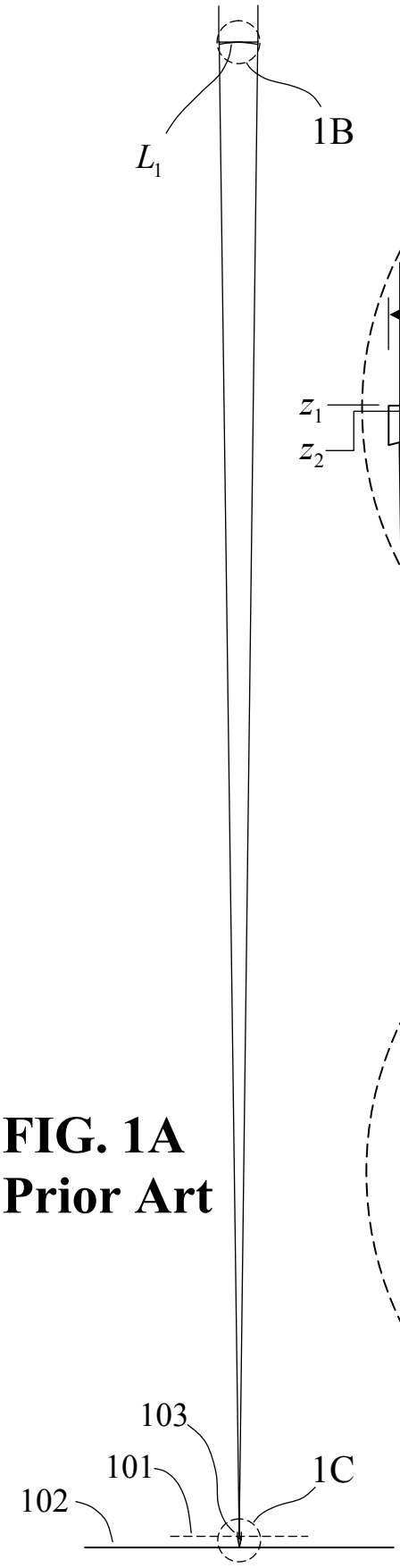


FIG. 1A
Prior Art

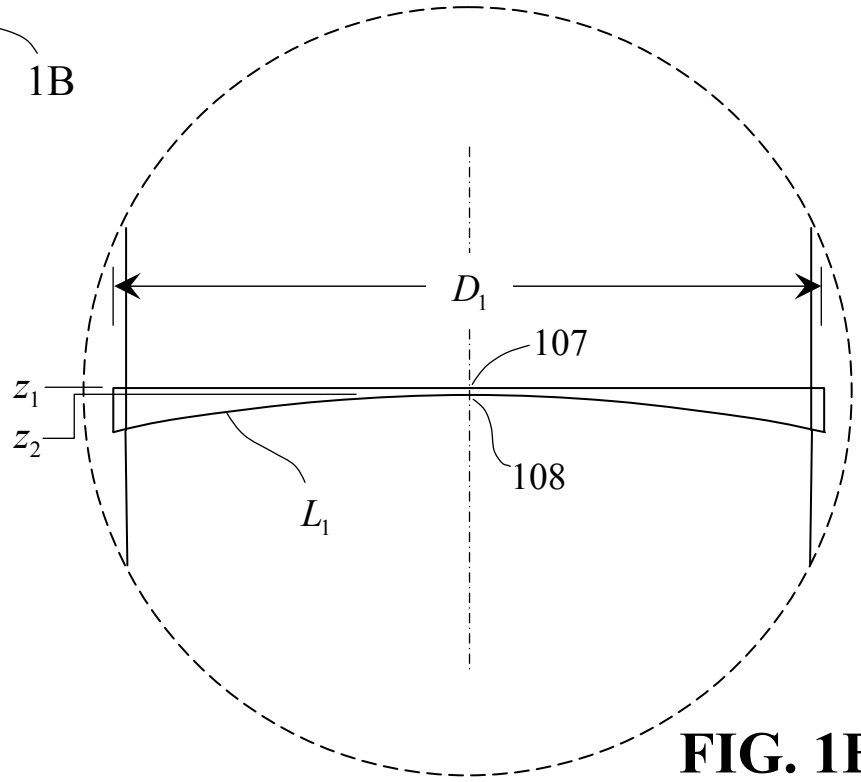


FIG. 1B
Prior Art

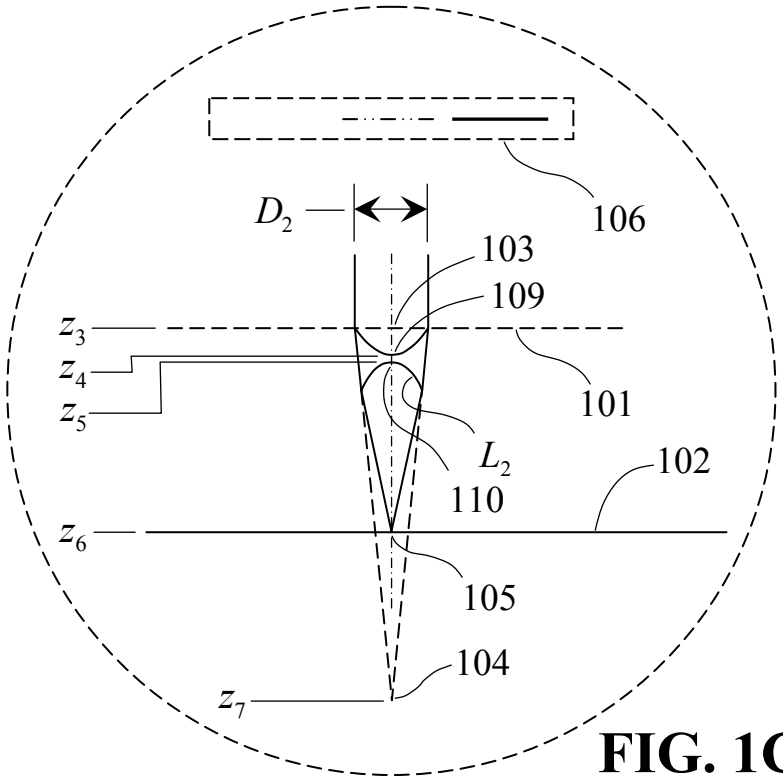


FIG. 1C
Prior Art

D_1	10 μm
D_2	1 μm
z_1	387.874 μm
z_2	387.774 μm
z_3	2.774 μm
z_4	2.410 μm
z_5	2.310 μm
z_6	0
z_7	-2.261 μm

FIG. 2

Wavelength	1-N	K	Xe intensity
9.50 nm	0.04312	0.00427	0.02974
9.75 nm	0.04619	0.00434	0.03346
10.00 nn	0.04941	0.00448	0.03346
10.25 nm	0.05276	0.00467	0.04275
10.50 nm	0.05626	0.00496	0.07063
10.75 nm	0.05990	0.00529	0.17100
11.00 nm	0.06370	0.00568	0.15613
11.25 nm	0.06776	0.00616	0.12082
11.50 nm	0.07197	0.00685	0.09665
11.75 nm	0.07633	0.00764	0.07807
12.00 nm	0.08081	0.00869	0.06320
12.25 nm	0.08532	0.00982	0.05576
12.50 nm	0.08997	0.01097	0.04833

FIG. 4

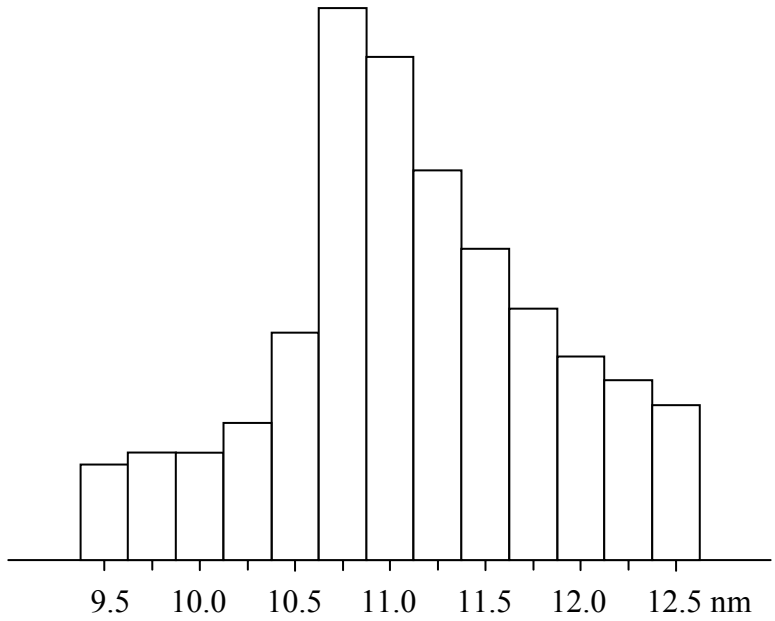


FIG. 5

Assumption	Focus spot FWHM
Monochromatic, point source	40.01 nm
Xe spectrum, point source	41.57 nm
Xe spectrum, 0.5 mrad source	41.72 nm
Xe spectrum, 0.5 mrad source, 21-point exposure	49.72 nm

FIG. 8

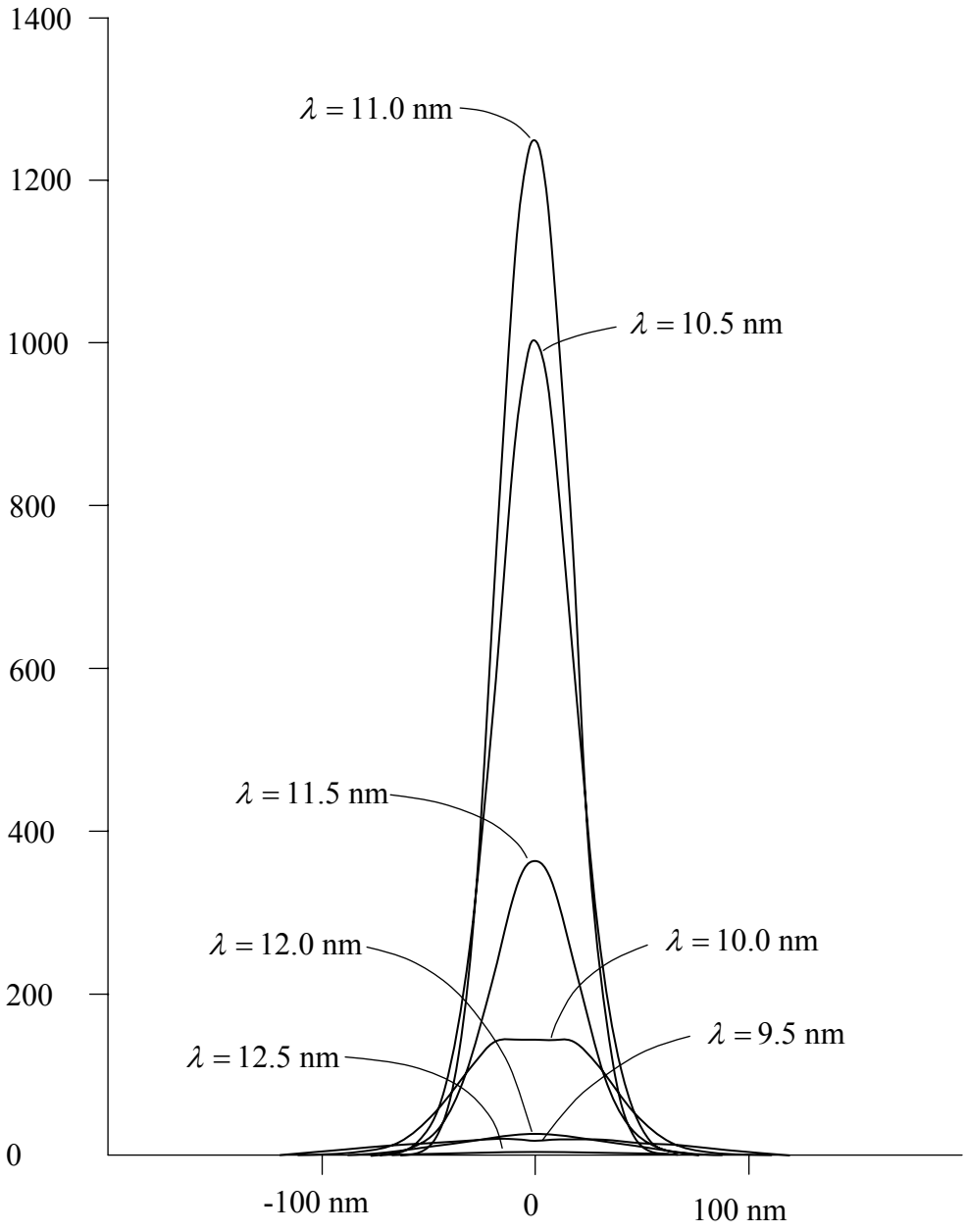

1400
1200
1000
800
600
400
200
0
λ = 11.0 nm
λ = 10.5 nm
λ = 11.5 nm
λ = 12.0 nm
λ = 10.0 nm
λ = 12.5 nm
λ = 9.5 nm
-100 nm
0
100 nm

