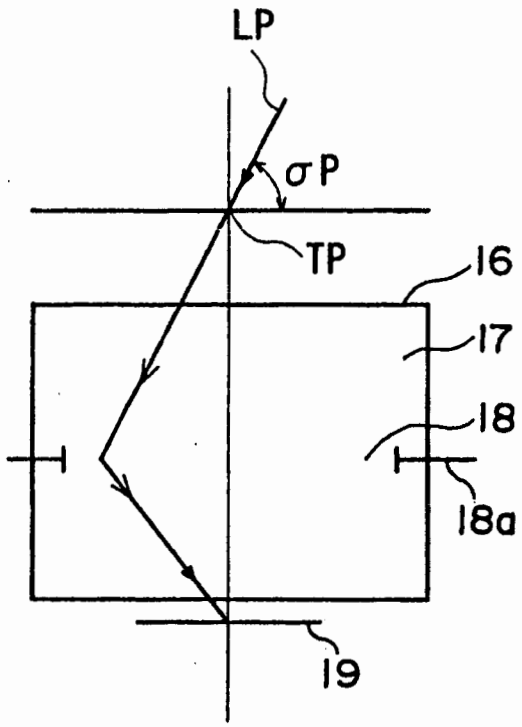

LP
σP
TP
16
17
18
18a
19

FIG. 1

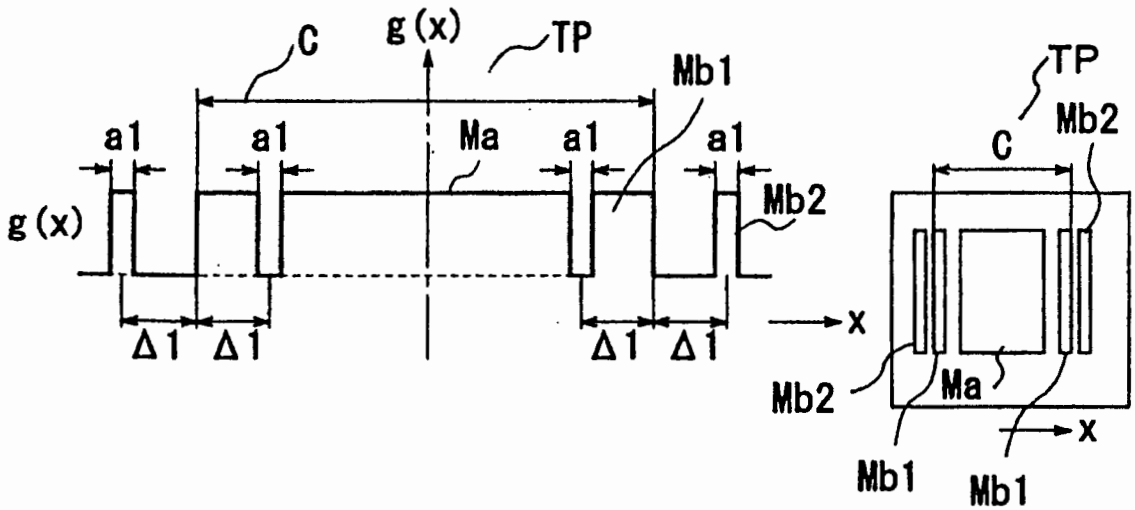

C
g(x)
TP
Mb1
a1
a1
Ma
a1
a1
Mb2
g(x)
Δ1
Δ1
Δ1
Δ1
x
TP
C
Mb2
Mb2
Ma
x
Mb1
Mb1

FIG. 2

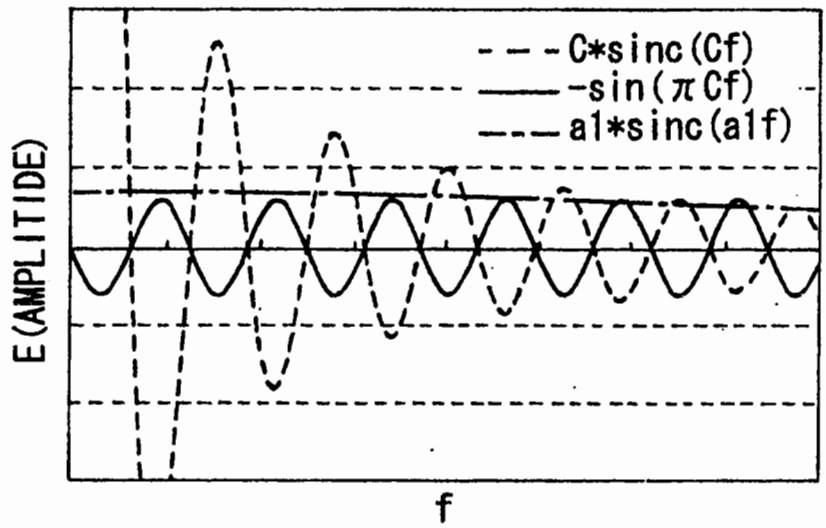

C*sinc(Cf)
-sin(πCf)
a1*sinc(a1f)
E(AMPLITIDE)
f

FIG. 3

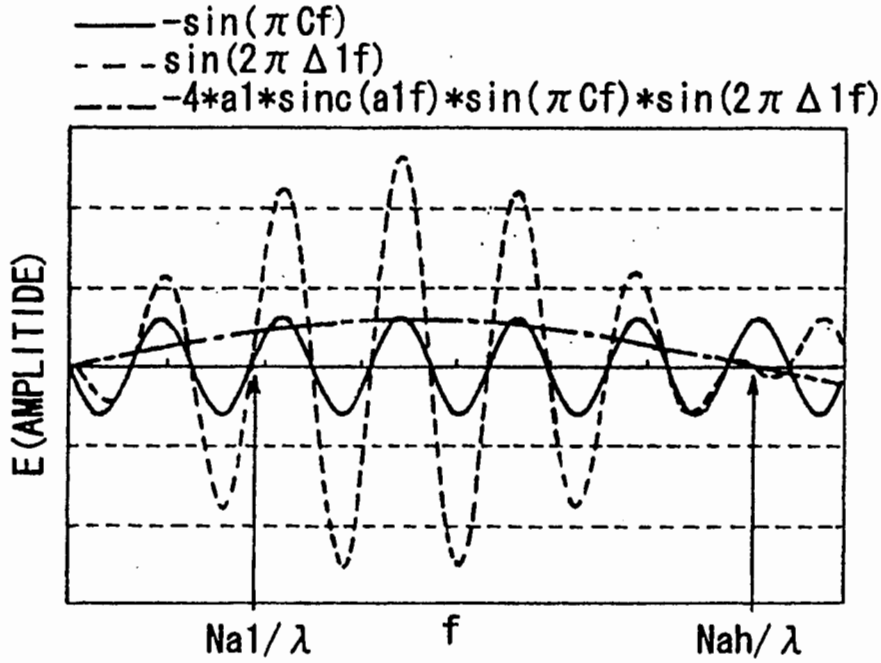

-sin(πCf)
sin(2π Δ1f)
-4*a1*sinc(a1f)*sin(πCf)*sin(2π Δ1f)
E(AMPLITIDE)
Na1/λ
f
Nah/λ

