

1997 12 31
 /002,157 , 1997 12 31
 , 1997 12 31
 09/001,453 , 1998 12 7
 09/207,165

FFT

09
 09/001,735

가

(Pitot)

가

(head)

60

ducer)

(vane trans

tion)

(radar cross-sec

ssembly)

(rugged microsensor a

(flow sensor)

2

1,2

가

2

가 ,

1

가

가

가 , 1

가

1,2

2

1

2

(microbridge)

(thin-film microanemometer)

1
2

1
2

1,2

(energizer)

가

1,2

(microbridge flow sensor)

1
2

가 , 1
2

가

가

가

가

(過渡)

(transient elevated temperature condition)

가

1(,)

2(,)

1

가 , 2

1

2

,077 ,
1997 12 31

4,501,144 ,

4,651,564 ,

4,478,076 ,
4,683,159 ,

4,478 ,
5,050,429 ,

, 1997 12 31
12 31

FFT

09/001,735 , 1997

/001,453

09

(active ciucuit)

가 , 가 . 가
 가 , 가 가
 가 , 가 가
 가 , (haet transfer load)
 가 , (flow rate correction facto
 r) 가 가

10 가 S/N(15) 가 가 가¹ /
 가 (flux)

(filler)

()

UV 가

- (off-chip)
(thin contact wire)

(TTW)(Through-The-Wafer)

- 1 2
- 3
- 4
- 5

1-2
 1-2
 가

26², 22, 24, 26, (permalloy), 80%, 20%, (dielectric), Si₃N₄, 28, 29, 1, 2, 24, 2, 26, 32, 34, 1/2, 150, 32, 22, 400, 34, 26, 30, 22, 24, 36, 22, 24, 26, 0.05, 0.12, 5, 0.8, 5, 20, 32, 34, 30, 100, 32, 34, 20, 36, 30, 가, 30, 32, 34, 30, (cantilever), 30, 가, 32, 34, 1-2, (Si₃N₄), 32, 34, 26, 26, 22, 24, 2, 24, 가, 26, 26, 2, 24, 26, 3, 1-2, 154, 1, 150, 2, 152, 가, 158, 154, 1, 150, 2, 152, 3, 154가, 4, 가, 160, 154, 가, 160, 160, 154, 160, 150, 1, 50, 152, 154, 가, 152, 가, 160, 160, 150, 1, Bohrer et.al., 4,478,077, 160, 154, 160, 150, 152, (non-zero), 160, 150, 152

160

(time lag)

(air stream)

7 8,077, 4,501,144, 4,651,564, 4,683,159, 5,050,429 , 4,478,076, 4,4
 , 1997.12.31 1997.12.31 1997,12,31 09/001,735 , 09/002,157 , FFT
 , 09/001,453

가

5-6 210 214 210 212 252
 5 210 210 210 214 214 212 252
 210 210 210 214 214 212 252

(micribridge) (serpentine) (serpentine)
 210 1 216 2 220 1 216 2 220
 212 218 218

216 2 220 215 218 222 218
 224 222 90 217 2 222 1 218 2 220 1 218
 220 210 214 216 214 214 214 214 214 214
 5 212가 (zero) 212 214 212 214 212 214
 212 216 218 214 45 218 214 45 가 2 220 2
 22 214 45 224 218 218 218 218 'A' 230 45 'B' 236 45
 6 212 210 214 262 5
 가 1 216 218 214 45 262 5 'A' 230 가
 212 2 220 222 214 45 'A' 254 5 'A' 230 224 1
 218 'B' 236 5 'B' 'A' 'B' 262 2 가 222
 90 가
) 212 1 216 1 218 (the incoming air stream
 1 2 220 2 222 212
 (1) (microbridge sensor) 1 , G A ,

$$\Delta G_A = v \cos^n(A) \dots\dots\dots(1)$$

G_A - 212 0° ; 'v' 252 가 ()
 ; 'n' 212 , 'A'
 (1) 5-6 212 1 218 (a curve fit factor)
 $G_A = a G'_A$
 G_A , 1 618 , 1 212
 G_B (2)

$$\Delta G_B = v \cos^n(B) \dots\dots\dots (2)$$

'A' 'B' 212 252 90°
 . (-45 45).
 $A + B$, (3)

