

**Double patterning technology (DPT) for $k_1 < 0.25$:
CLN Method example**

- Target CD 32nm half pitch using NA 0.93 $\rightarrow k_1 = 0.154$

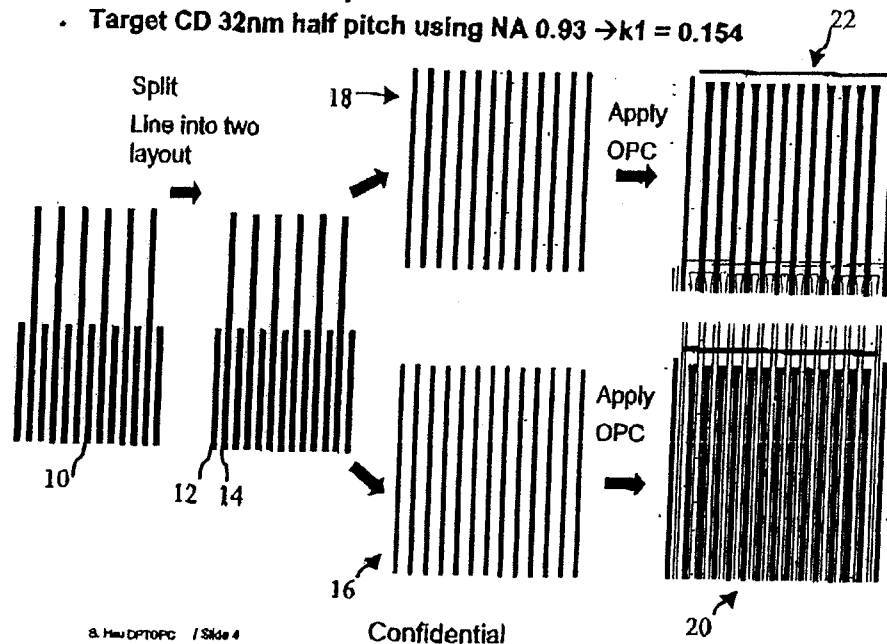


FIG. 1

CLN Method (cont.)

- Target CD 32nm half pitch using NA 0.93 $\rightarrow k_1 = 0.154$

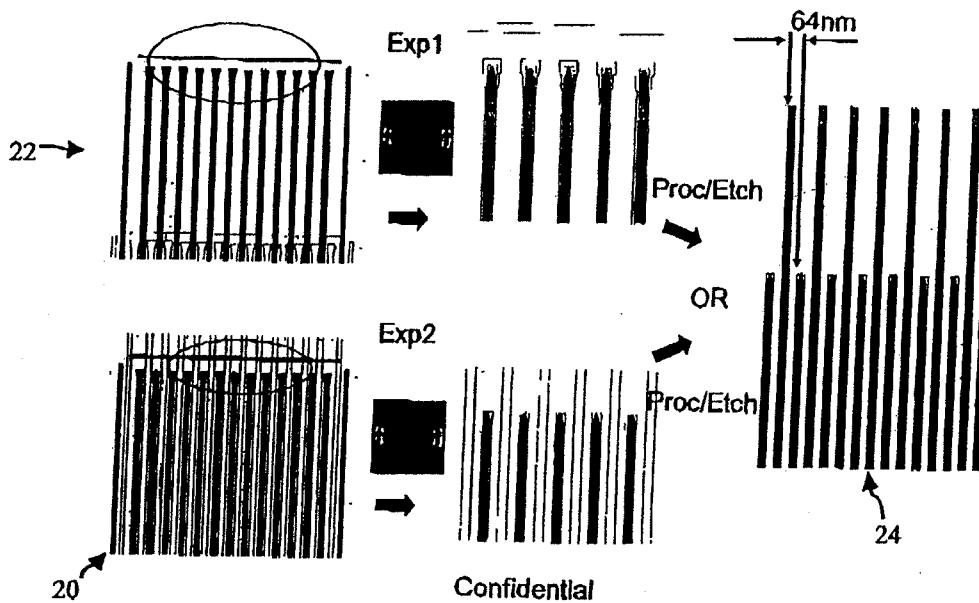


FIG. 2

DEL CLN imaging

- After double exposures the average intensity modulation is flat
- The final print image is the 'OR' of each exposure
- Needs materials/processing to preserve the images for each exposure