FIG. 4

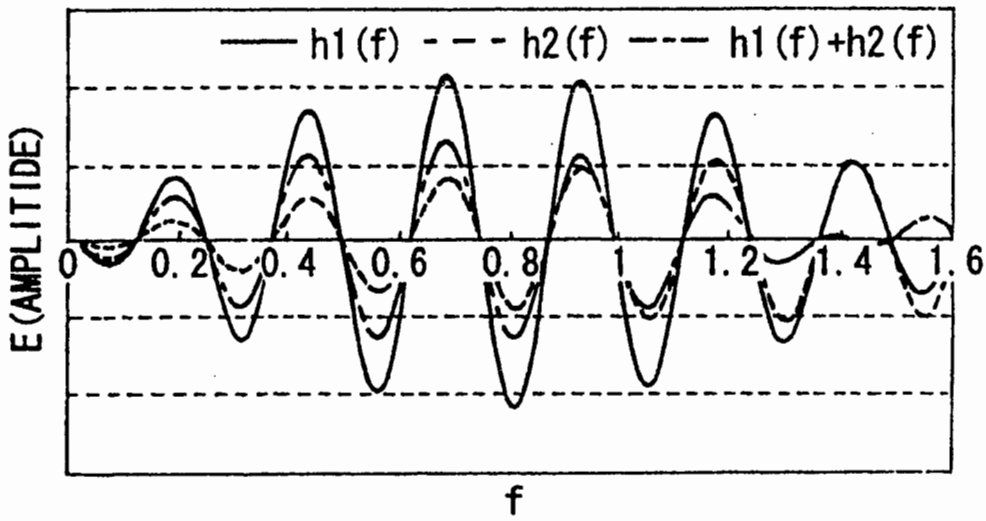

h1(f)
h2(f)
h1(f)+h2(f)
E(AMPLITIDE)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
f

FIG. 5

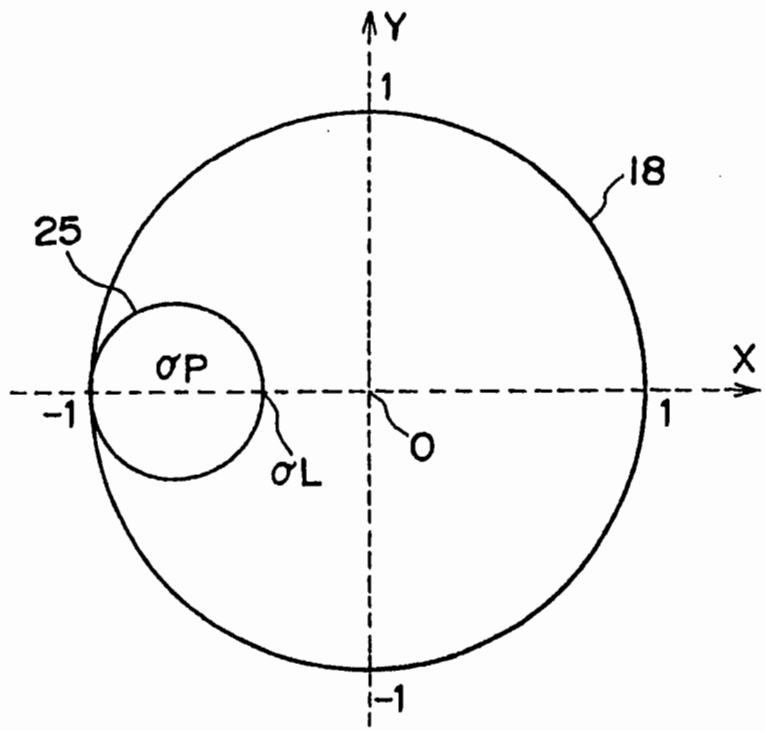

Y
1
18
25
σP
X
-1
1
σL
0
-1

FIG. 6

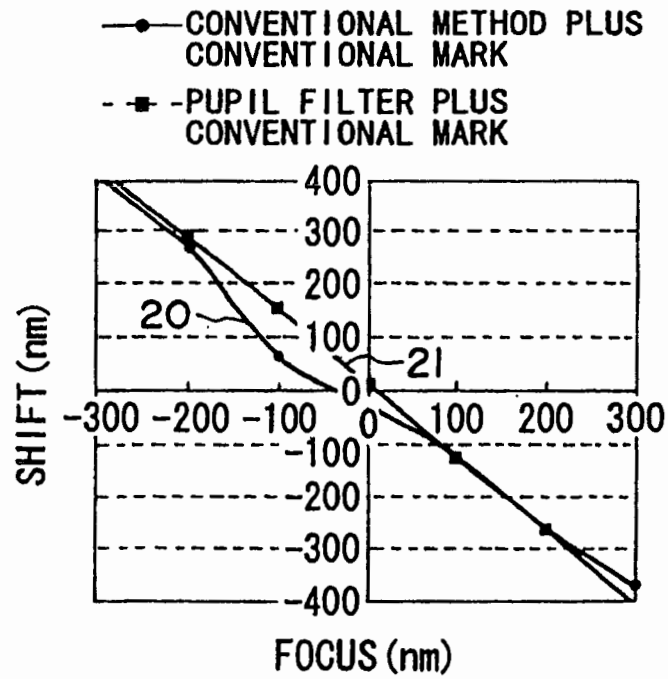

CONVENTIONAL METHOD PLUS CONVENTIONAL MARK
PUPIL FILTER PLUS CONVENTIONAL MARK
SHIFT (nm)
400
300
200
100
0
-100
-200
-300
-400
-300 -200 -100 0 100 200 300
20
21
FOCUS (nm)

