

(Method and Apparatus for Providing Security Features in Paper

"
r)"

가 , / 가 가가 (,
) , 가

가

< >

1

(polymer)

가 / , ,

(amplified spontaneous emission, ASE)

(robust)

(homogeneously)

(inhomogeneously)

(ASE)

< >

inating)

가 (illum

(gain medium)

(amplified spontaneous emission, ASE)

(toroid), (filament)

monolithic (polymer)

(carrier)

(derivative) 가 (signature) (linewidth)

(carrier)가 (encoding), /

1

2A

2B 1

2C

2D 가 2A

2E 가 2A

3 1

4 3

5 (B) (A) 2A 2E

6

7

8

9

10 가

" (Optical Sources
 Having a Strongly Scattering Gain Medium Providing Laser - Like Action)" 1995 9 5 Nab
 il M. Lawandy 5,448,582
 " (Optical Gain Medium Having Doped Na
 nocrystals of Semiconductors and also Optical Scatterers)" 1995 7 18 Nabil M. Lawandy
 5,434,878

(,)
 (gain medium)

5,448,582

(amplified spontaneous emission, ASE)

(illumination)

(ASE)

가 가

, ASE ASE (homogeneously) ASE (inhomogeneously)

lvent), () , (rare earth) (polymer) (so
 , () , /

가 , (ASE)
 (nanometer)
 ()
 (polymeric planchette) , .

가
 가

가 , 2

1 1 가 , (10)
 er) (textile fiber) (polymer fib
 (thread)(12) (12)

(spectral linewidth collapse) (temporal collapse) . Nd:YAG (14)
 2 (, 532 nm) , (12) (12)

가 가 가 (14)
 가 , (12) (10)

가 . 가 가

7 . 7

2A (planchette)(12A)
 (12A) 가 가 D T
 , 100 (micron) , D T 100
 , T D 1/2 1/2 ,
 , (12A) 7 ()
 (12A) n n' [, (12A)
] .

T ASE가 , ASE가

2B , (12B) DM 1/2 1/2 , (12B) 7 , (12B)
 n , n' , (12B)
 , 가 , DM , (12B) (12B)
 가 , (12B)

2C (distrubuted feedback, DFB) , DBF (12C)
 1 2 (n₁ n₂) , n₁ n₂ ,
 n' 가 , 1/4 1/4
 5 , , /
 가 (B) (A) , 2A 2E

, ():
 / $\alpha_0 = 1/\sqrt{2gL}$
 , g (, 200 cm⁻¹) , L
 , 10 (/ $\alpha_0 = 0.1$) , g ASE가 200 cm⁻¹ , L 2.5 mm

2D 2A (12A) (12B)
 [, 4 (sector)] (1 - 4) , 2E 2A
 (12A) (12B)

3 (, 3)(22, 24, 26) , 1, 2, 3
 (rare earth)
 (28) (30) (30)
 1 (12) 가 (strip) UV
) / (, 1, 2, 3)
 (, 10 nm) 3
 (16) (, 8) ,
 가 (wedge)
 (monolithic detector array) (, 9)가

- up table) (look

UV (22, 24, 26) UV (32) UV (32) /
 (32) UV (32)
 (12) nylon - 6, nylon 6/6, PET, ABS, SAN, PPS
 (pyrroemethene) 567, 590(Rhodamine 590 chloride), 640(Rhodamine 6
 40 perchlorate)
 (wet spinning) 2×10^{-3} M . 250
 (12) 가 (pump 12) 5 mJ/cm^2
 2 2 가 2E
 가 (slice) (12A)
 , 6 2 Nd:YAG (12) 532 nm , 552 nm 615 nm
 2×10^{-3} M Pyrromethene 567 Rhodamine 640 perchlorate
 (12) 가
 1 (signature) , \$50 2 , \$100
 6 6 nm 4 nm
 가 2 , 2
 620 nm Rhodamine 640 532 nm Rhodamine 640 (Nile Blue)
 700 nm
 4 3 (28) , (22, 24, 26) 가 (30)
 가
 8 (50)
 2 Nd:YAG (14a) (14) (14a)
 (mirror) M (10) (10) (52)
 M (52) , (12a) (10) ()
 10)가 (12) / (12A), 가 ,
 (, F1 Fn). F1 - Fn 가 F가
 PDn PD1 PDn (10)가 가 PD1
 (54a) (54) (10) 가 , PD1
 PDn /

(52) PD1 - PDn가 (area imaging array) (12a) (wedge), (grating)가 (conveyor belt) F1 - Fn CCD 가 6 nm).

(54) Fn 가 (14), M, (52), F1 -

9 (53) (54') (54a') (50') 9 8 (52) (12a) 가 가 가 가 (53) 가

9 8 가 (53a) (monolithic area array) (53) (53) (55) (10) SP 가 (54') (53) (10) (/ , ,) / /

8 9 (binary)

(12B) M 가 (12A) " 1" M (palette) N " 0" 2^M - 1 가 가 , M=3 7

N

가

$$Z_M^N = \frac{M!}{(M-N)!N!}$$

, ! (factorial) , M=5

$$Z^1_5 (1) = 5$$

$$Z^2_5 (2) = 10$$

$$Z^3_5 (3) = 10$$

$$Z^4_5 (4) = 5$$

$$Z^5_5 (5) = 1$$

가 가 0

10

0 3

" 0" , 0

" 1" , = A

" 2" , = B > A

, A

, 0

:

" 0" , 0

" +1" , = A

" -1" , = B > A

, M

$3^N - 1$

. Y

, $Y^N - 1$

가

7

, M=3, Y=3

, 26

가

(planchette)

(polymer filament)

(textile thread)

(amplified spontaneous emission, ASE)

toroid), (

가

가

(57)

1.

ium) (gain med

2.