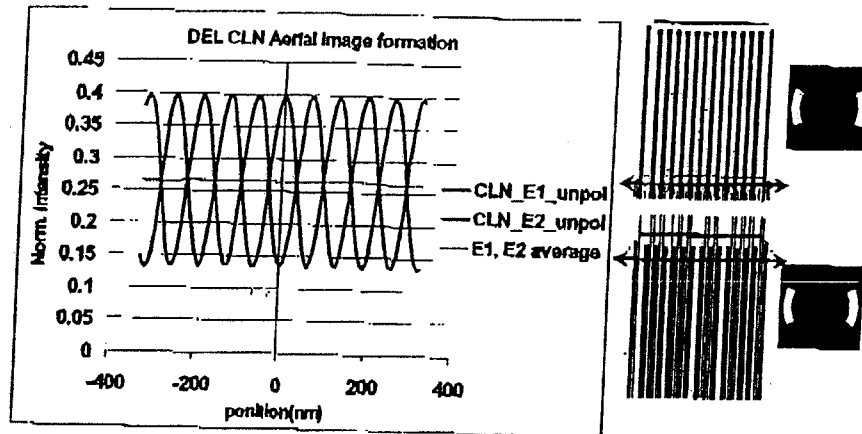


FIG. 3

Pattern split impact on patterning

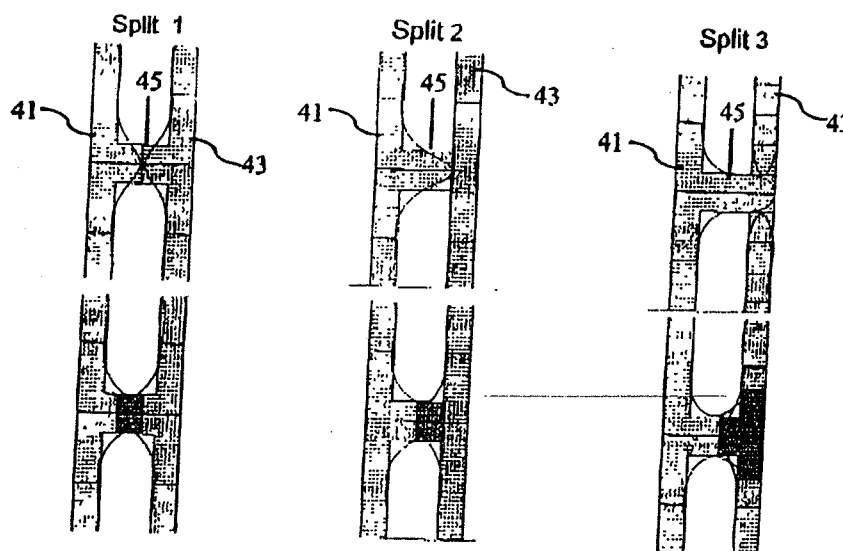


FIG. 4

- Using ArF for print feature one fifth of the wavelength have very strong proximity effect

