

US009864171B2

(12) United States Patent Hsieh et al.

(10) Patent No.: US 9,864,171 B2 (45) Date of Patent: Jan. 9, 2018

(54) OPTICAL PHOTOGRAPHING LENS ASSEMBLY, IMAGE CAPTURING DEVICE AND ELECTRONIC DEVICE

(71) Applicant: LARGAN PRECISION CO., LTD.,

Taichung (TW)

(72) Inventors: **Dung-Yi Hsieh**, Taichung (TW);

Chun-Yen Chen, Taichung (TW); Chun-Che Hsueh, Taichung (TW); Hsin-Hsuan Huang, Taichung (TW)

(73) Assignee: LARGAN PRECISION CO., LTD.,

Taichung (TW)

(*) Notice: Subject to any disclaimer, the term of this

patent is extended or adjusted under 35 U.S.C. 154(b) by 315 days.

(21) Appl. No.: 14/834,629

(22) Filed: Aug. 25, 2015

(65) Prior Publication Data

US 2017/0023768 A1 Jan. 26, 2017

(30) Foreign Application Priority Data

Jul. 24, 2015 (TW) 104124080 A

(51) Int. Cl. G02B 13/00

G02B 13/00 (2006.01) **G02B 9/60** (2006.01)

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

CPC G02B 13/0045 (2013.01); G02B 9/60

(2013.01)

(58) Field of Classification Search

CPC G02B 13/00; G02B 13/0045; G02B 9/60; G02B 1/041

USPC 359/659, 708, 714, 745, 746, 753, 763, 359/764, 766

See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

1,697,670 A 1/1929 Wandersleb et al. 4,790,638 A 12/1988 Iwasaki et al. 5,841,587 A 11/1998 Moskovich 7,050,245 B2 5/2006 Tesar et al. 8,508,649 B2 8/2013 Reshidko et al. 2014/0204480 A1 (Continued)

FOREIGN PATENT DOCUMENTS

JP 1987-039811 A 2/1987 JP 1993-264899 A 10/1993 (Continued)

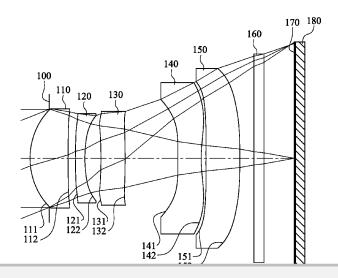
Primary Examiner — Ricky Mack Assistant Examiner — Gary O'Neill

(74) Attorney, Agent, or Firm — McClure, Qualey & Rodack, LLP

(57) ABSTRACT

An optical photographing lens assembly includes, in order from an object side to an image side, a first lens element, a second lens element, a third lens element, a fourth lens element and a fifth lens element. The first lens element with positive refractive power has an object-side surface being convex in a paraxial region thereof and an image-side surface being concave in a paraxial region thereof. The second lens element with negative refractive power has an image-side surface being concave in a paraxial region thereof. The third lens element has two surfaces being both aspheric. The fourth lens element with negative refractive power has an image-side surface being concave in a paraxial region thereof, wherein two surfaces thereof are aspheric. The fifth lens element has an image-side surface being convex in a paraxial region thereof, wherein two surfaces thereof are aspheric.

34 Claims, 27 Drawing Sheets





US 9,864,171 B2

Page 2

(56) References Cited

U.S. PATENT DOCUMENTS

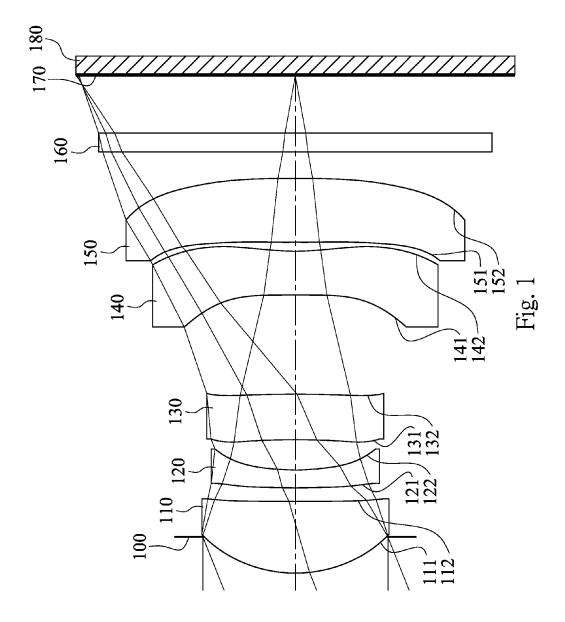
2015/0116569 A1 4/2015 Mercado

FOREIGN PATENT DOCUMENTS

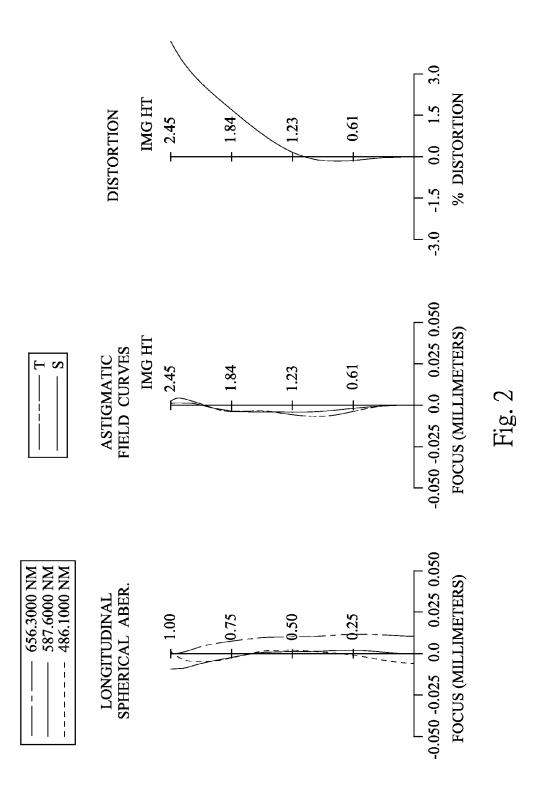
JР	1994-235858 A	8/1994
JP	2009-294527 A	12/2009
JP	2009-294528 A	12/2009
JP	2013-025202 A	2/2013

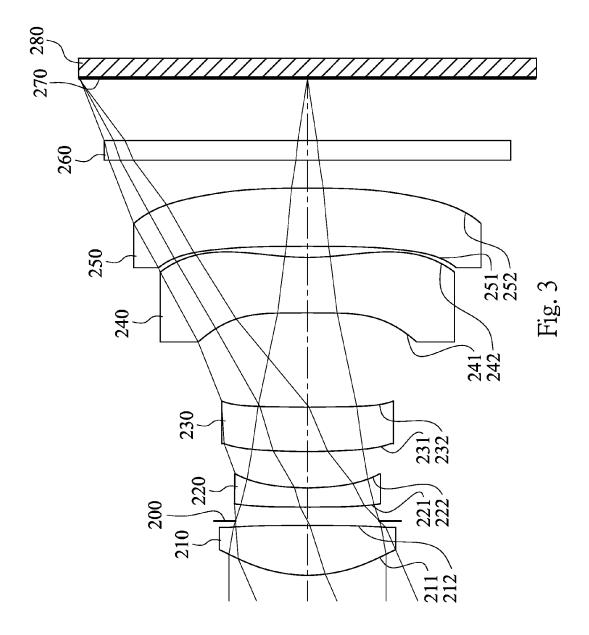
^{*} cited by examiner













DOCKET A L A R M

Explore Litigation Insights



Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time** alerts and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.

