

157nm 가 , 가 , 1 가 , 1pm
 , 157nm , - / - 가 ,
 1pm , / 가

6b

1999 6 23	60/140,531	, 2000 5 15	60/204,0
95 , 1999 10 29	60/162,735	, 1999 11 23	60/166,967 , 1999 12
13 60/170,342	.	1999 2 12	
60,120,218 , 1999 2 10	60/119,486		1999 5 2
4 09/317,527	.	1999 4 19	
60/130,392	2000 4 17		09/550,558

ing) 1pm VUV , - (line - narrow

- UV (157.6nm) , - (micro - ma
 chining) 0.1 :m . TFT

(imaging) 가 , 1pm
 (achromatic) (source)
 0.1pm 0.2pm , 0.1pm
 1pm VUV

157nm (stepper) (scanner) , 1pm
 10

1pm

VUV

VUV

157nm

VUV

1pm

가

1pm

157nm

가

1

가

157nm
(optics)

1pm

가

가

가

(etalons)

(expander)

2

(single interference order)가

(grating)
(aperture)

2

2, 3

4

VUV
(resonator reflector)

(stray light)

(highly reflective)

HR

(Littman configuration)

(Littrow)
(grism)

가

가

가

가

가

가

/

가 , 가

1

2a - 2f 1

3a 2

3b - 3d 2 가

4a (grain) 2

4b(i) - (iii) 3a

5a 3

5b - 5f 3 가

6a - 6b 4

가

2

1 - (U. Stamm), " 157nm 157nm " (SEMATECH) 157nm
 , 1999 2 15 - 17 , (Litchfield);

2 - (T.Hofman), (J.M.Hueber), (P.Das), (S.Scholler), "
 F₂ (157nm) " 157 , 1999 2 15 - 17 , ;

3- (I.Bragin), (S.Govorkov), (J. Kleinschmidt), (R.Patzel), (E. Slobodtchikov), (K/Vogler), (F.Voss), (D. Basting), " 157nm ", 24 , 19 99 3 14 - 19 ;

4- " DUV F₂ ", 24 , 1999 3 14 - 19 ;

5. (W.Muckenheim), (B.Ruckle), " , (J. Phys. E: Sci, Instrum.) 20(1987) 1394;

6. (G.Grunefeld), (H.Schluter), (P. Andersen), (E.W.Rothe), " (Cassegrain) KrF ArF 가 " , (B) 62 (1996) 241;

7- 09/317,526 , 09/343,333 , 60/122,145 , 60/140,531 , 60/162,735 , 60/166,952 , 60/171,172 , 60/141,678 , 60/173,993 , 60/166,697 , 60/172,674 , 60/181,156 , 2000 5 18 가 " (Speckle) " , 6,005,880 , ;

8- (W.Mueckemheim), " 2 7가 " , / - 1987 7 .

1 (deep ultraviolet: DUV) (vacuum ultraviolet: VUV) VUV . TFT / (micromachining) 1

VUV 가 09/317,695 , 09/317,526 , 09/317,527 , 09/343,333 , 60/122,145 , 60/140,531 , 60/162,735 , 60/166,952 , 60/171,172 , 60/141,678 , 60/173,993 , 60/166,967 , 60/172,674 60/181,156 2000 5 18 " , 6,005,880 , , .

1 - (4) 가 (gas handling module) (6) (8) (3) (2) - (4) (10) (12) (10), (12) (2) (14) (16) (18) (21) (main beam) (20) (20)

8) (16) (24) / (26) (2)

(2) 가 (3)
 (preionization) () (3) 09/453,
 670 , 60/184,705 60/128,277 ,
 5,729,565 4,860,300 ,
 4,691,322 , 5,535,233 5,557,629 ,
 (2) ()
 60/162,845 , 60/160,182 , 60/127,237 09/247,887 ,
 5,337,330 , 5,818,865 5,991,324

(14) (8) 가
 (2) (3) .
 5 15 가 60/149,392 , 60/198,058 09/390,146 , 2000
 " , 6,005,880 6,020,723 ,
 (Osmanow) "
 14,974 , 5,949,806 , 5,936,988 , 6,028,872 5,982,800 , 5,982,795 , 5,940,421 , 5,9
 3 5,729,562 ,
 ('988).

