



US009678310B2

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

(10) **Patent No.:** **US 9,678,310 B2**
(45) **Date of Patent:** **Jun. 13, 2017**

(54) **IMAGING LENS AND IMAGING APPARATUS EQUIPPED WITH THE IMAGING LENS**

(56) **References Cited**

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(71) Applicant: **FUJIFILM Corporation**, Tokyo (JP)

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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 0 days.

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(21) Appl. No.: **14/857,756**

“International Preliminary Report on Patentability” of PCT/JP2013/007642, mailed on Sep. 8, 2014, with partial English translation thereof, p. 1-p. 6, in which seven of the listed references (JP2008-176185, JP64-057221, JP10-020193, JP58-156916, U.S. Pat. No. 4,488,788, JP03-265809 and JP2004-029474) were cited.

(22) Filed: **Sep. 17, 2015**

(65) **Prior Publication Data**

US 2016/0004047 A1 Jan. 7, 2016

(Continued)

Related U.S. Application Data

Primary Examiner — Evelyn A Lester

(63) Continuation of application No. PCT/JP2013/007642, filed on Dec. 26, 2013.

(74) *Attorney, Agent, or Firm* — Jianq Chyun IP Office

(30) **Foreign Application Priority Data**

Mar. 25, 2013 (JP) 2013-061647

(57) **ABSTRACT**

(51) **Int. Cl.**

G02B 13/18 (2006.01)
G02B 9/64 (2006.01)

An imaging lens is constituted essentially by four or more lenses, including, in order from the object side to the image side: a first lens having a positive refractive power; a second lens having a negative refractive power; and a plurality of other lenses. The conditional formulae below are satisfied.

(Continued)

$0.8 < TL/f < 1.0$ (1)

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

CPC **G02B 13/0045** (2013.01); **G02B 5/005** (2013.01); **G02B 9/34** (2013.01);

$1.0 < f/ff < 3.0$ (2)

(Continued)

$2.03 \text{ mm} < f < 5.16 \text{ mm}$ (3)

(58) **Field of Classification Search**

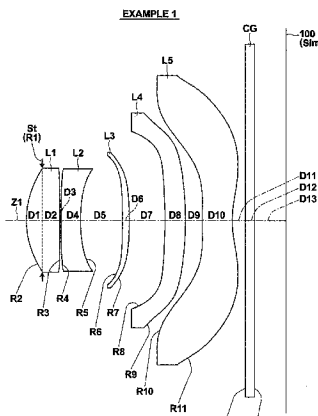
CPC .. G02B 13/0045; G02B 9/60; G02B 27/0025; G02B 13/18; G02B 5/005; G02B 13/002; G02B 13/004; G02B 9/34

$1.0 \text{ mm} < fl < 3.0 \text{ mm}$ (4)

(Continued)

wherein f is the focal length of the entire lens system, fl is the focal length of the first lens, TL is the distance along the optical axis from the surface of the first lens toward the object side to the paraxial focal point

(Continued)



position at the image side in the case that the portion corresponding to back focus is an air converted length.

17 Claims, 10 Drawing Sheets

- (51) **Int. Cl.**
G02B 13/00 (2006.01)
G02B 9/34 (2006.01)
G02B 9/60 (2006.01)
G02B 9/62 (2006.01)
G02B 5/00 (2006.01)
G02B 27/00 (2006.01)

- (52) **U.S. Cl.**
 CPC *G02B 9/60* (2013.01); *G02B 9/62* (2013.01); *G02B 13/004* (2013.01); *G02B 27/0025* (2013.01); *G02B 13/002* (2013.01); *G02B 13/18* (2013.01)

- (58) **Field of Classification Search**
 USPC 359/714, 715, 739, 740, 763, 764, 773
 See application file for complete search history.