FIG. 3

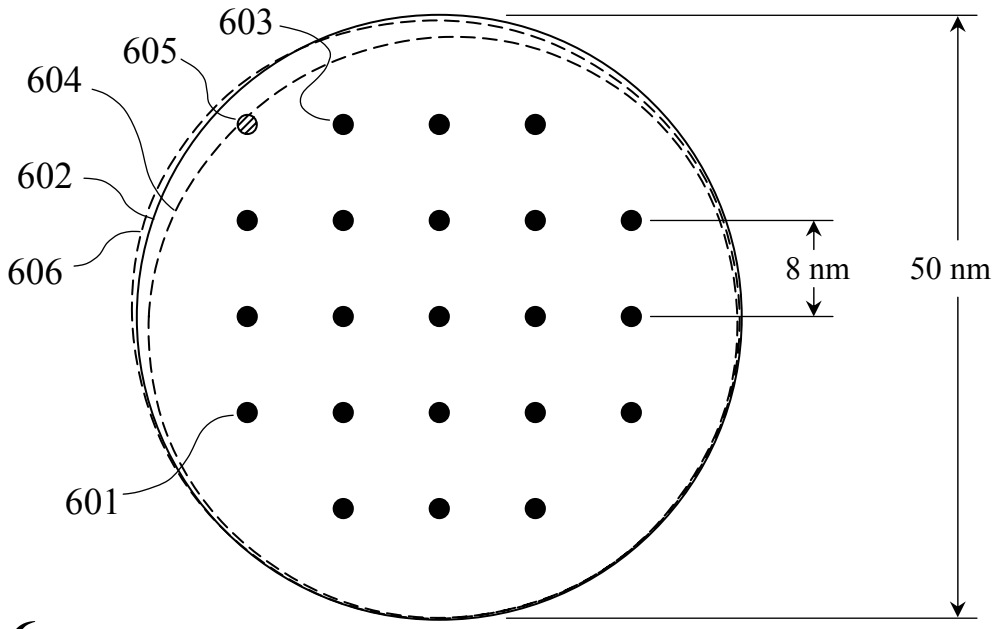

603
605
604
602
606
601
8 nm
50 nm

FIG. 6

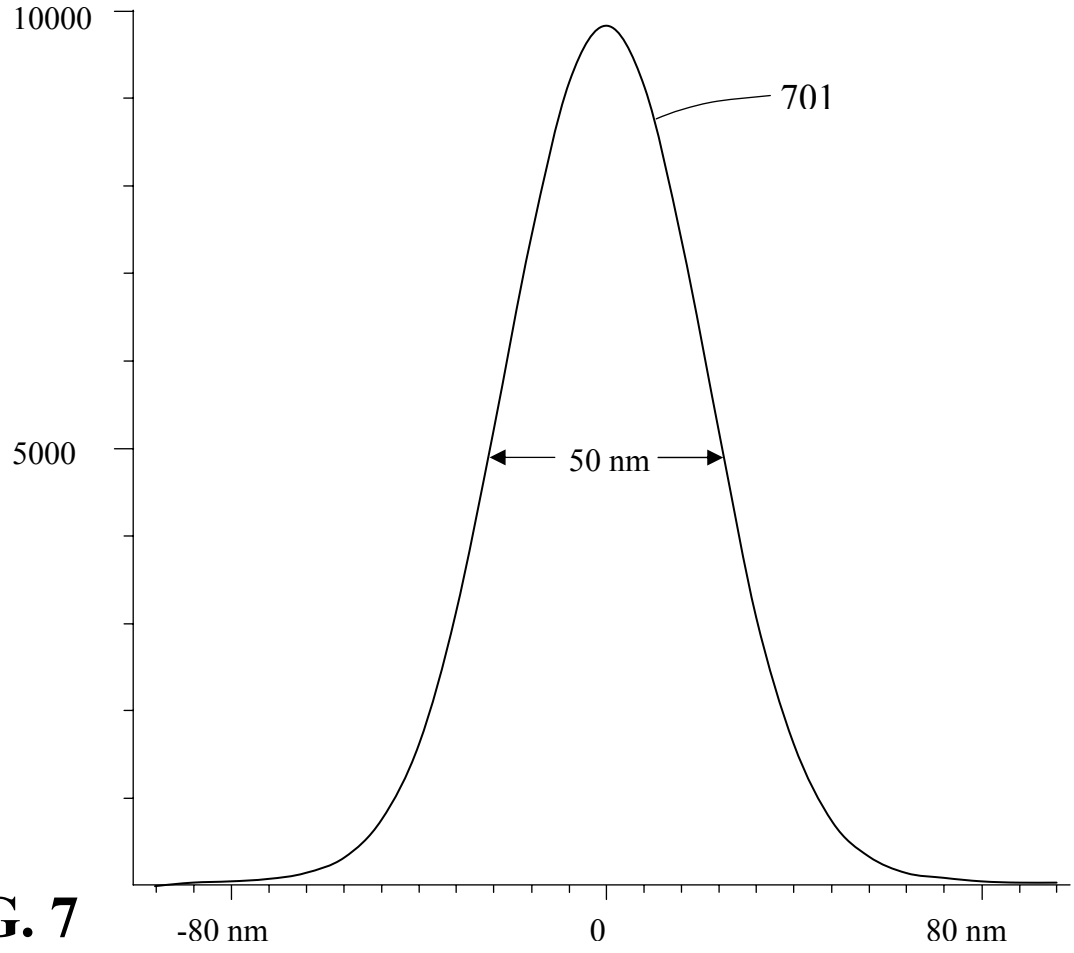

10000
5000
701
50 nm
-80 nm
0
80 nm

FIG. 7

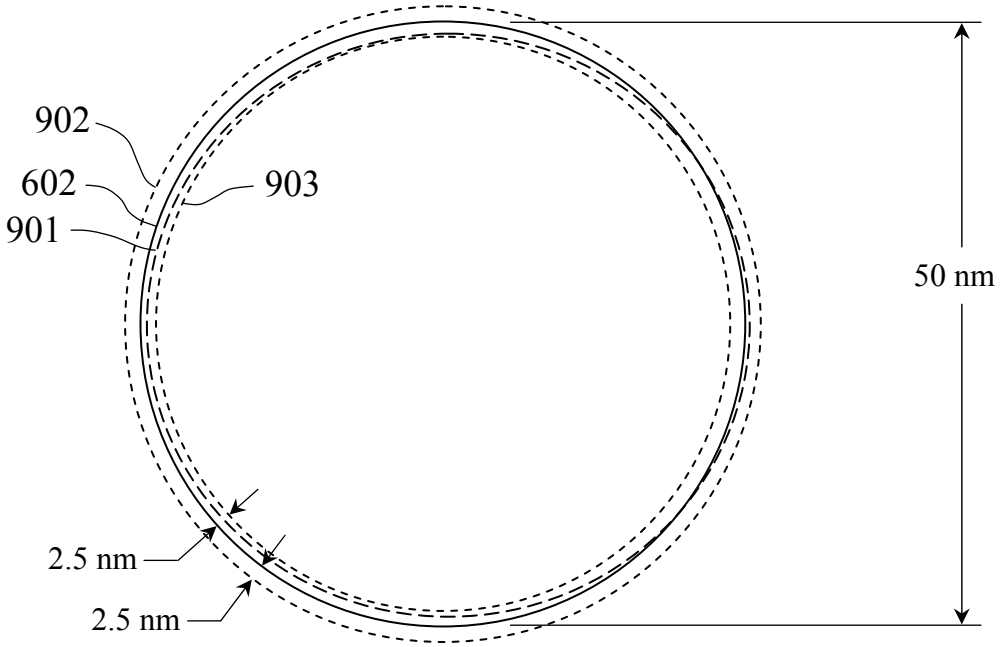

902
602
901
903
50 nm
2.5 nm
2.5 nm

FIG. 9

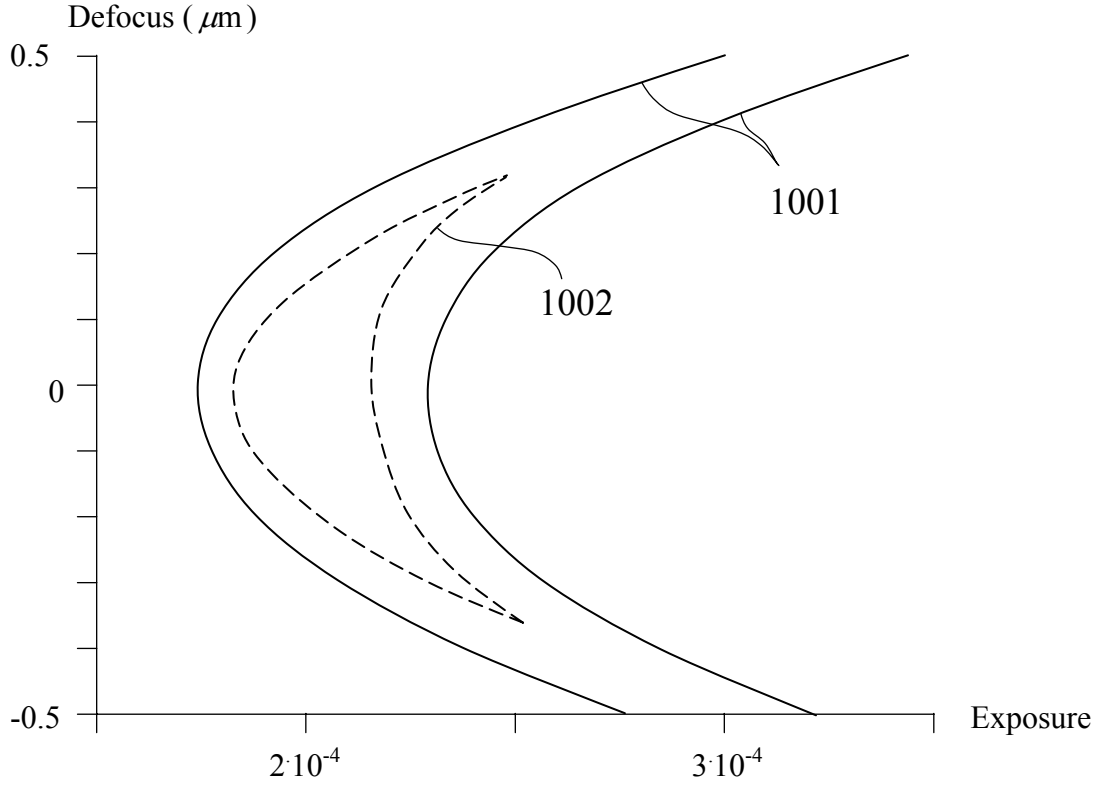

Defocus (μm)
0.5
0
-0.5
1001
1002
Exposure
2·10-4
3·10-4

FIG. 10

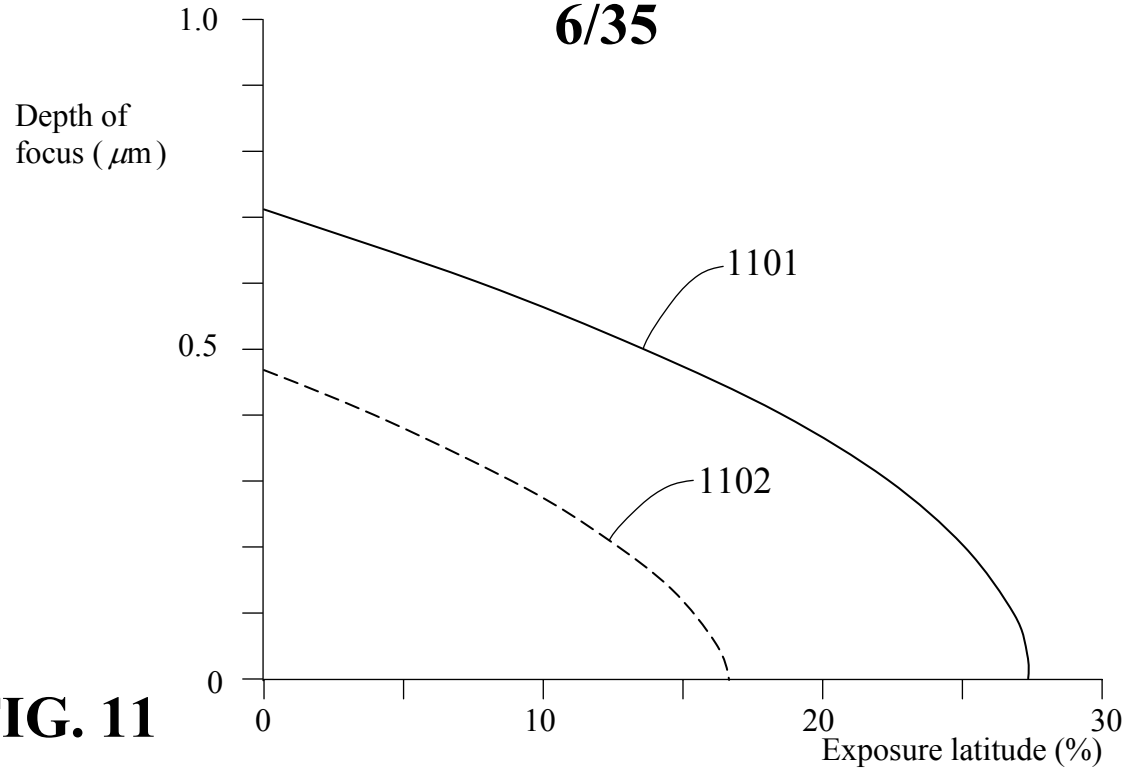


FIG. 11

Axisymmetric Zernike orders:

$R_0^0[\rho] = 1$
$\sqrt{3}R_2^0[\rho] = \sqrt{3}(-1+2\rho^2)$
$\sqrt{5}R_4^0[\rho] = \sqrt{5}(1-6\rho^2+6\rho^4)$
$\sqrt{7}R_6^0[\rho] = \sqrt{7}(-1+2\rho^2)(1-10\rho^2+10\rho^4)$

Odd-symmetric Zernike orders:

$2R_1^1[\rho]\cos\theta = 2\rho\cos\theta$
$2R_1^1[\rho]\sin\theta = 2\rho\sin\theta$
$2\sqrt{2}R_3^1[\rho]\cos\theta = 2\sqrt{2}\rho(-2+3\rho^2)\cos\theta$
$2\sqrt{2}R_3^1[\rho]\sin\theta = 2\sqrt{2}\rho(-2+3\rho^2)\sin\theta$
$2\sqrt{3}R_5^1[\rho]\cos\theta = 2\sqrt{3}\rho(3-12\rho^2+10\rho^4)\cos\theta$
$2\sqrt{3}R_5^1[\rho]\sin\theta = 2\sqrt{3}\rho(3-12\rho^2+10\rho^4)\sin\theta$

Modeled surface distortions:

L_1 top:	1.5 nm RMS, all orders
L_1 bottom:	1.5 nm RMS, all orders
L_2 top:	0.75 nm RMS, axisymmetric orders; 0.2 nm RMS, odd-symmetric orders
L_2 bottom:	0.75 nm RMS, axisymmetric orders; 0.2 nm RMS, odd-symmetric orders

