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(54) **MINIATURE TELEPHOTO LENS ASSEMBLY**

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(51) **Int. Cl.**  
**G02B 13/00** (2006.01)  
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(58) **Field of Classification Search**

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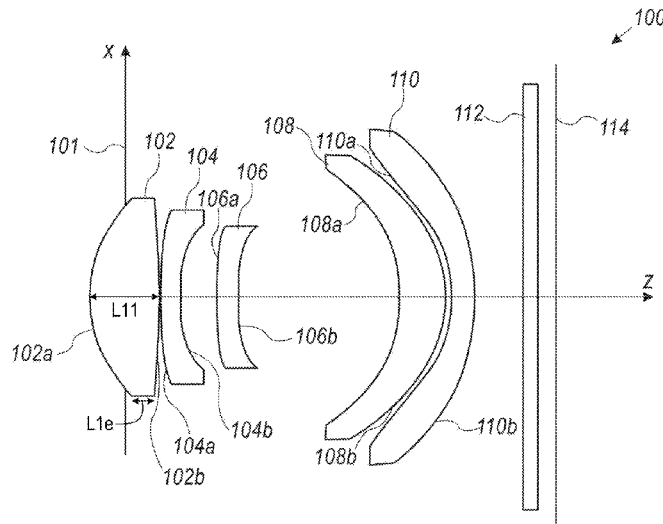
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(57) **ABSTRACT**

An optical lens assembly includes five lens elements and provides a TTL/EFL<1.0. In an embodiment, the focal length of the first lens element  $f_1 < TTL/2$ , an air gap between first and second lens elements is smaller than half the second lens element thickness, an air gap between the third and fourth lens elements is greater than  $TTL/5$  and an air gap between the fourth and fifth lens elements is smaller than about 1.5 times the fifth lens element thickness. All lens elements may be aspheric.

**24 Claims, 6 Drawing Sheets**



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**G02B 9/00** (2006.01)  
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- (52) **U.S. Cl.**  
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 See application file for complete search history.