(amplified spontaneous emission, ASE)

3.

4.

3

(filament)

(toroid),

5.

3

(monolithic)

(distribut

ed optical feedback)

6.

3

,

가

(carrier)

7.

(a)

(b)

(illuminating)

가

8.

7

,

(polymer lay

er)

9.

7

,

10.

7

,

11.

10

,

12.

10

,

13.

7 ,

14.

7 ,

15.

7 ,

(planchette) ,

16.

7 ,

(distributed feedback, DFB) ,

17.

(ASE)

18.

17 ,

가 , , ,

19.

, ,

(a)

(b)

(b)

(a)

27.

26

가

28.

26

가

29.

26

30.

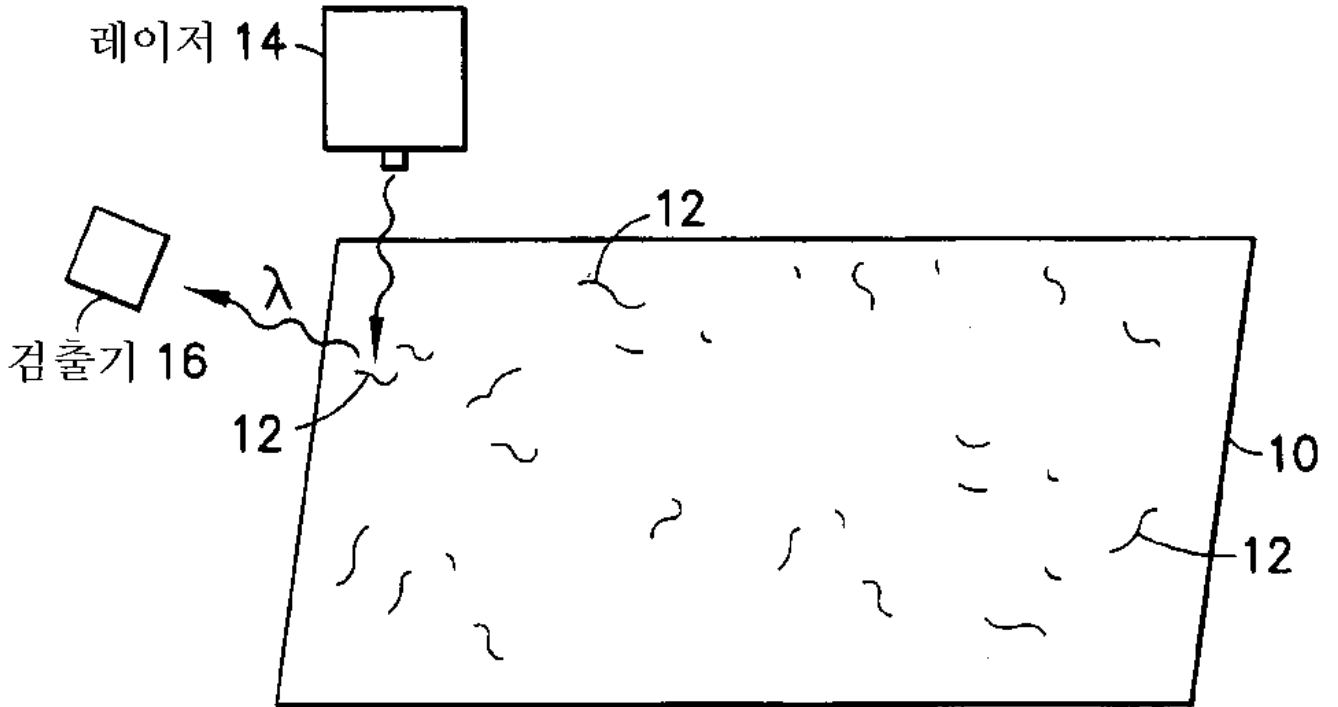
26

31.

