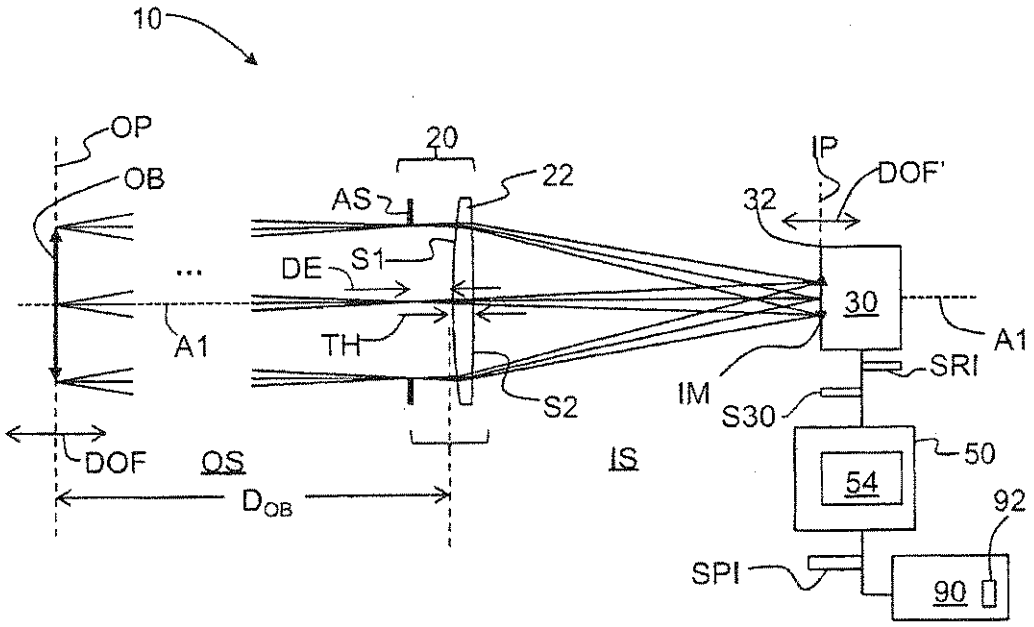

10
OP
OB
20
AS
22
IP
DOF'
32
DE
S1
30
A1
TH
A1
SRI
IM
S2
S30
DOF
OS
IS
50
54
92
SPI
90
D_{OB}

FIG. 1

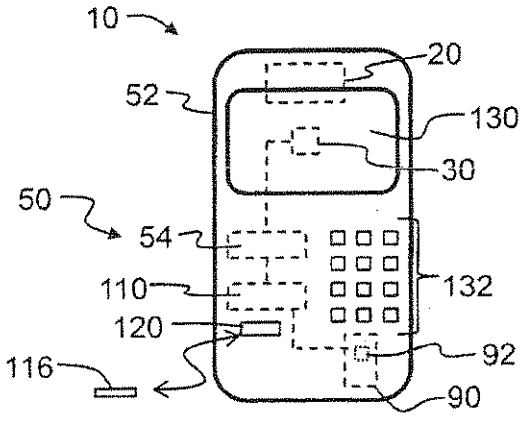

10
20
52
130
30
50
54
110
132
120
92
116
90

FIG. 2

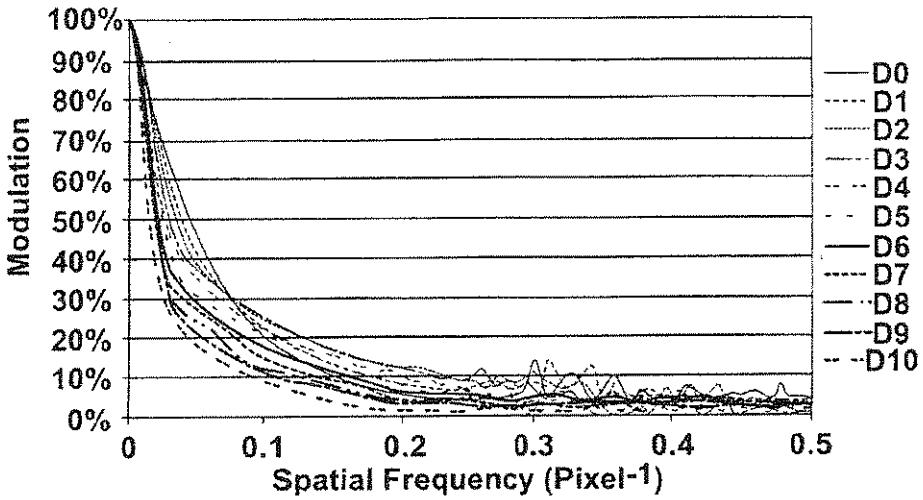

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Modulation
0
0.1
0.2
0.3
0.4
0.5
Spatial Frequency (Pixel-1)
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10

FIG. 3

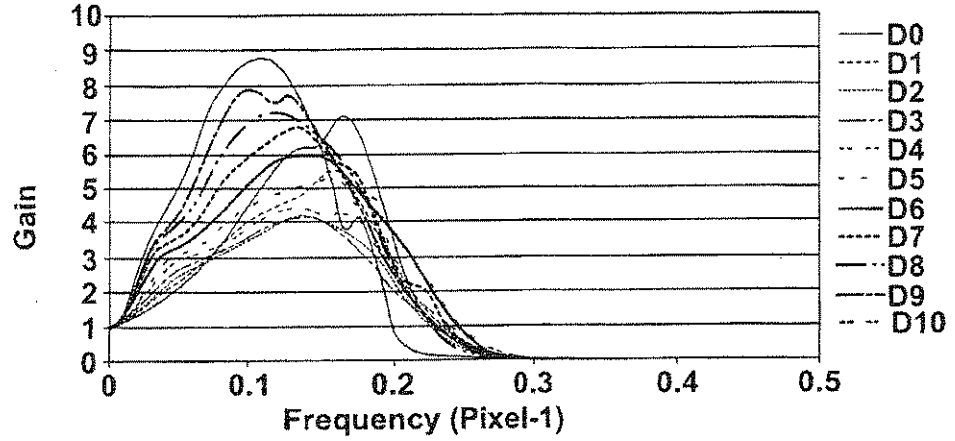

Gain
10
9
8
7
6
5
4
3
2
1
0
0
0.1
0.2
0.3
0.4
0.5
Frequency (Pixel-1)
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10

