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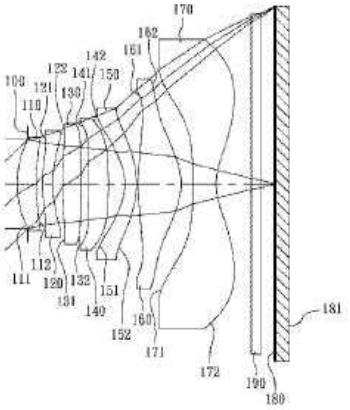
Claims: 3 pages. Specification: 39 pages. Drawings: 21 pages.

(54) Title of the Utility Model

OPTICAL IMAGE CAPTURING SYSTEM SET

(57) Abstract

An optical image capturing system set, comprises, in order from an object side to an image side, a first lens, a second lens, a third lens, a fourth lens, a fifth lens, a sixth lens and a seventh lens. The first lens with positive refractive power has a convex object-side surface. The second lens has refractive power. The third lens has refractive power. The fourth lens has refractive power. The fifth lens with refractive power has a convex image-side surface. The sixth lens with positive refractive power has both of the object-side and image-side surfaces thereof being aspheric. The seventh lens with negative refractive power has a concave image-side surface that changes from concave at a paraxial region to convex at a peripheral region, wherein the object-side and image-side surfaces thereof are aspheric. When the optical image capturing system set meets specific conditions, it can effectively correct aberrations and maintain a compact size.



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MOTOROLA MOBILITY
EXHIBIT 1005

1. An optical image capturing system set comprising, in order from an object side to an image side:
a first lens with positive refractive power having a convex object-side surface;
a second lens with refractive power;
a third lens with refractive power;
a fourth lens with refractive power;
a fifth lens with refractive power having a convex image-side surface;
a sixth lens with positive refractive power having an object-side surface and an image-side surface which are both aspheric; and
a seventh lens with negative refractive power having a concave image-side surface that changes from concave at a paraxial region to convex at a peripheral region, and an object-side surface and the image-side surface of the seventh lens are both aspheric;
wherein a curvature radius of the object-side surface of the seventh lens is R13, a curvature radios of the image-side surface of the seventh lens is R14, a focal length of the optical image capturing system is f, a focal length of the sixth lens is f6, and a focal length of the seventh lens is f7, the following conditions are satisfied:
$-5.0<R14/R13<1.0$; and
$1.8<|f/f6|+|f/f7|<6.0$.

2. The optical image capturing system set of claim 1**,** wherein the sixth lens has a convex image-side surface.

3. The optical image capturing system set of claim 2**,** wherein the fifth lens has a concave object-side surface.

4. The optical image capturing system set of claim 3**,** wherein the focal length of the optical image capturing system is f, the focal length of the sixth lens is f6, and the focal length of the seventh lens is f7, the following condition is satisfied:
$2.3<|f/f6|+|f/f7|<5.0$.

5. The optical image capturing system set of claim 3**,** wherein a displacement distance in parallel with an optical axis from a maximum effective diameter position on the image-side surface of the fifth lens to an optical axial is SAG52, and a thickness on the optical axis of the fifth lens is CT5, the following condition is satisfied:
$-0.7\ mm<SAG52+CT5<-0.1\ mm$.

6. The optical image capturing system set of claim 3**,** wherein the object-side surface of the sixth lens element is convex.

7. The optical image capturing system set of claim 3**,** wherein an Abbe number of the first lens is V1 and an Abbe number of the second lens is V2, and the following condition is satisfied:
$28<V1-V2<42$.

8. The optical image capturing system set of claim 2**,** wherein the object-side surface of the sixth lens changes from convex at a paraxial region to concave at a peripheral region.

9. The optical image capturing system set of claim 8**,** wherein all of the second lens to the seventh lens are made of plastic material, and the focal length of the optical image capturing system is f, and a distance from the object-side surface of the first lens to the image-side surface of the seventh lens on the optical axis is Td, the following condition is satisfied:
$0.50<Td/f<1.35$.

10. The optical image capturing system set of claim 8**,** wherein the focal length of the optical image capturing system is f, a focal length of the third lens is f3, and a focal length of the fourth lens is f4, the following condition is satisfied:
$|f/f3|+|f/f4|<1.0$.

11. The optical image capturing system set of claim 2, wherein the second lens has a concave image-side surface.

12. The optical image capturing system set of claim 11, wherein the focal length of the optical image capturing system set is f, and the focal length of the seventh lens is f7, the following condition is satisfied:

-3.0<f/f7/-1.3.

13. The optical image capturing system set of claim 12, wherein the fifth lens has negative refractive power.

14. The optical image capturing system set of claim 12, wherein a minimum thickness of a lens from the first lens to the seventh lens on the optical axis is CTmin, the following condition is satisfied:

0.10 mm<CTmin<0.30 mm.

15. The optical image capturing system set of claim 12, wherein the first lens has a concave image-side surface, and the second lens has a convex object-side surface.

16. The optical image capturing system set of claim 12, wherein the object-side surface of the seventh lens is concave.

17. An optical image capturing system set comprising, in order from an object side to an image side:

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

a second lens with refractive power;

a third lens with refractive power;

a fourth lens with refractive power;

a fifth lens with refractive power having an object-side surface and an image-side surface which are both aspheric;

a sixth lens with refractive power having an object-side surface and an image-side surface which are both aspheric; and

a seventh lens with refractive power having a convex image-side surface, and an object-side surface and the image-side surface thereof are both aspheric, wherein the image-side surface of the seventh lens comprises at least one inflection point;

wherein, the first lens to the seventh lens are single and non-cemented lenses, a curvature radius of the object-side surface of the seventh lens is R13, a curvature radius of the image-side surface of the seventh lens is R14, a focal length of the optical image capturing system set is f, on the image-side surface of the seventh lens, in addition to an intersection point with the optical axis, a tangent plane of the image-side surface thereof is perpendicular to the optical axis, a tangent point is formed between the tangent plane and the image-side surface, and a vertical distance from the tangent point to the optical axis is Yc72, and a distance from the object-side surface of the first lens to the image-side surface of the seventh lens on the optical axis is Td, the following conditions are satisfied:

-5.0<R14/R13<1.0;

0.1<Yc72/f<0.9; and

0.50<Td/f<1.35.

18. The optical image capturing system set of claim 17, wherein the focal length of the optical image capturing system set is f, and a distance from the object-side surface of the first lens to the image-side surface of the seventh lens on the optical axis is Td, the following condition is satisfied:

0.85<Td/f<1.25.

19. The optical image capturing system set of claim 18, wherein a curvature radius of the object-side surface of the seventh lens is R13, a curvature radius of the image-side surface of the seventh lens is R14, the following condition is satisfied:

-2.0<R14/R13<0.5.

20. The optical image capturing system set of claim 18, wherein a maximal field of view of the optical image capturing system set is FOV, the following condition is satisfied:

72 degrees<FOV<95 degrees.

21. The optical image capturing system set of claim 18, wherein the focal length of the optical image capturing system set is f, a focal length of the sixth lens is f6, and a focal length of the seventh lens is f7, the following condition is satisfied:

2.3<|f/f6|+|f/f7|<5.0.

22. The optical image capturing system set of claim 18, wherein the curvature radius of the image-side surface of the seventh lens is R14, and the focal length of the optical image capturing system set is f, and the following condition is satisfied:

0.1<R14/f<1.0.

23. The optical image capturing system set of claim 17, wherein the object-side surface of the sixth lens changes from convex at a paraxial region to concave at a peripheral region.

24. The optical image capturing system set of claim 23, wherein the sixth lens has positive refractive power, and the image-side surface thereof is convex, and the seventh lens has negative refractive power.

25. The optical image capturing system set of claim 23, wherein an Abbe number of the first lens is V1, and an Abbe number of the second lens is V2, the following condition is satisfied:

28<V1-V2<42.

26. The optical image capturing system set of claim 17, further comprising:

an image sensing element, disposed on an image plane, wherein a half of a diagonal length of an effective sensing area of the image sensing element is ImgH, and a distance between the object-side surface of the first lens and the image plane on the optical axis is TTL, the following condition is satisfied:

1.00 <TTL/ImgH<1.70.

OPTICAL IMAGE CAPTURING SYSTEM SET

TECHNICAL FIELD

[0001] The present utility model relates to an optical mage capturing system set. More particularly, the present invention relates to a miniaturized optical image capturing system set applicable to electronic products.

BACKGROUND ART

[0002] In recent years, with the popularity of mobile electronic products with camera functionalities, a demand for optical system is increasing. A photosensitive element of a conventional optical system is typically a CCD (Charge-Coupled Device) or a CMOS (Complementary Metal-Oxide-Semiconductor Sensor). As advanced semiconductor manufacturing technologies have allowed a pixel size of photosensitive elements to be reduced and the optical systems have gradually evolved toward the field of higher megapixels, there is an increasing demand for better image quality.

[0003] A conventional optical system employed in a portable electronic product, as shown in U.S. Pat. No. 7,869,142, mainly adopts a structure of four lenses. Due to the popularity of mobile products with high-end specifications, such as smart phones and PDAs (Personal Digital Assistants), requirements of higher megapixels and better image quality have increased rapidly. The conventional optical systems cannot satisfy the requirements of higher-end camera systems.

[0004] In the conventional lens technology, many lenses are assembled, making it bulky and difficult to have its size being miniaturized; therefore, it is not applicable to portable electronic products with a compact size. An optical image lens assembly with five lenses, such as five imaging lens optical system disclosed in U.S. Pat. No. 8,000,030, lacks good ability to correct high order aberrations and off-axis aberrations. Moreover, the space arrangement, the distribution of refractive power and the design of lens surface are not favorable to have its total length being effectively shortened thereof and it is thereby not easy to have a compact size lens with good image quality.

SUMMARY

[0005] Thus, one object of the present utility model is to provide an optical image capturing system set that appropriately configures the space among the lenses and cooperates with the use of aspherical surfaces and inflection points to facilitate correcting the high order aberration and the off-axis aberrations, for example, the comatic aberration and the astigmatism, and to reduce the angle at which the incident light projects onto the image sensing element under a limited total length and to realize an optical image capturing system set with a better image quality and a compact size.

[0006] According to an embodiment of the present utility model, an optical image capturing system set is provided, comprising, in order from an object side to an image side, a first lens, a second lens, a third lens, a fourth lens, a fifth lens, a sixth lens and a seventh lens. The first lens with positive refractive power has a convex object-side surface. The second lens has refractive power. The third lens has refractive power. The fourth lens has refractive power. The fifth lens with refractive power has a convex image-side surface. The sixth lens with positive refractive power has both an object-side surface and an image-side surface being aspheric. The seventh lens with negative refractive power has a concave image-side surface, and changes from concave at a paraxial region to convex at a peripheral region, wherein an object-side surface and the image-side surface of the seventh lens are both aspheric. A curvature radius of the object-side surface of the seventh lens is R13, a curvature radius of the image-side surface of the seventh lens is R14, a focal length of the optical image capturing system set is f, a focal length of the sixth lens is f6, and a focal length of the seventh lens is f7, the following conditions are satisfied:

[0007] $-5.0<R14/R13<1.0$; and

[0008] $1.8<|f/f6|+|f/f7|<6.0$.

[0009] In one embodiment of the present utility model, the six lens has a convex image-side surface.

[0010] In one embodiment of the present utility model, the fifth lens has a concave object-side surface.

[0011] In one embodiment of the present utility model, the focal length of the optical image capturing system set is f, the focal length of the sixth lens is f6, and the focal length of the seventh lens is f7, the following condition is satisfied:

[0012] $2.3<|f/f6|+|f/f7|<5.0$.

[0013] In one embodiment of the present utility model, a displacement distance in parallel with an optical axis from a maximum effective diameter position on the image-side surface of the fifth lens to an optical axial is SAG52, and a thickness on the optical axis of the fifth lens is CT5, the following condition is satisfied:

[0014] $-0.7\ \text{mm}<SAG52+CT5<-0.1\ \text{mm}$.

[0015] In one embodiment of the present utility model, the object-side surface of the sixth lens is convex.

[0016] In one embodiment of the present utility model, an Abbe number of the first lens is V1 and an Abbe number of the second lens is V2, and the following condition is satisfied:

[0017] $28<V1-V2<42$.

[0018] In one embodiment of the present utility model, the object-side surface of the sixth lens changes from convex at a paraxial region to concave at a peripheral region.

[0019] In one embodiment of the present utility model, all of the second lens to the seventh lens are made of plastic material, and the focal length of the optical image capturing system is f, and a distance from the object-side surface of the first lens to the image-side surface of the seventh lens on the optical axis is Td, the following condition is satisfied:

[0020] $0.50<Td/f<1.35$.

[0021] In one embodiment of the present utility model, the focal length of the optical image capturing system is f, a focal length of the third lens is f3, and a focal length of the fourth lens is f4, the following condition is satisfied:

[0022] $|f/f3|+|f/f4|<1.0$.

[0023] In one embodiment of the present utility model, the second lens has a concave image-side surface.

[0024] In one embodiment of the present utility model, the focal length of the optical image capturing system set is f, and the focal length of the seventh lens is f7, the following condition is satisfied:

[0025] $-3.0<f/f7/-1.3$.

[0026] In one embodiment of the present utility model, the fifth lens has negative refractive power.

[0027] In one embodiment of the present utility model, a minimum thickness on the optical axial of a lens from the first lens to the seventh lens is CTmin, the following condition is satisfied:

[0028] $0.10\ \text{mm}<CTmin<0.30\ \text{mm}$.

[0029] In one embodiment of the present utility model, the first lens has a concave image-side surface, and the second lens has a convex object-side surface.

[0030] In one embodiment of the present utility model, the object-side surface of the seventh lens is concave.

[0031] According to another embodiment of the present utility model, an optical image capturing system set is provided, comprising, in order from an object side to an image side, a first lens, a second lens, a third lens, a fourth lens, a fifth lens, a sixth lens, and a seventh lens. The first lens with positive refractive power has a convex object-side surface. The second lens has refractive power. The third lens has refractive power. The fourth lens has refractive power. The fifth lens with refractive power has an object-side surface and an image-side surface which are both aspheric. The sixth lens with refractive power, and has an object-side surface and an image-side surface which are both aspheric. The seventh lens with refractive power has a concave image-side surface and both an object-side surface and the image-side surface are aspheric, wherein the image-side surface of the seventh lens comprises at least one inflection point. The first lens to the seventh lens are single and non-cemented lenses. A curvature radius of the object-side surface of the seventh lens is R13, a curvature radius of the image-side surface of the seventh lens is R14, a focal length of the optical image capturing system set is f; on the image-side surface of the seventh lens, in addition to an intersection point with the optical axis, a tangent plane of the image-side surface thereof is perpendicular to the optical axis, a tangent point is formed

between the tangent plane and the image-side surface, and a vertical distance from the tangent point to the optical axis is Yc72, and a distance from the object-side surface of the first lens to the image-side surface of the seventh lens on the optical axis is Td, the following conditions are satisfied:

[0032] -5.0<R14/R13<1.0;

[0033] 0.1<Yc72/f<0.9; and

[0034] 0.50<Td/f<135.

[0035] In another embodiment of the present utility model, the focal length of the optical image capturing system set is f, and the distance from the object-side surface of the first lens to the image-side surface of the seventh lens on the optical axis is Td, the following condition is satisfied:

[0036] 0.85<Td/f<1.25.

[0037] In another embodiment of the present utility model, the curvature radius of the object-side surface of the seventh lens is R13, the curvature radius of the image-side surface of the seventh lens is R14, the following condition is satisfied:

[0038] -2.0<R14/R13<0.5.

[0039] In another embodiment of the present utility model, a maximal field of view of the optical image capturing system set is FOV, the following condition is satisfied:

[0040] 72 degrees<FOV<95 degrees.

[0041] In another embodiment of the present utility model, the focal length of the optical image capturing system set is f, a focal length of the sixth lens is f6, and a focal length of the seventh lens is f7, the following condition is satisfied:

[0042] 2.3<|f/f6|+|f/f7|<5.0.

[0043] In another embodiment of the present utility model, the curvature radius of the image-side surface of the seventh lens is R14, and the focal length of the optical image capturing system set is f, and the following condition is satisfied:

[0044] 0.1<R14/f<1.0.

[0045] In another embodiment of the present utility model, the object-side surface of the sixth lens changes from convex at a paraxial region to concave at a peripheral region.

[0046] In another embodiment of the present utility model, the sixth lens has positive refractive power, and the image-side surface thereof is convex, and the seventh lens has negative refractive power.

[0047] In another embodiment of the present utility model, an Abbe number of the first lens is V1, and an Abbe number of the second lens is V2, the following condition is satisfied:

[0048] 28<V1-V2<42.

[0049] In another embodiment of the present utility model, the optical image capturing system set further comprises:

[0050] an image sensing element, disposed on an image plane, wherein a half of a diagonal length of an effective sensing area of the image sensing element is ImgH, and a distance between the object-side surface of the first lens and the image plane on the optical axis is TTL, the following condition is satisfied:

[0051] 1.00 <TTL/ImgH<1.70.

[0052] When R14/R13 satisfy the above conditions, the configuration of the seventh lens surface curvature can cooperate with the configuration of other lenses of the optical image capturing system set and the disposition of aspherical lens surfaces and inflection points to correct the high order aberration and the off-axis aberrations, for example, the comatic aberration and the astigmatism, and to reduce the angle at which the incident light projects onto the electronic photosensitive element under a limited total length and to realize an optical image capturing system set with a better image quality and a compact size.

[0053] When |f/f6| + |f/f7| satisfies the above conditions, the focal lengths of the sixth lens and the seventh lens can be appropriately configured so as to form a positive-negative telephoto structure, and the total length of the optical image capturing system set can be effectively reduced.

[0054] When Yc72/f satisfies the above conditions, it can effectively reduce the angle at which the incident light projects onto the image sensing element from the off-axis field, thereby improving the response efficiency of the photosensitive element, thereby increasing image quality.

[0055] When Td/f satisfies the above conditions, it helps to reduce the total length of the optical image capturing system set, thereby helping to maintain a compact size thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0056] In order to make the above and other objects, features, advantages, and embodiments of the present utility model more clearly understandable, the accompanying drawings are described as follows:

[0057] FIG. 1 is a schematic view of an optical image capturing system set according to the 1st embodiment of the present utility model;

[0058] FIG. 2 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 1st embodiment;

[0059] FIG. 3 is a schematic view of an optical image capturing system set according to the 2nd embodiment of the present utility model;

[0060] FIG. 4 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 2nd embodiment;

[0061] FIG. 5 is a schematic view of an optical image capturing system set according to the 3rd embodiment of the present utility model;

[0062] FIG. 6 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 3rd embodiment;

[0063] FIG. 7 is a schematic view of an optical image capturing system set according to the 4th embodiment of the present utility model;

[0064] FIG. 8 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 4th embodiment;

[0065] FIG. 9 is a schematic view of an optical image capturing system set according to the 5th embodiment of the present utility model;

[0066] FIG. 10 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 5th embodiment;

[0067] FIG. 11 is a schematic view of an optical image capturing system set according to the 6th embodiment of the present utility model;

[0068] FIG. 12 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 6th embodiment;

[0069] FIG. 13 is a schematic view of an optical image capturing system set according to the 7th embodiment of the present utility model;

[0070] FIG. 14 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 7th embodiment;

[0071] FIG. 15 is a schematic view of an optical image capturing system set according to the 8th embodiment of the present utility model;

[0072] FIG. 16 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 8th embodiment;

[0073] FIG. 17 is a schematic view of an optical image capturing system set according to the 9th embodiment of the present utility model;

[0074] FIG. 18 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 9th embodiment;

[0075] FIG. 19 is a schematic view of an optical image capturing system set according to the 10th embodiment of the present utility model;

[0076] FIG. 20 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 10th embodiment;

[0077] FIG. 21 is a schematic parameter of the fifth lens of the optical image capturing system set according to the 1st embodiment of FIG. 1; and

[0078] FIG. 22 is a schematic parameter of the seventh lens of the optical image capturing system set according to the 1st embodiment of FIG. 1.

[0079] DESCRIPTION OF MAIN REFERENCE NUMERALS
[0080] Aperture: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000
[0081] First lens: 110, 210, 310, 410, 510, 610, 710, 810, 910, 1010
[0082] Object-side surfaces: 111, 211, 311, 411, 511, 611, 711, 811, 911, 1011
[0083] Image-side surface: 112, 212, 312, 412, 512, 612, 712, 812, 912, 1012
[0084] Second lens: 120, 220, 320, 420, 520, 620, 720, 820, 920, 1020
[0085] Object-side surface: 121, 221, 321, 421, 521, 621, 721, 821, 921, 1021
[0086] Image-side surface: 122, 222, 322, 422, 522, 622, 722, 822, 922, 1022
[0087] Third lens: 130, 230, 330, 430, 530, 630, 730, 830, 930, 1030
[0088] Object-side surface: 131, 231, 331, 431, 531, 631, 731, 831, 931, 1031
[0089] Image-side surface: 132, 232, 332, 432, 532, 632, 732, 832, 932, 1032
[0090] Fourth lens: 140, 240, 340, 440, 540, 640, 740, 840, 940, 1040
[0091] Object-side surface: 141, 241, 341, 441, 541, 641, 741, 841, 941, 1041
[0092] Image-side surfaces: 142, 242, 342, 442, 542, 642, 742, 842, 942, 1042
[0093] Fifth lens: 150, 250, 350, 450, 550, 650, 750, 850, 950, 1050
[0094] Object-side surface: 151, 251, 351, 451, 551, 651, 751, 851, 951, 1051
[0095] Image-side surface: 152, 252, 352, 452, 552, 652, 752, 852, 952, 1052
[0096] Sixth lens: 160, 260, 360, 460, 560, 660, 760, 860, 960, 1060
[0097] Object-side surface: 161, 261, 361, 461, 561, 661, 761, 861, 961, 1061
[0098] Image-side surface: 162, 262, 362, 462, 562, 662, 762, 862, 962, 1062
[0099] Seventh lens: 170, 270, 370, 470, 570, 670, 770, 870, 970, 1070
[0100] Object-side surface: 171, 271, 371, 471, 571, 671, 771, 871, 971, 1071
[0101] Image-side surface: 172, 272, 372, 472, 572, 672, 772, 872, 972, 1072
[0102] Image plane: 180, 280, 380, 480, 580, 680, 780, 880, 980, 1080
[0103] Image sensing element: 181, 281, 381, 481, 581, 681, 781, 881, 981, 1081
[0104] IR filters: 190, 290, 390, 490, 590, 690, 790, 890, 990, 1090
[0105] f: a focal length of the optical image capturing system set
[0106] Fno: an aperture value of the optical image capturing system set
[0107] HFOV: a half of the maximal field of view of the optical image capturing system set
[0108] V1: an Abbe number of the first lens
[0109] V2: an Abbe number of the second lens
[0110] CTmin : a minimum thickness on the optical axis of a lens from the first lens to the seventh lens
[0111] R13: a curvature radius of the object-side surface of the seventh lens
[0112] R14: a curvature radius of the image-side surface of the seventh lens
[0113] f3: a focal length of the third lens
[0114] f4: a focal length of the fourth lens
[0115] f6: a focal length of the sixth lens

[0116] f7 : a focal length of the seventh lens

[0117] SAG52: a displacement distance in parallel with an optical axis from a maximum effective diameter position on the image-side surface of the fifth lens to an optical axial lens

[0118] CT5: a thickness on the optical axis of the fifth lens

[0119] Yc72: on the image-side surface of the seventh lens, in addition to an intersection point with the optical axis, a tangent plane of the image-side surface thereof is perpendicular to the optical axis, a tangent point is formed between the tangent plane and the image-side surface, and a vertical distance from the tangent point to the optical axis

[0120] Td: a distance from the object-side surface of the first lens to the image-side surface of the seventh lens on the optical axis

[0121] FOV: maximal field of view of the optical image capturing system set

[0122] ImgH: a half of a diagonal length of an effective sensing area of the image sensing element

[0123] TTL: a distance between the object-side surface of the first lens and the image plane on the optical axis

DETAILED DESCRIPTION

[0124] An optical image capturing system set in order from an object side to an image side, includes a first lens, a second lens, a third lens, a fourth lens, a fifth lens, a sixth lens and a seventh lens. The optical image capturing system set further includes an image sensing element disposed on an image plane. Herein, the first lens to the seventh lens are seven single and non-cemented lenses. That is, any two lenses adjacent to each other are not cemented, and there is an air space between any two adjacent lenses. The manufacturing process of the cemented lenses is more complex than the single, non-cemented lenses; and particularly, the joint surface of the two lenses needs to have a highly accurate curved surface to ensure these two lenses will be highly cemented. Further, during the cementing process, those two lenses might not be highly cemented due to displacement, affecting the overall optical imaging quality. Therefore, the optical image capturing system set of the present utility model provides seven single and non-cemented lenses for improving upon the problem generated by the cemented lenses.

[0125] The first lens with positive refractive power has a convex object-side surface and a concave image-side surface, so that a total length of the optical image capturing system set can be reduced by adjusting the positive refractive power of the first lens.

[0126] The second lens has a convex object-side surface and a concave image-side surface so that the astigmatism of the optical image capturing system set can be corrected.

[0127] The fifth lens with negative refractive power can correct an aberration of the optical image capturing system set so as to improve image quality. The fifth lens can have a concave object-side surface and a convex image-side surface, so that the astigmatism of the optical image capturing system set can be effectively corrected.

[0128] The sixth lens with positive refractive power has an object-side surface and an image-side surface which are both convex, so that a high order aberration of the optical image capturing system set can be corrected so as to enhance the resolution of the optical image capturing system set for better image quality. Furthermore, the object-side surface of the sixth lens changes from convex at a paraxial region to concave at a peripheral region so as to maintain a relative illumination of the periphery of images.

[0129] The seventh lens with negative refractive power has an object-side surface and an image-side surface which are both concave, so that a principal point of the optical image capturing system set can be positioned away from the image plane for reducing a back focal length thereof so as to further reduce the total length of the optical image capturing system set, achieving the goal of a compact size. Moreover, the image-side surface of the seventh lens changes from concave at a paraxial region to convex at a peripheral region, and the seventh lens has inflection points. Therefore, an incident angle of an off-axis field of view onto the image sensing element can be effectively minimized, and preferably, aberrations of the off-axis field of view can be corrected.