$$\cos^2(A) + \cos^2(B) = 1 \dots\dots\dots (3)$$

(1)-(3) 'A' 'B' (4)(5)(6)

$$v = \left[\frac{(\Delta G_A^{2/n} + \Delta G_B^{2/n})}{2} \right]^{n/2} \dots\dots\dots (4)$$

$$A = \arccos \left[\left(\frac{G_A}{v} \right)^{1/n} \right] \dots\dots\dots (5)$$

$$B = 90 - A \dots\dots\dots (6)$$

$$212 \quad 252 \quad (7)$$

$$\varphi = \frac{A - B}{2} \dots\dots\dots (7)$$

1 216 1 218 2 2 222 (, 90°)
 18 2 , 90° , 1 2

7 , 1 318 314 + R°
 2 320 (offset) , 1 318 'X'°
 322 314 45-R° X=2R , 1 318 1
 1 318 'A' 330 45+R° , 2 320 2 322 326
 314 45-R° , 312 326 2 322
 'B' 336 45+R

- 312 252 , (1)-(7) (set) $A + B + X = 90$
 312 252
 (8)

$$v = \{\Delta G_A^2 + \Delta G_B^2 - 1.5\Delta G_A \Delta G_B \cos(90 + X)\}^{1/2} \dots\dots\dots (8)$$

X 가 , 312 ± 20° , 352 가 , G_A G_B
 가 . (sensor offset)
 X , 25° X . X가 20° 가
 8 5 1 216 2 220 1 216
 215 362 364 360 1 216
 360 가 (heater enegiger) 366
 368 362 , 364 가 (a feedback loop) 368
 (difference) 370 2 363,364 362,364 가
 9 8 1 216 2 220 372 374
 (data processing block) 384 382 380
 372,374 (4)-(8)
 8 , 1,2 216,220 (,)
 (signal to noise ratio)
 가 , 1 216 366 () 36
 0 220 392 390 2
 9 , 390,392 ,
 가 가 , () - - 가 () 39
 0 / 392 , 373 274
 가 (error flag) 400
 , () 390 / 392 360 (heat transfer load)
 , (rain), (sleet) (ice)
 가 (a flow rate correctio
 n factor)가
 가 , 8 366 360
 , 가 362,364
 (time lag)
 , (microbridge flow sensor) (time lag)
 362 370 가 360
 (time lag) (delay)
 360 (time lag) (delay)
 (time lag) (delay) 364

1 , 2 1 2

44, 4,651,564, 4,683,159, 4,478,076, 4,478,077, 4,501,1

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12 31 1997 12 31 09/001,453 FFT

(offset) , 가 (drift)

10 252 , G A , G A

252 1 2 ,

0.01 30 m/s (0.02 60 knots) 600m/s(1200 knots)

가 가 120x , ,

62)(3) 가 'd' (1

(micron) 가 'd' (162) 15 (162) 1 (mic

ron) 가 'd'(162) 10 (micron)

가 'd'(162)가 가 , 가 , 10 (ms)

(752) (750) (filler, 754) 가 11

(754) () UV() ,

(肋材) ,

(754)가 , 가 , 가

, 20 (ms) , ,

12 400 , 가 , 402

4x , 가 , 30

, S/N 4x 20% 가 ,

13 가 ,

710 712 714 , Pylex , 가 716

(Microbrick™) , Microbri

ck TM

가

, 가 . 710 712 714

가 , (가)

14
Microbrick TM

Microbrick TM

. Microbrick TM

가 , Microbrick TM I/O
(gold) 가 (through-
the-wafer(TTW) contact) 15A
704 700 , 702
706 가 706 702
708가 704 706 704
708가 가

15B 가 , 800 , 802
(TTW) , (through-the-wafer, TTW) 812
02 812 706 814 (TTW) 812 8
(TTW) (TTW) 가 (TTW)

802 , 816 816 800 816 800
800 , 816 820 800
02 , 800 가 , 802 가 8
802 (lumen,) (conduit) O- 15B 8
, 802 가) 802 가 822

가

가

(57)

1.

1 1 ; 1
2 2 ; 2

1 , 2 ;

1 2 1 2

2.

1 가 1 2

3.

1 , 1 2 90

4.

3 , 1 2

$$v = \left[\frac{(\Delta G_A^{2/n} + \Delta G_B^{2/n})}{2} \right]^{n/2}$$

, $G_A = 1$;

$G_B = 2$;

$n =$ (fit)

5.