FIG. 4A

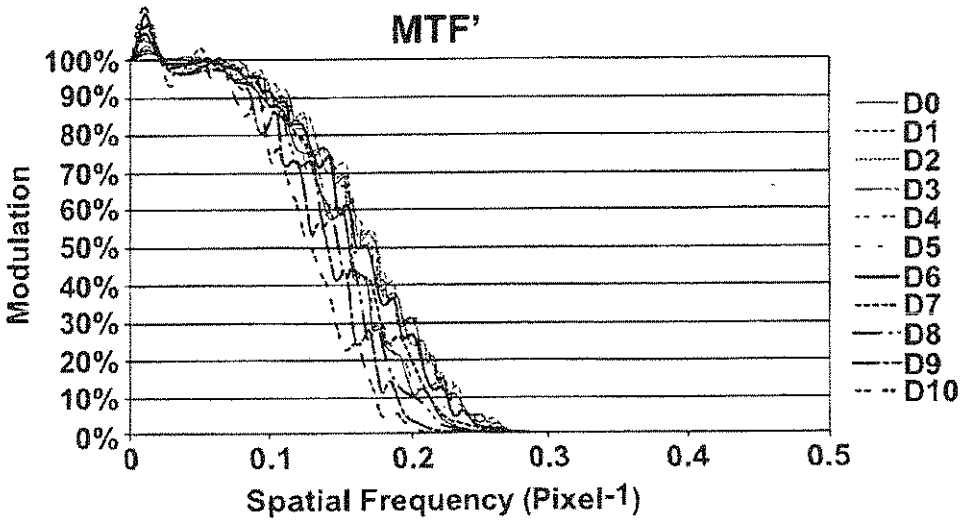

MTF'
Modulation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
Spatial Frequency (Pixel-1)
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10

FIG. 5A

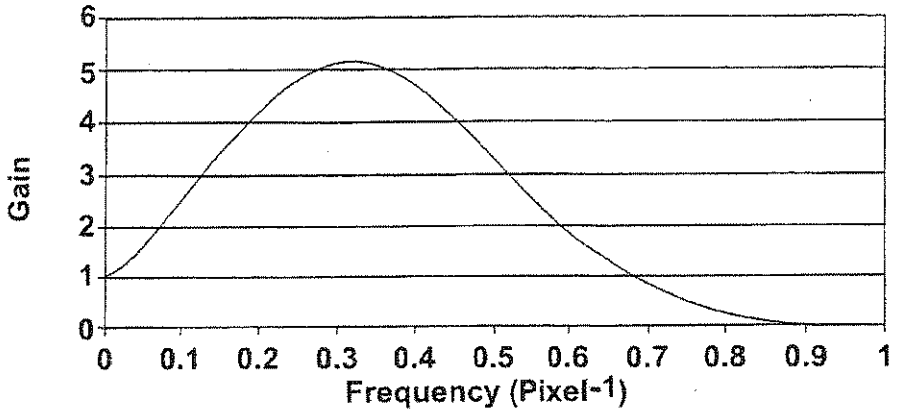

Gain
6
5
4
3
2
1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Frequency (Pixel-1)

FIG. 4B

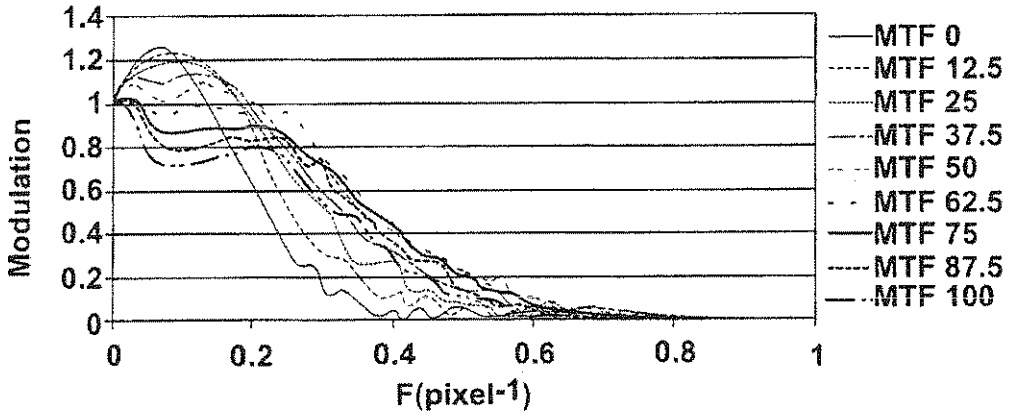

Modulation
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
F(pixel-1)
MTF 0
MTF 12.5
MTF 25
MTF 37.5
MTF 50
MTF 62.5
MTF 75
MTF 87.5
MTF 100

FIG. 5B

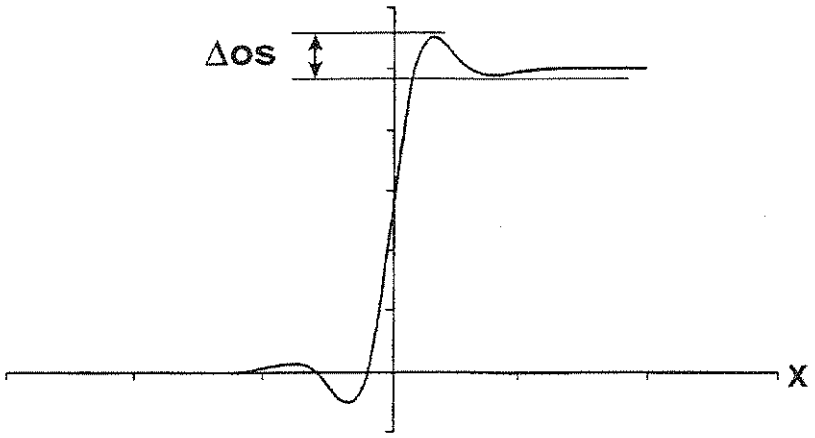

Δos
X

FIG. 6

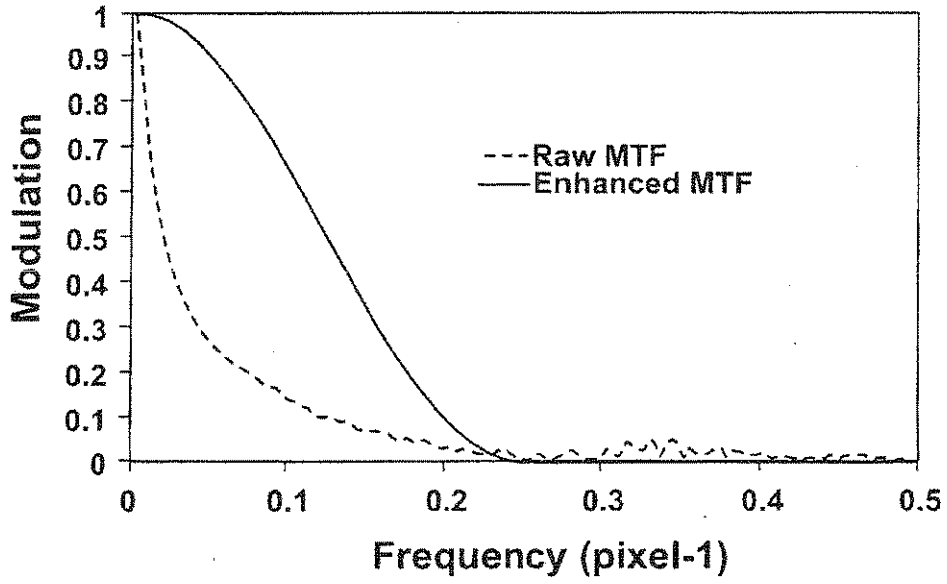

Modulation
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
Frequency (pixel-1)
---Raw MTF
——Enhanced MTF

