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(12) **United States Patent**
Lin

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(54) **WIDE-ANGLE PROJECTION OPTICAL SYSTEM**

(75) Inventor: **Lai-Chang Lin**, Taoyuan Hsien (TW)

(73) Assignee: **Delta Electronics, Inc.**, Taoyuan Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 238 days.

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(21) Appl. No.: **12/797,818**

(22) Filed: **Jun. 10, 2010**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 61/187,361, filed on Jun. 16, 2009.

(51) **Int. Cl.**

G02B 9/00 (2006.01)
G02B 17/00 (2006.01)
G02B 13/04 (2006.01)

(52) **U.S. Cl.** 359/649; 359/648; 359/728; 359/749

(58) **Field of Classification Search** 359/649-651
See application file for complete search history.

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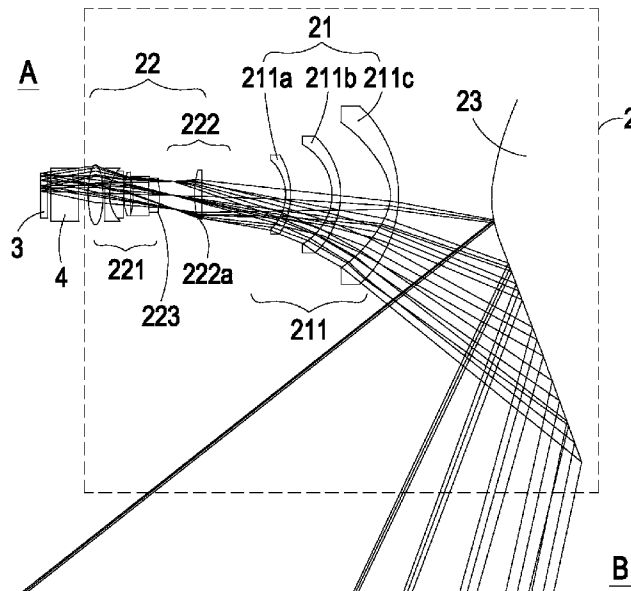
Primary Examiner — Jordan Schwartz

(74) *Attorney, Agent, or Firm* — Kirton McConkie; Evan R. Witt

(57) **ABSTRACT**

A wide-angle projection optical system includes a first lens set with positive power, an aperture stop, a second lens set with positive power, a third lens set with negative power, and a negative power reflecting mirror. The first lens set provides optical characteristics to match with a light beam coming from the object side. The second lens set is arranged behind the aperture stop to converge the light beam. The third lens set is configured to diverge the light to enlarge a full field angle. The negative power reflecting mirror is configured to further enlarge the full field angle and correct image distortion. The first lens set, the second lens set, the third lens set and the reflecting mirror have a common optical axis. The optical axis is shifted with respect to a center of a micro display.