4 , $n = 1$

6.

4 , 1 2

$$\varphi = \frac{A - B}{2}$$

$$A = \arccos \left[\left(\frac{G_A}{v} \right)^{1/n} \right] ;$$

$B = 90 - A$;

$v =$

7.

1 ,

8.

2 ,

9. 1, 1 2 90

10. 9, 1 2 90-X, X 0

11. 9, 1 2

$$v = \{\Delta G_A^2 + \Delta G_B^2 - 1.5\Delta G_A\Delta G_B \cos(90 + X)\}^{n/2}$$

12.

1, 1 ; 1

2, 2 ; 2

1 ; 2

1 2 1 2

13. 12, 1 가 2

14. 13, 1 2 90

15. 14, 1 2

$$v = \left[\frac{(\Delta G_A^{2/n} + \Delta G_B^{2/n})}{2} \right]^{n/2}$$

, G_A = 1 ;

$$G_B = 2 \quad ;$$

n = (scaling)

15 **16.** , n=2

16 **17.** , 1
2

$$\varphi = \frac{A - B}{2}$$

$$A = \arccos \left[\left(\frac{G_A}{v} \right)^{1/n} \right] ;$$

$$B = 90 - A$$

13 **18.** , 1 2 90

18 **19.** , 1 2 90-X , X 0

19 **20.** , 1 2

$$v = \{ \Delta G_A^2 + \Delta G_B^2 - 1.5 \Delta G_A \Delta G_B \cos(90 + X) \}^{1/2}$$

12 **21.** , 1 ,

21 **22.** , 1

22 **23.** , 1 ,

;

, 1

G

A ; 가 .

23 24. , 2 ,

24 25. , 2 ,

25 26. , 2 ,

;

B ; 가 , 2 G

12 27. , 1 , ,
(cavity)

27 28. ,

28 29. , 1 15 (micron)

27 30. ,

30 31. ,

30 32. ,

30 33. , UV

30 34. ,

30 35. , (肋材)

30 36. ,

37. 12 , 1

38. 12 , 1
(through-the-wafer, TTW)

39. 38 , (TTW)

40. 39 ,

41. 12 , 1

42. 12 , 가

43. 12 ,

44. 1

1 1 ;

2 2 ;

, 1 2 ;

1 2

45. 44 , 가

46. 45 , 1 2 90

47. 46 ,

$$V = \left[\frac{(\Delta G_A^{2/n} + \Delta G_B^{2/n})}{2} \right]^{n/2}$$

, $G_A = 1$;

$G_B = 2$;

n = (fit)