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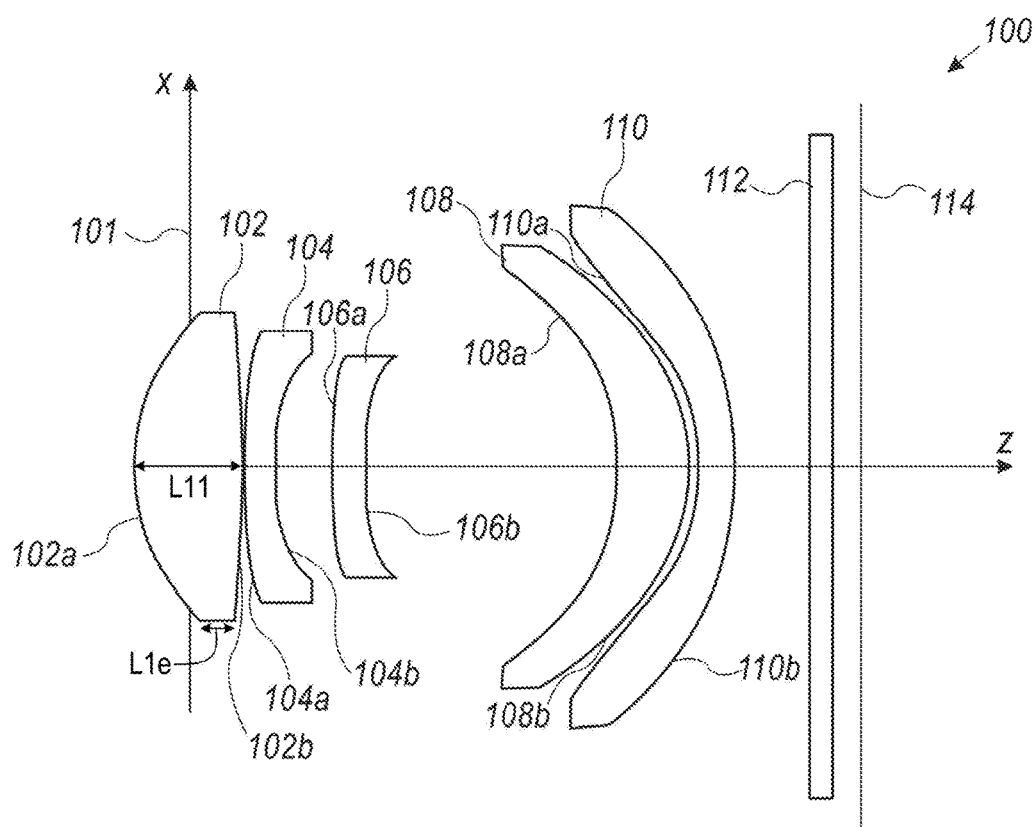
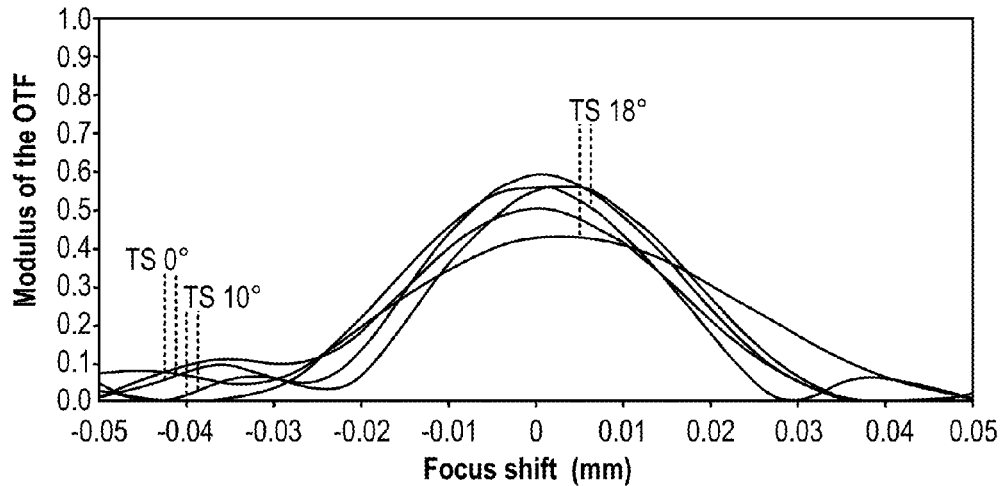
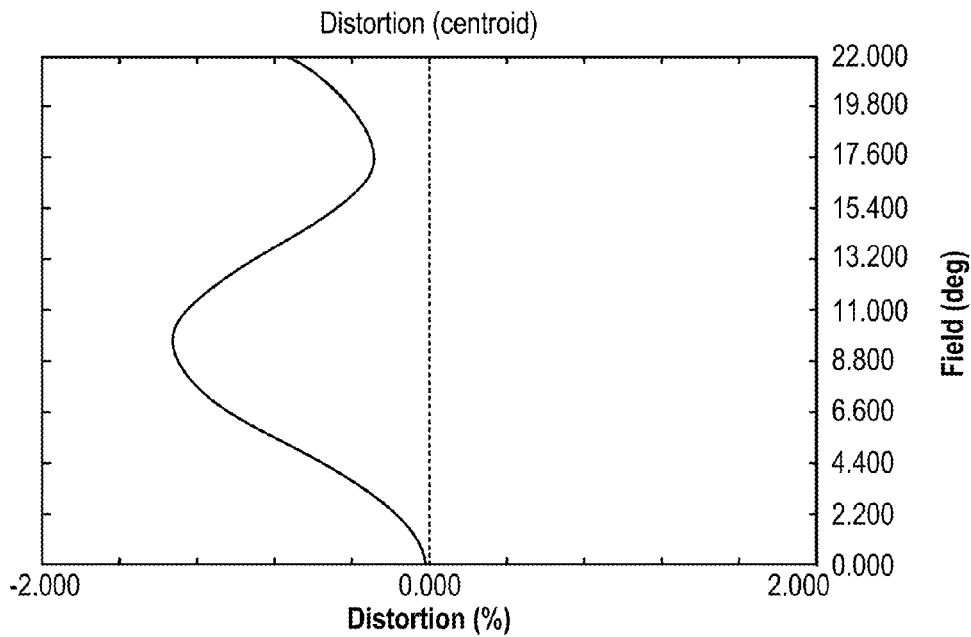


FIG. 1A



Polychromatic Diffraction Through Focus MTF  
Angle 6/2/2013  
Data for 0.4350 to 0.6560  $\mu\text{m}$ .  
Spatial Frequency: 180.0000 cycles/mm.

FIG. 1B



30/06/2013  
Maximum distortion = 1.3%

FIG. 1C

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