가 (2) - 가 가
 , - 가 (10) , (10) - 가 가
 , - 가 (12) , 가 가

(2) (14)
 (Brewster) (enclosures) (17), (19)
 (10), (12) VUV

(20) 가 (12) (outcoupler)
 (18) (18) (21) (20)
 (20)
 2 / HR / (di
 chroic) () (18)
 , , /
 (20)

(18) (20) (22)

(18) (20) (22) (18) (20)

(23) (22), (20)

(17), (19) (2) (10), (12) (23)

(21) 09/343,333 60/140,530

09/131,580 5,559,584 5,221,823 5,763,855 5,811,753

4,616,908 (21) VUV (18) 가

(20) 가 (purge)가

(23)

(18) (20)

172,749 60/166,952 60/178,620 (21) (09/172,805 60/

(spectrometer) (18)

08 / (09/416,344 60/186,003 60/158,8

60/186,096 , 2000 5 10 가 (Lokai) "

(Tandem See Through Hollow Cathode Lamp)

243 , 5,978,391 , 5,450,207 , 4,926,428 , 5,748,345 , 5,025,455 , 5,978,394 4,905,

818 09/418,052 ASE , 09/484,

/ 6,014,206 , 가

(16) (amplified spontaneous emission: ASE) ,

(purity) /

(16) /

(4), (8)

(16) 가 가 (dose) 가 (6)

가 (fills) (2) 가
 가 가
 09/317,526 , 09/513,025 , 60/124,785 , 09/418,052 , 60/159,525 60/160,126
 0.003% , 1.00% , 0.1% , , 가
 / '025 가 , F2 - , /
 rF - 가 0.0001% 0.1% 0.0001% 0.1% . A

가 가 (6) 가 (6) 가 ,
 / 가 가 가
 / 52 , 09/379,034 , 60/171,717 4,977,573 5,396,514 , 60/124,785 , 09/418,0
 , 5,978,406 , 6,014,398 6,028,880 , . Xe 가
 '025

(10) , (10) 2a - 6b -
 (catadioptric)
 (60/166,277 , 60/173,993 60/166,967 ,
).
 - (free - running) 1pm
 100pm

(10) - / 가 가
 60/178,445 , 09/317,527 ,
 , , , ,
 , / 가 , 가 4,399,540 , 4,905,243

, 5,226,050 , 5,559,816 , 5,659,419 , 5,663,973 , 5,761,236 5,946,337 ,
 09/317,695 , 09/130,277 , 09/244,554 , 09/317,527 , 09/073,070 , 60/
 124,241 , 60/140,532 , 60/147,219 60/140,531 , 6
 0/147,219 , 60/170,342 , 60/172,749 , 60/178,620 , 60/173,993 , 60/166,277 , 60
 /166,967 , 60/167,835 , 60/170,919 , 60/186,096 , 5,095,492 , 5,684,822 ,
 5,835,520 , 5,852,627 , 5,856,991 , 5,898,725 , 5,901,163 , 5,917,849 , 5,970,
 082 , 5,404,366 , 4,975,919 , 5,142,543 , 5,596,596 5,802,094 , 4,856,018 ,
 5,970,082 , 5,978,409 , 5,999,318 , 5,150,370 4,829,536 DE 298 22 090.
 3 , .

(12) , (20) . (20)
 (intraresonator)
 (12) . (14) (16)
 (10), (12) ('241, '
 695, 277, 554 527).

- 2a - 2f
 1 2a - 2f

2a 1 가 (3)()
 (2)(09/317,526) , () 2a
 (30) , (32) . (30)
 (60/170,342).

(34) , (34) (34) (34)
 5,161,238 , (09/130,277).
 2a (36) . (36)
 (, 5,150,370).

2b 2a (2) (34) , (3)
 6) (30) . 2b (38) (40)
 (38) 가 2
 a (32) . (32) 가 90E 가
 (38) 90E 가 . (38)
 , (38) (40) .

