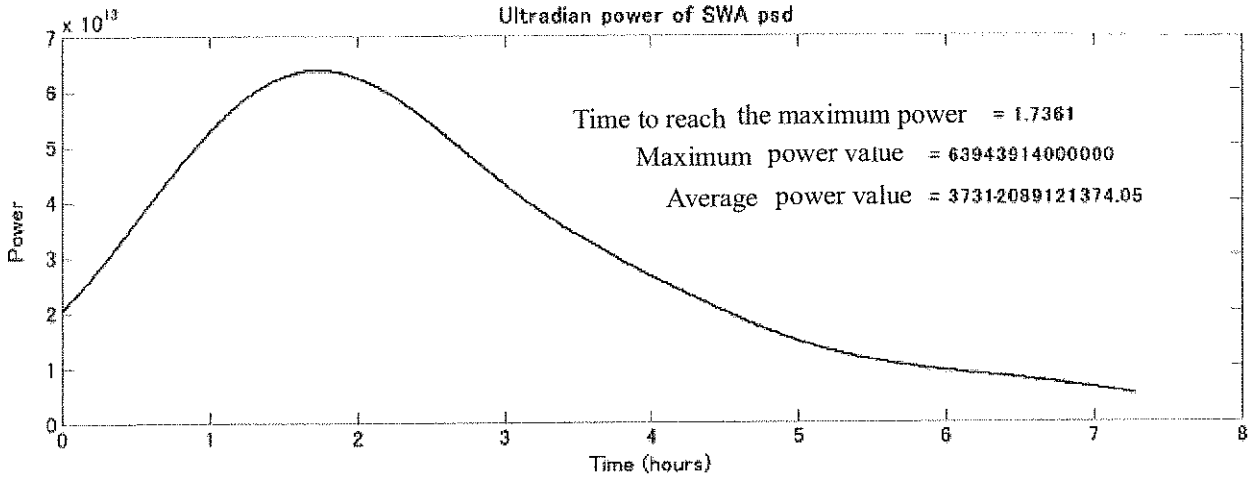
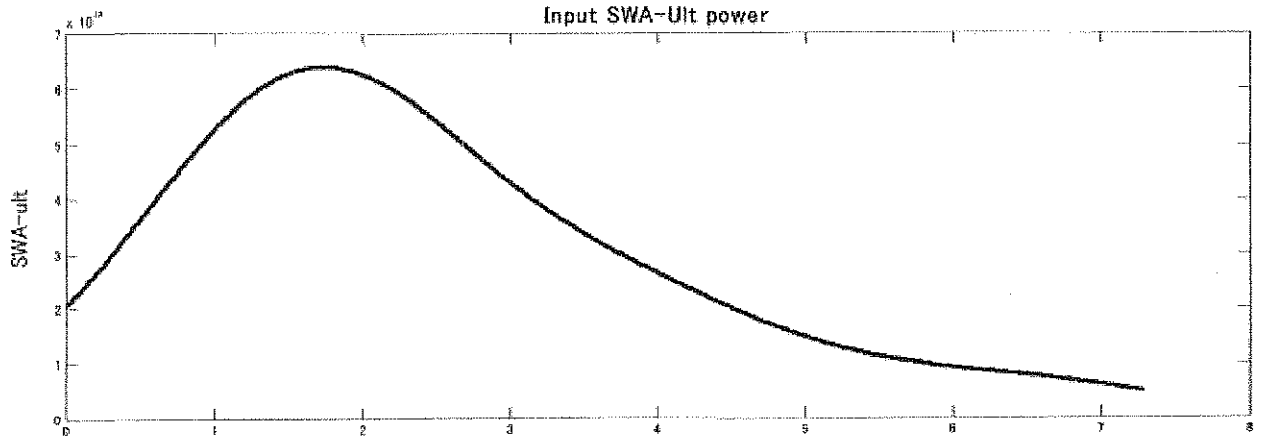


FIG. 31

Fourth case (NYHA III 、 BNP=1000)