FIG. 12

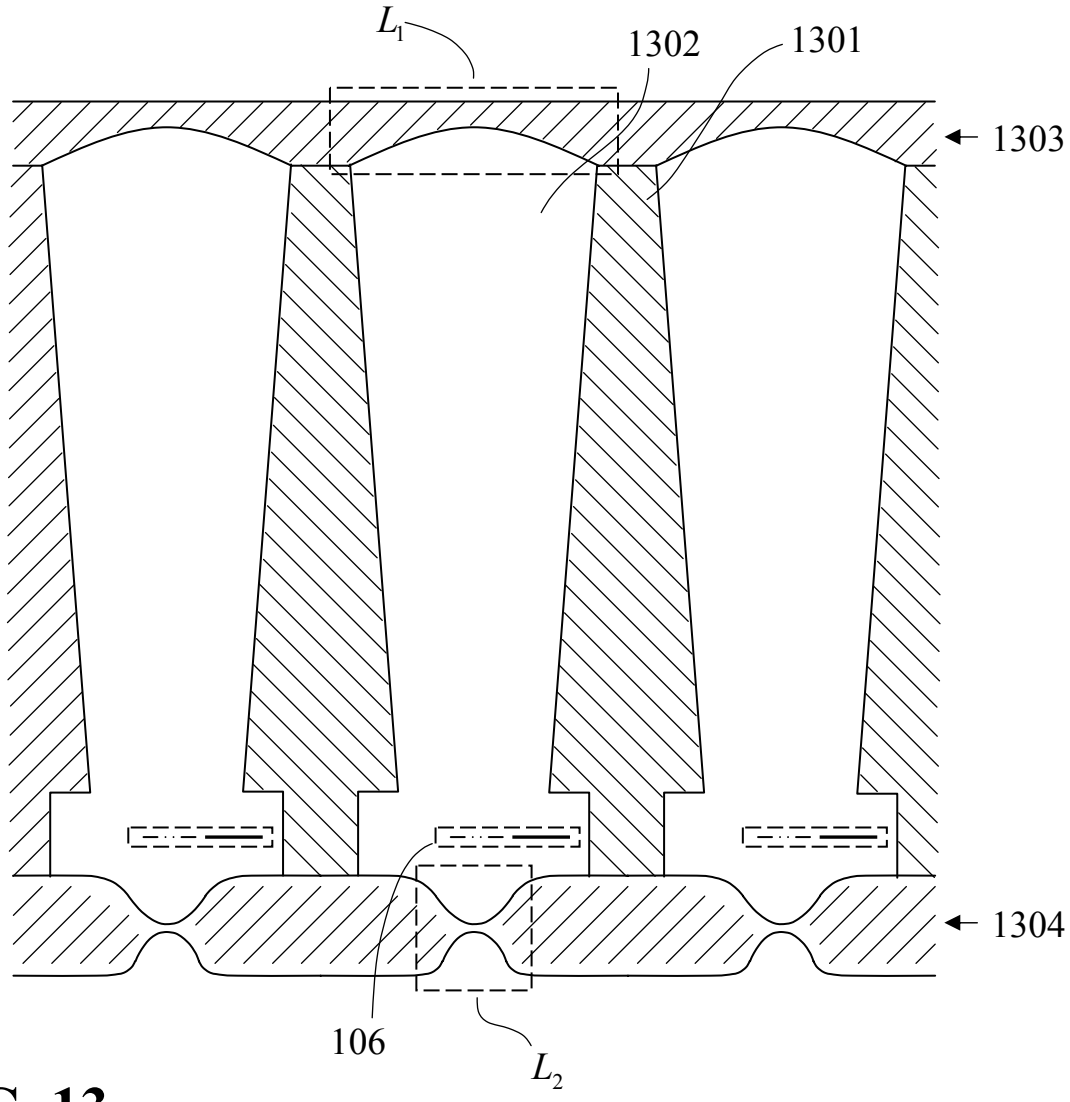


FIG. 13

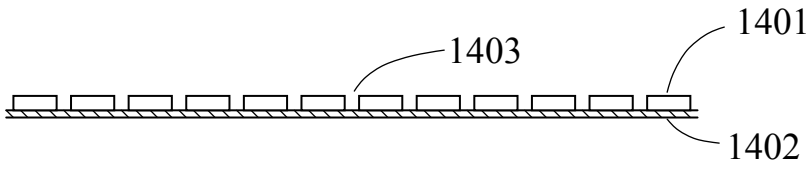


FIG. 14A

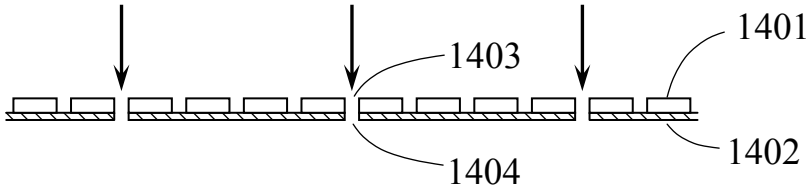


FIG. 14B

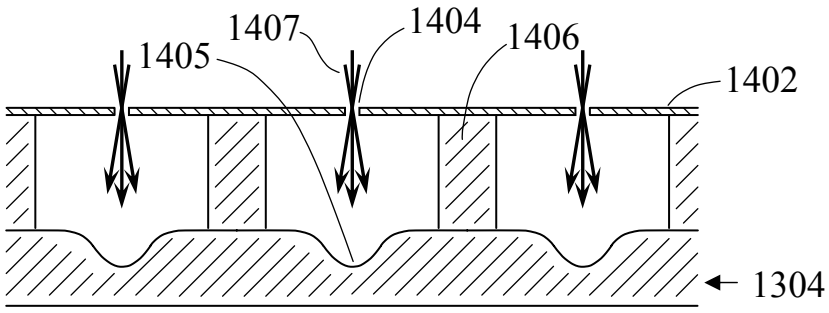


FIG. 14C

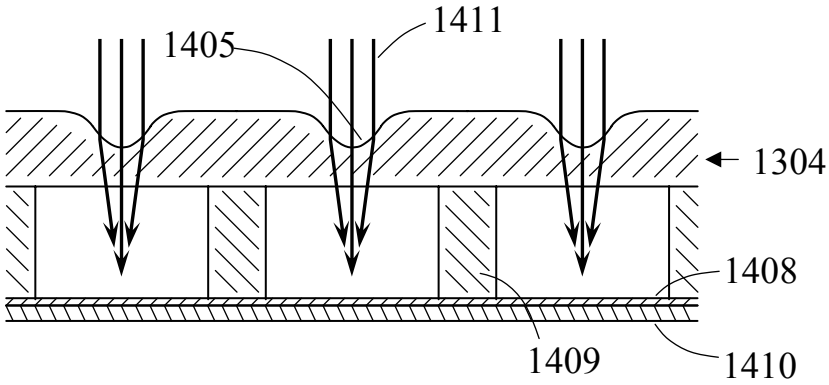


FIG. 14D

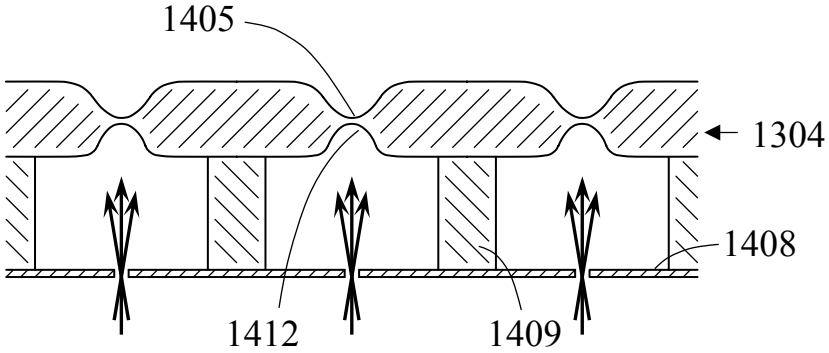


FIG. 14E

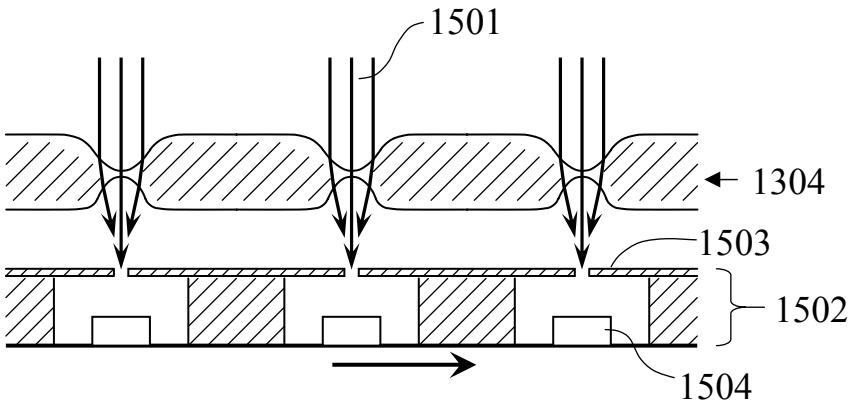


FIG. 15

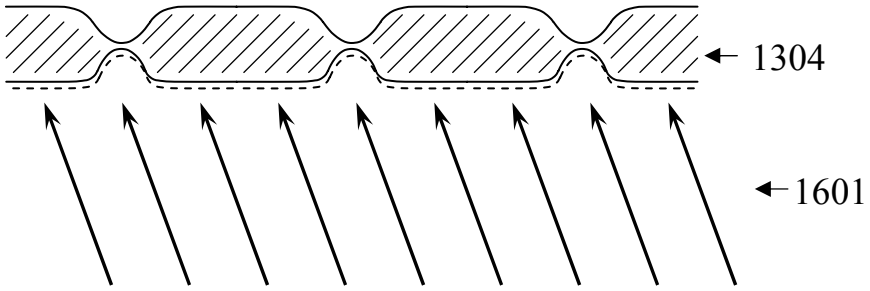


FIG. 16

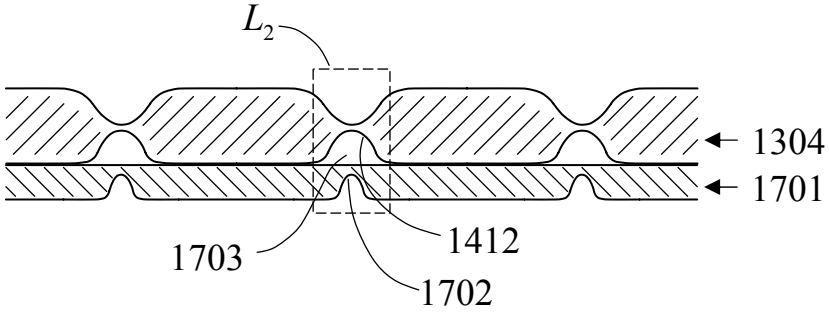


FIG. 17

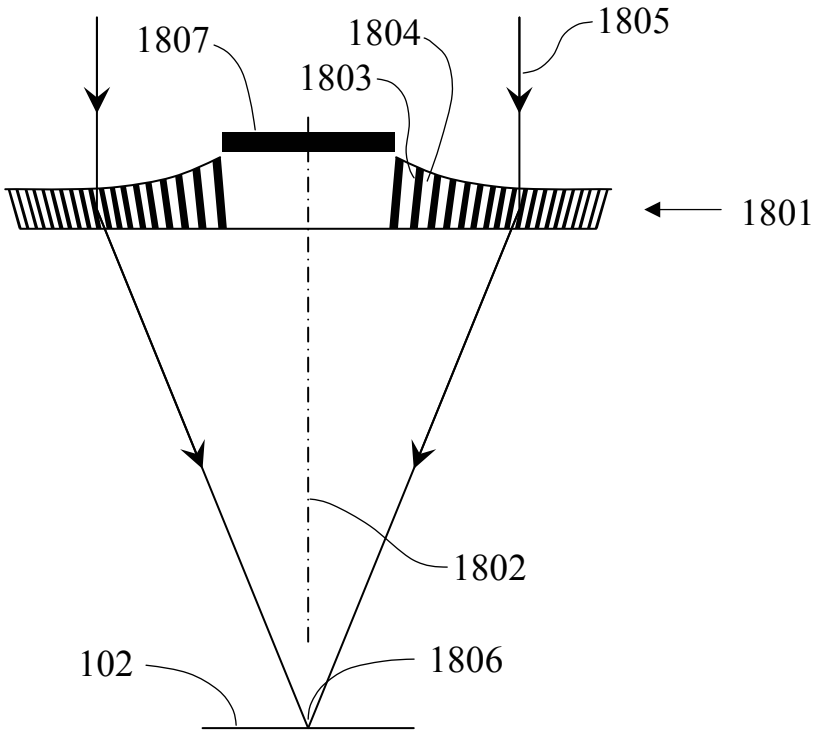


FIG. 18

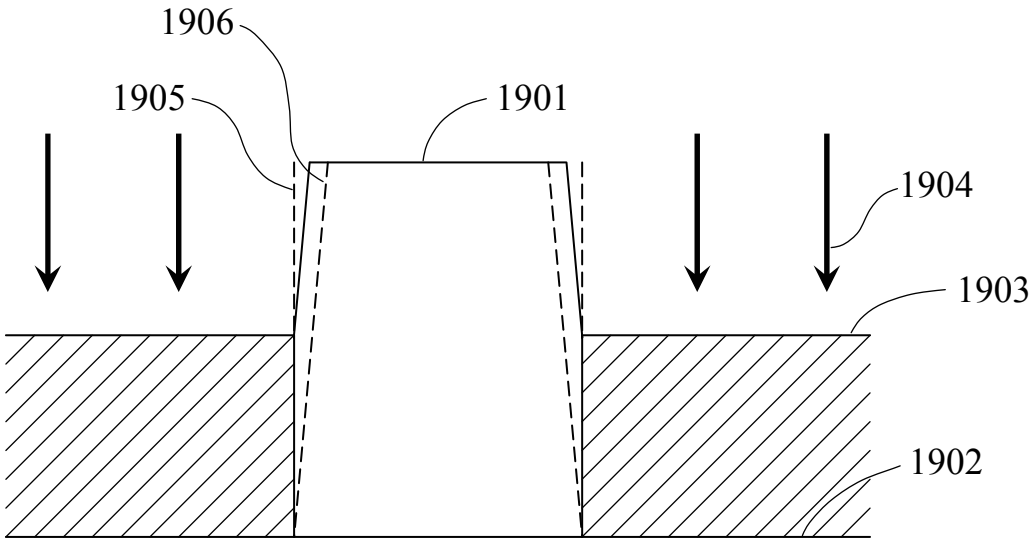


FIG. 19A

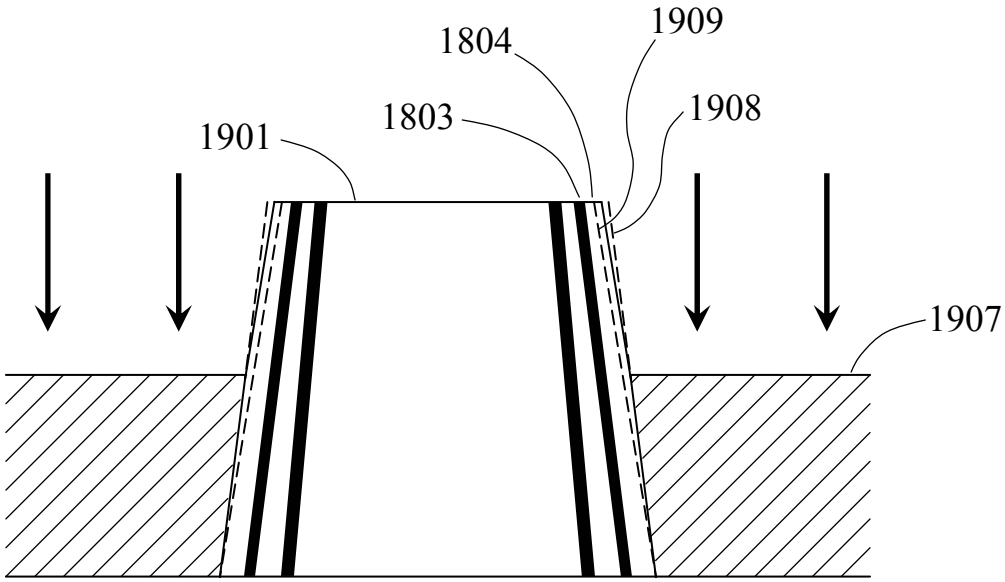


FIG. 19B

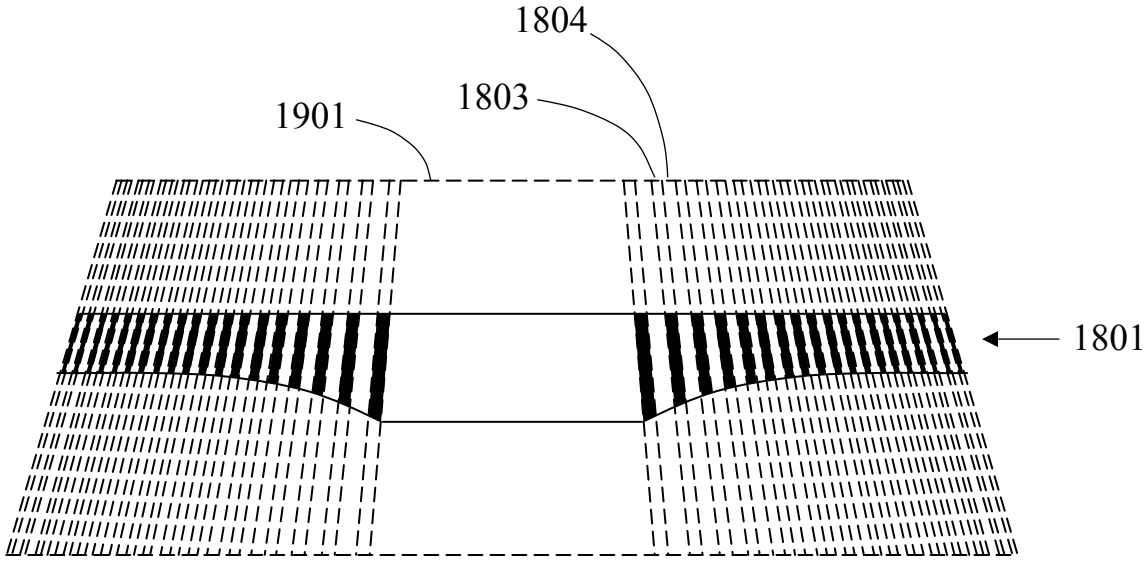


FIG. 19C

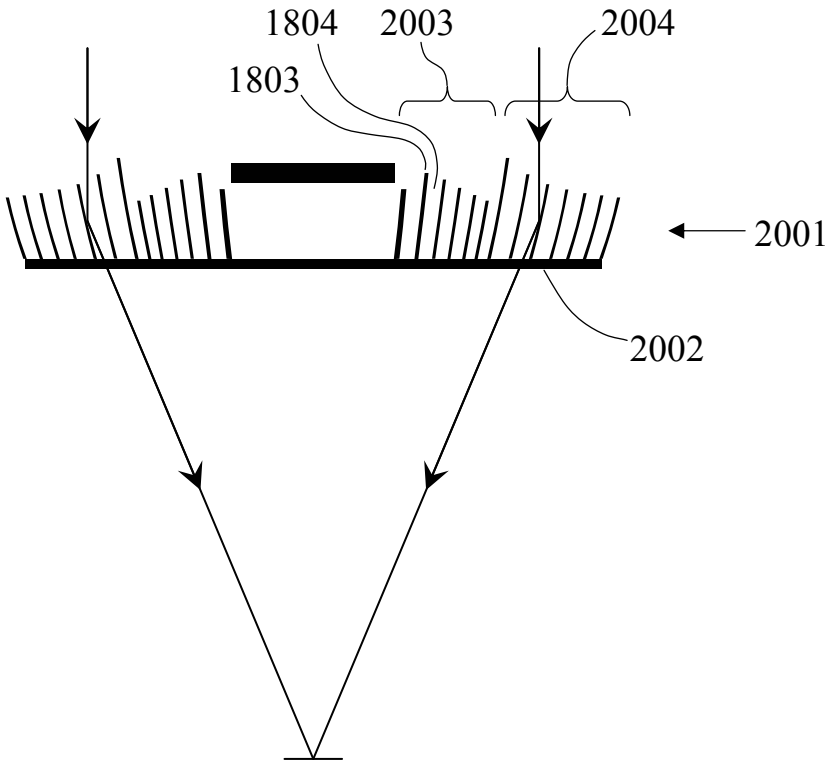


FIG. 20

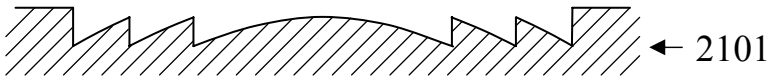


FIG. 21A

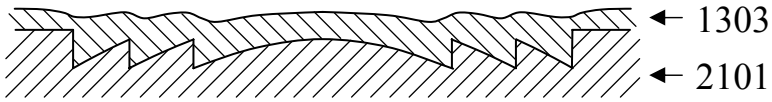


FIG. 21B

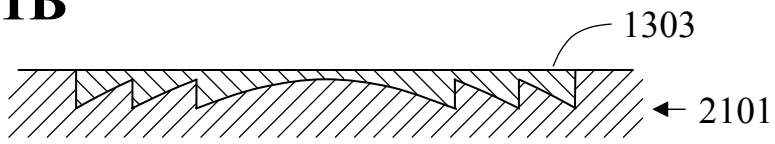


FIG. 21C

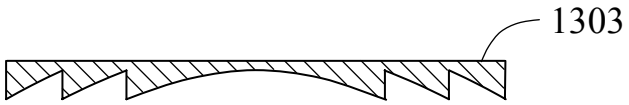


FIG. 21D

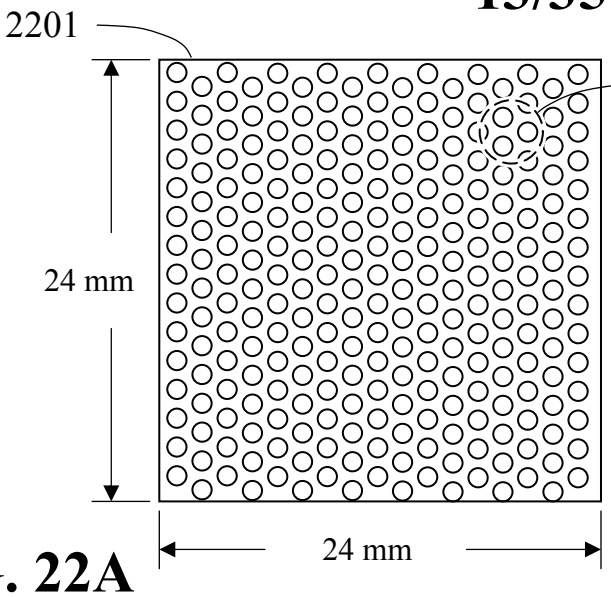


FIG. 22A

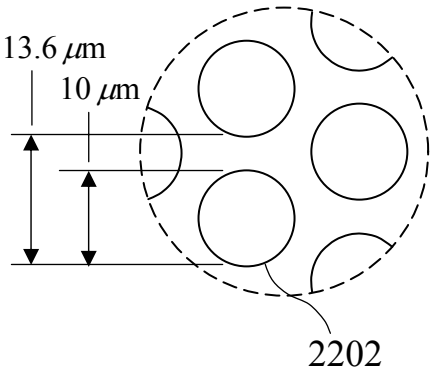


FIG. 22B

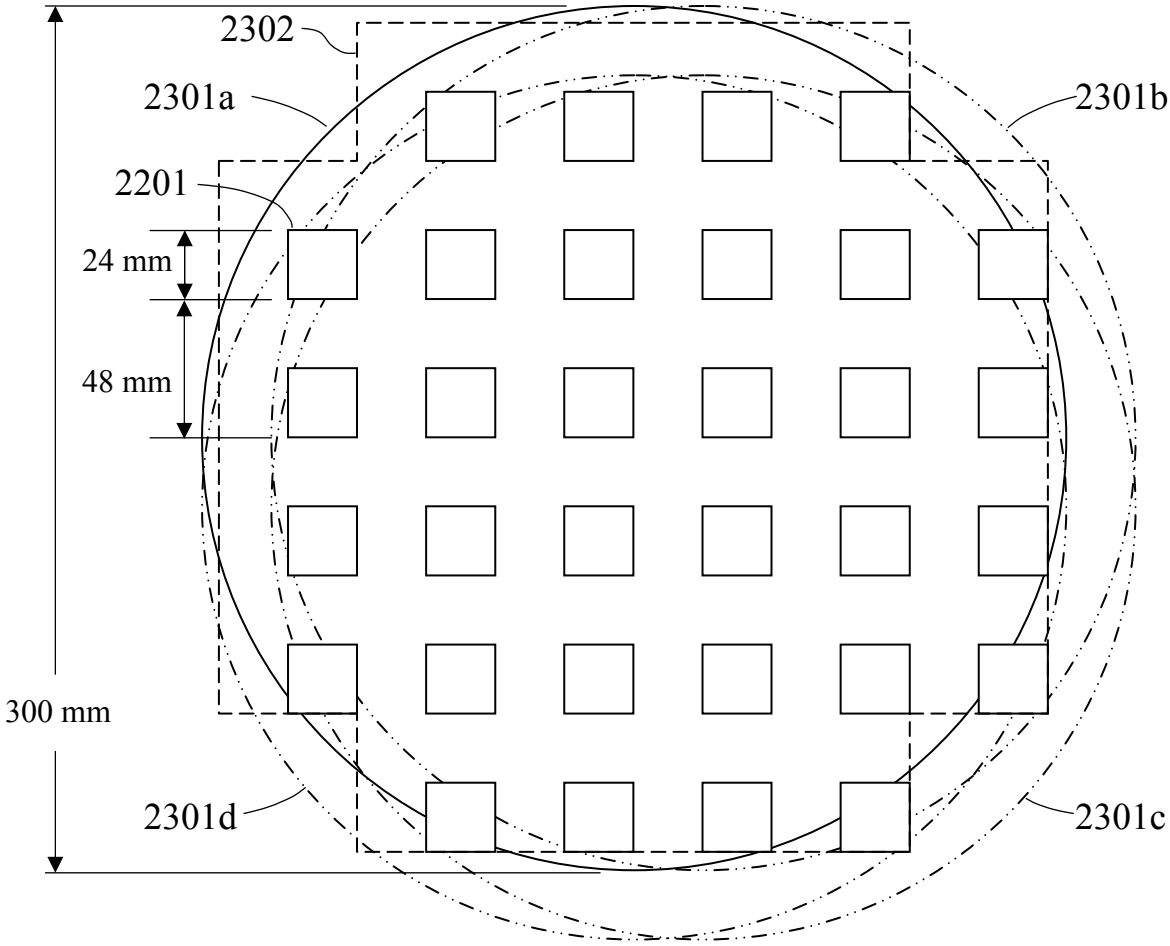


FIG. 23

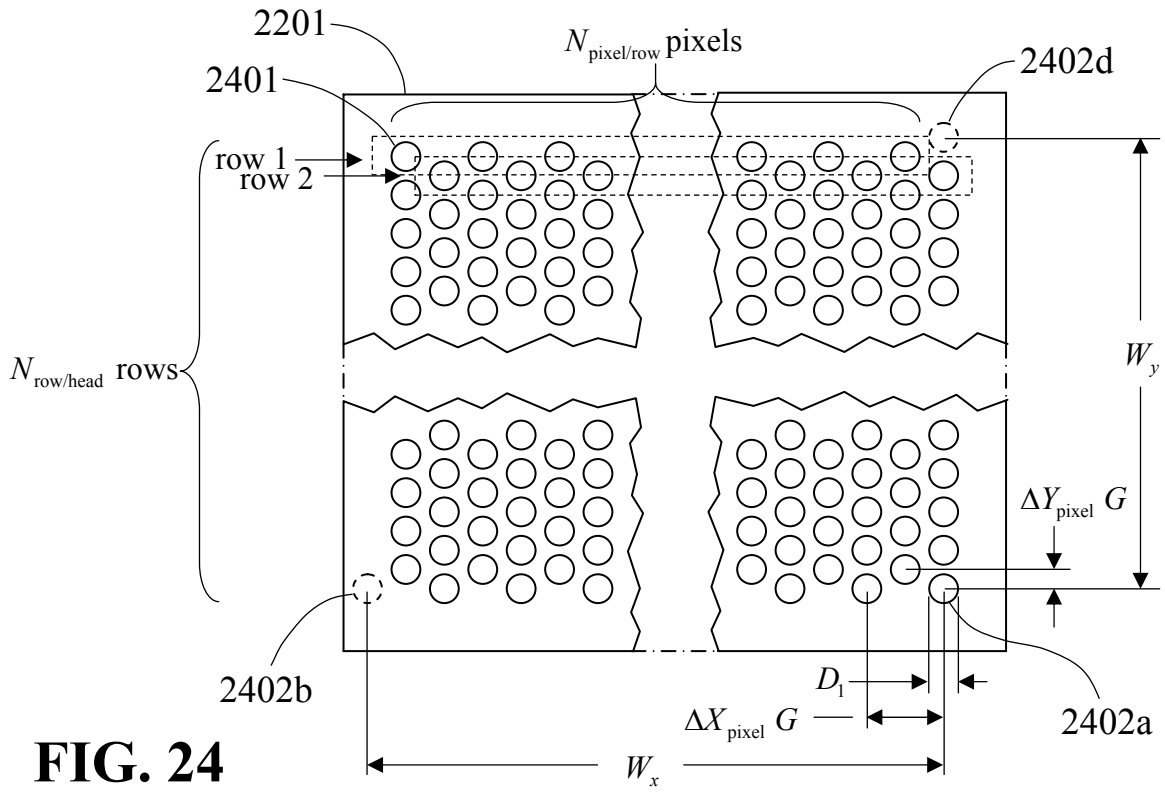


FIG. 24

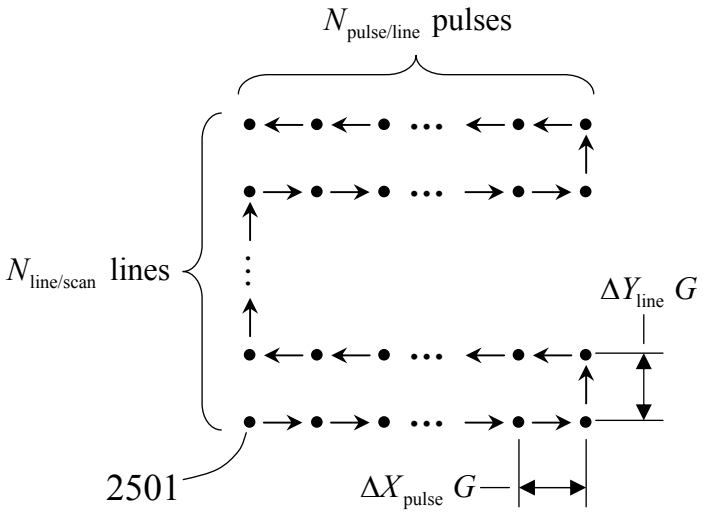


FIG. 25

Eq. **2601**	$G = 8$ nm
Eq. **2602**	$N_{pixel/row} = 1026$
Eq. **2603**	$N_{row/head} = 3538$
Eq. **2604**	$\Delta X_{pixel}\ G = 2924\,G$ $= 23.392\ \mu$m
Eq. **2605**	$\Delta Y_{pixel}\ G = 848\,G$ $= 6.784\ \mu$m
Eq. **2606**	$W_x = N_{pixel/row}\ \Delta X_{pixel}\ G$ $= 24.000192$ mm
Eq. **2607**	$W_y = N_{row/head}\ \Delta Y_{pixel}\ G$ $= 24.001792$ mm
Eq. **2608**	$N_{pulse/line} = \Delta X_{pixel}$ $= 2924$
Eq. **2609**	$N_{line/scan} = \Delta Y_{pixel}$ $= 848$
Eq. **2610**	$\Delta X_{pulse}\ G = 13\,G$ $= 104$ nm
Eq. **2611**	$\Delta Y_{line}\ G = 13\,G$ $= 104$ nm

FIG. 26

Printing throughput:

Eq. **2701**	number of pulses per scan	$N_{\text{pulse/scan}} = N_{\text{pulse/line}} \cdot N_{\text{line/scan}} = 2{,}479{,}552$
Eq. **2702**	number of pulses per print cycle	$N_{\text{pulse}} = 4 \cdot N_{\text{pulse/scan}} = 9{,}918{,}208$
Eq. **2703**	source repetition rate	$\nu_{\text{source}} = 10^4\ \text{sec}^{-1}$
Eq. **2704**	scanning time per print cycle	$t_{\text{cycle\_scan}} = N_{\text{pulse}} / \nu_{\text{source}} = 992.\text{sec} = 16.53\,\text{min}$