(40)

2c (2) (34) , (36), (30) (32) (42) (42)

(30) (42) (42)

2e - 2f (42) 2c 60/162,735 , 60/178,445 60/158,808

2d (43) , 2 (43) (43) (32) (43) (32) (43)

43) 2d (32) (43) (32) (43)

0) 2c 가, 1 (43) (43) (43) (43) (43)

2 (43) 2 (43) 2d (43)

4,856,018

2e 2f 2a 2b 가 (46)

2e 2f (32), (38) (30) (32), (38)

(46) (46)

(32), (38) (46) 2e / 2f 09/317,527 60/166,277

6,028,879 , 3,609,586 , 3,471,800 , 3,546,622 , 5,901,163 , 5,856,99

1 , 5,440,574 5,479,431 , (H.Lengfellner), Nd 가

: GaP YAG (Optics Letters), 12 , 3 (19

87 3), (S.Marcus), - CO₂ (Cavity dumping) (coup

ling modulation), (J.Appl.Phys), 53 , 9 (1982 9) ,

(eds.D.R.Hall) (P.E.Jackson), 244

2a - 2f (30), (42), (43), (46) , 157nm 200nm

CaF₂, MgF₂, BaF, BaF₂, LiF, LiF₂ SrF₂가 2a - 2f

(反) - (anti - reflective)

	가	가	F ₂ 가	가	가	가
	0.1%	/	0.003%	1.0%	가	가
	가	/	0.0001%	0.1%	가	가
	가	09/513,025	09/317,526			
2a - 2f		157nm	1pm			VU
V (20)	. 1pm			157nm		(fab)
1		2				
	. 1pm	3a - 6b	가	3a - 4b		1
3a - 4b		-		2		
3a	(48)			(48)		
	가	(48)	(20)	(50)		
		(52)				
3a	-	(48)	(50)	(52)		(5
0)		3b - 3d		3a	(48)	1pm
				2a - 2f		
		(48)	(50)			
		(20)		1pm		
		1	2	(54)		
60/204,095	(52)					
	6,005,880					(delay circuit)
	(50)	3b - 3d				
(20)				(20)		
3b	1		(20)		1pm	
		(58)			1	(50)
	(58)	(D)	가	(gas - filled gap)		, 2
	(R)		T(8)	8		

$$T(\theta) = (1 + (4F^2/B^2)\sin(2BnD\cos(\theta/8)))^{-1}$$

, n (58) , 가 , 1
 (58) , F (58) (finesse) :

2

$$F = BR^{1/2}/(1-R)$$

(R) (D) 가 (48)
 (58) , (58) 가 10 ,
 (Free Spectral Range: FSR) 1/10 ,
 (48) FSR 2 1pm .
 0.1pm .

(58) (contrast ratio) 가 . (1+4F²/B²)
 (58) , (1+4F²/B²)ⁿ .
 , n (58) , (58) 가 , 가

3b (56) (58) . 1pm FSR 가 , 1
 , 1 (spacing) D=1.2cm . (58) (1=
 O) , 1 (8/nD)^{1/2} mrad . , 3b
 F) (50) 1 가 , (factor) (58) (
 (48) 1 , 1 (millirads) , (56)
 (34) (09/130,277). (48)

(58) 가 .
 09/317,527 가 ,
 (piezoelectrically) 가 , (58)

3c (60) 3a (50) 2 (60)
 , 가 3c (60)
 ctrometer) , (Czerny - Turner type spe
 (62a) (61) (60) (64) , (20)
 66) (64) (60) (60) ,
 (66) , (62b) (62b)

1pm , (64) 1pm . (59) 1 .
(20) .

(60) (60) . (60)
:

3

$$d8/d1=(2/8)\tan 1$$

, 1 (66) (M) , (64) (L))8 (60) d8/d1 , (62a), (62b) (d)
:

4

$$)8=d(LMd8/d1)^{-1}$$

(50) , (1)가 78.6E , L=2m M=8 (60) , 3c
(20) 0.1pm 가 , (d) d=0.1mm . (61a)
(48) 가 , (48) (09/130,277
) .

3d (50) 3 가 3d . 3d (50) 3c
, 3d (64) (68)가 3c (64)
.

(48) (52) (2) (52)
, (48) - 가 (52)
(timing)
가
6,005,880 60/204,095 .

4a (72) (74) (70) 4a
(34) (48) - (70)
- (76) .
가 , 2a - 2f
.

3a , - (50) ,
 3b - 3d (,) , (50) ,
 (,) , (delay line) 2 (50)
 , 60/130,392 ,

4b(i) - (iii) , - (76) -
 (59) 4b(i) ,
 4b(ii) 1 (a) 2
 20 가 1 (76)
 (50) 가 (78)
 가 (78) (70)()
 , (50) - , 가 4b(iii)
 , 4b(i) 2 (b) , - (59)
 5a 1pm 1 2
 , 2a - 2f - (48) 5b - 5f .