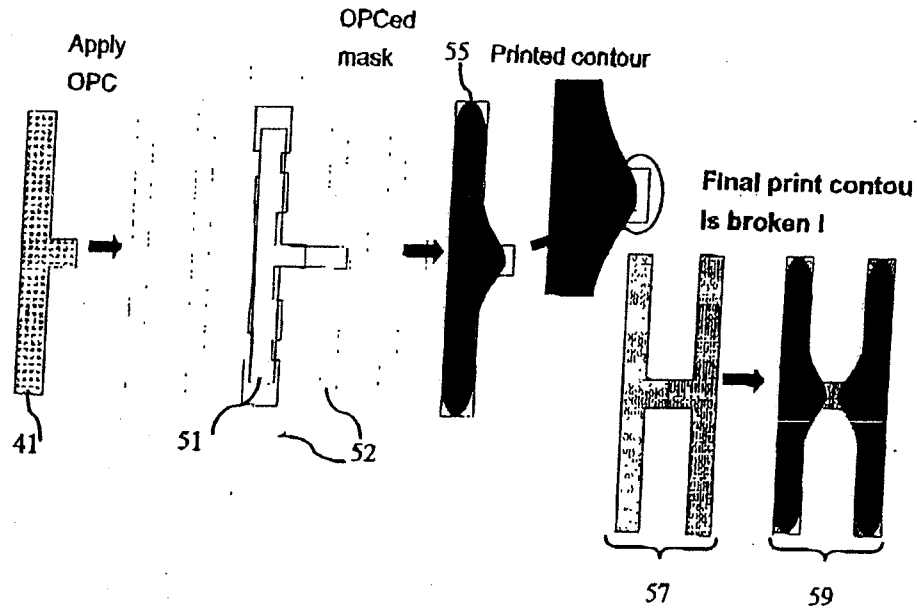


FIG. 5

Method for DPT OPC

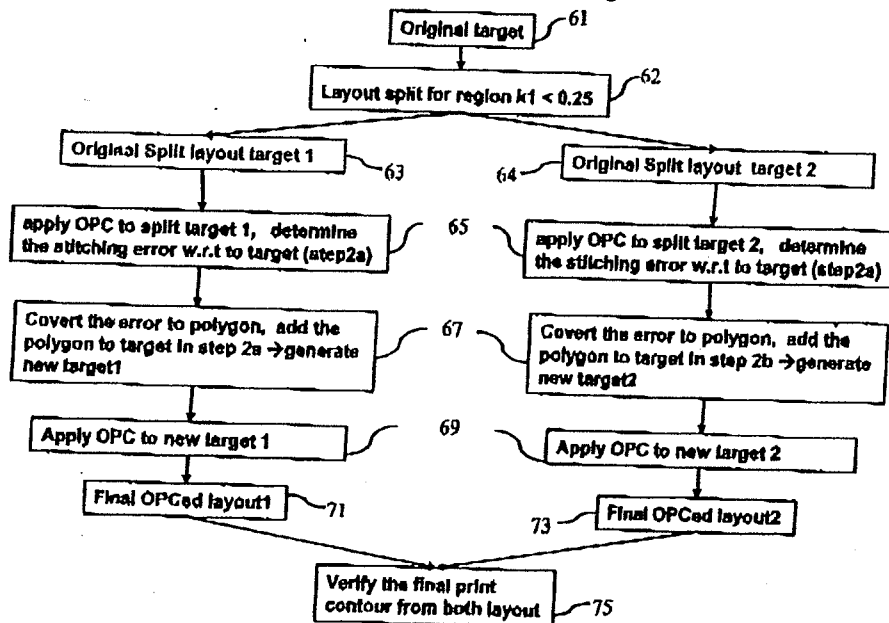


FIG. 6

