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- (54) **DYNAMIC FOCUSING CONFOCAL OPTICAL SCANNING SYSTEM**
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(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

- 5,760,901 A * 6/1998 Hill G02B 21/004
356/450
- 6,185,030 B1 * 2/2001 Overbeck B01L 3/0241
250/586

(Continued)

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(57) **ABSTRACT**

An optical scanning system adapted to scan a sample on a chip is provided. The optical scanning system includes at least one optical scanning head, at least one scanning light source, a light receiving device and a processor. Each of at least one optical scanning head includes a focusing light source, a first optical guiding structure, and a control unit. The first optical guiding structure is configured to guide the focusing light emitted from the focusing light source to travel to the sample, and the first optical guiding structure is configured to guide the at least one scanning light emitted from the at least one scanning light source to the sample to generate a secondary light. The control unit is configured to control the first optical guiding structure to keep the focusing light and at least one scanning light focusing on a surface of the chip. The light receiving device receives the secondary light and generates a scanning electronic signal. The processor is electrically coupled to the light receiving device to dispose the scanning electronic signal.

15 Claims, 9 Drawing Sheets

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