Eq. **2705**	total cycle time	$t_{\text{cycle}} \cong 20\,\text{min}$
Eq. **2706**	print time per wafer	$t_{\text{wafer}} = t_{\text{cycle}} / 2 \cong 10\,\text{min}$

FIG. 27

EUV power requirement:

Eq. **2801**	number of pixels per printhead	$N_{\text{pixel/head}} = N_{\text{pixel/row}} \cdot N_{\text{row/head}} = 3{,}629{,}988$
Eq. **2802**	total number of pixels	$N_{\text{pixel}} = N_{\text{pixel/head}} \cdot 32 \cdot 2 = 232{,}319{,}232$
Eq. **2803**	number printing dots	$N_{\text{dot}} = N_{\text{pixel}} \cdot N_{\text{pulse}} = 2{,}304{,}190{,}465{,}376{,}256$
Eq. **2804**	print area	$A_{\text{print}} = N_{\text{dot}} \cdot G^2 = 1475.\text{cm}^2$
Eq. **2805**	resist exposure threshold	$Q_{\text{A\_resist}} = 5\,\text{mJ/cm}^2$
Eq. **2806**	peak exposure level (21-dot pattern)	$Q_{\text{A\_peak}} = 2\,Q_{\text{A\_resist}} = 10\,\text{mJ/cm}^2$
Eq. **2807**	clearing exposure level	$Q_{\text{A\_clear}} = 2.12\,Q_{\text{A\_peak}} = 21.2\,\text{mJ/cm}^2$
Eq. **2808**	EUV energy delivered to 2 wafers	$Q_{\text{print}} = Q_{\text{A\_clear}} \cdot A_{\text{print}} = 31.26\,\text{J}$
Eq. **2809**	lens efficiency	$\eta_{L_1, L_2} = 0.0172$
Eq. **2810**	L_1 aperture fill factor	$\eta_{\text{ff}} = \pi(D_1/2)^2 / (\Delta X_{\text{pixel}}\ \Delta Y_{\text{pixel}}\ G^2) = 0.495$
Eq. **2811**	total EUV energy on printheads	$Q_{\text{heads}} = Q_{\text{print}} / (\eta_{L_1, L_2}\ \eta_{\text{ff}}) = 3673.\text{J}$
Eq. **2812**	collimation efficiency (from 2π sr)	$\eta_{\text{coll}} = 0.0808$
Eq. **2813**	fold mirror efficiency	$\eta_{\text{fold}} = 0.485$
Eq. **2814**	misc efficiency loss	$\eta_{\text{misc}} = 0.8$
Eq. **2815**	source energy (2π sr, 3.25-nm band)	$Q_{\text{source}} = Q_{\text{heads}} / (\eta_{\text{coll}}\ \eta_{\text{fold}}\ \eta_{\text{misc}}) = 1.171 \cdot 10^5\ \text{J}$
Eq. **2816**	source power (2π sr, 3.25-nm band)	$\Phi_{\text{source, 3.25 nm}} = Q_{\text{source}} / t_{\text{cycle\_scan}} = 118.1\,\text{W}$
Eq. **2817**	source power (2π sr, 2-nm band)	$\Phi_{\text{source, 2 nm}} = 0.784 \cdot \Phi_{\text{source, 3.25 nm}} = 92.6\,\text{W}$

FIG. 28

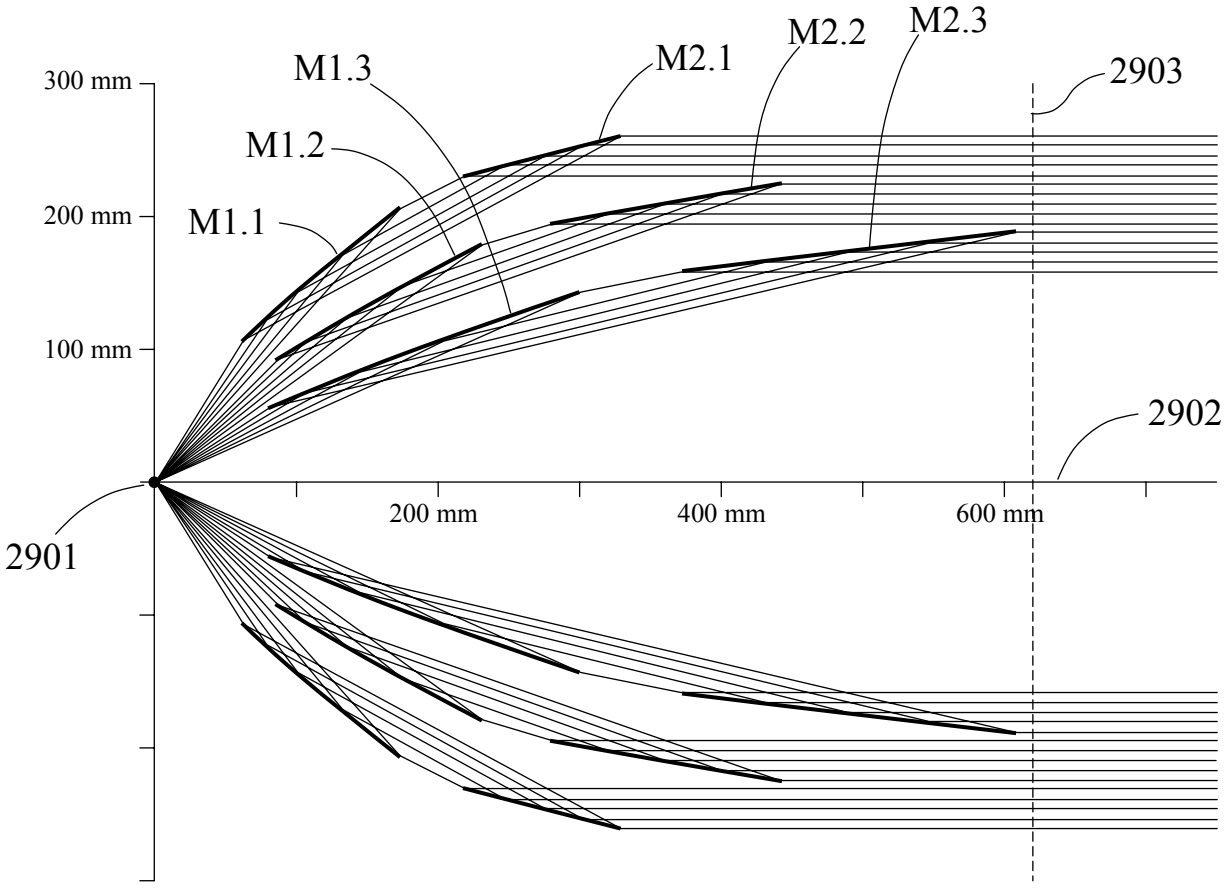

300 mm
200 mm
100 mm
M1.3
M1.2
M1.1
M2.1
M2.2
M2.3
2903
2902
2901
200 mm
400 mm
600 mm

