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FILED
JUN - 4 2013
RICHARD W. WIEKING
CLERK, U.S. DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

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UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

LARGAN PRECISION CO., LTD., Plaintiff, v. GENIUS ELECTRONIC OPTICAL CO., LTD., Defendant.	CV 13 2502 Case No. **COMPLAINT FOR PATENT INFRINGEMENT** **DEMAND FOR JURY TRIAL**

Plaintiff Largan Precision Co., Ltd. ("Largan") hereby pleads the following claims for patent infringement against Defendant Genius Electronic Optical Co., Ltd. ("Genius"), and alleges as follows:

PARTIES

1. Plaintiff Largan is a Taiwanese corporation with its principal place of business located at No. 11, Jingke Road, Nantun District, Taichung City 40852, Taiwan. Largan is the owner of the patent rights at issue in this action.

2. On information and belief, Defendant Genius Electronic Optical Co., Ltd. is a Taiwanese corporation with its principal offices at No.1, Keya East Road, Daya Dist, Taichung City 428, Taiwan. On information and belief, Genius designs, manufactures, and provides to the U.S. and world markets imaging lenses, including lenses for use in mobile phones and tablets.

ORIGINAL

JURISDICTION AND VENUE

3. This is an action for patent infringement arising under the patent laws of the United States, 35 U.S.C. § 1 *et seq.*, including but not limited to 35 U.S.C. § 271.

4. The Court has subject matter jurisdiction over this action under 28 U.S.C. §§ 1331 and 1338(a).

5. This Court has personal jurisdiction over Genius because, among other things, Genius has committed, aided, abetted, contributed to, induced, or participated in the commission of patent infringement in this judicial district and elsewhere that led to foreseeable harm and injury to Largan. Genius, directly or through third parties, manufactures or assembles products that are and have been offered for sale, sold, purchased, and used within this forum, including without limitation by Genius' direct or indirect customer Apple Inc. ("Apple") with its principal place of business at 1 Infinite Loop, Cupertino, California 95014, which is in the Northern District of California. Genius, directly or through its distribution networks, regularly place its products within the stream of commerce with the knowledge, understanding, and desire that such products will be sold in this forum and throughout the United States, including by Apple. On information and belief, Genius or its agents also have employees in and/or regularly send employees to Cupertino, California, including to meet with Apple. Thus, Genius has established minimum contacts within the forum and purposefully availed itself of the benefits of this forum, and the exercise of personal jurisdiction over Genius would not offend traditional notions of fair play and substantial justice.

6. Genius transacts business in this forum because, among other things, Genius manufactures, imports, and distributes products that are offered for sale, sold, purchased, and used within this forum, including to or by Apple. Genius also is subject to personal jurisdiction in this forum. Venue therefore is proper in this judicial district pursuant to 28 U.S.C. §§ 1391 and 1400(b).

GENERAL ALLEGATIONS

7. Largan is the world's largest designer and manufacturer of imaging lens products. Largan's imaging lens products can be used in cameras for a wide range of devices including

mobile phones, tablets, notebook computers, web cams, automobiles, and scanners. As products such as mobile phones have gotten smaller and users have increasingly relied upon cameras in its mobile phones rather than stand-alone products, the need for imaging lenses of compact size yet high performance has become increasingly pressing. Through its innovation and high quality design of products, Largan has developed a portfolio of patents, including the patents-in-suit, to address these needs.

8. Genius is a direct competitor of Largan's in the imaging lens market. On information and belief, one of Genius' direct or indirect customers is Apple. Many of Apple's mobile phones and tablets contain one or more cameras. Each camera includes an imaging lens. Largan has become aware that many imaging lenses from Genius, including lenses incorporated into products of Apple such as the iPhone 5 and iPad mini, incorporate the inventions of one or more Largan patents.

9. Largan placed Genius on notice of its infringement of the patents-in-suit by at least April 2, 2013, by means of letter and claim charts sent by Largan to CJ Lin, Head of Genius' Intellectual Property Department. As of the filing of this complaint, except for its confirmation of receipt, Genius has never responded to Largan regarding Largan's infringement allegations. Despite being aware of Largan's patents and Largan's infringement allegations, Genius has continued selling the infringing devices.

THE ASSERTED PATENTS

10. Largan owns by assignment all rights to United States Patent No. 7,826,151 ("the '151 patent"), titled "Optical Lens System for Taking Image," which duly and legally issued on November 2, 2010. A copy of the '151 patent is attached as Exhibit A.

11. Largan owns by assignment all rights to United States Patent No. 7,864,454 ("the '454 patent"), titled "Imaging Lens System," which duly and legally issued on January 4, 2011. A copy of the '454 patent is attached as Exhibit B.

12. Largan owns by assignment all rights to United States Patent No. 8,233,224 ("the '224 patent"), titled "Imaging Lens System," which duly and legally issued on July 31, 2012. A copy of the '224 patent is attached as Exhibit C.

13. Largan owns by assignment all rights to United States Patent No. 8,310,768 ("the '768 patent"), titled "Optical Imaging Lens System," which duly and legally issued on November 13, 2012. A copy of the '768 patent is attached as Exhibit D.

14. Largan owns by assignment all rights to United States Patent No. 8,395,691 ("the '691 patent"), titled "Optical Image-Capturing Lens Assembly," which duly and legally issued on March 12, 2013. A copy of the '691 patent is attached as Exhibit E.

CLAIMS FOR RELIEF

CLAIM 1 – INFRINGEMENT OF U.S. PATENT NO. 7,826,151

15. Largan incorporates by reference the allegations in the paragraphs above.

16. On information and belief, Genius has infringed and continues to infringe one or more claims of the '151 patent under 35 U.S.C. § 271.

17. Genius has directly infringed the '151 patent in the United States and this District through the making, using, sale, offer for sell, or importation of its products, including without limitation an imaging lens used in Apple's iPhone 5. On information and belief, the accused Genius imaging lens has optical shapes and parameters meeting the requirements of one or more claims of the '151 patent, whether literally or under the doctrine of equivalents.

18. Genius has induced infringement by inducing others, including without limitation Apple, cellular service providers, distributors, and end users, to make, use, sell, offer for sale, or import the accused devices in the United States and this District. On information and belief, Genius also has provided marketing materials, technical specifications, or other materials that instruct and encourage the purchaser of an accused device to use the device in a manner that infringes certain claims of the '151 patent.

19. Genius has contributed to the infringement of others, including without limitation Apple, cellular service providers, distributors, and end users, by offering to sell, selling, or importing within this District and the United States an imaging lens component constituting a material part of a patented optical system, knowing the same to be especially made or especially adapted for use in the infringement of the '151 patent and not a staple article of commerce suitable for substantial non-infringing use.

20. On information and belief, Genius's infringement has been, and continues to be, willful and deliberate, and has caused substantial damage to Largan. For example, Genius has continued to sell the accused devices despite its awareness of the '151 patent and Largan's infringement allegations.

21. On information and belief, Genius's infringement in violation of federal patent laws will continue to injure Largan unless otherwise enjoined by this Court.

CLAIM 2 – INFRINGEMENT OF U.S. PATENT NO. 7,864,454

22. Largan incorporates by reference the allegations in the paragraphs above.

23. On information and belief, Genius has infringed and continues to infringe one or more claims of the '454 patent under 35 U.S.C. § 271.

24. Genius has directly infringed the '454 patent in the United States and this District through the making, using, sale, offer for sell, and/or importation of its products, including without limitation an imaging lens used in Apple's iPhone 5. On information and belief, the accused Genius imaging lens has optical shapes and parameters meeting the requirements of one or more claims of the '454 patent, whether literally or under the doctrine of equivalents.

25. Genius has induced infringement by inducing others, including without limitation Apple, cellular service providers, distributors, and end users, to make, use, sell, offer for sale, or import the accused devices in the United States and this District. On information and belief, Genius also has provided marketing materials, technical specifications, or other materials that instruct and encourage the purchaser of an accused device to use the device in a manner that infringes certain claims of the '454 patent.

26. Genius has contributed to the infringement of others, including without limitation Apple, cellular service providers, distributors, and end users, by offering to sell, selling, or importing within this District and the United States an imaging lens component constituting a material part of a patented optical system, knowing the same to be especially made or especially adapted for use in the infringement of the '454 patent and not a staple article of commerce suitable for substantial non-infringing use.

27. On information and belief, Genius's infringement has been, and continues to be, willful and deliberate, and has caused substantial damage to Largan. For example, Genius has continued to sell the accused devices despite its awareness of the '454 patent and Largan's infringement allegations.

28. On information and belief, Genius's infringement in violation of federal patent laws will continue to injure Largan unless otherwise enjoined by this Court.

CLAIM 3 – INFRINGEMENT OF U.S. PATENT NO. 8,233,224

29. Largan incorporates by reference the allegations in the paragraphs above.

30. On information and belief, Genius has infringed and continues to infringe one or more claims of the '224 patent under 35 U.S.C. § 271.

31. Genius has directly infringed the '224 patent in the United States and this District through the making, using, sale, offer for sell, and/or importation of its products, including without limitation an imaging lens used in Apple's iPad mini. On information and belief, the accused Genius imaging lens has optical shapes and parameters meeting the requirements of one or more claims of the '224 patent, whether literally or under the doctrine of equivalents.

32. Genius has induced infringement by inducing others, including without limitation Apple, cellular service providers, distributors, and end users, to make, use, sell, offer for sale, or import the accused devices in the United States and this District. On information and belief, Genius also has provided marketing materials, technical specifications, or other materials that instruct and encourage the purchaser of an accused device to use the device in a manner that infringes certain claims of the '224 patent.

33. Genius has contributed to the infringement of others, including without limitation Apple, cellular service providers, distributors, and end users, by offering to sell, selling, or importing within this District and the United States an imaging lens component constituting a material part of a patented optical system, knowing the same to be especially made or especially adapted for use in the infringement of the '224 patent and not a staple article of commerce suitable for substantial non-infringing use.

34. On information and belief, Genius's infringement has been, and continues to be, willful and deliberate, and has caused substantial damage to Largan. For example, Genius has continued to sell the accused devices despite its awareness of the '224 patent and Largan's infringement allegations.

35. On information and belief, Genius's infringement in violation of federal patent laws will continue to injure Largan unless otherwise enjoined by this Court.

CLAIM 4 – INFRINGEMENT OF U.S. PATENT NO. 8,310,768

36. Largan incorporates by reference the allegations in the paragraphs above.

37. On information and belief, Genius has infringed and continues to infringe one or more claims of the '768 patent under 35 U.S.C. § 271.

38. Genius has directly infringed the '768 patent in the United States and this District through the making, using, sale, offer for sell, and/or importation of its products, including without limitation an imaging lens used in Apple's iPad mini. On information and belief, the accused Genius imaging lens has optical shapes and parameters meeting the requirements of one or more claims of the '768 patent, whether literally or under the doctrine of equivalents.

39. Genius has induced infringement by inducing others, including without limitation Apple, cellular service providers, distributors, and end users, to make, use, sell, offer for sale, or import the accused devices in the United States and this District. On information and belief, Genius also has provided marketing materials, technical specifications, or other materials that instruct and encourage the purchaser of an accused device to use the device in a manner that infringes certain claims of the '768 patent.

40. Genius has contributed to the infringement of others, including without limitation Apple, cellular service providers, distributors, and end users, by offering to sell, selling, or importing within this District and the United States an imaging lens component constituting a material part of a patented optical system, knowing the same to be especially made or especially adapted for use in the infringement of the '768 patent and not a staple article of commerce suitable for substantial non-infringing use.

41. On information and belief, Genius's infringement has been, and continues to be, willful and deliberate, and has caused substantial damage to Largan. For example, Genius has continued to sell the accused devices despite its awareness of the '768 patent and Largan's infringement allegations.

42. On information and belief, Genius's infringement in violation of federal patent laws will continue to injure Largan unless otherwise enjoined by this Court.

CLAIM 5 – INFRINGEMENT OF U.S. PATENT NO. 8,395,691

43. Largan incorporates by reference the allegations in the paragraphs above.

44. On information and belief, Genius has infringed and continues to infringe one or more claims of the '691 patent under 35 U.S.C. § 271.

45. Genius has directly infringed the '691 patent in the United States and this District through the making, using, sale, offer for sell, and/or importation of its products, including without limitation an imaging lens used in Apple's iPad mini. On information and belief, the accused Genius imaging lens has optical shapes and parameters meeting the requirements of one or more claims of the '691 patent, whether literally or under the doctrine of equivalents.

46. Genius has induced infringement by inducing others, including without limitation Apple, cellular service providers, distributors, and end users, to make, use, sell, offer for sale, or import the accused devices in the United States and this District. On information and belief, Genius also has provided marketing materials, technical specifications, or other materials that instruct and encourage the purchaser of an accused device to use the device in a manner that infringes certain claims of the '691 patent.

47. Genius has contributed to the infringement of others, including without limitation Apple, cellular service providers, distributors, and end users, by offering to sell, selling, or importing within this District and the United States an imaging lens component constituting a material part of a patented optical system, knowing the same to be especially made or especially adapted for use in the infringement of the '691 patent and not a staple article of commerce suitable for substantial non-infringing use.

48. On information and belief, Genius's infringement has been, and continues to be, willful and deliberate, and has caused substantial damage to Largan. For example, Genius has continued to sell the accused devices despite its awareness of the '691 patent and Largan's infringement allegations.

49. On information and belief, Genius's infringement in violation of federal patent laws will continue to injure Largan unless otherwise enjoined by this Court.

PRAYER FOR RELIEF

Wherefore, Largan prays for relief as follows:

A. That the Court render judgment declaring that Genius has infringed, directly or indirectly, literally or under the doctrine of equivalents, the '151 patent, '454 patent, '224 patent, '768 patent, and '691 patent in violation of 35 U.S.C. § 271;

B. That the Court render judgment declaring Genius's infringement of the '151 patent, '454 patent, '224 patent, '768 patent, and '691 patent is willful and deliberate;

C. That Largan be awarded damages adequate to compensate Largan for Genius' infringement of the '151 patent, '454 patent, '224 patent, '768 patent, and '691 patent;

D. That Largan be awarded pre-judgment and post-judgment interest on all damages awarded;

E. That the Court temporarily, preliminarily, and permanently enjoin Genius; its successors, assigns, subsidiaries, and transferees; its officers, directors, agents, and employees; and all others working on Genius's behalf from making, using, selling, offering for sale, or importing in the United States any product falling within the scope of the '151 patent, '454 patent, '224 patent, '768 patent, and '691 patent, or inducing or contributing to the infringement of others;

F. That the Court render judgment declaring this to be an exceptional case and awarding treble damages to Largan for the unlawful practices of Genius;

G. That Largan be awarded its costs, expenses, and reasonable attorneys' fees;

H. That the Court order a full accounting of the damages above, including for past infringement and any continuing or future infringement;

I. Such other and further relief as the Court deems just and proper.

DEMAND FOR JURY TRIAL

Largan hereby demands a trial by jury of all issues so triable.

DATED: June 4, 2013

PERKINS COIE LLP

By: [signature]

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JSchnurer@perkinscoie.com
Michael J. Engle, Bar No. 259476
MEngle@perkinscoie.com

Attorneys for Plaintiff Largan Precision Co., Ltd.

EXHIBIT A

US007826151B2

(12) **United States Patent**
Tsai

(10) **Patent No.:** **US 7,826,151 B2**
(45) **Date of Patent:** **Nov. 2, 2010**

(54) **OPTICAL LENS SYSTEM FOR TAKING IMAGE**

(75) Inventor: **Tsung-Han Tsai**, 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 0 days.

(21) Appl. No.: **12/390,474**

(22) Filed: **Feb. 22, 2009**

(65) **Prior Publication Data**

US 2010/0134904 A1 Jun. 3, 2010

(30) **Foreign Application Priority Data**

Dec. 1, 2008 (TW) .... 97146609 A

(51) **Int. Cl.**
G02B 9/60 (2006.01)

(52) **U.S. Cl.** **359/764**; 359/708; 359/714; 359/766

(58) **Field of Classification Search** 359/764, 359/766, 767, 714, 708
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,023,672 A * 3/1962 Sandback 359/753

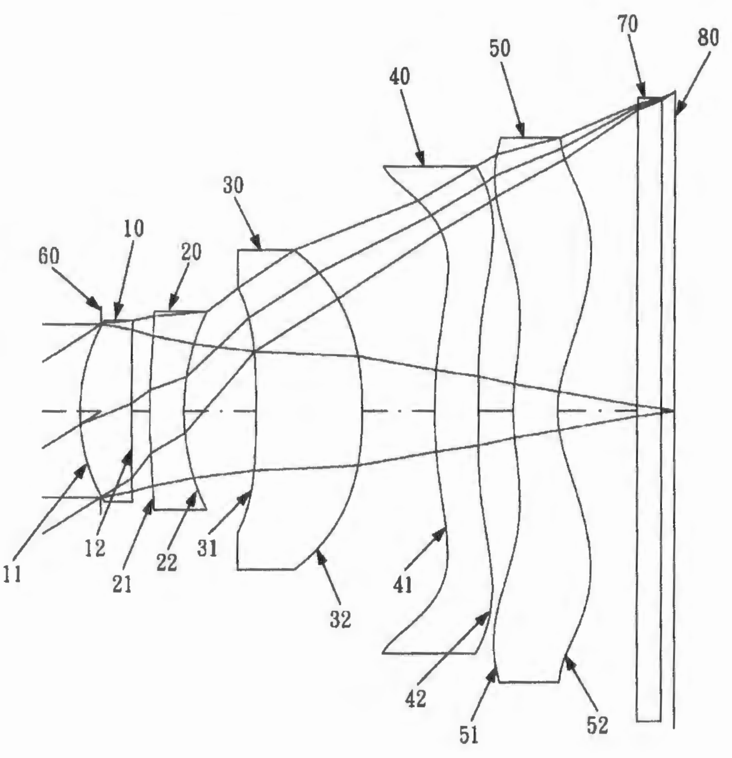
* cited by examiner

Primary Examiner—Darryl J Collins
(74) *Attorney, Agent, or Firm*—Banger Shia

(57) **ABSTRACT**

An optical lens system for taking image comprises, in order from the object side to the image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element with positive refractive power having a concave object-side surface and a convex image-side surface; a fourth lens element with positive refractive power; a fifth lens element with refractive power; and an aperture stop located between an object to be photographed and the second lens element. In the optical lens system for taking image, the number of the lens elements with refractive power being limited to five. Such lens arrangements can effectively reduce the volume of the optical lens system, reduce the sensitivity of the optical lens system and obtain higher resolution.