FIG. 7

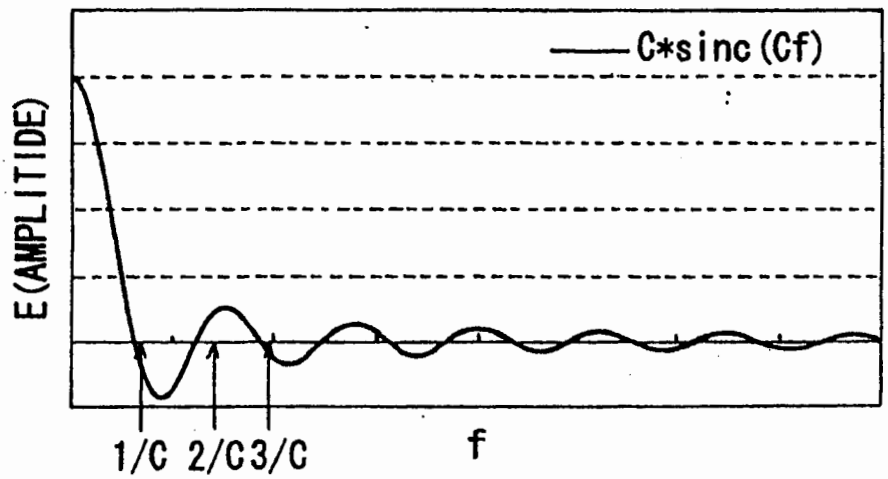

C*sinc (Cf)
E (AMPLITIDE)
1/C 2/C 3/C
f

FIG. 8

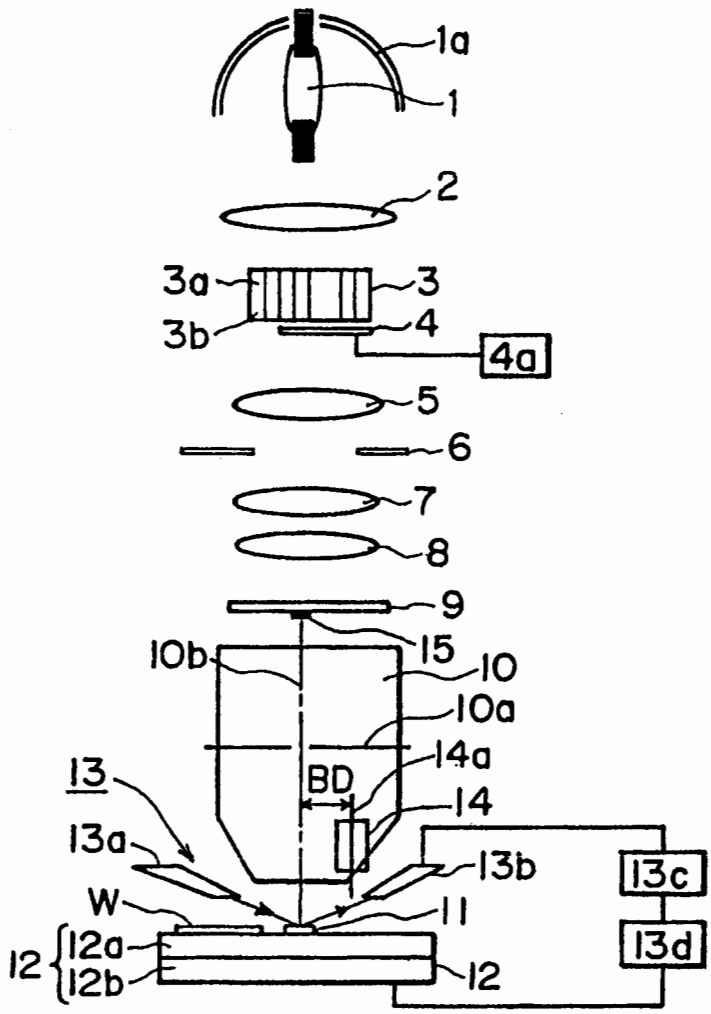


FIG. 9

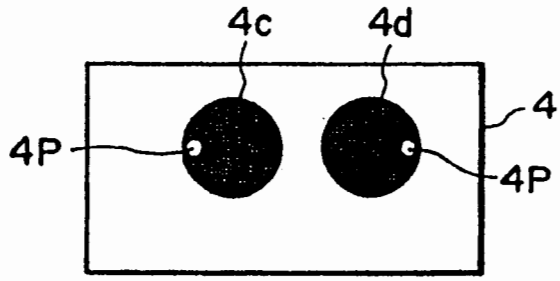


FIG. 10

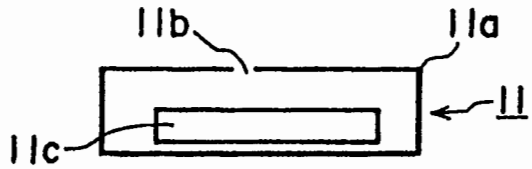


FIG. 11

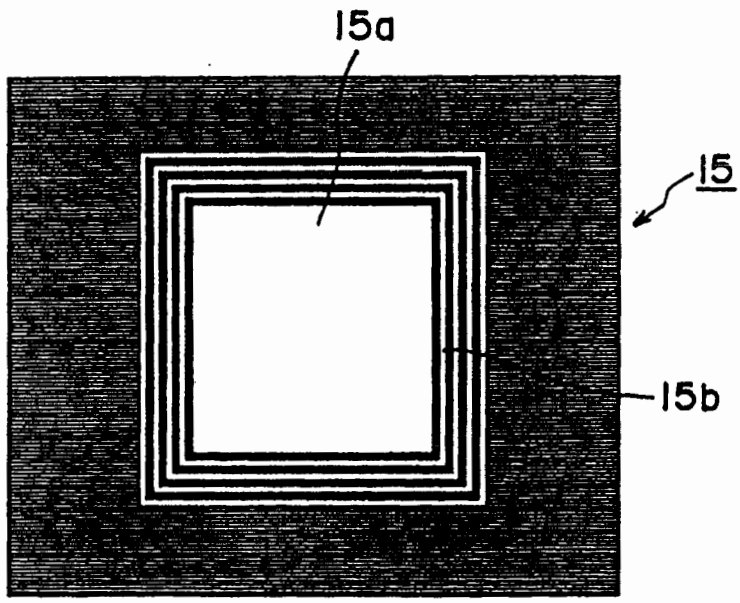


FIG. 12

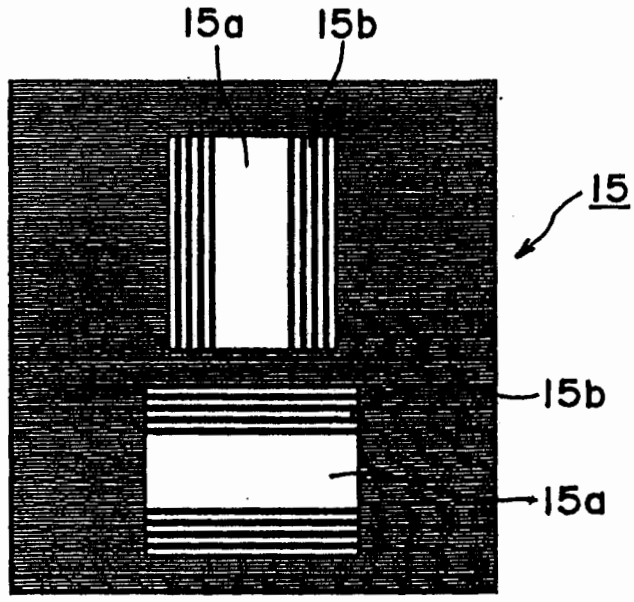


FIG. 13

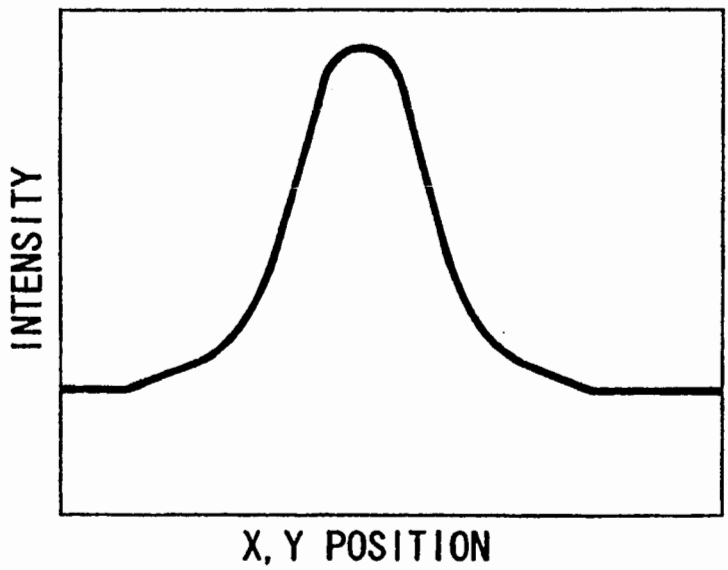


FIG. 14

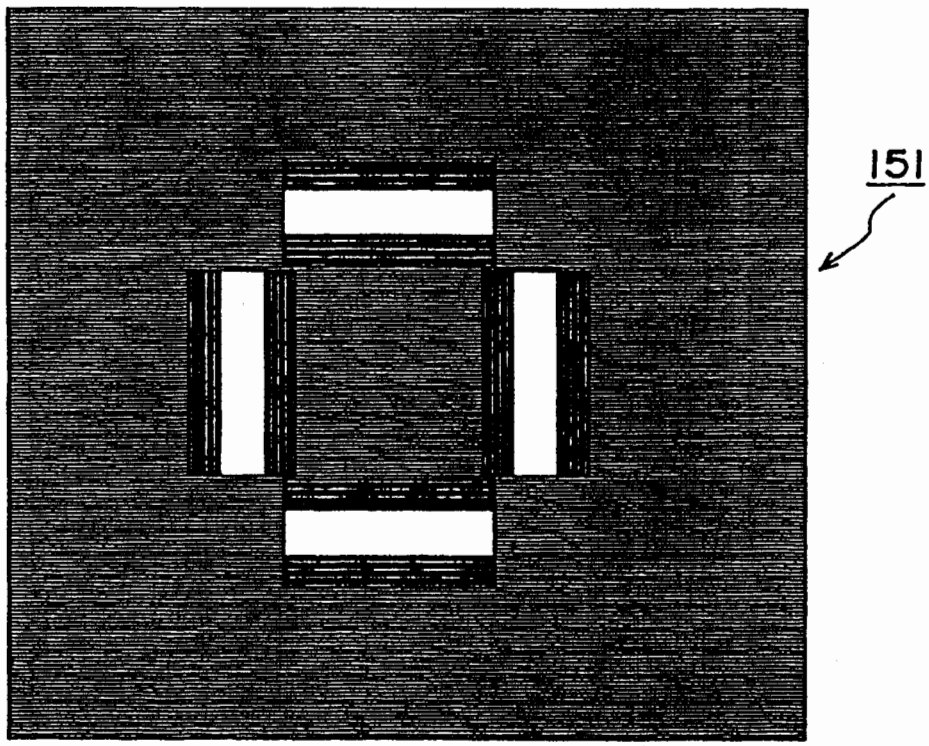