FIG. 7

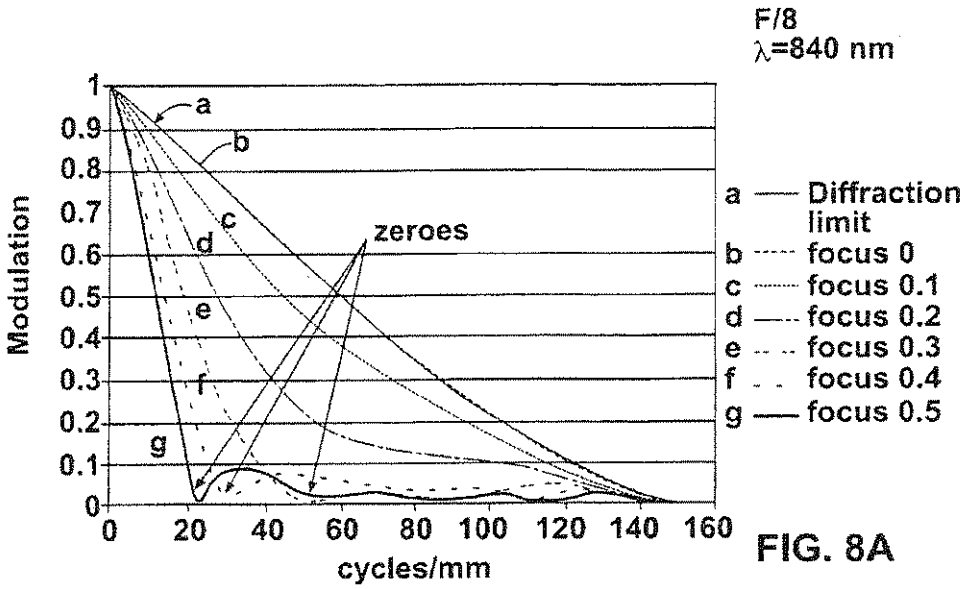

F/8
λ=840 nm
Modulation
cycles/mm
zeroes
a — Diffraction limit
b ---- focus 0
c ..... focus 0.1
d —.— focus 0.2
e - - - focus 0.3
f . . . focus 0.4
g —— focus 0.5

FIG. 8A

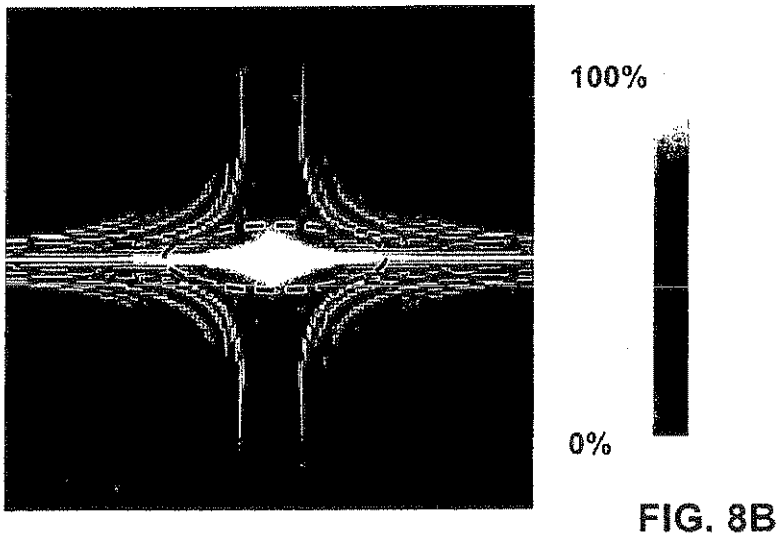

100%
0%

FIG. 8B

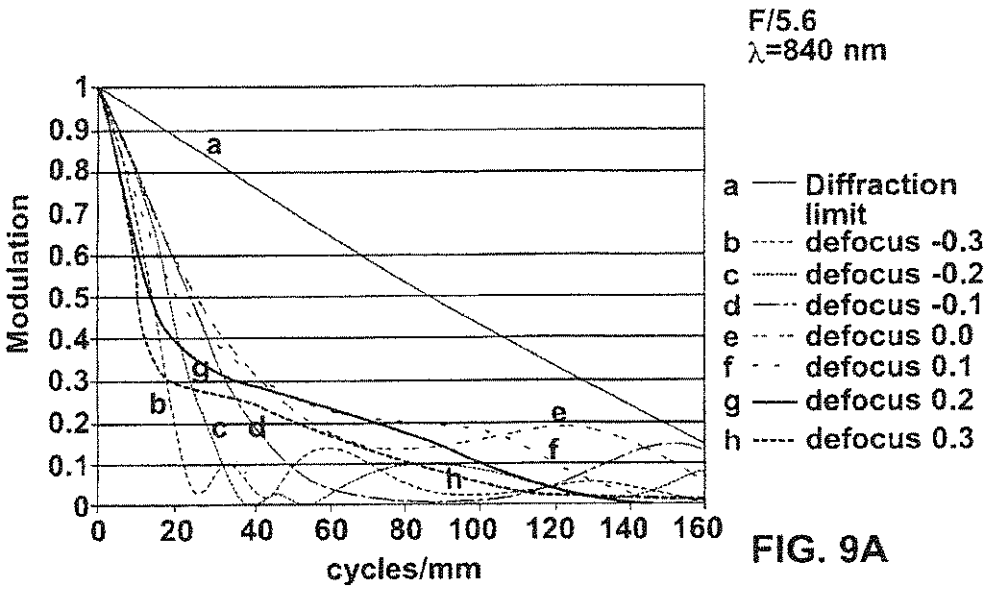

F/5.6
λ=840 nm
Modulation
cycles/mm
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
20
40
60
80
100
120
140
160
a
b
c
d
e
f
g
h
a —— Diffraction limit
b ----- defocus -0.3
c ..... defocus -0.2
d —·— defocus -0.1
e - - - defocus 0.0
f · · · defocus 0.1
g —— defocus 0.2
h ----- defocus 0.3