27 Claims, 8 Drawing Sheets



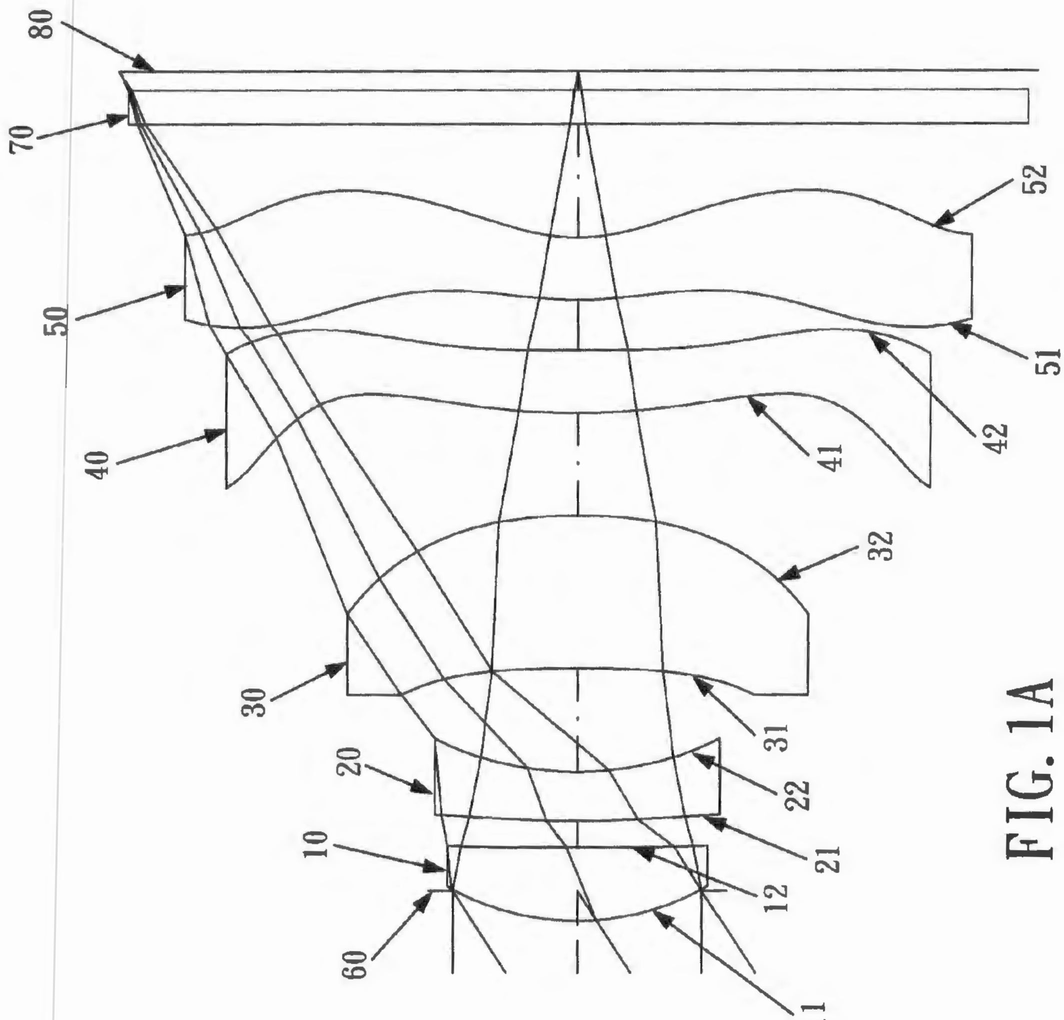


FIG. 1A

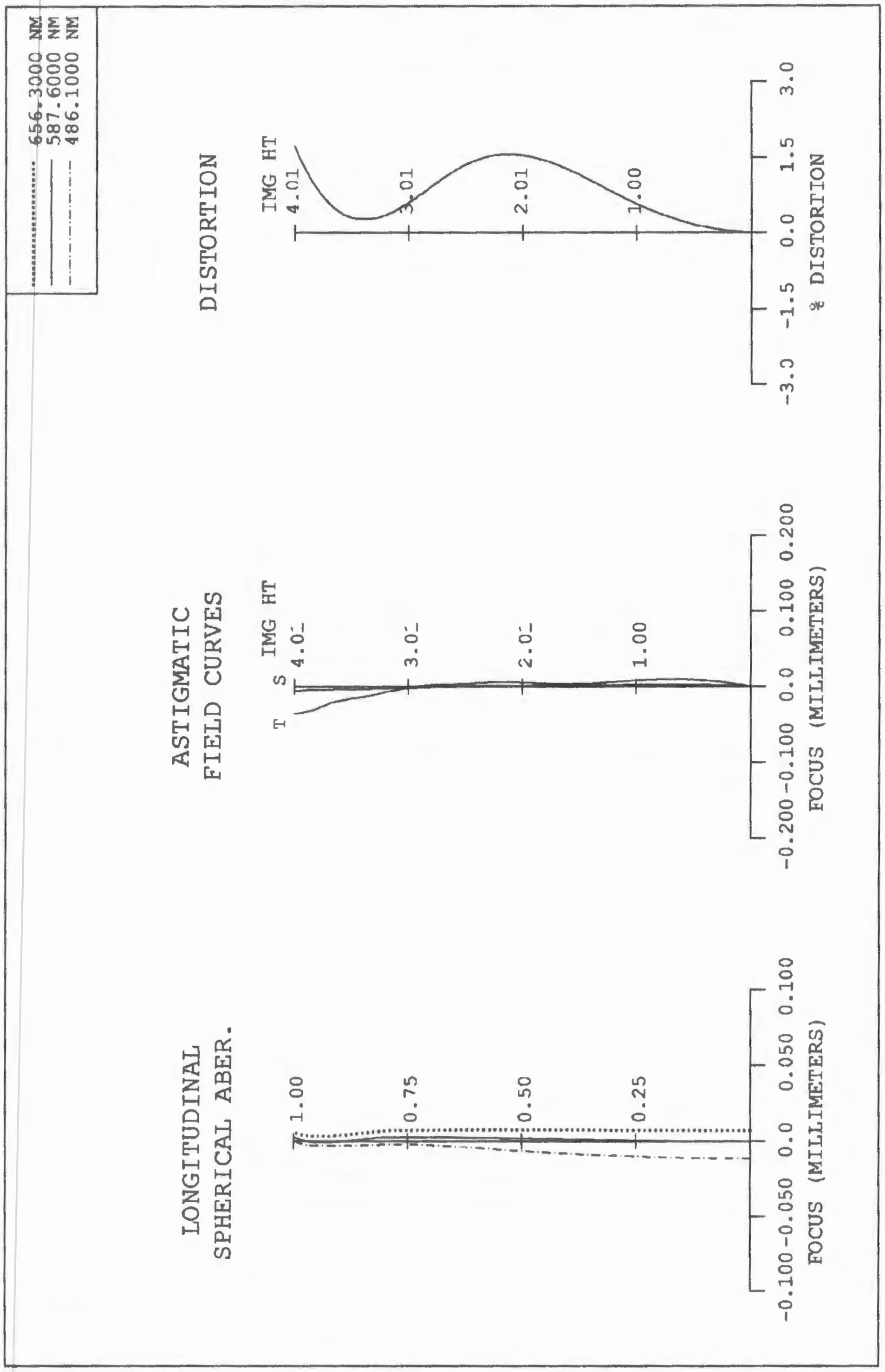

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FIG. 1B

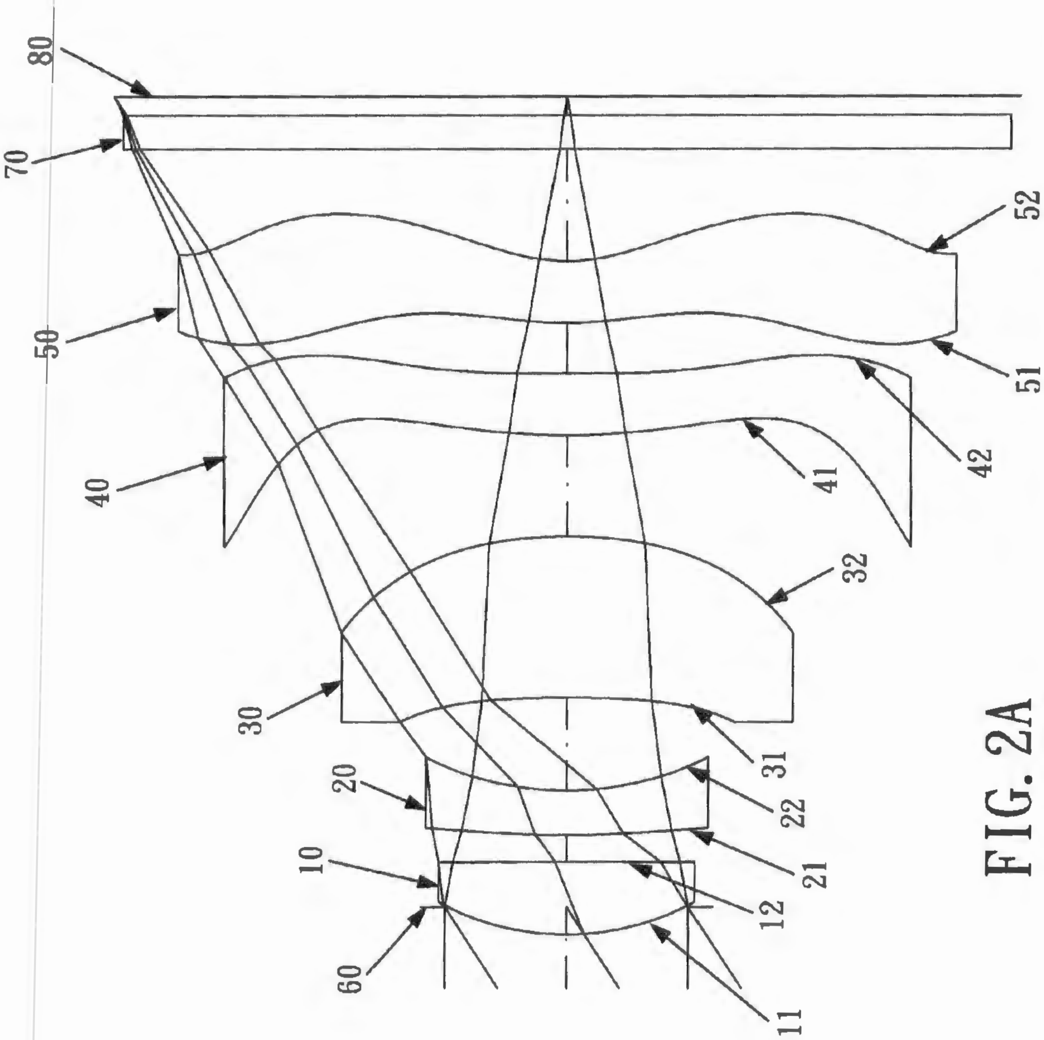

FIG. 2A

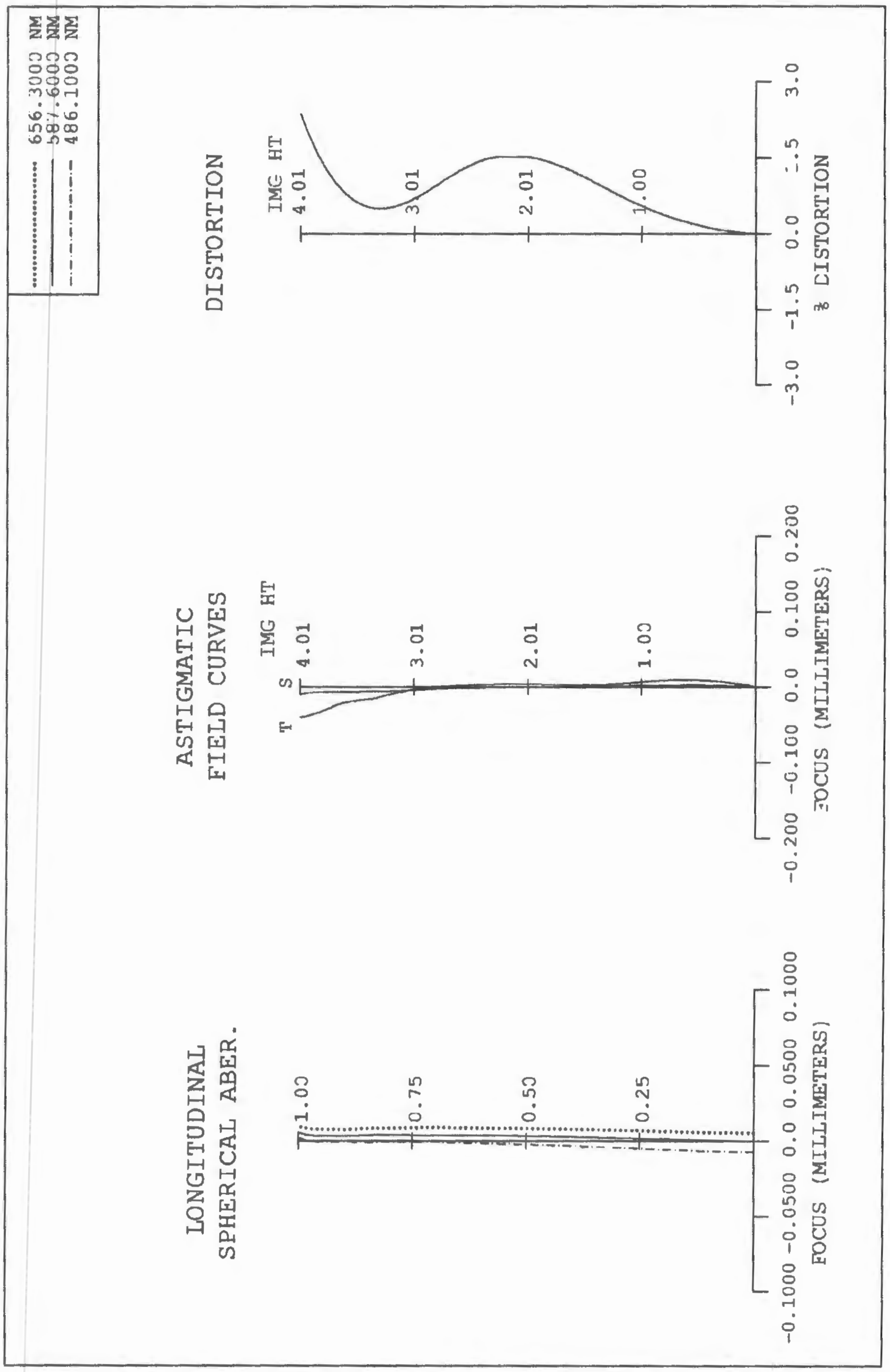
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FIG. 2B

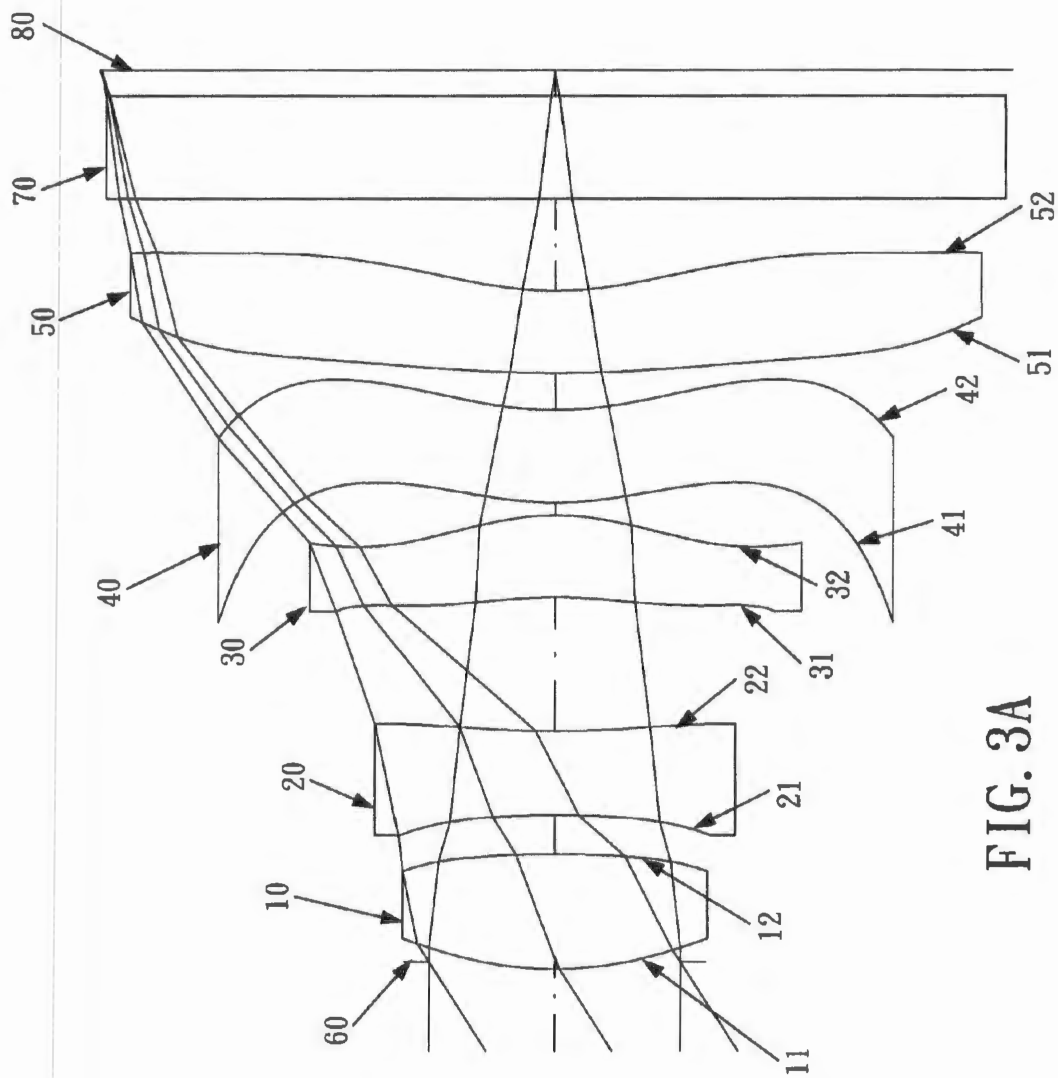

FIG. 3A

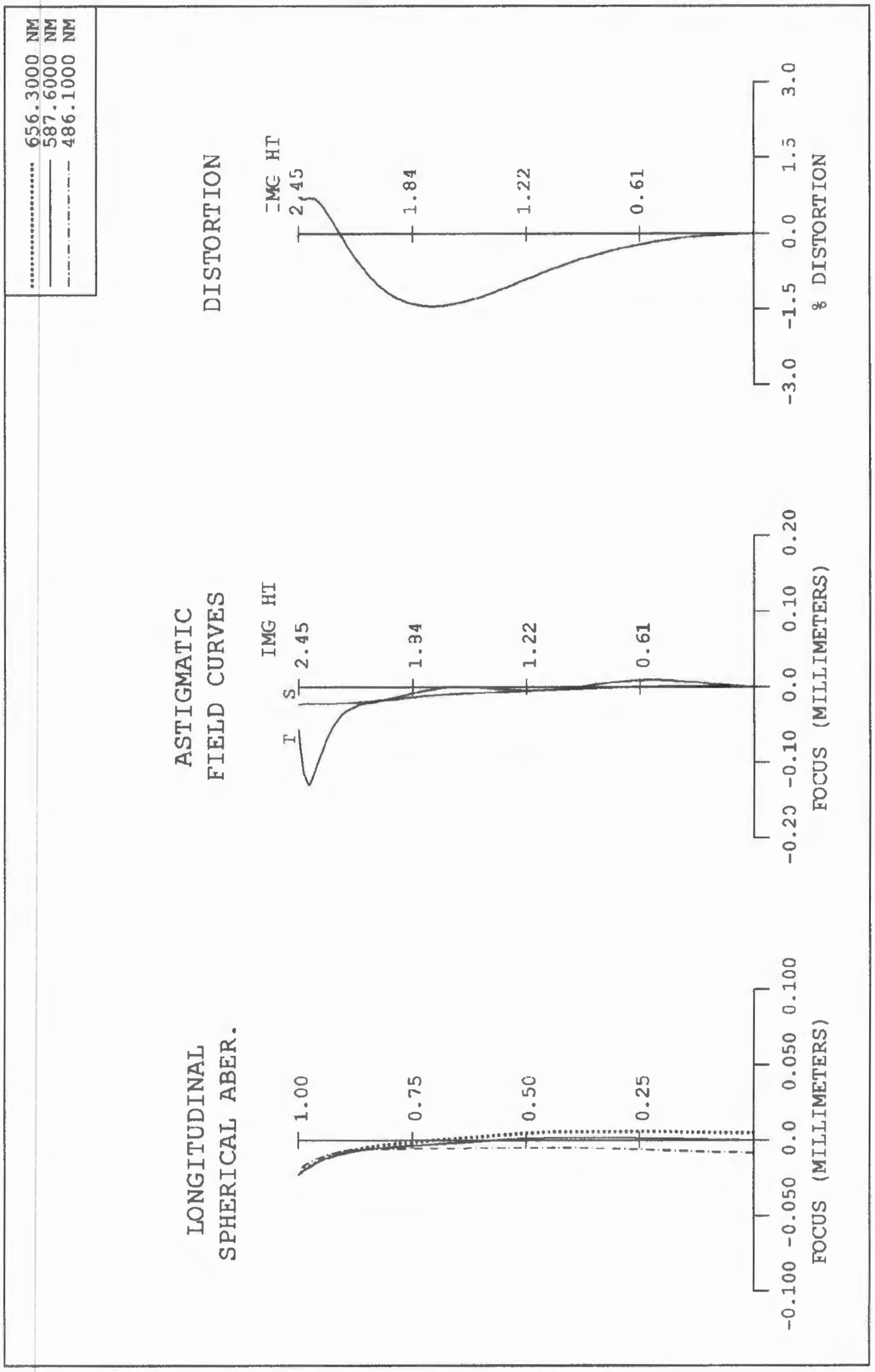
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FIG. 3B

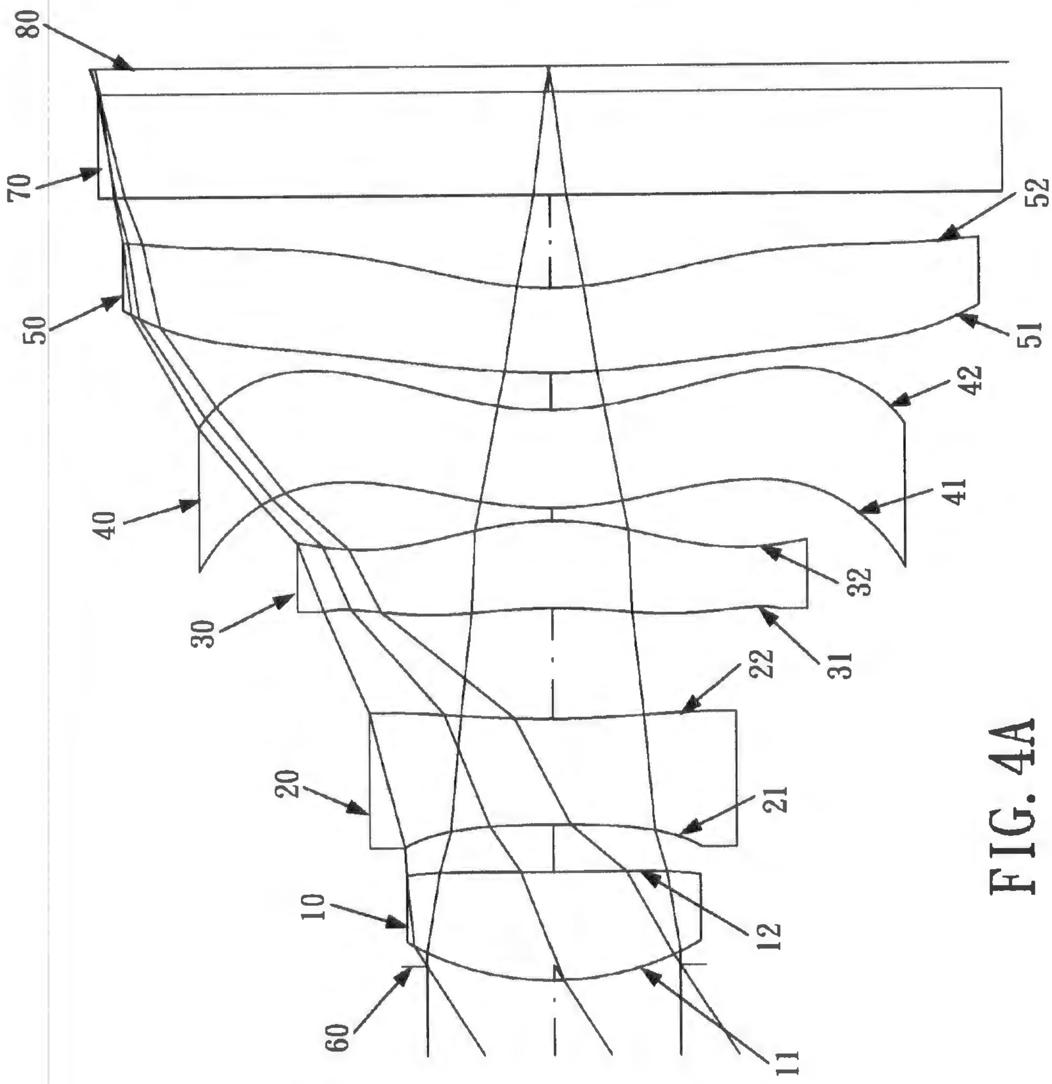

FIG. 4A

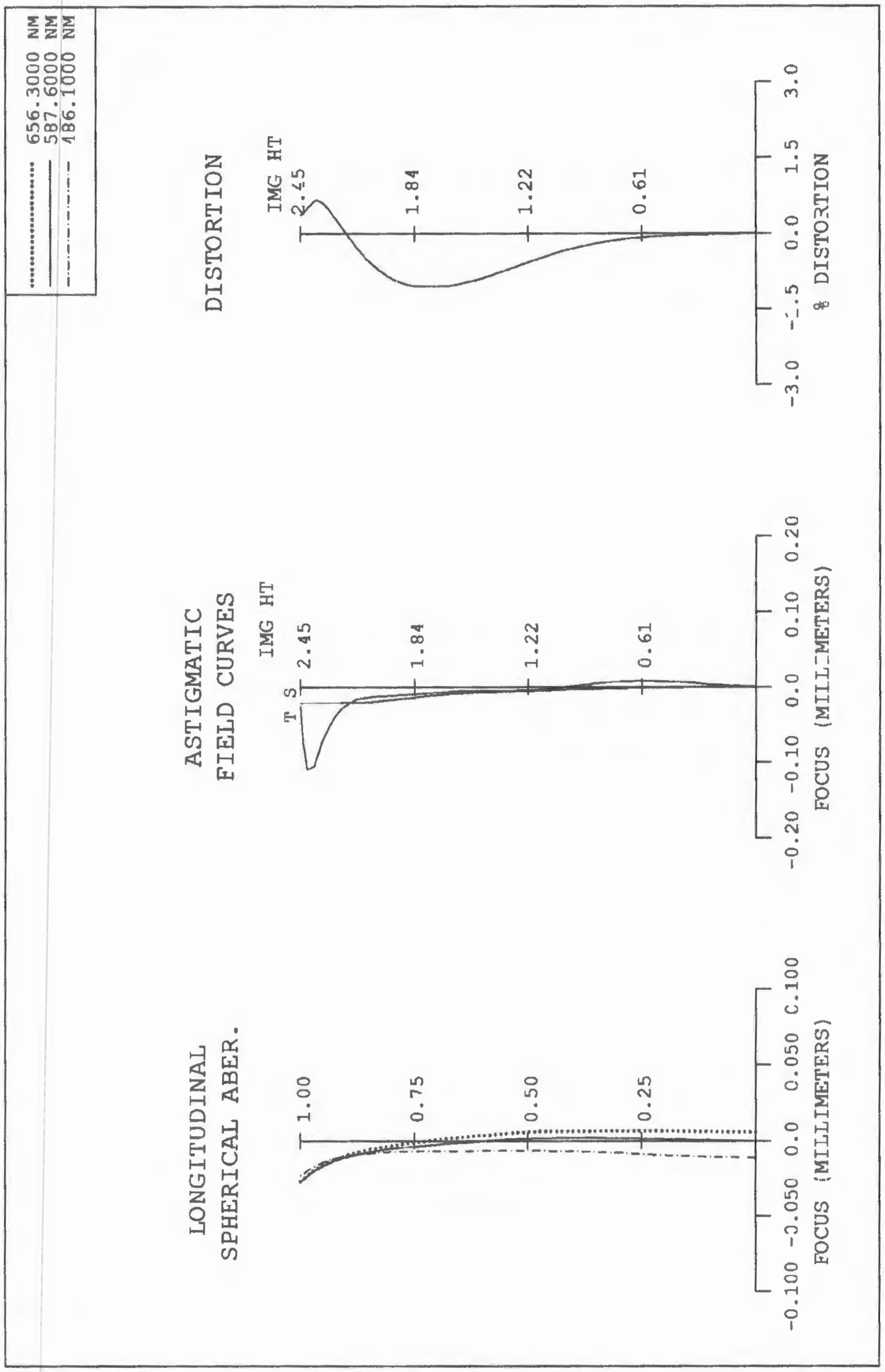
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FIG. 4B

OPTICAL LENS SYSTEM FOR TAKING IMAGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an optical lens system for taking image, and more particularly to a miniaturized optical lens system for taking image used in a mobile phone camera.