[0130] A curvature radius of the object-side surface of the seventh lens is R13, and a curvature radius of the image-side surface of the seventh lens is R14, the following condition is satisfied: $-5.0<R14/R13<1.0$. By such an arrangement, the configuration of the surface curvature of the seventh lens can cooperate with the configuration of the other lenses of the optical image capturing system set, the arrangement of the aspheric surface of the other lenses and the arrangement of the inflection point to correct the high order aberration and the off-axis aberrations, for example, the comatic aberration

and the astigmatism, and to reduce the angle at which the incident light projects onto the image sensing element under a limited total length and to realize an optical image capturing system set with a better image quality and a compact size. Preferably, the optical image capturing system set further satisfies the following condition: -2.0<R14/R13<0.5.

[0131] A focal length of the optical image capturing system set is f, a focal length of the sixth lens is f6, and a focal length of the seventh lens is f7, the following condition is satisfied: 1.8<|f/f6|+|f/f7|<6.0. By properly arranging the focal lengths of the sixth lens and the seven lens so as to form a positive--negative telephoto structure, the total length of the optical image capturing system set can be effectively reduced. Preferably, the optical image capturing system set further satisfies the following condition: 2.3<|f/f6|+|f/f7|<5.0.

[0132] A displacement distance in parallel with an optical axis from a maximum effective diameter position on the image-side surface of the fifth lens to an optical axial is SAG52, and a thickness on the optical axis of the fifth lens is CT5, the following condition is satisfied: -0.7 mm<SAG52+CT5<-0.1 mm. Accordingly, it is favorable for manufacturing and assembling the lenses by arranging a proper surface curvature of the image-side surface of the fifth lens and a proper thickness of the lens.

[0133] An Abbe number of the first lens is V1, and an Abbe number of the second lens is V2, the following condition is satisfied: 28<V1-V2<42. Accordingly, a chromatic aberration of the optical image capturing system set can be corrected.

[0134] When the focal length of the optical image capturing system aet is f, and a distance from the object-side surface of the first lens to the image-side surface of the seventh lens on the optical axis is Td, the following condition is satisfied. 0.50<Td/f<1.35. Therefore, the total length of the optical image capturing system set can be effectively reduced so as to keep the optical image capturing system set compact. Preferably, the optical image capturing system set further satisfies the following condition: 0.85<Td/f<1.25.

[0135] The focal length of the optical image capturing system is f, a focal length of the third lens is f3, and a focal length of the fourth lens is f4, the following condition is satisfied: |f/f3|+|f/f4| <1.0. Therefore, the focal lengths of the third lens and the fourth lens are favorable for reducing the sensitivity of the optical image capturing system set.

[0136] The focal length of the optical image capturing system is f, and the focal length of the seventh lens is f7, the following condition is satisfied: -3.0<f/f7 <1.3. Consequently, the refractive power of the seventh lens will be favorable for further reducing the back focal length of the optical image capturing system set so as to reduce the total length.

[0137] A minimum thickness on the optical axial of a lens from the first lens to the seventh lens is CTmin, the following condition is satisfied: 0.10 mm<CTmin<0.30 mm. Therefore, by adjusting the thickness of the lenses, it is favorable for manufacturing the lenses, and preventing the over-thin lenses from being formed abnormally so as to increase the yield rate of the lenses.

[0138] The focal length of the optical image capturing system set is f, on the image-side surface of the seventh lens, in addition to an intersection point with the optical axis, a tangent plane of the image-side surface thereof is perpendicular to the optical axis, a tangent point is formed between the tangent plane and the image-side surface, and a vertical distance from the tangent point to the optical axis is Yc72, the following condition is satisfied: 0.1<Yc72/f<0.9. Accordingly, the angle at which the incident light projects onto the image sensing element can be effectively reduced, thereby improving the response efficiency of the photosensitive element, thereby improving the image quality.

[0139] A maximal field of view of the optical image capturing system set is FOV, the following condition is satisfied: 72 degrees<FOV<95 degrees. Accordingly, a larger field of view can be provided so as to obtain the required image scope and to avoid the image from distortion.

[0140] The curvature radius of the image-side surface of the seventh lens is R14, and the focal length of the optical image capturing system set is f, and the following condition is satisfied: 0.1<R14/f<1.0. Therefore, the curvature of the image-side surface of the seventh lens will be favorable for the principal point of the optical image capturing system set being positioned away from the image plane so that the back focal length thereof can be reduced and the compact size thereof can be maintained.

[0141] When a half of a diagonal length of the effective sensing area of the image sensing element is ImgH, and a distance between the object-side surface of the first lens and the image plane is TTL, the following condition is satisfied: 1.00 <TTL/ImgH<1.70. Thus, the total length of the optical image capturing system set can be reduced so as to maintain the compact size thereof, and suitable for being applied to the compact portable electronic products.

[0142] In the optical image capturing system set of the present utility model, the lenses can be made of plastic or glass material. When the lenses are made of glass material, the distribution of the refractive power of the optical image capturing system set can be more flexible to design. When the lenses are

made of plastic material, the manufacturing cost thereof can be decreased. Furthermore, surfaces of the lenses can be arranged to be aspheric, because the aspheric surface of the lens is easy to form a shape other than spherical surface so as to have more controllable variables for eliminating the aberration thereof, and to further decrease the required number of the lenses. Thus, the total length of the optical image capturing system set can be effectively reduced.

[0143] In the optical image capturing system set of this utility model, when a lens has a convex surface, it indicates that the paraxial region of the surface is convex; and when the lens has a concave surface, it indicates that the paraxial region of the surface is concave.

[0144] In the optical image capturing system set of this utility model, the optical image capturing system set can include at least one stop, and its position can be set before the first lens, between the lenses, or after the last lens. The stop type can be, for example, a glare stop or a field stop. Said glare stop or said field stop is for eliminating the stray light and thereby improving the image quality.

[0145] In the optical image capturing system set of this utility model, an aperture can be configured between an object and a first lens (i.e., the front aperture) or between the first lens and the image plane (i.e., the center aperture). If the aperture is a front one, a longer distance between an exit pupil of the optical image capturing system set and an image plane is produced, which provides a telecentric effect and improves the image-receiving efficiency of the image sensing element CCD or CMOS. If it is a center aperture, it helps to enlarge the field of view of the optical image capturing system set, giving the optical image capturing system set the advantage of a wide-angle lens.

[0146] The optical image capturing system set do not only equip with superior aberration correction functionality but also equip with superior image quality that can be applied to many electronic image systems, such as three-dimensional image capturing systems, digital cameras, portable devices or digital tablets.

[0147] According to the above description of the present utility model, the following specific embodiments are provided for further explanation.

[0148] 1st Embodiment

[0149] Please refer to FIG. 1 and FIG. 2. FIG. 1 is a schematic view of an optical image capturing system set according to the 1st embodiment of the present utility model. FIG. 2 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 1st embodiment. Based on FIG. 1, it can be known that the optical image capturing system set includes, in order from an object side to an image side, an aperture 100, a first lens 110, a second lens 120, a third lens 130, a fourth lens 140, a fifth lens 150, a sixth lens 160, a seventh lens 170, an IR filter 190, an image plane 180 and an image sensing element 181.

[0150] The first lens 110 with positive refractive power has a convex object-side surface 111 and a concave image-side surface 112, which are both aspheric, and the first lens 110 is made of plastic material.

[0151] The second lens 120 with negative refractive power has a convex object-side surface 121 and a concave image-side surface 122 which are both aspheric, and the second lens 120 is made of plastic material.

[0152] The third lens 130 with positive refractive power has a convex object-side surface 131 and a concave image-side surface 132, which are both aspheric, and the third lens 130 is made of plastic material.

[0153] The fourth lens 140 with positive refractive power has both an object-side surface 141 and an image-side surface 142 being convex, and are both aspheric, and the fourth lens 140 is made of plastic material.

[0154] The fifth lens 150 with negative refractive power has a concave object-side surface 151 and a convex image-side surface 152, which are both aspheric, and the fifth lens 150 is made of plastic material.

[0155] The sixth lens 160 with positive refractive power has a convex object-side surface 161 that changes from convex at a paraxial region to concave at a peripheral region and a convex image-side surface 162, which are both aspheric, and the sixth lens 160 is made of plastic material.

[0156] The seventh lens 170 with negative refractive power has a concave object-side surface 171 and a concave image-side surface 172 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric, and the seventh lens 170 is made of plastic material. Furthermore, the image-side surface 172 of the seventh lens 170 includes inflection points.

[0157] The IR filter 190 is made of glass and located between the seventh lens 170 and the image

plane 180, and will not affect the focal length of the optical image capturing system set.

[0158] The equation of the aspheric surface profiles of the aforementioned lenses is expressed as follows:

[0159] $$X(Y) = (Y^2 / R) / (1 + sqrt(1 - (1 + k) \times (Y / R)^2)) + \sum_i (Ai) \times (Y^i)$$

[0160] where:

[0161] X is the relative distance between a point on the aspheric surface spaced at a distance Y from the optical axis and the tangential plane at the aspheric surface vertex;

[0162] Y is the distance from the point on the curve of the aspheric surface to the optical axis;

[0163] R is the curvature radius;

[0164] K is the conic coefficient; and

[0165] Ai is the i-th aspheric coefficient.

[0166] In the optical image capturing system set of the 1st embodiment, a focal length of the optical image capturing system set is f, an f-number of the optical image capturing system set is Fno, and a half of the maximal field of view of the optical mage capturing system set is HFOV, the values thereof are as follows: f=4.01 mm; Fno=2.00; and HFOV=44.3 degrees.

[0167] In the optical image capturing system set of the 1st embodiment, an Abbe number of the first lens 110 is V1 and an Abbe number of the second lens 120 is V2, the following condition is satisfied: V1-V2=32.6.

[0168] In the optical image capturing system set of the 1st embodiment, a minimum thickness on the optical axial of a lens from the first lens 110 to the seventh lens 170 is CTmin, the following condition is satisfied: CTmin=0.230 mm.

[0169] In the optical image capturing system set of the 1st embodiment, a curvature radius of the object-side surface 171 of the seventh lens 170 is R13, a curvature radius of the image-side surface 172 is R14, and the focal length of the optical image capturing system set is f, the following conditions are satisfied: R14/R13= -0.03; and R14/f= 0.27.

[0170] In the optical image capturing system set of the 1st embodiment, the focal length of the optical image capturing system set is f, a focal length of the third lens 130 is f3, a focal length of the fourth lens 140 is f4, a focal length of the sixth lens 160 is f6, and a focal length of the seventh lens 170 is f7, the following conditions are satisfied: |f/f3 + |f/f4| =0.67; |f/f6| + |f/f7| =4.17; and f/f7 = -2.07.

[0171] Reference is now made to FIG. 21, which is a schematic parameter of the fifth lens 150 of the optical mage capturing system set of the 1st embodiment of FIG. 1. Based on FIG. 21, it can be known that a displacement distance in parallel with the optical axis from a maximum effective diameter position on the image-side surface 152 of the fifth lens 150 to an optical axial is SAG52, and a thickness of the fifth lens 150 on the optical axis is CT5, the following condition is satisfied: SAG52+CT5= -0.19 mm.

[0172] Please refer to FIG. 22, which is a schematic parameter of the seventh lens 170 of the optical image capturing system set of the 1st embodiment of FIG. 1. Based on FIG. 22, it can be known that on the image-side surface 172 of the seventh lens 170, in addition to an intersection point with the optical axis, a tangent plane of the image-side surface 172 is perpendicular to the optical axis, a tangent point is formed between the tangent plane and the image-side surface 172, and a vertical distance from the tangent point to the optical axis is Yc72, the focal length of the optical image capturing system set is f, and a distance from the object-side surface 111of the first lens 110 to the image-side surface 172 of the seventh lens 170 on the optical axis is Td, the following conditions are satisfied: Yc72/f=0.49; and Td/f=1.11.

[0173] In the optical image capturing system set of the 1st embodiment, the maximal field of view of the optical image capturing system set is FOV, the following condition is satisfied: FOV=88.6 degrees.

[0174] In the optical image capturing system set of the 1st embodiment, a half of the diagonal length of the effective sensing area of the image sensing element 181 is ImgH, and a distance between the object-side surface 111 of the first lens 110 and an image plane 180 on the optical axis is TTL, the following condition is satisfied: TTL/ImgH = 1.43.

[0175] Refer to Table 1 and Table 2 as follows.

[0176]

TABLE 1: 1st Embodiment							
f (focal length)= 4.01 mm, Fno (F-number)= 2.00, HFOV (half field of view) = 44.3 deg.							
Surface		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape.	Plano	-0.232				
2	Lens 1	2.434710 (ASP)	0.432	Plastic	1.544	55.9	7.09
3		6.184400 (ASP)	0.129				
4	Lens 2	2.617130 (ASP)	0.230	Plastic	1.640	23.3	-18.39
5		2.067550 (ASP)	0.227				
6	Lens 3	8.427200 (ASP)	0.408	Plastic	1.544	55.9	18.55
7		50.097500 (ASP)	0.148				
8	Lens 4	8.616300 (ASP)	0.475	Plastic	1.544	55.9	8.83
9		-10.657500 (ASP)	0.369				
10	Lens 5	-1.135390 (ASP)	0.260	Plastic	1.640	23.3	-5.23
11		-1.871900 (ASP)	0.046				
12	Lens 6	5.095500 (ASP)	0.960	Plastic	1.544	55.9	1.92
13		-1.224510 (ASP)	0.260				
14	Lens 7	-39.871000 (ASP)	0.519	Plastic	1.544	55.9	-1.93
15		1.086250 (ASP)	0.800				
16	IR filter	Plano	0.200	Glass	1.517	64.2	--
17		Plano	0.333				
18	Image plane	Plano	—				
Reference wavelength (d-line) is 587.6 nm							

[0177]

TABLE 2: Aspheric Coefficients					
Surface	2	3	4	5	6
k =	8.27120E-01	4.62437E+00	-1.13191E+01	-6.38616E+00	0.00000E+00
A4 =	-1.74532E-03	-5.83063E-02	-1.16345E-01	-6.30254E-02	-3.22408E-03
A6 =	1.66444E-02	9.03971E-02	1.17622E-01	5.70756E-02	-2.88888E-03
A8 =	4.28968E-03	-3.60302E-02	-7.66726E-02	-2.83491E-02	4.75917E-04
A10 =	-3.07413E-02	-1.36439E-02	7.44823E-03	6.65499E-03	-2.13932E-03
A12 =	3.78197E-02	1.65731E-02	1.44225E-02	-8.04619E-03	
A14 =	-1.23654E-02	-1.71803E-03	-1.00255E-02	2.81404E-03	
Surface	7	8	9	10	11
k =	0.00000E+00	-1.41923E+01	3.00000E+00	-1.91162E+00	-2.91712E+00
A4 =	-2.22211E-02	-4.89368E-02	-2.77627E-02	1.27682E-01	4.41976E-02
A6 =	1.62467E-03	-9.79475E-03	-2.66788E-02	-1.56846E-01	-4.96818E-02
A8 =	-2.71793E-03	8.35766E-03	4.86057E-03	9.93741E-02	2.88045E-02
A10 =	-1.57662E-03	-3.63072E-03	7.65106E-05	-4.10875E-02	-1.07348E-02
A12 =		-2.59001E-03	-1.00897E-04	1.33686E-02	2.93622E-03
A14 =		1.02823E-03	1.39343 E-04	-2.16846E-03	-3.46573E-04
Surface	12	13	14	15	
k =	1.52786E+00	-5.57551E+00	-1.12826E+01	-6.42535E+00	
A4 =	-6.23424E-02	-1.65595E-02	-5.43119E-02	-2.80684E-02	
A6 =	2.96152E-02	1.11540E-04	6.52054E-03	4.82354E-03	
A8 =	-8.05261E-03	9.36251E-03	-1.28046E-04	-6.50633E-04	
A10 =	7.04579E-04	-3.77558E-03	1.85706E-05	5.03266E-05	
A12 =	2.48481E-05	5.75870E-04	1.46128E-06	-2.63079E-06	
A14 =	-5.10512E-06	-3.18169E-05	-5.41596E-07	7.71151E-08	

[0178] Table 1 shows the detailed structural data of the 1st embodiment, where the curvature radius, the thickness and the focal length are shown in mm. Surface numbers 0-18 represent the surfaces sequentially arranged from the object-side to the image-side. Table 2 shows the aspherical surface data in the 1st embodiment, where k represents the conic coefficient of the equation of the aspheric surface profiles. A1-A14 represent the aspheric coefficients ranging from the 1st order to the 14th order of each surface. In addition, the tables presented below for each embodiment are the corresponding schematic diagrams and aberration curves, and the definitions of the data in the tables are the same as Table 1 and Table 2 of the 1st embodiment. Therefore, an explanation in this regard will not be provided again.

[0179] 2nd Embodiment

[0180] Please refer to FIG. 3 and FIG. 4. FIG. 3 is a schematic view of an optical image capturing system set according to the 2nd embodiment of the present utility model. FIG. 4 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 2nd embodiment. Based on FIG. 3, it can be known that the optical image capturing system set includes, in order from an object side to an image side, a first lens 210, an aperture 200, a second lens 220, a third lens 230, a fourth lens 240, a fifth lens 250, a sixth lens 260, a seventh lens 270, an IR filter 290, an image plane 280 and an image sensing element 281.

[0181] The first lens 210 with positive refractive power has a convex object-side surface 211 and a concave image-side surface 212, which are both aspheric, and the first lens 210 is made of plastic material.

[0182] The second lens 220 with negative refractive power has a convex object-side surface 221 and a concave image-side surface 222, which are both aspheric, and the second lens 220 is made of

plastic material.

[0183] The third lens 230 with negative refractive power has a concave object-side surface 231 and a concave image-side surface 232, which are both aspheric, and the third lens 230 is made of plastic material.

[0184] The fourth lens 240 with positive refractive power has a convex object-side surface 241 and a convex image-side surface 242, which are both aspheric, and the fourth lens 240 is made of plastic material.

[0185] The fifth lens 250 with negative refractive power has a concave object-side surface 251 and a convex image-side surface 252, which are both aspheric and the fifth lens 250 is made of plastic material.

[0186] The sixth lens 260 with positive refractive power has a convex object-side surface 261 that changes from convex at a paraxial region to concave at a peripheral region, and a convex image-side surface 262 which are both aspheric, and the sixth lens 260 is made of plastic material.

[0187] The seventh lens 270 with negative refractive power has a concave object-side surface 271 and a concave image-side surface 272 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric, and the seventh lens 270 is made of plastic material. Furthermore, the image-side surface 272 of the seventh lens 270 includes inflection points.

[0188] The IR filter 290 is made of glass and located between the seventh lens 270 and the image plane 280, and will not affect the focal length of the optical mage capturing system set.

[0189] Please refer to Table 3 and Table 4 below.

[0190]

TABLE 3: 2nd Embodiment							
f (focal length)= 4.69 mm. Fno (F-number) = 2.00. HFOV (half of field of view)=39.9 deg.							
Surface		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Lens 1	2.338420 (ASP)	0.661	Plastic	1.544	55.9	5.34
2		10.750800 (ASP)	0.040				
3	Ape.	Plano	0.016				
4	Lens 2	7.445700 (ASP)	0.240	Plastic	1.640	23.3	-17.26
5		4.391600 (ASP)	0.445				
6	Lens 3	-21.710900 (ASP)	0.381	Plastic	1.544	55.9	-39.74
7		5361.416200 (ASP)	0.147				
8	Lens 4	5.575000 (ASP)	0.529	Plastic	1.544	55.9	7.69
9		-16.175800 (ASP)	0.515				
10	Lens 5	-1.284340 (ASP)	0.300	Plastic	1.650	21.4	-8.44
11		-1.831180 (ASP)	0.035				
12	Lens 6	4.475500 (ASP)	1.150	Plastic	1.544	55.9	2.49
13		-1.763930 (ASP)	0.325				
14	Lens 7	-3.393300 (ASP)	0.420	Plastic	1.544	55.9	-2.12
15		1.819780 (ASP)	0.700				
16	IR filter	Plano	0.200	Glass	1.517	64.2	——
17		Plano	0.272				
18	Image Plane	Plano	—				
Reference wavelength (d-line) is 587.6 nm							

[0191]

TABLE 4: Aspheric Coefficients					
Surface	1	2	4	5	6
k =	9.80773E-01	-1.92188E+01	8.90606E+00	-1.79159E+00	0.00000E+00

[0192]

A4 =	-2.18593E-03	-6.46057E-02	-1.10653E-01	-4.86404E-02	-3.93493E-02
A6 =	-1.54070E-02	7.63918E-02	1.13450E-01	5.13025E-02	-1.80331E-02
A8 =	3.05338E-02	-4.29638E-02	-6.80130E-02	-3.24642E-02	4.67850E-03
A10 =	-3.36226E-02	-2.10201E-03	8.54602E-03	1.32076E-02	-9.93176E-03
A12 =	1.79152E-02	1.22516E-02	1.21194E-02	-2.83179E-03	
A14 =	-4.00474E-03	-3.93519E-03	-4.15964E-03	1.09867E-03	
Surface	7	8	9	10	11
k =	0.00000E+00	-5.00000E+01	-1.99836E+01	-2.35110E+00	-5.56653E+00
A4 =	-9.08185E-02	-4.85174E-02	-2.66060E-02	1.14859E-01	2.33258E-02
A6 =	1.74613E-02	-1.31630E-02	-3.07938E-02	-1.72783E-01	-5.37931E-02
A8 =	-1.60883E-02	5.98634E-03	6.93109E-03	9.45890E-02	2.74189E-02
A10 =	1.15200E-03	-1.00384E-03	7.89597E-04	-4.12706E-02	-1.10956E-02
A12 =		-1.22616E-03	-3.12044E-04	1.37733E-02	2.94183E-03
A14 =		5.23056E-04	1.91696E-05	-1.93858E-03	-2.89735E-04
Surface	12	13	14	15	
k =	1.11152E-01	-5.90226E+00	-3.47383E+00	-9.89411E+00	
A4 =	-6.66847E-02	-2.36853E-02	-5.03202E-02	-2.43023E-02	
A6 =	2.67368E-02	-4.13868E-03	7.31438E-03	4.35401E-02	
A8 =	-7.42114E-03	9.41497E-03	-1.79551E-04	-6.10939E-04	
A10 =	5.58018E-04	-3.69867E-03	3.41602E-06	5.28792E-05	
A12 =	-1.77933E-05	5.80183E-04	1.46128E-06	-2.74531E-06	
A14 =	5.57785E-06	-3.25579E-05	-3.73207E-07	6.39095E-08	

[0193] In the 2nd embodiment, the equation of the aspheric surface profiles is the same as the equation of the 1st embodiment. Also, the definitions of f, Fno, HFOV, V1, V2, CTmin, R13, R14, f3, f4, f6, f7, SAG52, CT5, Yc72, Td, FOV, TTL and ImgH are the same as those stated in the 1st embodiment, so an explanation in this regard will not be provided again.

[0194] In conjunction with Table 3, the following data can be extrapolated.

[0195]

2nd Embodiment			
f (mm)	4.69	|f/f6| + |f/f7|	4.10
Fno	2.00	f/f7	-2.22
HFOV (deg.)	39.9	SAG52 + CT5 (mm)	-0.44
V1-V2	32.6	Yc72/f	0.40
CTmin (mm)	0.240	Td/f	1.11
R14/R13	-0.54	FOV (deg.)	79.8
R14/f	0.39	TTL/ImgH	1.58
|f/f3| + |f/f4|	0.73		

[0196] 3rd Embodiment

[0197] Please refer to FIG. 5 and FIG. 6. FIG. 5 is a schematic view of an optical image capturing system set according to the 3rd embodiment of the present utility model. FIG. 6 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 3rd embodiment. Based on FIG. 5, it can be

known that the optical image capturing system set includes, in order from an object side to an image side, an aperture 300, a first lens 310, a second lens 320, a third lens 330, a fourth lens 340, a fifth lens 350, a sixth lens 360, a seventh lens 370, an IR filter 390, an image plane 380 and an image sensing element 381.

[0198] The first lens 310 with positive refractive power has a convex object-side surface 311 and a concave image-side surface 312, which are both aspheric, and the first lens 310 is made of plastic material.

[0199] The second lens 320 with negative refractive power has a convex object-side surface 321 and a concave image-side surface 322, which are both aspheric, and the second lens 320 is made of plastic material.

[0200] The third lens 330 with negative refractive power has a convex object-side surface 331 and a concave image-side surface 332, which are both aspheric, and the third lens 330 is made of plastic material.

[0201] The fourth lens 340 with positive refractive power has a convex object-side surface 341 and a concave image-side surface 342, which are both aspheric, and the fourth lens 340 is made of plastic material.

[0202] The fifth lens 350 with negative refractive power has a concave object-side surface 351 and a convex image-side surface 352, which are both aspheric, and the fifth lens 350 is made of plastic material.

[0203] The sixth lens 360 with positive refractive power has a convex object-side surface 361 that changes from convex at a paraxial region to concave at a peripheral region, and a convex image-side surface 362 which are both aspheric. The sixth lens 360 is made of plastic material.

[0204] The seventh lens 370 with negative refractive power has a convex object-side surface 371 and a concave image-side surface 372 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric. The seventh lens 370 is made of plastic material. Furthermore, the image-side surface 372 of the seventh lens 370 includes inflection points.

[0205] The IR filter 390 is made of glass, and located between the seventh lens 370 and the image plane 380, and will not affect the focal length of the optical image capturing system set.

[0206] Please refer to Table 5 and Table 6 below.

[0207]

TABLE 5: 3rd Embodiment

f (focal length)= 5.20 mm. Fno (F-number) = 2.20. HFOV (half of field of view)= 40.3 deg.