FIG. 9A

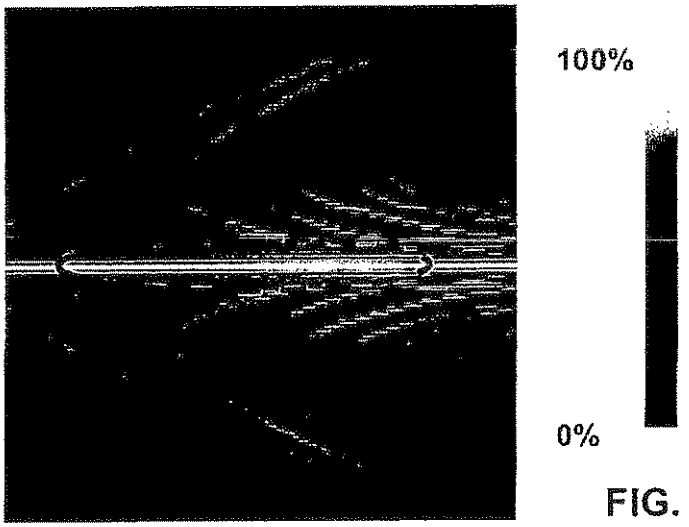

100%
0%

FIG. 9B

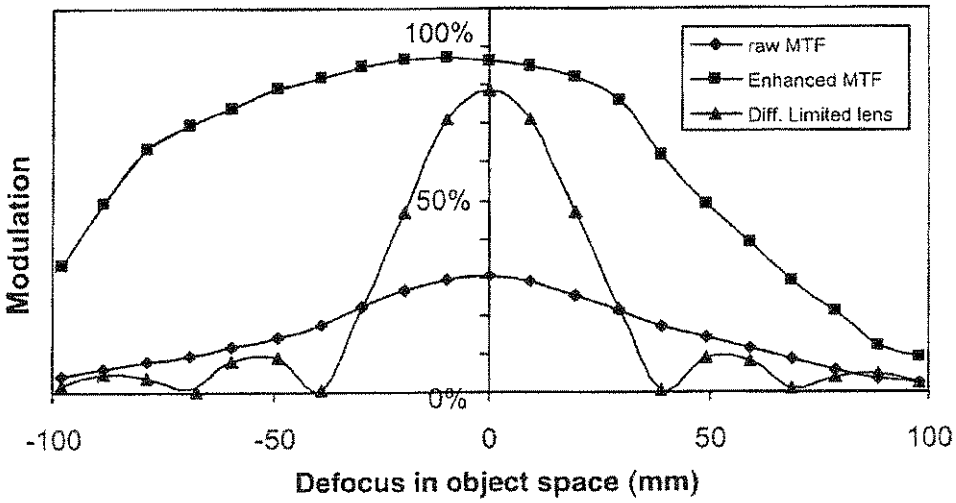

100%
50%
0%
Modulation
raw MTF
Enhanced MTF
Diff. Limited lens
-100
-50
0
50
100
Defocus in object space (mm)