10 Claims, 6 Drawing Sheets



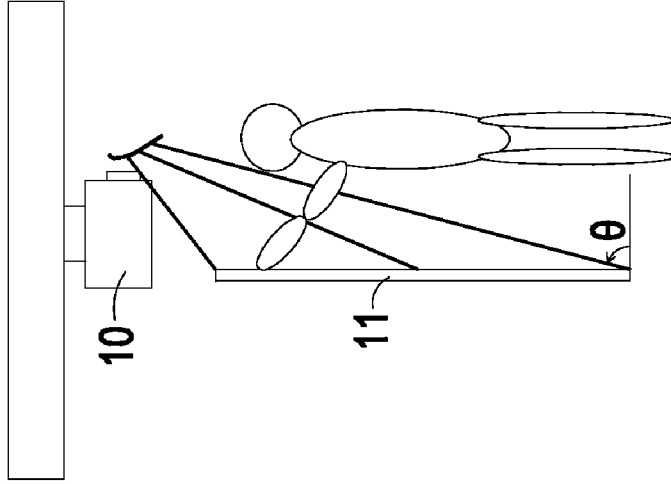


FIG. 1B PRIOR ART

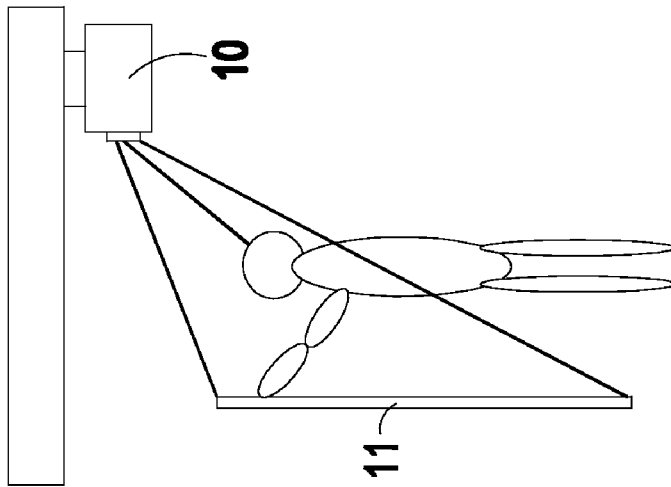


