

United States Patent [19]

[11] Patent Number: **5,533,634**

Pan et al.

[45] Date of Patent: **Jul. 9, 1996**

[54] **QUANTUM CHROMELESS LITHOGRAPHY**

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[21] Appl. No.: **299,458**

[22] Filed: **Sep. 1, 1994**

[51] Int. Cl.⁶ **B44C 1/22**

[52] U.S. Cl. **216/12; 216/24; 216/67**

[58] Field of Search 216/11, 12, 24,
216/45, 67; 156/643.1, 657.1, 659.11, 345;
430/5, 323

OTHER PUBLICATIONS

"Lithography's Leading Edge—Part I: Phase-Shift Technology" pub. in Semiconductor International Feb. 1992 pp. 42-47.

Primary Examiner—William Powell

Attorney, Agent, or Firm—George O. Saile; Larry J. Prescott

[57] ABSTRACT

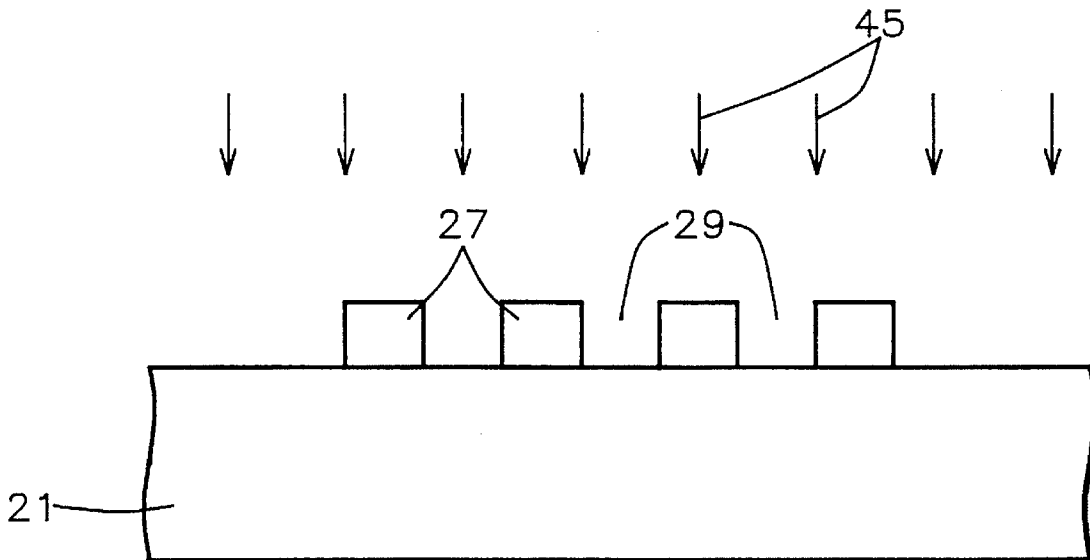
This invention describes the use and method of fabrication of a chromeless quantum phase shift mask and of a chromeless quantum phase shift build-on blank. The build-on blank can be readily inspected, stored for future use, and completed with a feature pattern when needed. The quantum phase shift mask provides improved image resolution and depth of focus tolerance. The quantum phase shift mask requires little or no CAD, or computer aided design, modification over that used for conventional masks.