48. 46, n 1

49. 46,

$$\varphi = \frac{A - B}{2}$$

$$A = \arccos \left[\left(\frac{G_A}{v} \right)^{1/n} \right];$$

$$B = 90 - A;$$

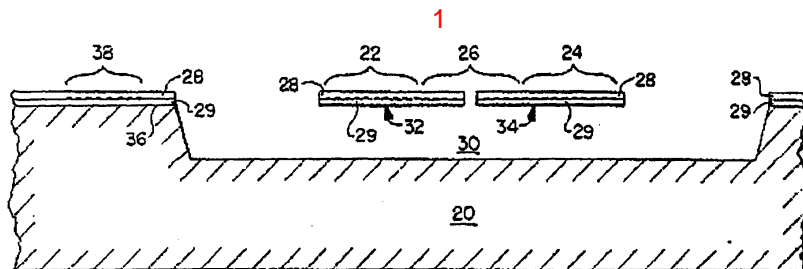
v =

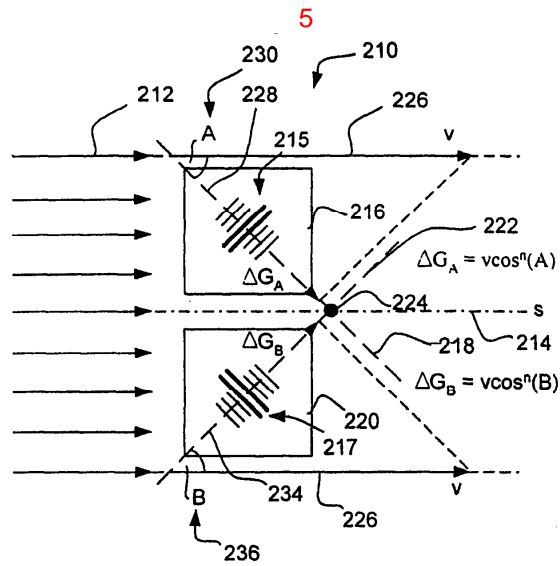
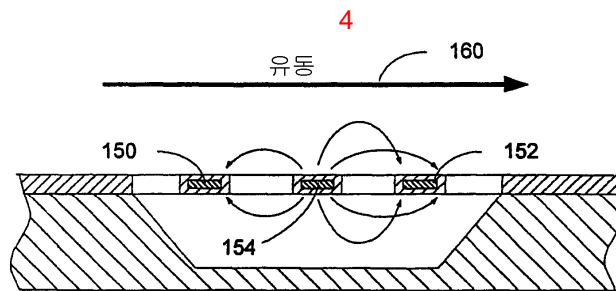
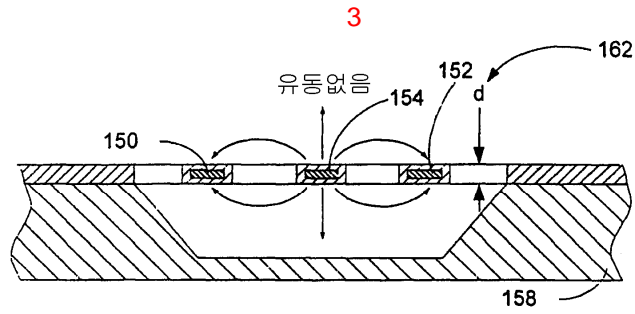
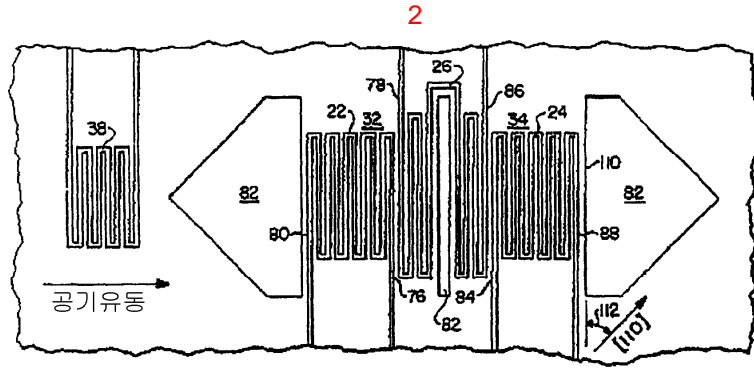
50. 44, 1 2 90

51. 50, 1 2 90 - X, X

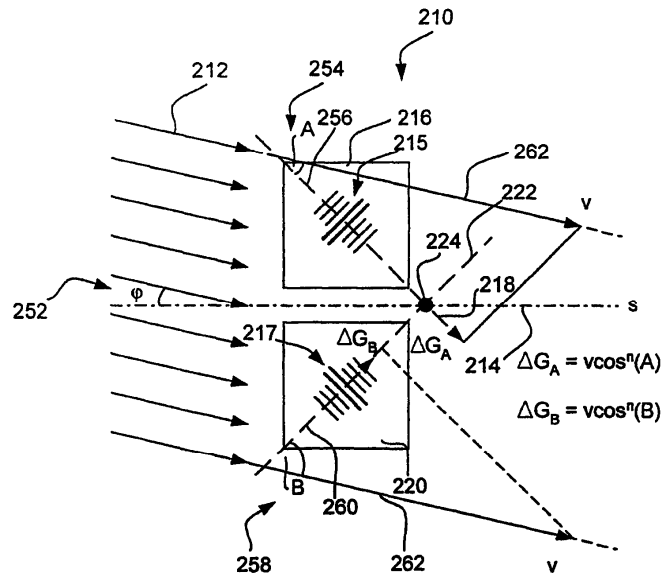
52. 51, 1 2

$$v = \{ \Delta G_A^2 + \Delta G_B^2 - 1.5 \Delta G_A \Delta G_B \cos(90 + X) \}^{1/2}$$