2. Description of the Prior Art

In recent years, with the popularity of the mobile phone camera, the optical lens system for taking image has become thinner and thinner, and the electronic imaging sensor of a general digital camera is typically a CCD (Charge Coupled Device) or CMOS (Complementary Metal Oxide Semiconductor) sensor. Due to advances in semiconductor manufacturing, the pixel size of sensors has been reduced continuously, and miniaturized optical lens systems for taking image have increasingly higher resolution.

A conventional high resolution mobile phone camera usually consists of four lens elements, such as the optical lens system for taking image described in U.S. Pat. No. 7,365,920. However, the resolution of the mobile phone camera has been improved rapidly. As the pixel size of electronic imaging sensors gradually becomes smaller and smaller, the system requires higher image quality. The conventional optical lens system comprising four lens elements cannot satisfy the requirements of higher resolution optical lens systems. In order to provide better image quality with higher resolution, the number of the lens elements must be increased, but too many lens elements will increase the total track length of the optical lens system, so it will be difficult to maintain the objective of miniaturization of the optical lens system for taking image.

The present invention mitigates and/or obviates the aforementioned disadvantages.

SUMMARY OF THE INVENTION

The primary objective of the present invention is to provide an optical lens system for taking image comprising five lens elements to provide better image quality with higher resolution, effectively control the total track length of the optical lens system and maintain the objective of miniaturization of the optical lens system.

An optical lens system for taking image in accordance with the present invention comprises: in order from the object side to the image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element with positive refractive power having a concave object-side surface and a convex image-side surface; a fourth lens element with positive refractive power; a fifth lens element with refractive power; and an aperture stop being located between an object to be photographed and the second lens element. In the optical lens system for taking image, the number of the lens elements with refractive power being limited to five. Such lens arrangements can effectively improve image quality of the system and maintain the objective of miniaturization of the optical lens system.

In the present optical lens system for taking image, the refractive power of the system is mainly provided by the first lens element with positive refractive power. The second lens element with negative refractive power mainly serves to correct the chromatic aberration. The third lens element with positive refractive power serves to distribute the refractive power of the optical lens system so that the sensitivity of the optical lens system will be reduced. The fourth lens element and the fifth lens element serve as correction lens elements to balance and correct various aberrations caused by the optical lens system, effectively improving image quality of the system.

The first lens element provides strong positive refractive power, and the aperture stop is located close to the object side, so that the total track length of the optical lens system can be effectively reduced, and the exit pupil of the optical lens system will be far away from the image plane. Therefore, the light will be projected onto the sensor with a relatively small incident angle, this is the telecentric feature of the image side, and this feature is very important to the photosensitive power of current solid-state sensors, since they are more sensitive when the light is incident at a small angle. This also reduces the probability of the occurrence of shading. According to one aspect of the present invention, in the present optical system for taking image, the inflection points formed on the fourth lens element and the fifth lens element will contribute to a better correction of the incident angle of the off axis light with respect to the sensor.

In addition, in wide angle optical systems, it is especially necessary to correct the distortion and the chromatic aberration of magnification, and this can be solved by locating the aperture stop at the balance point of the refractive power of the system. In the present optical lens system for taking image, if the aperture stop is located in front of the first lens element, the telecentric feature of the optical lens system is emphasized, and the total track length of the optical lens system will become shorter. If the aperture stop is located between the first and second lens elements, the wide field of view is emphasized, and the optical system is less sensitive as well.

According to another aspect of the present invention, in the present optical lens system for taking image, with the trend of miniaturization of the optical lens system and the requirement of increasing the field of view, the focal length of the optical lens system is becoming very short. Therefore, the radius of curvature and the size of the lens elements must be very small, and it is difficult to make such glass lens elements by the use of conventional grinding. Plastic material is introduced to make lens elements by injection molding, using relatively low cost to produce high precision lens elements. The lens elements are provided with aspheric surfaces, allowing more design parameter freedom (than spherical surfaces), so as to better reduce the aberration and the number of the lens elements, thus effectively reducing the total track length of the optical lens system.

According to another aspect of the present invention, in the present optical lens system for taking image, the focal length of the first lens element is f1, the focal length of the optical lens system for taking image is f, and they satisfy the relation:

$$1.1<f/f1<2.0.$$

If f/f1 satisfies the above relation, the refractive power of the first lens element is more balanced, thus allowing effective control of the total track length of the optical lens system, so as to maintain the objective of miniaturization of the optical lens system for taking image. Meanwhile, it can also prevent the excessive increase of high order spherical aberration and coma of the system, improving the image quality of the optical lens system. Further, it will be better if f/f1 satisfies the relation:

$$1.1<f/f1<1.4.$$

According to another aspect of the present invention, in the present optical lens system for taking image, the focal length of the second lens element is f2, the focal length of the optical lens system for taking image is f, and they satisfy the relation:

$$-2.5<f/f2<-0.7.$$

If f/f2 satisfies the above relation, it will be favorable to correct the chromatic aberration of magnification and the Petzval sum caused by the optical lens system.

According to another aspect of the present invention, in the present optical lens system for taking image, the focal length of the third lens element is f3, the focal length of the optical lens system for taking image is f, and they satisfy the relation:

$$0.6<f/f3<0.8.$$

The third lens element has positive refractive power and serves to distribute the refractive power of the optical lens system so that if f/f3 satisfies the above relation, the distribution of the refractive power of the optical lens system is more balanced and sensitivity of the optical lens system is reduced.

According to another aspect of the present invention, in the present optical lens system for taking image, the focal length of the fourth lens element is f4, the focal length of the fifth lens element is f5, the focal length of the optical lens system for taking image is f, and they satisfy the relations:

$$0<f/f4<0.8;$$

$$-2.0<f/f5<-0.75.$$

If f/f4 and f/f5 satisfy the above relations, the fourth lens element and the fifth lens element serve as correction lens elements to balance and correct various aberrations caused by the optical lens system, it will be favorable to correct the astigmatism and the distortion caused by the optical lens system, improving the resolution of the optical lens system. Further, it will be better if f/f4 satisfies the relation:

$$0.0<f/f4<0.3.$$

Further, it will be much better if f/f4 satisfies the relation:

$$0.03<f/f4<0.2.$$

According to another aspect of the present invention, in the present optical lens system for taking image, the radius of curvature of the object-side surface of the first lens element is R1, the radius of curvature of the image-side surface of the first lens element is R2, and they satisfy the relation:

$$R1/R2>-0.22.$$

If R1/R2 satisfies the above relation, it will be favorable to correct the spherical aberration caused by the system. Further, it will be better if R1/R2 satisfies the relation:

$$-0.2<R1/R2<0.3.$$

According to another aspect of the present invention, in the present optical lens system for taking image, the radius of curvature of the object-side surface of the fourth lens element is R7, the radius of curvature of the image-side surface of the fourth lens element is R8, the radius of curvature of the object-side surface of the fifth lens element is R9, the radius of curvature of the image-side surface of the fifth lens element is R10, and they satisfy the relations:

$$0<R7/R8<1.6;$$

$$2.0<R9/R10<4.0.$$

If R7/R8 and R9/R10 satisfy the above relations, the fourth lens element and the fifth lens element serve as correction lens elements, and it will be favorable to correct the high order aberration of the system, improving the image quality of the optical lens system.

According to another aspect of the present invention, in the present optical lens system for taking image, the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, and they satisfy the relations:

$$50<V1<58;$$

$$40<V4<70;$$

$$V1-V2>15;$$

$$V3-V2>15.$$

If V1, V2, V3 and V4 satisfy the above relations, it will be favorable to correct the chromatic aberration caused by the optical lens system, improving the resolution of the optical lens system.

According to another aspect of the present invention, in the present optical lens system for taking image, the Abbe number of the fourth lens element is V4, the Abbe number of the fifth lens element is V5, and they satisfy the relation:

$$|V4-V5|<15.$$

If V4 and V5 satisfy the above relation, it will be favorable to correct the astigmatism caused by the optical lens system.

According to another aspect of the present invention, in the present optical lens system for taking image, the edge thickness of the fourth lens element is ET4, the center thickness of the fourth lens element is CT4, and they satisfy the relation:

$$0.6<ET4/CT4<1.0.$$

The edge thickness is defined as: the length projected on the optical axis by the distance between points at the effective diameters the object-side and the image-side surfaces of the lens element. If ET4/CT4 satisfies the above relation, plastic lens elements made from injection molding can be reliably molded and have good material uniformity, and it will be favorable to maintain the image quality and stability of the optical lens system.

According to another aspect of the present invention, in the present optical lens system for taking image, the on-axis distance between the first lens element and the second lens element is T12, the focal length of the optical lens system for taking image is f, and they satisfy the relation:

$$0.4<(T12/f)*100<15.$$

The above relation can allow better correction of the astigmatism of the system.

According to another aspect of the present invention, in the present optical lens system for taking image, an object to be photographed is imaged on an electronic imaging sensor, the total track length of the optical lens system for taking image is TTL, which is defined as the distance from the object-side surface of the first lens element to the image plane along the optical axis, the maximum image height of the optical lens system for taking image is ImgH, and they satisfy the relation:

$$TTL/ImgH<2.05.$$

The above relation can maintain the objective of miniaturization of the optical lens system for taking image.

The present invention will become more obvious from the following description when taken in connection with the accompanying drawings, which show, for purpose of illustrations only, the preferred embodiments in accordance with the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A shows an optical lens system for taking image in accordance with a first embodiment of the present invention;

FIG. 1B shows the aberration curves of the first embodiment of the present invention;

FIG. 2A shows an optical lens system for taking image in accordance with a second embodiment of the present invention;

FIG. 2B shows the aberration curves of the second embodiment of the present invention;

FIG. 3A shows an optical lens system for taking image in accordance with a third embodiment of the present invention;

FIG. 3B shows the aberration curves of the third embodiment of the present invention;

FIG. 4A shows an optical lens system for taking image in accordance with a fourth embodiment of the present invention; and

FIG. 4B shows the aberration curves of the fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1A, which shows an optical lens system for taking image in accordance with a first embodiment of the present invention, and FIG. 1B shows the aberration curves of the first embodiment of the present invention. An optical lens system for taking image in accordance with the first embodiment of the present invention comprises: in order from the object side to the image side:

A plastic first lens element **10** with positive refractive power has a convex object-side surface **11** and a concave image-side surface **12**, and the object-side surface **11** and the image-side surface **12** of the first lens element **10** are aspheric.

A plastic second lens element **20** with negative refractive power has a convex object-side surface **21** and a concave image-side surface **22**, and the object-side surface **21** and the image-side surface **22** of the second lens element **20** are aspheric.

A plastic third lens element **30** with positive refractive power has a concave object-side surface **31** and a convex image-side surface **32**, and the object-side surface **31** and the image-side surface **32** of the third lens element **30** are aspheric.

A plastic fourth lens element **40** with positive refractive power has a convex object-side surface **41** and a concave image-side surface **42**, the object-side surface **41** and the image-side surface **42** of the fourth lens element **40** are aspheric, and inflection points are formed on the object-side surface **41** and the image-side surface **42** of the fourth lens element **40**.

A plastic fifth lens element **50** with negative refractive power has a convex object-side surface **51** and a concave image-side surface **52**, the object-side surface **51** and the image-side surface **52** of the fifth lens element **50** are aspheric, and inflection points are formed on the object-side surface **51** and the image-side surface **52** of the fifth lens element **50**.

An aperture stop **60**.

An IR cut filter **70** is located behind the fifth lens element **50** and has no influence on the focal length of the optical lens system.

An image plane **80** is located behind the IR cut filter **70**.

The equation for the aspheric surface profiles of the first embodiment is expressed as follows:

$$X(Y)=(Y^2/R)/\left(1+\mathrm{sqrt}\left(1-(1+k)*(Y/R)^2\right)\right)+\sum_i (Ai)*(Y^i)$$

wherein:

X: the height of a point on the aspheric lens surface at a distance Y from the optical axis relative to the tangential plane at the aspheric surface vertex;

Y: the distance from the point on the curve of the aspheric surface to the optical axis;

k: the conic coefficient;

Ai: the aspheric surface coefficient of order i.

In the first embodiment of the present optical lens system for taking image, the focal length of the optical lens system for taking image is f, the focal length of the first lens element is f1, the focal length of the second lens element is f2, the focal length of the third lens element is f3, the focal length of the fourth lens element is f4, the focal length of the fifth lens element is f5, and they satisfy the relations:

$$f=6.17\ \mathrm{mm};$$

$$f/f1=1.35;$$

$$f/f2=-0.89;$$

$$f/f3=0.50;$$

$$f/f4=0.50;$$

$$f/f5=-1.06.$$

In the first embodiment of the present optical lens system for taking image, the focal length of the optical lens system for taking image is f, the on-axis distance between the first lens element and the second lens element is T12, and they satisfy the relation:

$$(T12/f)*100=3.8.$$

In the first embodiment of the present optical lens system for taking image, the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, the Abbe number of the fifth lens element is V5, and they satisfy the relations:

$$V1=55.9;$$

$$V4=55.9;$$

$$V1-V2=32.5;$$

$$V3-V2=32.5;$$

$$|V4-V5|=0.0.$$

In the first embodiment of the present optical lens system for taking image, the radius of curvature of the object-side surface of the first lens element is R1, the radius of curvature of the image-side surface of the first lens element is R2, the radius of curvature of the object-side surface of the fourth lens element is R7, the radius of curvature of the image-side surface of the fourth lens element is R8, the radius of curvature of the object-side surface of the fifth lens element is R9, the radius of curvature of the image-side surface of the fifth lens element is R10, and they satisfy the relations:

$$R1/R2=0.05;$$

$$R7/R8=0.06;$$

$$R9/R10=2.15.$$

In the first embodiment of the present optical lens system for taking image, the edge thickness of the fourth lens element is ET4, the center thickness of the fourth lens element is CT4, and they satisfy the relation:

$ET4/CT4=1.34.$

In the first embodiment of the present optical lens system for taking image, an object to be photographed is imaged on an electronic imaging sensor, the total track length of the optical lens system for taking image is TTL, the maximum image height of the optical lens system for taking image is ImgH, and they satisfy the relation:

$TTL/ImgH=1.83.$

The detailed optical data of the first embodiment is shown in table 1, and the aspheric surface data is shown in table 2, wherein the units of the radius of curvature, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 1

(Embodiment 1)
f (focal length) = 6.17 mm, Fno = 2.8, HFOV (half of field of view) = 32.9 deg.

Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Aperture Stop	Plano	−0.259				
2	Lens 1	2.37429(ASP)	0.644	Plastic	1.544	55.9	4.56
3		50.00000(ASP)	0.232				
4	Lens 2	7.36880(ASP)	0.432	Plastic	1.632	23.4	−6.96
5		2.69229(ASP)	0.908				
6	Lens 3	−13.41500(ASP)	1.341	Plastic	1.544	55.9	12.25
7		−4.61080(ASP)	0.900				
8	Lens 4	6.26220(ASP)	0.550	Plastic	1.544	55.9	12.25
9		100.00000(ASP)	0.444				
10	Lens 5	3.22820(ASP)	0.550	Plastic	1.544	55.9	−5.8
11		1.49953(ASP)	1.000				
12	IR-filter	Plano	0.300	Glass	1.517	64.2	
13		Plano	0.166				
14	Image	Plano					

TABLE 2

Aspheric Coefficients

	Surface # 2	3	4	5	6
k =	3.40090E−02	−1.00000E+00	−2.00000E+01	−4.45409E+00	−1.00000E+00
A4 =	2.50978E−03	−9.81798E−03	−3.58117E−02	−1.98788E−03	−2.41609E−02
A6 =	2.31356E−03	1.23680E−02	2.27808E−02	1.86376E−02	2.78124E−03
A8 =	−1.13159E−03	−5.75426E−03	−7.30419E−03	−5.58513E−03	−3.13369E−03
A10 =	−1.00178E−03	2.00255E−03	6.73836E−04	1.34068E−03	9.15396E−04
A12 =	6.22089E−06				−3.87372E−06
A14 =					−8.79048E−05
A16 =					2.24027E−05

	Surface # 7	8	9	10	11
k =	3.10292E+00	−1.98506E+00	−1.00000E+00	−2.00000E+01	−4.75840E+00
A4 =	−2.60898E−02	−1.67843E−03	2.94138E−02	−4.33989E−02	−2.99692E−02
A6 =	5.44466E−03	−1.65151E−03	−7.08821E−03	6.34038E−03	4.66959E−03
A8 =	−1.21992E−03	−1.33350E−04	5.71459E−04	−3.53977E−04	−5.27592E−04
A10 =	1.18896E−04	7.52355E−07	−1.52177E−05	7.34318E−06	2.14947E−05
A12 =		1.66254E−06	−1.86400E−07		8.04115E−07
A14 =					−5.49145E−08

Referring to FIG. 2A, which shows an optical lens system for taking image in accordance with a second embodiment of the present invention, and FIG. 2B shows the aberration curves of the second embodiment of the present invention. The second embodiment of the present invention comprises: in order from the object side to the image side:

A plastic first lens element **10** with positive refractive power has a convex object-side surface **11** and a convex image-side surface **12**, and the object-side surface **11** and the image-side surface **12** of the first lens element **10** are aspheric.

A plastic second lens element **20** with negative refractive power has a convex object-side surface **21** and a concave image-side surface **22**, and the object-side surface **21** and the image-side surface **22** of the second lens element **20** are aspheric.

A plastic third lens element **30** with positive refractive power has a concave object-side surface **31** and a convex image-side surface **32**, and the object-side surface **31** and the image-side surface **32** of the third lens element **30** are aspheric.

A plastic fourth lens element **40** with positive refractive power has a convex object-side surface **41** and a concave image-side surface **42**, the object-side surface **41** and the image-side surface **42** of the fourth lens element **40** are aspheric, and inflection points are formed on the object-side surface **41** and the image-side surface **42** of the fourth lens element **40**.

A plastic fifth lens element **50** with negative refractive power has a convex object-side surface **51** and a concave image-side surface **52**, the object-side surface **51** and the image-side surface **52** of the fifth lens element **50** are aspheric, and inflection points are formed on the object-side surface **51** and the image-side surface **52** of the fifth lens element **50**.

An aperture stop **60**.

An IR cut filter **70** is located behind the fifth lens element **50** and has no influence on the focal length of the optical lens system.

An image plane **80** is located behind the IR cut filter **70**.

The equation for the aspheric surface profiles of the second embodiment has the same form as that of the first embodiment.

In the second embodiment of the present optical lens system for taking image, the focal length of the optical lens system for taking image is f, the focal length of the first lens element is f1, the focal length of the second lens element is f2, the focal length of the third lens element is f3, the focal length of the fourth lens element is f4, the focal length of the fifth lens element is f5, and they satisfy the relations:

$$f=6.10\ \text{mm};$$

$$f/f1=1.40;$$

$$f/f2=-0.94;$$

$$f/f3=0.50;$$

$$f/f4=0.50;$$

$$f/f5=-1.05.$$

In the second embodiment of the present optical lens system for taking image, the focal length of the optical lens system for taking image is f, the on-axis distance between the first lens element and the second lens element is T12, and they satisfy the relation:

$$(T12/f)*100=3.9.$$

In the second embodiment of the present optical lens system for taking image, the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, the Abbe number of the fifth lens element is V5, and they satisfy the relations:

$$V1=55.9;$$

$$V4=55.9;$$

$$V1-V2=32.5;$$

$$V3-V2=32.5;$$

$$|V4-V5|=0.0.$$

In the second embodiment of the present optical lens system for taking image, the radius of curvature of the object-side surface of the first lens element is R1, the radius of curvature of the image-side surface of the first lens element is R2, the radius of curvature of the object-side surface of the fourth lens element is R7, the radius of curvature of the image-side surface of the fourth lens element is R8, the radius of curvature of the object-side surface of the fifth lens element is R9, the radius of curvature of the image-side surface of the fifth lens element is R10, and they satisfy the relations:

$$R1/R2=-0.03;$$

$$R7/R8=0.06;$$

$$R9/R10=2.15.$$

In the second embodiment of the present optical lens system for taking image, the edge thickness of the fourth lens element is ET4, the center thickness of the fourth lens element is CT4, and they satisfy the relation:

$$ET4/CT4=1.40.$$

In the second embodiment of the present optical lens system for taking image, an object to be photographed is imaged on an electronic imaging sensor, the total track length of the optical lens system for taking image is TTL, the maximum image height of the optical lens system for taking image is ImgH, and they satisfy the relation:

$$TTL/ImgH=1.84.$$

The detailed optical data of the second embodiment is shown in table 3, and the aspheric surface data is shown in table 4, wherein the units of the radius of curvature, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 3

(Embodiment 2)
f (focal length) = 6.10 mm, Fno = 2.8, HFOV (half of field of view) = 33.0 deg.

Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Aperture Stop	Plano	-0.241				
2	Lens 1	2.44488(ASP)	0.644	Plastic	1.544	55.9	4.36
3		-73.06540(ASP)	0.236				
4	Lens 2	7.45920(ASP)	0.398	Plastic	1.632	23.4	-6.47
5		2.58696(ASP)	0.833				
6	Lens 3	-12.41340(ASP)	1.437	Plastic	1.544	55.9	12.13
7		-4.48430(ASP)	0.900				
8	Lens 4	6.20130(ASP)	0.550	Plastic	1.544	55.9	12.12
9		100.00000(ASP)	0.451				

TABLE 3-continued

(Embodiment 2) f (focal length) = 6.10 mm, Fno = 2.8, HFOV (half of field of view) = 33.0 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
10	Lens 5	3.20620(ASP)	0.550	Plastic	1.544	55.9	−5.8
11		1.49407(ASP)	1.000				
12	IR-filter	Plano	0.300	Glass	1.517	64.2	
13		Plano	0.169				
14	Image	Plano					

TABLE 4

Aspheric Coefficients					
	Surface #				
	2	3	4	5	6
k =	3.38122E−02	−1.00000E+00	−1.40371E+01	−5.14920E+00	−1.00000E+00
A4 =	2.11948E−03	−1.54572E−03	−3.05302E−02	4.46480E−03	−2.44065E−02
A6 =	2.02621E−03	7.30303E−03	2.14143E−02	1.51417E−02	2.69142E−03
A8 =	−1.61461E−03	−4.01875E−03	−8.90922E−03	−5.52371E−03	−3.13728E−03
A10 =	1.32164E−03	1.00104E−03	1.39261E−03	1.44236E−03	8.74639E−04
A12 =	−3.04095E−04				−1.99496E−05
A14 =					−6.92919E−05
A16 =					1.61802E−05
	Surface #				
	7	8	9	10	11
k =	3.04737E+00	−1.50822E+00	−1.00000E+00	−2.00000E+01	−4.73967E+00
A4 =	−2.61194E−02	−4.81459E−03	2.78069E−02	−4.14348E−02	−2.91332E−02
A6 =	5.88506E−03	−1.27033E−03	−6.78690E−03	6.10713E−03	4.49182E−03
A8 =	−1.28127E−03	−1.82527E−04	5.26123E−04	−3.43903E−04	−5.12035E−04
A10 =	1.29545E−04	−3.30863E−07	−1.03816E−05	7.37507E−06	2.11024E−05
A12 =		1.69518E−06	−3.91121E−07		7.79136E−07
A14 =					−5.30319E−08

Referring to FIG. 3A, which shows an optical lens system for taking image in accordance with a third embodiment of the present invention, FIG. 3B shows the aberration curves of the third embodiment of the present invention. The third embodiment of the present invention comprises: in order from the object side to the image side:

A plastic first lens element **10** with positive refractive power has a convex object-side surface **11** and a convex image-side surface **12**, and the object-side surface **11** and the image-side surface **12** of the first lens element **10** are aspheric.

A plastic second lens element **20** with negative refractive power has a concave object-side surface **21** and a concave image-side surface **22**, and the object-side surface **21** and the image-side surface **22** of the second lens element **20** are aspheric.

A plastic third lens element **30** with positive refractive power has a concave object-side surface **31** and a convex image-side surface **32**, and the object-side surface **31** and the image-side surface **32** of the third lens element **30** are aspheric.

A plastic fourth lens element **40** with positive refractive power has a convex object-side surface **41** and a concave image-side surface **42**, the object-side surface **41** and the image-side surface **42** of the fourth lens element **40** are aspheric, and inflection points are formed on the object-side surface **41** and the image-side surface **42** of the fourth lens element **40**.

A plastic fifth lens element **50** with negative refractive power has a convex object-side surface **51** and a concave image-side surface **52**, the object-side surface **51** and the image-side surface **52** of the fifth lens element **50** are aspheric, and inflection points are formed on the object-side surface **51** and the image-side surface **52** of the fifth lens element **50**.

An aperture stop **60**.

An IR cut filter **70** is located behind the fifth lens element **50** and has no influence on the focal length of the optical lens system.

An image plane **80** is located behind the IR cut filter **70**.

The equation for the aspheric surface profiles of the third embodiment has the same form as that of the first embodiment.

In the third embodiment of the present optical lens system for taking image, the focal length of the optical lens system for taking image is f, the focal length of the first lens element is f1, the focal length of the second lens element is f2, the focal length of the third lens element is f3, the focal length of the fourth lens element is f4, the focal length of the fifth lens element is f5, and they satisfy the relations:

$$f=3.82\ \text{mm};$$

$$f/f1=1.34;$$

$$f/f2=-0.80;$$

$f/f3=0.68;$

$f/f4=0.07;$

$f/f5=-0.81.$

In the third embodiment of the present optical lens system for taking image, the focal length of the optical lens system for taking image is f, the on-axis distance between the first lens element and the second lens element is T12, and they satisfy the relation:

$(T12/f)*100=5.4.$

In the third embodiment of the present optical lens system for taking image, the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, the Abbe number of the fifth lens element is V5, and they satisfy the relations:

$V1=55.9;$

$V4=55.9;$

$V1-V2=32.5;$

$V3-V2=32.5;$

$|V4-V5|=0.1.$

In the third embodiment of the present optical lens system for taking image, the radius of curvature of the object-side surface of the first lens element is R1, the radius of curvature of the image-side surface of the first lens element is R2, the

radius of curvature of the object-side surface of the fourth lens element is R7, the radius of curvature of the image-side surface of the fourth lens element is R8, the radius of curvature of the object-side surface of the fifth lens element is R9, the radius of curvature of the image-side surface of the fifth lens element is R10, and they satisfy the relations:

$R1/R2=-0.30;$

$R7/R8=1.03;$

$R9/R10=3.92.$

In the third embodiment of the present optical lens system for taking image, the edge thickness of the fourth lens element is ET4, the center thickness of the fourth lens element is CT4, and they satisfy the relation:

$ET4/CT4=0.80.$

In the third embodiment of the present optical lens system for taking image, an object to be photographed is imaged on an electronic imaging sensor, the total track length of the optical lens system for taking image is TTL, the maximum image height of the optical lens system for taking image is ImgH, and they satisfy the relation:

$TTL/ImgH=1.91.$

The detailed optical data of the third embodiment is shown in table 5, and the aspheric surface data is shown in table 6, wherein the units of the radius of curvature, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 5

(Embodiment 3)
f (focal length) = 3.82 mm, Fno = 2.8, HFOV (half of field of view) = 32.6 deg.

Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Aperture Stop	Plano	−0.038				
2	Lens 1	1.97505(ASP)	0.619	Plastic	1.544	55.9	2.86
3		−6.50090(ASP)	0.208				
4	Lens 2	−6.57340(ASP)	0.457	Plastic	1.632	23.4	−4.77
5		5.72860(ASP)	0.726				
6	Lens 3	−2.46821(ASP)	0.442	Plastic	1.544	55.9	5.63
7		−1.45351(ASP)	0.070				
8	Lens 4	1.92135(ASP)	0.500	Plastic	1.544	55.9	53.39
9		1.86875(ASP)	0.200				
10	Lens 5	7.03660(ASP)	0.446	Plastic	1.530	55.8	−4.69
11		1.79673(ASP)	0.500				
12	IR-filter	Plano	0.550	Glass	1.517	64.2	
13		Plano	0.140				
14	Image	Plano					

TABLE 6

Aspheric Coefficients

	Surface #				
	2	3	4	5	6
k =	−9.05029E−02	−1.00000E+00	1.40830E+01	−1.67187E+01	−4.11064E+00
A4 =	−6.23356E−03	−2.22204E−02	−3.25962E−02	3.06667E−02	3.00032E−01
A6 =	−1.00111E−02	−1.36874E−01	−2.53820E−01	−2.31584E−01	−2.30071E−01
A8 =	−4.91068E−02	8.59699E−02	2.90832E−01	2.69048E−01	8.86575E−02
A10 =	1.22597E−02	−3.83427E−02	−8.90063E−02	−1.41802E−01	−1.33785E−02
A12 =				3.13361E−02	−7.34373E−03

TABLE 6-continued

Aspheric Coefficients					
	Surface #				
	7	8	9	10	11
k =	-8.66158E-01	-4.88703E+00	-4.37347E+00	-2.00000E+01	-8.89658E+00
A4 =	1.96052E-01	-1.32396E-01	-8.86036E-02	-1.27544E-02	-4.40696E-02
A6 =	1.40082E-02	3.18970E-02	2.78597E-02	9.13900E-04	5.60032E-03
A8 =	-3.62703E-02	-5.81289E-03	-1.12211E-02	3.42219E-04	5.90040E-04
A10 =	8.22598E-03	-5.35146E-04	2.05881E-03	9.50879E-05	-1.14925E-04
A12 =			-1.87400E-04	-1.87141E-05	

Referring to FIG. 4A, which shows an optical lens system for taking image in accordance with a fourth embodiment of the present invention, FIG. 4B shows the aberration curves of the fourth embodiment of the present invention. The fourth embodiment of the present invention comprises: in order from the object side to the image side:

A plastic first lens element **10** with positive refractive power has a convex object-side surface **11** and a concave image-side surface **12**, and the object-side surface **11** and the image-side surface **12** of the first lens element **10** are aspheric.

A plastic second lens element **20** with negative refractive power has a concave object-side surface **21** and a concave image-side surface **22**, and the object-side surface **21** and the image-side surface **22** of the second lens element **20** are aspheric.

A plastic third lens element **30** with positive refractive power has a concave object-side surface **31** and a convex image-side surface **32**, and the object-side surface **31** and the image-side surface **32** of the third lens element **30** are aspheric.

A plastic fourth lens element **40** with positive refractive power has a convex object-side surface **41** and a concave image-side surface **42**, the object-side surface **41** and the image-side surface **42** of the fourth lens element **40** are aspheric, and inflection points are formed on the object-side surface **41** and the image-side surface **42** of the fourth lens element **40**.

A plastic fifth lens element **50** with negative refractive power has a convex object-side surface **51** and a concave image-side surface **52**, the object-side surface **51** and the image-side surface **52** of the fifth lens element **50** are aspheric, and inflection points are formed on the object-side surface **51** and the image-side surface **52** of the fifth lens element **50**.

An aperture stop **60**.

An IR cut filter **70** is located behind the fifth lens element **50** and has no influence on the focal length of the optical lens system.

An image plane **80** is located behind the IR cut filter **70**.

The equation for the aspheric surface profiles of the fourth embodiment has the same form as that of the first embodiment.

In the fourth embodiment of the present optical lens system for taking image, the focal length of the optical lens system for taking image is f, the focal length of the first lens element is f1, the focal length of the second lens element is f2, the focal length of the third lens element is f3, the focal length of the fourth lens element is f4, the focal length of the fifth lens element is f5, and they satisfy the relations:

$$f=3.82\text{ mm};$$

$$f/f1=1.24;$$

$$f/f2=-0.78;$$

$$f/f3=0.65;$$

$$f/f4=0.05;$$

$$f/f5=-0.61.$$

In the fourth embodiment of the present optical lens system for taking image, the focal length of the optical lens system for taking image is f, the on-axis distance between the first lens element and the second lens element is T12, and they satisfy the relation:

$$(T12/f)*100=6.6.$$

In the fourth embodiment of the present optical lens system for taking image, the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, the Abbe number of the fifth lens element is V5, and they satisfy the relations:

$$V1=55.9;$$

$$V4=55.9;$$

$$V1-V2=32.5;$$

$$V3-V2=32.5;$$

$$|V4-V5|=0.1.$$

In the fourth embodiment of the present optical lens system for taking image, the radius of curvature of the object-side surface of the first lens element is R1, the radius of curvature of the image-side surface of the first lens element is R2, the radius of curvature of the object-side surface of the fourth lens element is R7, the radius of curvature of the image-side surface of the fourth lens element is R8, the radius of curvature of the object-side surface of the fifth lens element is R9, the radius of curvature of the image-side surface of the fifth lens element is R10, and they satisfy the relations:

$$R1/R2=0.03;$$

$$R7/R8=1.07;$$

$$R9/R10=2.28.$$

In the fourth embodiment of the present optical lens system for taking image, the edge thickness of the fourth lens element is ET4, the center thickness of the fourth lens element is CT4, and they satisfy the relation:

$$ET4/CT4=0.79.$$

In the fourth embodiment of the present optical lens system for taking image, an object to be photographed is imaged on an electronic imaging sensor, the total track length of the optical lens system for taking image is TTL, the maximum image height of the optical lens system for taking image is ImgH, and they satisfy the relation:

$TTL/ImgH=1.93.$

The detailed optical data of the fourth embodiment is shown in table 7, and the aspheric surface data is shown in table 8, wherein the units of the radius of curvature, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 7

(Embodiment 4)
f (focal length) = 3.82 mm, Fno = 2.8, HFOV (half of field of view) = 32.7 deg.

Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Aperture Stop	Plano	−0.080				
2	Lens 1	1.63090(ASP)	0.577	Plastic	1.544	55.9	3.09
3		50.00000(ASP)	0.254				
4	Lens 2	−6.26590(ASP)	0.567	Plastic	1.632	23.4	−4.92
5		6.38450(ASP)	0.595				
6	Lens 3	−2.63676(ASP)	0.467	Plastic	1.544	55.9	5.85
7		−1.53265(ASP)	0.070				
8	Lens 4	1.81232(ASP)	0.526	Plastic	1.544	55.9	76.98
9		1.70054(ASP)	0.200				
10	Lens 5	3.93580(ASP)	0.456	Plastic	1.530	55.8	−6.27
11		1.72941(ASP)	0.500				
12	IR-filter	Plano	0.550	Glass	1.517	64.2	
13		Plano	0.138				
14	Image	Plano					

TABLE 8

Aspheric Coefficients

	Surface #				
	2	3	4	5	6
k =	3.83732E−01	−1.00000E+00	2.00000E+01	−2.50576E+00	−7.96225E+00
A4 =	6.52406E−03	−1.26393E−03	−6.25881E−02	3.71554E−02	3.10714E−01
A6 =	1.34131E−03	−1.22843E−01	−2.45549E−01	−2.30113E−01	−2.30716E−01
A8 =	−1.85615E−02	1.28473E−01	2.84382E−01	2.58060E−01	8.69199E−02
A10 =	1.55808E−02	−1.44427E−01	−2.31754E−01	−1.52593E−01	−1.27392E−02
A12 =				4.58557E−02	−4.98079E−03

	Surface #				
	7	8	9	10	11
k =	−8.66242E−01	−3.05074E+00	−2.92204E+00	−2.00000E+01	−7.61011E+00
A4 =	1.94704E−01	−1.23602E−01	−8.94261E−02	−1.51248E−02	−4.62221E−02
A6 =	1.73572E−02	2.93392E−02	2.78585E−02	8.56419E−04	5.64118E−03
A8 =	−3.61995E−02	−6.22203E−03	−1.10412E−02	3.34632E−04	6.89247E−04
A10 =	7.29550E−03	3.66878E−04	2.14494E−03	9.81896E−05	−1.19280E−04
A12 =			−1.97091E−04	−1.71293E−05	

TABLE 9-continued

	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4
V1 − V2	32.5	32.5	32.5	32.5
V3 − V2	32.5	32.5	32.5	32.5
|V4 − V5|	0.0	0.0	0.1	0.1
(T12/f) * 100	3.8	3.9	5.4	6.6
ET4/CT4	1.34	1.40	0.80	0.79

TABLE 9

	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4
f	6.17	6.10	3.82	3.82
Fno	2.8	2.8	2.8	2.8
HFOV	32.9	33.0	32.6	32.7
V1	55.9	55.9	55.9	55.9
V4	55.9	55.9	55.9	55.9

TABLE 9-continued

	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4
f/f1	1.35	1.40	1.34	1.24
f/f2	−0.89	−0.94	−0.80	−0.78
f/f3	0.50	0.50	0.68	0.65
f/f4	0.50	0.50	0.07	0.05
f/f5	−1.06	−1.05	−0.81	−0.61

TABLE 9-continued

	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4
R1/R2	0.05	−0.03	−0.30	0.03
R7/R8	0.06	0.06	1.03	1.07
R9/R10	2.15	2.15	3.92	2.28
TTL/ImgH	1.83	1.84	1.91	1.93

In the present optical lens system for taking image, the lens elements can be made of glass or plastic. If the lens elements are made of glass, there is more freedom in distributing the refractive power of the optical lens system. If the lens elements are made of plastic, the cost will be effectively reduced.

It is to be noted that the tables 1-8 show different data from the different embodiments, however, the data of the different embodiments is obtained from experiments. Therefore, any product of the same structure is deemed to be within the scope of the present invention even if it uses different data. Table 9 lists the relevant data for the various embodiments of the present invention.

While we have shown and described various embodiments in accordance with the present invention, it should be clear to those skilled in the art that further embodiments may be made without departing from the scope of the present invention.

What is claimed is:

1. An optical lens system for taking image comprising, in order from the object side to the image side:

a first lens element with positive refractive power having a convex object-side surface;

a second lens element with negative refractive power;

a third lens element with positive refractive power having a concave object-side surface and a convex image-side surface;

a fourth lens element with positive refractive power;

a fifth lens element with refractive power; and

an aperture stop being located between an object to be photographed and the second lens element; in the optical lens system for taking image, the number of the lens elements with refractive power being limited to five.

2. The optical lens system for taking image as claimed in claim **1**, wherein an on-axis distance between the first lens element and the second lens element is T12, a focal length of the optical lens system for taking image is f, and they satisfy the relation:

$$0.4<(T12/f)*100<15.$$

3. The optical lens system for taking image as claimed in claim **1**, wherein an object-side surface of the second lens element is convex.

4. The optical lens system for taking image as claimed in claim **1**, wherein the object to be photographed is imaged on an electronic imaging sensor, a total track length of the optical lens system for taking image is TTL, a maximum image height of the optical lens system for taking image is ImgH, and they satisfy the relation:

$$TTL/ImgH<2.05.$$

5. The optical lens system for taking image as claimed in claim 1, wherein the fifth lens element has negative refractive power, an Abbe number of the fourth lens element is V4, an Abbe number of the fifth lens element is V5, and they satisfy the relation:

$$|V4-V5|<15.$$

6. The optical lens system for taking image as claimed in claim **1**, wherein an image-side surface of the fifth lens element is concave.

7. The optical lens system for taking image as claimed in claim **6**, wherein an object-side surface of the fifth lens element is convex.

8. The optical lens system for taking image as claimed in claim **7**, wherein an image-side surface of the second lens element is concave.

9. The optical lens system for taking image as claimed in claim **8**, wherein the fifth lens element is made of plastic material and is formed with inflection points.

10. The optical lens system for taking image as claimed in claim **9**, wherein the fourth lens element is made of plastic material and is formed with inflection points.

11. The optical lens system for taking image as claimed in claim **9**, wherein an object-side surface of the fourth lens element is convex, and an image-side surface of the fourth lens element is concave.

12. The optical lens system for taking image as claimed in claim **11**, wherein an image-side surface of the first lens element is concave.

13. The optical lens system for taking image as claimed in claim **11**, wherein the aperture stop is located before the first lens element.

14. The optical lens system for taking image as claimed in claim **13**, wherein the fourth lens element is made of plastic material, at least one of the object-side and the image-side surfaces of the fourth lens element is aspheric, an Abbe number of the fourth lens element is V4, it satisfies the relation:

$$40<V4<70,$$

and the object-side surface and the image-side surface of the fifth lens element are aspheric.

15. The optical lens system for taking image as claimed in claim **14**, wherein the second lens element is made of plastic material, at least one of an object-side and the image-side surfaces of the second lens element is aspheric, the third lens element is made of plastic material, and at least one of the object-side and the image-side surfaces of the third lens element is aspheric.

