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(12) **United States Patent**
Kubota et al.

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(54) **IMAGING LENS**

(56) **References Cited**

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U.S. PATENT DOCUMENTS

7,277,238 B2 10/2007 Noda
8,179,470 B2 * 5/2012 Chen et al. 348/335
2011/0115962 A1 5/2011 Chen et al.

FOREIGN PATENT DOCUMENTS

JP 2008-107616 A 5/2008
JP 2009-020182 1/2009

* cited by examiner

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 66 days.

(21) Appl. No.: **13/206,136**

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(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Aug. 23, 2010 (JP) 2010-185703

(51) **Int. Cl.**

H04N 5/225 (2006.01)
G02B 3/02 (2006.01)
G02B 9/34 (2006.01)

(52) **U.S. Cl.**

USPC **348/340**; 359/715; 359/772

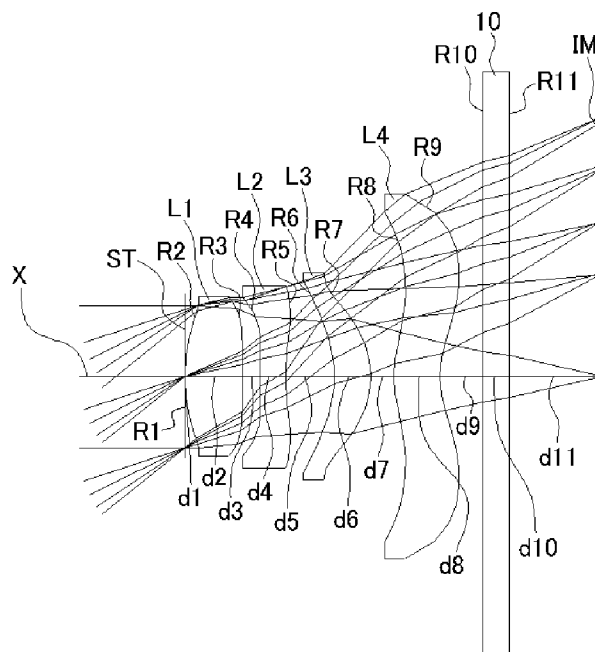
(58) **Field of Classification Search**

USPC 348/340; 359/715, 772, 773, 774
See application file for complete search history.

(57) **ABSTRACT**

An imaging lens includes an aperture stop ST, a first lens L1 that is shaped to form a meniscus lens that directs a convex surface to the object side near an optical axis and has positive refractive power, a second lens L2 that is shaped to form a meniscus lens that directs a convex surface to the object side near the optical axis and has negative refractive power, a third lens L3 that is shaped to form a meniscus lens that directs a concave surface to the object side near the optical axis and has positive refractive power, and a fourth lens L4 that is shaped to form a meniscus lens that directs a convex surface to the object side near the optical axis, arranged in this order from an object side to an image side. When the first lens L1 has a focal length f1 and the second lens L2 has a focal length f2, the imaging lens is configured such that a relationship $0.3 < |f1/f2| < 0.7$ is satisfied.