FIG. 29

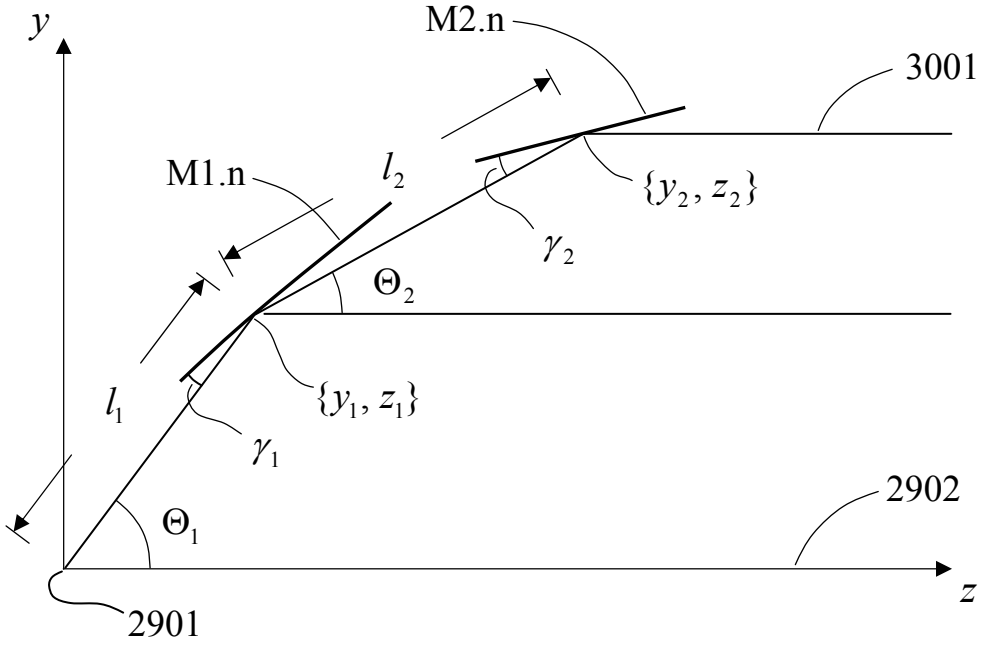

y
M2.n
3001
M1.n
l_2
$\{y_2, z_2\}$
γ_2
Θ_2
l_1
$\{y_1, z_1\}$
γ_1
Θ_1
2902
2901
z

FIG. 30

M1, **M2** geometry definition

Eq. **3101**	$y_1 = l_1 \sin\Theta_1$
Eq. **3102**	$z_1 = l_1 \cos\Theta_1$
Eq. **3103**	$l_2 = \frac{c - l_1 - z_1}{1 - \cos\Theta_2}$
Eq. **3104**	$y_2 = y_1 + l_2 \sin\Theta_2$
Eq. **3105**	$z_2 = z_1 + l_2 \cos\Theta_2$
Eq. **3106**	$\gamma_1 = (\Theta_1 - \Theta_2)/2$
Eq. **3107**	$\gamma_2 = \Theta_2/2$
Eq. **3108**	$(y_2 - y_1)\frac{dy_2}{d\Theta_1} + (z_2 - z_1 - l_2)\frac{dz_2}{d\Theta_1} = 0$
Eq. **3109**	$\frac{dy_2}{d\Theta_1} = \frac{\sin\Theta_1}{y_2}\frac{I_0}{E_{\text{print}}}$

FIG. 31

Derivation of Eq's. **3103**, **3108**

Eq. **3201**	$\left(\frac{\{y_1, z_1\}}{\sqrt{{y_1}^2 + {z_1}^2}} - \frac{\{y_2 - y_1, z_2 - z_1\}}{\sqrt{(y_2 - y_1)^2 + (z_2 - z_1)^2}}\right) \cdot \{dy_1, dz_1\} = 0$
Eq. **3202**	$\left(\frac{\{y_2 - y_1, z_2 - z_1\}}{\sqrt{(y_2 - y_1)^2 + (z_2 - z_1)^2}} - \{0, 1\}\right) \cdot \{dy_2, dz_2\} = 0$
Eq. **3203**	$d\left(\sqrt{{y_1}^2 + {z_1}^2} + \sqrt{(y_2 - y_1)^2 + (z_2 - z_1)^2} - z_2\right) = 0$
Eq. **3204**	$l_1 + l_2 - z_2 = c$
Eq. **3205**	$\frac{(y_2 - y_1)\,dy_2 + (z_2 - z_1)\,dz_2}{l_2} - dz_2 = 0$

FIG. 32

Derivation of Eq. **3109**

Eq. **3301**	$d\Phi_{\text{source}} = I_\lambda \; d\omega \; d\lambda$
Eq. **3302**	$d\omega = \sin\Theta_1 \; d\Theta_1 \; d\phi$
Eq. **3303**	$dA = y_2 \; dy_2 \; d\phi$
Eq. **3304**	$d\Phi_{\text{head}} = \eta_{\text{mirror}} \; d\Phi_{\text{source}}$
Eq. **3305**	$dE_{\text{head}} = \frac{d\Phi_{\text{head}}}{dA} = \left(\frac{d\Phi_{\text{head}}}{d\Phi_{\text{source}}}\right)\left(\frac{d\Phi_{\text{source}}}{d\omega}\right)\left(\frac{d\omega}{dA}\right) = \eta_{\text{mirror}} \; I_\lambda \; \frac{\sin\Theta_1 \; d\Theta_1}{y_2 \; dy_2} \; d\lambda$
Eq. **3306**	$dE_{\text{print}} = \eta_{\text{resist}} \; \eta_{\text{head}} \; dE_{\text{head}}$
Eq. **3307**	$E_{\text{print}} = \int dE_{\text{print}} = \int \eta_{\text{resist}} \; \eta_{\text{head}} \; \eta_{\text{mirror}} \; I_\lambda \; \frac{\sin\Theta_1 \; d\Theta_1}{y_2 \; dy_2} \; d\lambda = \frac{\sin\Theta_1 \; d\Theta_1}{y_2 \; dy_2} \; I_0$
Eq. **3308**	$I_0[\Theta_1] = \int \eta_{\text{resist}}[\lambda] \; \eta_{\text{head}}[\lambda] \; \eta_{\text{mirror}}[\lambda, \gamma_1, \gamma_2] \; I_\lambda[\lambda, \Theta_1] \; d\lambda$

FIG. 33

M1.1, **M2.1** design

Eq. **3401**	$I_0[\Theta_1] = I_1 \; \eta_{\text{mirror}}[11\,\text{nm}, \gamma_1, \gamma_2]$
Eq. **3402** (spec.)	$\Theta_{1\_\max} = 60^\circ$
Eq. **3403** (spec.)	$\Theta_{1\_\min} = 50^\circ$
Eq. **3404** (spec.)	$l_2[\Theta_{1\_\min}] = 50\,\text{mm}$
Eq. **3405** (spec.)	$\gamma_2[\Theta_{1\_\max}] = 15^\circ$
Eq. **3406** (spec.)	$y_2[\Theta_{1\_\max}] = 260\,\text{mm}$
Eq. **3407** (spec.)	$y_2[\Theta_{1\_\min}] = 230\,\text{mm}$
Eq. **3408**	$c = 102.166\,\text{mm}$
Eq. **3409**	$I_1 / E_{\text{print}} = (269.531\,\text{mm})^2$
Eq. **3410**	$l_1[\Theta_{1\_\min}] = 269.431\,\text{mm}$
Eq. **3411**	$\Theta_2[\Theta_{1\_\min}] = 28.1695^\circ$

FIG. 34

M1.2, **M2.2** design

Eq. **3501** (spec.)	$\Theta_{1\_max} = 47^\circ$
Eq. **3502** (spec.)	$l_2[\Theta_{1\_min}] = 50\,\text{mm}$
Eq. **3503** (spec.)	$\gamma_1[\Theta_{1\_min}] = \gamma_2[\Theta_{1\_min}]$
Eq. **3504** (spec.)	$I_1 / E_{\text{print}} = (269.531\,\text{mm})^2$
Eq. **3505** (spec.)	$y_2[\Theta_{1\_max}] = 224\,\text{mm}$
Eq. **3506** (spec.)	$y_2[\Theta_{1\_min}] = 194\,\text{mm}$
Eq. **3507**	$\Theta_{1\_min} = 37.7916^\circ$
Eq. **3508**	$c = 63.557\,\text{mm}$
Eq. **3509**	$l_1[\Theta_{1\_min}] = 290.160\,\text{mm}$
Eq. **3510**	$\Theta_2[\Theta_{1\_min}] = 18.8958^\circ$

FIG. 35

M1.3, **M2.3** design

Eq. **3601** (spec.)	$\Theta_{1\_max} = 34.7916^\circ$
Eq. **3602** (spec.)	$l_2[\Theta_{1\_min}] = 70\,\text{mm}$
Eq. **3603** (spec.)	$\gamma_1[\Theta_{1\_min}] = \gamma_2[\Theta_{1\_min}]$
Eq. **3604** (spec.)	$I_1 / E_{\text{print}} = (269.531\,\text{mm})^2$
Eq. **3605** (spec.)	$y_2[\Theta_{1\_max}] = 188\,\text{mm}$
Eq. **3606** (spec.)	$y_2[\Theta_{1\_min}] = 158\,\text{mm}$
Eq. **3607**	$\Theta_{1\_min} = 25.2994^\circ$
Eq. **3608**	$c = 33.7198\,\text{mm}$
Eq. **3609**	$l_1[\Theta_{1\_min}] = 333.851\ \text{mm}$
Eq. **3610**	$\Theta_2[\Theta_{1\_min}] = 12.6497^\circ$

FIG. 36

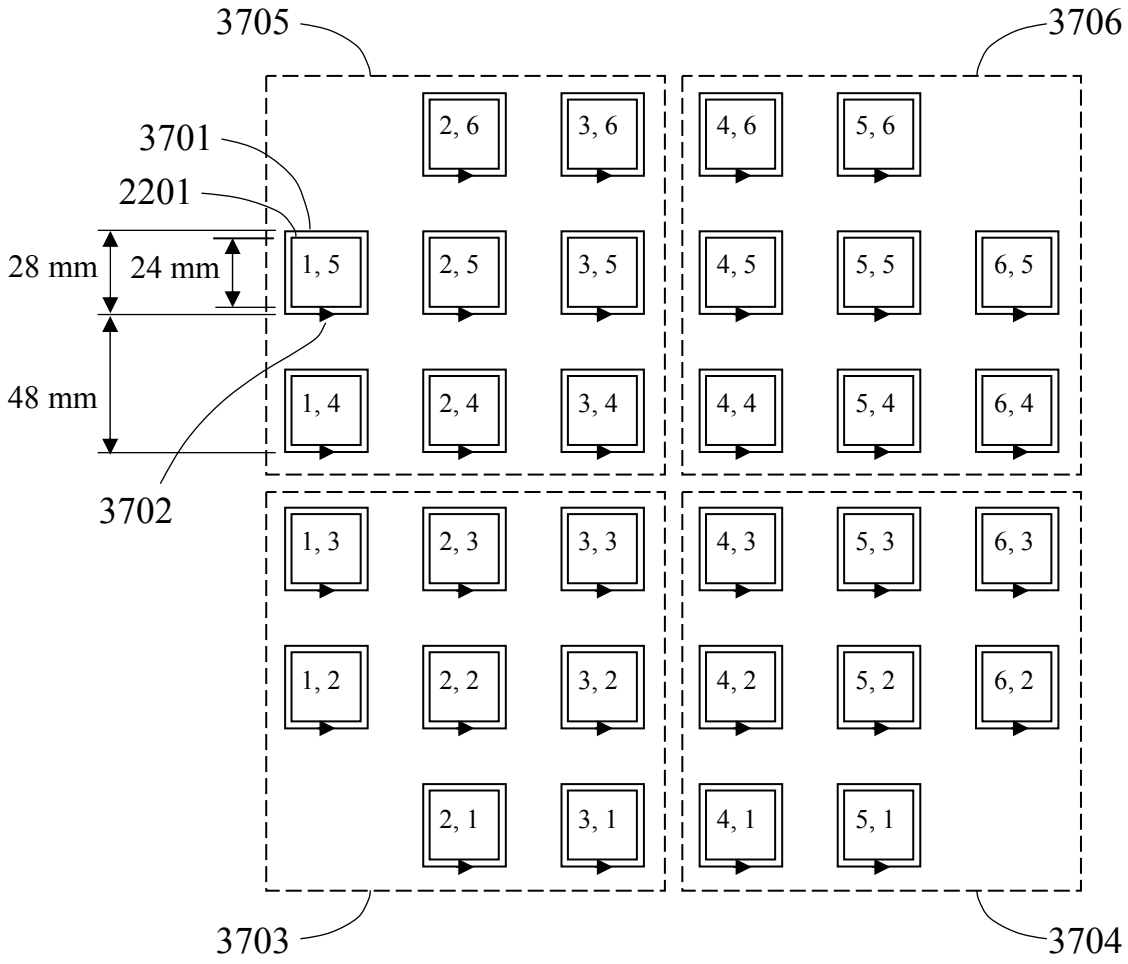

3705
3706
3701
2201
28 mm
24 mm
48 mm
3702
3703
3704
2, 6
3, 6
4, 6
5, 6
1, 5
2, 5
3, 5
4, 5
5, 5
6, 5
1, 4
2, 4
3, 4
4, 4
5, 4
6, 4
1, 3
2, 3
3, 3
4, 3
5, 3
6, 3
1, 2
2, 2
3, 2
4, 2
5, 2
6, 2
2, 1
3, 1
4, 1
5, 1