Surface		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape.	Plano	-0.247				
2	Lens 1	2.767090 (ASP)	0.539	Plastic	1.544	55.9	6.38
3		12.665200 (ASP)	0.099				

[0208]

4	Lens 2	5.044800 (ASP)	0.270	Plastic	1.634	23.8	-15.43
5		3.259300 (ASP)	0.368				
6	Lens 3	10.920300 (ASP)	0.462	Plastic	1.544	55.9	-34.51
7		6.802200 (ASP)	0.085				
8	Lens 4	3.989400 (ASP)	0.419	Plastic	1.544	55.9	7.64
9		96.088900 (ASP)	0.646				
10	Lens 5	-2.054730 (ASP)	0.350	Plastic	1.634	23.8	-8.46
11		-3.577300 (ASP)	0.070				
12	Lens 6	10.886400 (ASP)	1.152	Plastic	1.535	56.3	2.85
13		-1.703910 (ASP)	0.097				
14	Lens 7	15.384600 (ASP)	0.923	Plastic	1.535	56.3	-2.80
15		1.336710 (ASP)	0.900				
16	IR filter	Plano	0.300	Glass	1.517	64.2	__
17		Plano	0.422				
18	Image plane	Plano	__				
Reference wavelength (d-line) is 587.6 nm							

[0209]

TABLE 6: Aspheric Coefficients					
Surface	2	3	4	5	6
k =	3.52553E-01	-3.37368E+01	-9.47575E+00	-6.02858E+00	3.00000E+00
A4 =	-1.85103E-03	-4.12408E-02	-8.08093E-02	-4.19419E-02	-9.49326E-03
A6 =	-3.40118E-03	4.54419E-02	6.96078E-02	3.07246E-02	-1.02428E-02
A8 =	7.83761E-03	-2.38616E-02	-3.13092E-02	-1.31529E-02	1.38652E-03
A10 =	-1.11780E-02	-2.36325E-03	5.29695E-04	2.75455E-03	-1.05695E-03
A12 =	7.49400E-03	7.59632E-03	5.01418E-03	-1.11157E-03	
A14 =	-2.25623E-03	-3.29843E-03	-2.22181E-03	2.12214E-04	
Surface	7	8	9	10	11
k =	-6.24200E-01	-1.60325E+01	-2.00000E+01	-1.50067E+00	-8.18413E+00
A4 =	-4.44571E-02	-2.44682E-02	-1.02379E-02	8.48765E-02	2.22208E-02
A6 =	3.51367E-03	-1.31705E-02	-2.07363E-02	-8.98396E-02	-3.01459E-02
A8 =	-3.87828E-03	3.00348E-03	3.71865E-03	4.18718E-02	1.25384E-02
A10 =	-3.59950E-04	-6.35328E-04	2.26563E-04	-1.47834E-02	-3.88355E-03
A12 =		-4.41456E-04	-4.60637E-05	3.82222E-03	8.20642E-04
A14 =		1.91129E-04	5.60135E-05	-4.33119E-04	-6.93937E-05
Surface	12	13	14	15	
k =	-1.55961E+01	-5.41368E+00	-1.00000E+00	-4.99510E+00	
A4 =	-3.68193E-02	-2.75200E-02	-5.52252E-02	-2.04338E-02	
A6 =	1.63940E-02	1.17221E-03	8.08138E-03	3.00855E-03	
A8 =	-4.13324E-03	4.36791E-03	-2.17936E-04	-3.08074E-04	
A10 =	3.21097E-04	-1.34050E-04	-2.60573E-05	1.95617E-05	
A12 =	1.44523E-05	1.57879E-04	-8.43969E-07	-7.52512E-07	
A14 =	-2.23880E-06	-7.06951E-06	1.80932E-07	1.29525E-08	

[0210] In the 3rd embodiment, the equation of the aspheric surface profiles is the same as the equation of the 1st embodiment. Also, the definitions of f, Fno, HFOV, V1, V2, CTmin, R13, R14, f3, f4, f6, f7, SAG52, CT5, Yc72, Td, FOV, TTL and ImgH are the same as those stated in the 1st embodiment, so an explanation in this regard will not be provided again.

[0211] In conjunction with Table 5, the following data can be extrapolated:

[0212]

3rd Embodiment			
f (mm)	5.20	|f/f6| + |f/f7|	3.68
Fno	2.20	f/f7	-1.85
HFOV (deg.)	40.3	SAG52 + CT5 (mm)	-0.16
V1-V2	32.1	Yc72/f	0.49
CTmin (mm)	0.270	Td/f	1.05
R14/R13	0.09	FOV (deg.)	80.6
R14/f	0.26	TTL/ImgH	1.56
|f/f3| + |f/f4|	0.83		

[0213] 4th Embodiment

[0214] Please refer to FIG. 7 and FIG. 8. FIG. 7 is a schematic view of an optical image capturing system set according to the 4th embodiment of the present utility model. FIG. 8 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set of the 4th embodiment. Based on FIG. 7, it can be known that the optical image capturing system set includes, in order from an object side to an image side, a first lens 410, a second lens 420, an aperture 400, a third lens 430, a fourth lens 440, a fifth lens 450, a sixth lens 460, a seventh lens 470, an IR filter 490, an image plane 480 and an image sensing element 481.

[0215] The first lens 410 with positive refractive power has a convex object-side surface 411 and a concave image-side surface 412, which are both aspheric, and the first lens 410 is made of plastic material.

[0216] The second lens 420 with negative refractive power has a convex object-side surface 421 and a concave image-side surface 422, which are both aspheric, and the second lens 420 is made of plastic material.

[0217] The third lens 430 with negative refractive power has a concave object-side surface 431 and a convex image-side surface 432, which are both aspheric, and the third lens 430 is made of plastic material.

[0218] The fourth lens 440 with positive refractive power has a convex object-side surface 441 and a convex image-side surface 442, which are both aspheric, and the fourth lens 440 is made of plastic material.

[0219] The fifth lens 450 with negative refractive power has a concave object-side surface 451 and a convex image-side surface 452, which are both aspheric, and the fifth lens 450 is made of plastic material.

[0220] The sixth lens 460 with positive refractive power has a convex object-side surface 461 that changes from convex at a paraxial region to concave at a peripheral region and a convex image-side surface 462, and both are aspheric. The sixth lens 460 is made of plastic material.

[0221] The seventh lens 470 with negative refractive power has a concave object-side surface 471 and a concave image-side surface 472 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric, and the seventh lens 470 is made of plastic material. Furthermore, the image-side surface 472 of the seventh lens 470 includes inflection points.

[0222] The IR filter 490 is made of glass and located between the seventh lens 470 and the image plane 480, and will not affect the focal length of the optical image capturing system set.

[0223] Please refer to Table 7 and Table 8 below.

[0224]

TABLE 7: 4th Embodiment							
f (focal length)= 4.61 mm. Fno (F-number) = 2.30. HFOV (half of field of view)= 37.5 deg.							
Surface		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Lens 1	2.389670 (ASP)	0.633	Plastic	1.544	55.9	4.60
2		46.838100 (ASP)	0.047				
3	Lens 2	8.712400 (ASP)	0.240	Plastic	1.640	23.3	-15.14
4		4.537300 (ASP)	0.091				
5	Ape.	Plano	0.208				
6	Lens 3	-12.471700 (ASP)	0.237	Plastic	1.640	23.3	-26.34
7		-48.317500 (ASP)	0.222				
8	Lens 4	6.178900 (ASP)	0.462	Plastic	1.544	55.9	8.37
9		-16.846700 (ASP)	0.521				
10	Lens 5	-1.097580 (ASP)	0.280	Plastic	1.650	21.4	-8.13
11		-1.524590 (ASP)	0.035				
12	Lens 6	4.355700 (ASP)	0.802	Plastic	1.544	55.9	3.20
13		-2.706150 (ASP)	0.504				
14	Lens 7	-4.028200 (ASP)	0.703	Plastic	1.535	56.3	-2.82
15		2.559930 (ASP)	0.500				
16	IR filter	Plano	0.300	Glass	1.517	64.2	—
17		Plano	0.315				
18	Image plane	Plano	—				
Reference wavelength (d-line) is 587.6 nm.							

[0225]

TABLE 8: Aspheric Coefficients

[0226]

Surface	1	2	3	4	6
k =	1.57610E+00	0.00000E+00	2.24432E+01	-9.81610E+00	0.00000E+00
A4 =	-7.07207E-03	-2.87756E-02	-9.04706E-02	-6.10678E-02	-4.44285E-02
A6 =	-1.73645E-02	7.01684E-02	1.09158E-01	3.92193E-02	-2.89024E-03
A8 =	2.79532E-02	-4.79826E-02	-7.54503E-02	-9.10816E-03	3.45020E-03
A10 =	-3.14039E-02	-9.04108E-04	9.41003E-03	-1.62587E-02	-1.87971E-02
A12 =	1.74531E-02	1.24907E-02	1.80847E-02	1.36062E-02	
A14 =	-4.70458E-03	-3.66630E-03	-5.00907E-03	1.38208E-03	
Surface	7	8	9	10	11
k =	0.00000E+00	-2.96150E+01	-2.00000E+01	-2.26652E+00	-4.54917E+00
A4 =	-6.62324E-02	-7.68638E-02	-5.17014E-02	1.10874E-01	1.52213E-02
A6 =	2.37827E-02	1.57132E-04	-3.08132E-02	-1.74659E-01	-5.08872E-02
A8 =	-3.96313E-03	6.90401E-03	6.97349E-03	9.48529E-02	2.77209E-02
A10 =	-1.35674E-02	-1.61108E-03	1.31243E-03	-4.06977E-02	-1.11489E-02
A12 =		4.41316E-04	-2.05109E-04	1.37104E-02	2.97559E-03
A14 =		3.73746E-04	1.46854E-04	-2.37068E-03	-2.24668E-04
Surface	12	13	14	15	
k =	1.18222E+00	-4.28114E+00	-1.42975E+00	-1.14325E+01	
A4 =	-6.34381E-02	7.42374E-03	-4.49002E-02	-2.28851E-02	
A6 =	2.49561E-02	-8.55673E-03	7.09692E-03	3.88514E-03	
A8 =	-7.40096E-03	8.95202E-03	-3.08539E-04	-6.48704E-04	
A10 =	5.43575E-04	-3.66943E-03	1.94081E-05	5.58332E-05	
A12 =	-2.86123E-05	5.92930E-04	7.86735E-06	-1.82732E-06	
A14 =	1.63381E-05	-2.99776E-05	-6.29814E-07	-9.15485E-09	

[0227] In the 4th embodiment, the equation of the aspheric surface profiles is the same as the equation of the 1st embodiment. Also, the definitions of f, Fno, HFOV, V1, V2, CTmin, R13, R14, f3, f4, f6, f7, SAG52, CT5, Yc72, Td, FOV, TTL and ImgH are the same as those stated in the 1st embodiment; so an explanation in this regard will not be provided again.

[0228] In conjunction with Table 7, the following data can be extrapolated:

[0229]

4th Embodiment			
f (mm)	4.61	|f/f6| + |f/f7|	3.07
Fno	2.30	f/f7	-1.63
HFOV (deg.)	37.5	SAG52 + CT5 (mm)	-0.32
VI-V2	32.6	Yc72/f	0.37
CTmin (mm)	0.237	Td/f	1.08
R14/R13	-0.64	FOV (deg.)	75.0
R14/f	0.56	TTL/ImgH	1.67
|f/f3| + |f/f4|	0.73		

[0230] 5th Embodiment

[0231] Please refer to FIG. 9 and FIG. 10. FIG. 9 is a schematic view of an optical image capturing system set according to the 5th embodiment of the present utility model. FIG. 10 shows, in order

from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 5th embodiment. Based on FIG. 9, it can be known that the optical image capturing system set includes, in order from an object side to an image side, an aperture 500, a first lens 510, a second lens 520, a third lens 530, a fourth lens 540, a fifth lens 550, a sixth lens 560, a seventh lens 570, an IR filter 590, an image plane 580 and an image sensing element 581.

[0232] The first lens 510 with positive refractive power has a convex object-side surface 511 and a convex image-side surface 512, which are both aspheric, and the first lens 510 is made of plastic material.

[0233] The second lens 520 with negative refractive power has a convex object-side surface 521 and a concave image-side surface 522, which are both aspheric, and the second lens 520 is made of plastic material.

[0234] The third lens 530 with positive refractive power has a convex object-side surface 531 and a convex image-side surface 532, which are both aspheric, and the third lens 530 is made of plastic material.

[0235] The fourth lens 540 with positive refractive power has a convex object-side surface 541 and a concave image-side surface 542, which are both aspheric, and the fourth lens 540 is made of plastic material.

[0236] The fifth lens 550 with negative refractive power has a concave object-side surface 551 and a convex image-side surface 552, which are both aspheric, and the fifth lens 550 is made of plastic material.

[0237] The sixth lens 560 with positive refractive power has a convex object-side surface 561 that changes from convex at a paraxial region to concave at a peripheral region and a convex image-side surface 562, and both are aspheric. The sixth lens 560 is made of plastic material.

[0238] The seventh lens 570 with negative refractive power has a concave object-side surface 571 and a concave image-side surface 572 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric, and the seventh lens 570 is made of plastic material. Furthermore, the image-side surface 572 of the seventh lens 570 includes inflection points.

[0239] The IR filter 590 is made of glass and located between the seventh lens 570 and the image plane 580, and will not affect the focal length of the optical image capturing system set.

[0240] Please refer to Table 9 and Table 10 below.

[0241]

TABLE 9: 5th Embodiment							
f (focal length)= 3.74 mm. Fno (F-number) = 2.10. HFOV (half of field of view) = 38.7 deg.							
Surface	Curvature Radius		Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	infinity				
1	Ape.	Plano	-0.200				

[0242]

2	Lens 1	2.036410 (ASP)	0.498	Plastic	1.544	55.9	3.47
3		-23.551600 (ASP)	0.030				
4	Lens 2	2.627980 (ASP)	0.220	Plastic	1.650	21.4	-7.14
5		1.622050 (ASP)	0.426				
6	Lens 3	248.664500 (ASP)	0.508	Plastic	1.544	55.9	69.73
7		-44.742700 (ASP)	0.132				
8	Lens 4	4.625300 (ASP)	0.365	Plastic	1.544	55.9	10.43
9		24.281800 (ASP)	0.241				
10	Lens 5	-1.596190 (ASP)	0.250	Plastic	1.650	21.4	-8.74
11		-2.357310 (ASP)	0.030				
12	Lens 6	3.574000 (ASP)	0.825	Plastic	1.544	55.9	2.53
13		-2.063240 (ASP)	0.457				
14	Lens 7	-1.894410 (ASP)	0.320	Plastic	1.544	55.9	-2.04
15		2.837640 (ASP)	0.350				
16	IR filter	Plano	0.145	Glass	1.517	64.2	—
17		Plano	0.204				
18	Image plane	Plano	—				
Reference wavelength (d-line) is 587.6 nm.							

[0243]

TABLE 10: Aspheric Coefficients					
Surface	2	3	4	5	6
k =	2.20625E+00	-1.00000E+00	7.37774E-01	-4.60870E+00	-8.50000E+00
A4 =	-1.75513E-02	3.06838E-02	-1.27831E-01	-3.67140E-02	-2.57989E-02
A6 =	-3.96576E-02	5.61015E-02	1.53096E-01	9.14770E-02	-1.55297E-02
A8 =	8.70611E-02	-1.17110E-01	-1.43188E-01	-1.02582E-01	2.26274E-02
A10 =	-1.76322E-01	9.72894E-02	-1.49053E-02	5.13291E-02	-3.91197E-02
A12 =	1.67677E-01	-2.38813E-02	1.03153E-01	-1.57919E-02	1.70202E-02
A14 =	-7.01622E-02	-9.74824E-03	-5.68855E-02	3.40552E-03	
Surface	7	8	9	10	11
k =	-1.00000E+00	-1.25015E+01	-1.00000E+00	-3.56188E+00	-1.35942E+01
A4 =	-1.05499E-01	-1.38805E-01	-6.34312E-02	2.42110E-01	8.14332E-02
A6 =	3.32319E-02	4.14127E-03	-4.60031E-02	-3.21783E-01	-1.10006E-01
A8 =	-1.93231E-02	1.53781E-02	1.16320E-02	2.32868E-01	6.91190E-02
A10 =	-7.07693E-03	-1.01486E-02	-2.46831E-03	-1.42663E-01	-3.64787E-02
A12 =	2.21073E-03	-9.20265E-03	-8.59666E-04	5.87983E-02	1.28753E-02
A14 =		4.46565E-03	1.74660E-03	-9.87907E-03	-1.75963E-03
Surface	12	13	14	15	
k =	-3.39853E+00	-4.40903E+00	-2.12503E+00	-2.00964E+01	
A4 =	-1.07531E-01	-1.45461E-02	-4.53039E-02	-2.63996E-02	
A6 =	4.54702E-02	-1.61418E-02	1.65877E-02	6.43803E-03	
A8 =	-1.84675E-02	2.48627E-02	-8.83767E-04	-1.44751E-03	
A10 =	2.21076E-03	-1.18993E-02	-8.66834E-05	1.61180E-04	
A12 =	-2.65924E-04	2.54456E-03	-3.82312E-06	-1.33173E-05	
A14 =	1.12042E-04	-2.06928E-04	1.23641E-06	6.78805E-07	

[0244] In the 5th embodiment, the equation of the aspheric surface profiles is the same as the equation of the 1st embodiment. Also, the definitions of f, Fno, HFOV, V1, V2, CTmin, R13, R14, f3, f4, f6, f7, SAG52, CT5, Yc72, Td, FOV, TTL and ImgH are the same as those stated in the 1st embodiment, so an explanation in this regard will not be provided again.

[0245] In conjunction with Table 9, the following data can be extrapolated:

[0246]

5th Embodiment			
f (mm)	3.74	|f/f6| + |f/f7|	3.31
Fno	2.10	f/f7	-1.83
HFOV (deg.)	38.7	SAG52 + CT5 (mm)	-0.05
V1-V2	34.5	Yc72/f	0.40
CTmin (mm)	0.220	Td/f	1.15
R14/R13	-1.50	FOV (deg.)	77.4
R14/f	0.76	TTL/ImgH	1.62
|f/f3|+ |f/f4|	0.41		

[0247] 6th Embodiment

[0248] Please refer to FIG. 11 and FIG. 12. FIG. 11 is a schematic view of an optical image capturing system set according to the 6th embodiment of the present utility model. FIG. 12 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 6th embodiment. Based on FIG. 11, it can be known that the optical image capturing system set includes, in order from an object side to an image side, an aperture 600, a first lens 610, a to second lens 620, a third lens 630, a fourth lens 640, a fifth lens 650, a sixth lens 660, a seventh lens 670, an IR filter 690, an image plane 680 and an image sensing element 681.

[0249] The first lens 610 with positive refractive power has a convex object-side surface 611 and a convex image-side surface 612, which are both aspheric, and the first lens 610 is made of plastic material.

[0250] The second lens 620 with negative refractive power has a convex object-side surface 621 and a concave image-side surface 622, which are both aspheric, and the second lens 620 is made of plastic material.

[0251] The third lens 630 with negative refractive power has a concave object-side surface 631 and a concave image-side surface 632, which are both aspheric, and the third lens 630 is made of plastic material.

[0252] The fourth lens 640 with positive refractive power has a convex object-side surface 641 and a convex image-side surface 642, which are both aspheric, and the fourth lens 640 is made of plastic material.

[0253] The fifth lens 650 with negative refractive power has a concave object-side surface 651 and a convex image-side surface 652, which are both aspheric, and the fifth lens 650 is made of plastic material.

[0254] The sixth lens 660 with positive refractive power has a concave object-side surface 661 and a convex image-side surface 662 which are both aspheric, and the sixth lens element 660 is made of plastic material.

[0255] The seventh lens 670 with negative refractive power has a convex object-side surface 671 and a concave image-side surface 672 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric, and the seventh lens 670 is made of plastic material. Furthermore, the image-side surface 672 of the seventh lens 670 includes inflection points.

[0256] The IR filter 690 is made of glass and located between the seventh lens 670 and the image plane 680, and will not affect the focal length of the optical image capturing system set.

[0257] Please refer to Table 11 and Table 12 below.

[0258]

TABLE 11: 6th Embodiment							
f (focal length)= 5.38 mm. Fno (F-number) = 2.20. HFOV(half of field of view)= 39.1 deg.							
Surface		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape.	Plano	-0.240				
2	Lens 1	2.999970 (ASP)	0.606	Plastic	1.544	55.9	5.29
3		-67.612600 (ASP)	0.072				
4	Lens 2	8.567900 (ASP)	0.273	Plastic	1.634	23.8	-14.38
5		4.361700 (ASP)	0.509				
6	Lens 3	-26.055100 (ASP)	0.471	Plastic	1.544	55.9	-18.30
7		16.219900 (ASP)	0.098				
8	Lens 4	4.863200 (ASP)	0.586	Plastic	1.544	55.9	6.92
9		-15.971000 (ASP)	0.637				
10	Lens 5	-1.609130 (ASP)	0.330	Plastic	1.634	23.8	-8.17
11		-2.520100 (ASP)	0.070				
12	Lens 6	-25.286300 (ASP)	0.823	Plastic	1.535	56.3	3.27
13		-1.653350 (ASP)	0.051				
14	Lens 7	28.203800 (ASP)	1.235	Plastic	1.535	56.3	-3.15
15		1.564750 (ASP)	0.900				
16	IR filter	Plano	0.300	Glass	1.517	64.2	-
17		Plano	0.376				
18	Image plane	Plano	-				
Reference wavelength (d-line) is 587.6 nm.							

[0259]

Table 12: Aspheric Coefficients

[0260]

Surface	2	3	4	5	6
k =	4.01544E-01	-5.00000E+01	-8.42402E+00	-9.30597E+00	3.00000E+00
A4 =	-1.56440E-03	-3.80636E-02	-8.19776E-02	-4.68550E-02	-1.24630E-02
A6 =	-2.89629E-03	4.41253E-02	6.66015E-02	2.79083E-02	-7.20040E-03
A8 =	5.74626E-03	-2.40812E-02	-3.05395E-02	-1.33958E-02	6.99479E-04
A10 =	-9.82788E-03	-1.13343E-03	9.24213E-04	3.07751E-03	-1.24872E-03
A12 =	7.50285E-03	7.58909E-03	5.01905E-03	-1.11147E-03	
A14 =	-2.25574E-03	-3.29879E-03	-2.22159E-03	2.12328E-04	
Surface	7	8	9	10	11
k =	-9.69905E+00	-2.00000E+01	-3.24011E+00	-1.08216E+00	-2.91816E+00
A4 =	-4.82613E-02	-2.98065E-02	-6.80002E-03	8.05669E-02	2.11134E-02
A6 =	3.37685E-03	-1.29738E-02	-2.28135E-02	-8.91292E-02	-3.01124E-02
A8 =	-2.79449E-03	2.81599E-03	3.46632E-03	4.20982E-02	1.24422E-02
A10 =	-9.37756E-05	-6.72440E-04	2.15464E-07	-1.47389E-02	-3.90392E-03
A12 =		-4.96332E-04	-1.38855E-04	3.81920E-03	8.23878E-04
A14 =		1.90099E-04	4.01335E-05	-4.44578E-04	-6.55653E-05
Surface	12	13	14	15	
k =	5.00000E+00	-3.91428E+00	-1.00000E+00	-5.65225E+00	
A4 =	-3.12302E-02	-2.53693E-02	-4.42218E-02	-1.83434E-02	
A6 =	1.47040E-02	1.66451E-03	7.06313E-03	2.88292E-03	
A8 =	-4.37468E-03	4.26941E-03	-2.47434E-04	-3.18087E-04	
A10 =	3.12703E-04	-1.35527E-03	2.49118E-05	2.05537E-05	
A12 =	1.96691E-05	1.57833E-04	-5.34985E-07	-7.48457E-07	
A14 =	-9.39014E-07	-6.65177E-06	1.89711E-07	1.10386E-08	

[0261] In the 6th embodiment, the equation of the aspheric surface profiles is the same as the equation of the 1st embodiment. Also, the definitions of f, Fno, HFOV, V1, V2, CTmin, R13, R14, f3, f4, f6, f7, SAG52, CT5, Yc72, Td, FOV, TTL and ImgH are the same as those stated in the 1st embodiment, so an explanation in this regard will not be provided again.

[0262] In conjunction with Table 11, the following data can be extrapolated:

[0263]

6th Embodiment			
f (mm)	5.38	|f/f6| + |f/f7|	3.35
Fno	2.20	f/f7	-1.71
HFOV (deg.)	39.1	SAG52 + CT5 (mm)	-0.41
V1-V2	32.1	Yc72/f	0.48
CTmin (mm)	0.273	Td/f	1.07
R14/R13	0.06	FOV (deg.)	78.2
R14/f	0.29	TTL/ImgH	1.61
|f/f3| + |f/f4|	1.07		

[0264] 7th Embodiment

[0265] Please refer to FIG. 13 and FIG. 14. FIG. 13 is a schematic view of an optical image

capturing system set according to the 7th embodiment of the present utility model. FIG. 14 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 7th embodiment. Based on FIG. 13, it can be known that the optical image capturing system set includes, in order from an object side to an image side, a first lens 710, an aperture 700, a second lens 720, a third lens 730, a fourth lens 740, a fifth lens 750, a sixth lens 760, a seventh lens 770, an IR filter 790, an image plane 780 and an image sensing element 781.

[0266] The first lens 710 with positive refractive power has a convex object-side surface 711 and a convex image-side surface 712, which are both aspheric, and the first lens 710 is made of plastic material.

[0267] The second lens 720 with negative refractive power has a concave object-side surface 721 and a concave image-side surface 722, which are both aspheric, and the second lens 720 is made of plastic material.

[0268] The third lens 730 with negative refractive power has a concave object-side surface 731 and a convex image-side surface 732, which are both aspheric, and the third lens 730 is made of plastic material.

[0269] The fourth lens 740 with positive refractive power has a convex object-side surface 741 and a convex image-side surface 742, which are both aspheric, and the fourth lens 740 is made of plastic material.

[0270] The fifth lens 750 with negative refractive power has a concave object-side surface 751 and a convex image-side surface 752, which are both aspheric, and the fifth lens 750 is made of plastic material.

[0271] The sixth lens 760 with positive refractive power has a convex object-side surface 761 that changes from convex at a paraxial region to concave at a peripheral region and a convex image-side surface 762, and both are aspheric. The sixth lens 760 is made of plastic material.

[0272] The seventh lens 770 with negative refractive power has a concave object-side surface 771 and a concave image-side surface 772 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric. The seventh lens 770 is made of plastic material. Furthermore, the image-side surface 772 of the seventh lens 770 includes inflection points.

[0273] The IR filter 790 is made of glass and located between the seventh lens 770 and the image plane 780, and will not affect the focal length of the optical image capturing system set.

[0274] Please refer to Table 13 and Table 14 below.

[0275]

TABLE 13: 7th Embodiment

f (focal length)= 4.70 mm. Fno (F-number)= 2.05. HFOV (half field of view) = 39.9 deg.

Surface		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Lens 1	2.552000 (ASP)	0.644	Plastic	1.544	55.9	4.51

[0276]

2		-59.234700(ASP)	-0.019				
3	Ape.	Plano	0.087				
4	Lens 2	-33.697200 (ASP)	0.271	Plastic	1.650	21.4	-13.48
5		11.539200 (ASP)	0.443				
6	Lens 3	-9.405600 (ASP)	0.326	Plastic	1.544	55.9	-20.22
7		-65.634000 (ASP)	0.074				
8	Lens 4	5.508100 (ASP)	0.488	Plastic	1.544	55.9	8.43
9		-26.548500 (ASP)	0.512				
10	Lens 5	-1.455840 (ASP)	0.300	Plastic	1.650	21.4	-9.21
11		-2.080300 (ASP)	0.035				
12	Lens 6	5.526900 (ASP)	1.196	Plastic	1.544	55.9	2.63
13		-1.781640 (ASP)	0.381				
14	Lens 7	-3.779400 (ASP)	0.450	Plastic	1.530	55.8	-2.29
15		1.864430 (ASP)	0.700				
16	IR filter	Plano	0.200	Glass	1.517	64.2	__
17		Plano	0.316				
18	Image plane	Plano	__				
Reference wavelength (d-line) is 587.6 nm.							