FIG. 15

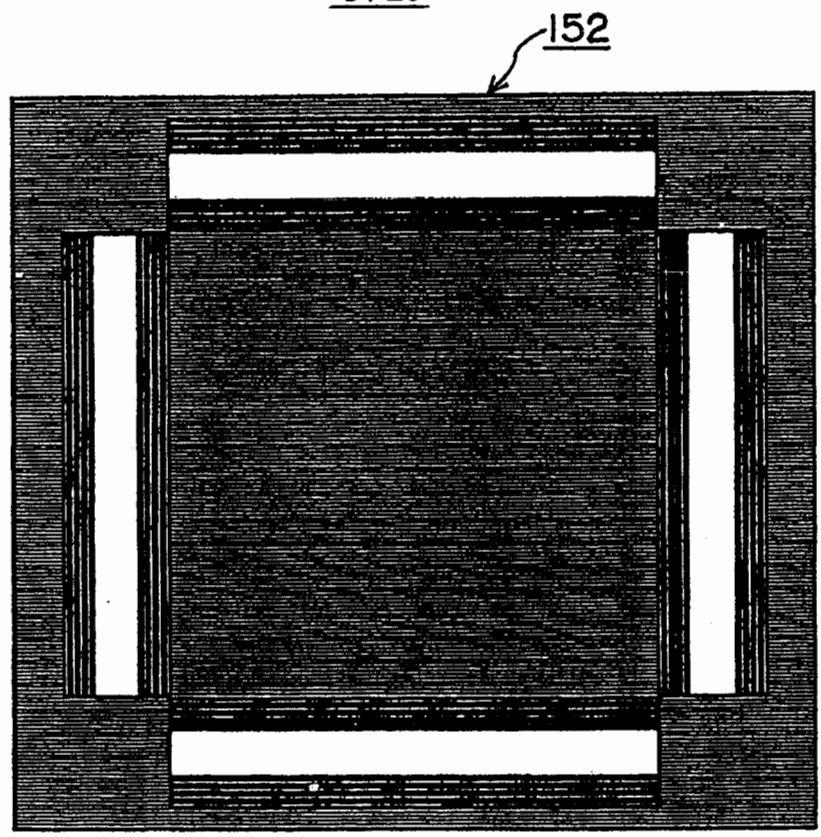


FIG. 16

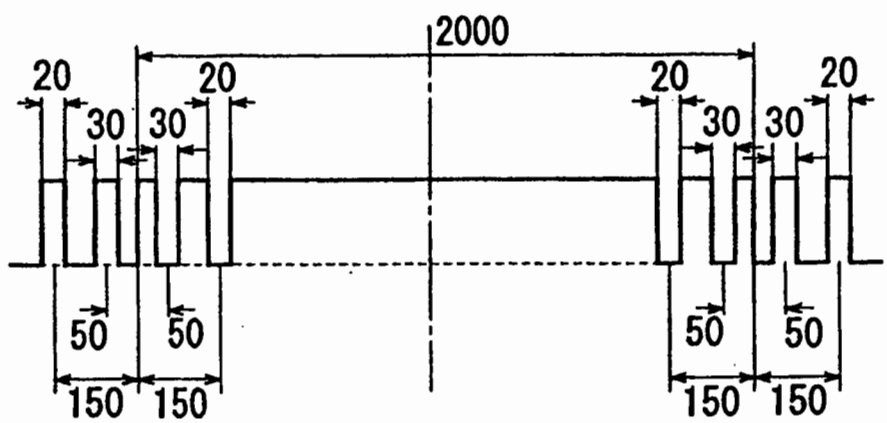


FIG. 17

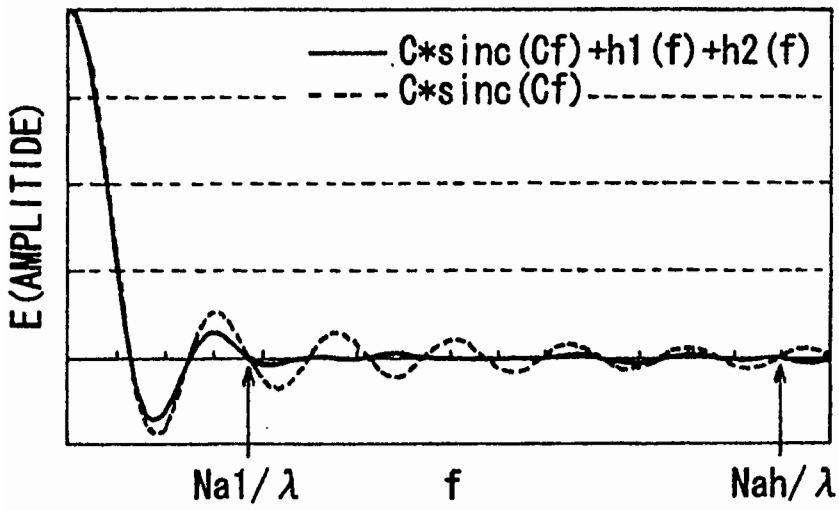

C*sinc(Cf)+h1(f)+h2(f)
C*sinc(Cf)
E(AMPLITIDE)
Na1/λ
f
Nah/λ

FIG. 18

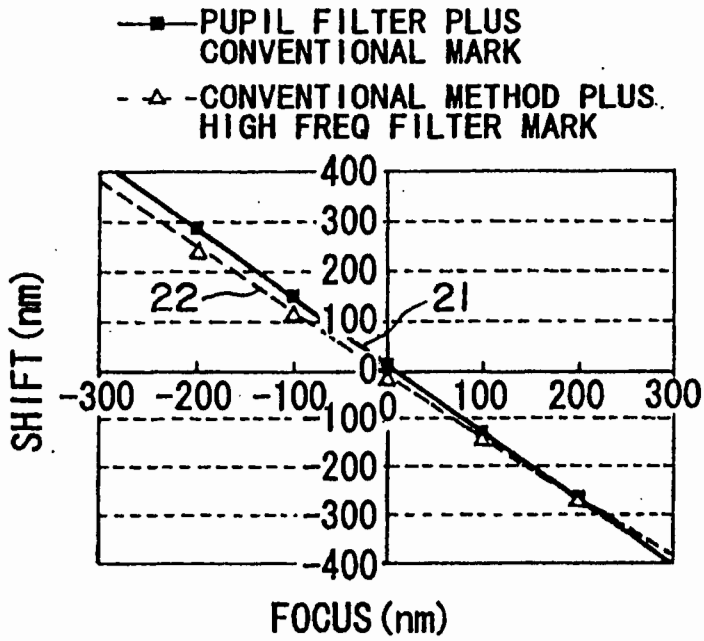

PUPIL FILTER PLUS CONVENTIONAL MARK
CONVENTIONAL METHOD PLUS HIGH FREQ FILTER MARK
400
300
200
100
0
-100
-200
-300
-400
-300 -200 -100 0 100 200 300
22
21
SHIFT (nm)
FOCUS (nm)