(xi) Change of ultradian power included in brain wave SWA trend



(xii) Change of ultradian power included in respiratory cycle RSI trend

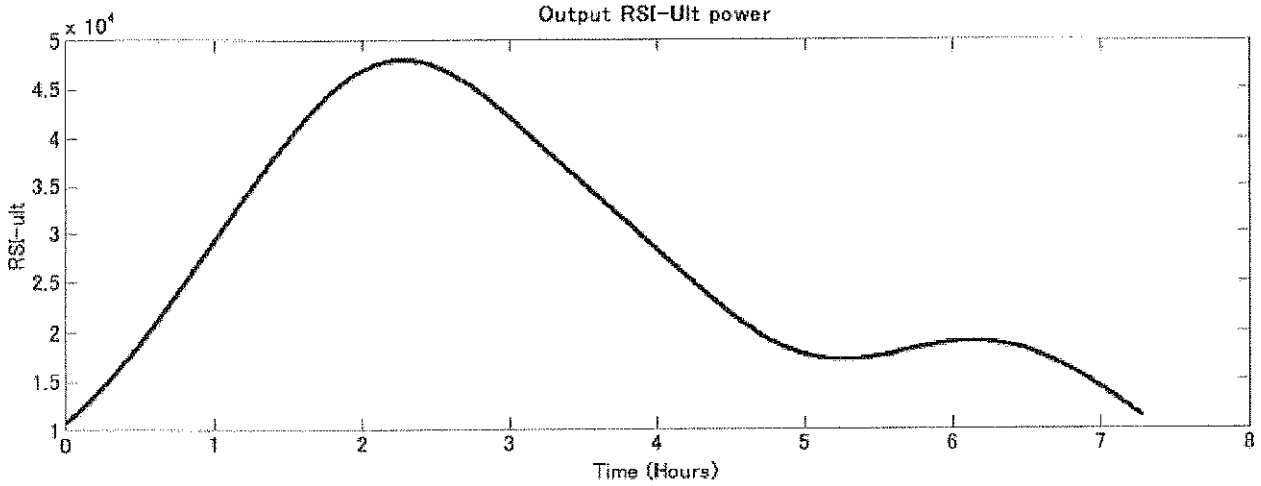


FIG. 32

Change of RSI and ultradian power in fifth case (before oxygen therapy)

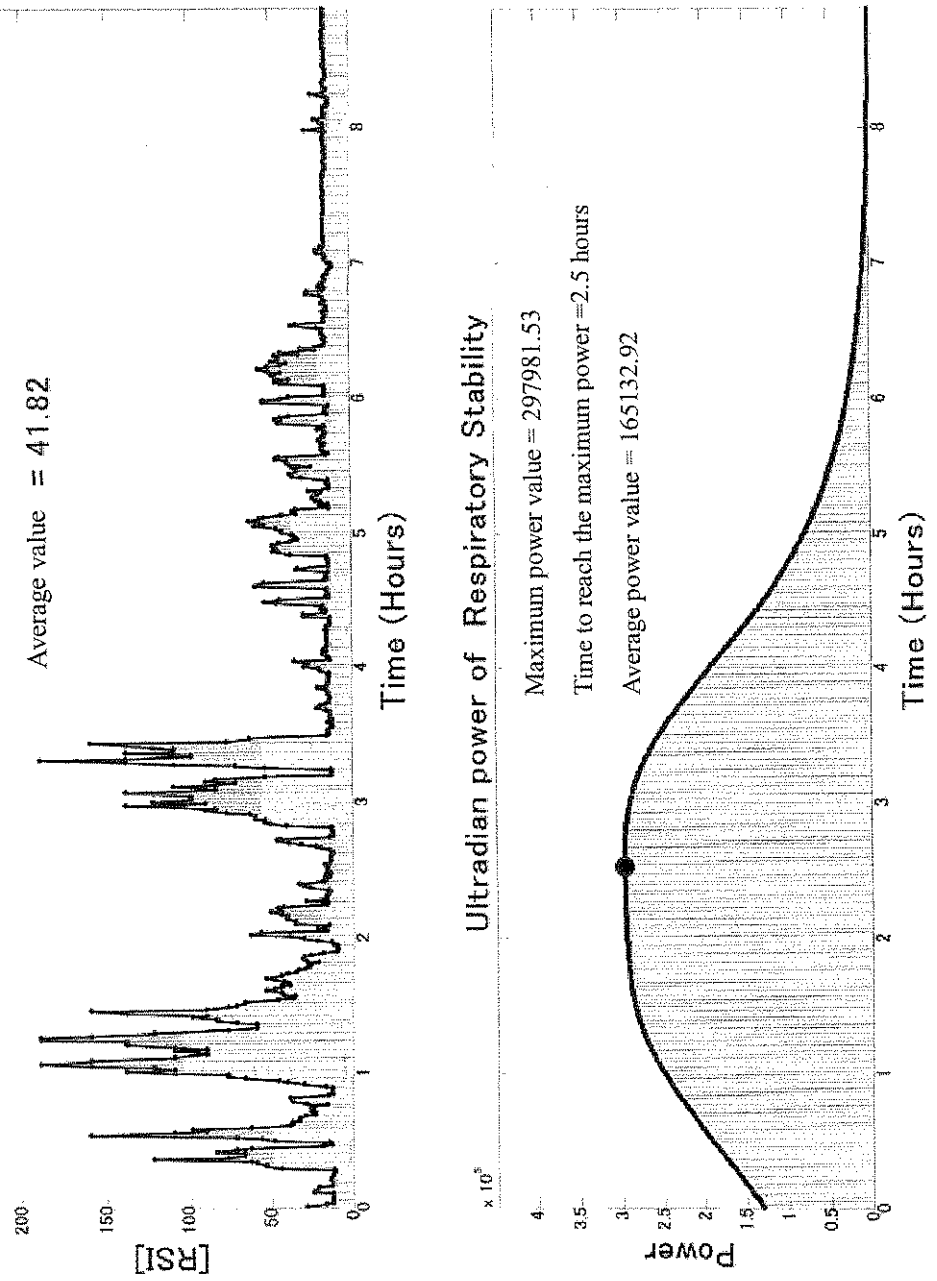


FIG. 33

Change of RSI and ultradian power in fifth case (during oxygen treatment)