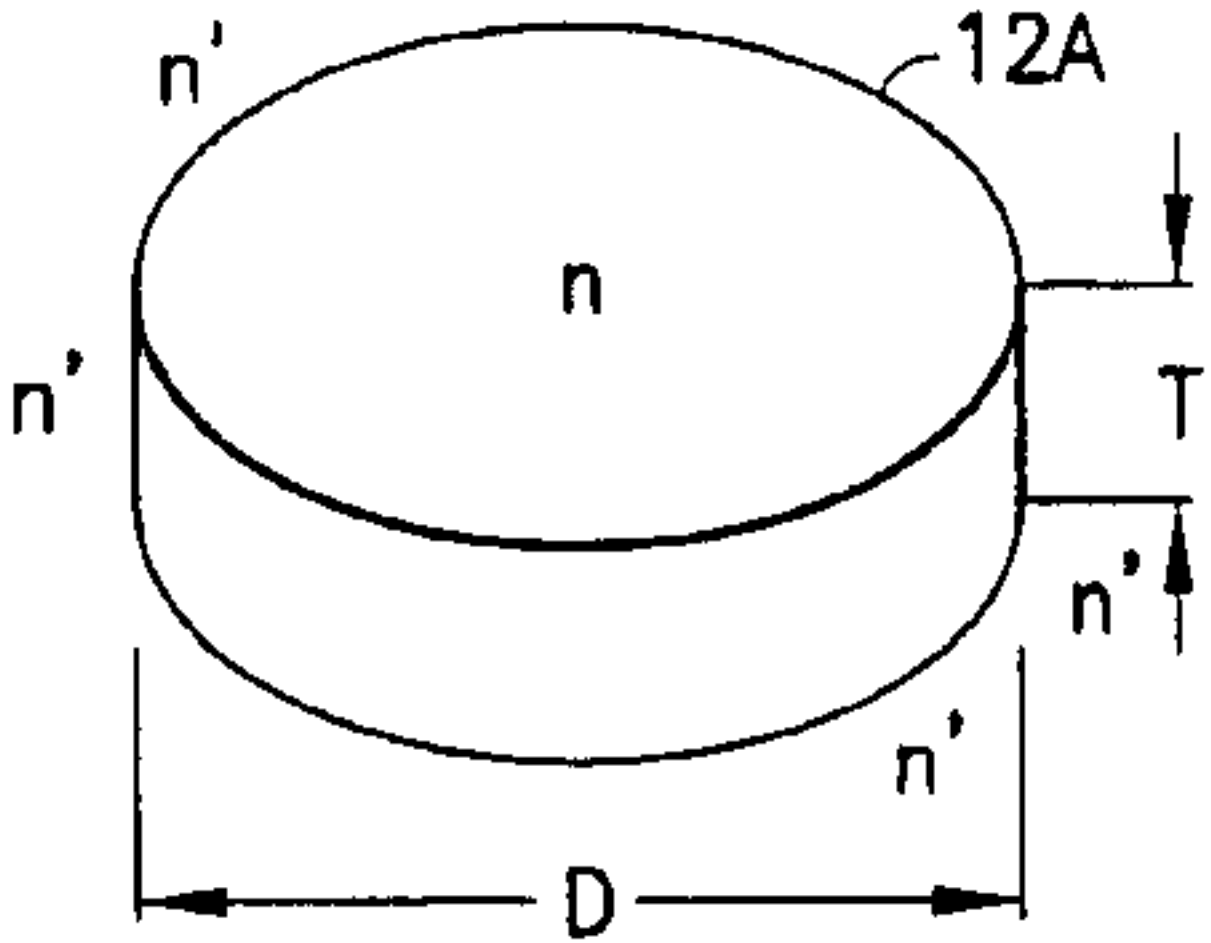
26

32.