5(b) - (30) (32) ,
 5,559,816 , 298 22 090.3 DE, 4,985,898 , 5,150,370 , 5,852,627
 , 가 (2b) . 2a - 4a
 가 ((34) ,
 09/130,277) .

5c (43) (2d) . (34)
 (30) (43) ,
 (43) ,

5d - 5e , RF (mic
 rowave excited waveguide laser) , 5d RF - (80) , 가
 (82) . 2a - 5c 가
 (2)가 5d RF - . 5d -
 5e (C.P.Christenson), - (Compact
 Self - Contained) ArF AFOSR IR 95 - 0370; . (T.Ishihara), . . ()
 S.C.Lin), 가 B 48, 315 - 326 (1989); (Ohmi),
 (Tadahiro) (Tanaka), (Nobuyosi), ,
 가 , EP 0 820 132 A2 , RF -
 " , (Kurt Bondelie) " 가
 , 1996 8 , 95 - 100 , .

5d (38) HR (40) (30) (32) (34)
 (2b 2f). (36) (20)
 (46) (36) (2e - 2f).

5e (43) HR (44) (46)
 5d (32) (38) (43) ,
 (36) .

RF - (trips) , 가 RF -
 (0.5mm) , 가 (30) (32)
 5d - 5e .

5f 5a (48)
 . 5f 355nm 3 (85) ,
 Nd:YAG 6,002,697
 . (85) 472.9nm ,
 가 (86) 472.9nm 가
 157.6nm 3 , 가
 (88) . 가 3 : (Kung A.H),
 . (Young J.F.), . (Bjorklung G.C.), . (Harris S.E.), , 29 ,
 985 (1972); , 22 301(1973)

6a 6b 가 (2)
 , (2)가 (52) . 6a (30)
 , (50)가 , 4a
 . (50) 6a - 가 ,
 (2a - 2f, 5c 5f) ,
 ,
 1 (20) (20) (90) (90)
 ,
 (92) (78) ('392) , (70)
 , (78) ,
 4a - 4b(iii) . (20)
 , 가 가 , (2), (70) 가

가 , ,

· , ,

·

, , , , , ,

(57)

1.

, , :

가 가 ;

가 가 르 ;

- , 157nm 1pm

;

가

2.

1 , - ,

·

3.

2 , -

가

·

4.

3 ,

·

5.

4 , -

가 ,

·

6.

4 5 , 가
.

7.

6 ,
.

8.

4 5 , 1 ,
2 가 .

9.

8 , 1
.

10.

1 , - ,
2 .

11.

10 , -
가 .

12.

11 ,
.

13.

12 , -
가 , .

14.

12 13 , 가
.

15.

14 , .

16.

12 13 , 1 ,
2 가 .

17.

16 , 1 .

18.

1 , - , .

19.

18 , -
가 .

20.

18 , -
가 .

21.

18 , -
가 .

22.

18 , -
가 .

23.

19 22 , - 가
.

24.

23 , .

25.

23 ,
.

26.

25 , 2 가 , 1 2
.

27.

5 13 20 ,
가 ,
.

28.

5 13 20 ,
.

29.

1 , 가 , 가 가
가 , :
가 ;

가 F2 - 가

30.

1 , 가 , 가 가
가 , :
가 ;

가 F2 - 가

31.

1 , 가 가

32.

31 , ,

33.

32 , 2

34.

32 33 ,
가

35.

31 ,

36.

35 , 가

37.

36 , 가 ,

38.

37 , - 2 2 2 , ,

39.

, :
가 가 , ;

가 ;

157nm ;

1pm - ;

가 , -

40.

39 , -

41.

40 , - ,

42.

41 , ,

43.

42 , 2

44.

42 43 , 가

45.

41 ,

46.

45 , 가

47.

46 , 가 ,

48.

47 , 2 2 , , 2

49.

39 , - -

50.

49 , - ,

51.

50 , - 가

52.

51 ,

53.

52 가 , - ,

54.

52 53 , 가

55.

54 ,

56.

52 53 , 1 ,
2 가

57.

56 , 1

58.

49 , - , 2

59.

58 , - 가

60.

59 ,

61.

60 , - 가

62.

60 61 , 가

63.

62 ,

64.

60 61 , 1 , 2 가

65.

64 , 1

66.

49 , ,

67.