Method for DPT OPC

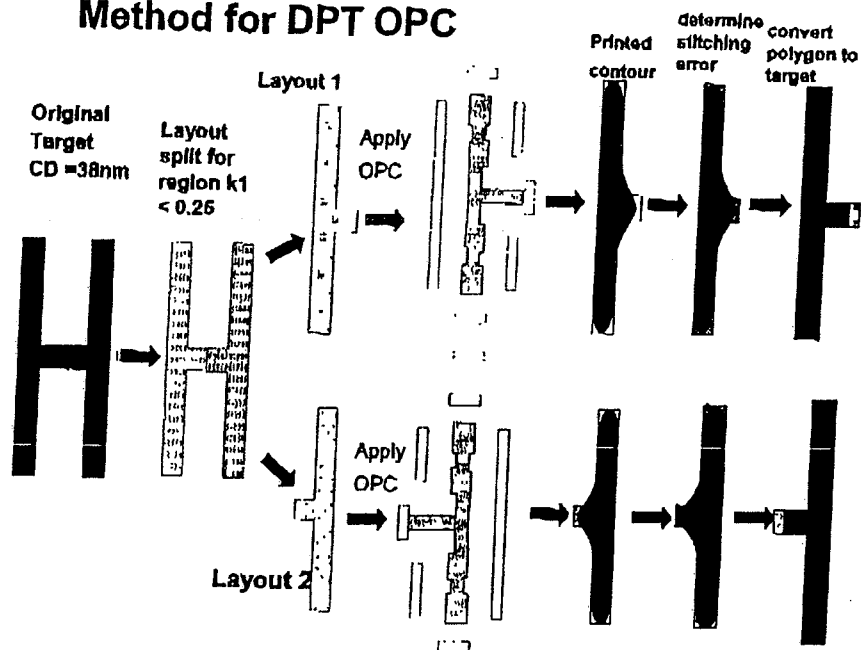


FIG. 7

Method for DPT OPC

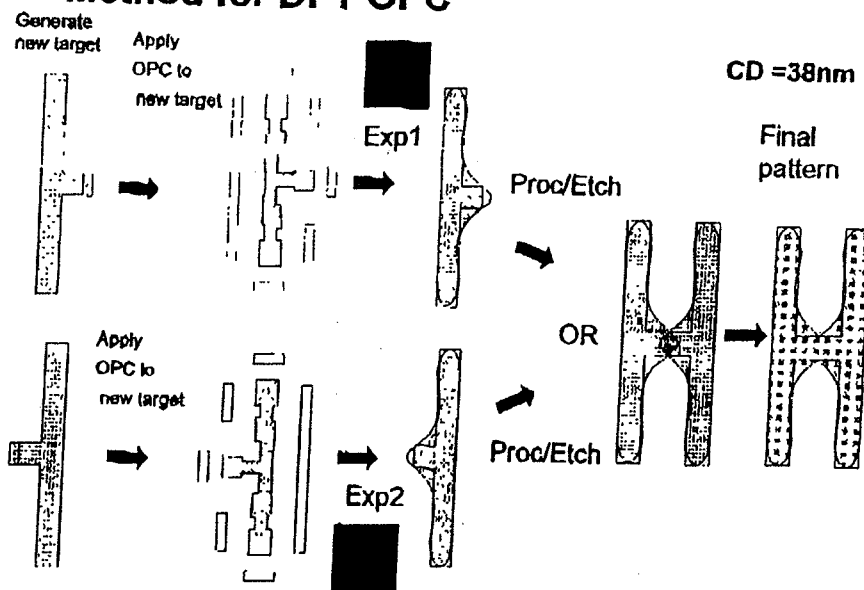


FIG. 8