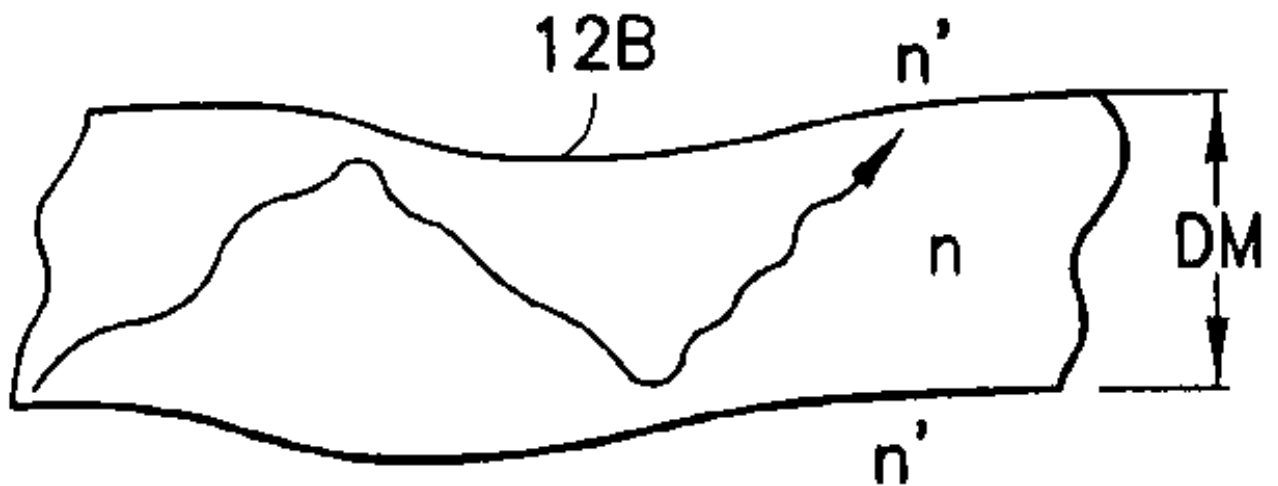
1



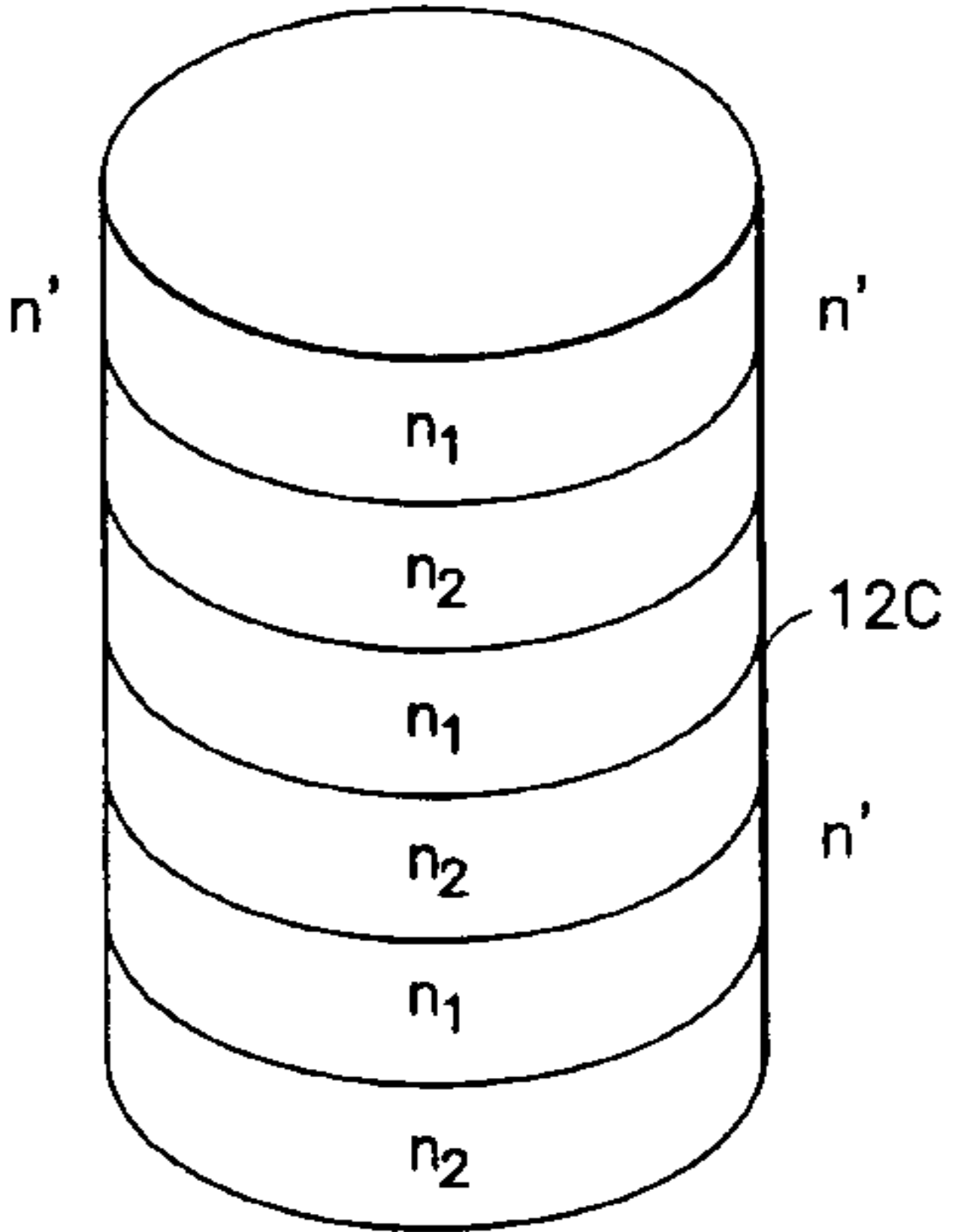
2A



2B