[0277]

TABLE 14: Aspheric Coefficients					
Surface	1	2	4	5	6
k =	1.24996E+00	-5.00000E+01	-5.00000E+01	-5.00000E+01	-1.47280E+01
A4 =	-6.55257E-03	-5.28204E-02	-8.73850E-02	-5.59195E-02	-4.28602E-02
A6 =	-1.77310E-02	7.30552E-02	1.14595E-01	5.56109E-02	-1.89061E-02
A8 =	3.02431E-02	-4.28443E-02	-6.87772E-02	-3.99650E-02	6.43553E-03
A10 =	-3.30032E-02	-2.94210E-03	4.82093E-03	1.66795E-02	-4.33981E-03
A12 =	1.72237E-02	1.22346E-02	1.37324E-02	-3.82242E-03	-5.02596E-05
A14 =	-4.03478E-03	-3.93520E-03	-4.15965E-03	1.09866E-03	-4.36603E-09
Surface	7	8	9	10	11
k =	-5.00000E-01	-5.00000E+01	3.00000E+00	-2.11829E+00	-7.16778E+00
A4 =	-8.75294E-02	-5.93688E-02	-3.06406E-02	1.22411E-01	2.60299E-02
A6 =	1.95170E-02	-8.93391E-03	-3.18133E-02	-1.71303E-01	-5.34072E-02
A8 =	-1.44992E-02	5.53314E-03	7.75816E-03	9.38898E-02	2.73223E-02
A10 =	2.16819E-03	-1.19246E-03	1.04262E-03	-4.15955E-02	-1.11730E-02
A12 =	4.65110E-04	-1.16400E-03	-4.08272E-04	1.36852E-02	2.93311E-03
A14 =	-4.14156E-04	5.27523E-04	-4.78330E-05	-1.99216E-03	-2.75785E-04
Surface	12	13	14	15	
k =	2.13050E+00	-4.68712E+00	-1.92871E+01	-7.18320E+00	
A4 =	-5.78245E-02	-1.04836E-02	-5.71189E-02	-2.59797E-02	
A6 =	2.40501E-02	-7.74761E-03	6.98751E-03	4.42064E-03	
A8 =	-7.84867E-03	9.20324E-03	-1.87842E-04	-5.99594E-04	
A10 =	5.33907E-04	-3.68429E-03	5.07686E-06	5.25450E-05	
A12 =	-1.75044E-05	5.84664E-04	1.90670E-06	-2.78886E-06	
A14 =	1.26961E-05	-3.16505E-05	-2.77147E-07	6.51816E-08	

[0278] In the 7th embodiment, the equation of the aspheric surface profiles is the same as the equation of the 1st embodiment. Also, the definitions of f, Fno, HFOV, V1, V2, CTmin, R13, R14, f3, f4, f6, f7, SAG52, CT5, Yc72, Td, FOV, TTL and ImgH are the same as those stated in the 1st embodiment, so an explanation in this regard will not be provided again.

[0279] In conjunction with Table 13, the following data can be extrapolated:

[0280]

7th Embodiment			
f (mm)	4.70	|f/f6| + |f/f7|	3.84
Fno	2.05	f/f7	-2.05
HFOV (deg.)	39.9	SAG52 + CT5 (mm)	-0.32
V1-V2	34.5	Yc72/f	0.42
CTmin (mm)	0.271	Td/f	1.10
R14/R13	-0.49	FOV (deg.)	79.8
R14/f	0.40	TTL/ImgH	1.58
|f/f3| + |f/f4|	0.79		

[0281] 8th Embodiment

[0282] Please refer to FIG. 15 and FIG. 16. FIG. 15 is a schematic view of an optical image capturing system set according to the 8th embodiment of the present utility model. FIG. 16 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 8th embodiment. Based on FIG. 15, it can be known that, the optical image capturing system set includes, in order from an object side to an image side, a first lens 810, an aperture 800, a second lens 820, a third lens 830, a fourth lens 840, a fifth lens 850, a sixth lens 860, a seventh lens 870, an IR filter 890, an image plane 880 and an image sensing element 881.

[0283] The first lens 810 with positive refractive power has a convex object-side surface 811 and a concave image-side surface 812, which are both aspheric, and the first lens 810 is made of plastic material.

[0284] The second lens 820 with negative refractive power has a convex object-side surface 821 and a concave image-side surface 822, which are both aspheric, and the second lens 820 is made of plastic material.

[0285] The third lens 830 with positive refractive power has a concave object-side surface 831 and a convex image-side surface 832, which are both aspheric, and the third lens 830 is made of plastic material.

[0286] The fourth lens 840 with positive refractive power has a concave object-side surface 841 and a convex image-side surface 842, which are both aspheric, and the fourth lens 840 is made of plastic material.

[0287] The fifth lens 850 with negative refractive power has a concave object-side surface 851 and a convex image-side surface 852, which are both aspheric, and the fifth lens 850 is made of plastic material.

[0288] The sixth lens 860 with positive refractive power has a convex object-side surface 861 that changes from convex at a paraxial region to concave at a peripheral region and a convex image-side surface 862, and both are aspheric, and the sixth lens 860 is made of plastic material.

[0289] The seventh lens 870 with negative refractive power has a concave object-side surface 871 and a concave image-side surface 872 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric, and the seventh lens 870 is made of plastic material. Furthermore, the image-side surface 872 of the seventh lens 870 comprises inflection points.

[0290] The IR filter 890 is made of glass and located between the seventh lens 870 and the image plane 880, and will not affect the focal length of the optical image capturing system set.

[0291] Please refer to Table 15 and Table 16 below.

[0292]

TABLE 15: 8th Embodiment							
f (focal length)= 5.08 mm. Fno (F-number)= 2.20. HFOV (half of field of view) = 37.5 deg.							
Surface		Curvature Radius	Thickness	Material	index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Lens 1	2.106050 (ASP)	0.727	Plastic	1.530	55.8	4.48
2		16.377300 (ASP)	0.058				
3	Ape.	Plano	0.042				
4	Lens 2	9.396400 (ASP)	0.240	Plastic	1.650	21.4	-11.76
5		4.171200 (ASP)	0.447				
6	Lens 3	-6.904700 (ASP)	0.449	Plastic	1.530	55.8	14.72
7		-3.745600 (ASP)	0.050				
8	Lens 4	-237.531700 (ASP)	0.364	Plastic	1.530	55.8	279.46
9		-91.271700 (ASP)	0.476				
10	Lens 5	-1.264930 (ASP)	0.300	Plastic	1.650	21.4	-10.79
11		-1.687700 (ASP)	0.090				
12	Lens 6	4.716500 (ASP)	0.612	Plastic	1.530	55.8	4.50
13		-4.604000 (ASP)	0.936				
14	Lens 7	-4.091400 (ASP)	0.460	Plastic	1.530	55.8	-3.60
15		3.720800 (ASP)	0.500				
16	IR filter	Plano	0.200	Glass	1.517	64.2	—
17		Plano	0.294				
18	Image plane	Plano	—				
Reference wavelength (d-line) is 587.6 nm.							

[0293]

TABLE 16: Aspheric Coefficients					
Surface	1	2	4	5	6
k =	8.90178E-01	-3.61096E-01	-3.83218E+01	-9.14738E+00	-1.98164E+01
A4 =	-4.95272E-03	-4.57358E-02	-9.83371E-02	-5.31829E-02	-3.94999E-02
A6 =	-1.44552E-02	5.29770E-02	1.11966E-01	6.97942E-02	-1.95451E-02
A8 =	2.49942E-02	-3.15473E-02	-6.31640E-02	-3.75623E-02	3.72584E-04
A10 =	-2.93336E-02	2.41746E-03	7.64209E-03	1.03095E-02	-8.46446E-03
A12 =	1.61703E-02	4.39750E-03	1.24249E-02	5.48284E-04	2.58665E-03
A14 =	-4.07081E-03	-1.46693E-03	-4.15965E-03	1.09866E-03	-1.17926E-08
Surface	7	8	9	10	11
k =	-2.56555E+00	3.00000E+00	-1.03183E+00	-1.76852E+00	-3.42595E+00
A4 =	-6.18956E-02	-1.04186E-01	-5.10015E-02	1.55550E-01	3.32805E-02
A6 =	1.87497E-02	4.15342E-03	-2.98507E-02	-1.66325E-01	-5.00058E-02
A8 =	-1.53337E-02	8.38758E-03	9.54388E-03	9.12039E-02	2.70150E-02
A10 =	2.17052E-03	8.77193E-04	1.30623E-03	-4.24285E-02	-1.14852E-02
A12 =	1.95878E-03	-4.85466E-04	-4.86555E-04	1.37199E-02	2.89303E-03
A14 =	-4.05129E-04	1.22823E-05	8.10409E-06	-1.81567E-03	-2.38389E-04
Surface	12	13	14	15	
k=	-6.58821E+00	-1.61451E+01	-2.62115E+00	-2.11643E+01	
A4 =	-6.25392E-02	-8.14410E-03	-4.42315E-02	-2.19259E-02	
A6 =	2.57139E-02	-7.65552E-03	7.71517E-03	3.60828E-03	
A8 =	-7.55747E-03	9.57982E-03	-2.57484E-04	-5.48595E-04	
A10 =	9.90623E-04	-3.64717E-03	-1.43974E-05	5.09581E-05	
A12 =	-1.45805E-04	5.80279E-04	7.50606E-07	-3.19315E-06	
A14 =	1.30850E-05	-3.36611E-05	-2.46540E-08	1.00041E-07	

[0294] In the 8th embodiment, the equation of the aspheric surface profiles is the same as the equation of the 1st embodiment. Also, the definitions of f, Fno, HFOV, V1, V2, CTmin, R13, R14, f3, f4, f6, f7, SAG52, CT5, Yc72, Td, FOV, TTL and ImgH are the same as those stated in the 1st embodiment, so an explanation in this regard will not be provided again.

[0295] In conjunction with Table 15, the following data can be extrapolated:

[0296]

8th Embodiment			
f (mm)	5.08	|f/f6| + |f/f7|	2.54
Fno	2.20	f/f7	-1.41
HFOV (deg.)	37.5	SAG52 + CT5 (mm)	-0.38
VI-V2	34.4	Yc72/f	0.30
CTmin (mm)	0.240	Td/f	1.03
R14/R13	-0.91	FOV (deg.)	75.0
R14/f	0.73	TTL/ImgH	1.54

[0297]

|f/f3| + |f/f4|	0.36		

[0298] 9th Embodiment

[0299] Please refer to FIG. 17 and FIG. 18. FIG. 17 is a schematic view of an optical image capturing system set according to the 9th embodiment of the present utility model. FIG. 18 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 9th embodiment. Based on FIG. 17, it can be known that the optical image capturing system set includes, in order from an object side to an image side, a first lens 910, an aperture 900, a second lens 920, a third lens 930, a fourth lens 940, a fifth lens 950, a sixth lens 960, a seventh lens 970, an IR filter 990, an image plane 980 and an image sensing element 981.

[0300] The first lens 910 with positive refractive power has a convex object-side surface 911 and a concave image-side surface 912, which are both aspheric, and the first lens 910 is made of plastic material.

[0301] The second lens 920 with negative refractive power has a convex object-side surface 921 and a concave image-side surface 922, which are both aspheric, and the second lens 920 is made of plastic material.

[0302] The third lens 930 with positive refractive power has a concave object-side surface 931 and a convex image-side surface 932, which are both aspheric, and the third lens 930 is made of plastic material.

[0303] The fourth lens 940 with negative refractive power has a concave object-side surface 941 and a concave image-side surface 942, which are both aspheric, and the fourth lens 940 is made of plastic material.

[0304] The fifth lens 950 with negative refractive power has a concave object-side surface 951 and a convex image-side surface 952, which are both aspheric, and the fifth lens 950 is made of plastic material.

[0305] The sixth lens 960 with positive refractive power has a convex object-side surface 961 that changes from convex at a paraxial region to concave at a peripheral region and a convex image-side surface 962, and both are aspheric, and the sixth lens 960 is made of plastic material.

[0306] The seventh lens 970 with negative refractive power has a concave object-side surface 971 and a concave image-side surface 972 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric, and the seventh lens 970 is made of plastic material. Furthermore, the image-side surface 972 of the seventh lens 970 includes inflection points.

[0307] The IR filter 990 is made of glass and located between the seventh lens 970 and the image plane 980, and will not affect the focal length of the optical image capturing system set.

[0308] Please refer to Table 17 and Table 18 below.

[0309]

TABLE 17: 9th Embodiment						
f (focal length)= 5.19 mm. Fno (F-number)= 2.20. HFOV (half field of view)= 36.9 deg.						
Surface	Curvature Radius	Thickness	Material	Index	Abbe #	Focal length

[0310]

0	Object	Plano	Infinity				
1	Lens 1	2.016660 (ASP)	0.778	Plastic	1.530	55.8	4.30
2		15.131600 (ASP)	0.073				
3	Ape.	Plano	0.030				
4	Lens 2	6.870700 (ASP)	0.240	Plastic	1.650	21.4	-10.88
5		3.436500 (ASP)	0.396				
6	Lens 3	-11.287400 (ASP)	0.443	Plastic	1.530	55.8	18.44
7		-5.309200 (ASP)	0.131				
8	Lens 4	-75.949000 (ASP)	0.275	Plastic	1.614	25.6	-28.98
9		23.276000 (ASP)	0.512				
10	Lens 5	-1.507460 (ASP)	0.306	Plastic	1.583	30.2	-30.36
11		-1.770930 (ASP)	0.090				
12	Lens 6	5.383000 (ASP)	0.640	Plastic	1.530	55.8	4.20
13		-3.638100 (ASP)	0.580				
14	Lens 7	-5.525900 (ASP)	0.460	Plastic	1.514	56.8	-3.47
15		2.704660 (ASP)	0.500				
16	IR filter	Plano	0.200	Glass	1.517	64.2	—
17		Plano	0.574				
18	Image plane	Plano	—				
Reference wavelength (d-line) is 587.6 nm.							

[0311]

TABLE 18: Aspheric Coefficients					
Surface	1	2	4	5	6
k =	7.06581E-01	1.43308E+00	-1.70988E+01	-6.76507E+00	-5.00000E+01
A4 =	-5.20571E-03	-4.45093E-02	-9.83870E-02	-5.12300E-02	-2.97615E-02
A6 =	-1.43494E-02	5.06872E-02	1.09598E-01	6.89375E-02	-1.00827E-02
A8 =	2.44478E-02	-2.98149E-02	-5.98233E-02	-3.70644E-02	-4.95992E-04
A10 =	-2.85733E-02	4.01557E-03	7.18376E-03	1.10013E-02	-1.06053E-02
A12 =	1.53650E-02	2.22862E-03	1.16900E-02	6.95250E-04	5.81239E-03
A14 =	-3.67572E-03	-7.58506E-04	-4.15965E-03	1.09866E-03	-1.37340E-08
Surface	7	8	9	10	11
k =	-3.60203E+00	3.00000E+00	6.00756E-01	-1.33044E+00	-1.94664E+00
A4 =	-5.98240E-02	-1.39760E-01	-7.64183E-02	1.60132E-01	1.88715E-02
A6 =	1.66271E-02	-5.04354E-03	-2.27892E-02	-1.65334E-01	4.82161E-02
A8 =	-1.72316E-02	7.79298E-03	1.09834E-02	8.79958E-02	2.72834E-02
A10 =	1.09129E-03	1.30186E-03	8.03602E-04	-4.25563E-02	-1.16685E-02
A12 =	2.17693E-03	-2.58667E-04	-4.59790E-04	1.38851E-02	2.87178E-03
A14 =	-2.13849E-04	3.54222E-04	1.04242E-04	-1.79214E-02	-1.95884E-04
Surface	12	13	14	15	
k =	-3.16527E+01	-1.32837E+01	-2.00000E+01	-1.02392E+01	
A4 =	-7.21293E-02	-7.69920E-03	-4.22026E-02	-2.47789E-02	
A6 =	2.94689E-02	-8.05827E-03	-7.35719E-03	3.72634E-03	
A8 =	-7.19999E-03	9.55590E-03	-2.91687E-04	-5.55536E-04	
A10 =	8.26684E-04	-3.64828E-03	-1.57467E-05	5.20424E-05	
A12 =	-1.98203E-04	5.79269E-04	8.72367E-07	-3.10945E-06	
A14 =	2.72684E-05	-3.34003E-05	1.39566E-08	9.28903E-08	

[0312] In the 9th embodiment, the equation of the aspheric surface profiles is the same as the equation of the 1st embodiment. Also, the definitions of f, Fno, HFOV, V1, V2, CTmin, R13, R14, f3, f4, f6, f7, SAG5, CT5, Yc72, Td, FOV, TTL and ImgH are the same as those stated in the 1st embodiment, so an explanation in this regard will not be provided again.

[0313] In conjunction with Table 17, the following data can be extrapolated:

[0314]

9th Embodiment			
f (mm)	5.19	|f/f6| + |f/f7|	2.73
Fno	2.20	f/f7	-1.50
HFOV (deg.)	36.9	SAG52 + CT5 (mm)	-0.48
VI-V2	34.4	Yc72/f	0.32
CTmin (mm)	0.240	Td/f	0.95
R14/R13	-0.49	FOV (deg.)	73.8
R14/f	0.52	TTL/ImgH	1.54
|f/f3| + |f/f4|	0.46		

[0315] 10th Embodiment

[0316] Please refer to FIG. 19 and FIG, 20. FIG. 19 is a schematic view of an optical image capturing system set according to the 10th embodiment of the present utility model. FIG. 20 shows, in order from left to right, spherical aberration curves, astigmatic field curves and a distortion curve of the optical image capturing system set according to the 10th embodiment. Based on FIG. 19, it can be known that the optical image capturing system set includes, in order from an object side to an image side, an aperture 1000, a first lens 1010, a second lens 1020, a third lens 1030, a fourth lens 1040, a fifth lens 1050, a sixth lens 1060, a seventh lens 1070, an IR filter 1090, an image plane 1080 and an image sensing element 1081.

[0317] The first lens 1010 with positive refractive power has a convex object-side surface 1011 and a concave image-side surface 1012, which are both aspheric, and the first lens 1010 is made of glass material.

[0318] The second lens 1020 with negative refractive power has a concave object-side surface 1021 and a concave image-side surface 1022, which are both aspheric, and the second lens 1020 is made of plastic material.

[0319] The third lens 1030 with negative refractive power has a convex object-side surface 1031 and a concave image-side surface 1032, which are both aspheric, and the third lens 1030 is made of plastic material.

[0320] The fourth lens 1040 with positive refractive power has a convex object-side surface 1041 and a concave image-side surface 1042, which are both aspheric, and the fourth lens 1040 is made of plastic material.

[0321] The fifth lens 1050 with negative refractive power has a concave object-side surface 1051 and a convex image-side surface 1052, which are both aspheric, and the fifth lens 1050 is made of plastic material.

[0322] The sixth lens 1060 with positive refractive power has a convex object-side surface 1061 that changes from convex at a paraxial region to concave at a peripheral region and a convex image-side surface 1062, and both are aspheric, and the sixth lens 1060 is made of plastic material.

[0323] The seventh lens 1070 with negative refractive power has a convex object-side surface 1071 and a concave image-side surface 1072 that changes from concave at a paraxial region to convex at a peripheral region, and both are aspheric. The seventh lens 1070 is made of plastic material. Furthermore, the image-side surface 1072 of the seventh lens 1070 includes inflection points.

[0324] The IR filter 1090 is made of glass and located between the seventh lens 1070 and the image plane 1080, and will not affect the focal length of the optical image capturing system set.

[0325] Please refer to Table 19 and Table 20 below.

[0326]

TABLE 19:10th Embodiment							
f (focal length)= 4.88 mm. Fno (F-number)= 2.15. HFOV (half of field of view)= 39.6 deg.							
Surface		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape.	Plano	-0.238				
2	Lens 1	2.545850 (ASP)	0.566	Glass	1.566	61.1	5.15
3		18.457300 (ASP)	0.254				
4	Lens 2	-67.453600 (ASP)	0.270	Plastic	1.640	23.3	-9.77
5		6.896600 (ASP)	0.238				
6	Lens 3	14.079200 (ASP)	0.398	Plastic	1.544	55.9	-28.08
7		7.254400 (ASP)	0.050				
8	Lens 4	3.358300 (ASP)	0.391	Plastic	1.544	55.9	7.12
9		24.159000 (ASP)	0.620				
10	Lens 5	-2.101660 (ASP)	0.300	Plastic	1.640	23.3	-11.56
11		-3.099900 (ASP)	0.070				
12	Lens 6	10.558400 (ASP)	0.838	Plastic	1.544	55.9	3.12
13		-1.967170(ASP)	0.402				
14	Lens 7	100.000000 (ASP)	0.613	Plastic	1.530	55.8	-2.72
15		1.418470 (ASP)	0.840				
16	IR filter	Plano	0.250	Glass	1.517	64.2	—
17		Plano	0.278				
18	Image plane	Plano	—				
Reference wavelength (d-line) is 587.6 nm							

[0327]

TABLE 20: Aspheric Coefficients					
Surface	2	3	4	5	6
k =	2.61987E-01	3.00000E+00	0.00000E+00	-9.20422E+01	-2.83188E+00
A4 =	-3.63978E-03	-2.79071E-02	-7.95060E-02	-5.54800E-02	-2.96051E-02
A6 =	-3.09516E-03	3.95639E-02	9.01905E-02	5.13235E-02	-1.77213E-02
A8 =	1.03902E-02	-3.70198E-02	-5.81773E-02	-2.76094E-02	7.58927E-03
A10 =	-1.97431E-02	-8.45516E-05	5.72088E-03	7.40557E-03	-6.43235E-04
A12 =	1.60070E-02	1.62255E-02	1.07101E-02	-2.37428E-03	
A14 =	-5.53229E-03	-8.08778E-03	-5.44790E-03	5.20350E-04	
Surface	7	8	9	10	11
k =	6.22360E-01	-1.95196E+01	-2.00000E+01	-1.44416E+00	-7.00358E+00
A4 =	-5.49905E-02	-3.10114E-02	-2.61120E-02	1.05443 E-01	2.78749E-02
A6 =	1.85625E-03	-1.91982E-02	-2.68191E-02	-1.26072E-01	-4.36409E-02
A8 =	-6.56285E-03	5.12567E-03	8.18832E-03	6.70012E-02	2.00423E-02
A10 =	1.09821E-03	-7.72213E-04	2.09360E-04	-2.77086E-02	-7.25670E-03
A12 =		-1.17845E-03	-3.85316E-04	8.16094E-03	1.75013E-03
A14 =		4.68650E-04	1.37346E-04	-1.05290E-03	-1.58397E-04
Surface	12	13	14	15	
k =	2.44764E+00	-7.56032E+00	-1.00000E+00	-5.83393E+00	
A4 =	-4.43411E-02	-2.49270E-02	-7.10947E-02	-2.94847E-02	
A6 =	2.32256E-02	1.35465E-03	1.19834E-02	5.04950E-03	
A8 =	-6.70400E-03	6.97483E-03	-2.89486E-04	-5.66326E-04	
A10 =	6.22040E-04	-2.49613E-03	-4.57341E-05	3.60309E-05	
A12 =	3.43416E-05	3.37937E-04	-2.10360E-06	-1.42065E-06	
A14 =	-8.28303E-06	-1.71240E-05	3.65101E-07	2.88039E-08	

[0328] In the 10th embodiment, the equation of the aspheric surface profiles is the same as the equation of the 1st embodiment. Also, the definitions of f, Fno, HFOV, V1, V2, CTmin, R13, R14, f3, f4, f6, f7 SAG52, CT5, Yc72, Td, FOV, TTL and ImgH are the same as those stated in the 1st embodiment, so an explanation in this regard will not be provided again.

[0329] In conjunction with Table 19, the following data can be extrapolated:

[0330]

10th Embodiment			
f (mm)	4.88	|f/f6| + |f/f7|	3.36
Fno	2.15	f/f7	-1.79
HFOV (deg.)	39.6	SAG52 + CT5 (mm)	-0.23
VI-V2	37.8	Yc72/f	0.43
CTmin (mm)	0.270	Td/f	1.03

[0331]

R14/R13	0.01	FOV (deg.)	79.2
R14/f	0.29	TTL/ImgH	1.54
|f/f3| + |f/f4|	0.86		

[0332] Although the present utility model has been disclosed in the above embodiments, it is not intended to limit the utility model. Those skilled in the art may make various modifications and variations without departing from the spirit and scope of the present utility model. Therefore, the protection scope of the present utility model shall be determined by the scope defined by the appended claims.