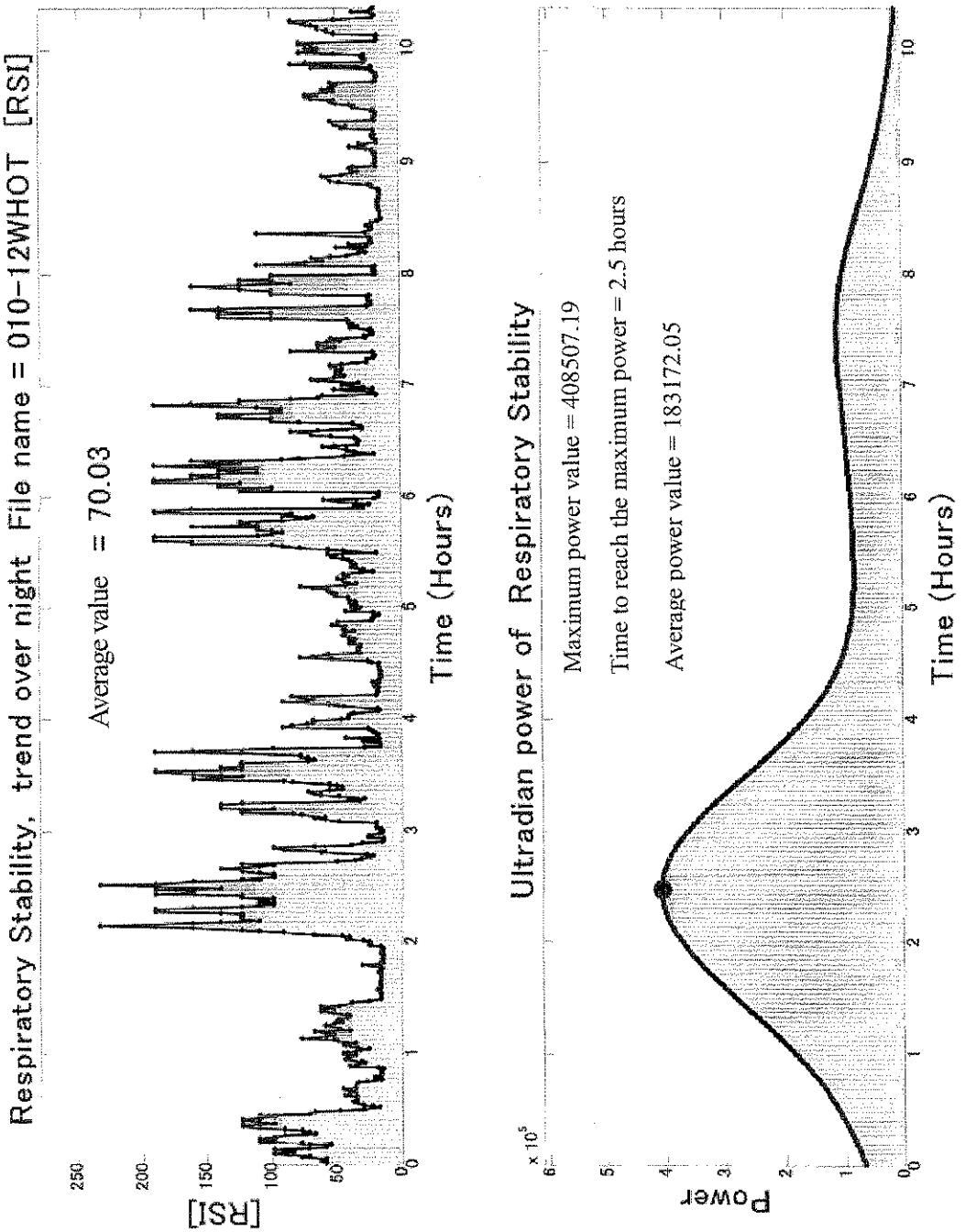


FIG. 34

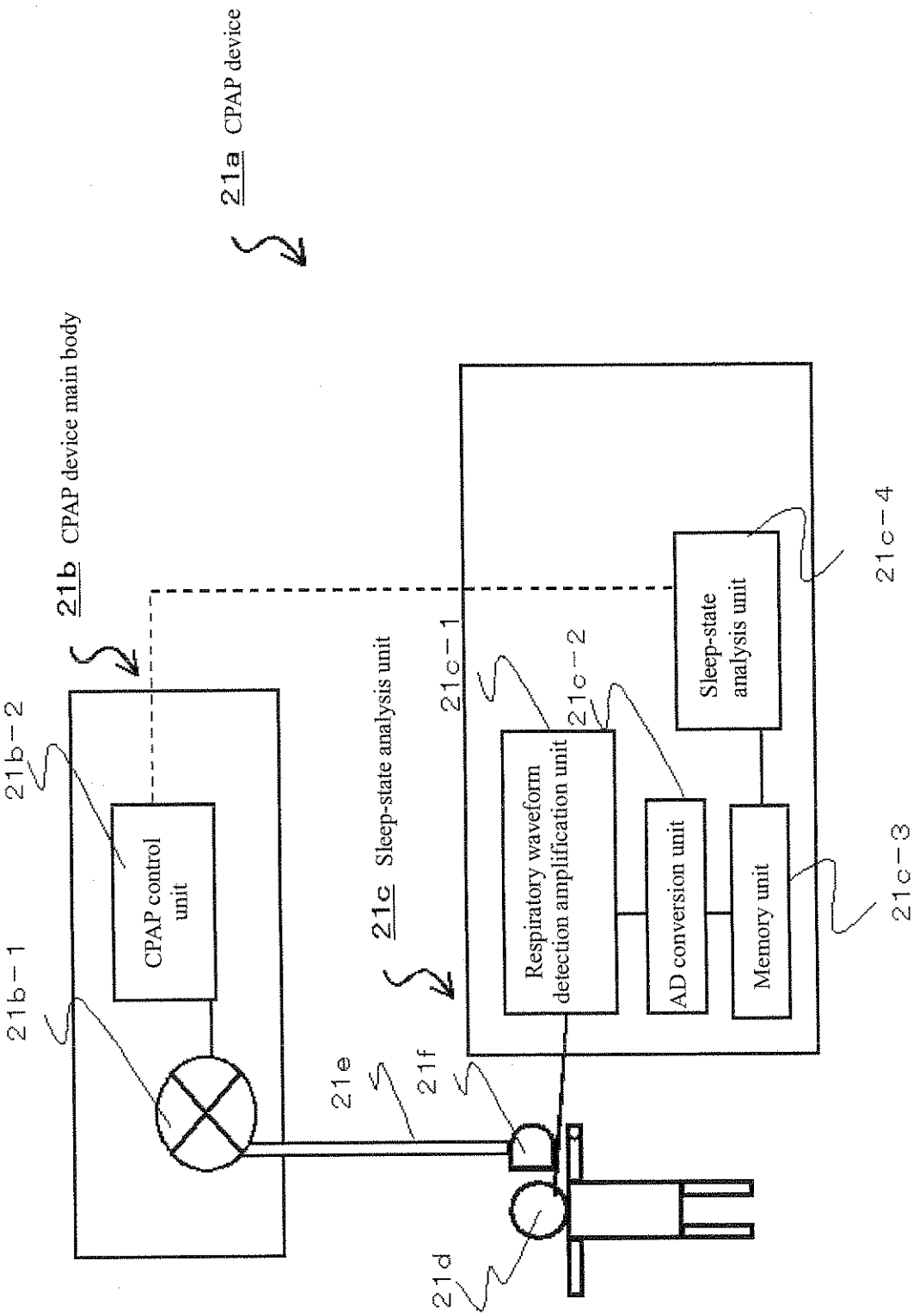

21a CPAP device
21b CPAP device main body
21b-1
21b-2
CPAP control unit
21c Sleep-state analysis unit
21c-1
Respiratory waveform detection amplification unit
21c-2
AD conversion unit
Memory unit
21c-3
Sleep-state analysis unit
21c-4
21d
21e
21f