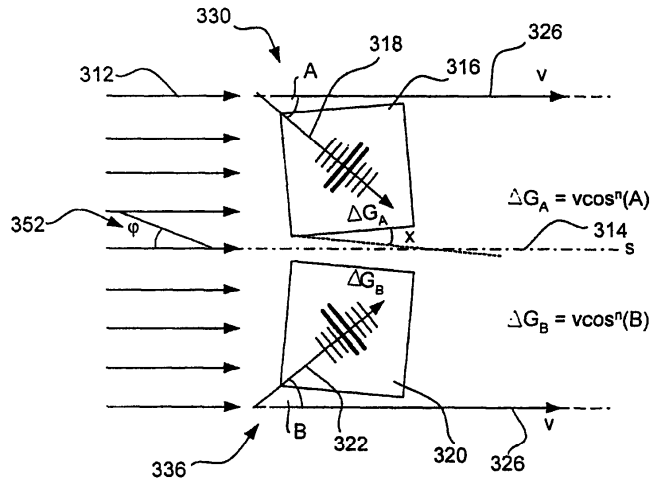




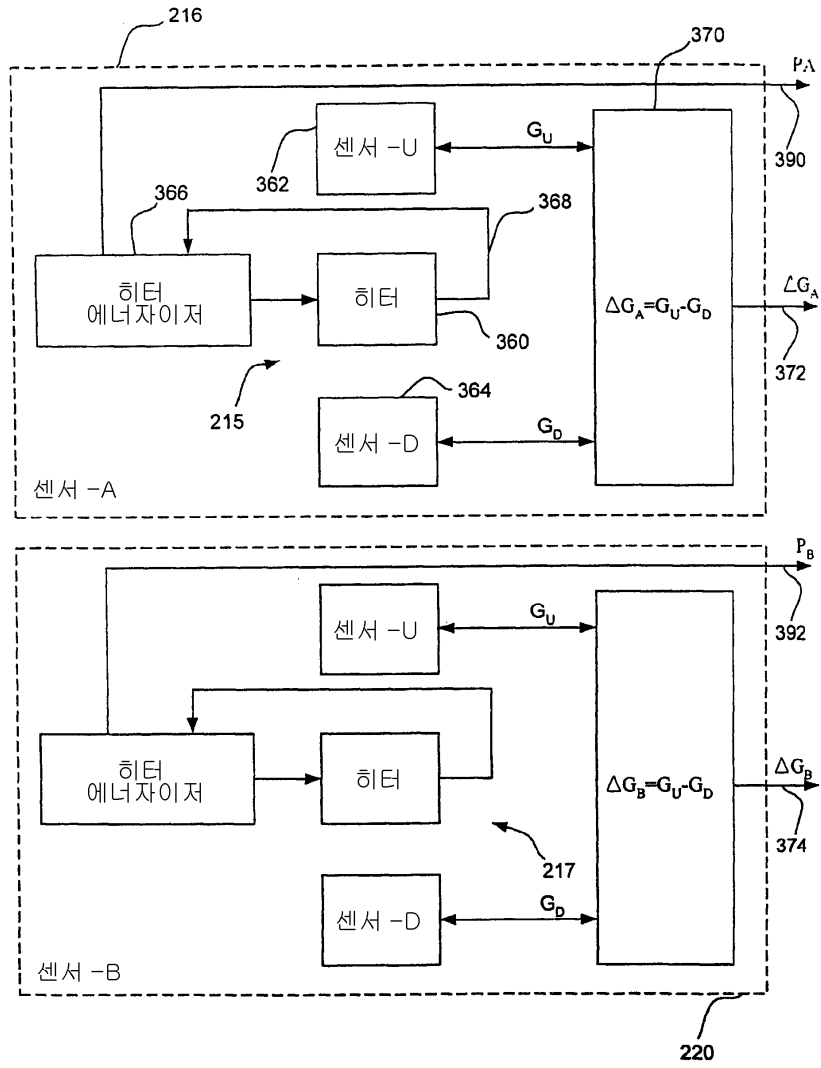
6



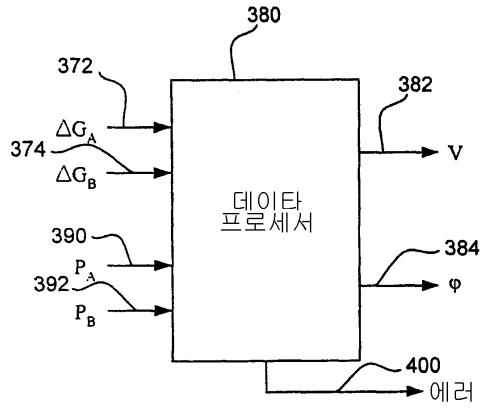
7