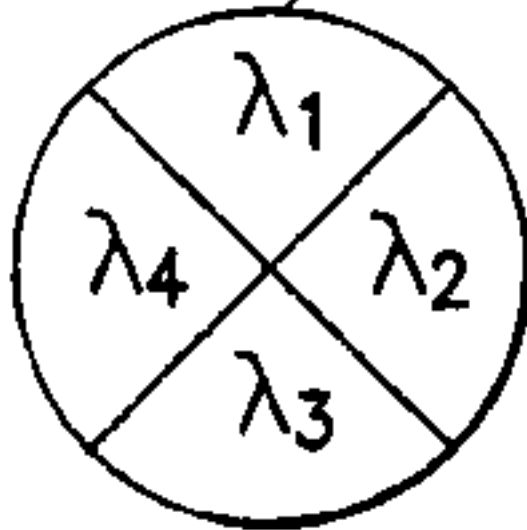


2C



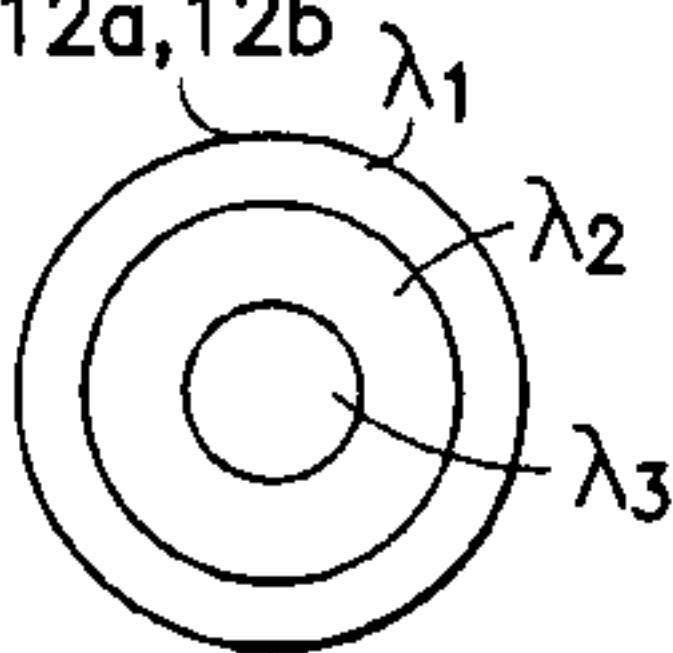
2D

12a, 12b

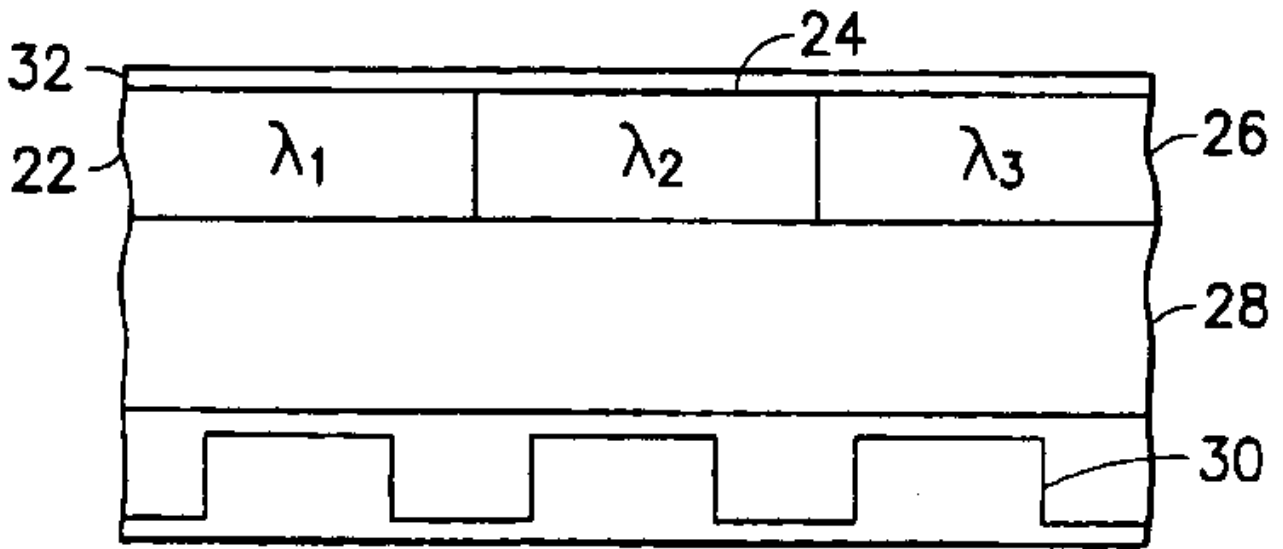