FIG. 35

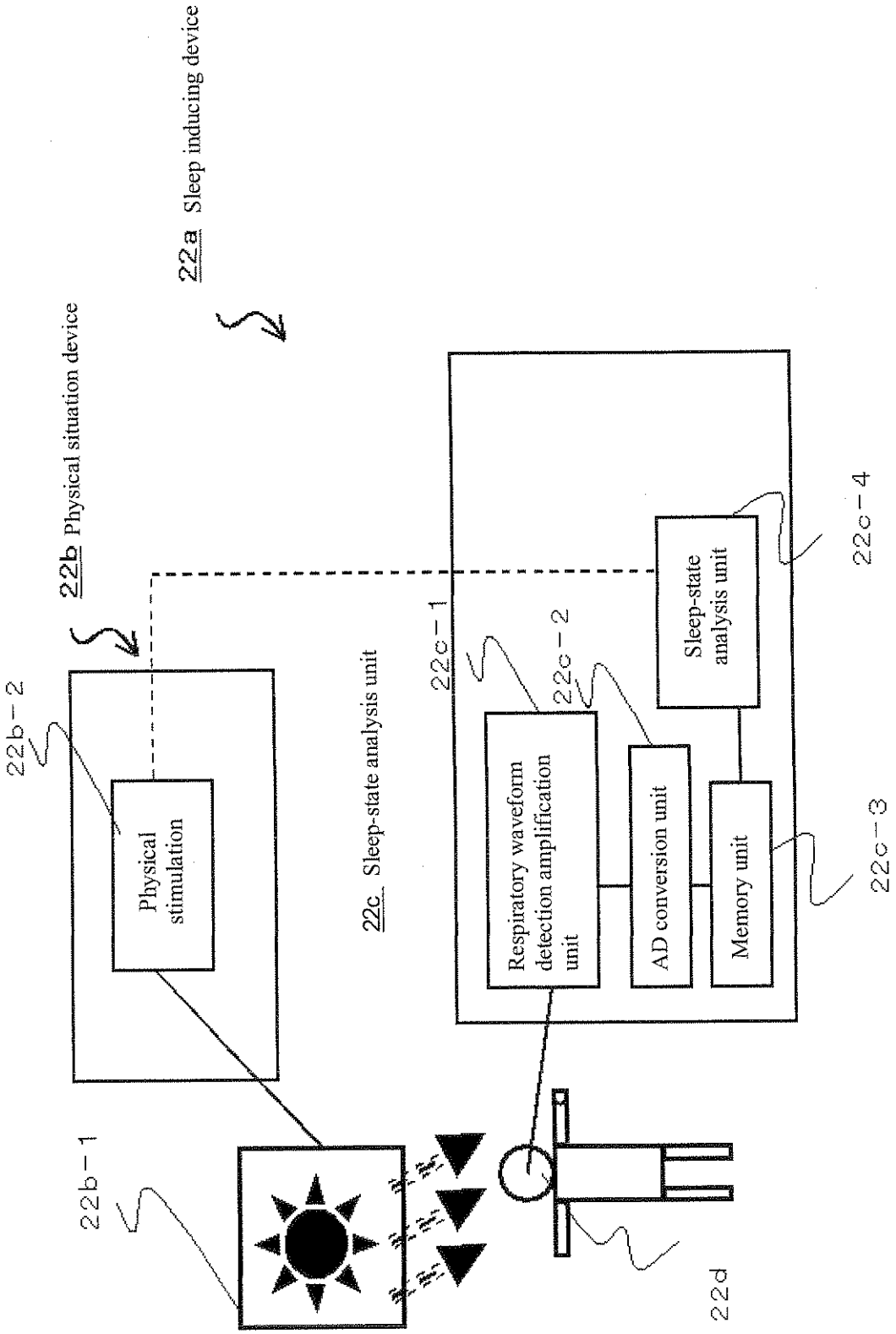

22a Sleep inducing device
22b Physical situation device
22b-2
Physical stimulation
22b-1
22c Sleep-state analysis unit
22c-1
Respiratory waveform detection amplification unit
22c-2
AD conversion unit
Memory unit
22c-3
Sleep-state analysis unit
22c-4