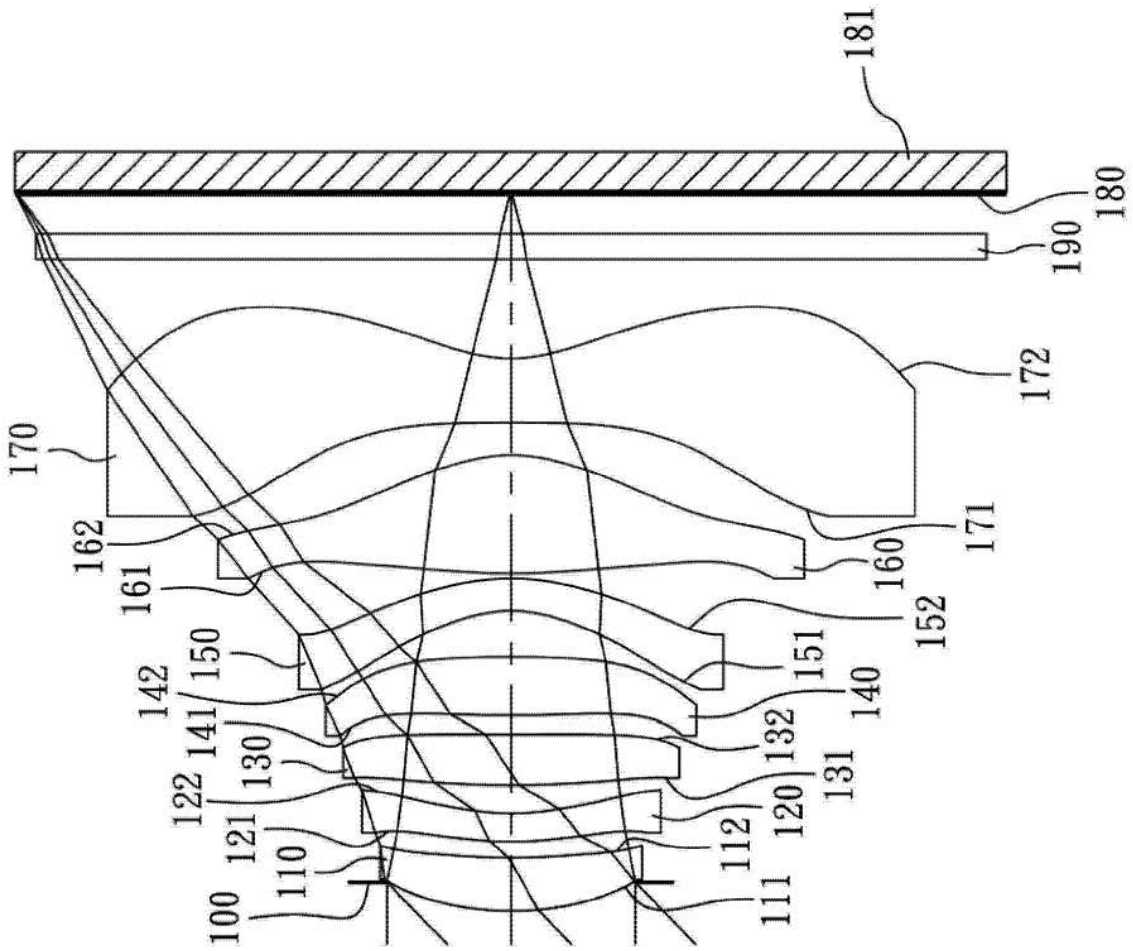

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112
110
111
100

FIG. 1

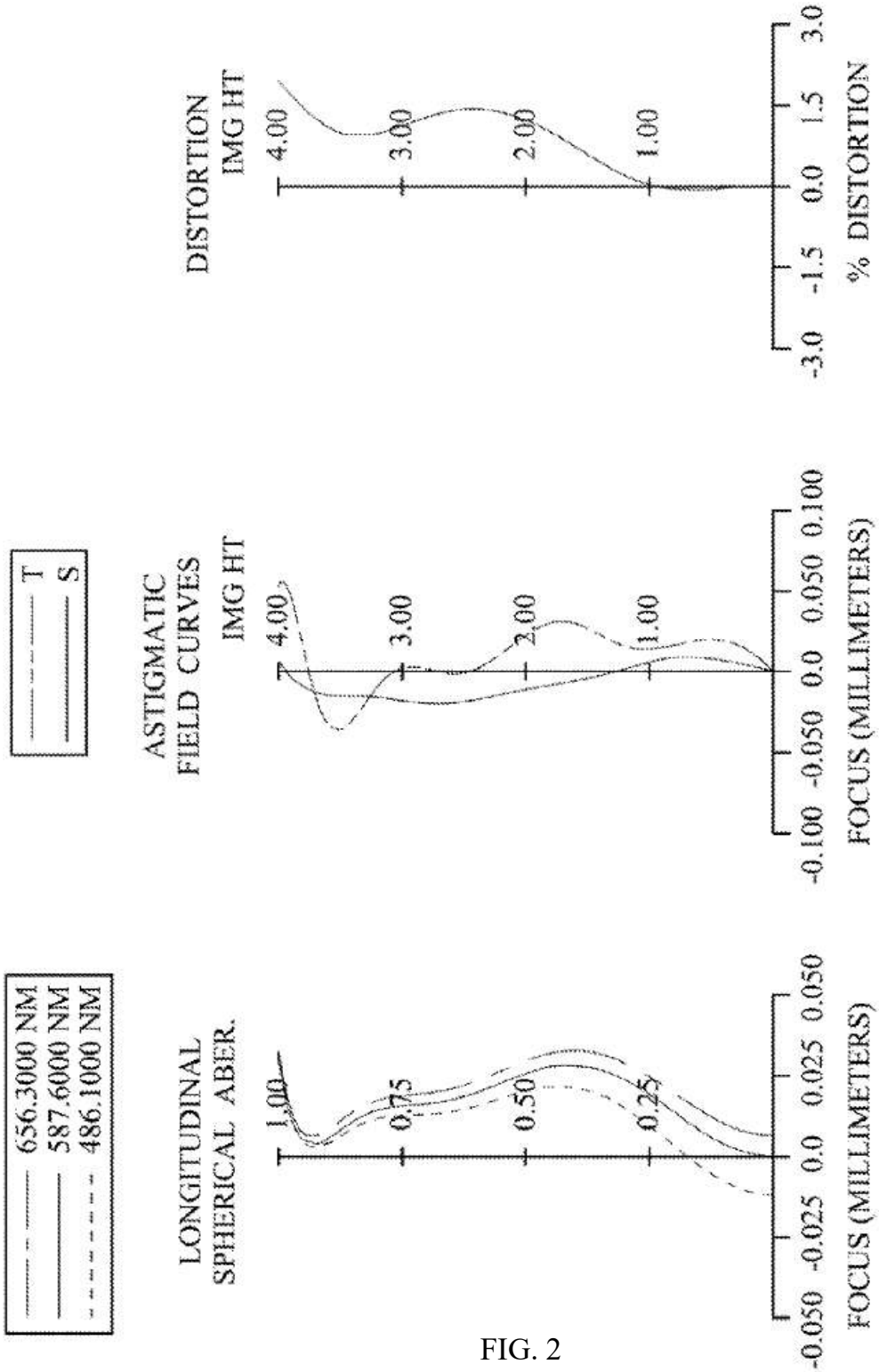

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
T
S
ASTIGMATIC FIELD CURVES
IMG HT
4.00
3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
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3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 2

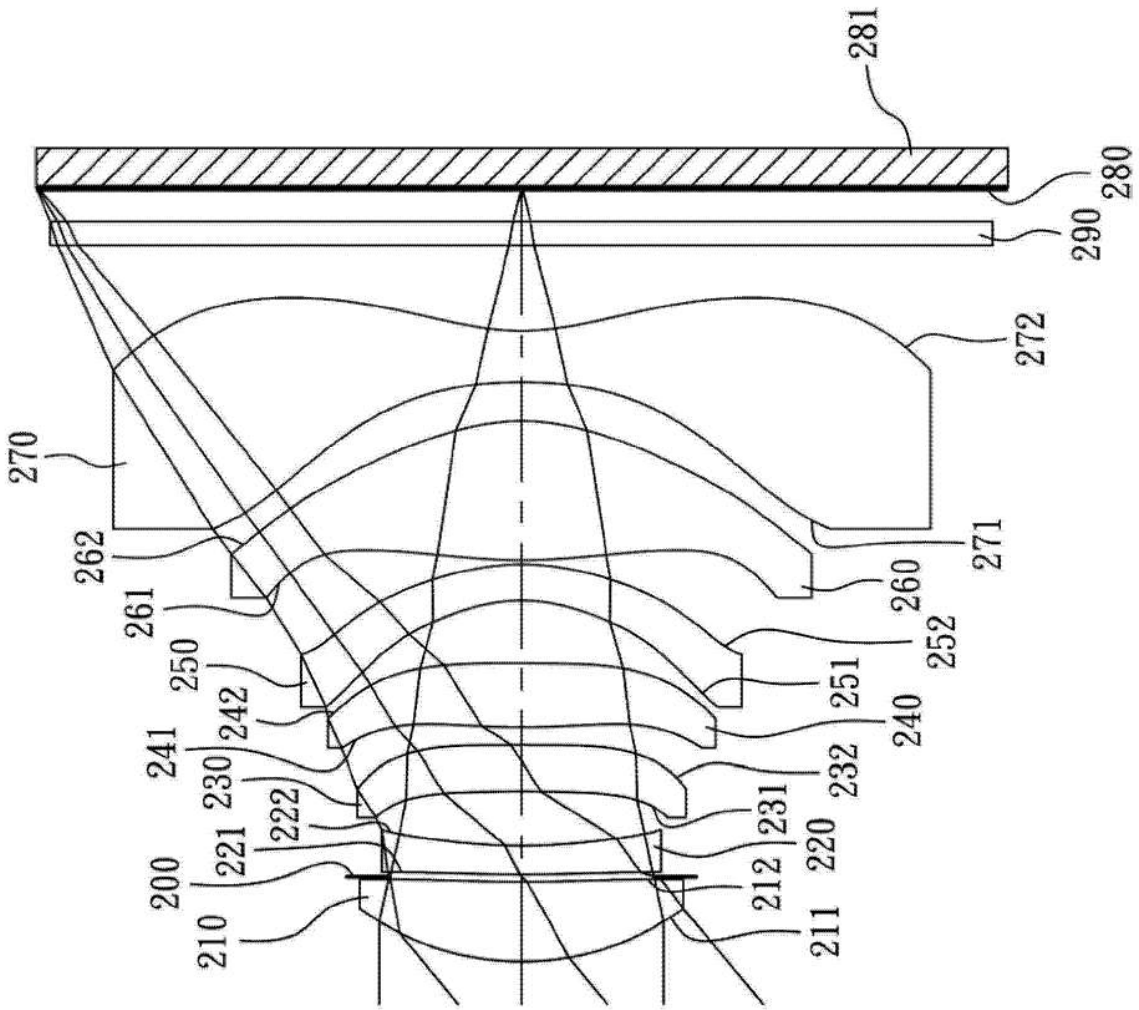

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211
210

FIG. 3

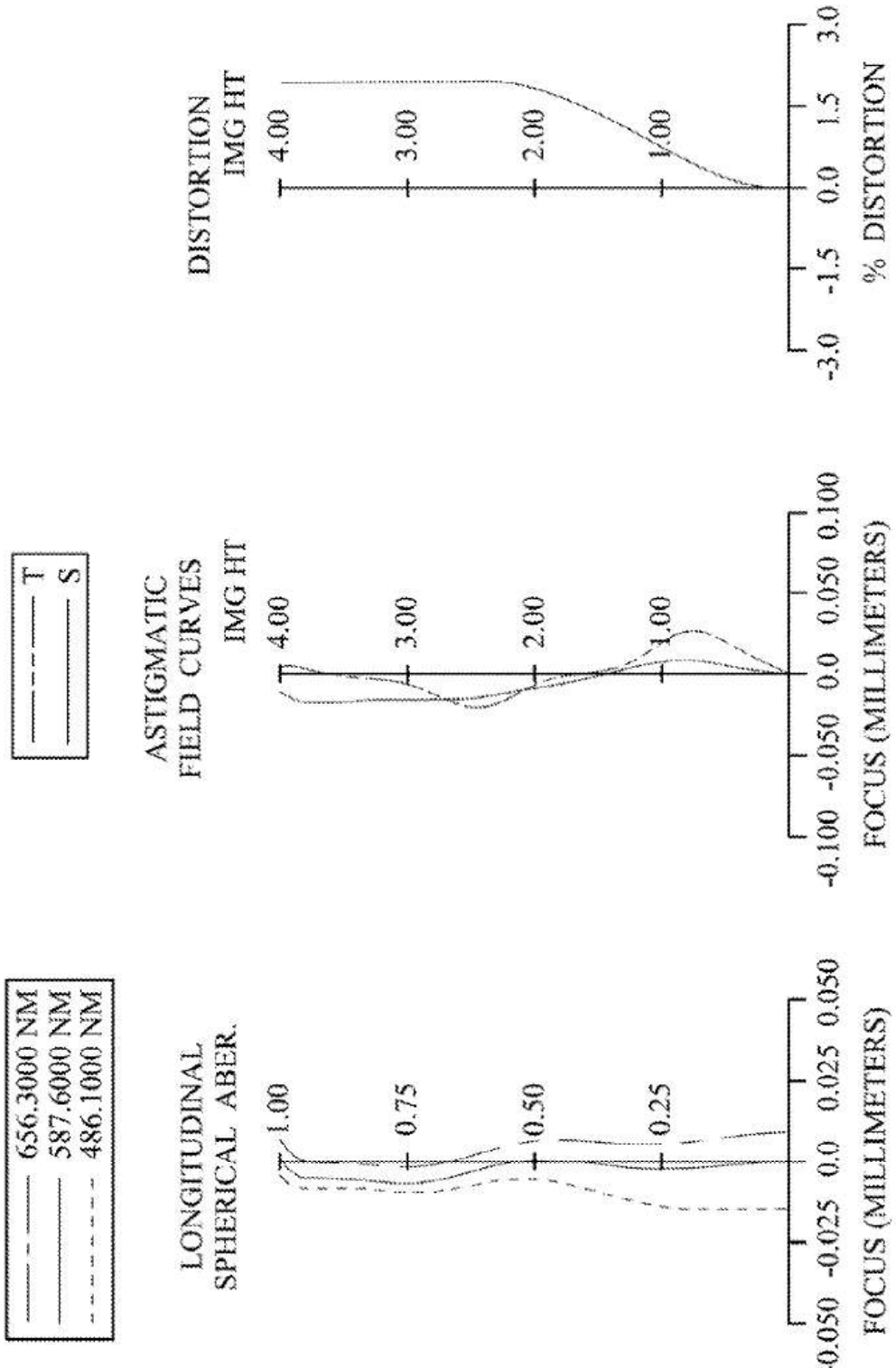

656.3000 NM
587.6000 NM
486.1000 NM
T
S
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
ASTIGMATIC FIELD CURVES
IMG HT
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3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
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3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 4

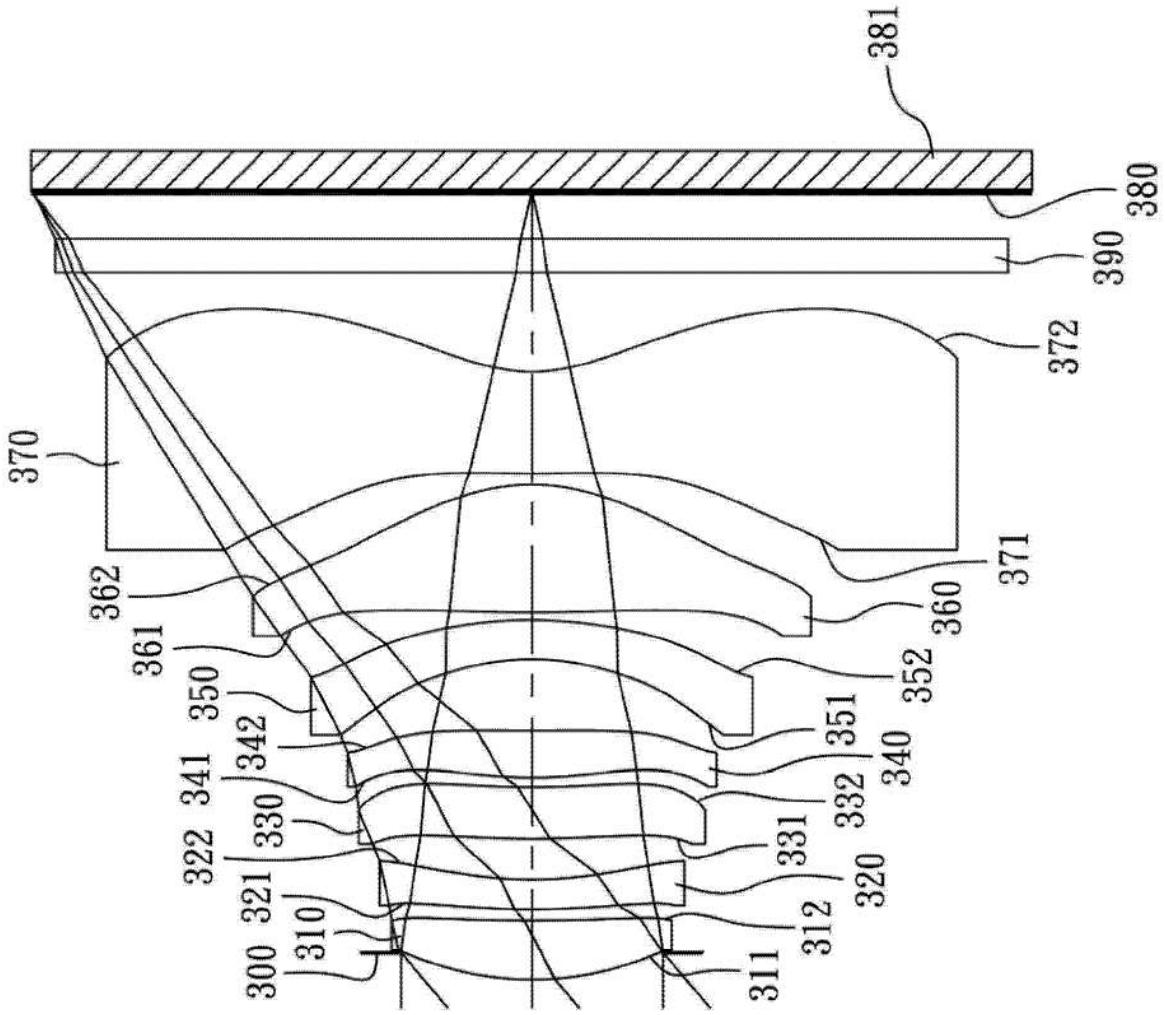

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310
311
300

FIG. 5

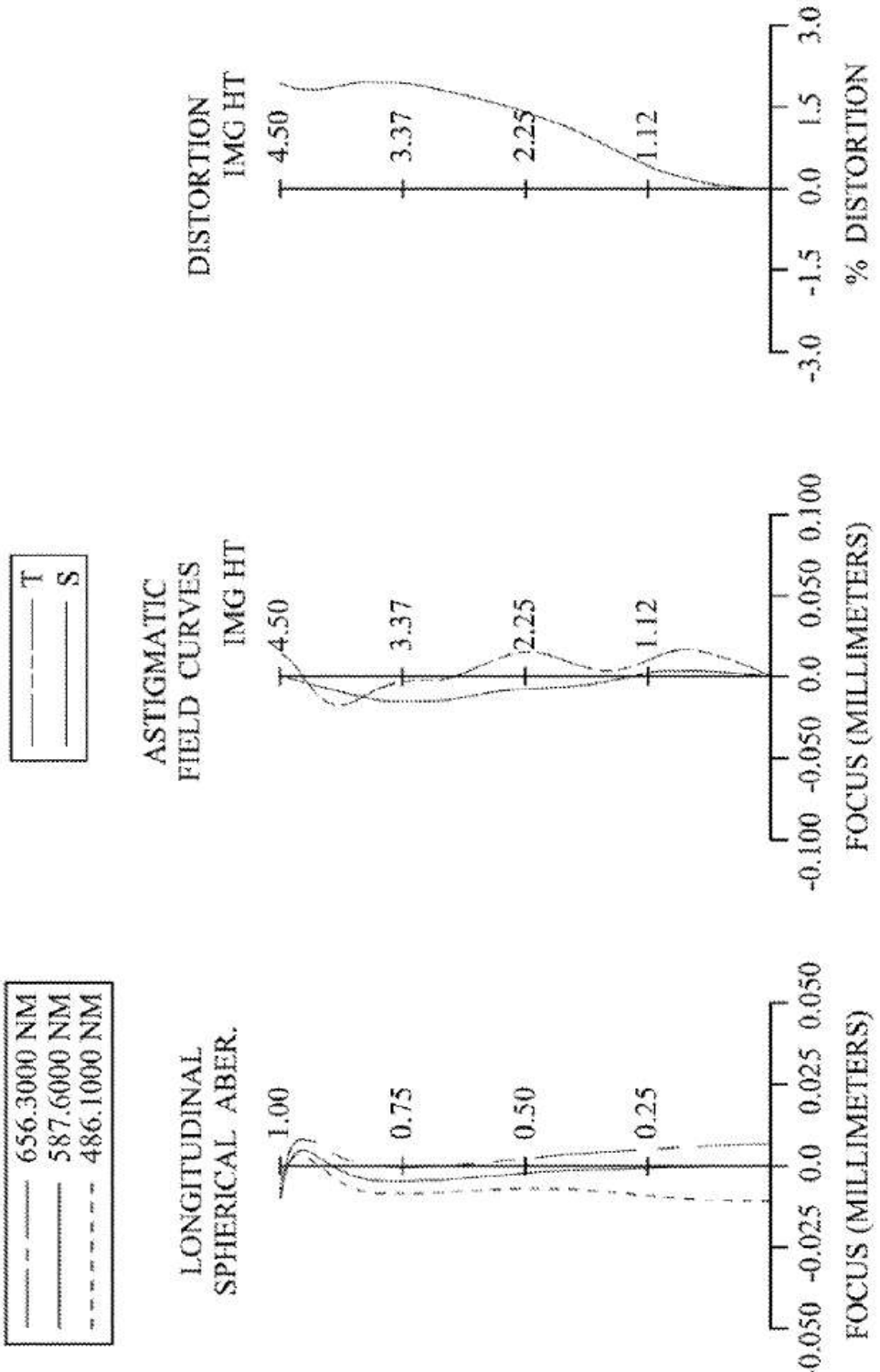

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587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
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0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
T
S
ASTIGMATIC FIELD CURVES
IMG HT
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3.37
2.25
1.12
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
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3.37
2.25
1.12
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 6

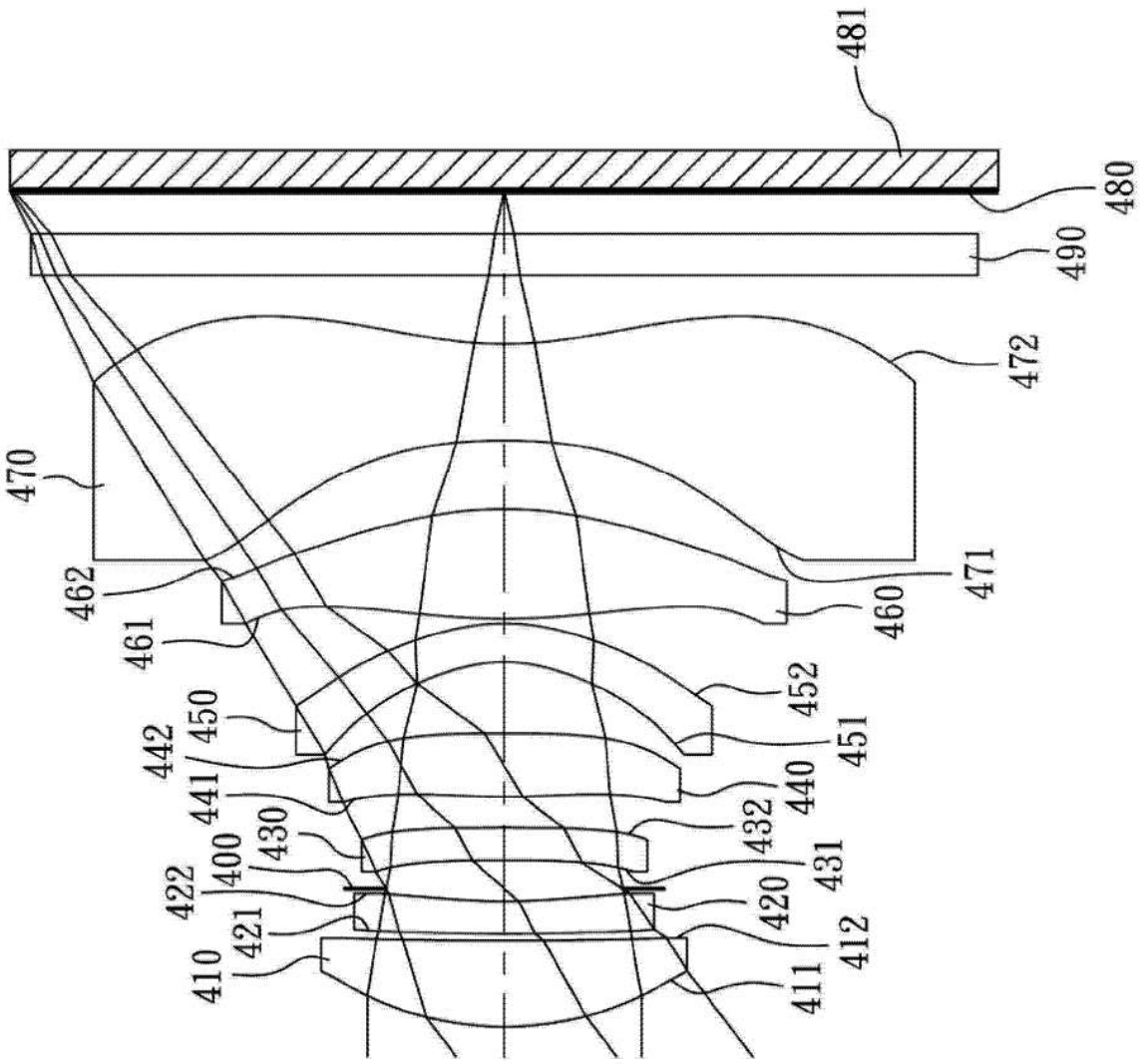

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412
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411