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FIG. 1

EXAMPLE 1

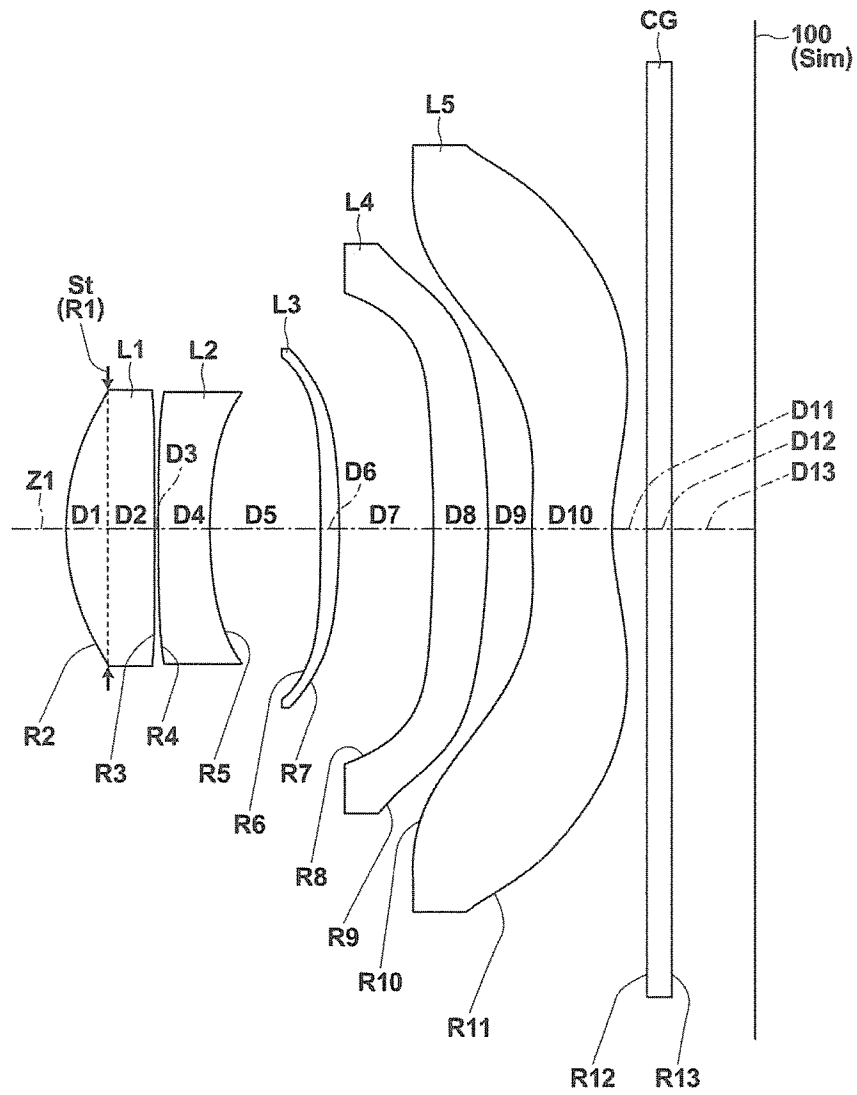


FIG.2

EXAMPLE 2