2E

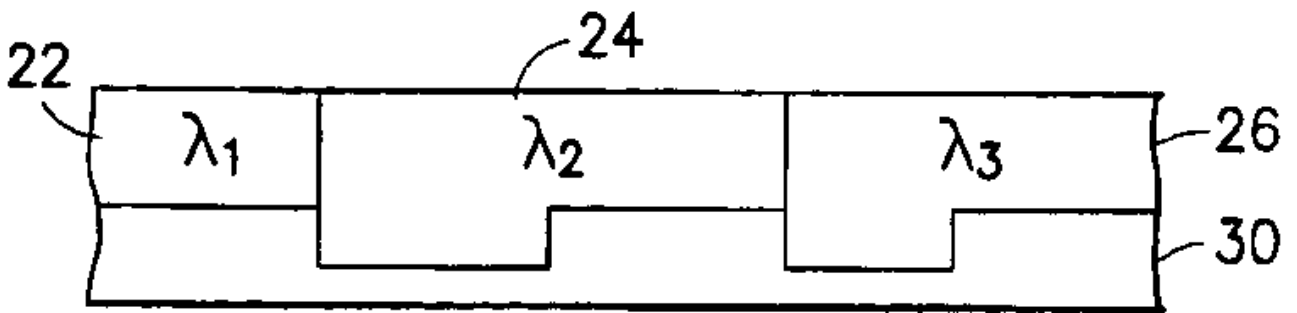
12a, 12b



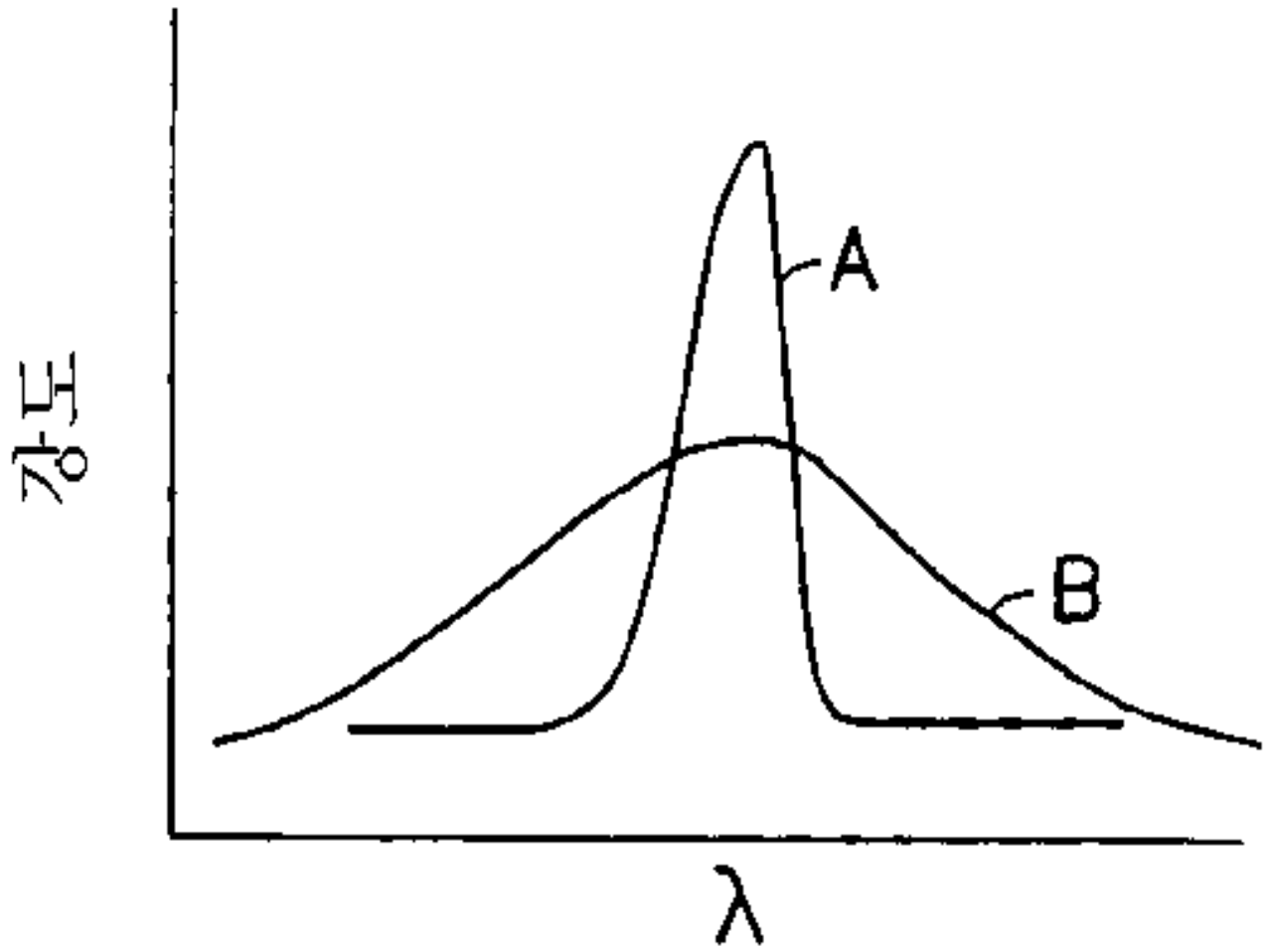