FIG. 9C

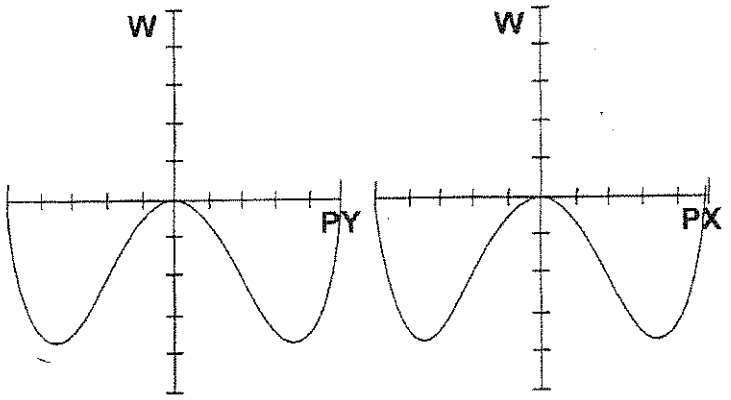


FIG. 10A

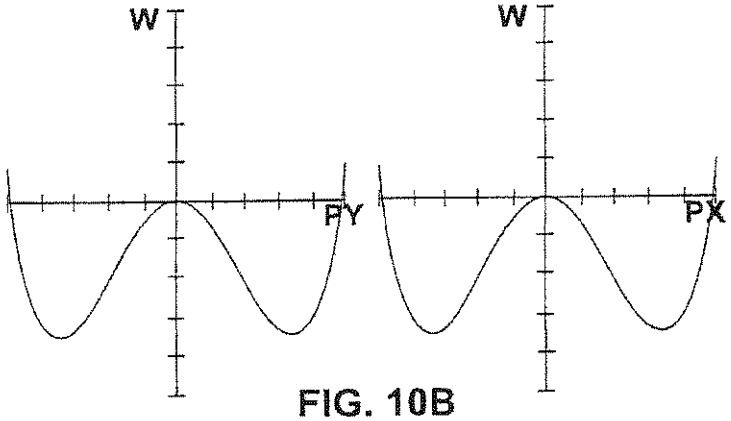


FIG. 10B

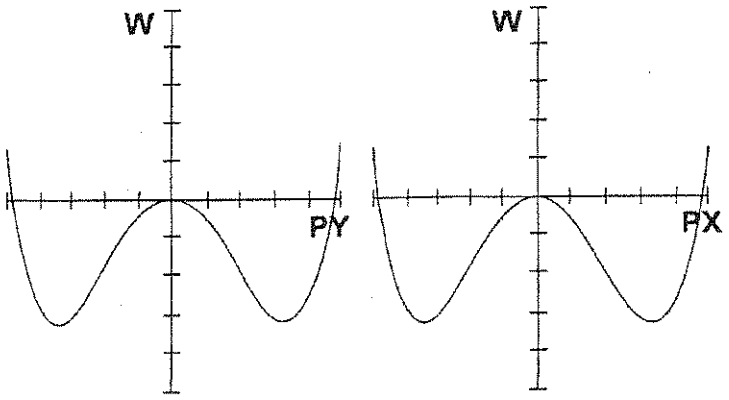


FIG. 10C

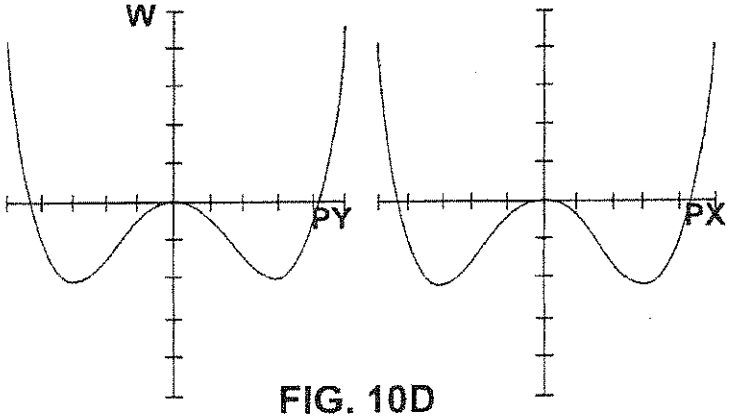


FIG. 10D

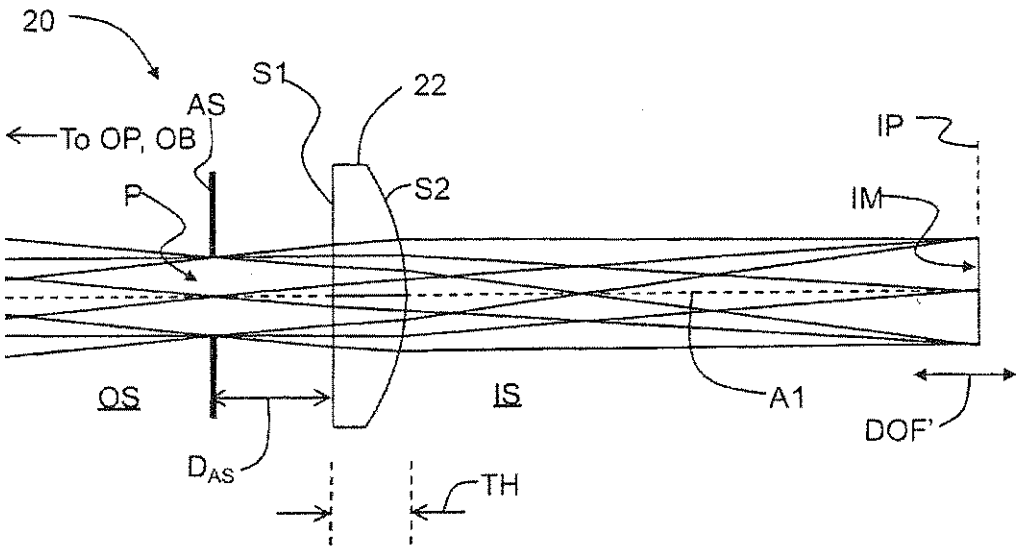

20
S1
22
AS
To OP, OB
IP
S2
P
IM
OS
IS
A1
DOF'
D_{AS}
TH

FIG. 11

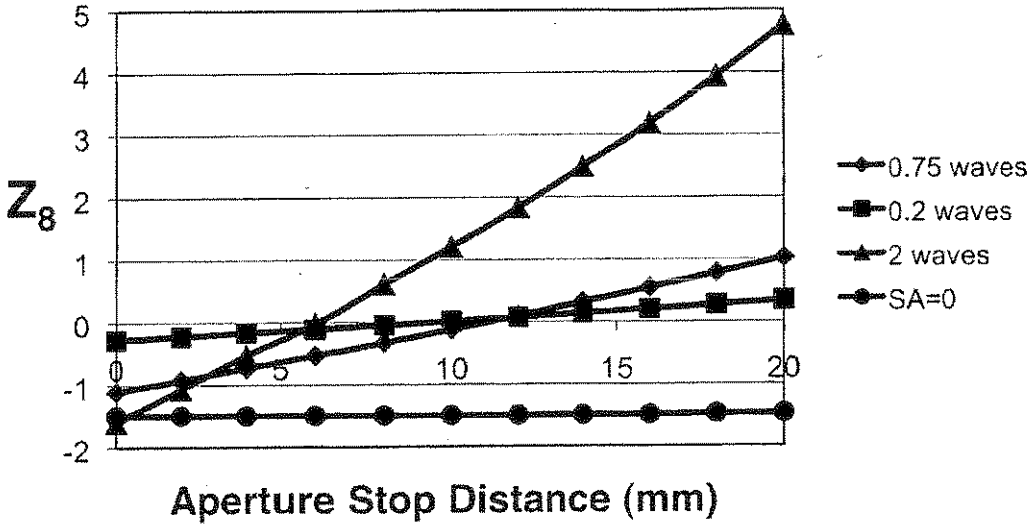

5
4
3
2
1
0
-1
-2
Z_8
0
5
10
15
20
0.75 waves
0.2 waves
2 waves
SA=0
Aperture Stop Distance (mm)