FIG. 19

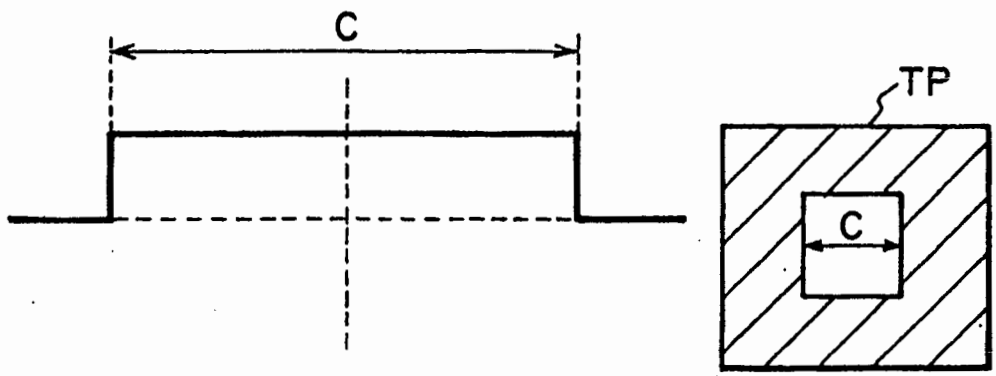


FIG. 20

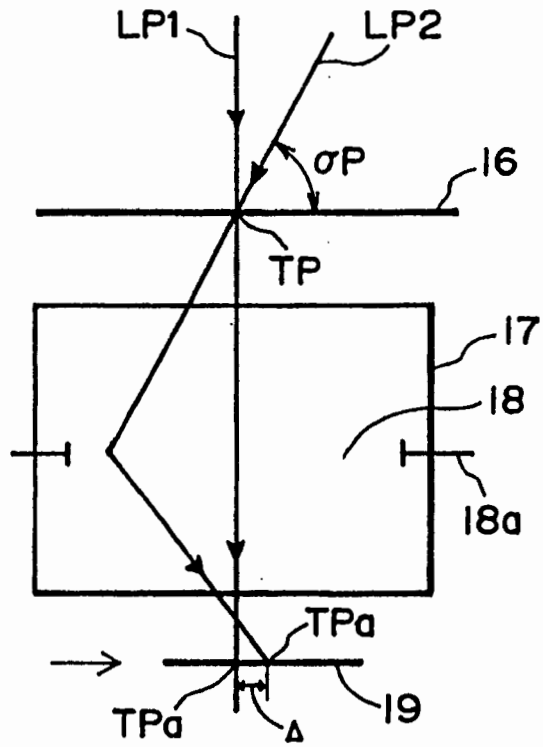


FIG. 21

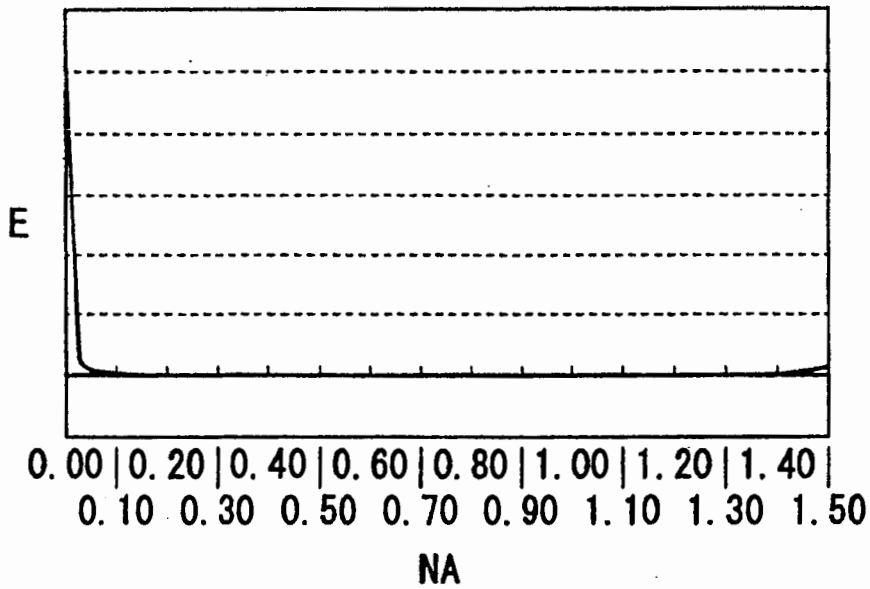

E
0.00 | 0.20 | 0.40 | 0.60 | 0.80 | 1.00 | 1.20 | 1.40 |
0.10 0.30 0.50 0.70 0.90 1.10 1.30 1.50
NA

FIG. 22

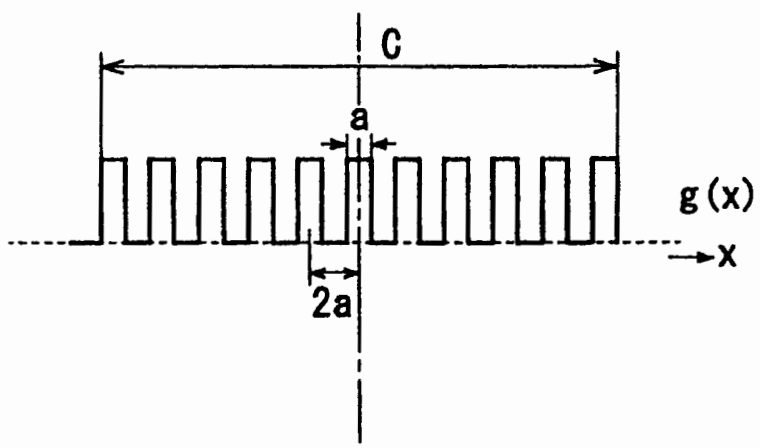

C
a
g(x)
x
2a

FIG. 23

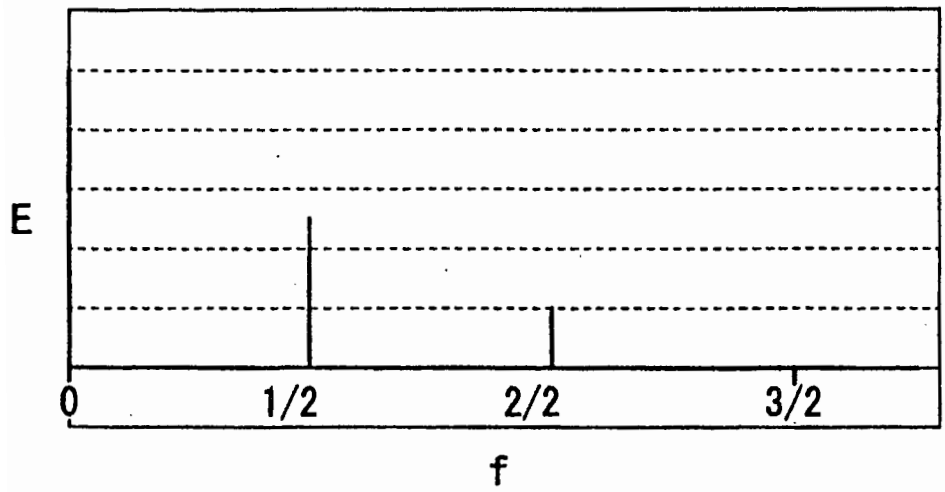


FIG. 24

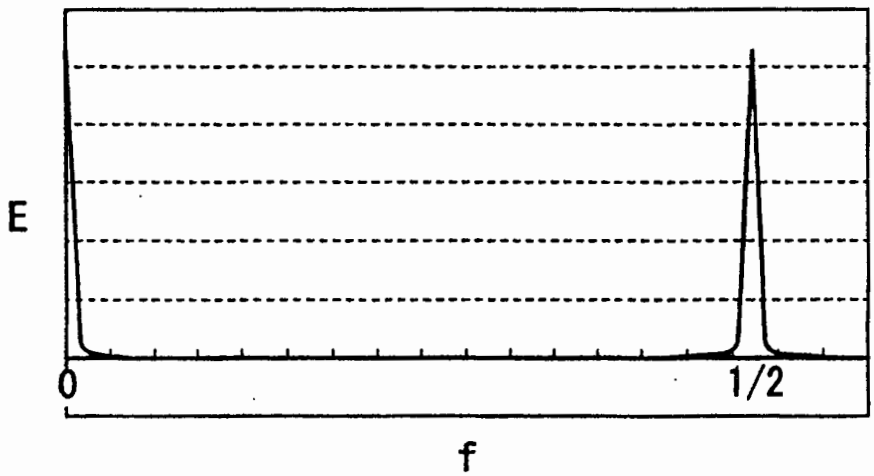


FIG. 25