66 , - 가

68.

66 , -
가

69.

66 , -
가

70.

66 , -
가

71.

67 70 , - 가

72.

71 ,

73.

71 ,

74.

73 , 2 가 , 1 2

75.

53 61 68 ,
가 ,

76.

53 61 68 ,

77.

39 , 가 , 가 가
가 , :

가 ;

가 F2 - 가

78.

39 가 , 가 , 가 : 가 ;

가 F2 - 가

79.

39 40 49 53 58 59 61 , - .

80.

57 , - .

81.

65 , - .

82.

74 , - .

83.

, , : 가 ;

, 가 RF RF ;

157nm 1pm ;

가

84.

1 , - ,

85.

84 , -

가

86.

85 ,

87.

86 가 , - ,

88.

86 87 , 가

89.

88 ,

90.

86 87 가 , 1 , 2 가

91.

90 , 1

92.

83 , - ,

93.

92 , -
가 .

94.

92 , -
가 .

95.

92 , -
가 .

96.

92 , -
가 .

97.

93 96 , - 가
.

98.

97 ,

99.

97 ,

100.

99 , 2 가 , 1 2
.

101.

87 94 , 가 ,

102.

87 95 ,

103.

가 : 157nm 1pm

157nm ;

1pm ;

;

104.

103 ,

105.

104 ,

106.

104 105 ,

,

107.

106 ,

108.

103 ,

109.

103 ,

,

110.

103 105 108 109 , , 가

111.

109 ,

112.

109 ,

113.

103 , 가

114.

157nm ;
1pm ;
;

115.

114 ,

116.

115 , -

117.

115 116 ,
,

118.

117 ,

119.

114 ,

120.

114 ,

121.

114 116 119 120 ,
, 가 가

122.

121 ,

123.

121 ,

124.

114 ,

125.

1 , -

126.

125 , - 가

127.

126 , VUV

128.

127

129.

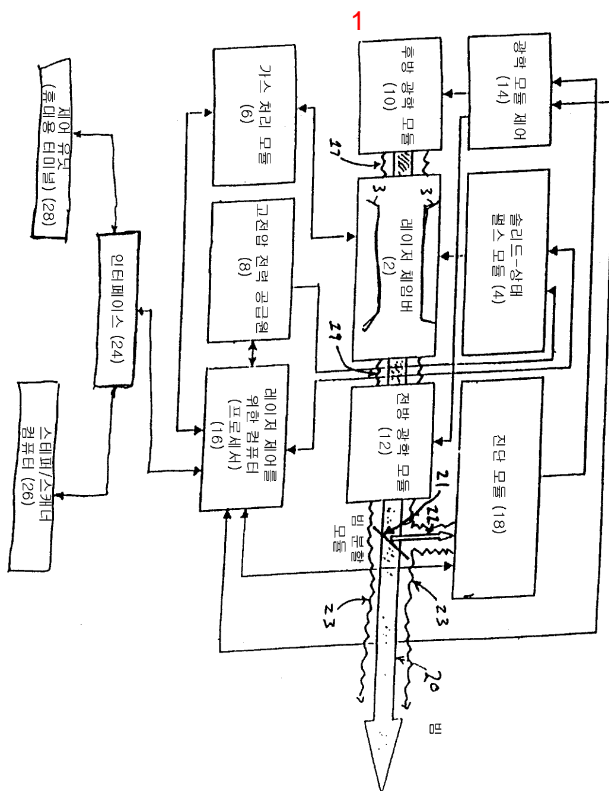
128

2

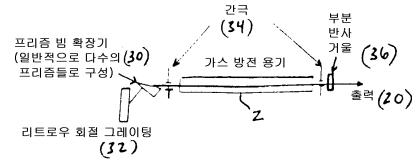
130.