16. The optical lens system for taking image as claimed in claim **15**, wherein the first lens element is made of plastic material, at least one of the object-side and an image-side surfaces of the first lens element is aspheric, an Abbe number of the first lens element is V1, an Abbe number of the second lens element is V2, an Abbe number of the third lens element is V3, and they satisfy the relations:

$$V1-V2>15;$$

$$V3-V2>15.$$

17. The optical lens system for taking image as claimed in claim **13**, wherein a focal length of the optical lens system for taking image is f, a focal length of the first lens element is f1, a focal length of the fourth lens element is f4, and they satisfy the relations:

$$1.1<f/f1<2.0;$$

$$0<f/f4<0.8.$$

18. The optical lens system for taking image as claimed in claim **17**, wherein the focal length of the optical lens system for taking image is f, a focal length of the second lens element is f2, and they satisfy the relation:

$$-2.5<f/f2<-0.7.$$

19. The optical lens system for taking image as claimed in claim 18, wherein the focal length of the optical lens system for taking image is f, a focal length of the fifth lens element is f5, and they satisfy the relation:

$$-2.0<f/f5<-0.75.$$

20. The optical lens system for taking image as claimed in claim 19, wherein the focal length of the optical lens system for taking image is f, the focal length of the fourth lens element is f4, and they satisfy the relation:

$$0.0<f/f4<0.3.$$

21. The optical lens system for taking image as claimed in claim 17, wherein the focal length of the optical lens system for taking image is f, the focal length of the first lens element is f1, a focal length of the third lens element is f3, the focal length of the fourth lens element is f4, and they satisfy the relations:

$$1.1<f/f1<1.4;$$

$$0.6<f/f3<0.8;$$

$$0.03<f/f4<0.2.$$

22. The optical lens system for taking image as claimed in claim 13, wherein a radius of curvature of the object-side surface of the first lens element is R1, a radius of curvature of an image-side surface of the first lens element is R2, and they satisfy the relation:

$$R1/R2>-0.22.$$

23. The optical lens system for taking image as claimed in claim 22, wherein a radius of curvature of the object-side surface of the fourth lens element is R7, a radius of curvature of the image-side surface of the fourth lens element is R8, and they satisfy the relation:

$$0<R7/R8<1.6.$$

24. The optical lens system for taking image as claimed in claim 23, wherein the radius of curvature of the object-side surface of the first lens element is R1, the radius of curvature of an image-side surface of the first lens element is R2, and they satisfy the relation:

$$-0.2<R1/R2<0.3.$$

25. The optical lens system for taking image as claimed in claim 24, wherein a radius of curvature of the object-side surface of the fifth lens element is R9, a radius of curvature of the image-side surface of the fifth lens element is R10, and they satisfy the relation:

$$2.0<R9/R10<4.0.$$

26. The optical lens system for taking image as claimed in claim 13, wherein an Abbe number of the first lens element is V1, and it satisfies the relations:

$$50<V1<58.$$

27. The optical lens system for taking image as claimed in claim 13, wherein an edge thickness of the fourth lens element is ET4, a center thickness of the fourth lens element is CT4, and they satisfy the relation:

$$0.6<ET4/CT4<1.0.$$

* * * * *

POS-010

ATTORNEY OR PARTY WITHOUT ATTORNEY (Name, State Bar number, and address)
JENNIFER I. FREEDMAN, ESQ.
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FOR COURT USE ONLY

SAN DIEGO COUNTY SUPERIOR COURT NORTH COUNTY DIVISION
STREET ADDRESS: 325 SOUTH MELROSE DRIVE
MAILING ADDRESS:
CITY AND ZIP CODE: VISTA, CA 92083-6693
BRANCH NAME: NORTH COUNTY DIVISION

PLAINTIFF/PETITIONER: ROIC CALIFORNIA
DEFENDANT/RESPONDENT: LTS INC,

CASE NUMBER: 37201300050180CL-UD-NC

PROOF OF SERVICE OF SUMMONS

Ref. No. or File No.:

(Separate proof of service is required for each party served.)

1. At the time of service I was at least 18 years of age and not a party to this action.
2. I served copies of:
   a. [X] summons
   b. [X] complaint
   c. [ ] Alternative Dispute Resolution (ADR) package
   d. [ ] Civil Case Cover Sheet *(served in complex cases only)*
   e. [ ] cross-complaint
   f. [X] other *(specify documents)*: **NOTICE OF ELIGIBILITY TO EFILE AND ASSIGNMENT TO IMAGING DEPARTMENT**
3. a. Party served *(specify name of party as shown on documents served)*:
   LTS INC., ALSO KNOWN AS LTS, INC., A CALIFORNIA CORPORATION, INDIVIDUALLY DOING BUSINESS AS LIBERTY TAX SERVICE

   b. [X] Person (other than the party in item 3a) served on behalf of an entity or as an authorized agent (and not a person under item 5b on whom substituted service was made) *(specify name and relationship to the party named in item 3a)*:
   CARL HENGER - AGENT FOR SERVICE OF PROCESS
4. Address where the party was served: **601 OCEANSIDE BLVD
   OCEANSIDE, CA 92054**
5. I served the party *(check proper box)*
   a. [ ] **by personal service.** I personally delivered the documents listed in item 2 to the party or person authorized to receive service of process for the party (1) on *(date)*: (2) at *(time)*:

   b. [X] **by substituted service.** On *(date)*: **05/30/2013** at *(time)*: **03:40 pm** I left the documents listed in item 2 with or in the presence of *(name and title or relationship to person indicated in item 3b)*:
   BRENDA DAUGHERTY - PERSON IN CHARGE- EMPLOYEE

   (1) [X] **(business)** a person at least 18 years of age apparently in charge at the office or usual place of business of the person to be served. I informed him of her of the general nature of the papers.

   (2) [ ] **(home)** a competent member of the household (at least 18 years of age) at the dwelling house or usual place of abode of the party. I informed him or her of the general nature of the papers.

   (3) [ ] **(physical address unknown)** a person at least 18 years of age apparently in charge at the usual mailing address of the person to be served, other than a United States Postal Service post office box. I informed him of her of the general nature of the papers.

   (4) [ ] I thereafter mailed (by first-class, postage prepaid) copies of the documents to the person to be served at the place where the copies were left (Code Civ. Proc., §415.20). I mailed the documents on *(date)*: from *(city)*: or [X] a declaration of mailing is attached.

   (5) [ ] I attach a **declaration of diligence** stating actions taken first to attempt personal service.

PETITIONER: **ROIC CALIFORNIA** RESPONDENT: **LTS INC,**	CASE NUMBER: **37201300050180CL-UD-NC**

c. ☐ **by mail and acknowledgment of receipt of service.** I mailed the documents listed in item 2 to the party, to the address shown in item 4, by first-class mail, postage prepaid,

(1) on *(date):* (2) from *(city):*

(3) ☐ with two copies of the *Notice and Acknowledgment of Receipt* and a postage-paid return envelope addressed to me. *(Attach completed* Notice and Acknowledgement of Receipt.) (Code Civ. Proc., § 415.30.)

(4) ☐ to an address outside California with return receipt requested. (Code Civ. Proc., § 415.40.)

d. ☐ **by other means** *(specify means of service and authorizing code section):*

☐ Additional page describing service is attached.

6. The "Notice to the Person Served" (on the summons) was completed as follows:

a. ☐ as an individual defendant.
b. ☐ as the person sued under the fictitious name of *(specify):*
c. ☐ as occupant.
d. ☒ On behalf of *(specify):* **LTS INC., ALSO KNOWN AS LTS, INC., A CALIFORNIA CORPORATION, INDIVIDUALLY DOING BUSINESS AS LIBERTY TAX SERVICE**

under the following Code of Civil Procedure section:

☒ 416.10 (corporation)	☐ 415.95 (business organization, form unknown)
☐ 416.20 (defunct corporation)	☐ 416.60 (minor)
☐ 416.30 (joint stock company/association)	☐ 416.70 (ward or conservatee)
☐ 416.40 (association or partnership)	☐ 416.90 (authorized person)
☐ 416.50 (public entity)	☐ 415.46 (occupant)
	☐ other:

7. **Person who served papers**

a. Name: **DEBRA DELGADILLO - Diversified Legal Services, Inc.**
b. Address: **4665 Park Blvd San Diego, CA 92116**
c. Telephone number: **(619) 260-8224**
d. The fee for service was: **$ 50.50**
e. I am:

(1) ☐ not a registered California process server.
(2) ☐ exempt from registration under Business and Professions Code section 22350(b).
(3) ☒ registered California process server:
(i) ☐ **owner** ☒ **employee** ☐ **independent contractor.**
(ii) Registration No.: **1761**
(iii) County: **SAN DIEGO**

8. ☒ **I declare** under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

or

9. ☐ **I am a California sheriff or marshal and** I certify that the foregoing is true and correct.

Date: **05/30/2013**

Diversified Legal Services, Inc.
4665 Park Blvd
San Diego, CA 92116
(619) 260-8224

DEBRA DELGADILLO
(NAME OF PERSON WHO SERVED PAPERS/SHERIFF OR MARSHAL) ▶ (SIGNATURE)

ATTORNEY OR PARTY WITHOUT ATTORNEY (Name, State Bar number, and address)	FOR COURT USE ONLY
JENNIFER I. FREEDMAN, ESQ. JENNIFER I. FREEDMAN, ESQ. 4225 EXECUTIVE SQUARE SUITE 380 LA JOLLA, CA 92037 TELEPHONE NO.: (858) 550-0474 FAX NO.(Optional): (858) 550-0499 E-MAIL ADDRESS (Optional): ATTORNEY FOR (Name): :	
SAN DIEGO COUNTY SUPERIOR COURT NORTH COUNTY DIVISION STREET ADDRESS: 325 SOUTH MELROSE DRIVE MAILING ADDRESS: CITY AND ZIP CODE: VISTA, CA 92083-6693 BRANCH NAME: NORTH COUNTY DIVISION	
PLAINTIFF/PETITIONER: ROIC CALIFORNIA DEFENDANT/RESPONDENT: LTS INC,	CASE NUMBER: 37201300050180CL-UD-NC
PROOF OF SERVICE BY MAIL	Ref. No. or File No.:

I am a citizen of the United States and employed in the County of San Diego, State of California. I am over the age of 18 and not a party to the within action. My business address is 4665 Park Blvd, San Diego, CA 92116.

On May 30, 2013, after substituted service under section CCP 415.20(a) or 415.20(b) or FRCIV.P 4(d)(1) was made, I mailed copies of the:

Summons;Complaint;NOTICE OF ELIGIBILITY TO EFILE AND ASSIGNMENT TO IMAGING DEPARTMENT

to the defendant in said action by placing a true copy thereof enclosed in a sealed envelope, with First Class postage thereon fully prepaid, in the United States Mail at SAN DIEGO, California, addressed as follows:

LTS INC., ALSO KNOWN AS LTS, INC., A CALIFORNIA CORPORATION, INDIVIDUALLY DOING BUSINESS AS LIBERTY TAX SERVICE
ATTENTION: CARL HENGER - AGENT FOR SERVICE OF PROCESS
601 OCEANSIDE BLVD
OCEANSIDE, CA 92054

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EXHIBIT B

US007864454B1

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

(10) **Patent No.:** **US 7,864,454 B1**
(45) **Date of Patent:** **Jan. 4, 2011**

(54) **IMAGING LENS SYSTEM**

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(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 0 days.

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(22) Filed: **Nov. 20, 2009**

(30) **Foreign Application Priority Data**

Aug. 11, 2009 (TW) .... 98126907 A

(51) **Int. Cl.**
G02B 9/60 (2006.01)
G02B 9/02 (2006.01)

(52) **U.S. Cl.** **359/764**; 359/714; 359/765; 359/766

(58) **Field of Classification Search** 359/714, 359/763, 764, 765, 766
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,365,920 B2 4/2008 Noda
7,502,181 B2 * 3/2009 Shinohara 359/764

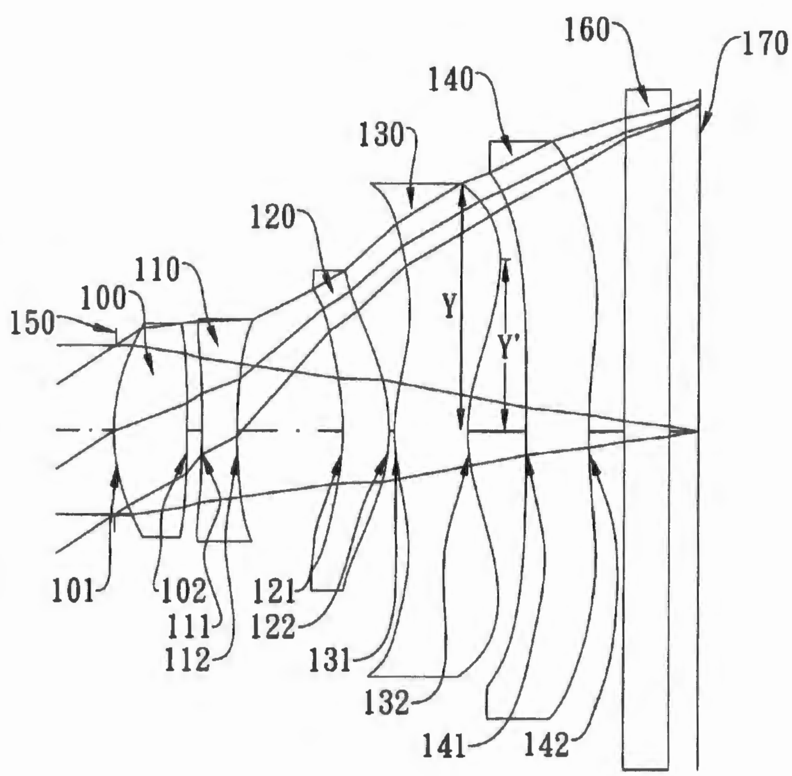
* cited by examiner

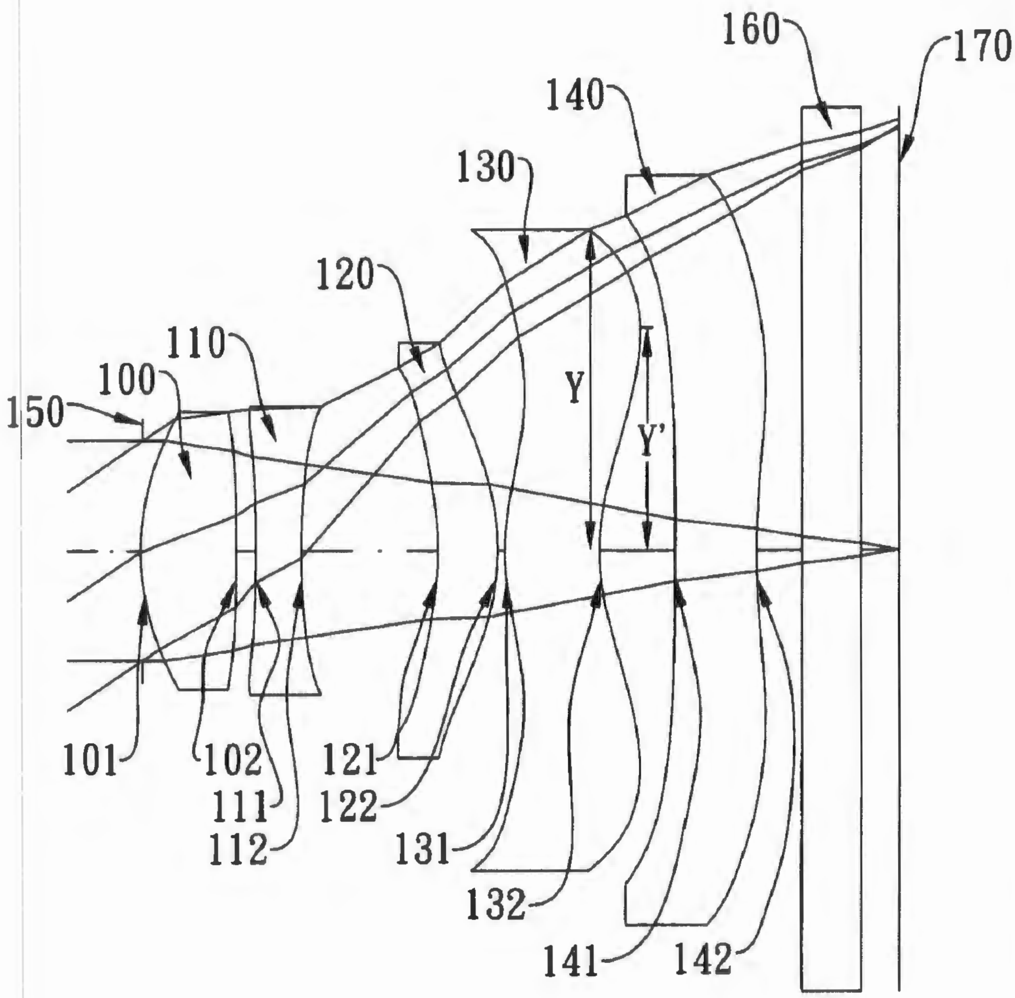
Primary Examiner—Jack Dinh
(74) *Attorney, Agent, or Firm*—Bacon & Thoms, PLLC

(57) **ABSTRACT**

The present invention provides an imaging lens system comprising, in order from an object side to an image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element with positive refractive power, at least one of the object-side and image-side surfaces thereof being aspheric; a fourth lens element, the image-side surface thereof being aspheric and provided with at least one inflection point; a fifth lens element having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric; and an aperture stop disposed between an imaged object and the second lens element. Such an arrangement of optical elements can effectively reduce the total track length and sensitivity of the optical system, and image quality can also be improved.

20 Claims, 17 Drawing Sheets

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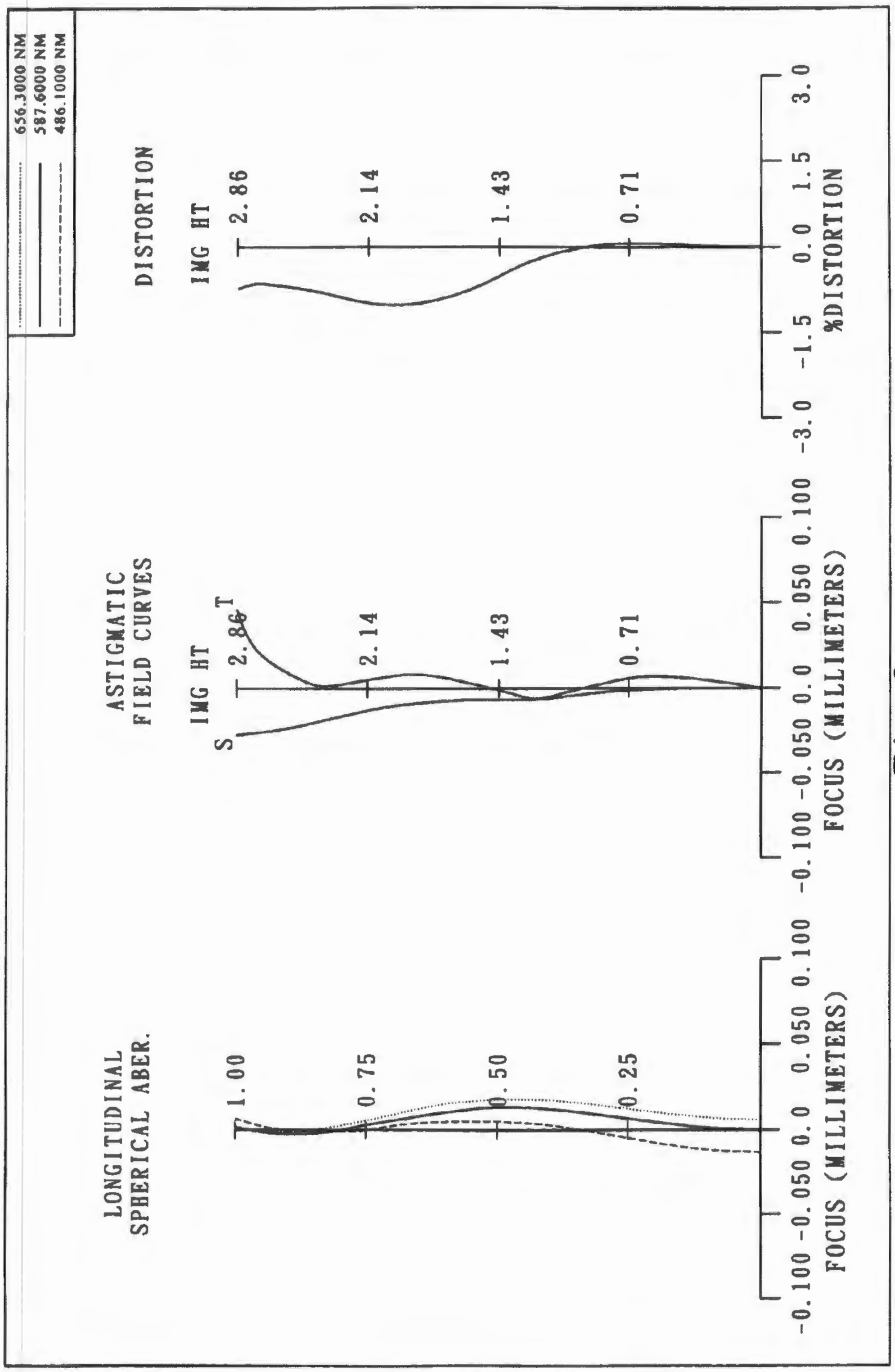
142

Fig. 1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ASTIGMATIC FIELD CURVES
IMG HT
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FOCUS (MILLIMETERS)
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2.14
1.43
0.71
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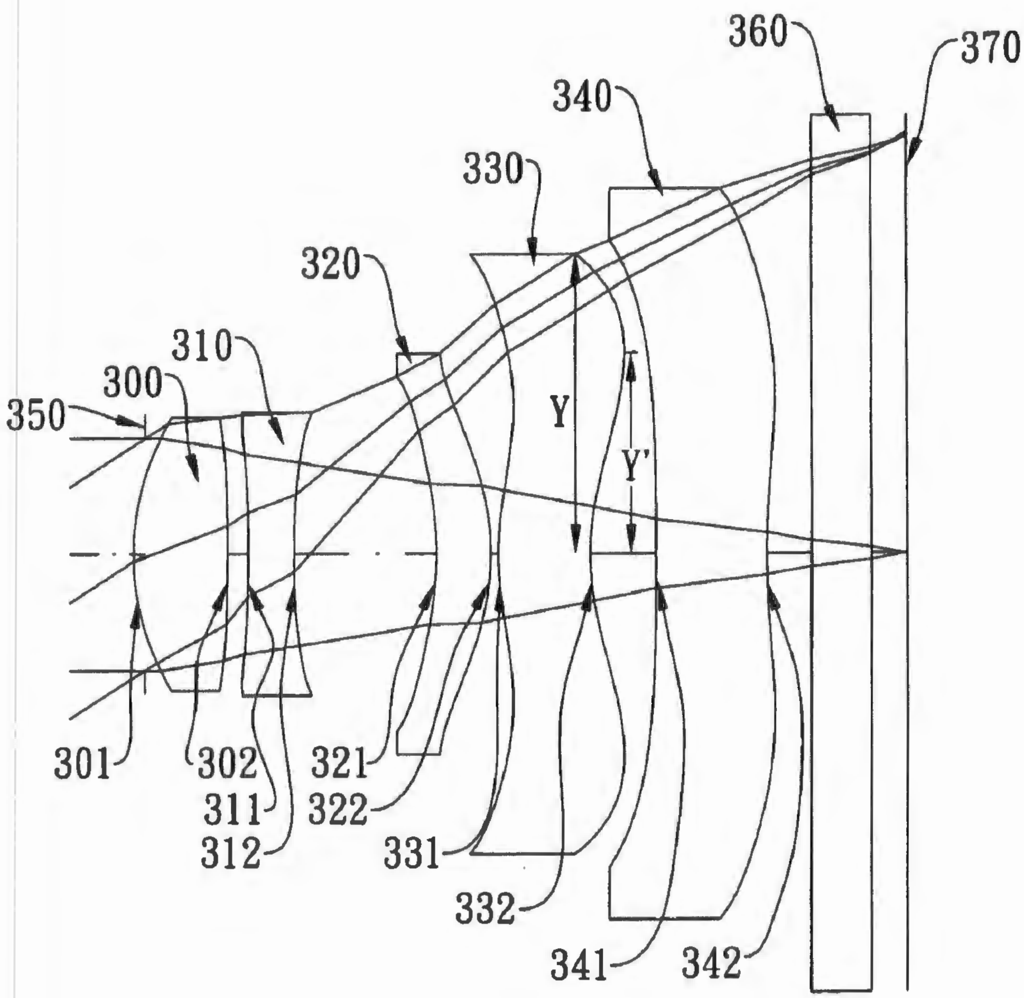
%DISTORTION