FIG. 12

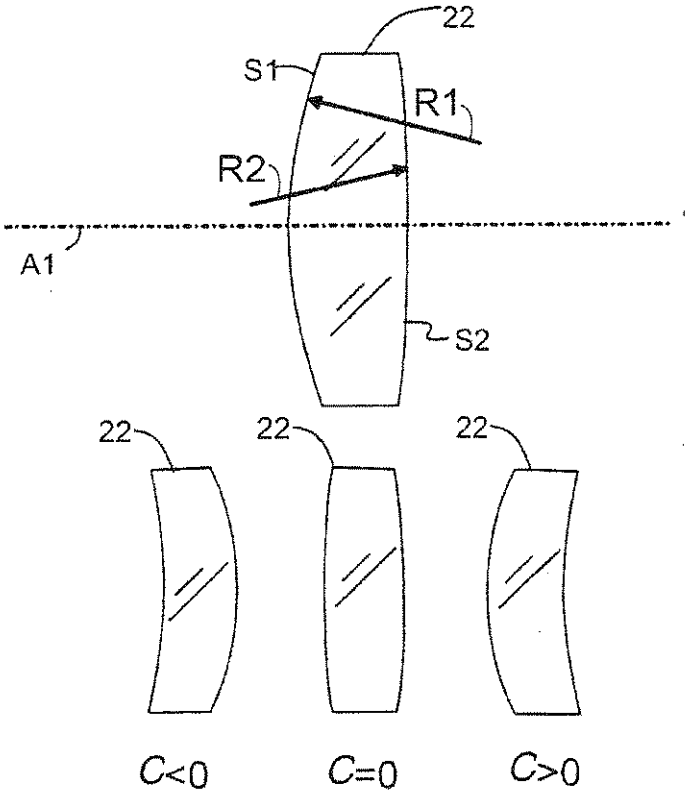


FIG. 13

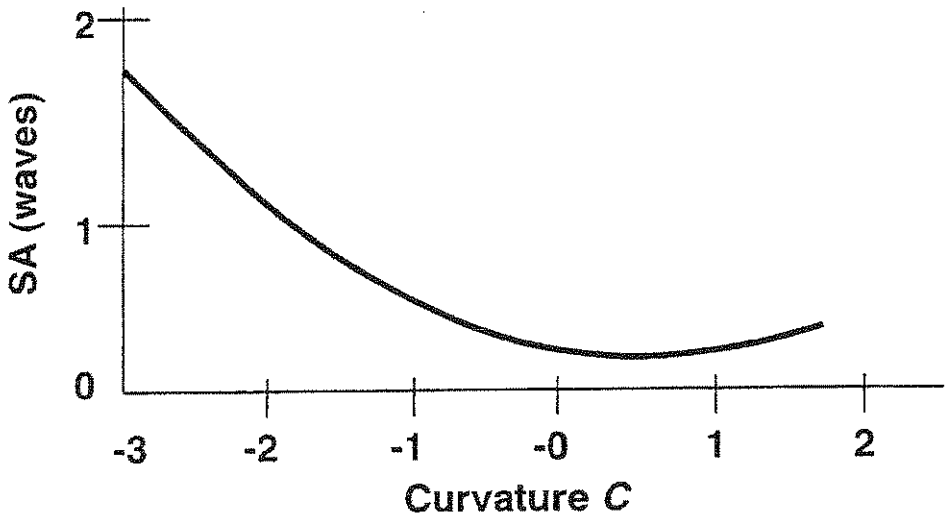


FIG. 14

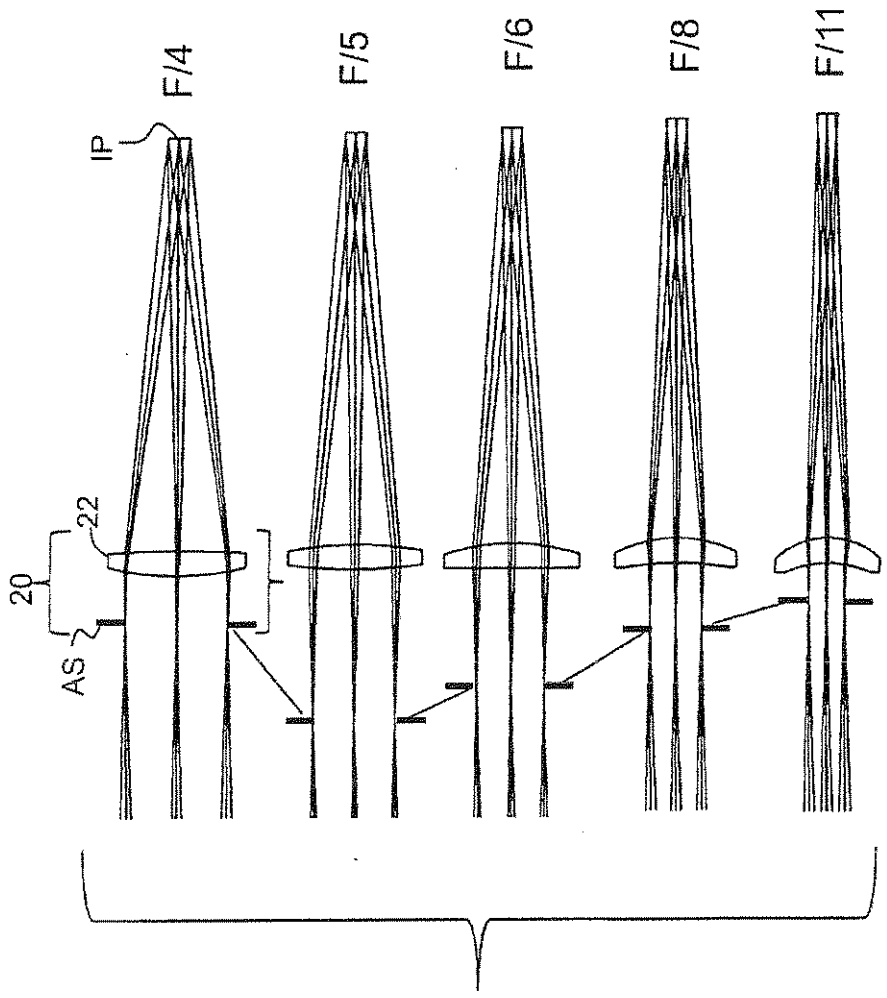


FIG. 15

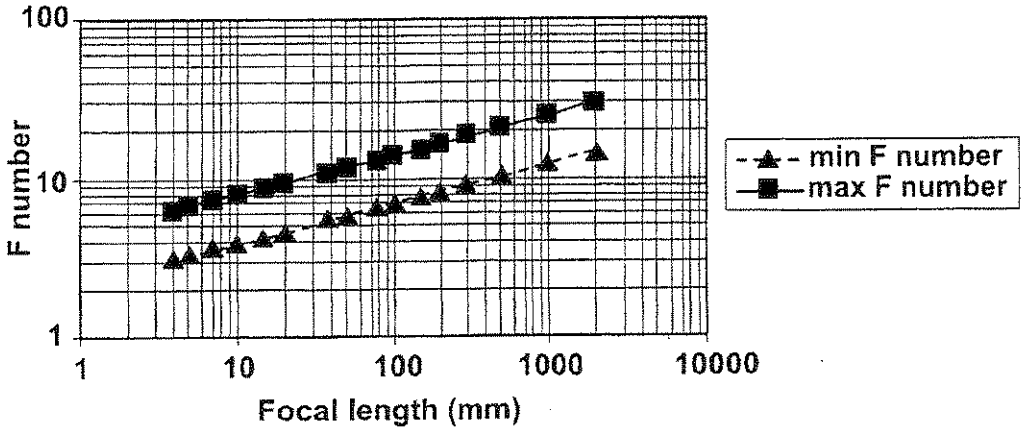

100
10
1
F number
1
10
100
1000
10000
Focal length (mm)
min F number
max F number