3



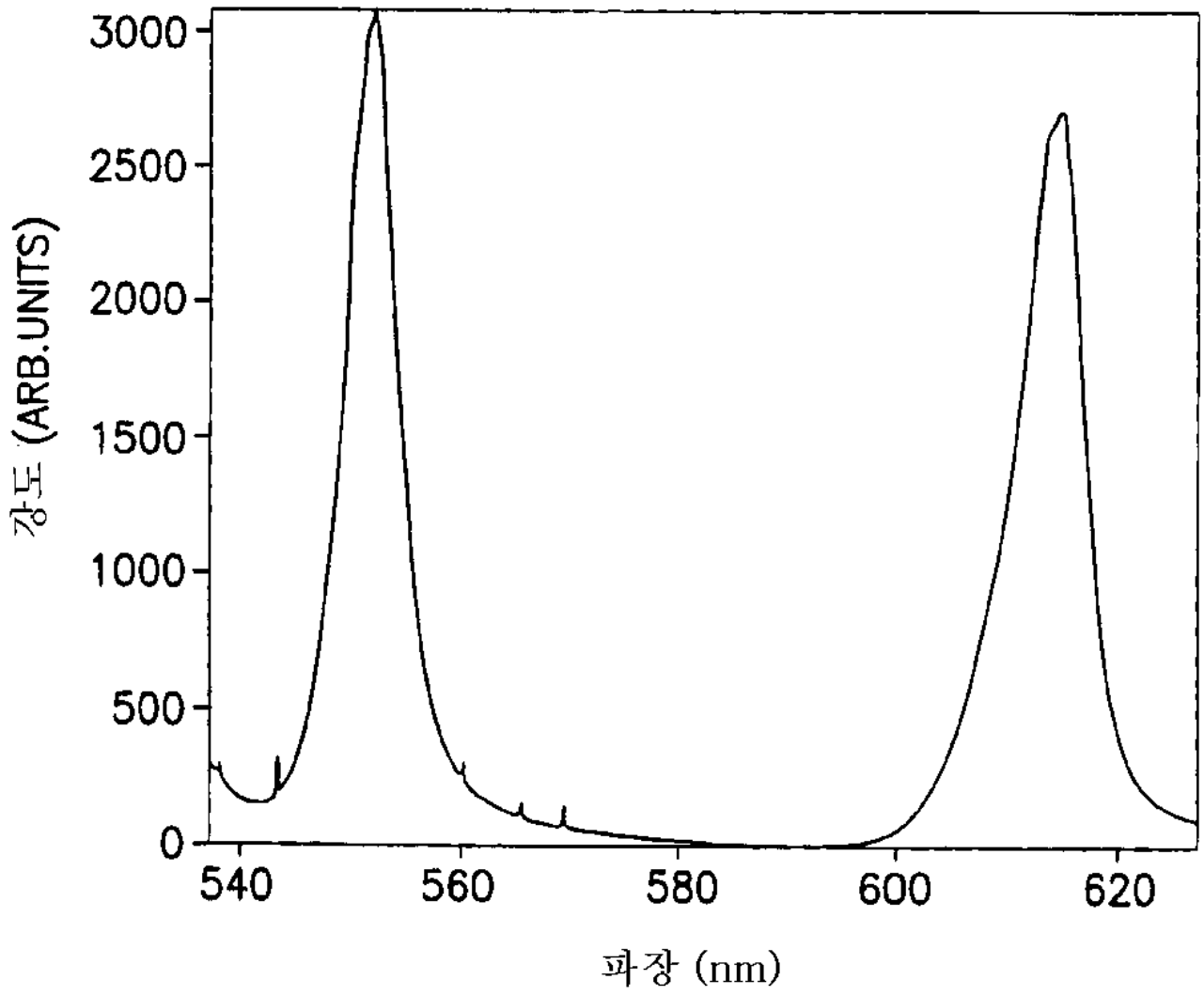
4



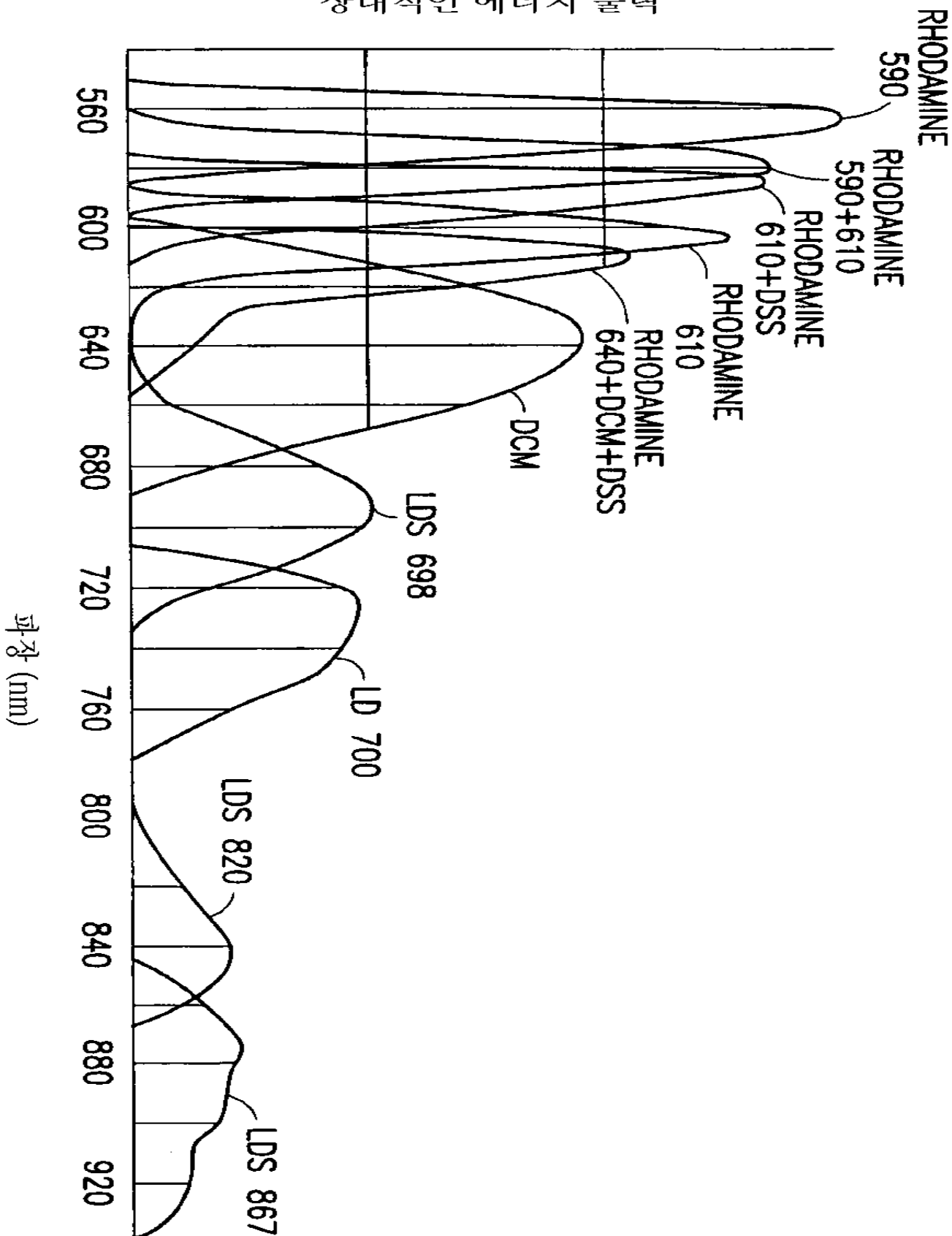
5