18 Claims, 18 Drawing Sheets



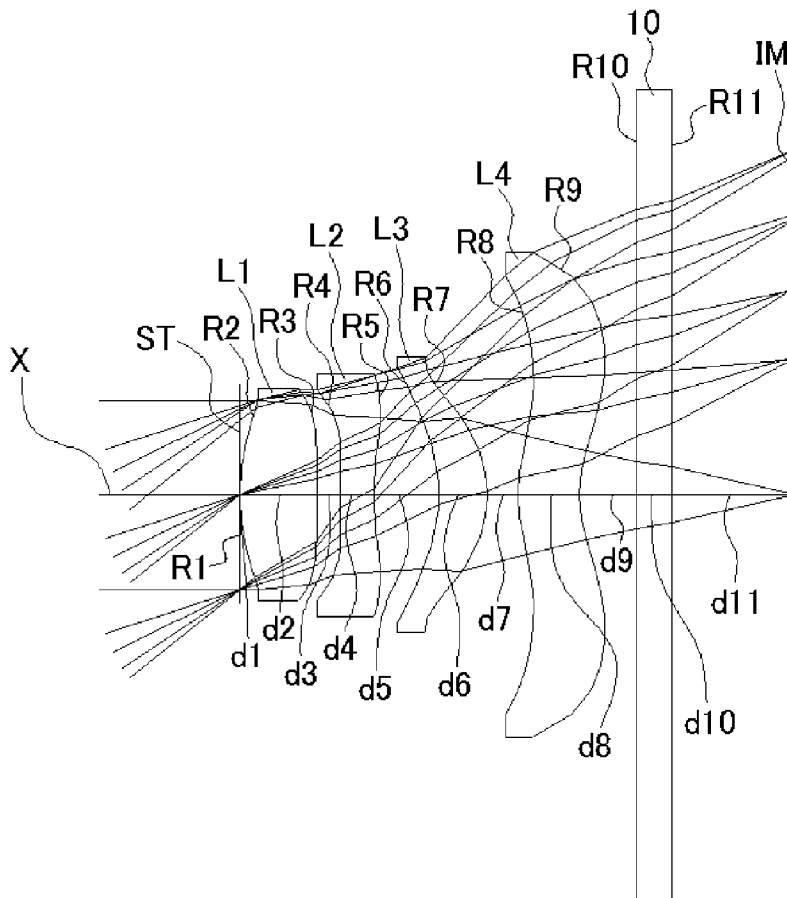


FIG. 1

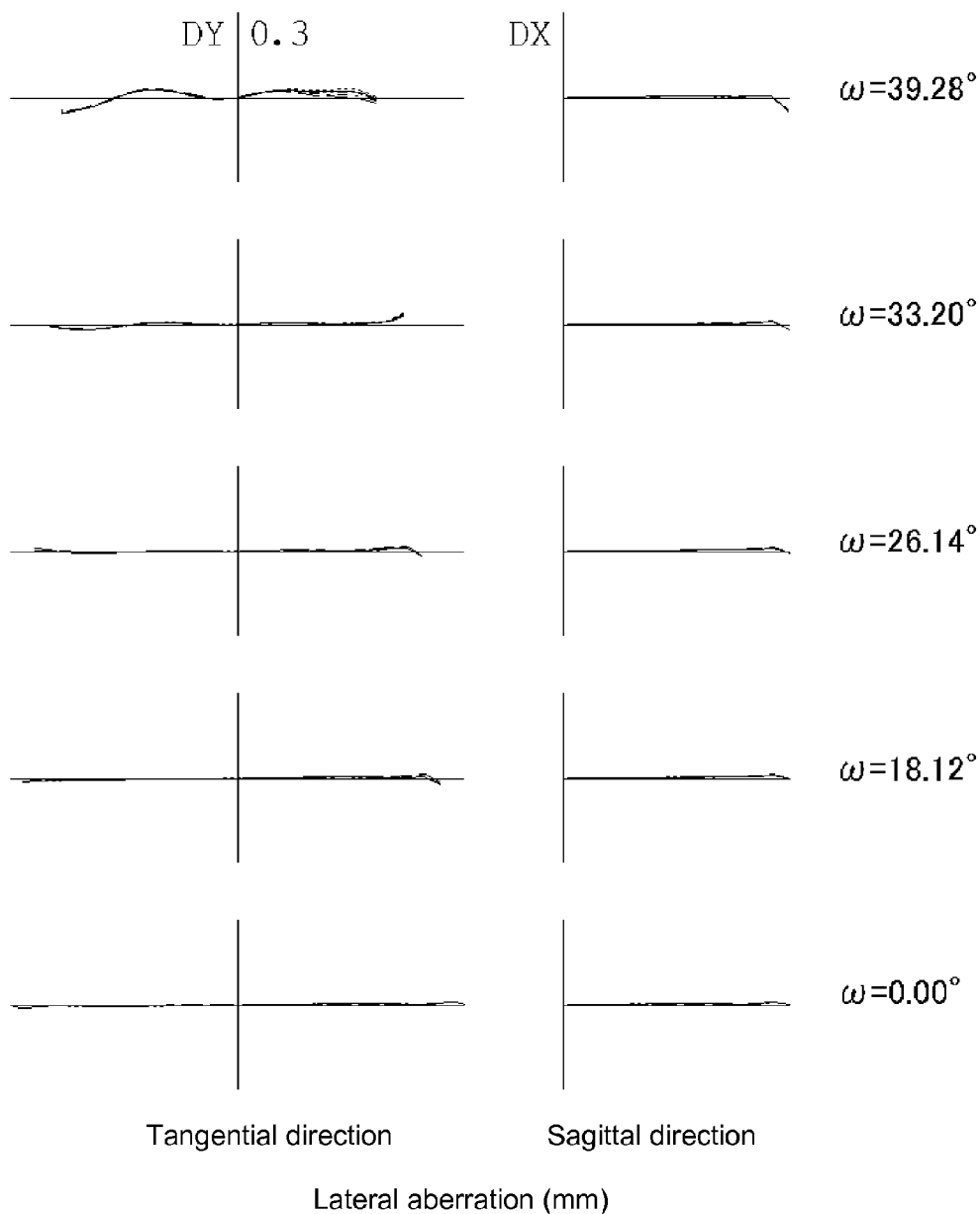


FIG. 2