FIG. 16

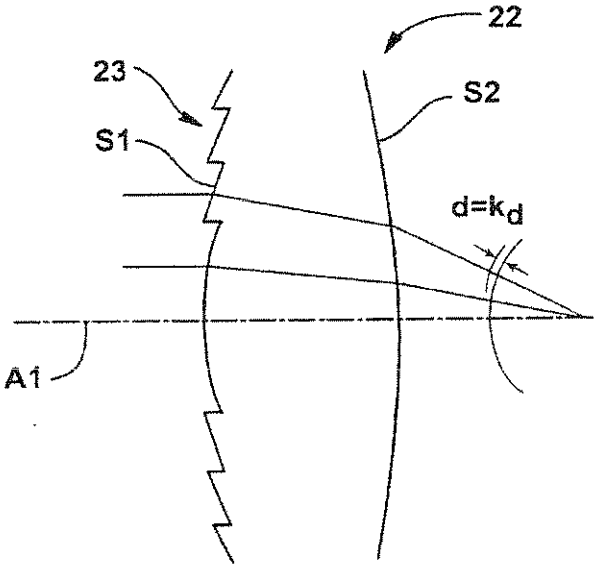

22
23
S1
S2
d=k_d
A1

FIG. 17

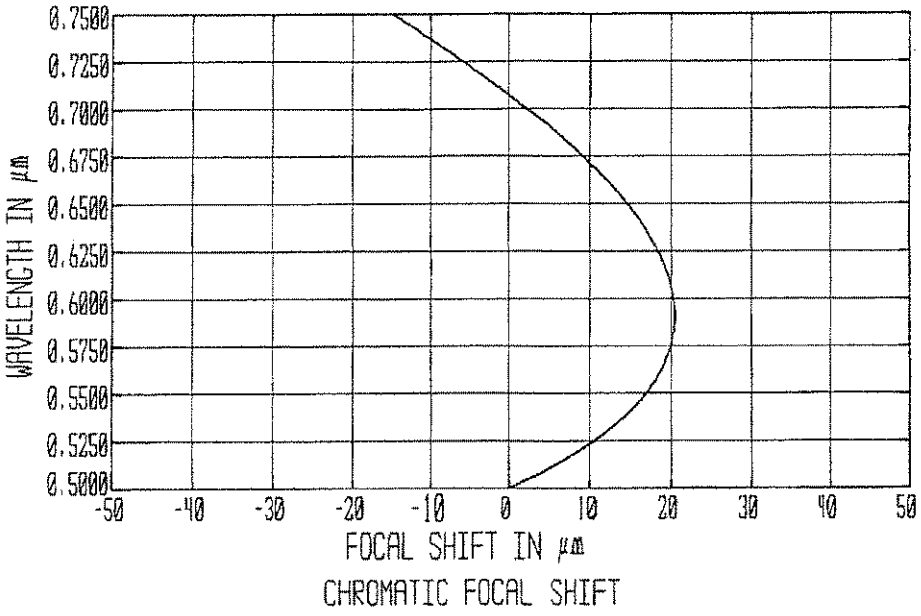

0.7500
0.7250
0.7000
0.6750
0.6500
0.6250
0.6000
0.5750
0.5500
0.5250
0.5000
WAVELENGTH IN μm
-50
-40
-30
-20
-10
0
10
20
30
40
50
FOCAL SHIFT IN μm
CHROMATIC FOCAL SHIFT