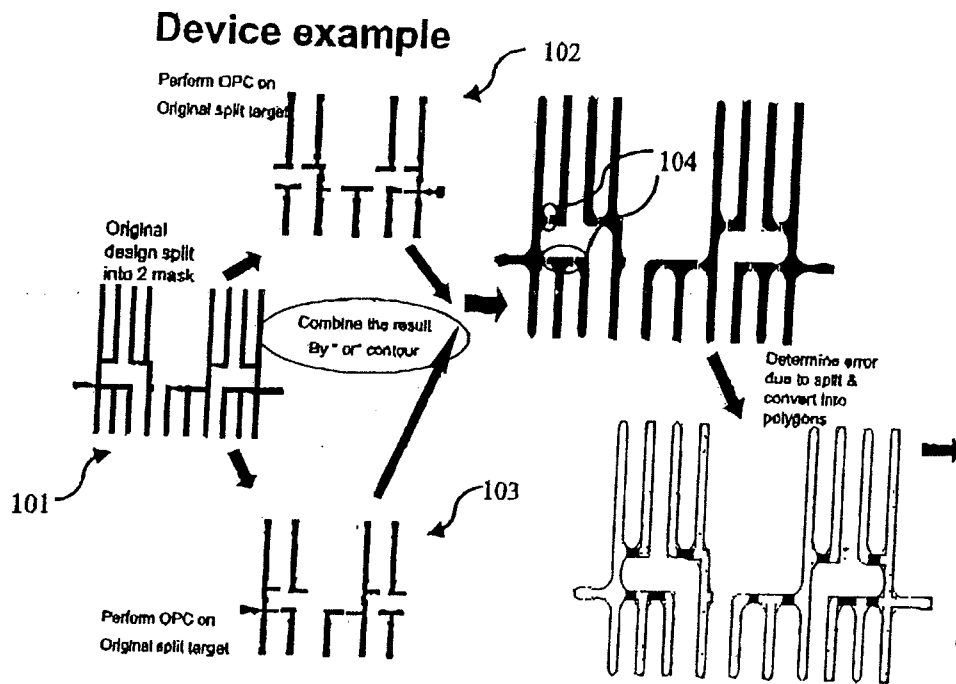


FIG. 9

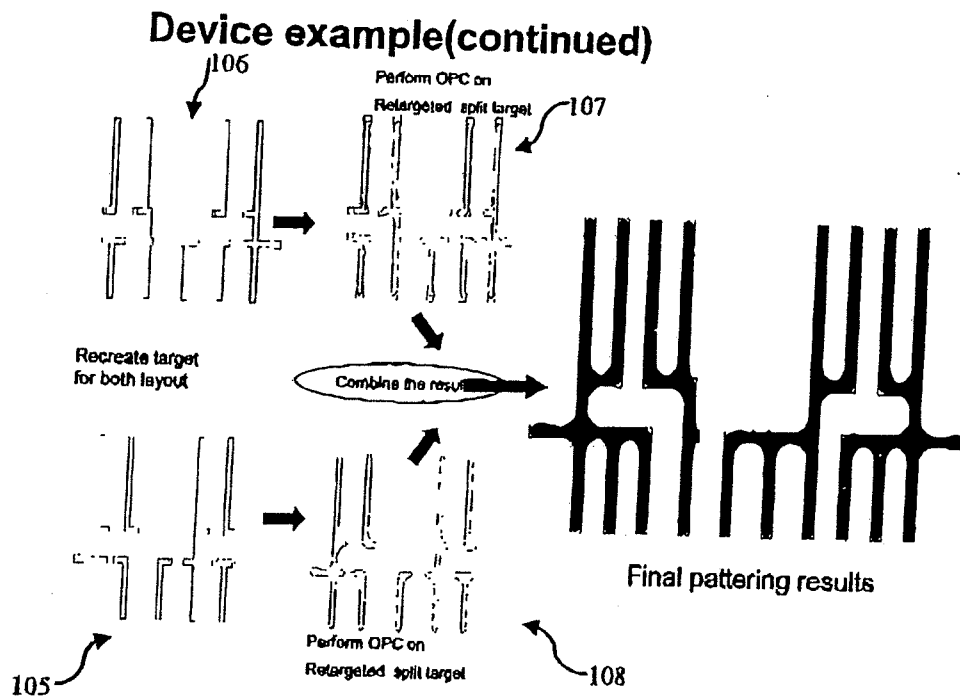


FIG. 10

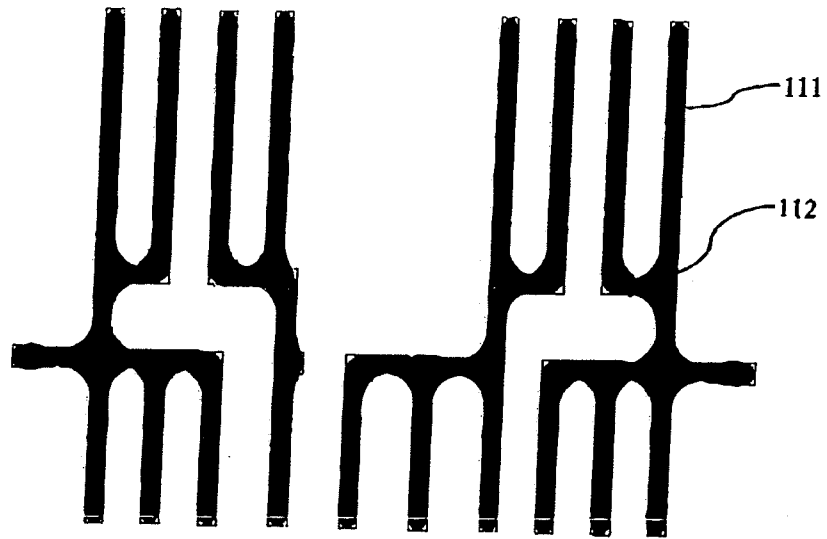