FIG. 1A PRIOR ART

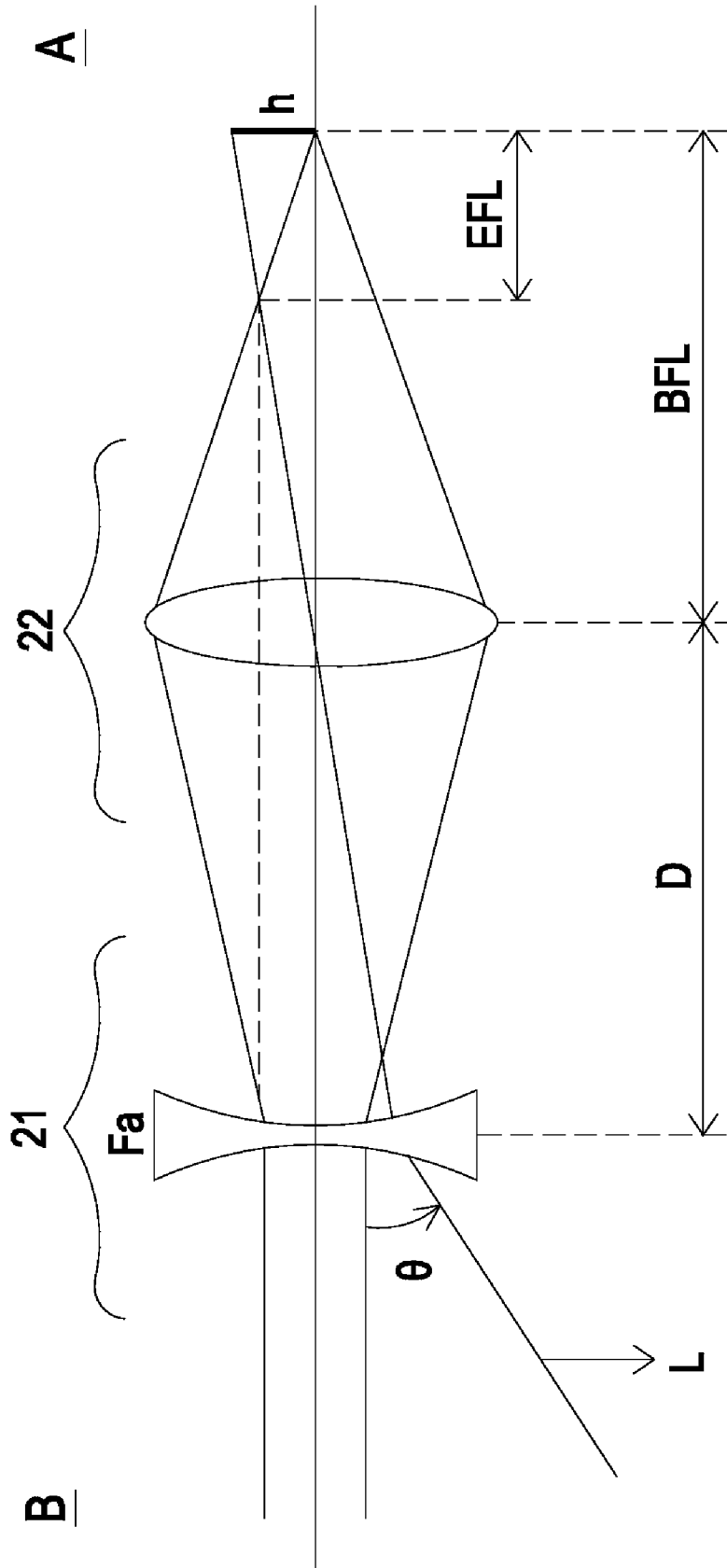


FIG. 2

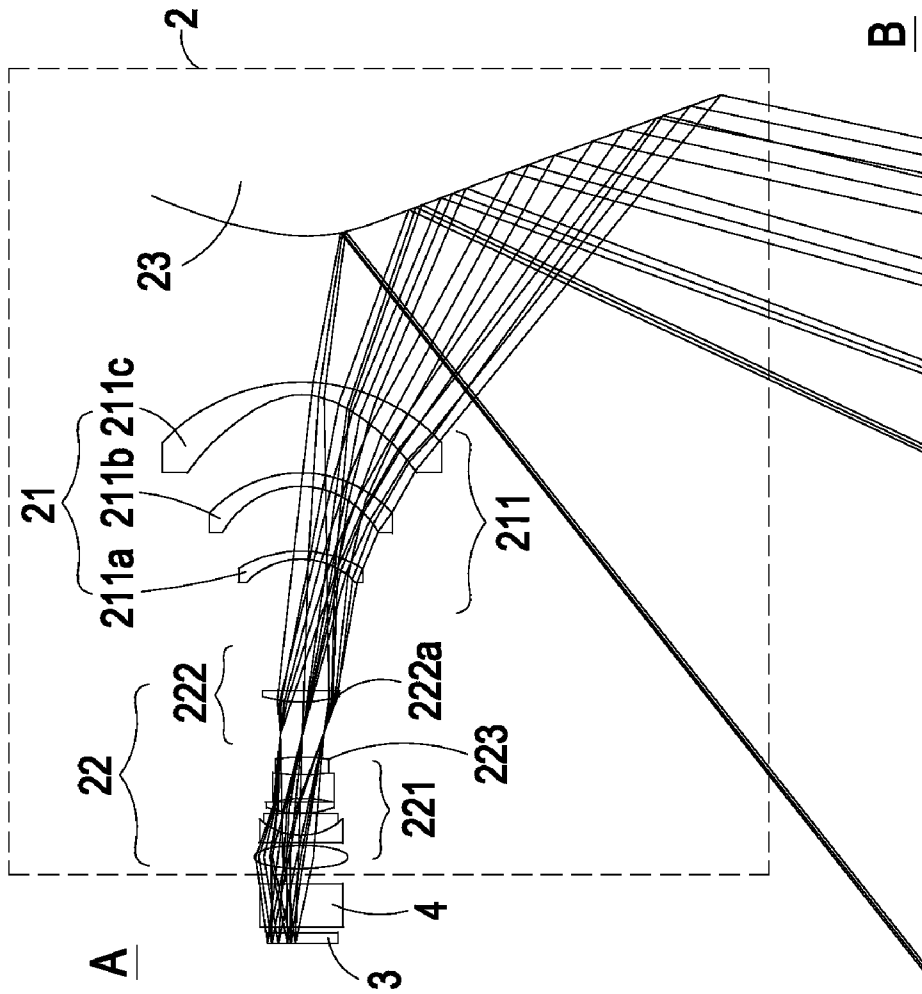