FIG. 18

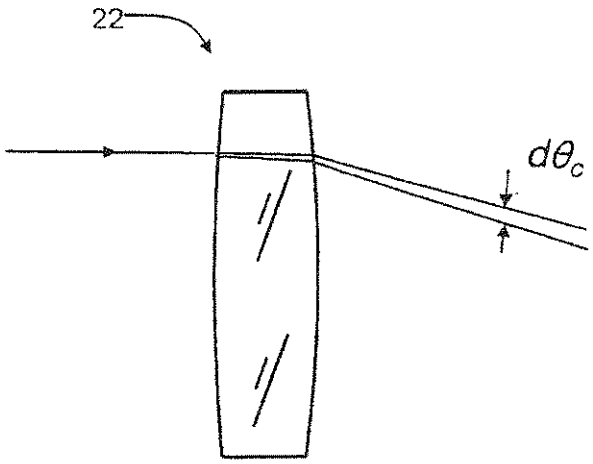


FIG. 19A

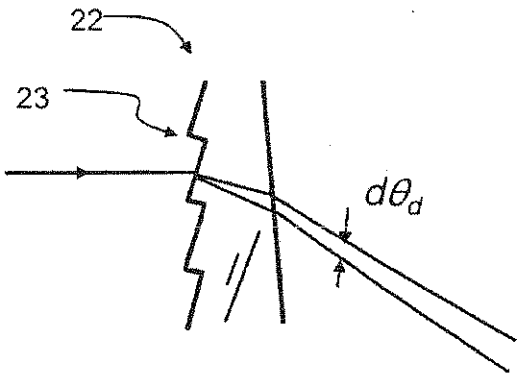


FIG. 19B

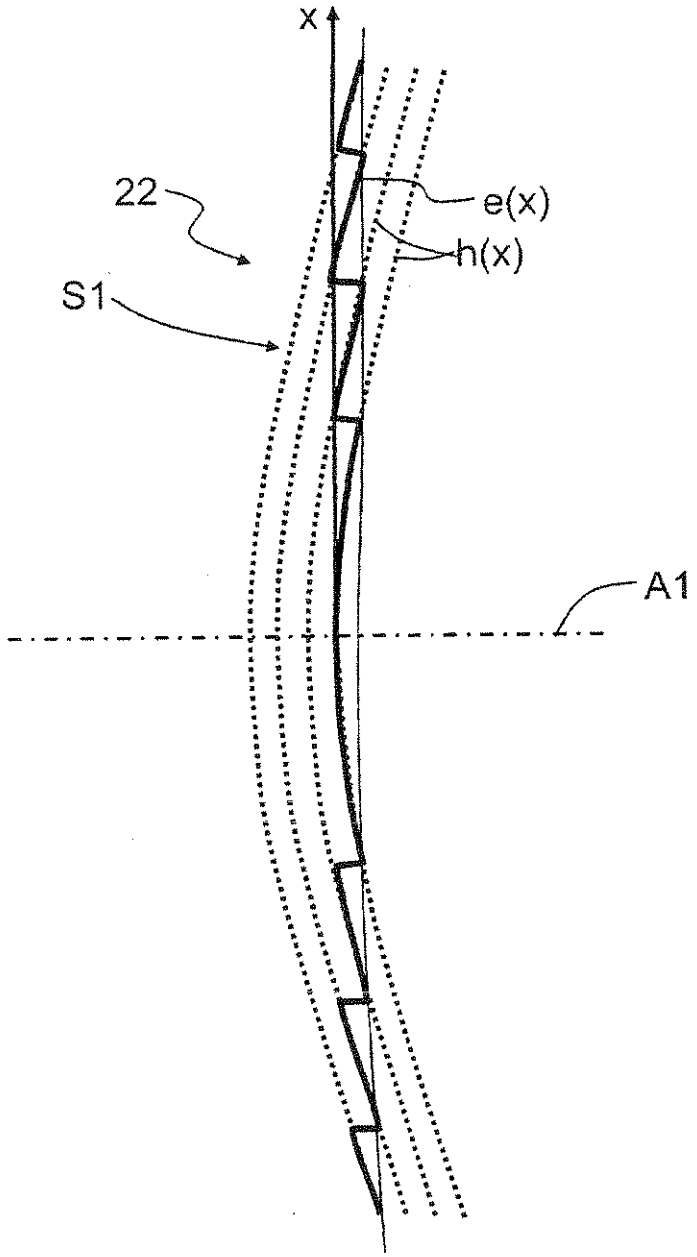


FIG. 20

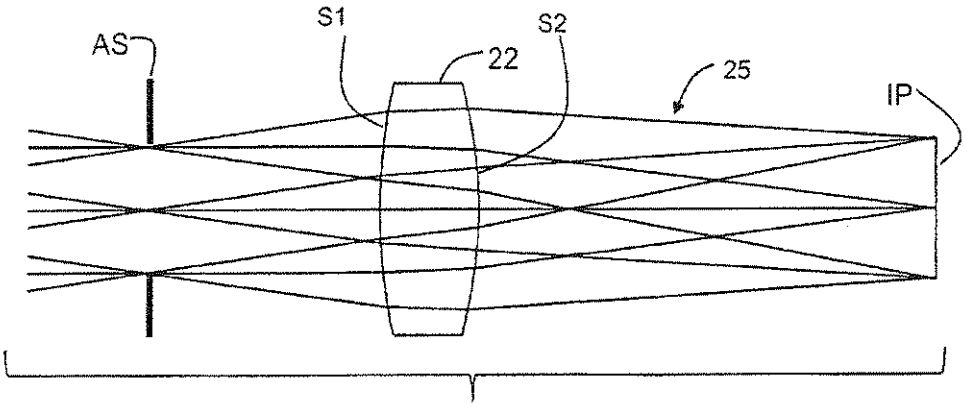


FIG. 21A

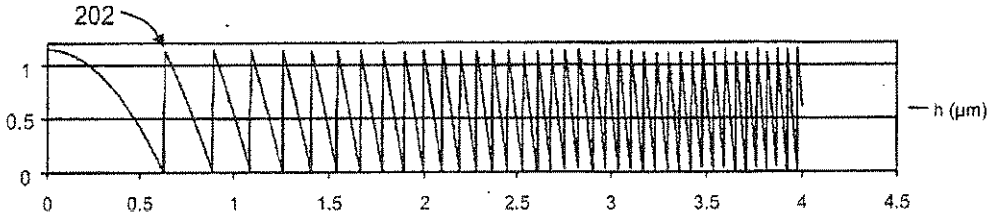


FIG. 21B

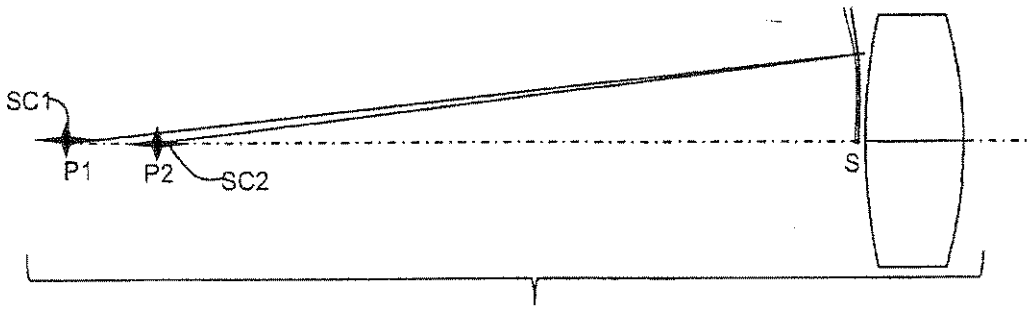


FIG. 21C

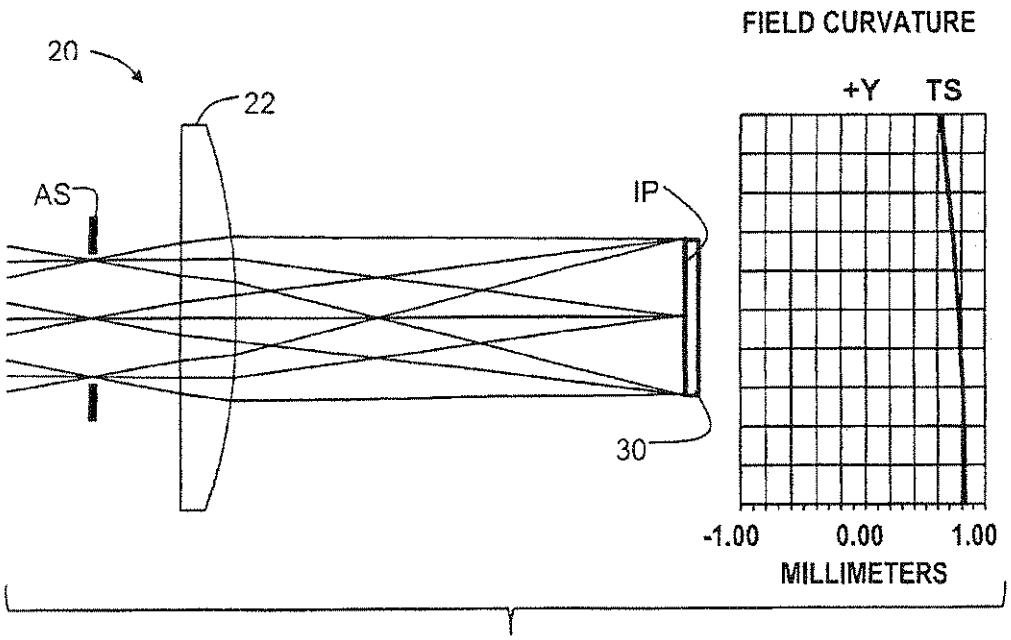


FIG. 22A

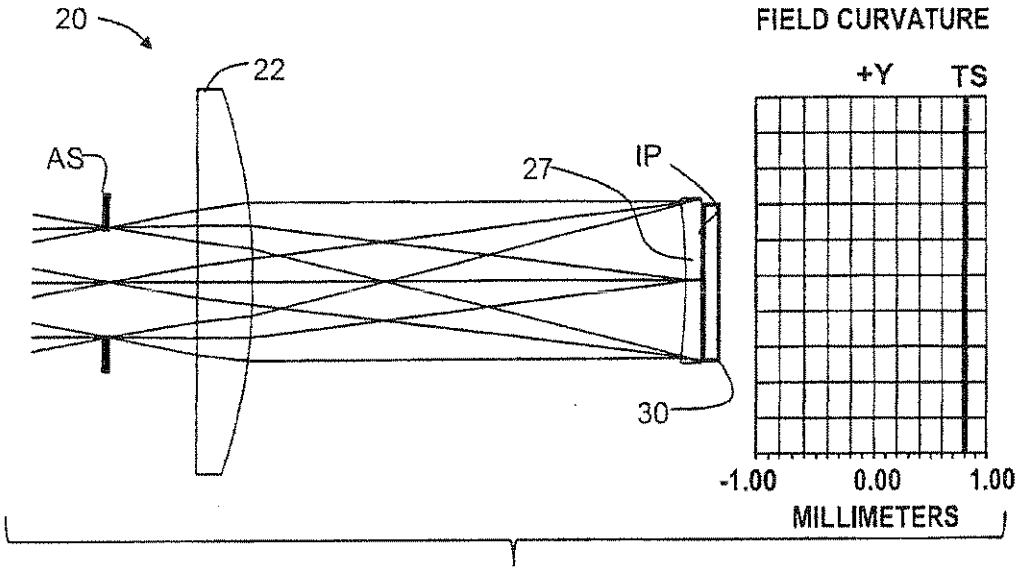


FIG. 22B