Fig. 2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342

Fig. 3

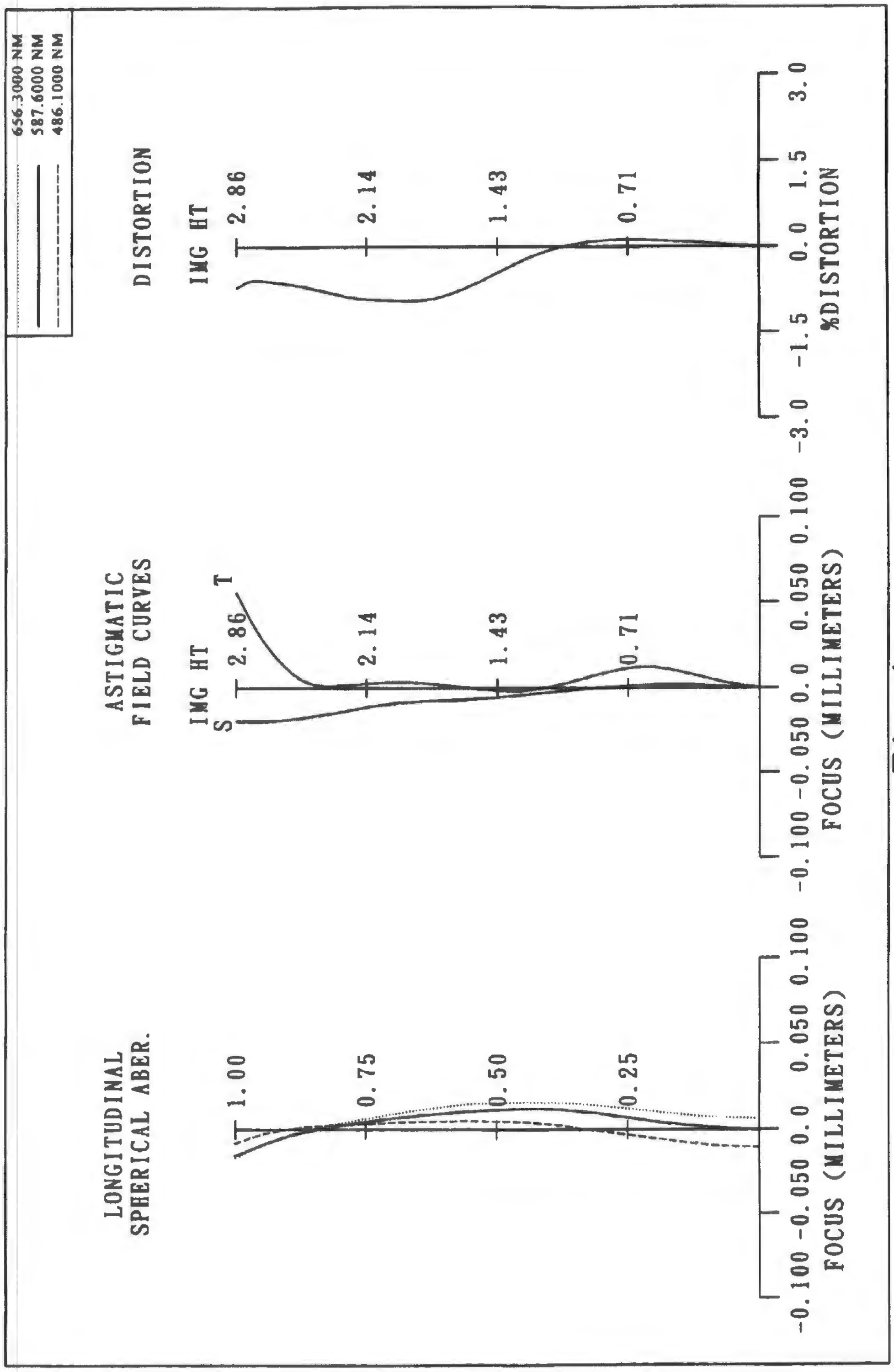
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Fig. 4

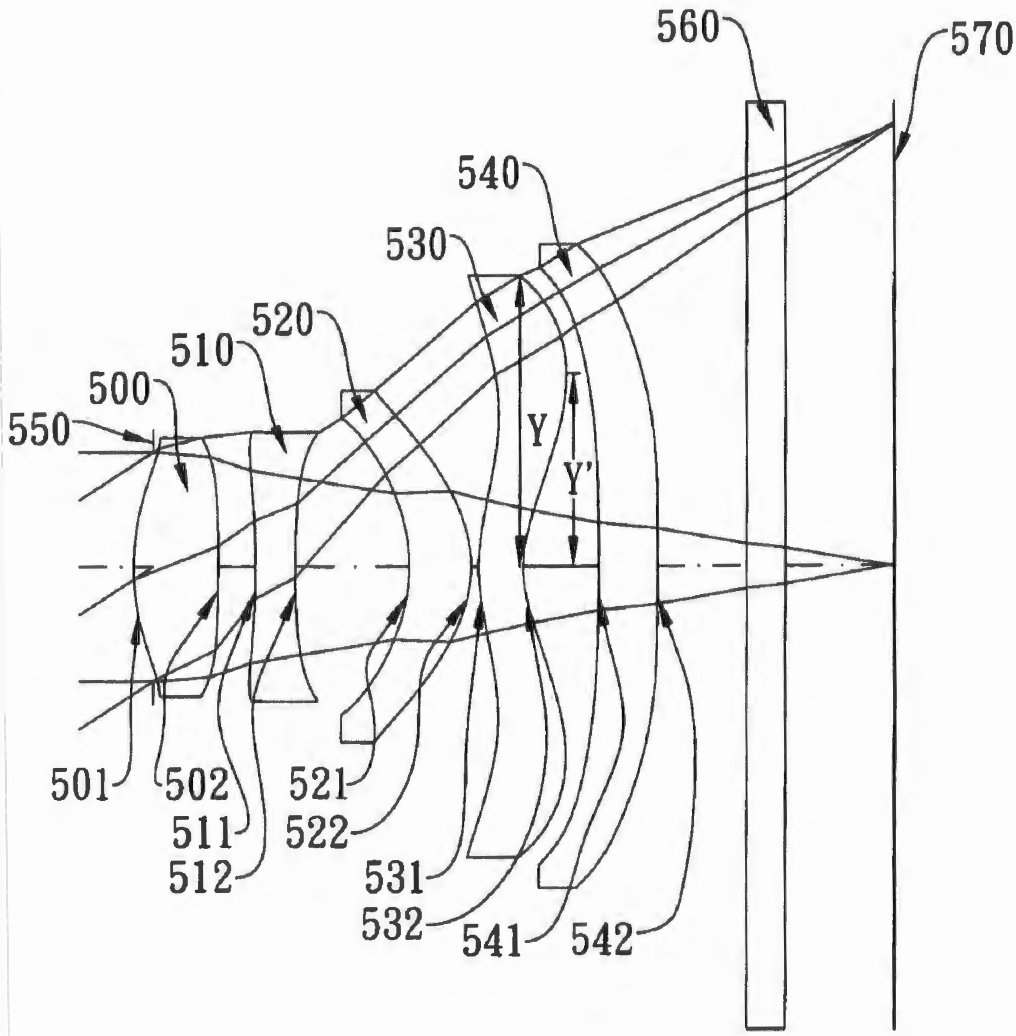
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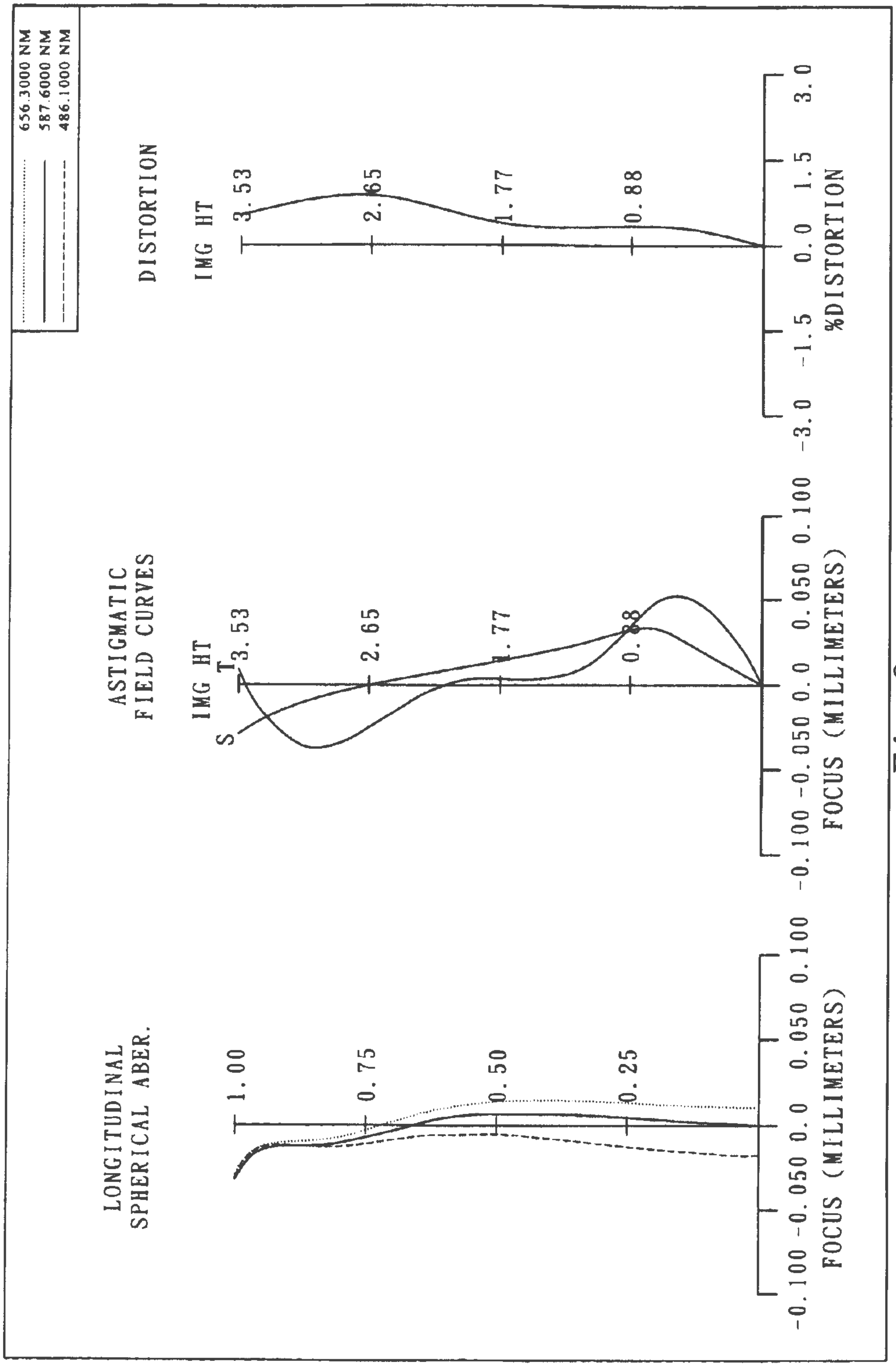
Fig. 5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0.88
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T
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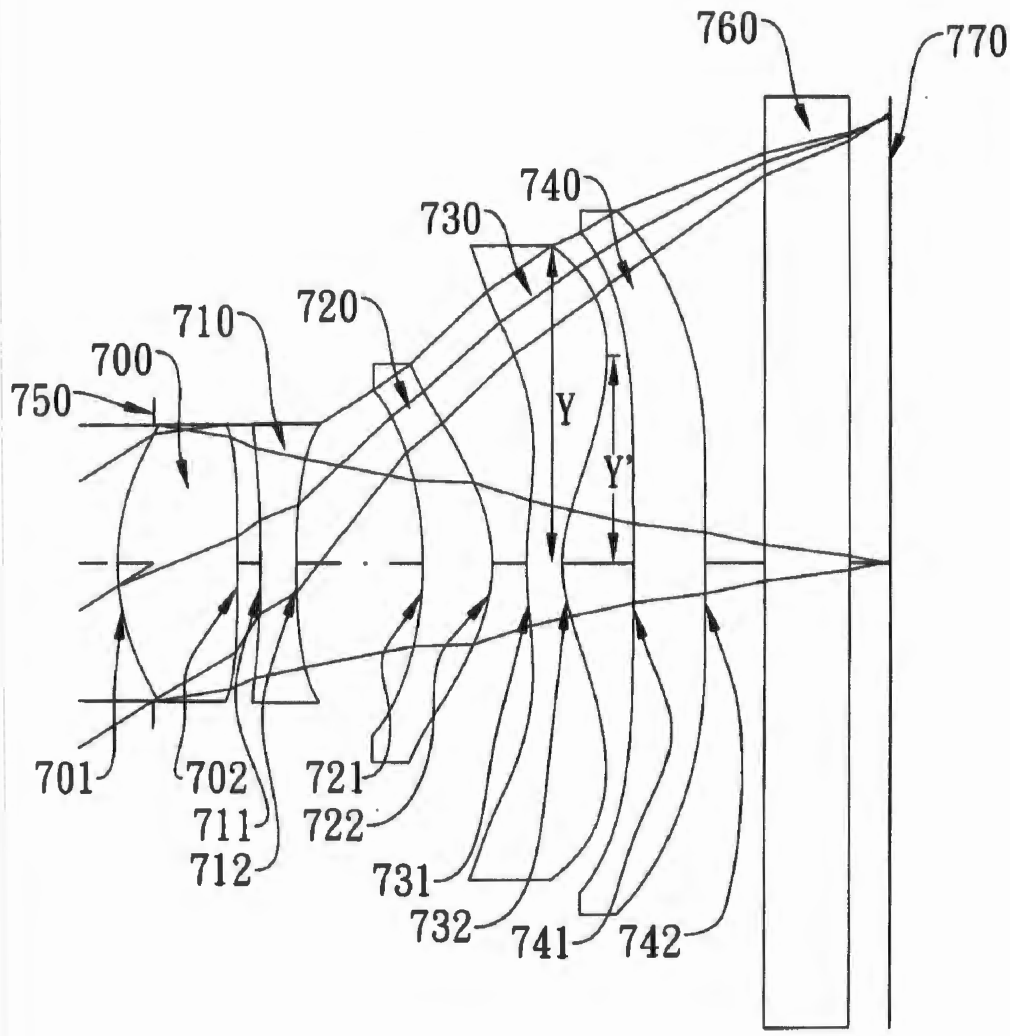
%DISTORTION

Fig. 6



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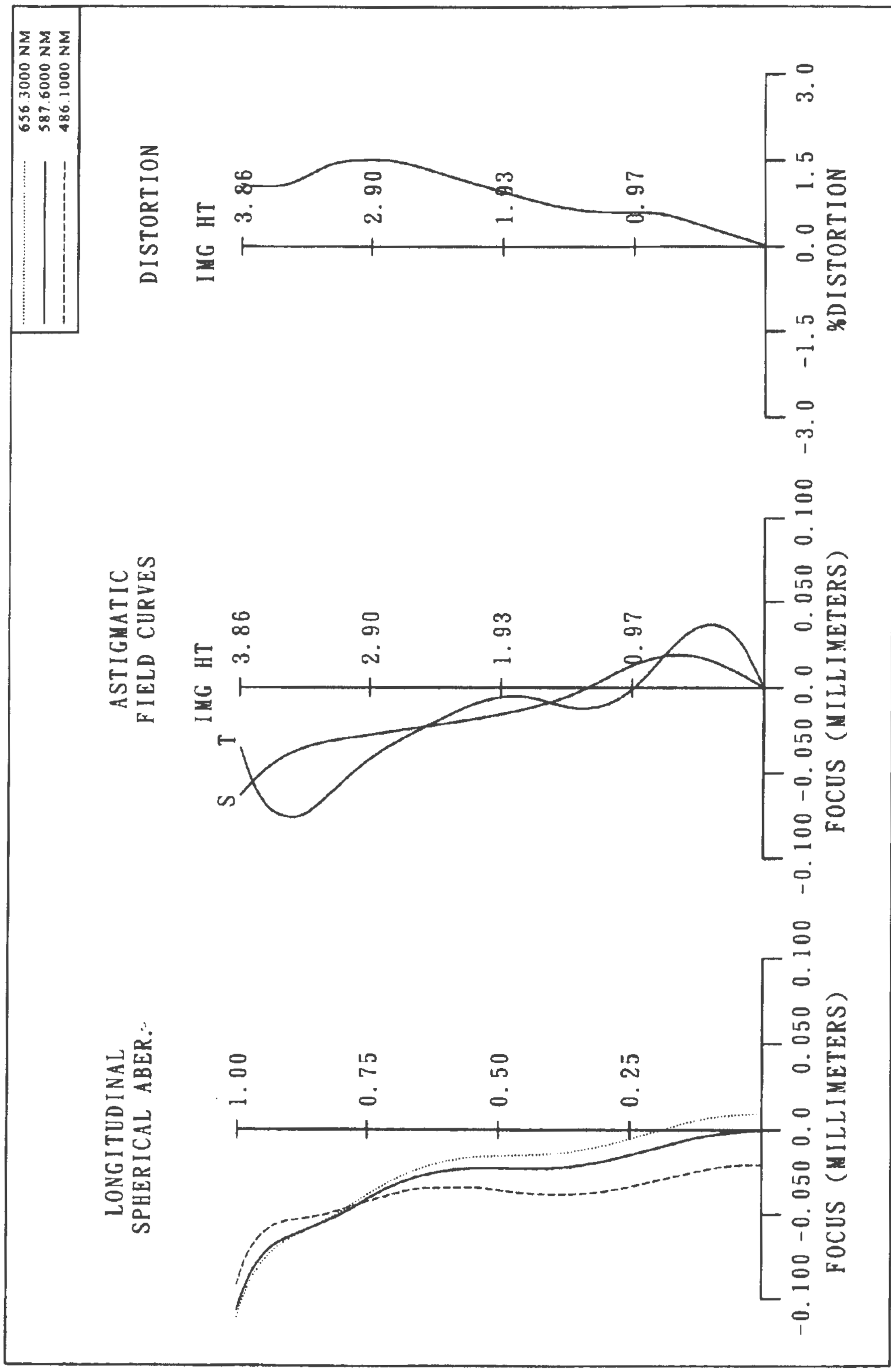
742

Fig. 7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FOCUS (MILLIMETERS)
ASTIGMATIC FIELD CURVES
IMG HT
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2.90
1.93
0.97
S
T
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
3.86
2.90
1.93
0.97
-3.0 -1.5 0.0 1.5 3.0
%DISTORTION

Fig. 8

TABLE 1							
(Embodiment 1)							
f = 4.31 mm, Fno = 2.85, HFOV = 33.9 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape. Stop	Plano	-0.013				
2	Lens 1	1.76600 (ASP)	0.636	Plastic	1.544	55.9	3.12
3		-36.90680 (ASP)	0.136				
4	Lens 2	-13.88090 (ASP)	0.312	Plastic	1.632	23.4	-6.16
5		5.45680 (ASP)	0.931				
6	Lens 3	-2.10325 (ASP)	0.407	Plastic	1.544	55.9	14.40
7		-1.77135 (ASP)	0.050				
8	Lens4	1.72865 (ASP)	0.631	Plastic	1.544	55.9	60.44
9		1.58985 (ASP)	0.510				
10	Lens5	-57.00100 (ASP)	0.549	Plastic	1.583	30.2	-7.82
11		4.97820 (ASP)	0.300				
12	IR-filter	Plano	0.400	Glass	1.517	64.2	-
13		Plano	0.253				
14	Image	Plano					

Fig.9

TABLE 2					
Aspheric Coefficients					
Surface #	2	3	4	5	6
k =	-3.36023E-01	-2.89556E+02	1.89850E+02	1.00604E+01	-1.72027E+01
A4 =	-2.35185E-03	-4.44230E-02	-1.92983E-02	3.33608E-02	1.54344E-02
A6 =	1.28721E-02	-2.76747E-02	-3.96324E-02	-4.43290E-02	-3.76453E-02
A8 =	-2.16258E-02	7.29300E-03	2.61897E-02	4.15247E-02	2.51528E-02
A10=	-4.49702E-03	1.55459E-02	5.90912E-02	-4.47111E-03	-8.12481E-03
A12=		1.35582E-03	2.96697E-03	1.61684E-02	-2.52200E-03
Surface #	7	8	9	10	11
k =	-9.81773E-01	-8.61296E+00	-3.75996E+00	-1.75913E+02	-3.28042E-01
A4 =	1.10696E-03	-9.04269E-02	-6.24714E-02	-8.07215E-03	-4.67164E-02
A6 =	2.96193E-02	1.30237E-02	1.26887E-02	8.48626E-04	2.81014E-03
A8 =	-4.00060E-03	2.26884E-03	-1.99542E-03	-2.95793E-04	7.46621E-04
A10=	-3.74913E-04	-5.57978E-04	2.77903E-05	5.37594E-06	-1.07033E-04
A12=	7.18921E-05	1.61249E-06	6.00347E-06		-2.93947E-07
A14=					2.33812E-07

Fig.10

TABLE 3							
(Embodiment 2)							
f = 4.46 mm, Fno = 2.78, HFOV = 33.0 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape. Stop	Plano	-0.080				
2	Lens 1	1.75541 (ASP)	0.627	Plastic	1.544	55.9	3.06
3		-28.32860 (ASP)	0.141				
4	Lens 2	-12.44190 (ASP)	0.310	Plastic	1.632	23.4	-6.11
5		5.65620 (ASP)	0.969				
6	Lens 3	-2.22833 (ASP)	0.370	Plastic	1.544	55.9	13.24
7		-1.80140 (ASP)	0.050				
8	Lens4	2.03602 (ASP)	0.609	Plastic	1.544	55.9	-88.02
9		1.74714 (ASP)	0.447				
10	Lens5	-50.00270 (ASP)	0.745	Plastic	1.583	30.2	-8.1
11		5.25090 (ASP)	0.300				
12	IR-filter	Plano	0.400	Glass	1.517	64.2	-
13		Plano	0.244				
14	Image	Plano					