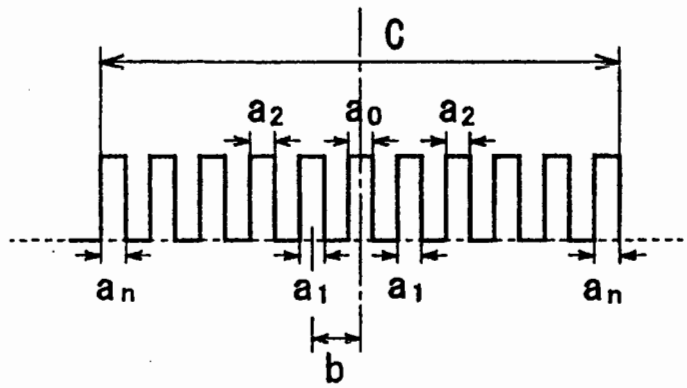


FIG. 26

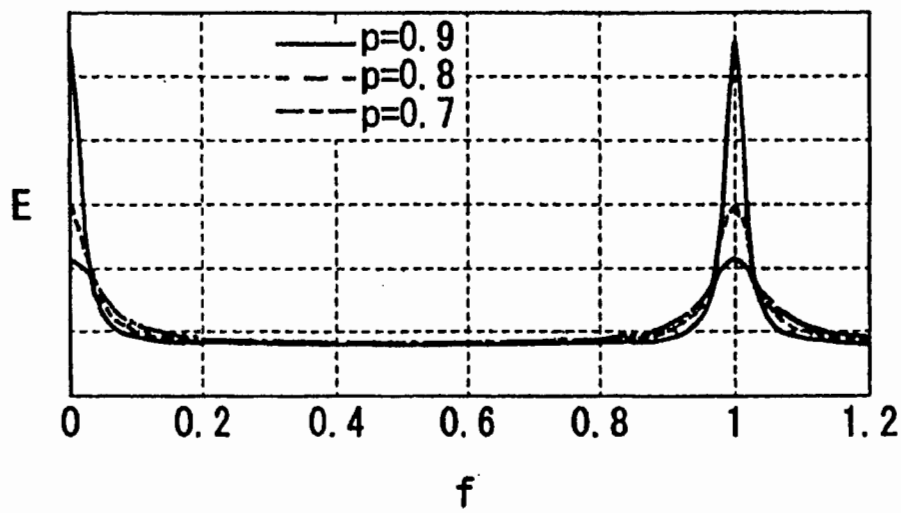


FIG. 27

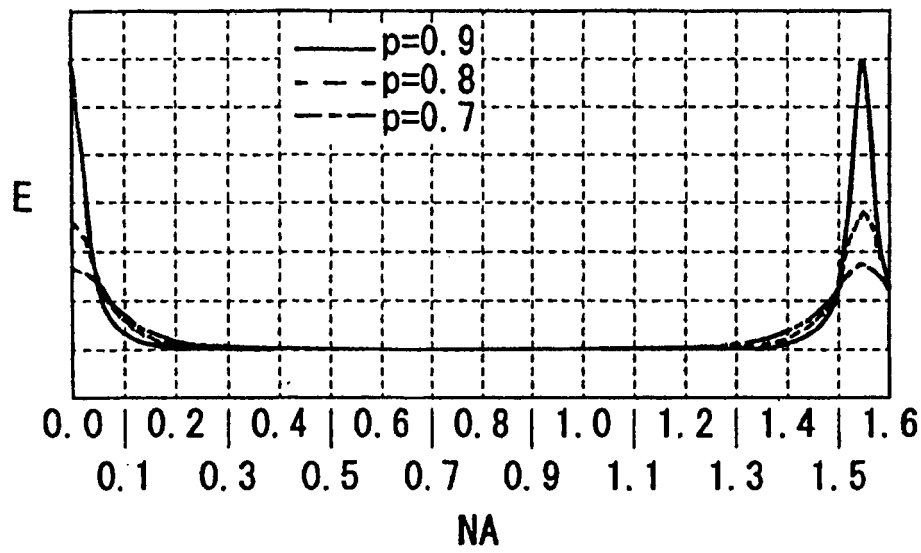

p=0.9
p=0.8
p=0.7
E
0.0 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6
0.1 0.3 0.5 0.7 0.9 1.1 1.3 1.5
NA

FIG. 28

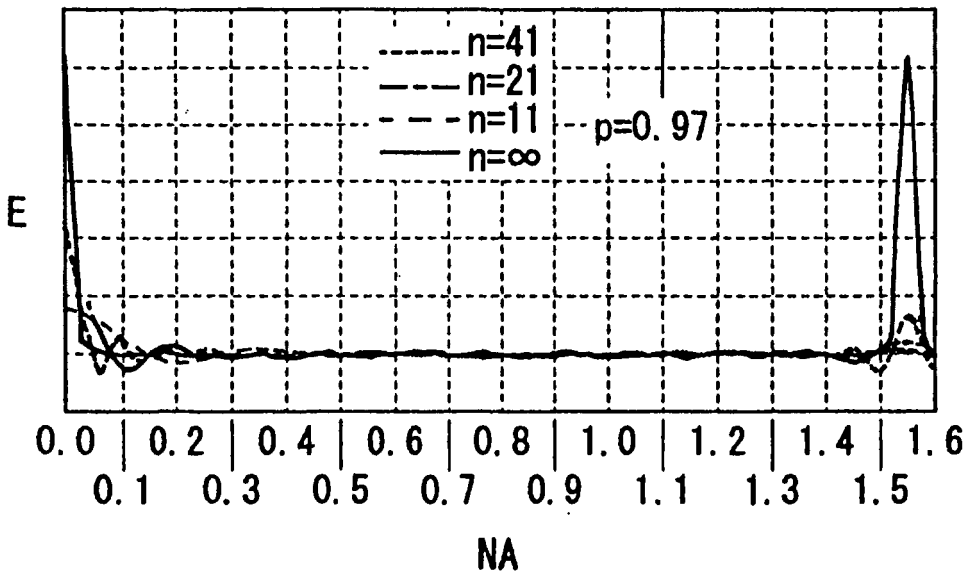

n=41
n=21
n=11
n=∞
p=0.97
E
0.0 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6
0.1 0.3 0.5 0.7 0.9 1.1 1.3 1.5
NA