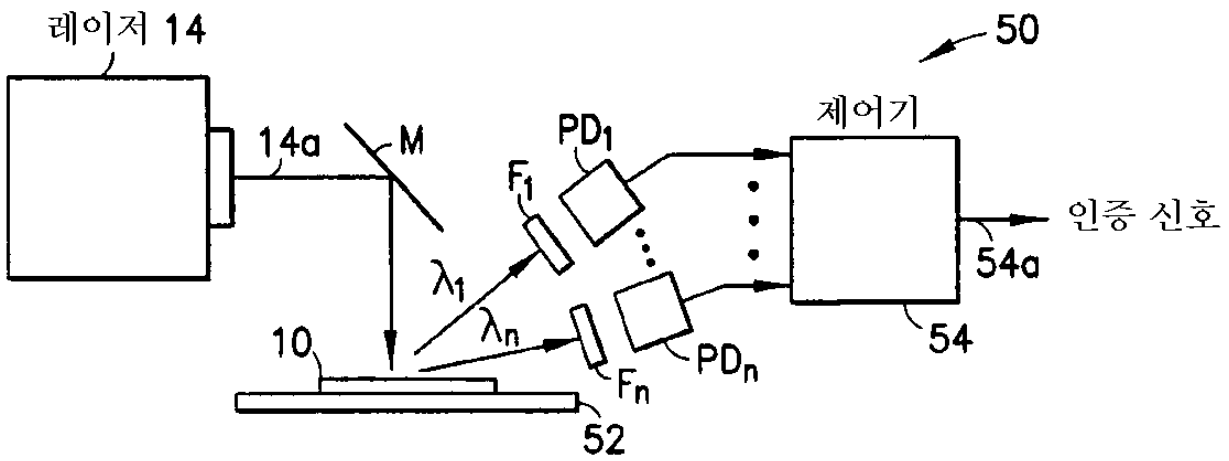
6



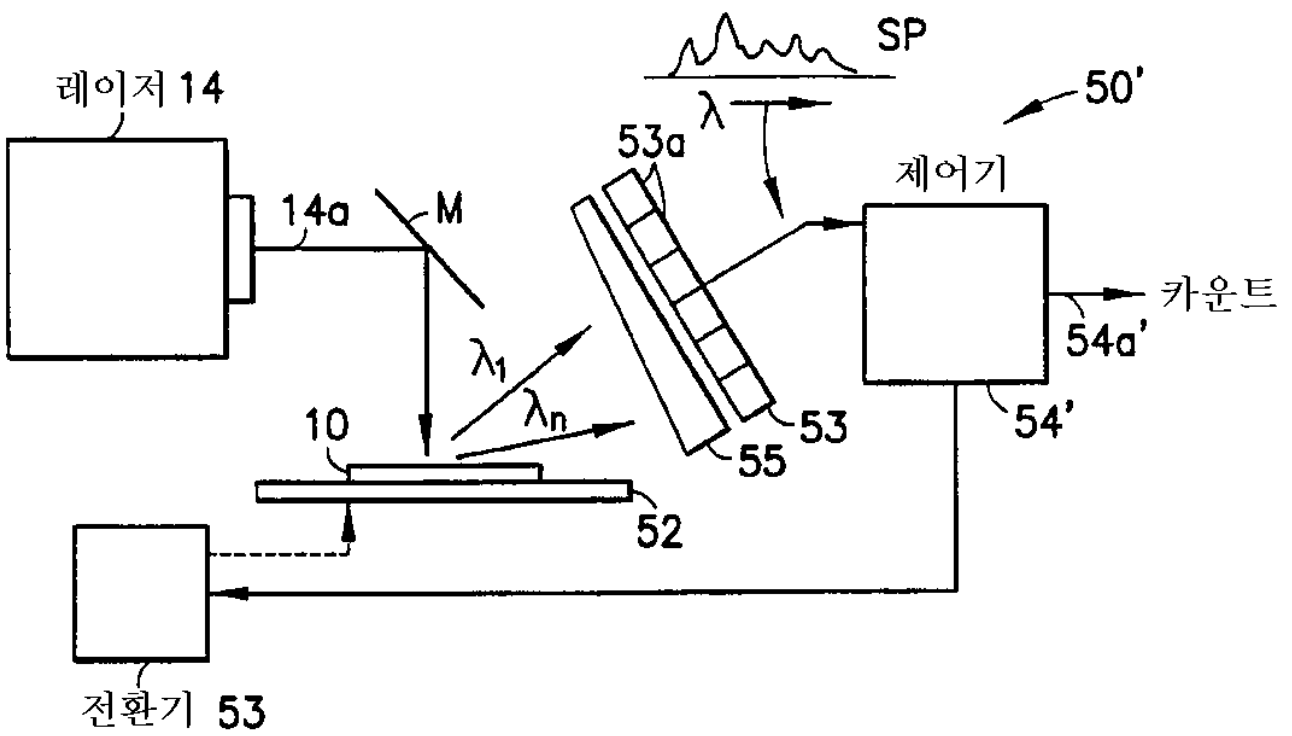
상대적인 에너지 출력



8



9



10