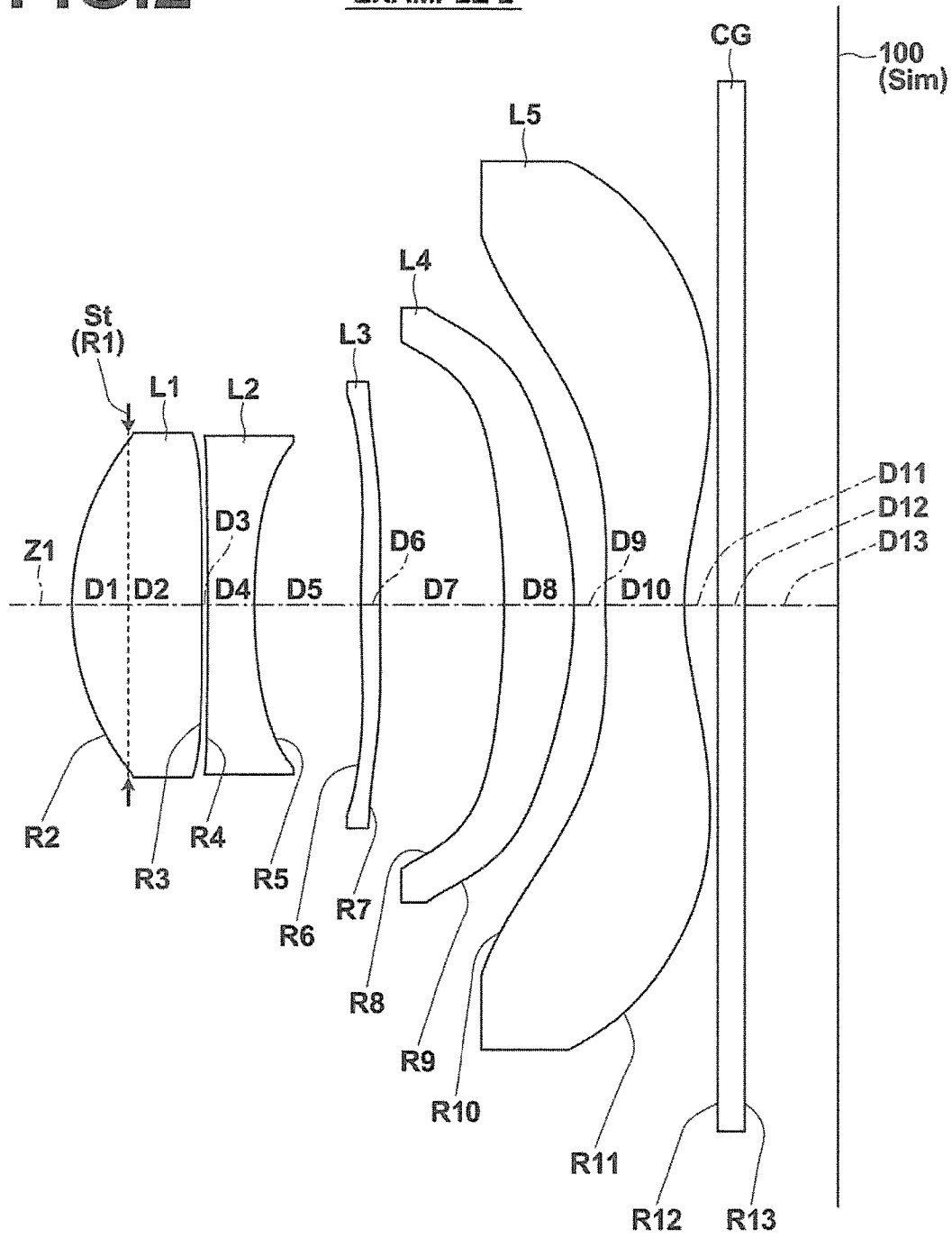
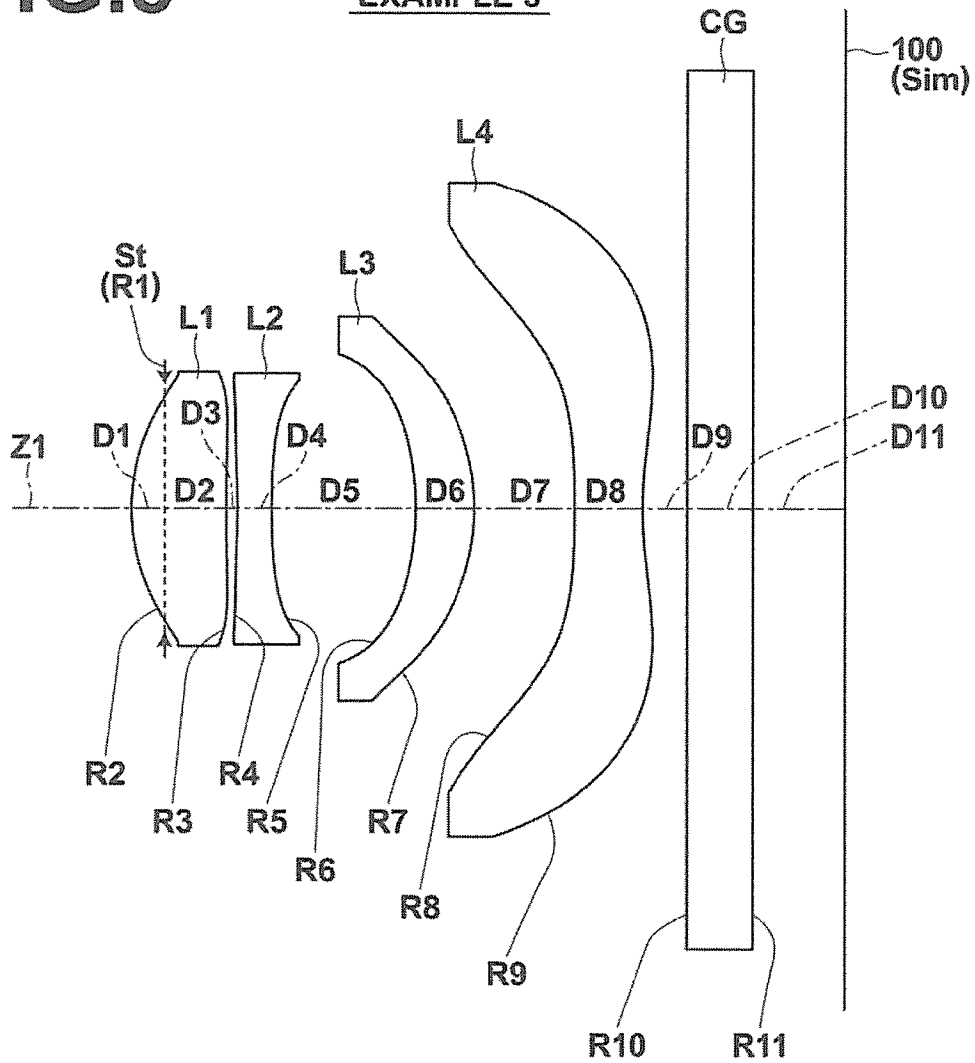


FIG. 3

EXAMPLE 3



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