FIG. 7

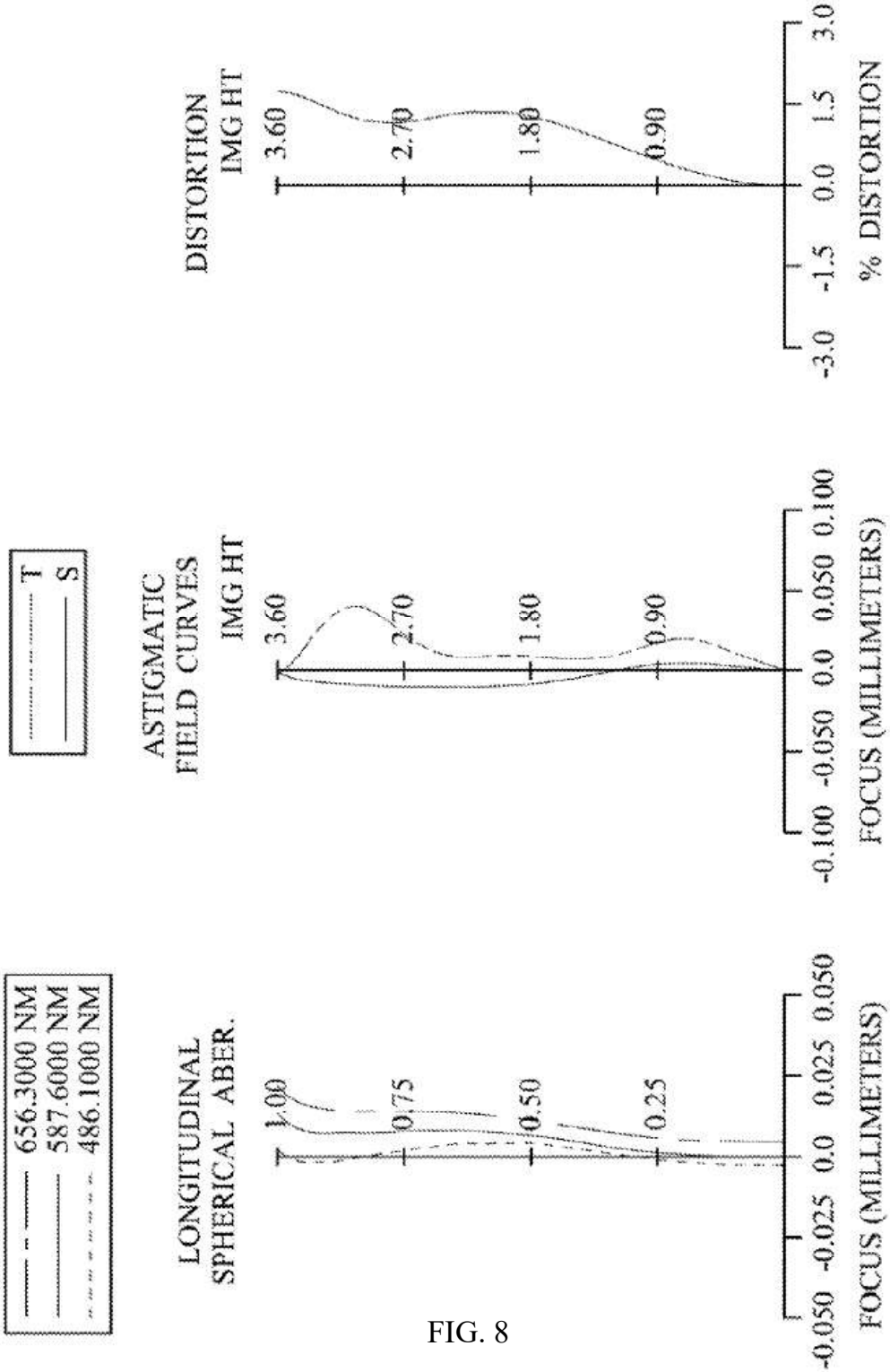

656.3000 NM
587.6000 NM
486.1000 NM
T
S
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
ASTIGMATIC FIELD CURVES
IMG HT
3.60
2.70
1.80
0.90
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
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2.70
1.80
0.90
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 8

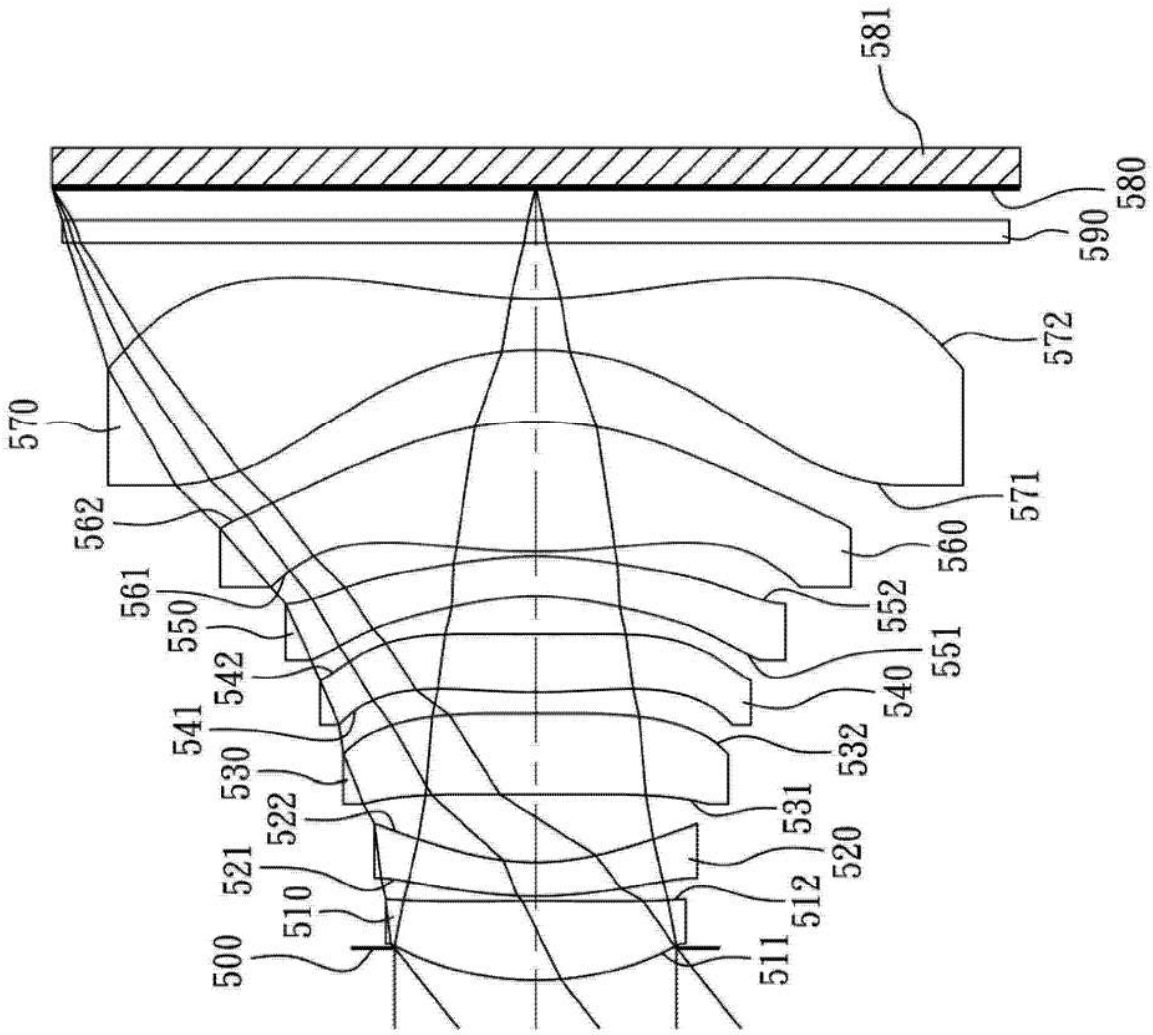

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510
511
500

FIG. 9

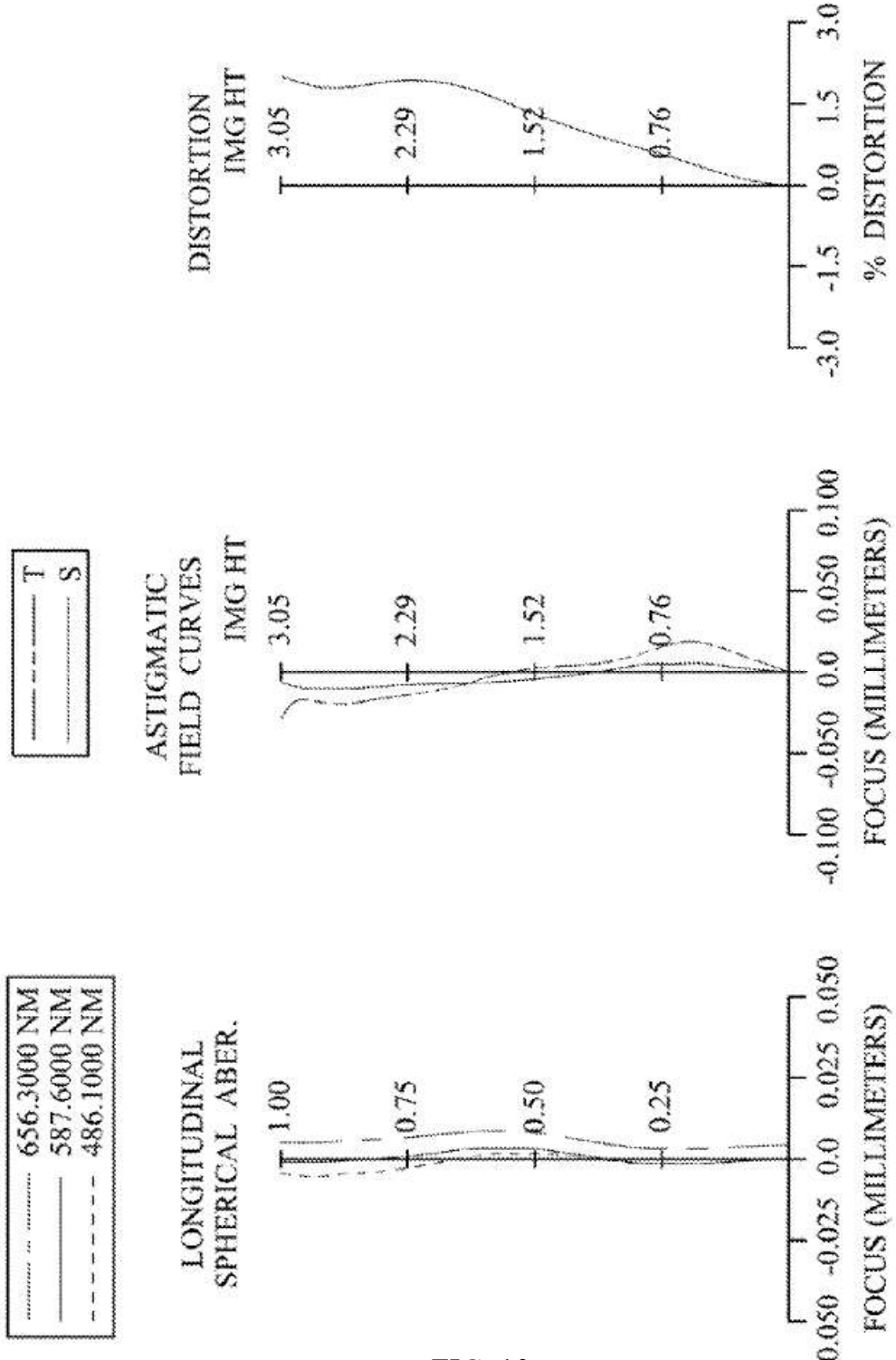

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
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0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
T
S
ASTIGMATIC FIELD CURVES
IMG HT
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2.29
1.52
0.76
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
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2.29
1.52
0.76
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 10

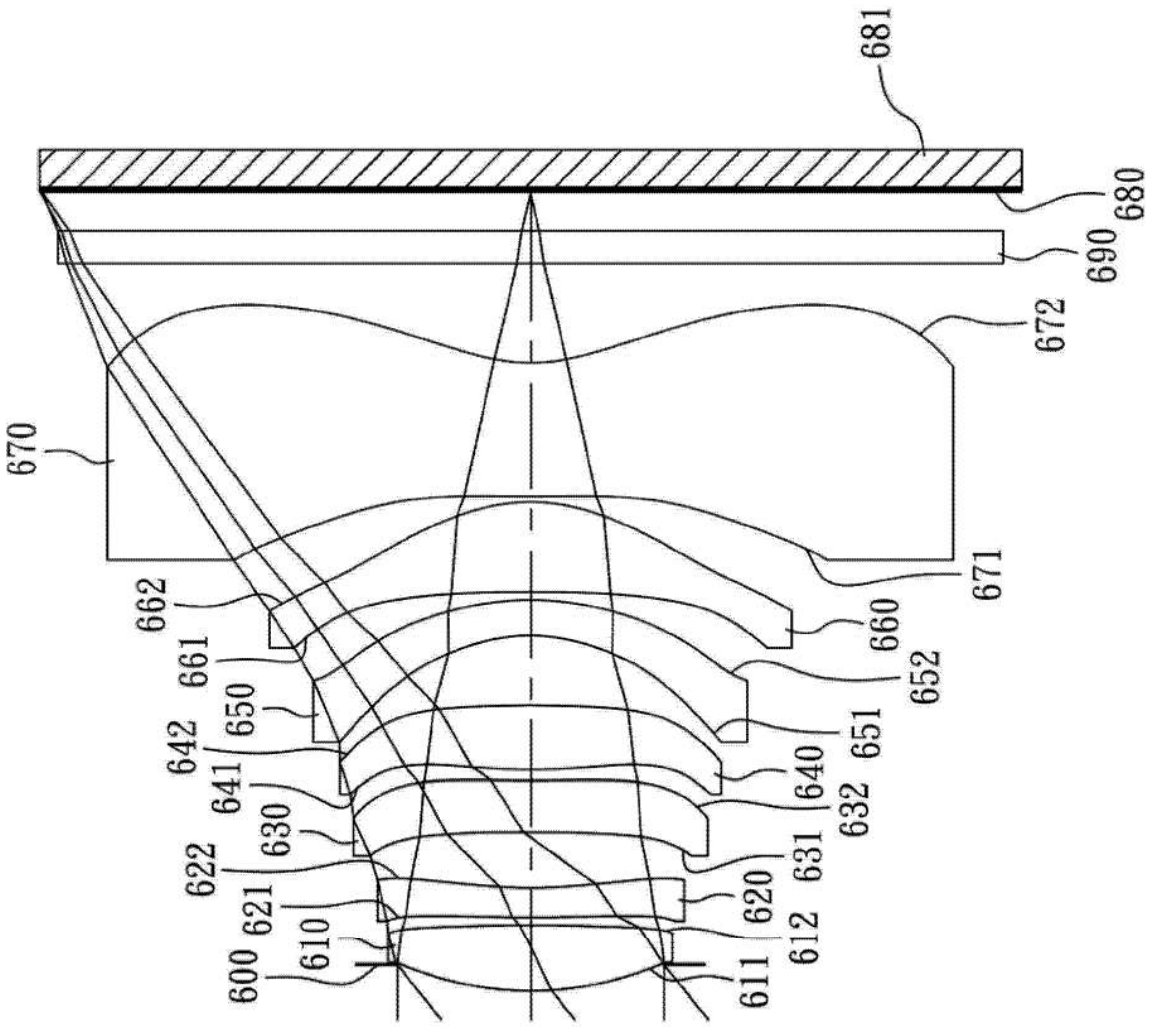

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612
600
611

FIG. 11

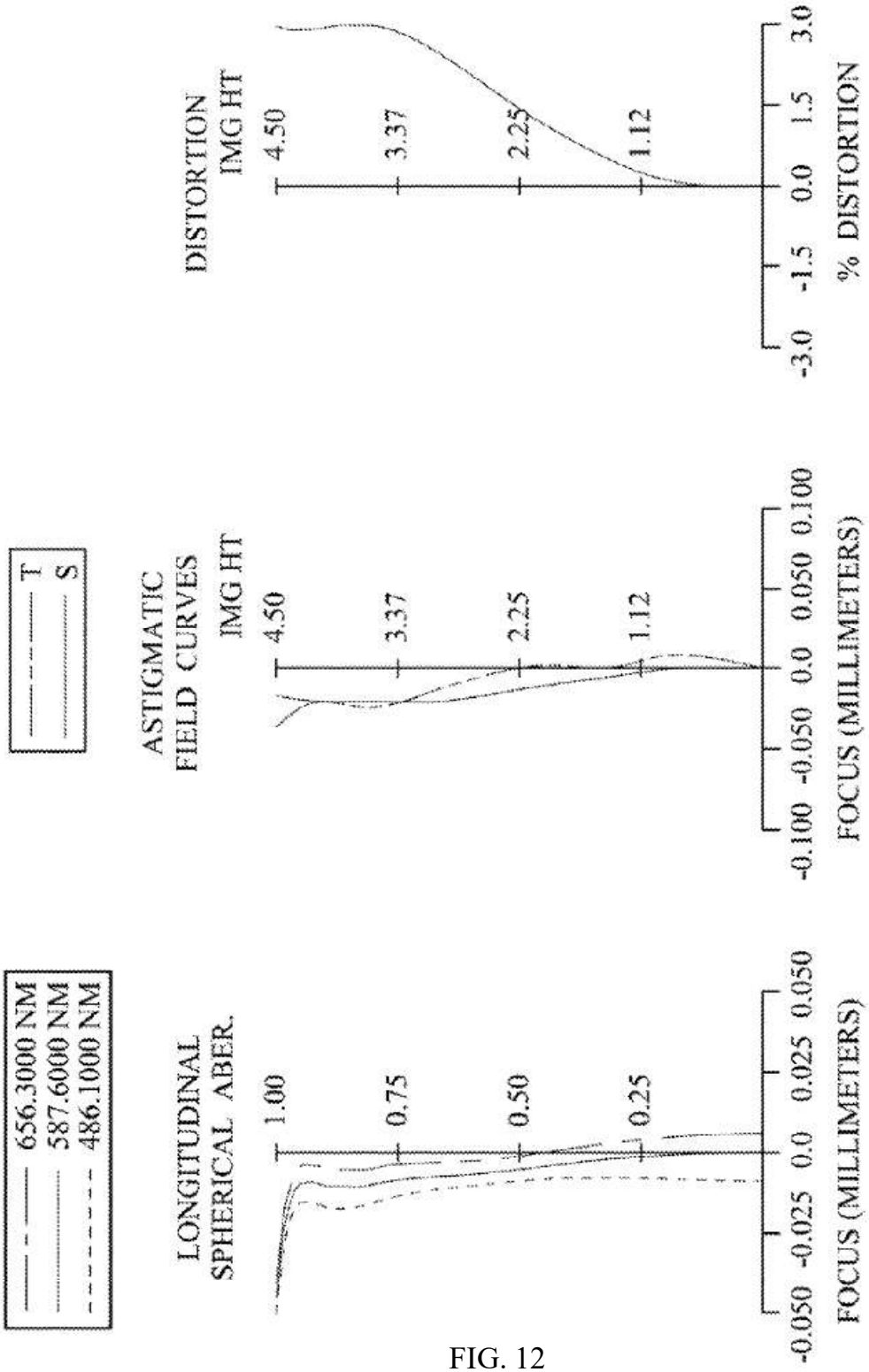

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
T
S
ASTIGMATIC FIELD CURVES
IMG HT
4.50
3.37
2.25
1.12
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
4.50
3.37
2.25
1.12
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 12

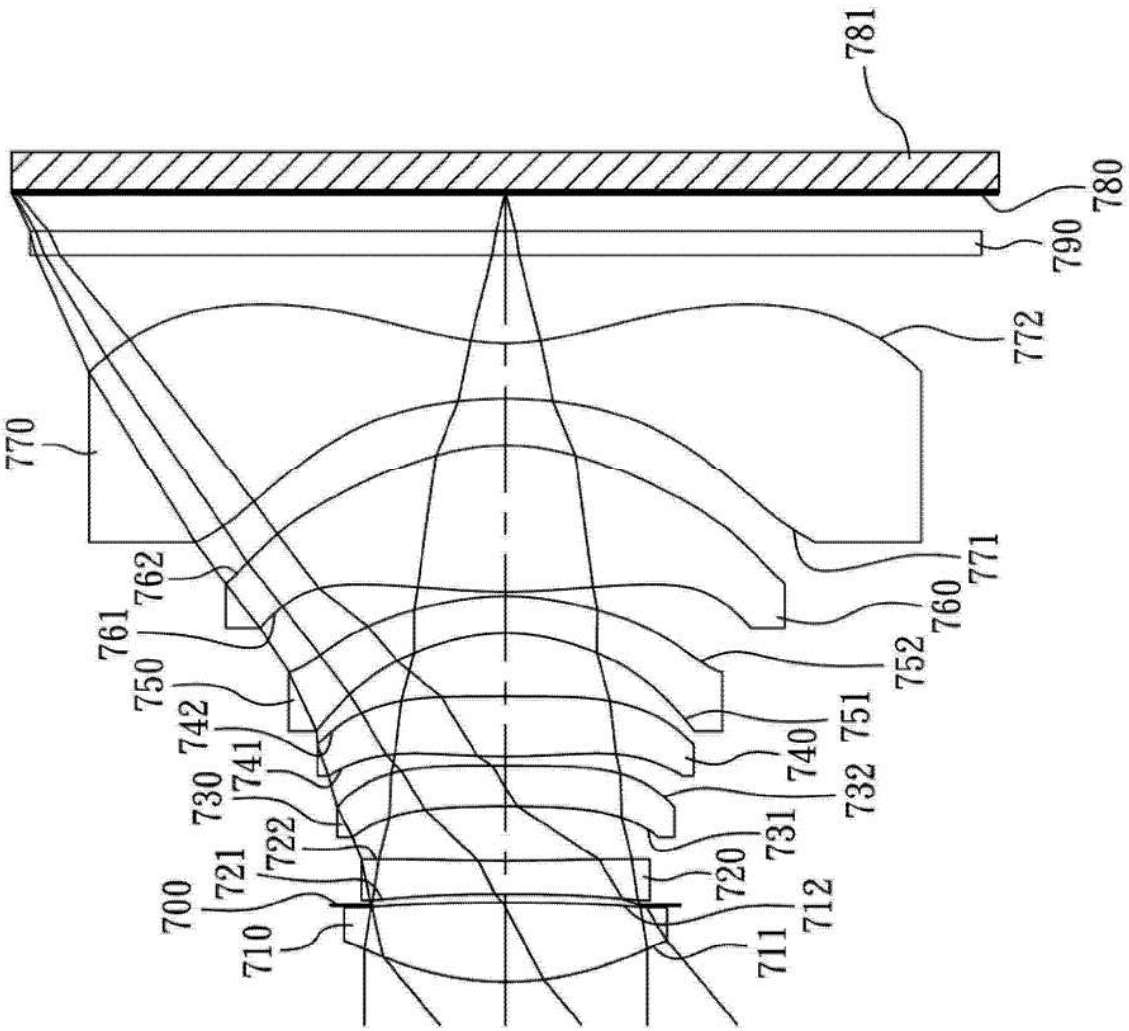

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711

FIG. 13

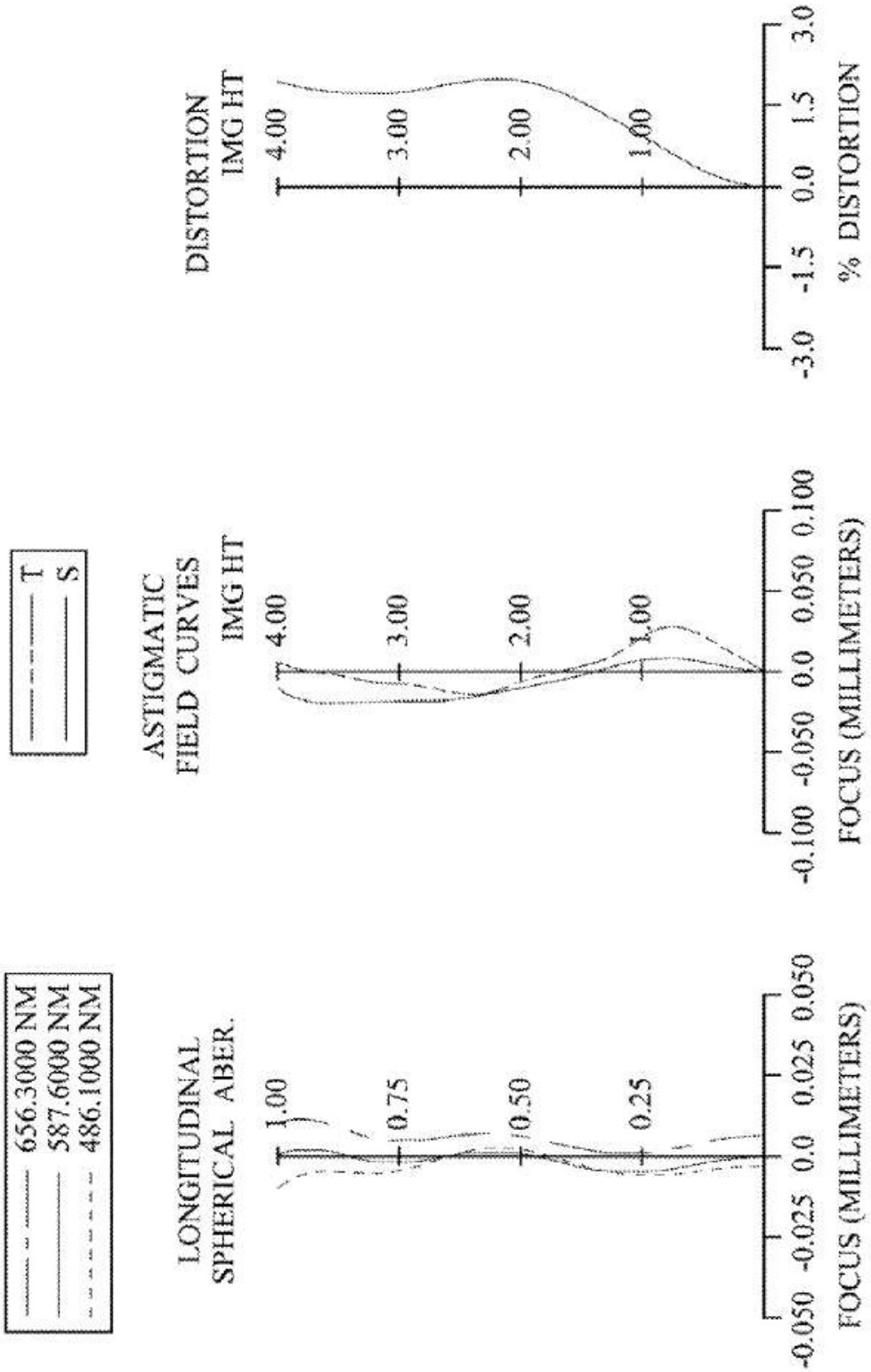

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
T
S
ASTIGMATIC FIELD CURVES
IMG HT
4.00
3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
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3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 14