Fig.11

TABLE 4

Aspheric Coefficients

Surface #	2	3	4	5	6
k =	-2.95046E-01	-2.98548E+02	1.48063E+02	6.47796E+00	-1.41087E+01
A4 =	-7.67074E-04	-3.85532E-02	-1.55766E-02	2.61170E-02	9.18377E-03
A6 =	7.45372E-03	-3.20701E-02	-3.95270E-02	-3.42026E-02	-3.48626E-02
A8 =	-2.41701E-02	1.84820E-03	2.79441E-02	4.64932E-02	2.70673E-02
A10=	3.67001E-03	1.58100E-02	6.32449E-02	-1.12686E-02	-1.10018E-02
A12=		1.35563E-02	-1.35990E-03	1.68540E-02	-1.93478E-03
Surface #	7	8	9	10	11
k =	-9.98824E-01	-1.08738E+01	-3.39117E+00	-2.99473E+02	-2.15779E+00
A4 =	1.81629E-03	-8.60343E-02	-7.04228E-02	-1.10437E-02	-4.50837E-02
A6 =	3.73949E-02	1.28387E-02	1.35632E-02	5.48040E-04	2.79505E-03
A8 =	-5.83402E-03	1.85880E-03	-2.18057E-03	-2.57303E-04	8.22227E-04
A10=	-6.53488E-04	-6.01977E-04	-3.38558E-05	1.32058E-05	-1.15953E-04
A12=	2.19533E-04	2.06532E-05	1.55827E-05		-1.06607E-06
A14=					3.24105E-07

Fig.12

TABLE 5							
(Embodiment 3)							
f = 5.33 mm, Fno = 2.90, HFOV = 33.5 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape. Stop	Plano	-0.150				
2	Lens 1	1.99306 (ASP)	0.652	Plastic	1.544	55.9	3.43
3		-25.78100 (ASP)	0.295				
4	Lens 2	-6.34730 (ASP)	0.315	Plastic	1.632	23.4	-6.34
5		11.07940 (ASP)	0.899				
6	Lens 3	-1.41949 (ASP)	0.493	Plastic	1.544	55.9	4.92
7		-1.04137 (ASP)	0.057				
8	Lens4	1.54733 (ASP)	0.347	Plastic	1.544	55.9	-6.31
9		0.98245 (ASP)	0.600				
10	Lens5	-27.39420 (ASP)	0.463	Plastic	1.632	23.4	-31.59
11		74.12050 (ASP)	0.700				
12	IR-filter	Plano	0.300	Glass	1.517	64.2	-
13		Plano	0.854				
14	Image	Plano					

Fig.13

TABLE 6					
Aspheric Coefficients					
Surface #	2	3	4	5	6
k =	-7.31488E-01	-1.00000E+00	-6.93011E+01	1.00000E+01	-4.81192E+00
A4 =	-4.33067E-03	-5.52544E-02	7.19571E-04	7.69228E-02	-1.09318E-01
A6 =	-3.53836E-02	-4.23539E-02	-2.95759E-02	-1.61888E-03	1.45056E-02
A8 =	2.50236E-02	1.64020E-02	4.79030E-02	1.45137E-03	1.38029E-02
A10=	-3.77928E-02	-1.19947E-02	-2.23010E-03	7.83440E-03	-7.59344E-03
A12=		-7.82094E-04	-1.10055E-03	4.01261E-03	-4.05183E-03
Surface #	7	8	9	10	11
k =	-2.15474E+00	-1.25498E+01	-5.72475E+00	-1.00000E+00	-8.74856E+01
A4 =	-4.07892E-02	-4.83948E-02	-4.34306E-02	-1.00624E-02	-3.56423E-02
A6 =	-4.04022E-04	3.58089E-03	5.84028E-03	2.17273E-04	5.56415E-03
A8 =	3.58488E-03	6.19957E-04	-7.98856E-04	2.55401E-04	-1.66385E-04
A10=	1.50324E-03	-6.42718E-05	2.84327E-05	-5.77673E-05	-3.99533E-05
A12=	-3.07711E-04	-1.20545E-06	-5.34470E-07		3.32964E-08
A14=					1.63207E-07

Fig. 14

TABLE 7							
(Embodiment 4)							
f = 5.80 mm, Fno = 2.45, HFOV = 33.5 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape. Stop	Plano	-0.300				
2	Lens 1	2.10958 (ASP)	0.994	Plastic	1.544	55.9	3.81
3		-100.00000 (ASP)	0.195				
4	Lens 2	-11.65230 (ASP)	0.300	Plastic	1.632	23.4	-7.11
5		7.39440 (ASP)	1.072				
6	Lens 3	-3.21010 (ASP)	0.583	Plastic	1.544	55.9	4.01
7		-1.38143 (ASP)	0.280				
8	Lens4	2.98427 (ASP)	0.300	Plastic	1.544	55.9	-3.86
9		1.18924 (ASP)	0.601				
10	Lens5	-100.23910 (ASP)	0.593	Plastic	1.632	23.4	-41.3
11		35.37620 (ASP)	0.500				
12	IR-filter	Plano	0.700	Glass	1.517	64.2	-
13		Plano	0.360				
14	Image	Plano					

Fig. 15

TABLE 8					
Aspheric Coefficients					
Surface #	2	3	4	5	6
k =	-1.73596E-01	-1.00000E+00	-4.24190E+01	-2.33297E+00	-1.11095E+01
A4 =	2.61395E-03	-2.61418E-02	1.07137E-03	4.09559E-02	-3.79415E-02
A6 =	-1.14534E-02	-1.05479E-02	-2.26425E-02	-5.91110E-03	3.01182E-03
A8 =	9.62116E-03	-2.12075E-03	1.62113E-02	5.87344E-03	1.96746E-03
A10=	-5.82039E-03	7.02650E-04	-4.18134E-03	9.95414E-04	-6.08712E-04
A12=		-1.31832E-06	1.55468E-03	8.33940E-04	-3.32230E-04
Surface #	7	8	9	10	11
k =	-3.41196E+00	-5.35968E+01	-6.36496E+00	-1.00000E+00	-6.54693E+01
A4 =	-2.01326E-02	-4.24958E-02	-2.78785E-02	-8.04980E-04	-1.75074E-02
A6 =	-9.21571E-05	3.31432E-03	3.70173E-03	-1.22871E-03	7.97640E-04
A8 =	1.87139E-03	3.34438E-04	-4.63718E-04	1.25259E-04	1.19970E-04
A10=	5.69561E-04	-3.20777E-05	1.79533E-05	-7.04814E-06	-1.80276E-05
A12=	-1.77028E-04	-5.92288E-07	-2.27728E-07		5.41637E-07

Fig. 16

Table 9				
	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4
f	4.31	4.46	5.33	5.80
Fno	2.85	2.78	2.90	2.45
HFOV	33.9	33.0	33.5	33.5
V1-V2	32.5	32.5	32.5	32.5
Vp-Vn	25.7	0.0	0.0	0.0
		25.7	32.5	32.5
f1/f3	0.22	0.23	0.70	0.95
|f/f3|	0.30	0.34	1.08	1.45
f/f4	0.07	-0.05	-0.84	-1.50
f/f5	-0.55	-0.55	-0.17	-0.14
R1/f	0.41	0.39	0.37	0.36
Y'/Y	0.68	0.67	0.66	0.66
TTL/ImgH	1.74	1.78	1.66	1.62

Fig.17

IMAGING LENS SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an imaging lens system, and more particularly, to a compact imaging lens system used in a mobile phone camera.

2. Description of the Prior Art

In recent years, with the popularity of mobile phone cameras, the demand for compact imaging lenses is increasing, and the sensor of a general photographing camera is none other than CCD (charge coupled device) or CMOS device (Complementary Metal Oxide Semiconductor device).

Furthermore, as advances in semiconductor manufacturing technology has allowed the pixel size of sensors to be reduced and the resolution of compact imaging lenses has gradually increased, there is an increasing demand for compact imaging lenses featuring better image quality.

A conventional compact lens assembly for mobile phone cameras, such as the four lens element assembly disclosed in U.S. Pat. No. 7,365,920, generally comprises four lens elements. However, the four-element lens has become insufficient for a high-end imaging lens assembly due to the rapid increase in the resolution of mobile phone cameras, the reduction in the pixel size of sensors and the increasing demand for compact lens assemblies featuring better image quality. As there is an ongoing trend toward compact yet powerful electronic products, a need exists in the art for an imaging lens system applicable to high-resolution mobile phone cameras while maintaining a moderate total track length.

SUMMARY OF THE INVENTION

The present invention provides an imaging lens system comprising, in order from an object side to an image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element with positive refractive power, at least one of the object-side and image-side surfaces thereof being aspheric; a fourth lens element, the image-side surface thereof being aspheric and provided with at least one inflection point; a fifth lens element having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric; and an aperture stop disposed between an imaged object and the second lens element.

Such an arrangement of optical elements can effectively correct aberrations to improve image quality of the system, and can reduce the total track length of the imaging lens system to keep the system compact.

In the aforementioned imaging lens system, the first lens element provides positive refractive power, and the aperture stop is disposed near the object side of the imaging lens system, and thereby the total track length of the imaging lens system can be reduced effectively. The aforementioned arrangement also enables the exit pupil of the imaging lens system to be positioned far away from the image plane, and thus light will be projected onto the electronic sensor at a nearly perpendicular angle; this is the telecentric feature of the image side. The telecentric feature is very important to the photosensitive power of the current solid-state sensor as it can improve the photosensitivity of the sensor to reduce the probability of the occurrence of shading. Moreover, the image-side surface of the fourth lens element provided with at least one inflection point can effectively reduce the angle at which the light is projected onto the sensor from the off-axis field so that the off-axis aberrations can be further corrected. In addition, when the aperture stop is disposed near the second lens element, a wide field of view can be favorably achieved. Such an aperture stop placement facilitates the correction of the distortion and chromatic aberration of magnification, and thereby the sensitivity of the imaging lens system can be effectively reduced. In other words, when the aperture stop is disposed near the imaged object, the telecentric feature is emphasized and this enables a shorter total track length. When the aperture stop is disposed near the second lens element, the emphasis is on the wide field of view so that the sensitivity of the imaging lens system can be effectively reduced.

The present invention provides another imaging lens system comprising, in order from the object side to the image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element with positive refractive power; a fourth lens element with positive or negative refractive power, the image-side surface thereof being aspheric and provided with at least one inflection point; and a fifth lens element with positive or negative refractive power having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric. In this imaging lens system, the focal length of the first lens element is f1, the focal length of the third lens element is f3, and they satisfy the relation: $0<f1/f3<1.2$; the curvature radius of the object-side surface of the first lens element is R1, the focal length of the imaging lens system is f, and they satisfy the relation: $0.30<R1/f<0.50$; the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, and they satisfy the relation: $22.0<V1-V2$; and the lens elements with refractive power are limited to the first, second, third, fourth, and fifth lens elements.

The present invention provides yet another imaging lens system comprising, in order from the object side to the image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element with positive or negative refractive power; a fourth lens element with positive or negative refractive power, the image-side surface thereof being aspheric and provided with at least one inflection point; and a fifth lens element with positive or negative refractive power having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric. In this imaging lens system, the focal length of the imaging lens system is f, the focal length of the third lens element is f3, and they satisfy the relation: $0.2<|f/f3|$; the curvature radius of the object-side surface of the first lens element is R1, the focal length of the imaging lens system is f, and they satisfy the relation: $0.30<R1/f<0.50$; the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, and they satisfy the relation: $22.0<V1-V2$; and the lens elements with refractive power are limited to the first, second, third, fourth, and fifth lens elements.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows an imaging lens system in accordance with a first embodiment of the present invention.

FIG. 2 shows the aberration curves of the first embodiment of the present invention.

FIG. 3 shows an imaging lens system in accordance with a second embodiment of the present invention.

FIG. 4 shows the aberration curves of the second embodiment of the present invention.

FIG. **5** shows an imaging lens system in accordance with a third embodiment of the present invention.

FIG. **6** shows the aberration curves of the third embodiment of the present invention.

FIG. **7** shows an imaging lens system in accordance with a fourth embodiment of the present invention.

FIG. **8** shows the aberration curves of the fourth embodiment of the present invention.

FIG. **9** is TABLE 1 which lists the optical data of the first embodiment.

FIG. **10** is TABLE 2 which lists the aspheric surface data of the first embodiment.

FIG. **11** is TABLE 3 which lists the optical data of the second embodiment.

FIG. **12** is TABLE 4 which lists the aspheric surface data of the second embodiment.

FIG. **13** is TABLE 5 which lists the optical data of the third embodiment.

FIG. **14** is TABLE 6 which lists the aspheric surface data of the third embodiment.

FIG. **15** is TABLE 7 which lists the optical data of the fourth embodiment.

FIG. **16** is TABLE 8 which lists the aspheric surface data of the fourth embodiment.

FIG. **17** is TABLE 9 which lists the data of the respective embodiments resulting from the equations.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides an imaging lens system including, in order from an object side to an image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element with positive refractive power, at least one of the object-side and image-side surfaces thereof being aspheric; a fourth lens element, the image-side surface thereof being aspheric and provided with at least one inflection point; a fifth lens element having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric; and an aperture stop disposed between an imaged object and the second lens element.

In the aforementioned imaging lens system, the first lens element has positive refractive power and a convex object-side surface so that the total track length of the imaging lens system can be effectively reduced. The second lens element has negative refractive power so that the chromatic aberration of the system can be favorably corrected. The third lens element has positive refractive power so that the refractive power of the first lens element can be effectively distributed to reduce the sensitivity of the imaging lens system. The fourth and fifth lens elements may have either positive or negative refractive power. When the fourth and fifth lens elements both have positive refractive power, disposing them behind the second lens element having negative refractive power can effectively reduce the occurrence of astigmatism and distortion, so that the resolution of the imaging lens system can be improved. When the fourth lens element has positive refractive power and the fifth lens element has negative refractive power, a telephoto structure is formed; this facilitates reducing the back focal length as well as the total track length of the imaging lens system. When the fourth lens element has negative refractive power and the fifth lens element has positive refractive power, the aberrations can be favorably corrected, and such an arrangement prevents other kinds of aberrations from becoming too large. When the fourth and fifth lens elements both have negative refractive power, the principal

point of the system can be positioned far away from the image plane, thereby effectively reducing the total track length of the imaging lens system.

In the aforementioned imaging lens system, it is preferable that the fourth lens element has a convex object-side surface and a concave image-side surface so that the astigmatism of the system can be favorably corrected.

In the aforementioned imaging lens system, it is preferable that the second lens element has concave object-side and image-side surfaces so that the Petzval Sum of the system can be effectively corrected and the back focal length of the system can be lengthened. It is also preferable that the third lens element has a concave object-side surface and a convex image-side surface so that the astigmatism of the system can be favorably corrected.

In the aforementioned imaging lens system, when the fifth lens element has a concave object-side surface and a convex image-side surface, this helps to ensure that there is sufficient space behind the lens system for accommodating other components. When the fifth lens element has concave object-side and image-side surfaces, the Petzval Sum of the system can be effectively corrected, enabling the focal plane to become more flat near the periphery.

In the aforementioned imaging lens system, the focal length of the first lens element is $f1$, the focal length of the third lens element is $f3$, and they preferably satisfy the relation: $0<f1/f3<1.2$. When the above relation is satisfied, the refractive power of the system is mainly provided by the first lens element and thereby the total track length of the system can be effectively reduced. And it will be more preferable that $f1$ and $f3$ satisfy the relation: $0.55<f1/f3<1.0$.

In the aforementioned imaging lens system, the focal length of the imaging lens system is f, the focal length of the fourth lens element is $f4$, and they preferably satisfy the relation: $-1.9<f/f4<0.4$. When the above relation is satisfied, the high order aberrations of the system can be favorably corrected. And it will be more preferable that f and $f4$ satisfy the relation: $-1.7<f/f4<-0.5$.

In the aforementioned imaging lens system, the Abbe number of the first lens element is $V1$, the Abbe number of the second lens element is $V2$, and they preferably satisfy the relation: $28.5<V1-V2<45.2$. When the above relation is satisfied, the chromatic aberration can be effectively corrected.

In the aforementioned imaging lens system, it is preferable that at least one of the third, fourth, and fifth lens elements has positive refractive power with the Abbe number Vp, that at least one of them has negative refractive power with the Abbe number Vn, and that Vp and Vn satisfy the relation: $22.0<Vp-Vn$. When the above relation is satisfied, the chromatic aberration of the system can be corrected more effectively.

In the aforementioned imaging lens system, the curvature radius of the object-side surface of the first lens element is $R1$, the focal length of the imaging lens system is f, and they preferably satisfy the relation: $0.30<R1/f<0.50$. When the above relation is satisfied, the total track length of the imaging lens system can be effectively reduced, and the high order aberrations can be prevented from becoming too large.

In the aforementioned imaging lens system, there is a point on the image-side surface of the fourth lens element with a tangent plane perpendicular to the optical axis; the distance between the point and the optical axis is Y'; and the clear aperture radius of the image-side surface of the fourth lens element is Y. The clear aperture radius is the distance between the optical axis and the farthest point of the effective area of the lens surface that allows incoming light to pass through the lens element. It is preferable that Y' and Y satisfy the relation:

$0.55<Y'/Y<1.0$. When the above relation is satisfied, the off-axis aberrations of the system can be favorably corrected.

In the aforementioned imaging lens system, the lens elements can be made of glass or plastic material. If the lens elements are made of glass, there is more freedom in distributing the refractive power of the system. If plastic material is adopted to produce lens elements, the production cost will be reduced effectively. Additionally, the surfaces of the lens elements can be aspheric and easily made into non-spherical profiles, allowing more design parameter freedom which can be used to reduce aberrations and the number of the lens elements, so that the total track length of the imaging lens system can be reduced effectively. Preferably, at least three of the lens elements are made of plastic, and their object-side and image-side surfaces are aspheric.

In the aforementioned imaging lens system, it is preferable that the aperture stop is disposed between the imaged object and the first lens element so that the telecentric feature is emphasized, resulting in a shorter total track length.

The aforementioned imaging lens system further comprises an electronic sensor on which an object is imaged. The on-axis spacing between the object-side surface of the first lens element and the electronic sensor is TTL, half of the diagonal length of the effective pixel area of the electronic sensor is ImgH, and they preferably satisfy the relation: $TTL/ImgH<1.95$. When the above relation is satisfied, the imaging lens system can more easily maintain a compact form, enabling it for it to be equipped in compact portable electronic products.

In the aforementioned imaging lens system, the focal length of the imaging lens system is f, the focal length of the fifth lens element is **f5**, and they preferably satisfy the relation: $-0.58<f/f5<0.30$. When the above relation is satisfied, the fifth lens element functions as a correction lens that can balance and correct the aberrations of the system to improve image quality.

According to another aspect of the present invention, an imaging lens system comprises, in order from the object side to the image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element with positive refractive power; a fourth lens element with positive or negative refractive power, the image-side surface thereof being aspheric and provided with at least one inflection point; and a fifth lens element with positive or negative refractive power having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric. In this imaging lens system, the focal length of the first lens element is **f1**, the focal length of the third lens element is **f3**, and they satisfy the relation: $0<f1/f3<1.2$; the curvature radius of the object-side surface of the first lens element is **R1**, the focal length of the imaging lens system is f, and they satisfy the relation: $0.30<R1/f<0.50$; the Abbe number of the first lens element is **V1**, the Abbe number of the second lens element is **V2**, and they satisfy the relation: $22.0<V1-V2$; and the lens elements with refractive power are limited to the first, second, third, fourth, and fifth lens elements.

In the aforementioned imaging lens system, when the relation $0<f1/f3<1.2$ relation is satisfied, the refractive power of the system is mainly provided by the first lens element and thereby the total track length of the system can be effectively reduced. When the relation $0.30<R1/f<0.50$ is satisfied, the total track length of the imaging lens system can be effectively reduced, and the high order aberrations can be prevented from becoming too large. When the relation $22.0<V1-V2$ is satisfied, the chromatic aberration of the system can be effectively corrected.

According to another aspect of the present invention, an imaging lens system comprises, in order from the object side to the image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element with positive or negative refractive power; a fourth lens element with positive or negative refractive power, the image-side surface thereof being aspheric and provided with at least one inflection point; and a fifth lens element with positive or negative refractive power having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric. In this imaging lens system, the focal length of the imaging lens system is f, the focal length of the third lens element is **f3**, and they satisfy the relation: $0.2<|f/f3|$; the curvature radius of the object-side surface of the first lens element is **R1**, the focal length of the imaging lens system is f, and they satisfy the relation: $0.30<R1/f<0.50$; the Abbe number of the first lens element is **V1**, the Abbe number of the second lens element is **V2**, and they satisfy the relation: $22.0<V1-V2$; and the lens elements with refractive power are limited to the first, second, third, fourth, and fifth lens elements.

In the aforementioned imaging lens system, when the relation $0.2<|f/f3|$ is satisfied, the refractive power that the system requires can be effectively distributed; the sensitivity of the system can thus be reduced, thereby reducing manufacturing variability of the imaging lens system. When the relation $0.30<R1/f<0.50$ is satisfied, the total track length of the imaging lens system can be effectively reduced, and the high order aberrations can be prevented from becoming too large. When the relation $22.0<V1-V2$ is satisfied, the chromatic aberration of the system can be effectively corrected.

In an imaging lens system of the present invention, the lens elements can be made of glass or plastic material. If the lens elements are made of glass, there is more freedom in distributing the refractive power of the system. If plastic material is adopted to produce lens elements, the production cost will be reduced effectively. Additionally, the surfaces of the lens elements can be aspheric and easily made into non-spherical profiles, allowing more design parameter freedom which can be used to reduce aberrations and the number of the lens elements, so that the total track length of the imaging lens system can be reduced effectively.

In an imaging lens system of the present invention, if a lens element has a convex surface, it means the portion of the surface near the axis is convex; if a lens element has a concave surface, it means the portion of the surface near the axis is concave.

Preferred embodiments of the present invention will be described in the following paragraphs by referring to the accompanying drawings.

FIG. **1** shows an imaging lens system in accordance with a first embodiment of the present invention, and FIG. **2** shows the aberration curves of the first embodiment of the present invention. The imaging lens system of the first embodiment of the present invention mainly comprises five lens elements, in order from the object side to the image side: a plastic first lens element **100** with positive refractive power having convex object-side and image-side surfaces **101** and **102**, the object-side and image-side surfaces **101** and **102** both being aspheric; a plastic second lens element **110** with negative refractive power having concave object-side and image-side surfaces **111** and **112**, the object-side and image-side surfaces **111** and **112** both being aspheric; a plastic third lens element

120 with positive refractive power having a concave object-side surface **121** and a convex image-side surface **122**, the object-side and image-side surfaces **121** and **122** both being aspheric; a plastic fourth lens element **130** with positive refractive power having a convex object-side surface **131** and a concave image-side surface **132**, the object-side and image-side surfaces **131** and **132** both being aspheric and provided with at least one inflection point; and a plastic fifth lens element **140** with negative refractive power having concave object-side and image-side surfaces **141** and **142**, the object-side and image-side surfaces **141** and **142** both being aspheric; and an aperture stop **150** disposed between an imaged object and the first lens element **100**. The imaging lens system further comprises an IR filter **160** disposed between the image-side surface **142** of the fifth lens element **140** and the image plane **170**; the IR filter **160** has no influence on the focal length of the imaging lens system.