[56] References Cited

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28 Claims, 7 Drawing Sheets



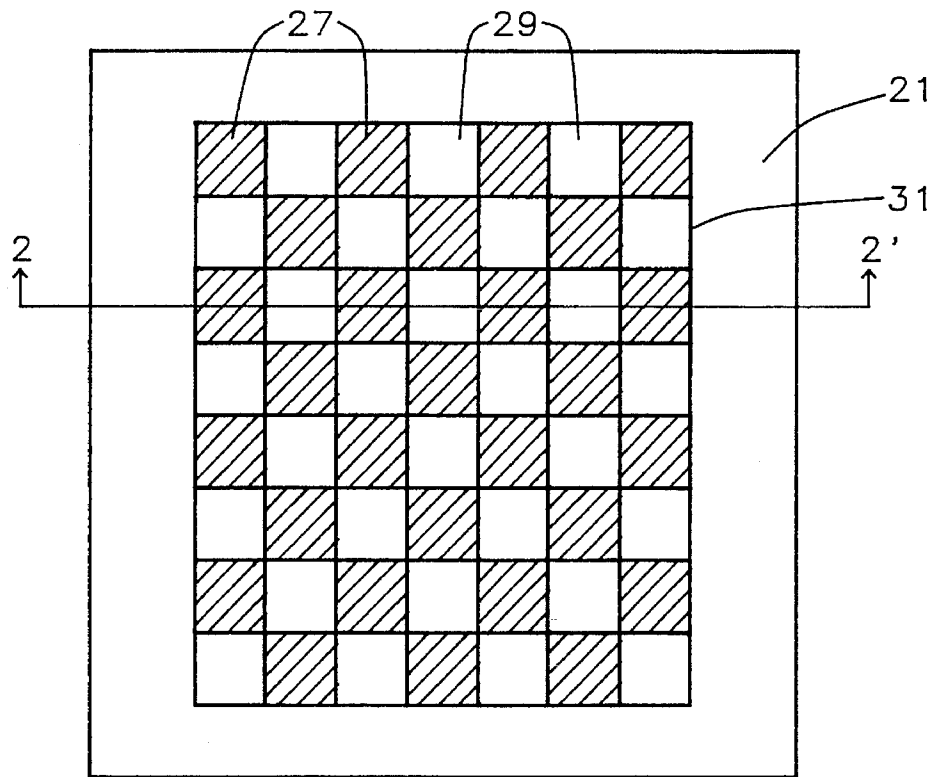


FIG. 1

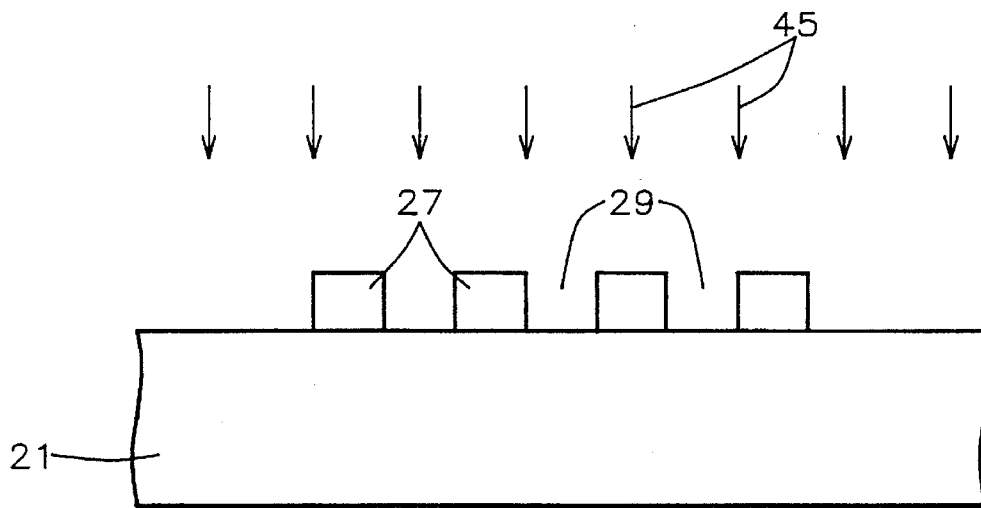


FIG. 2