22d

FIG. 36

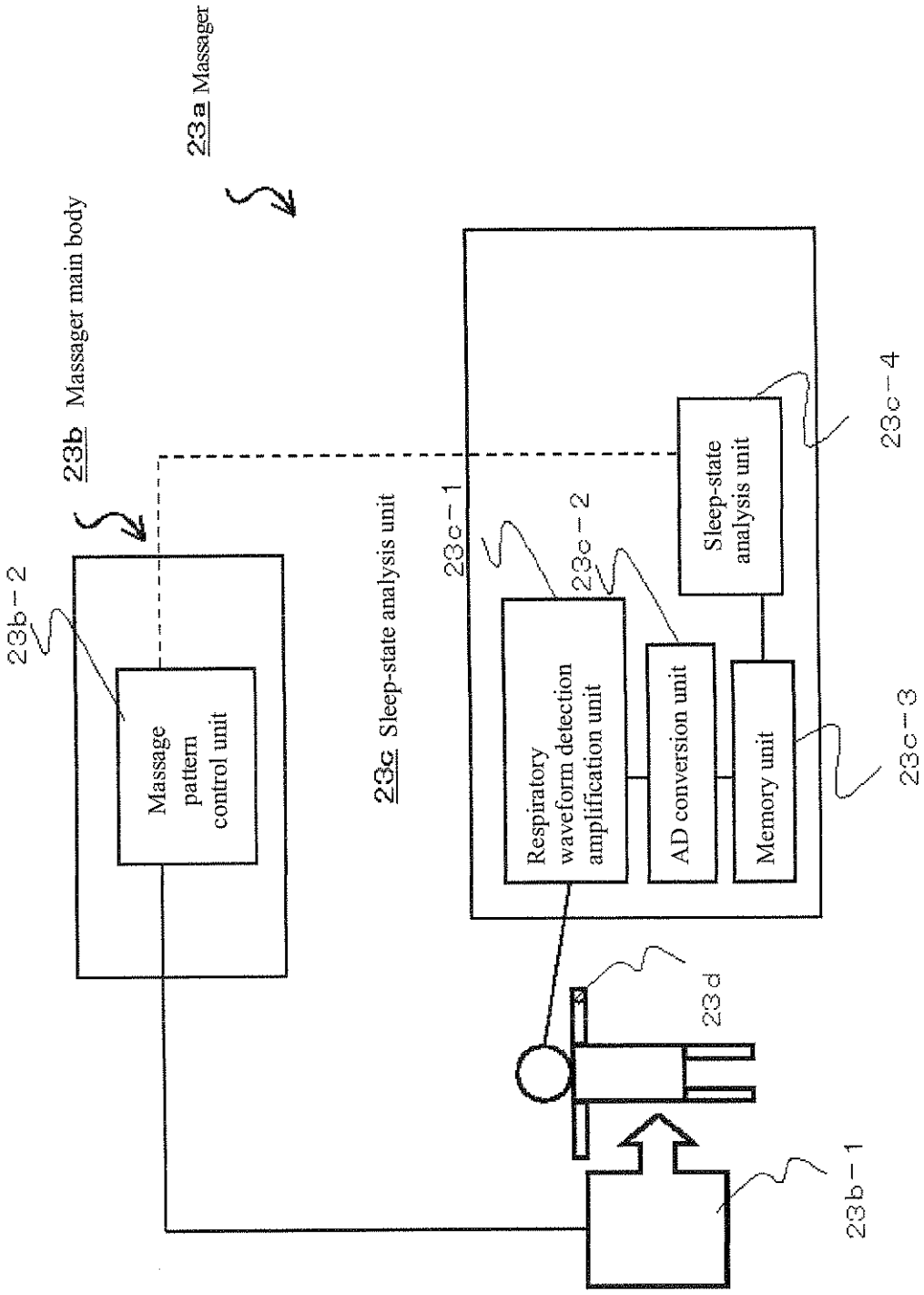

23a Massager
23b Massager main body
23b-2
Massage pattern control unit
23b-1
23c Sleep-state analysis unit
23c-1
Respiratory waveform detection amplification unit
23c-2
AD conversion unit
Memory unit
23c-3
Sleep-state analysis unit
23c-4
23d