The equation of the aspheric surface profiles is expressed as follows:

$$X(Y) = (Y^2/R)/(1+sqrt(1-(1+k)*(Y/R)^2)) + \sum_i (Ai)*(Y^i)$$

wherein:

X: the height of a point on the aspheric surface at a distance Y from the optical axis relative to the tangential plane at the aspheric surface vertex;

Y: the distance from the point on the curve of the aspheric surface to the optical axis;

k: the conic coefficient;

Ai: the aspheric coefficient of order i.

In the first embodiment of the present imaging lens system, the focal length of the imaging lens system is f, and it satisfies the relation: f=4.31.

In the first embodiment of the present imaging lens system, the f-number of the imaging lens system is Fno, and it satisfies the relation: Fno=2.85.

In the first embodiment of the present imaging lens system, half of the maximal field of view of the imaging lens system is HFOV, and it satisfies the relation: HFOV=33.9 degrees.

In the first embodiment of the present imaging lens system, the focal length of the first lens element **100** is f1, the focal length of the third lens element **120** is f3, and they satisfy the relation: f1/f3=0.22.

In the first embodiment of the present imaging lens system, the focal length of the system is f, the focal length of the fourth lens element **130** is f4, and they satisfy the relation: f/f4=0.07.

In the first embodiment of the present imaging lens system, the Abbe number of the first lens element **100** is **V1**, the Abbe number of the second lens element **110** is **V2**, and they satisfy the relation: **V1**−**V2**=32.5.

In the first embodiment of the present imaging lens system, the third lens element **120** has positive refractive power and its Abbe number Vp satisfies the relation: Vp=55.9; the fourth lens element **130** has positive refractive power and its Abbe number Vp satisfies the relation: Vp=55.9; the fifth lens element **140** has negative refractive power and its Abbe number Vn satisfies the relation: Vn=30.2. Vp and Vn satisfy the relations:

Vp−Vn=25.7 (the third lens element **120** and the fifth lens element **140**);

Vp−Vn=25.7 (the fourth lens element **130** and the fifth lens element **140**).

In the first embodiment of the present imaging lens system, the curvature radius of the object-side surface **101** of the first lens element **100** is **R1**, the focal length of the imaging lens system is f, and they satisfy the relation: **R1**/f=0.41.

In the first embodiment of the present imaging lens system, on the image-side surface **132** of the fourth lens element **130**, there is a point which has a tangent plane perpendicular to the optical axis; the distance between the point and the optical axis is Y' (referring to FIG. **1**); the clear aperture radius of the image-side surface **132** of the fourth lens element is Y (referring to FIG. **1**); and Y' and Y satisfy the relation: Y'/Y=0.68.

In the first embodiment of the present imaging lens system, the image plane **170** is provided with an electronic sensor on which an object is imaged. The on-axis spacing between the object-side surface **101** of the first lens element **100** and the electronic sensor is TTL, half of the diagonal length of the effective pixel area of the electronic sensor is ImgH, and they satisfy the relation: TTL/ImgH=1.74.

In the first embodiment of the present imaging lens system, the focal length of the fifth lens element **140** is f5, the focal length of the system is f, and they satisfy the relation: f/f**5**=−0.55.

In the first embodiment of the present imaging lens system, the focal length of the system is f, the focal length of the third lens element **120** is f3, and they satisfy the relation: |f/f3|=0.30.

The detailed optical data of the first embodiment is shown in FIG. **9** (TABLE 1), and the aspheric surface data is shown in FIG. **10** (TABLE 2), wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

FIG. **3** shows an imaging lens system in accordance with a second embodiment of the present invention, and FIG. **4** shows the aberration curves of the second embodiment of the present invention. The imaging lens system of the second embodiment of the present invention mainly comprises five lens elements, in order from the object side to the image side: a plastic first lens element **300** with positive refractive power having convex object-side and image-side surfaces **301** and **302**, the object-side and image-side surfaces **301** and **302** both being aspheric; a plastic second lens element **310** with negative refractive power having concave object-side and image-side surfaces **311** and **312**, the object-side and image-side surfaces **311** and **312** both being aspheric; a plastic third lens element **320** with positive refractive power having a concave object-side surface **321** and a convex image-side surface **322**, the object-side and image-side surfaces **321** and **322** both being aspheric; a plastic fourth lens element **330** with negative refractive power having a convex object-side surface **331** and a concave image-side surface **332**, the object-side and image-side surfaces **331** and **332** both being aspheric and provided with at least one inflection point; and a plastic fifth lens element **340** with negative refractive power having concave object-side and image-side surfaces **341** and **342**, the object-side and image-side surfaces **341** and **342** both being aspheric; and an aperture stop **350** disposed between an imaged object and the first lens element **300**. The imaging lens system further comprises an IR filter **360** disposed between the image-side surface **342** of the fifth lens element **340** and the image plane **370**; the IR filter **360** has no influence on the focal length of the imaging lens system.

The equation of the aspheric surface profiles of the second embodiment has the same form as that of the first embodiment.

In the second embodiment of the present imaging lens system, the focal length of the imaging lens system is f, and it satisfies the relation: f=4.46.

In the second embodiment of the present imaging lens system, the f-number of the imaging lens system is Fno, and it satisfies the relation: Fno=2.78.

In the second embodiment of the present imaging lens system, half of the maximal field of view of the imaging lens system is HFOV, and it satisfies the relation: HFOV=33.0 degrees.

In the second embodiment of the present imaging lens system, the focal length of the first lens element **300** is f1, the focal length of the third lens element **320** is f3, and they satisfy the relation: f1/f3=0.23.

In the second embodiment of the present imaging lens system, the focal length of the system is f, the focal length of the fourth lens element **330** is f4, and they satisfy the relation: f/f4=−0.05.

In the second embodiment of the present imaging lens system, the Abbe number of the first lens element **300** is V1, the Abbe number of the second lens element **310** is V2, and they satisfy the relation: V1−V2=32.5.

In the second embodiment of the present imaging lens system, the third lens element **320** has positive refractive power and its Abbe number Vp satisfies the relation: Vp=55.9; the fourth lens element **330** has negative refractive power and its Abbe number Vn satisfies the relation: Vn=55.9; the fifth lens element **340** has negative refractive power and its Abbe number Vn satisfies the relation: Vn=30.2. Vp and Vn satisfy the relations:

Vp−Vn=0.0 (the third lens element **320** and the fourth lens element **330**);

Vp−Vn=25.7 (the third lens element **320** and the fifth lens element **340**).

In the second embodiment of the present imaging lens system, the curvature radius of the object-side surface **301** of the first lens element **300** is R1, the focal length of the imaging lens system is f, and they satisfy the relation: R1/f=0.39.

In the second embodiment of the present imaging lens system, on the image-side surface **332** of the fourth lens element **330**, there is a point which has a tangent plane perpendicular to the optical axis; the distance between the point and the optical axis is Y' (referring to FIG. **3**); the clear aperture radius of the image-side surface **332** of the fourth lens element is Y (referring to FIG. **3**); and Y' and Y satisfy the relation: Y'/Y=0.67.

In the second embodiment of the present imaging lens system, the image plane **370** is provided with an electronic sensor on which an object is imaged. The on-axis spacing between the object-side surface **301** of the first lens element **300** and the electronic sensor is TTL, half of the diagonal length of the effective pixel area of the electronic sensor is ImgH, and they satisfy the relation: TTL/ImgH=1.78.

In the second embodiment of the present imaging lens system, the focal length of the fifth lens element **340** is f5, the focal length of the system is f, and they satisfy the relation: f/f5=−0.55.

In the second embodiment of the present imaging lens system, the focal length of the system is f, the focal length of the third lens element **320** is f3, and they satisfy the relation: |f/f3|=0.34.

The detailed optical data of the second embodiment is shown in FIG. **11** (TABLE 3), and the aspheric surface data is shown in FIG. **12** (TABLE 4), wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

FIG. **5** shows an imaging lens system in accordance with a third embodiment of the present invention, and FIG. **6** shows the aberration curves of the third embodiment of the present invention. The imaging lens system of the third embodiment of the present invention mainly comprises five lens elements, in order from the object side to the image side: a plastic first lens element **500** with positive refractive power having convex object-side and image-side surfaces **501** and **502**, the object-side and image-side surfaces **501** and **502** both being aspheric; a plastic second lens element **510** with negative refractive power having concave object-side and image-side surfaces **511** and **512**, the object-side and image-side surfaces **511** and **512** both being aspheric; a plastic third lens element **520** with positive refractive power having a concave object-side surface **521** and a convex image-side surface **522**, the object-side and image-side surfaces **521** and **522** both being aspheric; a plastic fourth lens element **530** with negative refractive power having a convex object-side surface **531** and a concave image-side surface **532**, the object-side and image-side surfaces **531** and **532** both being aspheric and provided with at least one inflection point; and a plastic fifth lens element **540** with negative refractive power having concave object-side and image-side surfaces **541** and **542**, the object-side and image-side surfaces **541** and **542** both being aspheric; and an aperture stop **550** disposed between an imaged object and the first lens element **500**. The imaging lens system further comprises an IR filter **560** disposed between the image-side surface **542** of the fifth lens element **540** and the image plane **570**; the IR filter **560** has no influence on the focal length of the imaging lens system.

The equation of the aspheric surface profiles of the third embodiment has the same form as that of the first embodiment.

In the third embodiment of the present imaging lens system, the focal length of the imaging lens system is f, and it satisfies the relation: f=5.33.

In the third embodiment of the present imaging lens system, the f-number of the imaging lens system is Fno, and it satisfies the relation: Fno=2.90.

In the third embodiment of the present imaging lens system, half of the maximal field of view of the imaging lens system is HFOV, and it satisfies the relation: HFOV=33.5 degrees.

In the third embodiment of the present imaging lens system, the focal length of the first lens element **500** is f1, the focal length of the third lens element **520** is f3, and they satisfy the relation: f1/f3=0.70.

In the third embodiment of the present imaging lens system, the focal length of the system is f, the focal length of the fourth lens element **530** is f4, and they satisfy the relation: f/f4=−0.84.

In the third embodiment of the present imaging lens system, the Abbe number of the first lens element **500** is V1, the Abbe number of the second lens element **510** is V2, and they satisfy the relation: V1−V2=32.5.

In the third embodiment of the present imaging lens system, the third lens element **520** has positive refractive power and its Abbe number Vp satisfies the relation: Vp=55.9; the fourth lens element **530** has negative refractive power and its Abbe number Vn satisfies the relation: Vn=55.9; the fifth lens element **540** has negative refractive power and its Abbe number Vn satisfies the relation: Vn=23.4. Vp and Vn satisfy the relations:

Vp−Vn=0.0 (the third lens element **520** and the fourth lens element **530**);

Vp−Vn=32.5 (the third lens element **520** and the fifth lens element **540**).

In the third embodiment of the present imaging lens system, the curvature radius of the object-side surface **501** of the first lens element **500** is R1, the focal length of the imaging lens system is f, and they satisfy the relation: R1/f=0.37.

In the third embodiment of the present imaging lens system, on the image-side surface **532** of the fourth lens element **530**, there is a point which has a tangent plane perpendicular to the optical axis; the distance between the point and the optical axis is Y' (referring to FIG. **5**); the clear aperture radius of the image-side surface **532** of the fourth lens element **530** is Y (referring to FIG. **5**); and Y' and Y satisfy the relation: Y'/Y=0.66.

In the third embodiment of the present imaging lens system, the image plane **570** is provided with an electronic sensor on which an object is imaged. The on-axis spacing between the object-side surface **501** of the first lens element **500** and the electronic sensor is TTL, half of the diagonal length of the effective pixel area of the electronic sensor is ImgH, and they satisfy the relation: TTL/ImgH=1.66.

In the third embodiment of the present imaging lens system, the focal length of the fifth lens element **540** is **f5**, the focal length of the system is f, and they satisfy the relation: f/**f5**=−0.17.

In the third embodiment of the present imaging lens system, the focal length of the system is f, the focal length of the third lens element **520** is **f3**, and they satisfy the relation: |f/**f3**|=1.08.

The detailed optical data of the third embodiment is shown in FIG. **13** (TABLE 5), and the aspheric surface data is shown in FIG. **14** (TABLE 6), wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

FIG. **7** shows an imaging lens system in accordance with a fourth embodiment of the present invention, and FIG. **8** shows the aberration curves of the fourth embodiment of the present invention. The imaging lens system of the fourth embodiment of the present invention mainly comprises five lens elements, in order from the object side to the image side: a plastic first lens element **700** with positive refractive power having convex object-side and image-side surfaces **701** and **702**, the object-side and image-side surfaces **701** and **702** both being aspheric; a plastic second lens element **710** with negative refractive power having concave object-side and image-side surfaces **711** and **712**, the object-side and image-side surfaces **711** and **712** both being aspheric; a plastic third lens element **720** with positive refractive power having a concave object-side surface **721** and a convex image-side surface **722**, the object-side and image-side surfaces **721** and **722** both being aspheric; a plastic fourth lens element **730** with negative refractive power having a convex object-side surface **731** and a concave image-side surface **732**, the object-side and image-side surfaces **731** and **732** both being aspheric and provided with at least one inflection point; and a plastic fifth lens element **740** with negative refractive power having concave object-side and image-side surfaces **741** and **742**, the object-side and image-side surfaces **741** and **742** both being aspheric; and an aperture stop **750** disposed between an imaged object and the first lens element **700**. The imaging lens system further comprises an IR filter **760** disposed between the image-side surface **742** of the fifth lens element **740** and the image plane **770**; the IR filter **760** has no influence on the focal length of the imaging lens system.

The equation of the aspheric surface profiles of the fourth embodiment has the same form as that of the first embodiment.

In the fourth embodiment of the present imaging lens system, the focal length of the imaging lens system is f, and it satisfies the relation: f=5.80.

In the fourth embodiment of the present imaging lens system, the f-number of the imaging lens system is Fno, and it satisfies the relation: Fno=2.45.

In the fourth embodiment of the present imaging lens system, half of the maximal field of view of the imaging lens system is HFOV, and it satisfies the relation: HFOV=33.5 degrees.

In the fourth embodiment of the present imaging lens system, the focal length of the first lens element **700** is **f1**, the focal length of the third lens element **720** is **f3**, and they satisfy the relation: **f1**/**f3**=0.95.

In the fourth embodiment of the present imaging lens system, the focal length of the system is f, the focal length of the fourth lens element **730** is **f4**, and they satisfy the relation: f/**f4**=−1.50.

In the fourth embodiment of the present imaging lens system, the Abbe number of the first lens element **700** is **V1**, the Abbe number of the second lens element **710** is **V2**, and they satisfy the relation: **V1**−**V2**=32.5.

In the fourth embodiment of the present imaging lens system, the third lens element **720** has positive refractive power and its Abbe number Vp satisfies the relation: Vp=55.9; the fourth lens element **730** has negative refractive power and its Abbe number Vn satisfies the relation: Vn=55.9; the fifth lens element **740** has negative refractive power and its Abbe number Vn satisfies the relation: Vn=23.4. Vp and Vn satisfy the relations:

Vp−Vn=0.0 (the third lens element **720** and the fourth lens element **730**);

Vp−Vn=32.5 (the third lens element **720** and the fifth lens element **740**).

In the fourth embodiment of the present imaging lens system, the curvature radius of the object-side surface **701** of the first lens element **700** is **R1**, the focal length of the imaging lens system is f, and they satisfy the relation: **R1**/f=0.36.

In the fourth embodiment of the present imaging lens system, on the image-side surface **732** of the fourth lens element **730**, there is a point which has a tangent plane perpendicular to the optical axis; the distance between the point and the optical axis is Y' (referring to FIG. **7**); the clear aperture radius of the image-side surface **732** of the fourth lens element **730** is Y (referring to FIG. **7**); and Y' and Y satisfy the relation: Y'/Y=0.66.

In the fourth embodiment of the present imaging lens system, the image plane **770** is provided with an electronic sensor on which an object is imaged. The on-axis spacing between the object-side surface **701** of the first lens element **700** and the electronic sensor is TTL, half of the diagonal length of the effective pixel area of the electronic sensor is ImgH, and they satisfy the relation: TTL/ImgH=1.62.

In the fourth embodiment of the present imaging lens system, the focal length of the fifth lens element **740** is **f5**, the focal length of the system is f, and they satisfy the relation: f/**f5**=−0.14.

In the fourth embodiment of the present imaging lens system, the focal length of the system is f, the focal length of the third lens element **720** is **f3**, and they satisfy the relation: |f/**f3**|=1.45.

The detailed optical data of the first embodiment is shown in FIG. **15** (TABLE 7), and the aspheric surface data is shown in FIG. **16** (TABLE 8), wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

It is to be noted that TABLES 1-8 (illustrated in FIGS. **9-16** respectively) show different data of the different embodiments; however, the data of the different embodiments are obtained from experiments. Therefore, any imaging lens system of the same structure is considered to be within the scope of the present invention even if it uses different data. The preferred embodiments depicted above are exemplary and are not intended to limit the scope of the present invention. TABLE 9 (illustrated in FIG. **17**) shows the data of the respective embodiments resulting from the equations.

What is claimed is:

1. An imaging lens system comprising, in order from an object side to an image side:

a first lens element with positive refractive power having a convex object-side surface;

a second lens element with negative refractive power;

a third lens element with positive refractive power, at least one of the object-side and image-side surfaces thereof being aspheric;

a fourth lens element, the image-side surface thereof being aspheric and provided with at least one inflection point;

a fifth lens element having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric; and

an aperture stop disposed between an imaged object and the second lens element.

2. The imaging lens system according to claim 1, wherein the fourth lens element has a convex object-side surface and a concave image-side surface.

3. The imaging lens system according to claim 2, wherein the second lens element has concave object-side and image-side surfaces while the third lens element has a concave object-side surface and a convex image-side surface.

4. The imaging lens system according to claim 1, wherein the focal length of the first lens element is f1, the focal length of the third lens element is f3, and they satisfy the relation: $0<f1/f3<1.2$.

5. The imaging lens system according to claim 4, wherein the focal length of the imaging lens system is f, the focal length of the fourth lens element is f4, and they satisfy the relation: $-1.9<f/f4<0.4$.

6. The imaging lens system according to claim 5, wherein the focal length of the imaging lens system is f, the focal length of the fourth lens element is f4, and they satisfy the relation: $-1.7<f/f4<-0.5$.

7. The imaging lens system according to claim 4, wherein the focal length of the first lens element is f1, the focal length of the third lens element is f3, and they satisfy the relation: $0.55<f1/f3<1.0$.

8. The imaging lens system according to claim 4, wherein the fifth lens element has negative refractive power.

9. The imaging lens system according to claim 8, wherein the fifth lens element has a concave image-side surface.

10. The imaging lens system according to claim 4, wherein the focal length of the imaging lens system is f, the focal length of the fifth lens element is f5, and they satisfy the relation: $-0.58<f/f5<0.30$.

11. The imaging lens system according to claim 1, wherein the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, and they satisfy the relation: $28.5<V1-V2<45.2$.

12. The imaging lens system according to claim 11, wherein at least one of the third, fourth, and fifth lens elements has positive refractive power with the Abbe number Vp, at least one of the third, fourth, and fifth lens elements has negative refractive power with the Abbe number Vn, and they satisfy the relation: $22.0<Vp-Vn$.

13. The imaging lens system according to claim 1, wherein the curvature radius of the object-side surface of the first lens element is R1, the focal length of the imaging lens system is f, and they satisfy the relation: $0.30<R1/f<0.50$.

14. The imaging lens system according to claim 1, wherein there is a point on the image-side surface of the fourth lens element, the point having a tangent plane perpendicular to the optical axis; the distance between the point and the optical axis is Y'; the clear aperture radius of the image-side surface of the fourth lens element is Y; and Y' and Y satisfy the relation: $0.55<Y'/Y<1.0$.

15. The imaging lens system according to claim 1, wherein at least three of the lens elements are made of plastic, and their object-side and image-side surfaces are both aspheric.

16. The imaging lens system according to claim 15, wherein the lens elements with refractive power are limited to the first, second, third, fourth, and fifth lens elements.

17. The imaging lens system according to claim 1, wherein the aperture stop is disposed between the imaged object and the first lens element.

18. The imaging lens system according to claim 17 further comprising an electronic sensor on which an object is imaged, wherein an on-axis spacing between the object-side surface of the first lens element and the electronic sensor is TTL, half of the diagonal length of the effective pixel area of the electronic sensor is ImgH, and they satisfy the relation: $TTL/ImgH<1.95$.

19. An imaging lens system comprising, in order from an object side to an image side:

a first lens element with positive refractive power having a convex object-side surface;

a second lens element with negative refractive power;

a third lens element with positive refractive power;

a fourth lens element with positive or negative refractive power, the image-side surface thereof being aspheric and provided with at least one inflection point; and

a fifth lens element with positive or negative refractive power having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric;

wherein the focal length of the first lens element is f1, the focal length of the third lens element is f3, and they satisfy the relation: $0<f1/f3<1.2$;

wherein the curvature radius of the object-side surface of the first lens element is R1, the focal length of the imaging lens system is f, and they satisfy the relation: $0.30<R1/f<0.50$;

wherein the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, and they satisfy the relation: $22.0<V1-V2$; and

wherein the lens elements with refractive power are limited to the first, second, third, fourth, and fifth lens elements.

20. An imaging lens system comprising, in order from an object side to an image side:

a first lens element with positive refractive power having a convex object-side surface;

a second lens element with negative refractive power;

a third lens element with positive or negative refractive power;

a fourth lens element with positive or negative refractive power, the image-side surface thereof being aspheric and provided with at least one inflection point; and

a fifth lens element with positive or negative refractive power having a concave object-side surface, at least one of the object-side and image-side surfaces thereof being aspheric;

wherein the focal length of the imaging lens system is f, the focal length of the third lens element is f3, and they satisfy the relation: $0.2<|f/f3|$;

wherein the curvature radius of the object-side surface of the first lens element is R1, the focal length of the imaging lens system is f, and they satisfy the relation: $0.30<R1/f<0.50$;

wherein the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, and they satisfy the relation: $22.0<V1-V2$; and

wherein the lens elements with refractive power are limited to the first, second, third, fourth, and fifth lens elements.

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