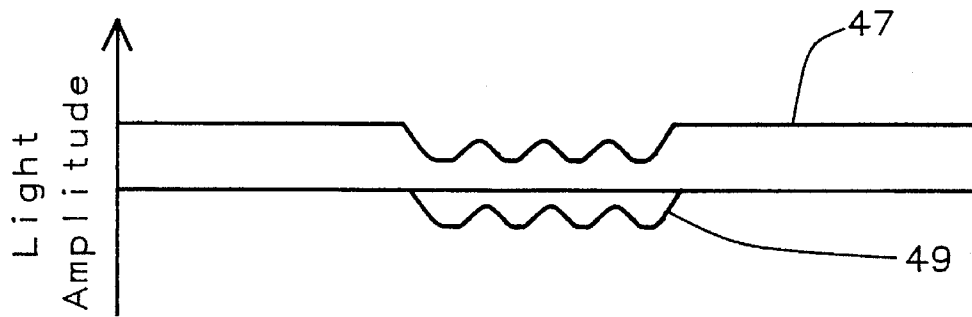


FIG. 3

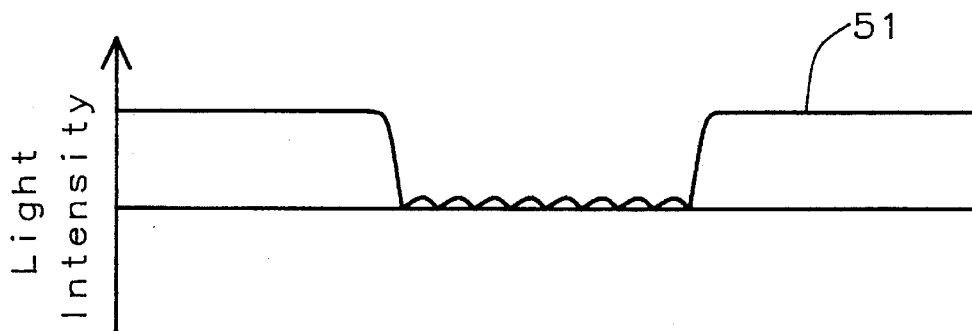


FIG. 4

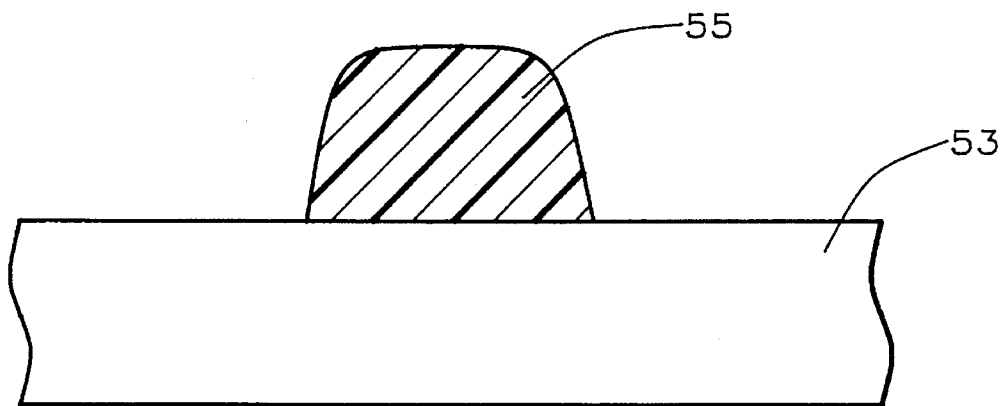


FIG. 5

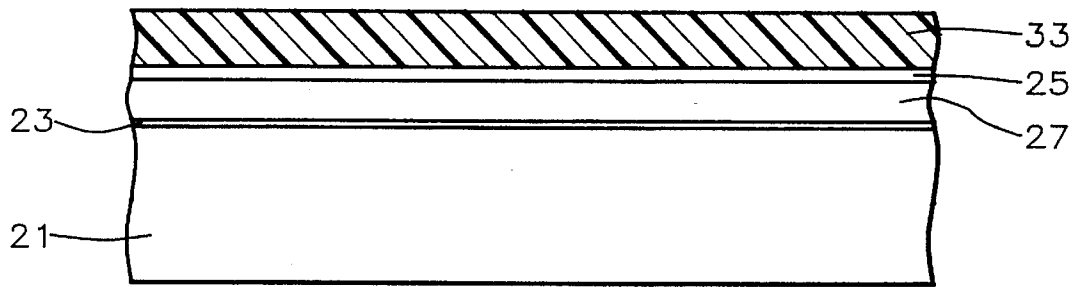


FIG. 6

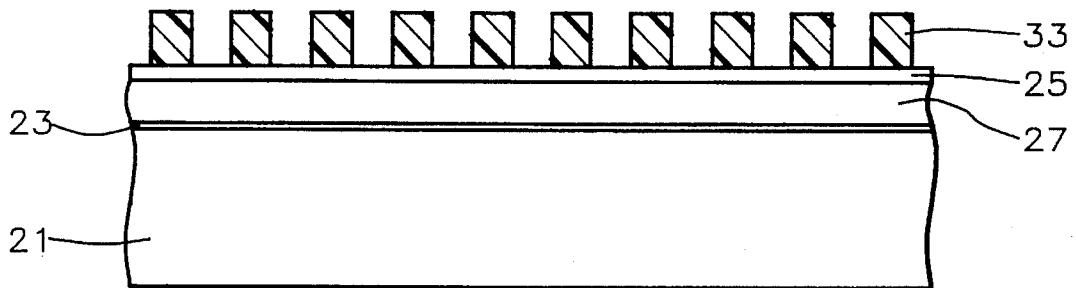