FIG. 37

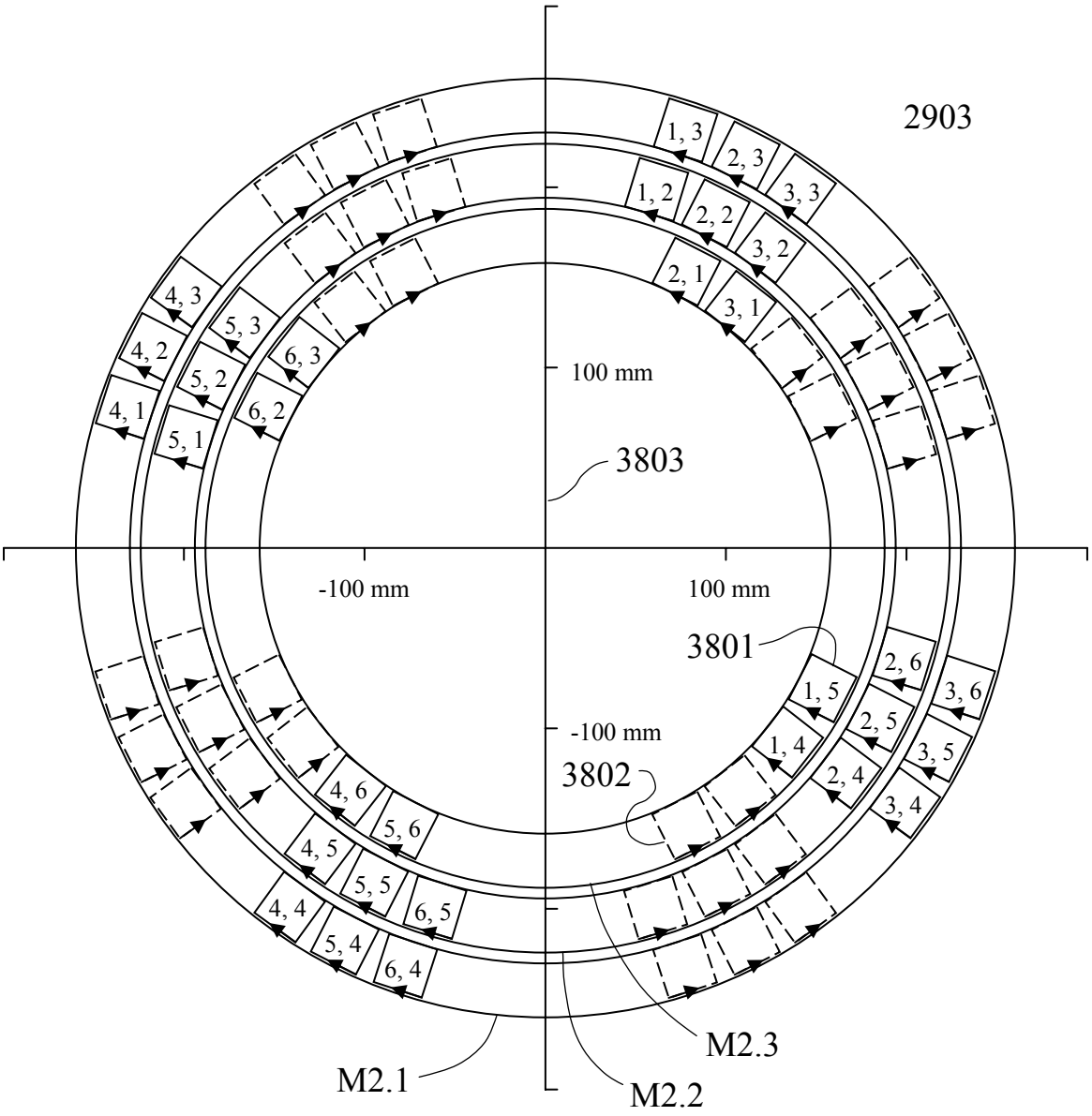

2903
1, 3
2, 3
3, 3
1, 2
2, 2
3, 2
2, 1
3, 1
4, 3
5, 3
6, 3
4, 2
5, 2
6, 2
4, 1
5, 1
100 mm
3803
-100 mm
100 mm
3801
2, 6
3, 6
1, 5
2, 5
3, 5
1, 4
2, 4
3, 4
-100 mm
3802
4, 6
5, 6
4, 5
5, 5
6, 5
4, 4
5, 4
6, 4
M2.1
M2.3
M2.2

FIG. 38

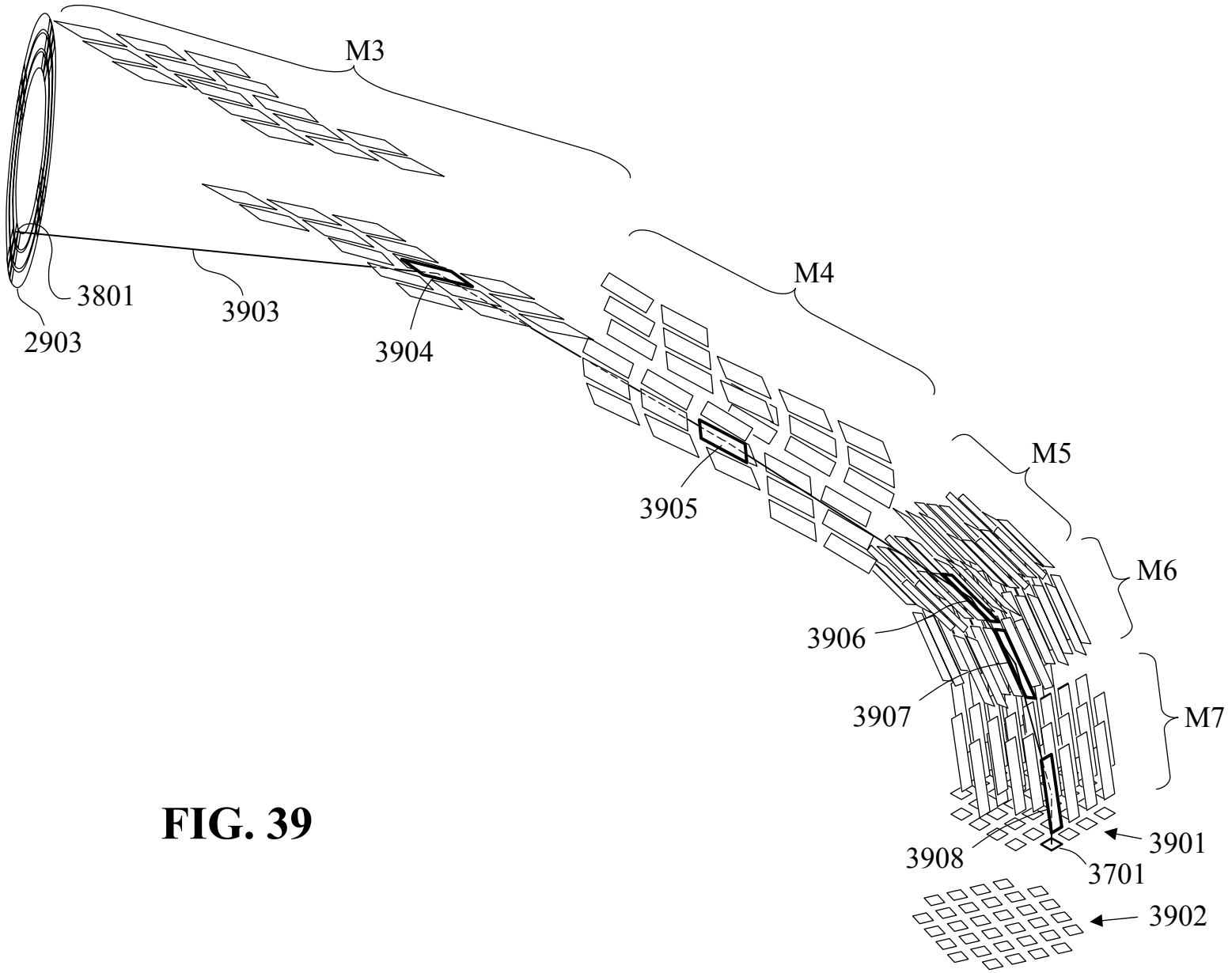

M3
M4
M5
M6
M7
3801
3903
2903
3904
3905
3906
3907
3908
3901
3701
3902

FIG. 39

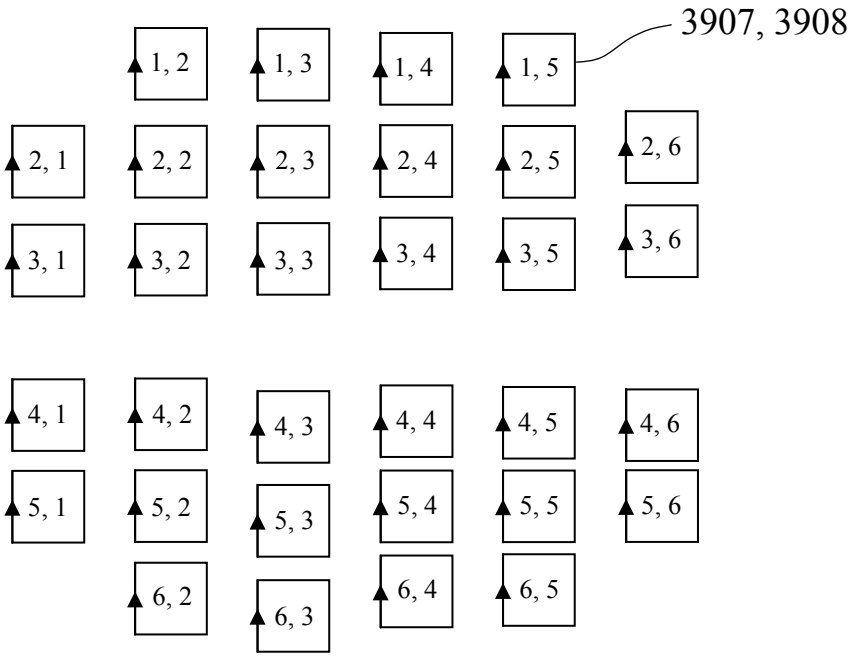

3907, 3908
1, 2
1, 3
1, 4
1, 5
2, 1
2, 2
2, 3
2, 4
2, 5
2, 6
3, 1
3, 2
3, 3
3, 4
3, 5
3, 6
4, 1
4, 2
4, 3
4, 4
4, 5
4, 6
5, 1
5, 2
5, 3
5, 4
5, 5
5, 6
6, 2
6, 3
6, 4
6, 5

FIG. 40

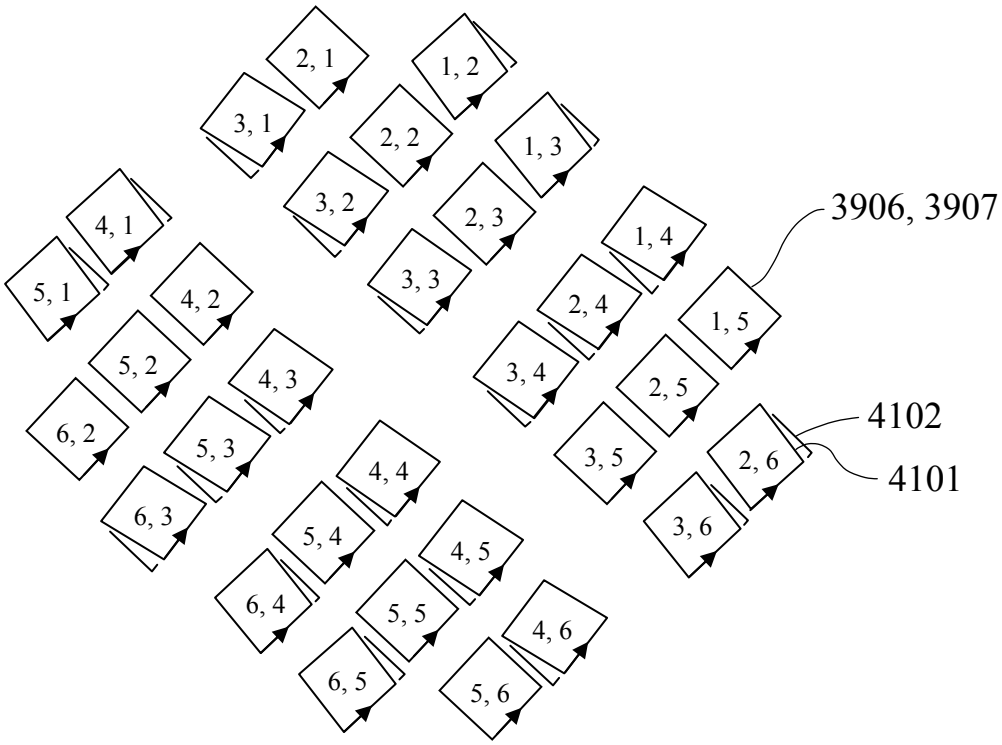

3906, 3907
4102
4101
2, 1
3, 1
1, 2
2, 2
1, 3
3, 2
2, 3
3, 3
4, 1
5, 1
4, 2
5, 2
4, 3
6, 2
5, 3
6, 3
1, 4
2, 4
1, 5
3, 4
2, 5
3, 5
2, 6
3, 6
4, 4
5, 4
4, 5
6, 4
5, 5
4, 6
6, 5
5, 6

FIG. 41

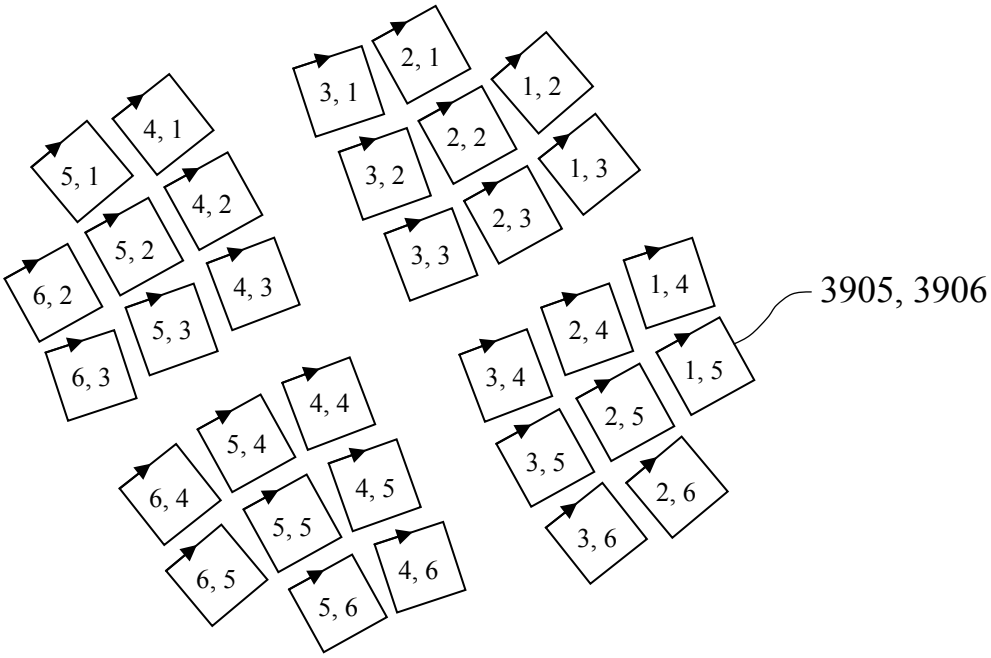
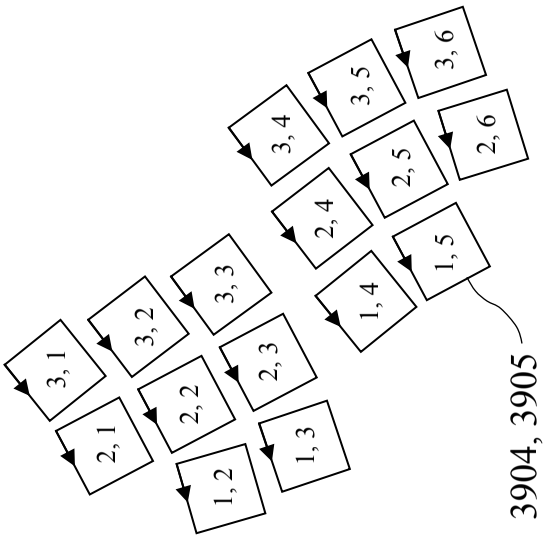

3, 1
2, 1
1, 2
4, 1
5, 1
2, 2
3, 2
1, 3
4, 2
5, 2
3, 3
2, 3
6, 2
4, 3
5, 3
6, 3
1, 4
3905, 3906
2, 4
3, 4
1, 5
2, 5
3, 5
2, 6
3, 6
4, 4
5, 4
6, 4
4, 5
5, 5
6, 5
4, 6
5, 6

FIG. 42


3, 1
2, 1
3, 2
2, 2
1, 2
3, 3
2, 3
1, 3
3, 4
2, 4
1, 4
3, 5
2, 5
1, 5
3, 6
2, 6
3904, 3905