FIG. 3

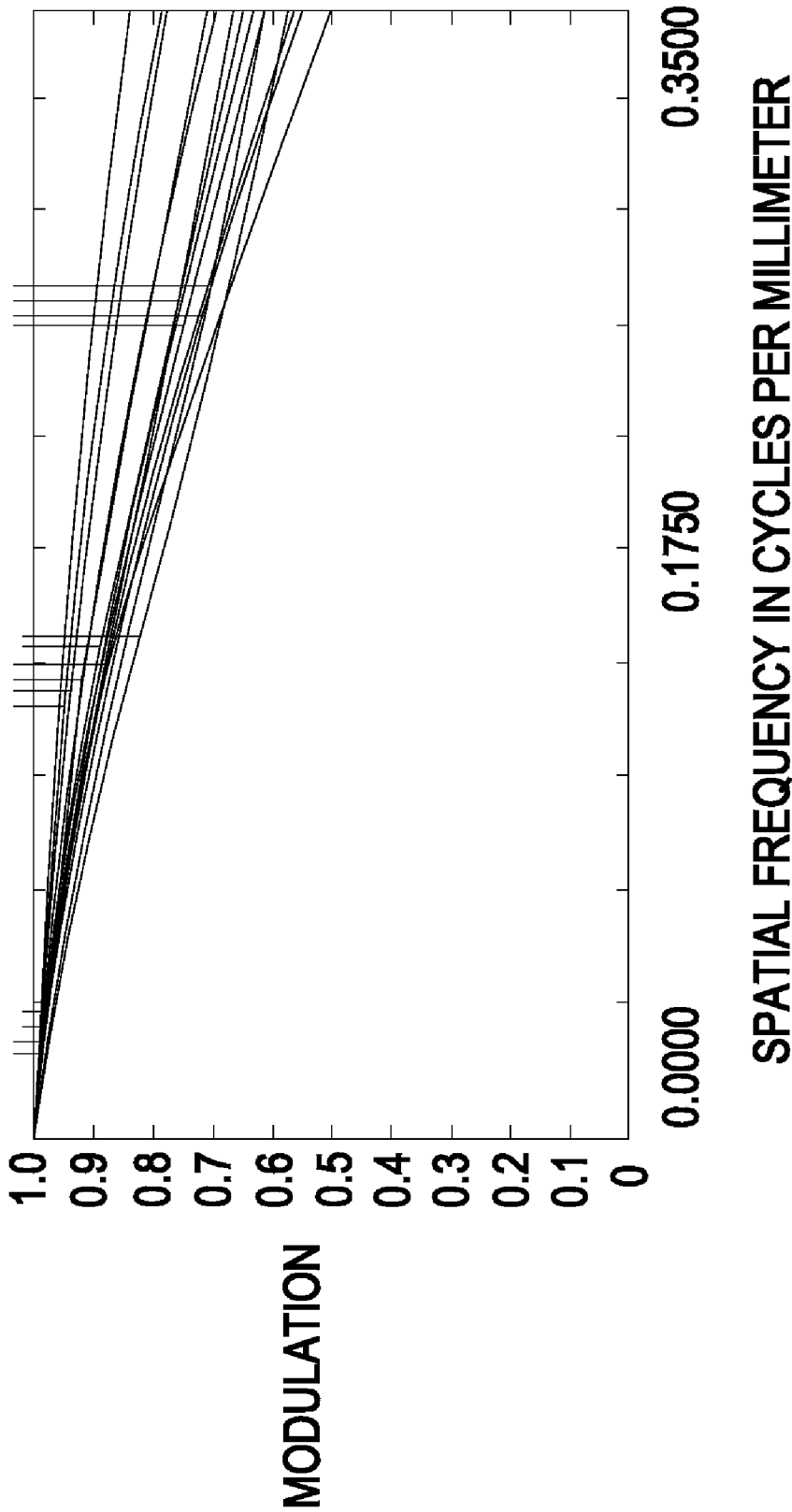


FIG. 4

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