127

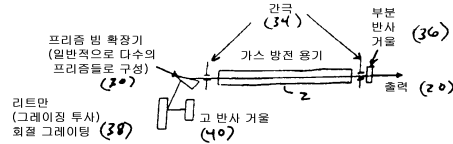
가



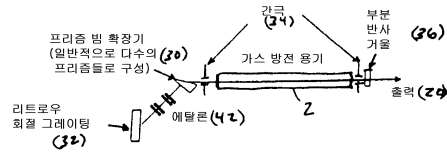
2a



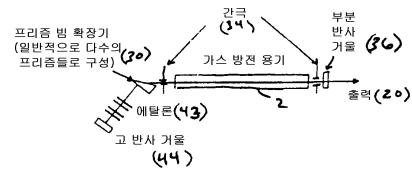
2b



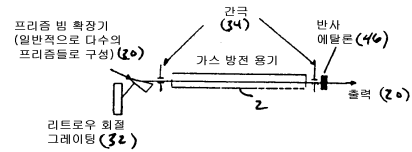
2c



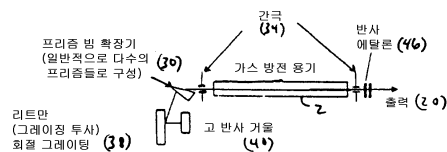
2d



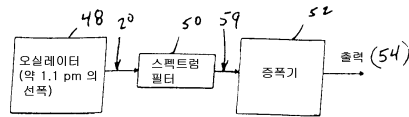
2e



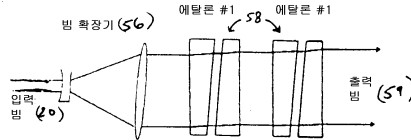
2f



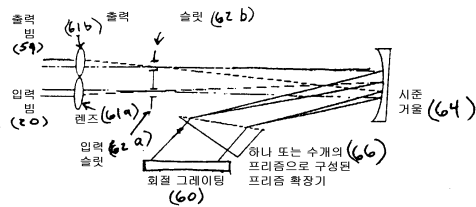
3a



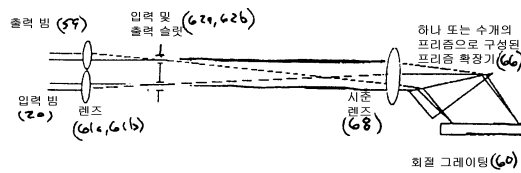
3b



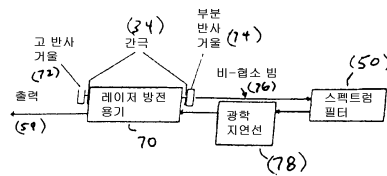
3c



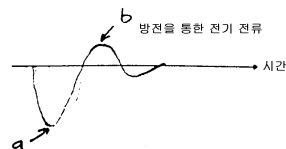
3d



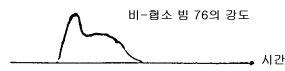
4a



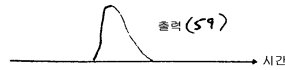
4b(i)



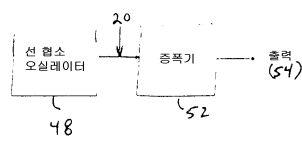
4b(ii)



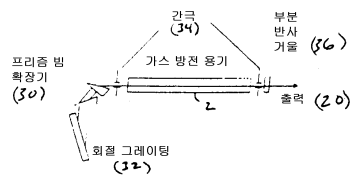
4b(iii)



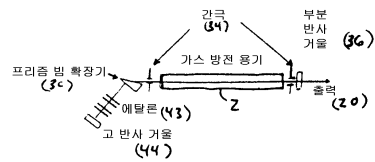
5a



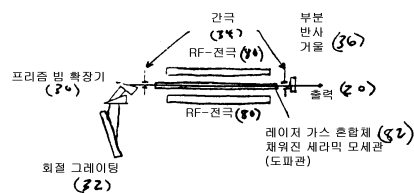
5b



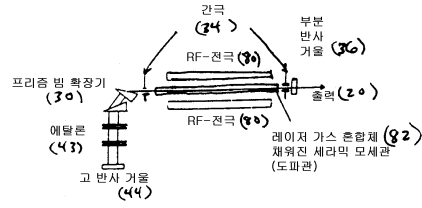
5c



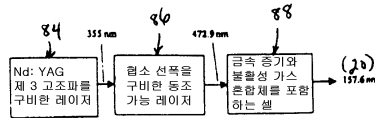
5d



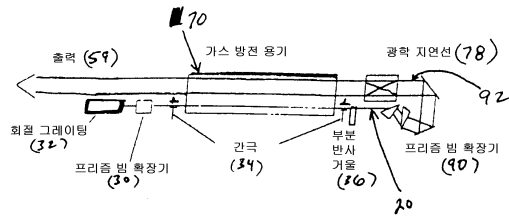
5e



5f



6a



6b