FIG. 11

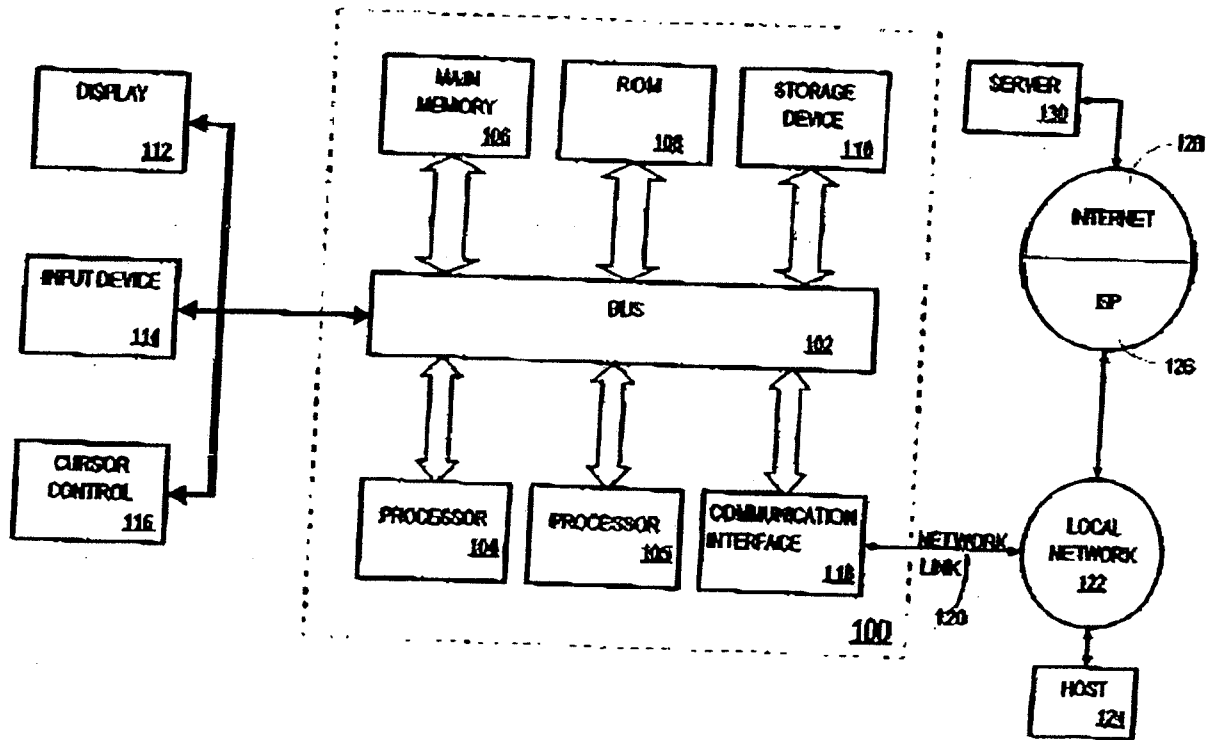


FIG. 12

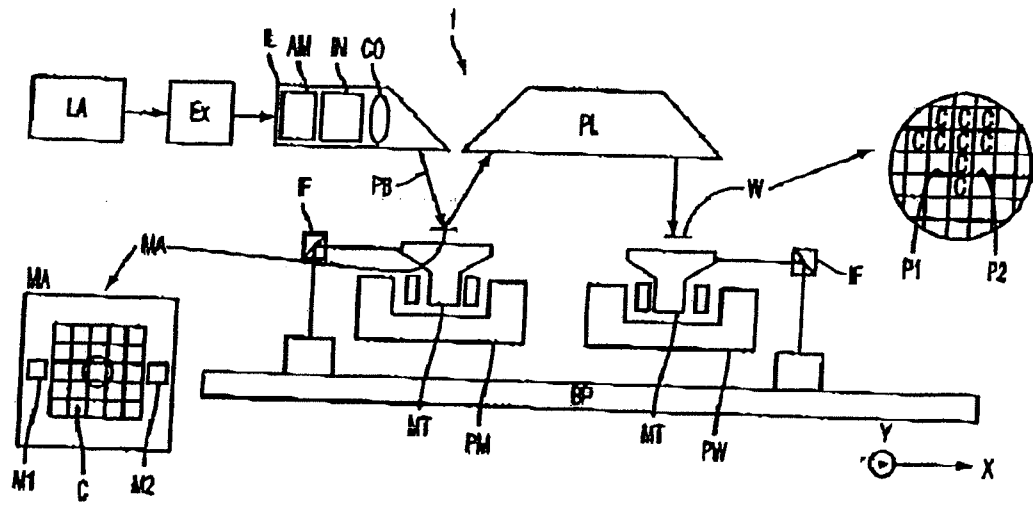


FIG. 13