FIG. 37

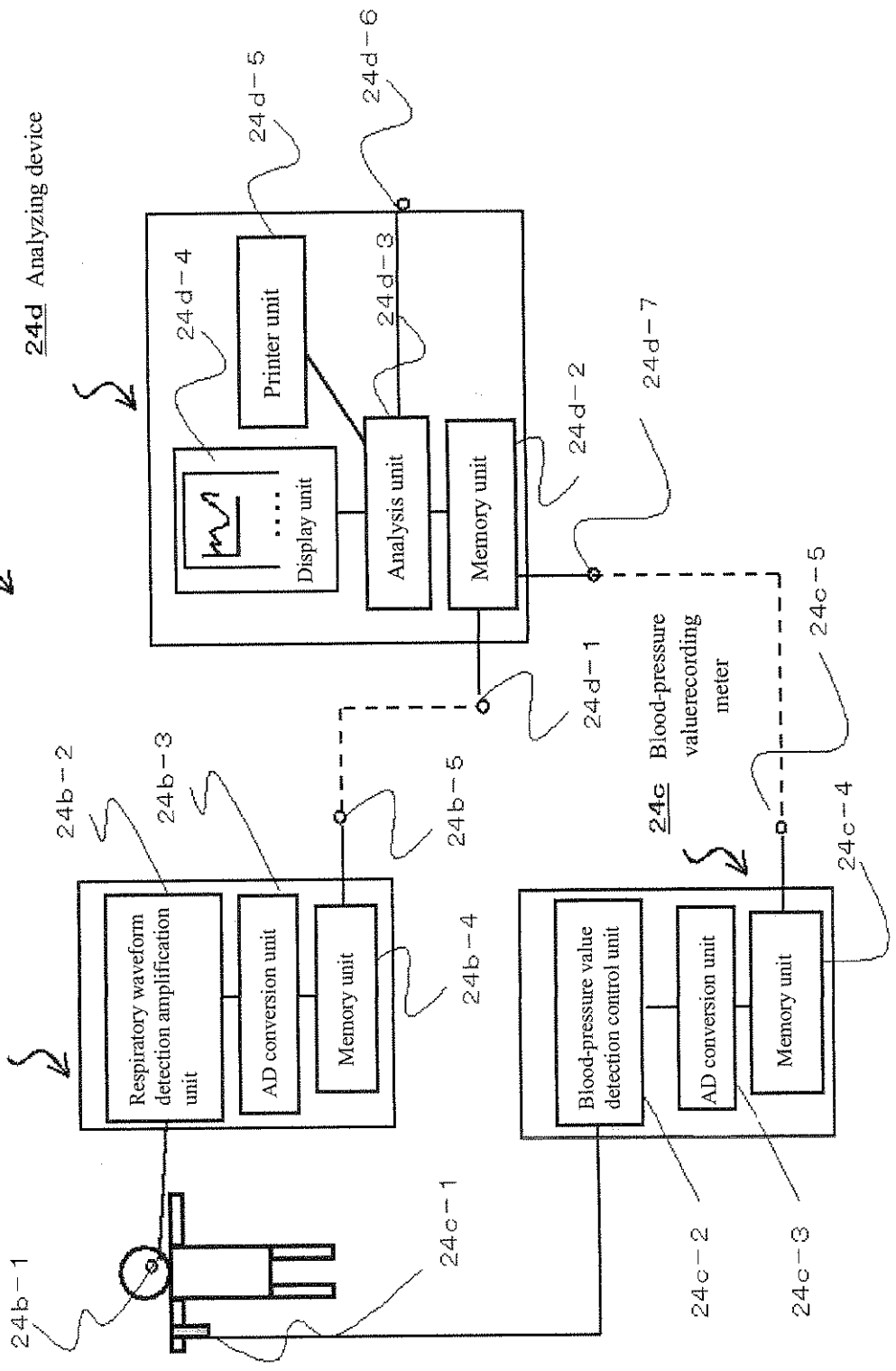

24a Blood-pressure measurement system
24d Analyzing device
24d-4
Printer unit
24d-5
24d-6
24d-3
Display unit
Analysis unit
Memory unit
24d-2
24d-7
24d-1
24b Respiratory waveform recording meter
24b-2
24b-3
24b-5
Respiratory waveform detection amplification unit
AD conversion unit
Memory unit
24b-4
24c Blood-pressure valuerecording meter
24c-5
24c-4
Blood-pressure value detection control unit
AD conversion unit
Memory unit
24b-1
24c-1
24c-2
24c-3