FIG. 29

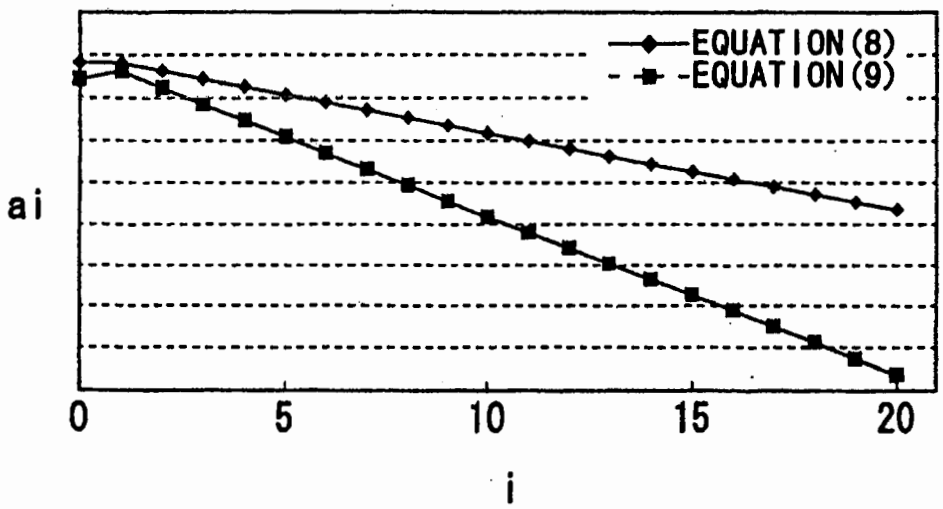

EQUATION(8)
EQUATION(9)
ai
0
5
10
15
20
i

FIG. 30

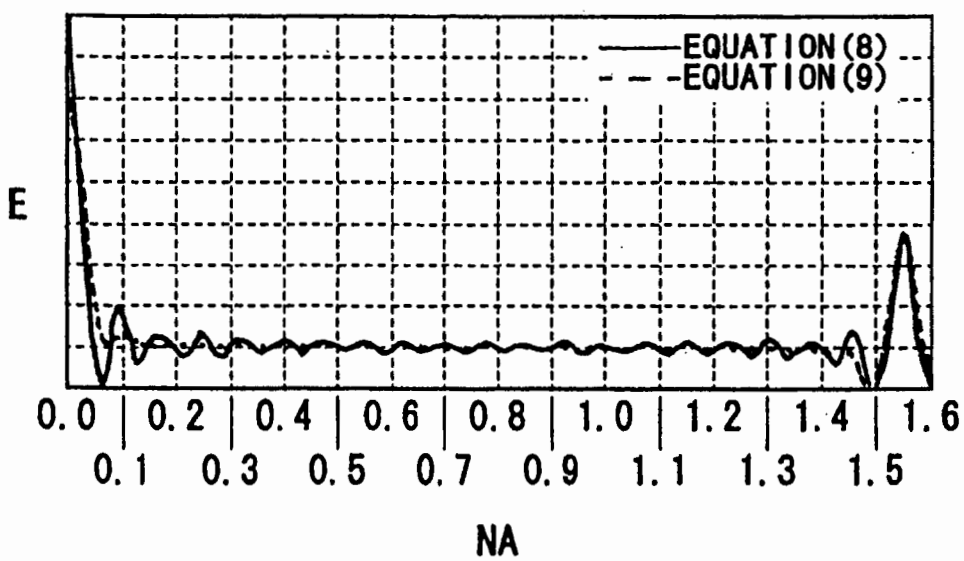

EQUATION(8)
EQUATION(9)
E
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
NA