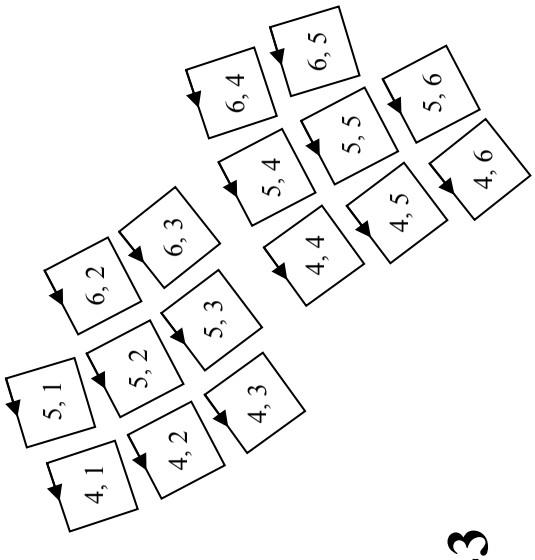

5, 1
4, 1
6, 2
5, 2
4, 2
6, 3
5, 3
4, 3
6, 4
5, 4
4, 4
6, 5
5, 5
4, 5
5, 6
4, 6

FIG. 43

Subgroup 2, 2 ray coordinates (mm)

zone:	1, 2	1, 3	2, 1	2, 2	2, 3	3, 1	3, 2	3, 3
P	-61.440338	-77.854626	-78.086366	-94.430024	-110.773682	-107.826121	-124.653006	-141.320046
	198.718607	231.245880	153.253122	185.329357	217.405592	134.005700	166.510144	198.908634
	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000
M3	-61.440338	-77.854626	-78.086366	-94.430024	-110.773682	-107.826121	-124.653006	-141.320046
	198.718607	231.245880	153.253122	185.329357	217.405592	134.005700	166.510144	198.908634
	1106.780763	985.387327	1276.460264	1156.750126	1037.039987	1348.292621	1226.984385	1106.071575
M4	-61.440338	-77.854626	-78.086366	-94.430024	-110.773682	-107.826121	-124.653006	-141.320046
	-309.562894	-351.816793	-192.874500	-234.313986	-275.753472	-110.443189	-152.050076	-193.674170
	1987.150148	1995.281501	1875.970891	1883.593716	1891.216541	1771.690517	1778.746870	1786.044937
M5	247.634502	208.041962	305.033965	265.650706	226.267448	324.976273	285.533941	246.092939
	-867.390622	-867.811703	-884.341796	-884.198706	-884.055616	-891.578192	-892.368029	-892.888980
	2457.517836	2430.375206	2459.025223	2431.585072	2404.144922	2430.353840	2402.992719	2375.632075
M6	263.990679	224.612453	322.862358	283.479100	244.095842	344.571761	304.830218	265.176070
	-1021.020840	-1021.587846	-1038.959636	-1038.816546	-1038.673457	-1047.335442	-1047.935903	-1048.321065
	2542.843724	2515.396334	2542.246297	2514.806147	2487.365996	2511.013442	2484.088748	2457.038320
M7	204.843718	165.429740	271.653651	232.239673	192.825695	299.049606	259.635628	220.221650
	-1296.524552	-1297.258088	-1277.487345	-1277.487345	-1277.487345	-1259.375460	-1258.450139	-1257.716603
	2627.937199	2600.541244	2615.919176	2588.523221	2561.127266	2576.505198	2549.109243	2521.713288
H	204.843718	165.429740	271.653651	232.239673	192.825695	299.049606	259.635628	220.221650
	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229
	2627.937199	2600.541244	2615.919176	2588.523221	2561.127266	2576.505198	2549.109243	2521.713288

FIG. 44

Subgroup 2, 5 ray coordinates (mm)

zone:	1, 4	1, 5	2, 4	2, 5	2, 6	3, 4	3, 5	3, 6
P	-134.005700	-153.253122	-166.510144	-185.329357	-198.718607	-198.908634	-217.405592	-231.245880
	-107.826121	-78.086366	-124.653006	-94.430024	-61.440338	-141.320046	-110.773682	-77.854626
	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000
M3	-134.005700	-153.253122	-166.510144	-185.329357	-198.718607	-198.908634	-217.405592	-231.245880
	-107.826121	-78.086366	-124.653006	-94.430024	-61.440338	-141.320046	-110.773682	-77.854626
	1524.649949	1413.659672	1587.448739	1474.655034	1351.535849	1649.650980	1535.650396	1412.794807
M4	-134.005700	-153.253122	-166.510144	-185.329357	-198.718607	-198.908634	-217.405592	-231.245880
	-362.999205	-395.460458	-281.465904	-315.533154	-363.130741	-200.411892	-235.605850	-282.403260
	1966.622696	1963.367724	1859.056646	1857.616889	1874.078955	1752.001060	1751.866054	1767.083434
M5	160.454095	123.245947	180.076551	142.477398	101.631627	199.581856	161.708848	121.050442
	-894.449254	-894.494439	-906.996176	-907.168815	-905.212033	-919.619721	-919.843192	-918.238443
	2414.748377	2384.159750	2386.512011	2356.491872	2331.169041	2358.446574	2328.823993	2303.228035
M6	180.049584	141.074341	199.372827	160.305791	117.987803	218.664987	179.537242	137.620933
	-1050.206504	-1049.112280	-1062.564050	-1061.786656	-1058.842251	-1075.051806	-1074.461032	-1072.014586
	2495.407979	2467.380825	2467.608039	2439.712946	2416.494930	2439.852819	2412.045068	2388.249163
M7	126.015762	86.601784	153.411717	113.997739	74.583762	180.807672	141.393694	101.979717
	-1301.893457	-1302.842841	-1276.648701	-1277.487345	-1261.016197	-1251.389368	-1252.131849	-1238.029664
	2573.145289	2545.749334	2533.731311	2506.335356	2478.939401	2494.317333	2466.921378	2439.525423
H	126.015762	86.601784	153.411717	113.997739	74.583762	180.807672	141.393694	101.979717
	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229
	2573.145289	2545.749334	2533.731311	2506.335356	2478.939401	2494.317333	2466.921378	2439.525423

FIG. 45

Subgroup 5, 2 ray coordinates (mm)

zone:	4, 1	4, 2	4, 3	5, 1	5, 2	5, 3	6, 2	6, 3
P	231.245880	217.405592	198.908634	198.718607	185.329357	166.510144	153.253122	134.005700
	77.854626	110.773682	141.320046	61.440338	94.430024	124.653006	78.086366	107.826121
	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000
M3	231.245880	217.405592	198.908634	198.718607	185.329357	166.510144	153.253122	134.005700
	77.854626	110.773682	141.320046	61.440338	94.430024	124.653006	78.086366	107.826121
	924.322019	801.466429	687.465846	985.580977	862.461791	749.668086	923.457153	812.466877
M4	231.245880	217.405592	198.908634	198.718607	185.329357	166.510144	153.253122	134.005700
	-637.013399	-683.810809	-719.004767	-556.285919	-603.883506	-637.950755	-523.956202	-556.417454
	2162.509759	2177.727139	2177.592134	2055.514238	2071.976304	2070.536547	1966.225469	1962.970498
M5	367.262643	326.597708	288.731229	386.683869	345.829158	308.238945	365.060608	327.865425
	-882.500614	-880.884081	-881.119336	-895.531375	-893.558457	-893.747232	-906.232834	-906.301418
	2369.507812	2343.901918	2314.289274	2341.570475	2316.234039	2286.227506	2288.566161	2257.997264
M6	383.833133	344.426101	307.814361	403.040046	363.657552	327.535222	382.889002	347.460913
	-1036.276757	-1035.501922	-1036.551421	-1049.161593	-1048.176298	-1049.315106	-1060.850675	-1062.058668
	2454.528940	2427.122992	2395.695518	2426.896364	2399.455114	2367.323534	2371.787235	2338.656867
M7	326.445561	287.031583	247.617605	353.841516	314.427538	275.013560	341.823493	302.409515
	-1303.585323	-1302.842841	-1316.945026	-1278.325989	-1277.487345	-1293.958493	-1252.131849	-1271.905922
	2537.091220	2509.695265	2482.299310	2497.677243	2470.281288	2442.885332	2430.867310	2403.471355
H	326.445561	287.031583	247.617605	353.841516	314.427538	275.013560	341.823493	302.409515
	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229
	2537.091220	2509.695265	2482.299310	2497.677243	2470.281288	2442.885332	2430.867310	2403.471355

FIG. 46

Subgroup 5, 5 ray coordinates (mm)

zone:	4, 4	4, 5	4, 6	5, 4	5, 5	5, 6	6, 4	6, 5
P	141.320046	124.653006	107.826121	110.773682	94.430024	78.086366	77.854626	61.440338
	-198.908634	-166.510144	-134.005700	-217.405592	-185.329357	-153.253122	-231.245880	-198.718607
	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000	608.374000
M3	141.320046	124.653006	107.826121	110.773682	94.430024	78.086366	77.854626	61.440338
	-198.908634	-166.510144	-134.005700	-217.405592	-185.329357	-153.253122	-231.245880	-198.718607
	1231.045251	1110.132441	988.824205	1300.076839	1180.366700	1060.656562	1351.729499	1230.336063
M4	141.320046	124.653006	107.826121	110.773682	94.430024	78.086366	77.854626	61.440338
	-725.742489	-767.366584	-808.973471	-643.663188	-685.102674	-726.542159	-567.599867	-609.853766
	2143.548256	2150.846323	2157.902677	2038.376652	2045.999477	2053.622302	1934.311692	1942.443046
M5	242.220146	202.781555	163.343248	262.039108	222.655849	183.272591	280.271123	240.680994
	-907.850077	-908.375380	-909.172480	-916.671657	-916.528567	-916.385477	-932.927354	-933.352786
	2297.103773	2269.746797	2242.391801	2268.580989	2241.140839	2213.700688	2242.360642	2215.221681
M6	261.303278	222.077832	182.938736	279.867501	240.484243	201.100985	296.841613	257.037170
	-1063.282162	-1063.943254	-1064.929730	-1071.289498	-1071.146408	-1071.003318	-1086.703497	-1086.983004
	2378.510018	2350.842826	2323.051404	2351.802064	2324.361913	2296.921763	2327.381770	2300.547570
M7	208.203627	168.789649	129.375672	235.599582	196.185604	156.771627	262.995537	223.581560
	-1310.617791	-1312.157056	-1314.423919	-1277.487345	-1277.487345	-1277.487345	-1244.356899	-1242.817635
	2454.903355	2427.507400	2400.111445	2415.489377	2388.093422	2360.697467	2376.075400	2348.679445
H	208.203627	168.789649	129.375672	235.599582	196.185604	156.771627	262.995537	223.581560
	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229	-1420.192229
	2454.903355	2427.507400	2400.111445	2415.489377	2388.093422	2360.697467	2376.075400	2348.679445

FIG. 47

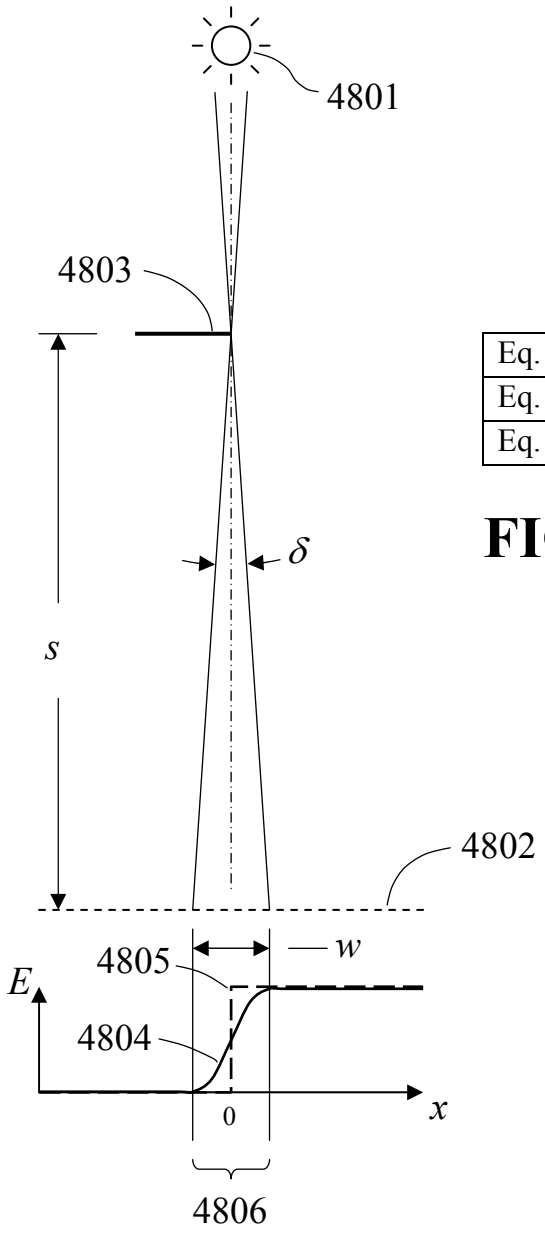


FIG. 48

Eq. **4901**	$\delta = 0.0005$ rad
Eq. **4902**	$s = 3000$ mm
Eq. **4903**	$w = s\ \delta = 1.5$ mm

FIG. 49

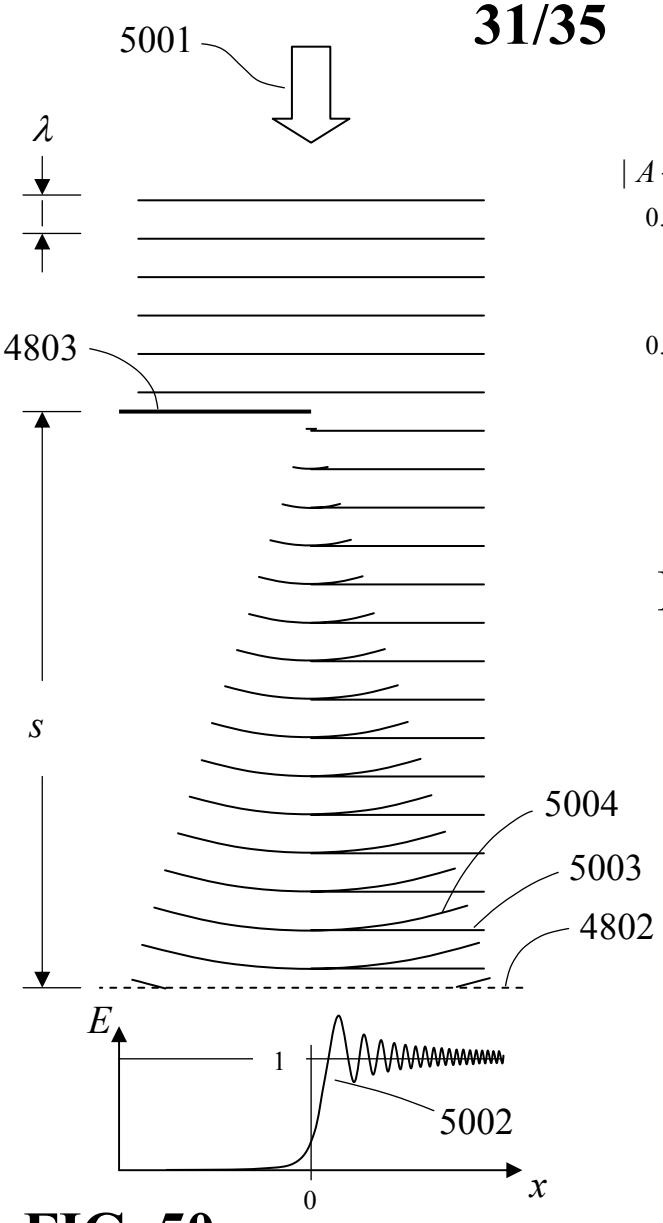


FIG. 50

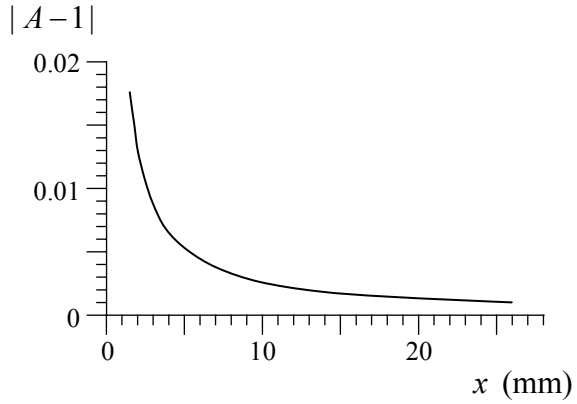


FIG. 52

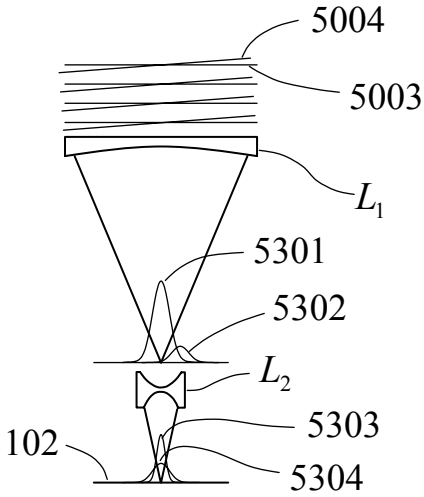


FIG. 53

Eq. **5101**	$\lambda = 11\,\text{nm}$
Eq. **5102**	$s = 3000\,\text{mm}$
Eq. **5103**	$E[x] \propto \lvert A[x] \rvert^2$
Eq. **5104**	$A[x] = \frac{1}{2}\left(1 + (1-i)\,\mathcal{C}[\sqrt{\frac{2}{\lambda\, s}}\,x] + (1+i)\,\mathcal{S}[\sqrt{\frac{2}{\lambda\, s}}\,x]\right)$ $\cong 1 - \frac{1+i}{2\pi\sqrt{\frac{2}{\lambda\, s}}\,x}\exp[i\,\pi\,\frac{x^2}{\lambda\, s}] \qquad (x >> \sqrt{\lambda\, s} = 0.18\,\text{mm})$