FIG. 38

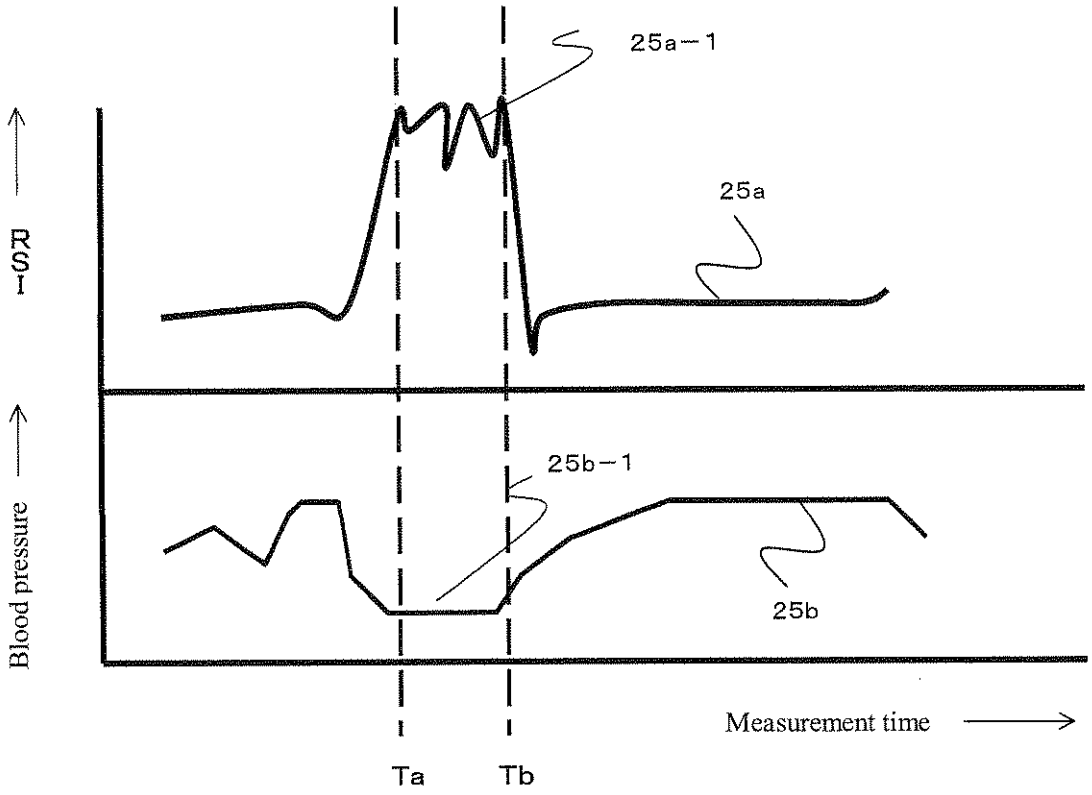


FIG.39

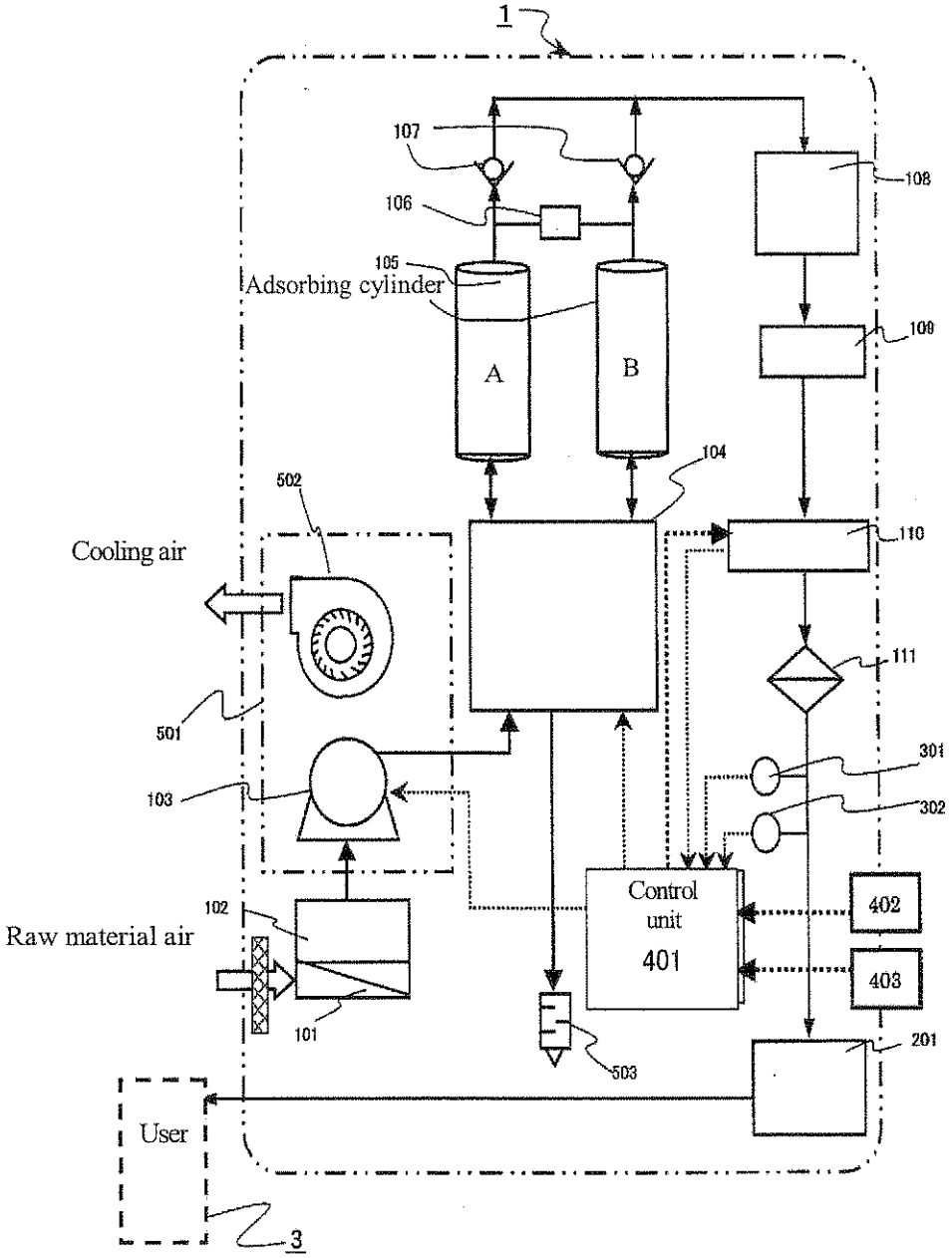
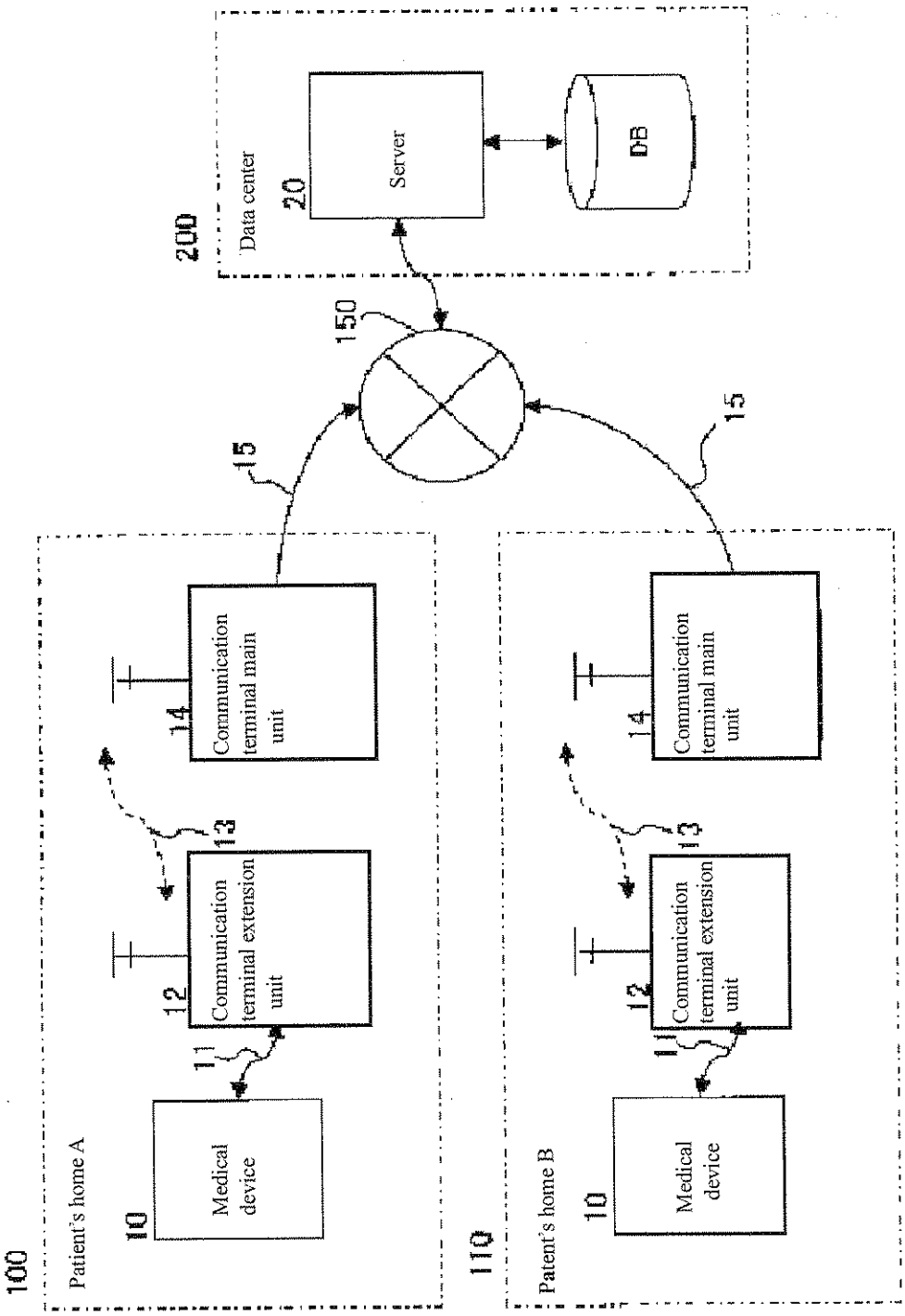

1
107
108
106
105
Adsorbing cylinder
A
B
100
104
502
Cooling air
110
111
501
301
103
302
Control unit
401
402
403
102
Raw material air
101
503
201
User
3

FIG. 40


100
Patient's home A
10
Medical device
11
12
Communication terminal extension unit
13
14
Communication terminal main unit
15
150
200
Data center
20
Server
DB
15
110
Patent's home B
10
Medical device
11
12
Communication terminal extension unit
13
14
Communication terminal main unit