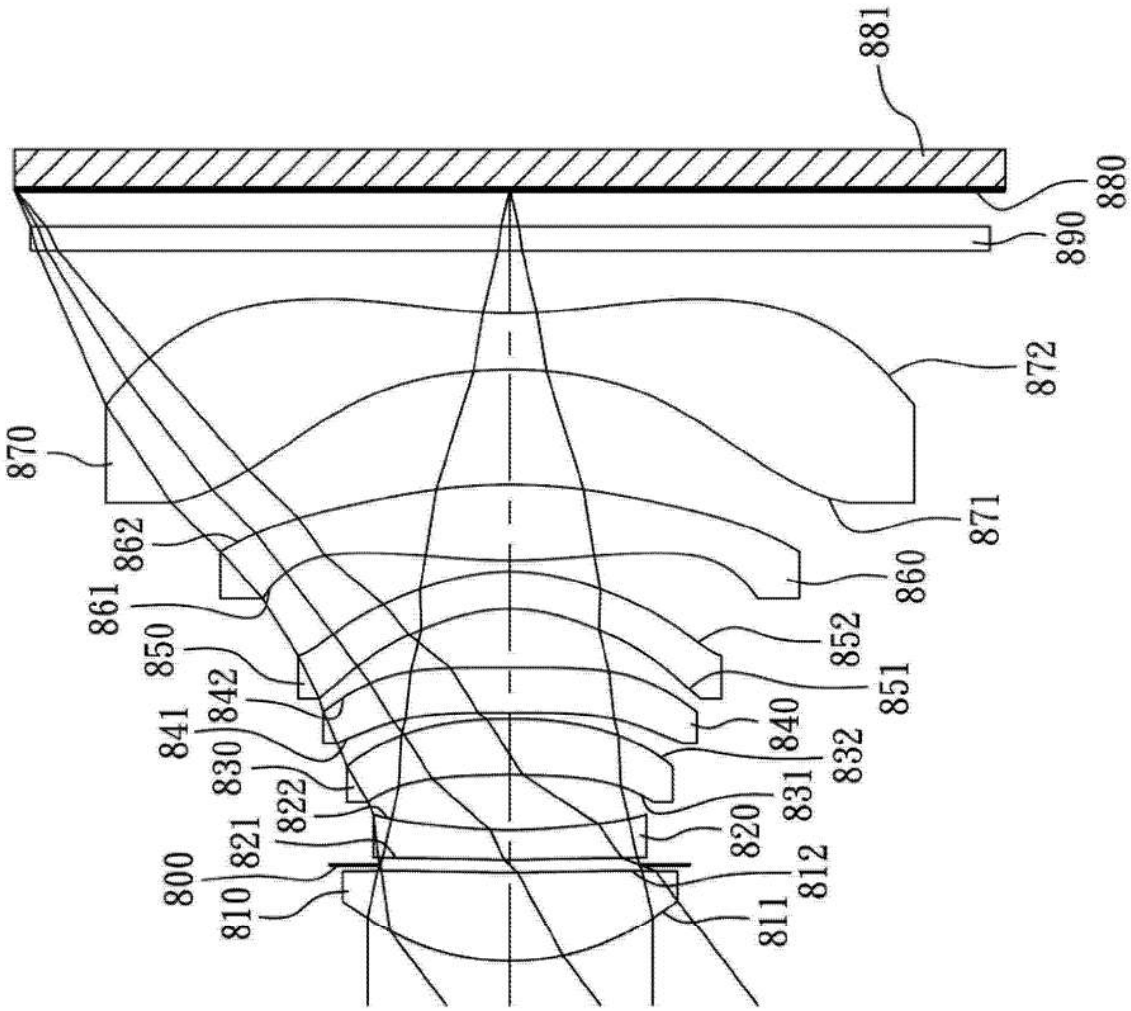

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861
852
850
851
842
841
840
830
832
822
831
821
820
800
812
810
811

FIG. 15

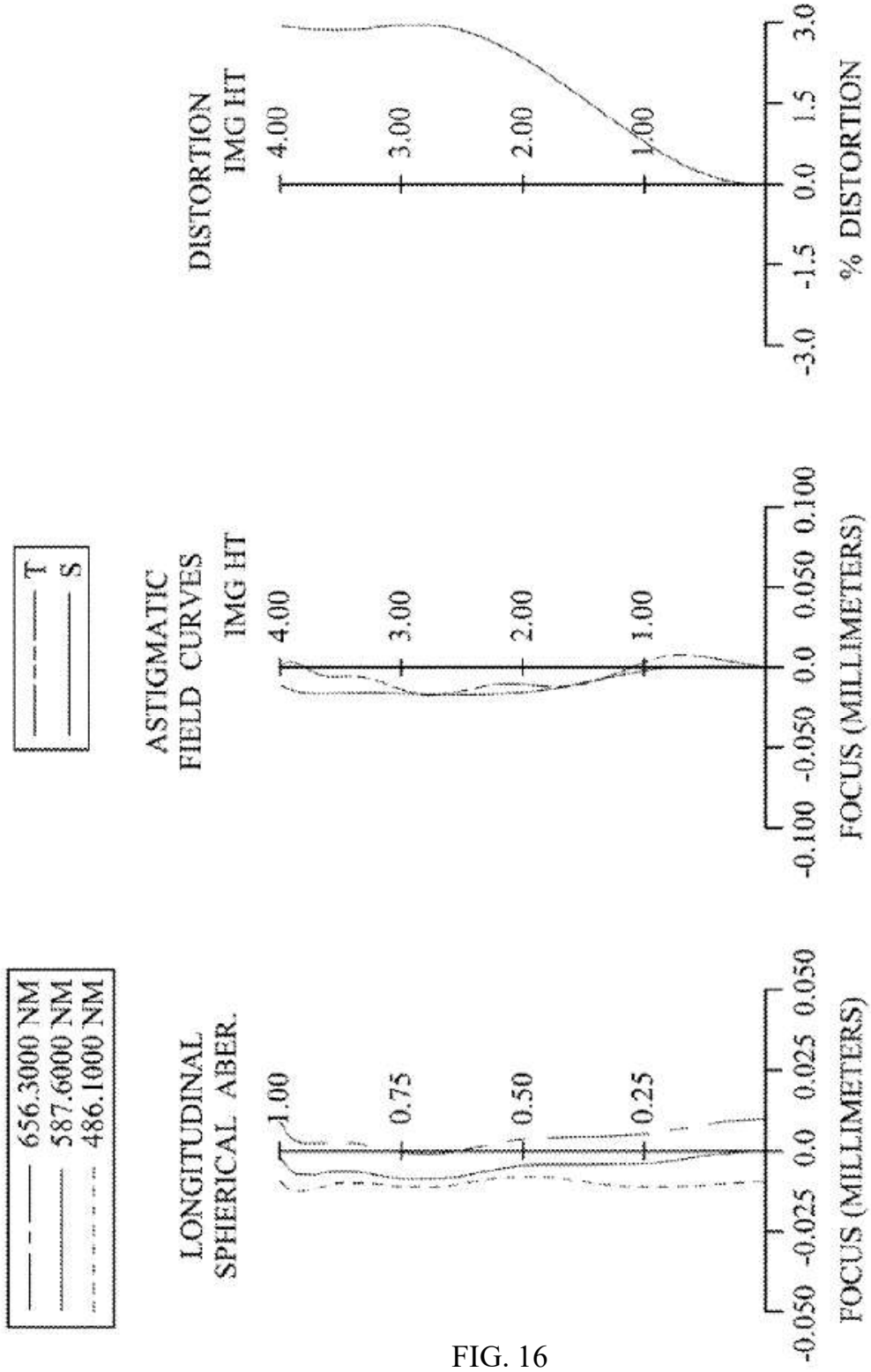

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
T
S
ASTIGMATIC FIELD CURVES
IMG HT
4.00
3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
4.00
3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 16

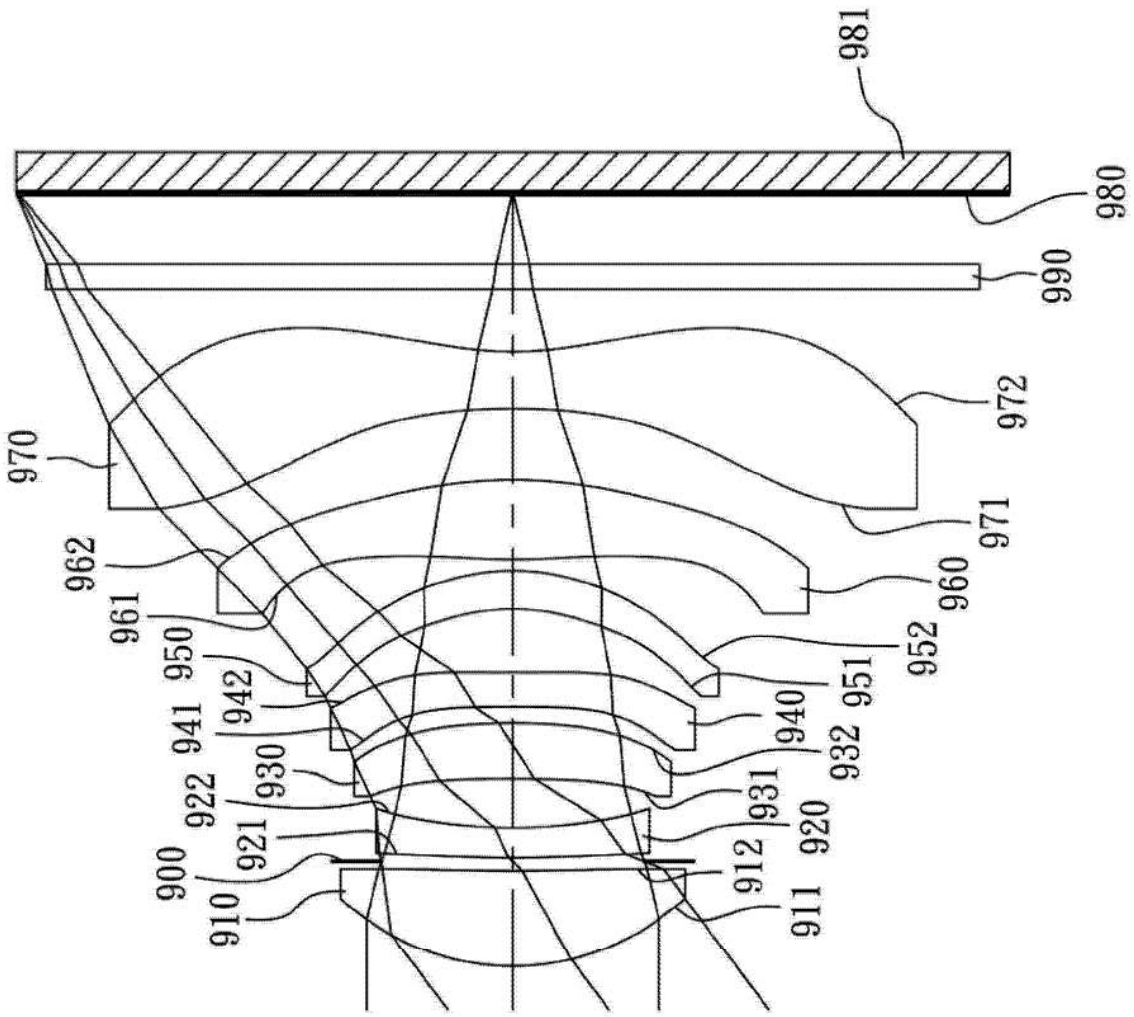

981
980
990
972
970
971
962
960
961
950
952
942
951
941
940
930
932
922
931
921
920
900
912
910
911

FIG. 17

k

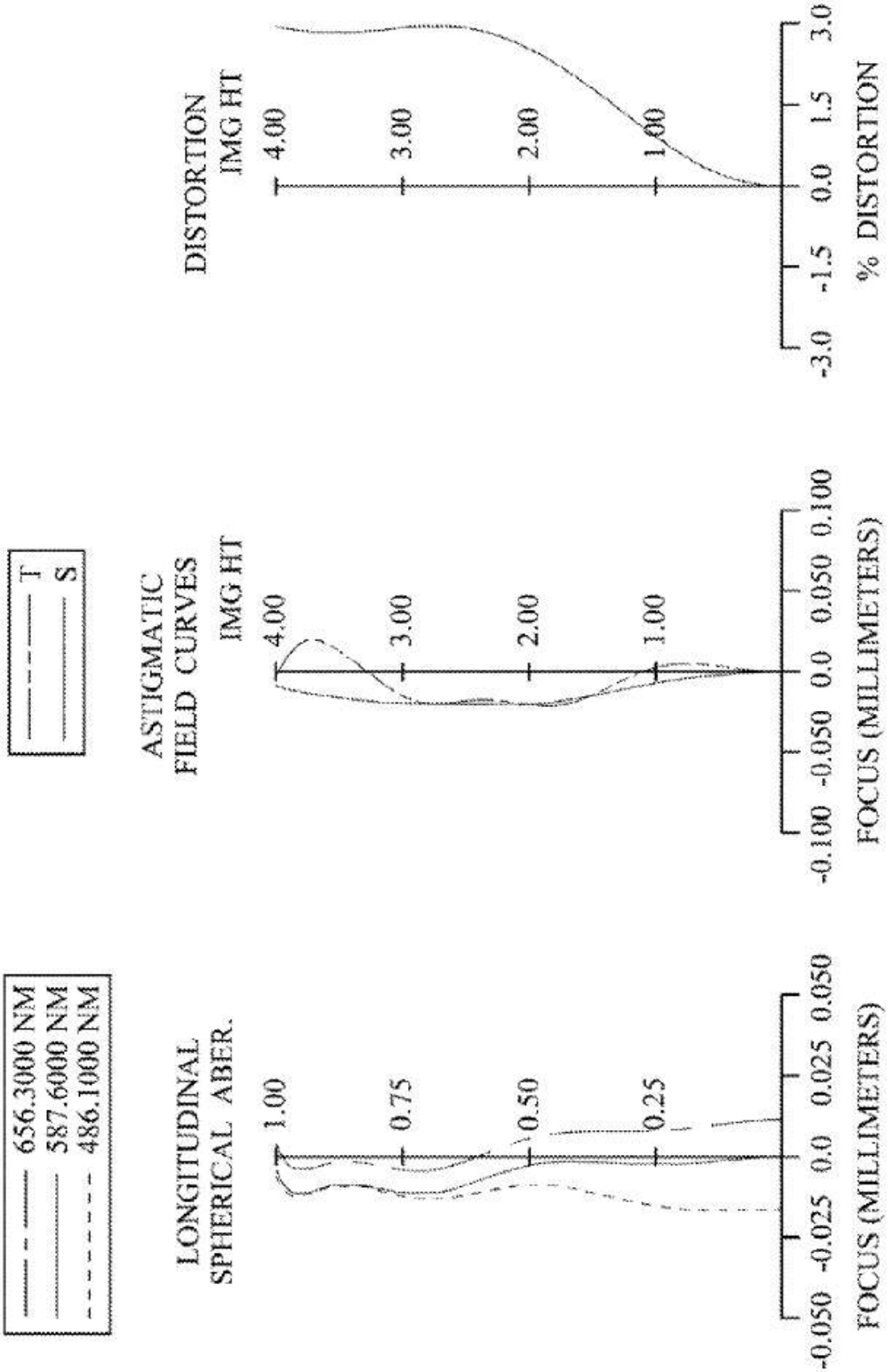

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
T
S
ASTIGMATIC FIELD CURVES
IMG HT
4.00
3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
4.00
3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 18

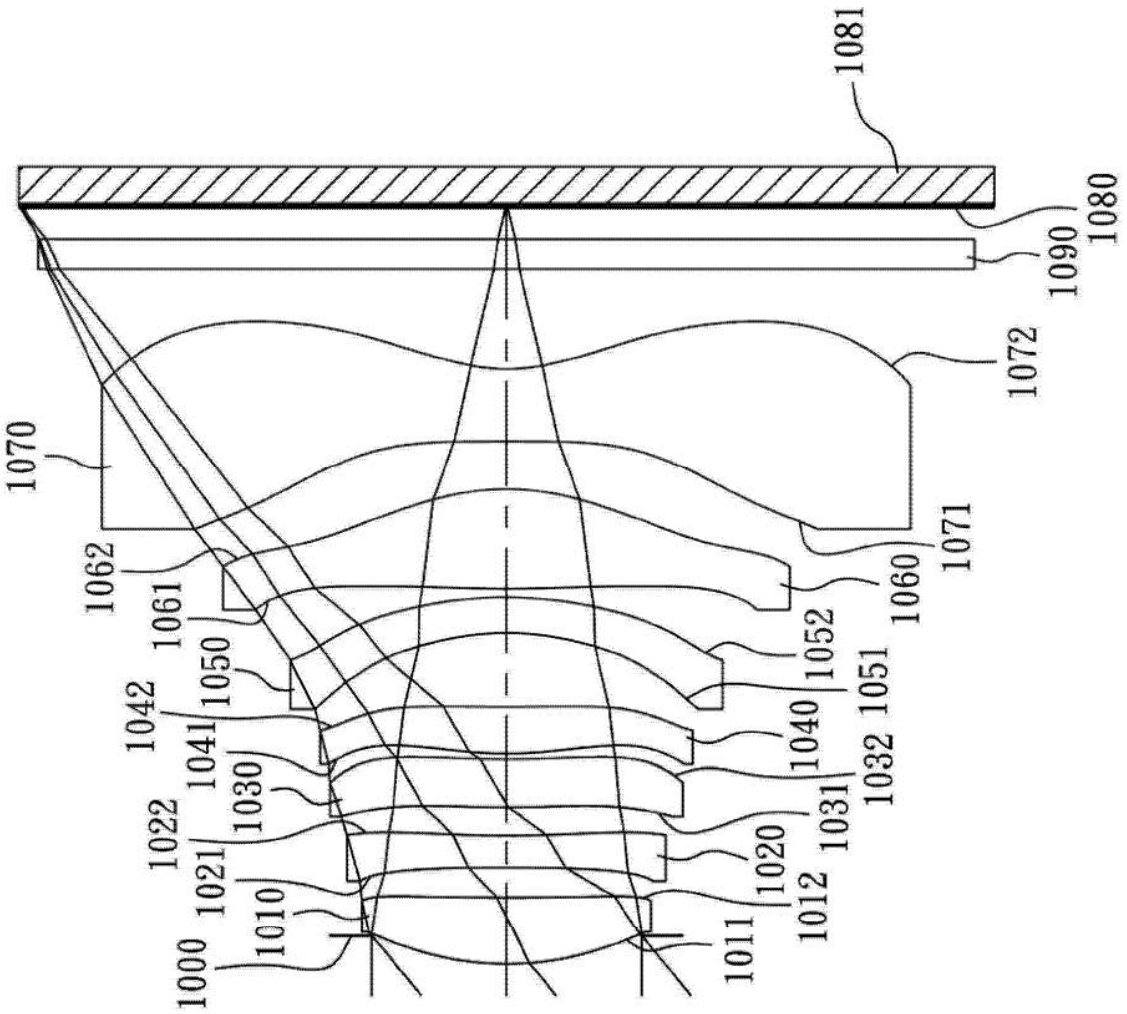

1081
1080
1090
1072
1070
1071
1062
1060
1061
1052
1050
1051
1042
1040
1041
1032
1030
1031
1022
1020
1021
1012
1010
1011
1000

FIG. 19

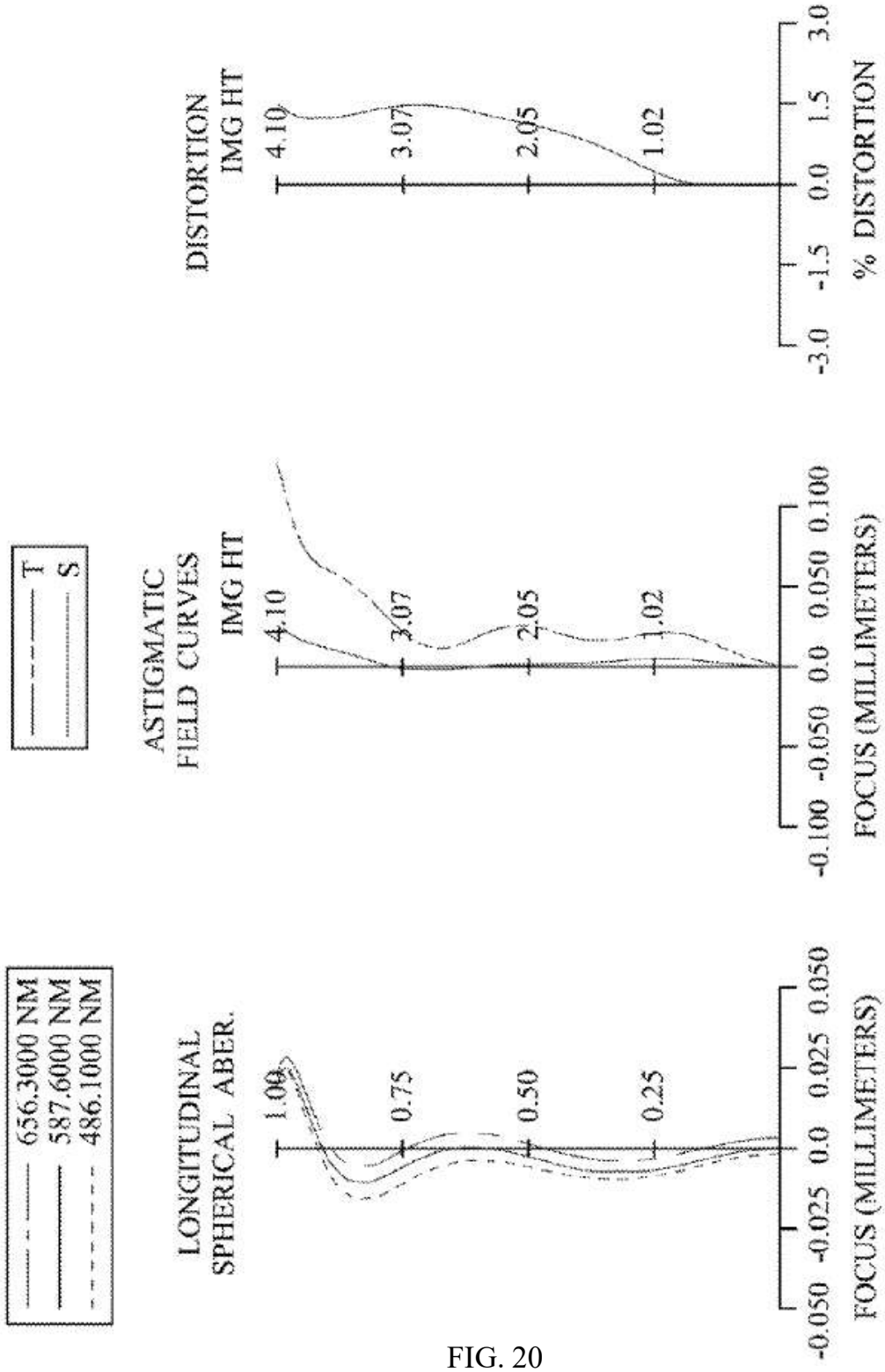

656.3000 NM
587.6000 NM
486.1000 NM
T
S
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
ASTIGMATIC FIELD CURVES
IMG HT
4.10
3.07
2.05
1.02
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
4.10
3.07
2.05
1.02
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

FIG. 20

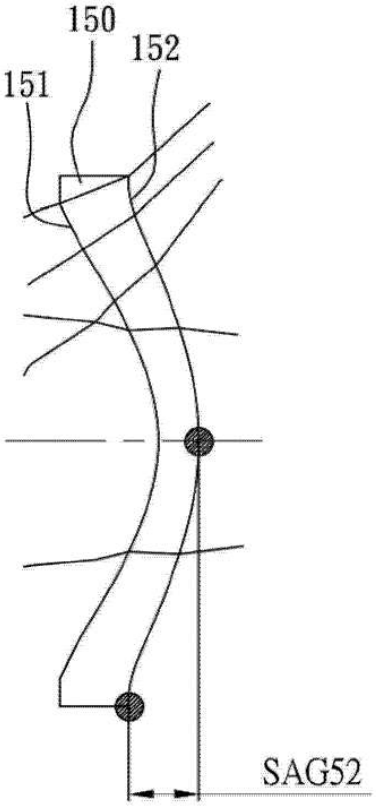


FIG. 21

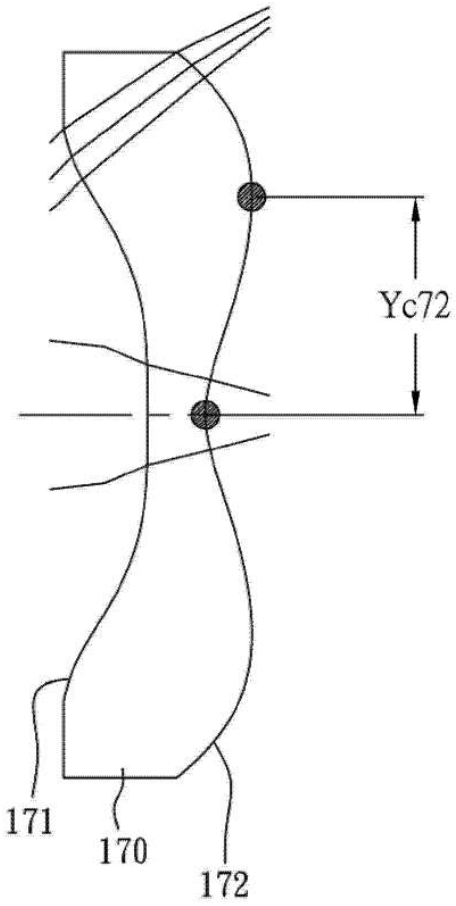


FIG. 22

(19)中华人民共和国国家知识产权局

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代理人 徐金国

(51)Int.Cl.
G02B 13/18(2006.01)
G02B 13/00(2006.01)
G02B 1/04(2006.01)

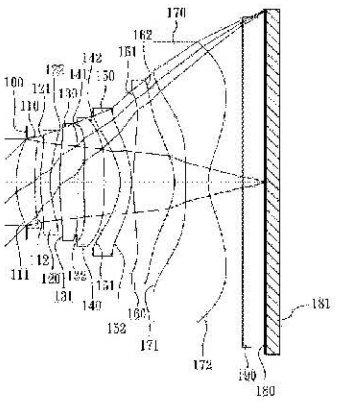
权利要求书 3 页 说明书 39 页 附图 21 页

(54)实用新型名称

光学影像拾取系统组

(57)摘要

一种光学影像拾取系统组，由物侧至像侧依序包含第一透镜、第二透镜、第三透镜、第四透镜、第五透镜、第六透镜以及第七透镜。第一透镜具有正屈折力，其物侧表面为凸面。第二透镜具有屈折力。第三透镜具有屈折力。第四透镜具有屈折力。第五透镜具有屈折力，其像侧表面为凹面。第六透镜具有正屈折力，其物侧表面及像侧表面皆为非球面。第七透镜具有负屈折力，其像侧表面为凹面且由近光轴至边缘存在由凹面转凸面的变化，其中第七透镜的物侧表面及像侧表面皆为非球面。当光学影像拾取系统组满足特定条件时，可有效修正像差及维持小型化。