FIG. 31

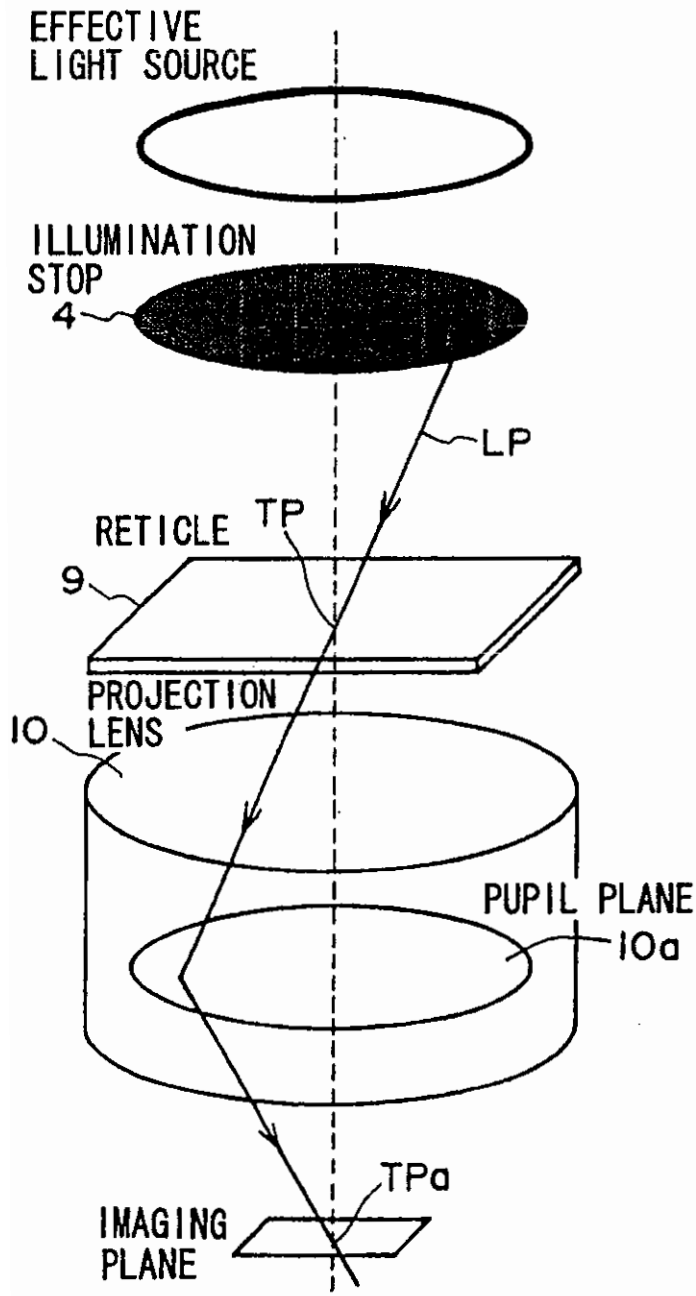

EFFECTIVE
LIGHT SOURCE
ILLUMINATION
STOP
4
LP
RETICLE
TP
9
PROJECTION
LENS
10
PUPIL PLANE
10a
TPa
IMAGING
PLANE

FIG. 32

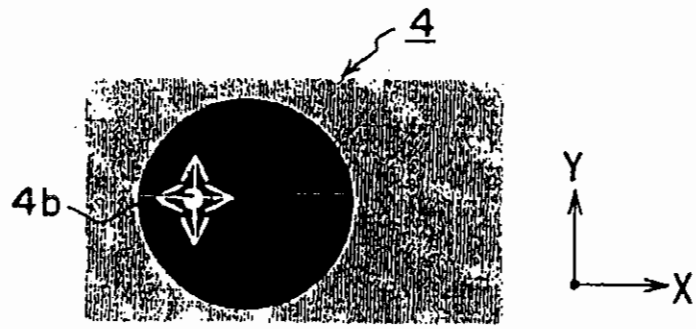


FIG. 33

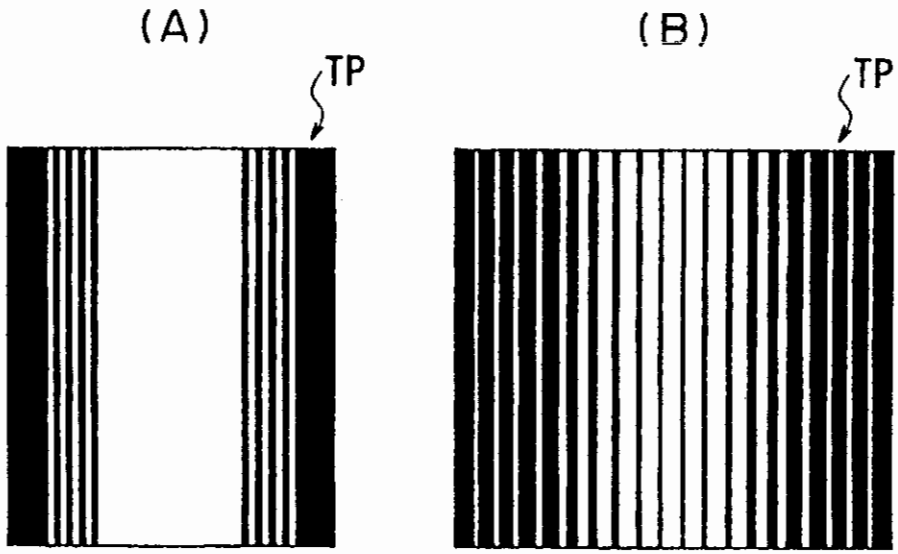


FIG. 34

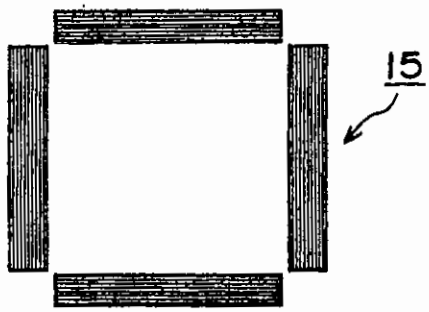


FIG. 35

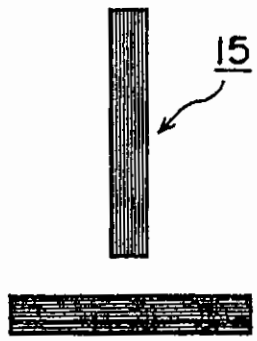


FIG. 36

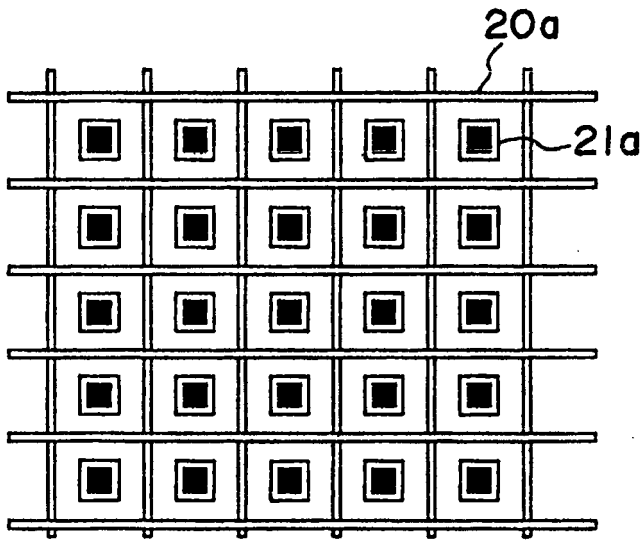


FIG. 37

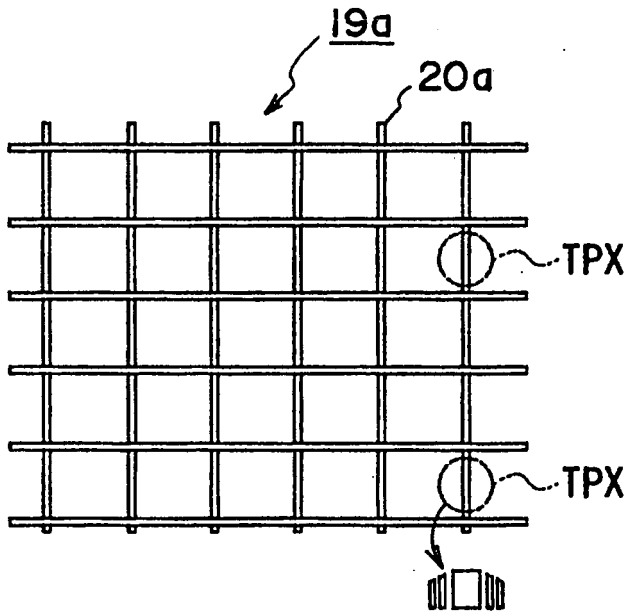


FIG. 38

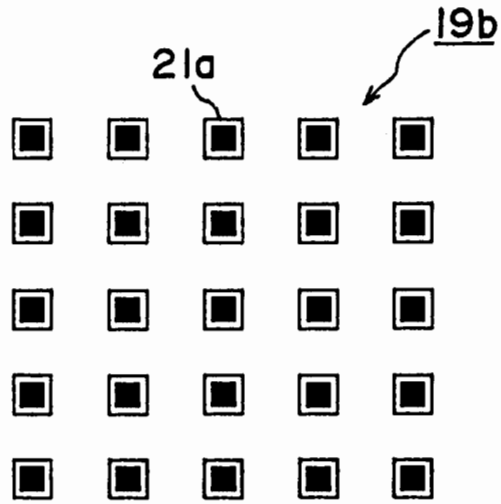


FIG. 39

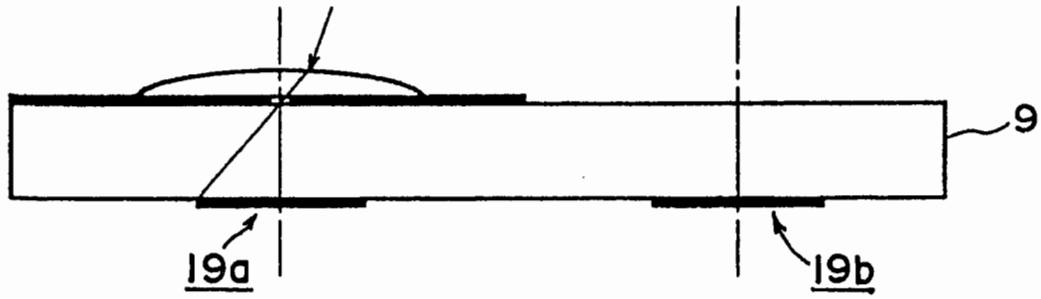


FIG. 40