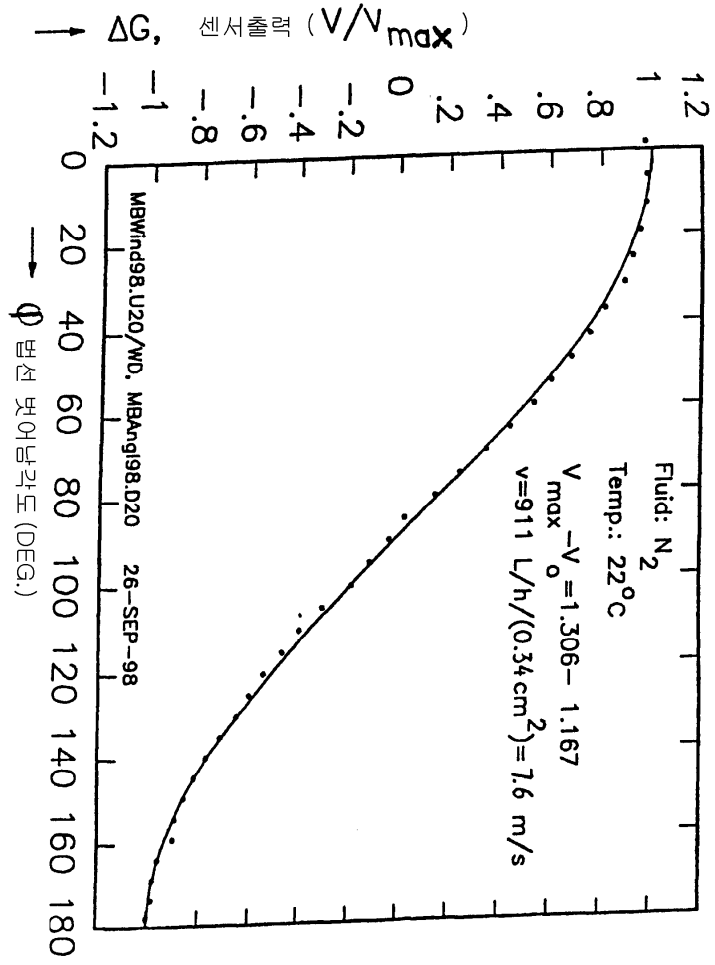
8



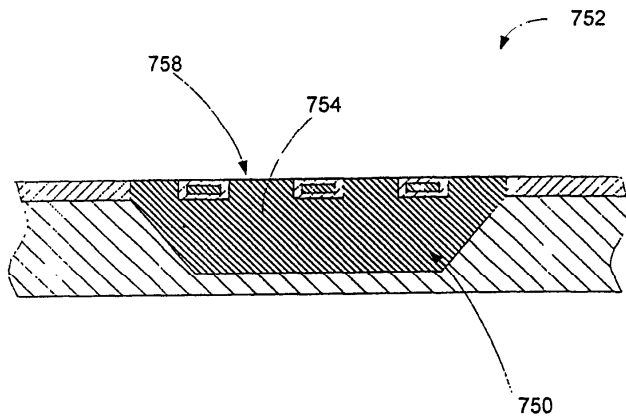
9

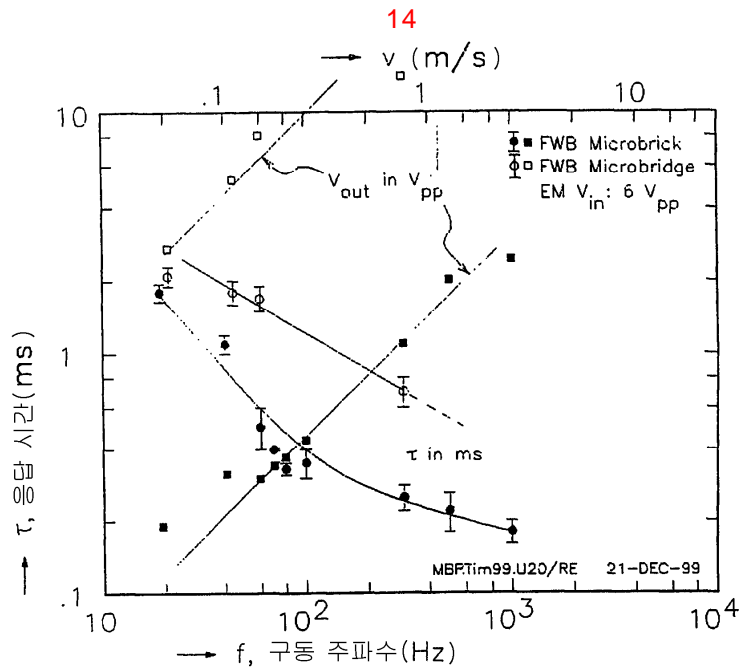