FIG. 51

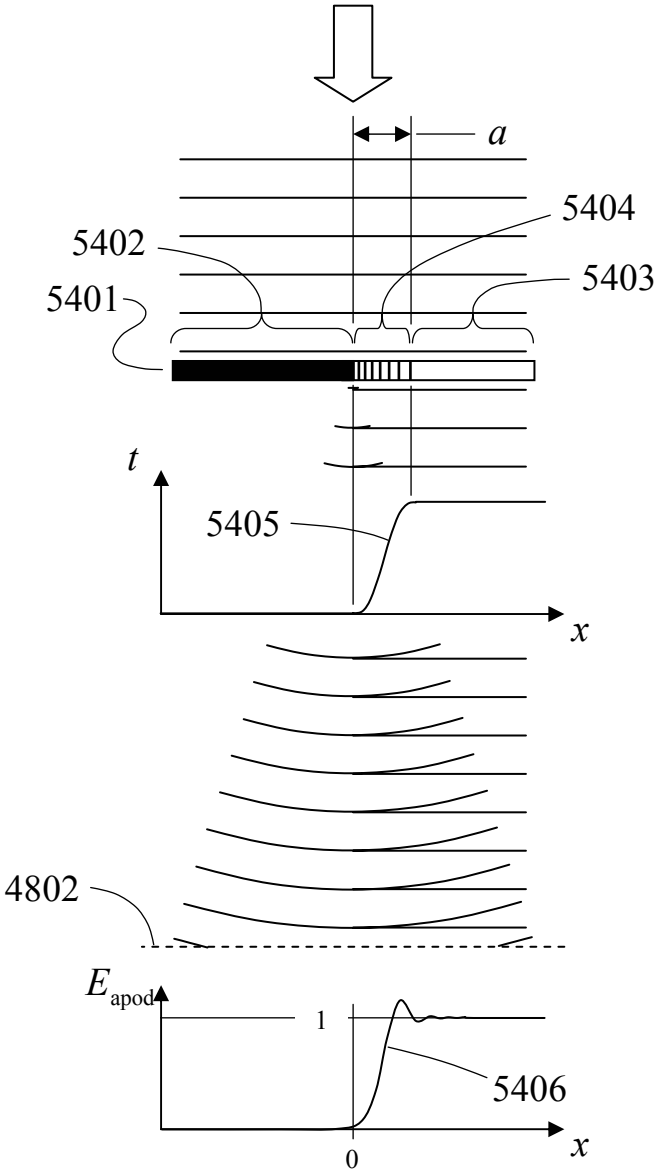


FIG. 54

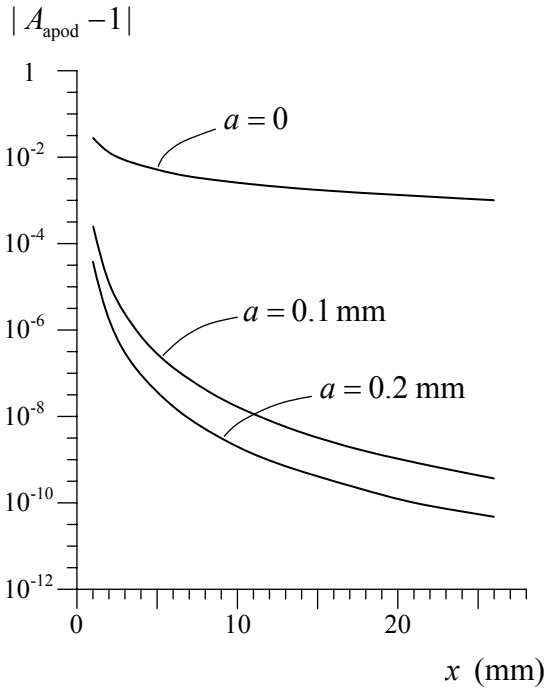


FIG. 56

Eq. **5501**	$t[x] = \begin{cases} 0, & x \le 0 \\ x/a - \sin[2\pi x/a]/(2\pi), & 0 \le x \le a \\ 1, & x \ge a \end{cases}$
Eq. **5502**	$E_{apod}[x] \propto \lvert A_{apod}[x] \rvert^2$
Eq. **5503**	$A_{apod}[x] = \int_0^a A[x - x_0]\, t'[x_0]\, dx_0$

FIG. 55

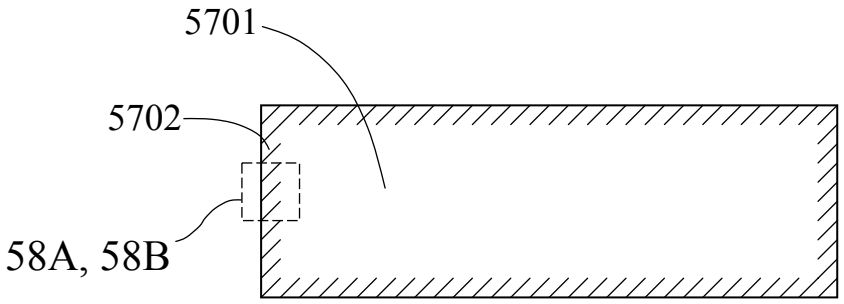


FIG. 57

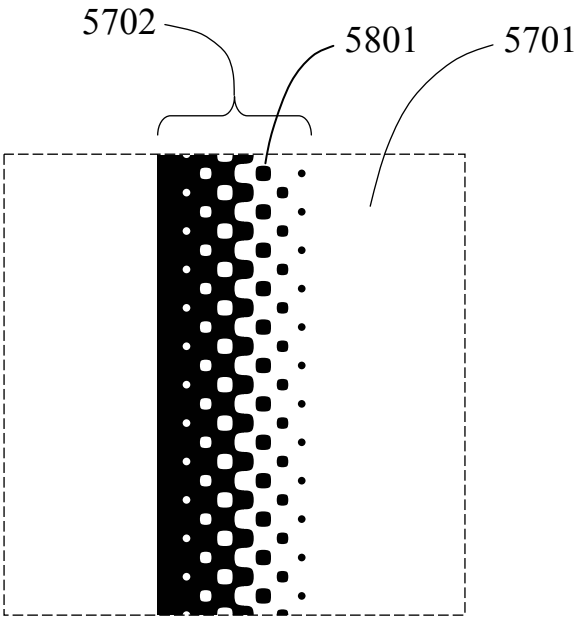


FIG. 58A

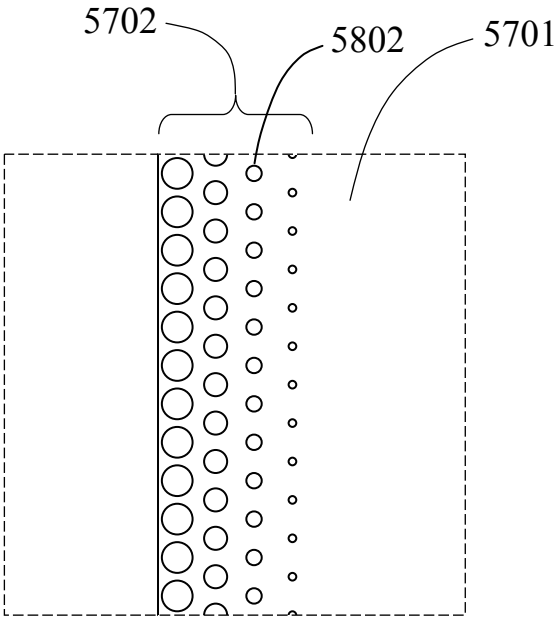


FIG. 58B

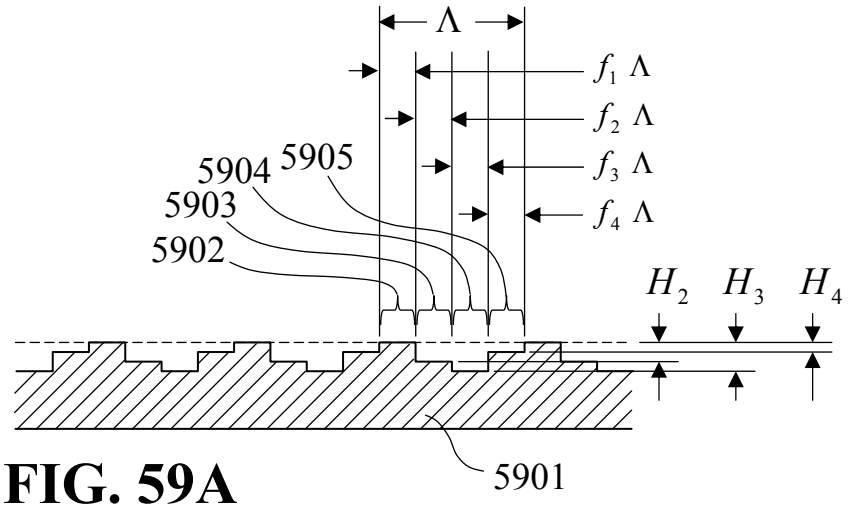


FIG. 59A

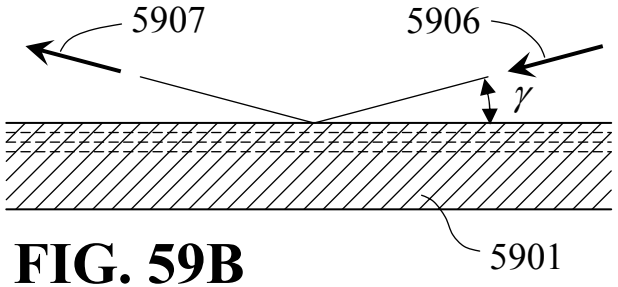


FIG. 59B

Eq. **6001**	$\gamma = 15^\circ$
Eq. **6002**	$\lambda_{\text{design}} = 11\,\text{nm}$
Eq. **6003**	$\Lambda = 1.5\,\mu\text{m}$
Eq. **6004**	$h = \dfrac{\lambda_{\text{design}}}{2\sin\gamma} = 21.25\,\text{nm}$
Eq. **6005**	$H_j = m_j\ h$
Eq's. **6006**	$m_1 = 0, \quad m_2 = 8, \quad m_3 = 12, \quad m_4 = 4$
Eq's. **6007**	$f_1 = f_2 = f_3 = f_4 = 0.25$
Eq. **6008**	$R_{\text{rel}} = \dfrac{R_{\text{grating}}}{R_{\text{flat}}} \cong \left\lvert \sum_j f_j \exp[i\,2\pi\ m_j\ \lambda_{\text{design}} / \lambda] \right\rvert^2$

FIG. 60

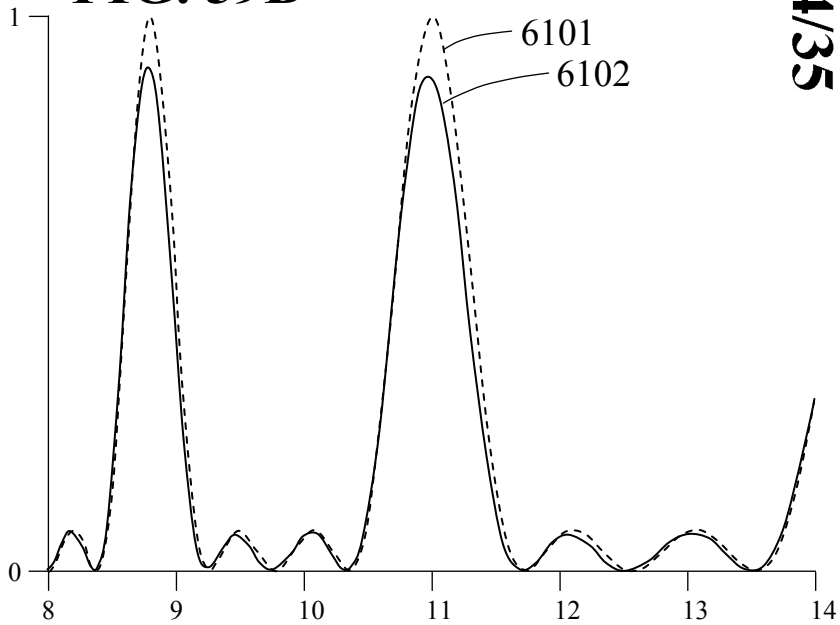


FIG. 61

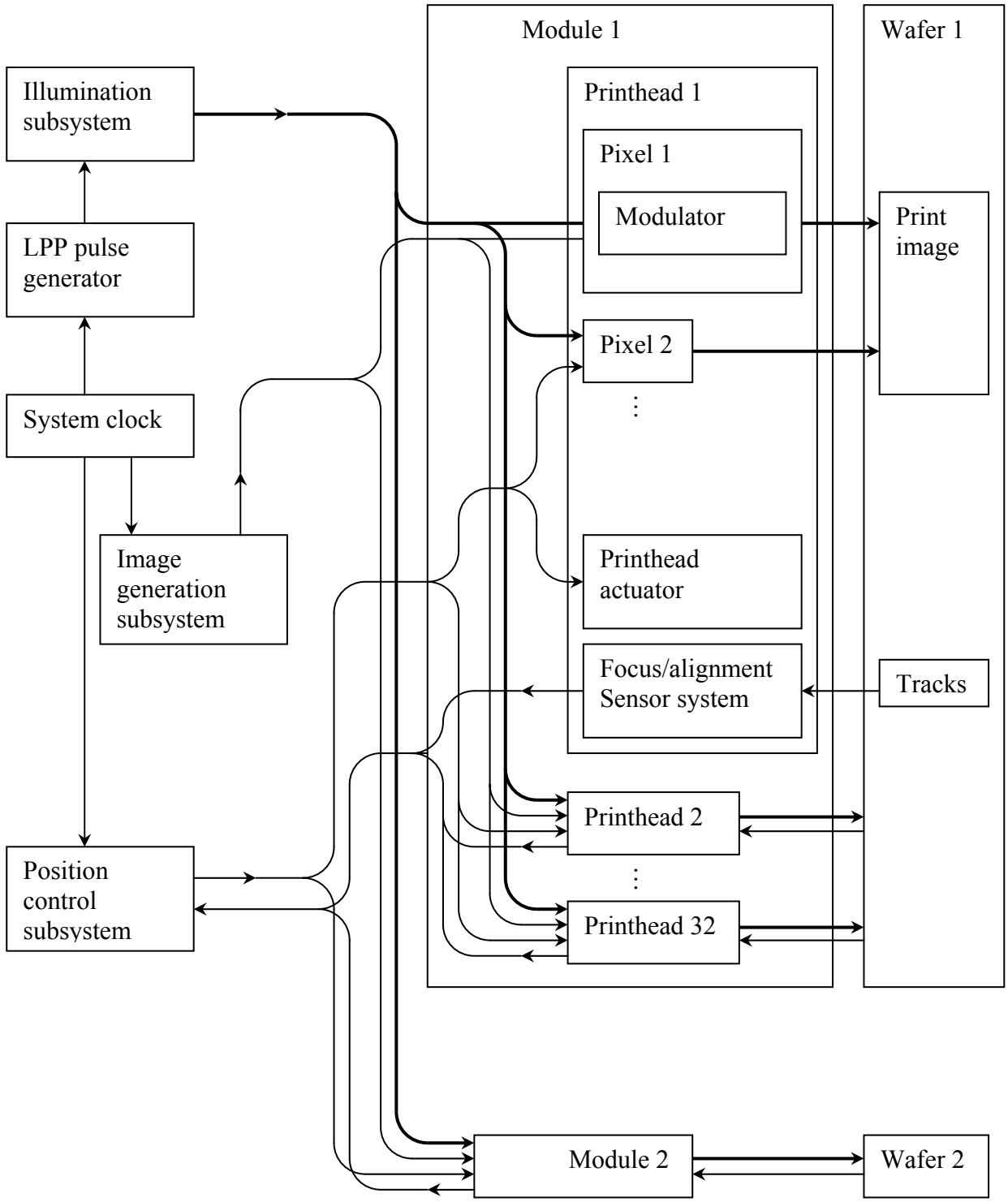

Module 1
Wafer 1
Illumination subsystem
Printhead 1
Pixel 1
Modulator
Print image
LPP pulse generator
Pixel 2
System clock
Image generation subsystem
Printhead actuator
Focus/alignment Sensor system
Tracks
Printhead 2
Position control subsystem
Printhead 32
Module 2
Wafer 2

FIG. 62