FIG. 7

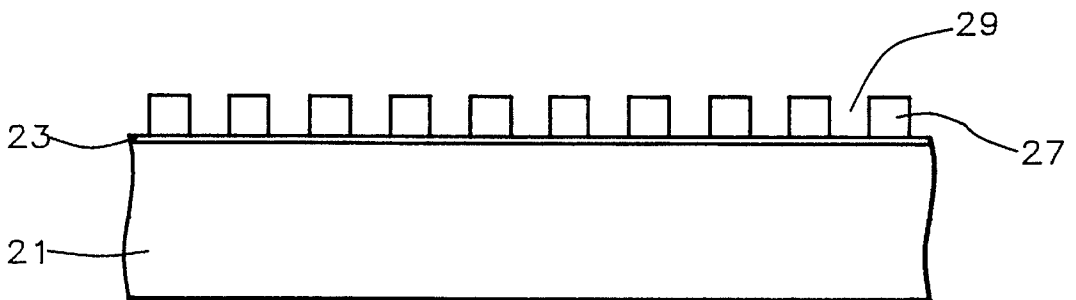


FIG. 8

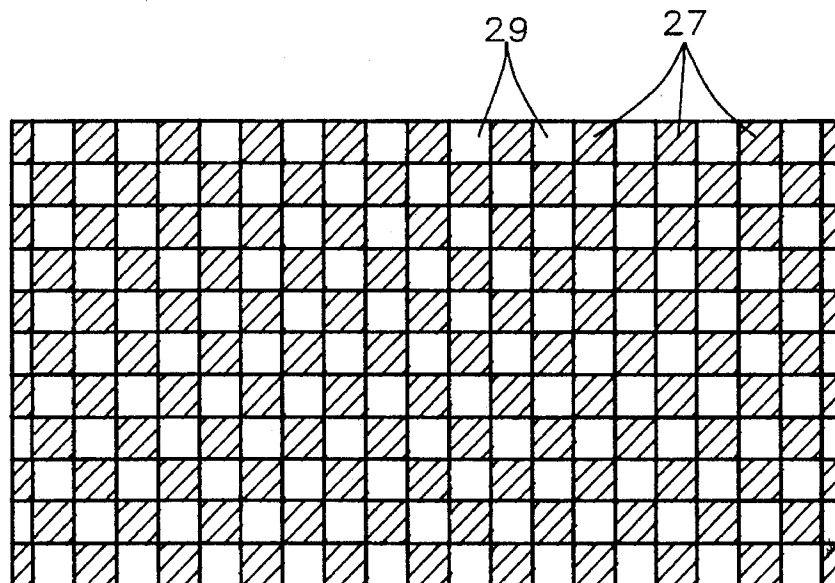


FIG. 9

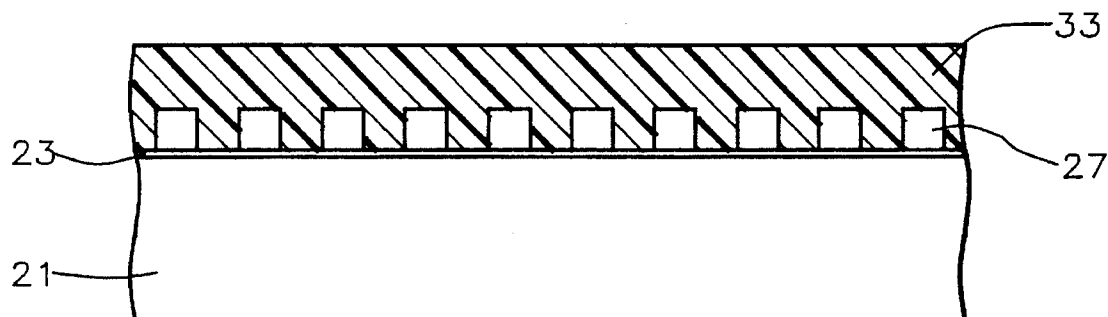


FIG. 10

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