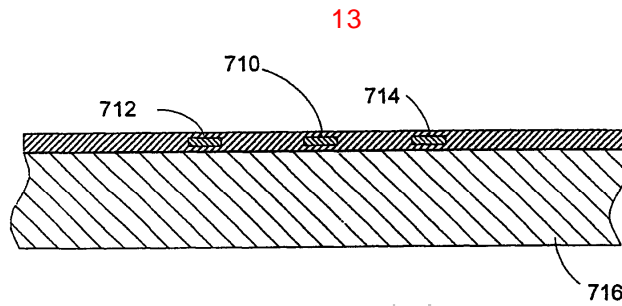
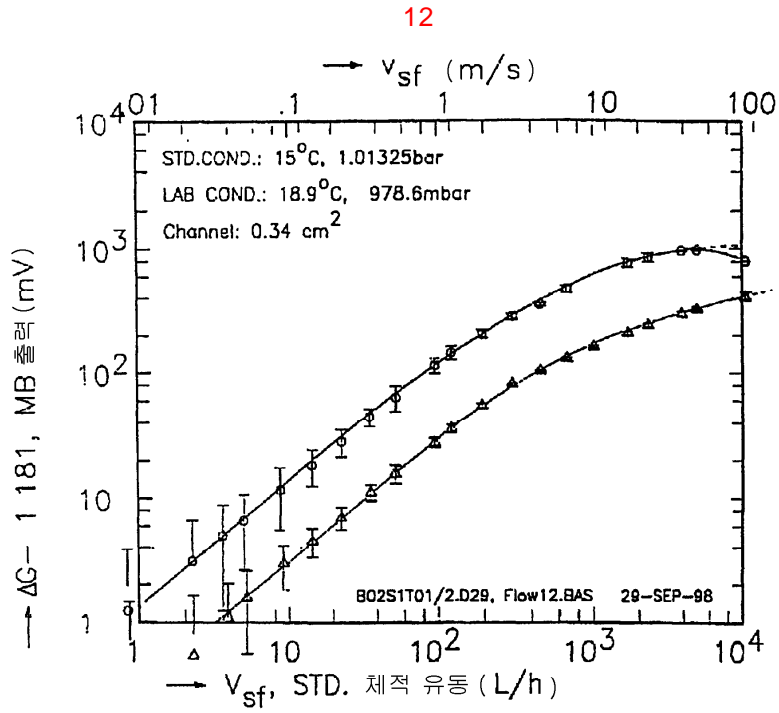


10

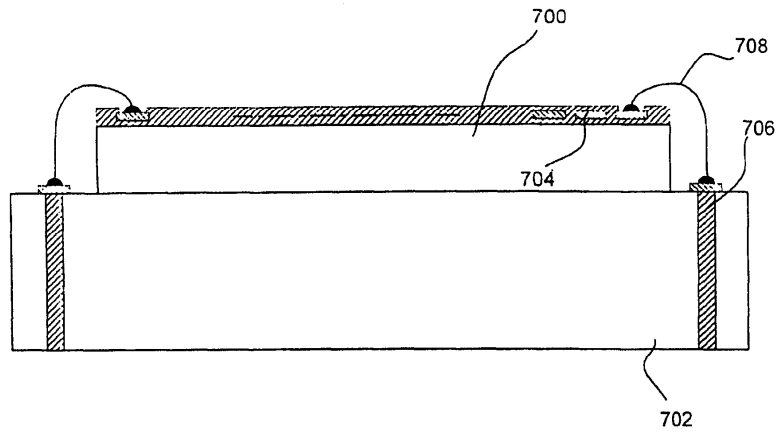


11





15A



15B