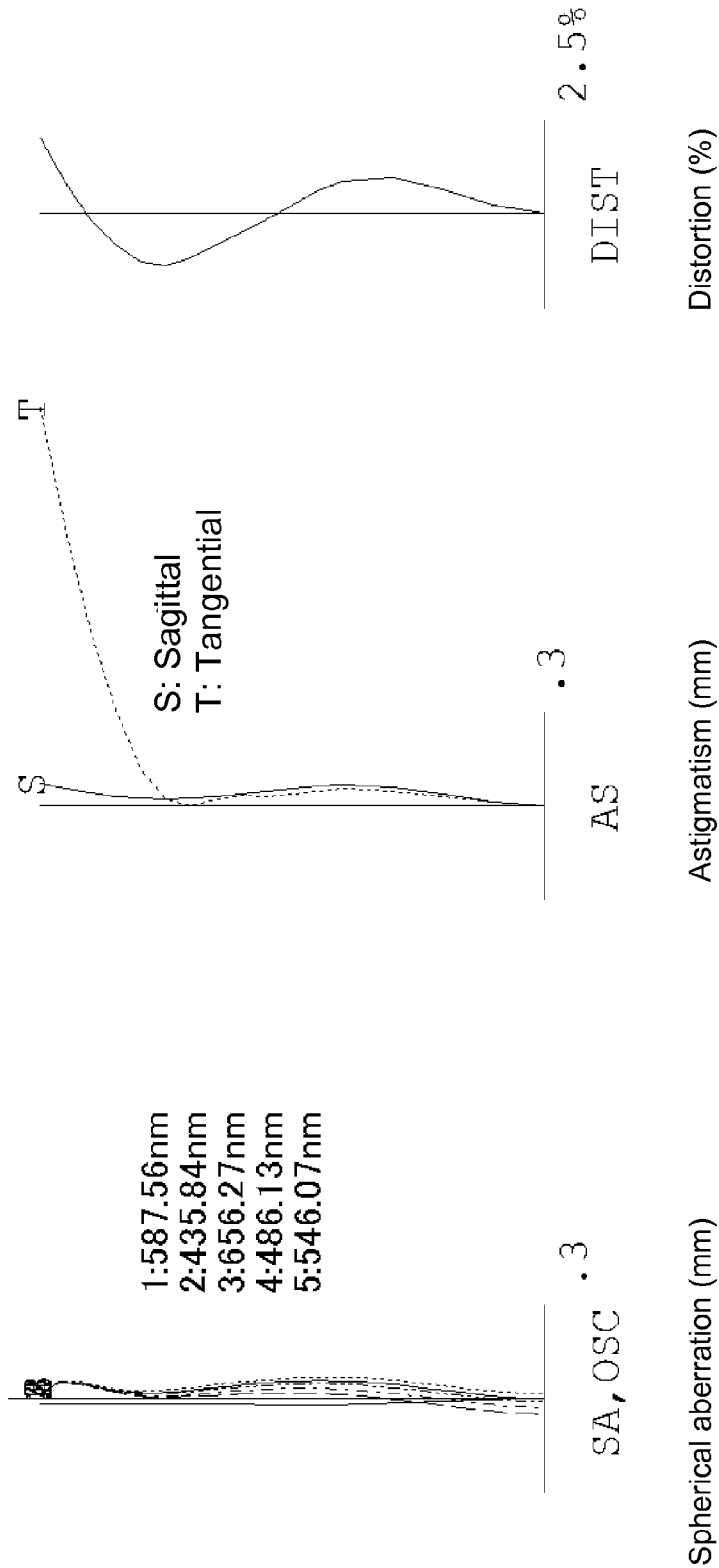


FIG. 3

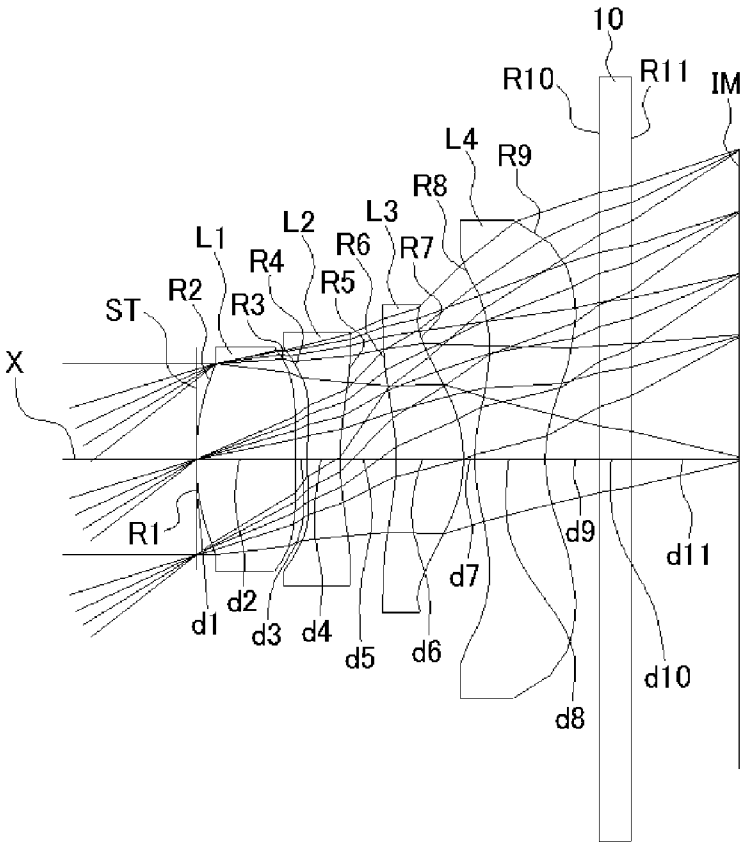


FIG. 4

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