CN 202886720 U

1. 一种光学影像拾取系统组，其特征在于，由物侧至像侧依序包含：

一第一透镜，具有正屈折力，其物侧表面为凸面；

一第二透镜，具有屈折力；

一第三透镜，具有屈折力；

一第四透镜，具有屈折力；

一第五透镜，具有屈折力，其像侧表面为凸面；

一第六透镜，具有正屈折力，其物侧表面及像侧表面皆为非球面；以及

一第七透镜，具有负屈折力，其像侧表面为凹面且由近光轴至边缘存在由凹面转凸面的变化，其中该第七透镜的物侧表面及像侧表面皆为非球面；

其中，该第七透镜的物侧表面曲率半径为 R13、像侧表面曲率半径为 R14，该光学影像拾取系统组的焦距为 f，该第六透镜的焦距为 f6，该第七透镜的焦距为 f7，其满足下列条件：

$-5.0<R14/R13<1.0$；以及

$1.8< |f/f6|+|f/f7| <6.0$。

2. 根据权利要求 1 所述的光学影像拾取系统组，其特征在于，该第六透镜的像侧表面为凸面。

3. 根据权利要求 2 所述的光学影像拾取系统组，其特征在于，该第五透镜的物侧表面为凹面。

4. 根据权利要求 3 所述的光学影像拾取系统组，其特征在于，该光学影像拾取系统组的焦距为 f，该第六透镜的焦距为 f6，该第七透镜的焦距为 f7，其满足下列条件：

$2.3<|f/f6|+|f/f7|<5.0$。

5. 根据权利要求 3 所述的光学影像拾取系统组，其特征在于，该第五透镜的像侧表面于最大有效径位置与光轴水平的位移距离为 SAG52，该第五透镜于光轴上的厚度为 CT5，其满足下列条件：

$-0.7mm<SAG52+CT5<-0.1mm$。

6. 根据权利要求 3 所述的光学影像拾取系统组，其特征在于，该第六透镜的物侧表面为凸面。

7. 根据权利要求 3 所述的光学影像拾取系统组，其特征在于，该第一透镜的色散系数为 V1，该第二透镜的色散系数为 V2，其满足下列条件：

$28<V1-V2<42$。

8. 根据权利要求 2 所述的光学影像拾取系统组，其特征在于，该第六透镜的物侧表面由近光轴至边缘存在由凸面转凹面的变化。

9. 根据权利要求 8 所述的光学影像拾取系统组，其特征在于，该第二透镜至该第七透镜皆为塑胶材质，且该光学影像拾取系统组的焦距为 f，该第一透镜的物侧表面至该第七透镜的像侧表面于光轴上的距离为 Td，其满足下列条件：

$0.50<Td/f<1.35$。

10. 根据权利要求 8 所述的光学影像拾取系统组，其特征在于，该光学影像拾取系统组的焦距为 f，该第三透镜的焦距为 f3，该第四透镜的焦距为 f4，其满足下列条件：

$|f/f3|+|f/f4|<1.0$。

11. 根据权利要求 2 所述的光学影像拾取系统组，其特征在于，该第二透镜的像侧表面为凹面。

12. 根据权利要求 11 所述的光学影像拾取系统组，其特征在于，该光学影像拾取系统组的焦距为 f，该第七透镜的焦距为 f7，其满足下列条件：

-3.0<f/f7<-1.3。

13. 根据权利要求 12 所述的光学影像拾取系统组，其特征在于，该第五透镜具有负屈折力。

14. 根据权利要求 12 所述的光学影像拾取系统组，其特征在于，该第一透镜至该第七透镜中于光轴上的厚度最小者为 CTmin，其满足下列条件：

0.10mm<CTmin<0.30mm。

15. 根据权利要求 12 所述的光学影像拾取系统组，其特征在于，该第一透镜的像侧表面为凹面，且该第二透镜的物侧表面为凸面。

16. 根据权利要求 12 所述的光学影像拾取系统组，其特征在于，该第七透镜的物侧表面为凹面。

17. 一种光学影像拾取系统组，其特征在于，由物侧至像侧依序包含：

一第一透镜，具有正屈折力，其物侧表面为凸面；

一第二透镜，具有屈折力；

一第三透镜，具有屈折力；

一第四透镜，具有屈折力；

一第五透镜，具有屈折力，其物侧表面及像侧表面皆为非球面；

一第六透镜，具有屈折力，其物侧表面及像侧表面皆为非球面；以及

一第七透镜，具有屈折力，其像侧表面为凹面，且其物侧表面及像侧表面皆为非球面，其中该第七透镜的像侧表面具有至少一反曲点；

其中，该第一透镜至该第七透镜为七枚独立且非接合透镜，该第七透镜的物侧表面曲率半径为 R13、像侧表面曲率半径为 R14，该光学影像拾取系统组的焦距为 f，而该第七透镜像侧表面上，除与光轴的交点外，该像侧表面垂直光轴的一切面，该切面与该像侧表面的一切点，该切点与光轴的垂直距离为 Yc72，该第一透镜的物侧表面至该第七透镜的像侧表面于光轴上的距离为 Td，其满足下列条件：

-5.0<R14/R13<1.0；

0.1<Yc72/f<0.9；以及

0.50<Td/f<1.35。

18. 根据权利要求 17 所述的光学影像拾取系统组，其特征在于，该光学影像拾取系统组的焦距为 f，该第一透镜的物侧表面至该第七透镜的像侧表面于光轴上的距离为 Td，其满足下列条件：

0.85<Td/f<1.25。

19. 根据权利要求 18 所述的光学影像拾取系统组，其特征在于，该第七透镜的物侧表面曲率半径为 R13、像侧表面曲率半径为 R14，其满足下列条件：

-2.0<R14/R13<0.5。

20. 根据权利要求 18 所述的光学影像拾取系统组，其特征在于，该光学影像拾取系统

组的最大视角为FOV，其满足下列条件：

72度<FOV<95度。

21. 根据权利要求18所述的光学影像拾取系统组，其特征在于，该光学影像拾取系统组的焦距为f，该第六透镜的焦距为f6，该第七透镜的焦距为f7，其满足下列条件：

2.3< |f/f6|+|f/f7 <5.0。

22. 根据权利要求18所述的光学影像拾取系统组，其特征在于，该第七透镜的像侧表面曲率半径为R14，该光学影像拾取系统组的焦距为f，其满足下列条件：

0.1<R14/f<1.0。

23. 根据权利要求17所述的光学影像拾取系统组，其特征在于，该第六透镜的物侧表面由近光轴至边缘存在由凸面转凹面的变化。

24. 根据权利要求23所述的光学影像拾取系统组，其特征在于，该第六透镜具有正屈折力，其像侧表面为凹面，且该第七透镜具有负屈折力。

25. 根据权利要求23所述的光学影像拾取系统组，其特征在于，该第一透镜的色散系数为V1，该第二透镜的色散系数为V2，其满足下列条件：

28<V1-V2<42。

26. 根据权利要求17所述的光学影像拾取系统组，其特征在于，还包含：

一影像感测元件，其设置于一成像面，其中该影像感测元件有效感测区域对角线长的一半为ImgH，该第一透镜的物侧表面至该成像面于光轴上的距离为TTL，其满足下列条件：

1.00<TTL/ImgH<1.70。

光学影像拾取系统组

技术领域

[0001] 本实用新型是有关于一种光学影像拾取系统组，且特别是有关于一种应用于电子产品上的小型化光学影像拾取系统组。

背景技术

[0002] 近年来，随着具有摄影功能的可携式电子产品的兴起，光学系统的需求日渐提高。一般光学系统的感光元件不外乎是感光耦合元件(Charge Coupled Device，CCD)或互补性氧化金属半导体元件(Complementary Metal-Oxide Semiconductor Sensor，CMOS Sensor)两种，且随着半导体制程技术的精进，使得感光元件的像素尺寸缩小，光学系统逐渐往高像素领域发展，因此，对成像品质的要求也日益增加。

[0003] 传统搭载于可携式电子产品上的光学系统，如美国专利第7,869,142号所示，多采用四片式透镜结构为主，但由于智能手机(Smart Phone)与PDA(Personal Digital Assistant)等高规格移动装置的盛行，带动光学系统在像素与成像品质上的迅速攀升，已知的光学系统将无法满足更高阶的摄影系统。

[0004] 旧有的镜头技术之中，配置较多的镜片数通常造成镜头体积笨重而难以实现小型化，因此较不适用于具轻薄特性的可携式电子装置上，目前发展的五片式光学系统，如美国专利第8,000,030号所揭示的五片镜片光学系统，于修正高阶像差及离轴像差的能力不彰，且其镜组内空间的配置、镜片的屈折力分布与面型设计导致较无法有效缩短总长，因而不易实现于高品质的小型化镜头。

实用新型内容

[0005] 因此，本实用新型的一目的是在提供一种光学影像拾取系统组，其适当配置各透镜间的空间，并配合非球面及反曲点的使用，有利于修正光学影像拾取系统组的高阶像差及离轴像差，如彗差、像散，并可在有限的总长度内压制光线入射于电子感光元件的入射角度，实现高品质且小型化的光学影像拾取系统组。

[0006] 依据本实用新型一实施方式，提供一种光学影像拾取系统组，由物侧至像侧依序包含第一透镜、第二透镜、第三透镜、第四透镜、第五透镜、第六透镜以及第七透镜。第一透镜具有正屈折力，其物侧表面为凸面。第二透镜具有屈折力。第三透镜具有屈折力。第四透镜具有屈折力。第五透镜具有屈折力，其像侧表面为凸面。第六透镜具有正屈折力，其物侧表面及像侧表面皆为非球面。第七透镜具有负屈折力，其像侧表面为凹面且由近光轴至边缘存在由凹面转凸面的变化，其中第七透镜的物侧表面及像侧表面皆为非球面。第七透镜的物侧表面曲率半径为R13、像侧表面曲率半径为R14，光学影像拾取系统组的焦距为f，第六透镜的焦距为f6，第七透镜的焦距为f7，其满足下列条件：

[0007] $-5.0<R14/R13<1.0$；以及

[0008] $1.8< |f/f6|+|f/f7| <6.0$。

[0009] 在本实用新型一实施例中，该第六透镜的像侧表面为凸面。

[0010] 在本实用新型一实施例中，该第五透镜的物侧表面为凹面。

[0011] 在本实用新型一实施例中，该光学影像拾取系统组的焦距为 f，该第六透镜的焦距为 f6，该第七透镜的焦距为 f7，其满足下列条件：

[0012] 2.3< |f/f6|+|f/f7 <5.0。

[0013] 在本实用新型一实施例中，该第五透镜的像侧表面于最大有效径位置与光轴水平的位移距离为 SAG52，该第五透镜于光轴上的厚度为 CT5，其满足下列条件：

[0014] -0.7mm<SAG52+CT5<-0.1mm。

[0015] 在本实用新型一实施例中，该第六透镜的物侧表面为凸面。

[0016] 在本实用新型一实施例中，该第一透镜的色散系数为 V1，该第二透镜的色散系数为 V2，其满足下列条件：

[0017] 28<V1-V2<42。

[0018] 在本实用新型一实施例中，该第六透镜的物侧表面由近光轴至边缘存在由凸面转凹面的变化。

[0019] 在本实用新型一实施例中，该第二透镜至该第七透镜皆为塑胶材质，且该光学影像拾取系统组的焦距为 f，该第一透镜的物侧表面至该第七透镜的像侧表面于光轴上的距离为 Td，其满足下列条件：

[0020] 0.50<Td/f<1.35。

[0021] 在本实用新型一实施例中，该光学影像拾取系统组的焦距为 f，该第三透镜的焦距为 f3，该第四透镜的焦距为 f4，其满足下列条件：

[0022] |f/f3|+ f/f4|<1.0。

[0023] 在本实用新型一实施例中，该第二透镜的像侧表面为凹面。

[0024] 在本实用新型一实施例中，该光学影像拾取系统组的焦距为 f，该第七透镜的焦距为 f7，其满足下列条件：

[0025] -3.0<f/f7<-1.3。

[0026] 在本实用新型一实施例中，该第五透镜具有负屈折力。

[0027] 在本实用新型一实施例中，该第一透镜至该第七透镜中于光轴上的厚度最小者为 CTmin，其满足下列条件：

[0028] 0.10mm<CTmin<0.30mm。

[0029] 在本实用新型一实施例中，，该第一透镜的像侧表面为凹面，且该第二透镜的物侧表面为凸面。

[0030] 在本实用新型一实施例中，该第七透镜的物侧表面为凹面。

[0031] 依据本实用新型另一实施方式，提供一种光学影像拾取系统组，由物侧至像侧依序包含第一透镜、第二透镜、第三透镜、第四透镜、第五透镜、第六透镜以及第七透镜。第一透镜具有正屈折力，其物侧表面为凸面。第二透镜具有屈折力。第三透镜具有屈折力。第四透镜具有屈折力。第五透镜具有屈折力，其物侧表面及像侧表面皆为非球面。第六透镜具有屈折力，其物侧表面及像侧表面皆为非球面。第七透镜具有屈折力，其像侧表面为凹面，且其物侧表面及像侧表面皆为非球面，其中第七透镜的像侧表面具有至少一反曲点。第一透镜至第七透镜为独立且非接合透镜，第七透镜的物侧表面曲率半径为 R13、像侧表面曲率半径为 R14，光学影像拾取系统组的焦距为 f，第七透镜像侧表面上，除与光轴的交点外，像

侧表面垂直光轴的一切面，该切面与像侧表面的一切点，该切点与光轴的垂直距离为 Yc72，第一透镜的物侧表面至第七透镜的像侧表面于光轴上的距离为 Td，其满足下列条件：

[0032] $-5.0<R14/R13<1.0$；

[0033] $0.1<Yc72/f<0.9$；以及

[0034] $050<Td/f<135$。

[0035] 在本实用新型另一实施例中，该光学影像拾取系统组的焦距为 f，该第一透镜的物侧表面至该第七透镜的像侧表面于光轴上的距离为 Td，其满足下列条件：

[0036] $0.85<Td/f<1.25$。

[0037] 在本实用新型另一实施例中，该第七透镜的物侧表面曲率半径为 R13、像侧表面曲率半径为 R14，其满足下列条件：

[0038] $-2.0<R14/R13<0.5$。

[0039] 在本实用新型另一实施例中，该光学影像拾取系统组的最大视角为 FOV，其满足下列条件：

[0040] 72 度 <FOV<95 度。

[0041] 在本实用新型另一实施例中，该光学影像拾取系统组的焦距为 f，该第六透镜的焦距为 f6，该第七透镜的焦距为 f7，其满足下列条件：

[0042] $2.3< |f/f6|+|f/f7| <5.0$。

[0043] 在本实用新型另一实施例中，该第七透镜的像侧表面曲率半径为 R14，该光学影像拾取系统组的焦距为 f，其满足下列条件：

[0044] $0.1<R14/f<1.0$。

[0045] 在本实用新型另一实施例中，该第六透镜的物侧表面由近光轴至边缘存在由凸面转凹面的变化。

[0046] 在本实用新型另一实施例中，该第六透镜具有正屈折力，其像侧表面为凸面，且该第七透镜具有负屈折力。

[0047] 在本实用新型另一实施例中，该第一透镜的色散系数为 V1，该第二透镜的色散系数为 V2，其满足下列条件：

[0048] $28<V1-V2<42$。

[0049] 在本实用新型另一实施例中，所述的光学影像拾取系统组还包含：

[0050] 一影像感测元件，其设置于一成像面，其中该影像感测元件有效感测区域对角线长的一半为 ImgH，该第一透镜的物侧表面至该成像面于光轴上的距离为 TTL，其满足下列条件：

[0051] $1.00<TTL/ImgH<1.70$。

[0052] 当 R14/R13 满足上述条件时，第七透镜表面曲率的配置，可配合光学影像拾取系统组其他透镜的配置以及非球面的透镜表面及反曲点的设置，以修正高阶像差及离轴像差，如彗差、像散，并可在有限的总长度内压制光线入射于电子感光元件的入射角度，实现高品质且小型化的光学影像拾取系统组。

[0053] 当 $|f/f6 +|f/f7|$ 满足上述条件时，可适当配置第六透镜及第七透镜的焦距，以形成一正、一负的望远 (Telephoto) 结构，可有效缩短光学影像拾取系统组总长度。

[0054] 当 Yc72/f 满足上述条件时，可有效地压制离轴视场的光线入射于影像感测元件

上的角度，使感光元件的响应效率提升，进而增加成像品质。

[0055] 当 Td/f 满足上述条件时，有助于缩短光学影像拾取系统组的总长度，促进其小型化。

附图说明

[0056] 为让本实用新型的上述和其他目的、特征、优点与实施例能更明显易懂，所附附图的说明如下：

[0057] 图 1 绘示依照本实用新型第一实施例的一种光学影像拾取系统组的示意图；

[0058] 图 2 由左至右依序为第一实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0059] 图 3 绘示依照本实用新型第二实施例的一种光学影像拾取系统组的示意图；

[0060] 图 4 由左至右依序为第二实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0061] 图 5 绘示依照本实用新型第三实施例的一种光学影像拾取系统组的示意图；

[0062] 图 6 由左至右依序为第三实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0063] 图 7 绘示依照本实用新型第四实施例的一种光学影像拾取系统组的示意图；

[0064] 图 8 由左至右依序为第四实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0065] 图 9 绘示依照本实用新型第五实施例的一种光学影像拾取系统组的示意图；

[0066] 图 10 由左至右依序为第五实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0067] 图 11 绘示依照本实用新型第六实施例的一种光学影像拾取系统组的示意图；

[0068] 图 12 由左至右依序为第六实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0069] 图 13 绘示依照本实用新型第七实施例的一种光学影像拾取系统组的示意图；

[0070] 图 14 由左至右依序为第七实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0071] 图 15 绘示依照本实用新型第八实施例的一种光学影像拾取系统组的示意图；

[0072] 图 16 由左至右依序为第八实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0073] 图 17 绘示依照本实用新型第九实施例的一种光学影像拾取系统组的示意图；

[0074] 图 18 由左至右依序为第九实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0075] 图 19 绘示依照本实用新型第十实施例的一种光学影像拾取系统组的示意图；

[0076] 图 20 由左至右依序为第十实施例的光学影像拾取系统组的球差、像散及歪曲曲线图；

[0077] 图 21 系绘示依照图 1 的第一实施例中光学影像拾取系统组的第五透镜的参数示意图；

[0078] 图 22 系绘示依照图 1 的第一实施例中光学影像拾取系统组的第七透镜的参数示意图。

[0079] 【主要元件符号说明】

[0080] 光圈 :100、200、300、400、500、600、700、800、900、1000

[0081] 第一透镜 :110、210、310、410、510、610、710、810、910、1010

[0082] 物侧表面 :111、211、311、411、511、611、711、811、911、1011

[0083] 像侧表面 :112、212、312、412、512、612、712、812、912、1012

[0084] 第二透镜 :120、220、320、420、520、620、720、820、920、1020

[0085] 物侧表面 :121、221、321、421、521、621、721、821、921、1021

[0086] 像侧表面 :122、222、322、422、522、622、722、822、922、1022

[0087] 第三透镜 :130、230、330、430、530、630、730、830、930、1030

[0088] 物侧表面 :131、231、331、431、531、631、731、831、931、1031

[0089] 像侧表面 :132、232、332、432、532、632、732、832、932、1032

[0090] 第四透镜 :140、240、340、440、540、640、740、840、940、1040

[0091] 物侧表面 :141、241、341、441、541、641、741、841、941、1041

[0092] 像侧表面 :142、242、342、442、542、642、742、842、942、1042

[0093] 第五透镜 :150、250、350、450、550、650、750、850、950、1050

[0094] 物侧表面 :151、251、351、451、551、651、751、851、951、1051

[0095] 像侧表面 :152、252、352、452、552、652、752、852、952、1052

[0096] 第六透镜 :160、260、360、460、560、660、760、860、960、1060

[0097] 物侧表面 :161、261、361、461、561、661、761、861、961、1061

[0098] 像侧表面 :162、262、362、462、562、662、762、862、962、1062

[0099] 第七透镜 :170、270、370、470、570、670、770、870、970、1070

[0100] 物侧表面 :171、271、371、471、571、671、771、871、971、1071

[0101] 像侧表面 :172、272、372、472、572、672、772、872、972、1072

[0102] 成像面 :180、280、380、480、580、680、780、880、980、1080

[0103] 影像感测元件 :181、281、381、481、581、681、781、881、981、1081

[0104] 红外线滤除滤光片 :190、290、390、490、590、690、790、890、990、1090

[0105] f :光学影像拾取系统组的焦距

[0106] Fno :光学影像拾取系统组的光圈值

[0107] HFOV :光学影像拾取系统组中最大视角的一半

[0108] V1 :第一透镜的色散系数

[0109] V2 :第二透镜的色散系数

[0110] CTmin :第一透镜至第七透镜中于光轴上的厚度最小者

[0111] R13 :第七透镜的物侧表面曲率半径

[0112] R14 :第七透镜的像侧表面曲率半径

[0113] f3 :第三透镜的焦距

[0114] f4 :第四透镜的焦距

[0115] f6 :第六透镜的焦距

[0116] f7：第七透镜的焦距

[0117] SAG52：第五透镜的像侧表面于最大有效径位置与光轴水平的位移距离（往物侧方向为负，往像侧方向为正）

[0118] CT5：第五透镜于光轴上的厚度

[0119] Yc72：第七透镜像侧表面上，除与光轴的交点外，像侧表面垂直光轴的一切面，该切面与像侧表面的一切点，该切点与光轴的垂直距离

[0120] Td：第一透镜的物侧表面至第七透镜的像侧表面于光轴上的距离

[0121] FOV：光学影像拾取系统组的最大视角

[0122] ImgH：影像感测元件有效感测区域对角线长的一半

[0123] TTL：第一透镜的物侧表面至成像面于光轴上的距离

具体实施方式

[0124] 一种光学影像拾取系统组，由物侧至像侧依序包含第一透镜、第二透镜、第三透镜、第四透镜、第五透镜、第六透镜以及第七透镜。光学影像拾取系统组还包含影像感测元件，设置于成像面。其中，第一透镜至第七透镜可为七枚独立且非接合（Non-cemented）透镜，意即两相邻的透镜并未相互接合，而彼此间设置有空气间距。由于接合透镜的制程较独立且非接合透镜复杂，特别在两透镜的接合面需拥有高准度的曲面，以使达到两透镜接合时的高密合度，几在接合的过程中，也可能因偏位而造成粘贴密合度不佳，影响整体光学成像品质。因此，本光学影像拾取系统组提供七枚独立且非接合透镜，以改善接合透镜所产生的问题。

[0125] 第一透镜具有正屈折力，其物侧表面为凸面、像侧表面可为凹面。借此可适当调整第一透镜的正屈折力强度，有助于缩短光学影像拾取系统组的总长度。

[0126] 第二透镜的物侧表面可为凸面、像侧表面可为凹面。借此有助于修正光学影像拾取系统组的像散。

[0127] 第五透镜可具有负屈折力有助于修正光学影像拾取系统组的像差，以利增进成像品质。第五透镜的物侧表面可为凹面、像侧表面则为凸面，可有效修正光学影像拾取系统组的像散。

[0128] 第六透镜具有正屈折力，且其物侧表面及像侧表面可皆为凸面。借此，有利于修正光学影像拾取系统组的高阶像差，提升其解像力以获得良好成像品质。另外，第六透镜的物侧表面由近光轴至边缘存在由凸面转凹面的变化，有助于维持影像周边相对照度（Relative Illumination）。

[0129] 第七透镜具有负屈折力，其物侧表面及像侧表面可皆为凹面。借此，有助于使光学影像拾取系统组的主点有效远离成像面，以加强缩短其后焦距，进而可减少光学影像拾取系统组总长度，达到小型化的目标。另外，第七透镜的像侧表面由近光轴至边缘存在由凹面转凸面的变化，且其具有反曲点，借此可有效地压制离轴视场的光线入射于影像感测元件上的角度，较佳地可修正离轴视场的像差。

[0130] 第七透镜的物侧表面曲率半径为 R13、像侧表面曲率半径为 R14，其满足下列条件：$-5.0<R14/R13<1.0$。借此，第七透镜表面曲率的配置，可配合光学影像拾取系统组其他透镜的配置以及非球面的透镜表面及反曲点的设置，以修正高阶像差及离轴像差，如彗差、

像散，并可在有限的总长度内压制光线入射于电子感光元件的入射角度，实现高品质且小型化的光学影像拾取系统组。较佳地，光学影像拾取系统组可满足下列条件：-2.0<R14/R13<0.5。

[0131] 光学影像拾取系统组的焦距为 f，第六透镜的焦距为 f6，第七透镜的焦距为 f7，其满足下列条件：1.8<|f/f6 +|f/f7|<6.0。适当配置第六透镜及第七透镜的焦距，以形成一正、一负的望远 (Telephoto) 结构，可有效缩短光学影像拾取系统组总长度。较佳地，光学影像拾取系统组可满足下列条件：2.3<|f/f6 +|f/f7|<5.0。

[0132] 第五透镜的像侧表面于最大有效径位置与光轴水平的位移距离为 SAG52，第五透镜于光轴上的厚度为 CT5，其满足下列条件：-0.7mm<SAG52+CT5<-0.1mm。借此，以配置适当的第五透镜像侧表面形状与该镜片厚度，有利于加工制造与组装。

[0133] 第一透镜的色散系数为 V1，第二透镜的色散系数为 V2，其满足下列条件：28<V1-V2<42。借此，有助于光学影像拾取系统组色差的修正。

[0134] 光学影像拾取系统组的焦距为 f，第一透镜的物侧表面至第七透镜的像侧表面于光轴上的距离为 Td，其满足下列条件：0.50<Td/f<1.35。借此，有助于缩短光学影像拾取系统组的总长度，促进其小型化。较佳地，光学影像拾取系统组可满足下列条件：0.85<Td/f<1.25。

[0135] 光学影像拾取系统组的焦距为 f，第三透镜的焦距为 f3，第四透镜的焦距为 f4，其满足下列条件：|f/f3|+|f/f4 <1.0。借此，第三透镜及第四透镜的焦距有助于降低光学影像拾取系统组的敏感度。

[0136] 光学影像拾取系统组的焦距为 f，第七透镜的焦距为 f7，其满足下列条件：-3.0<f/f7<-1.3。借此，第七透镜的屈折力有助于进一步缩短光学影像拾取系统组的后焦距以减少总长。

[0137] 第一透镜至第七透镜中于光轴上的厚度最小者为 CTmin，其满足下列条件：0.10mm<CTmin<0.30mm。借此，透镜厚度的配置有利于镜片的成型加工，避免过薄的透镜成型不良，以提高镜片的制作合格率。

[0138] 光学影像拾取系统组的焦距为 f，第七透镜像侧表面上，除与光轴的交点外，像侧表面垂直光轴的一切面，该切面与像侧表面的一切点，该切点与光轴的垂直距离为 Yc72，其满足下列条件：0.1<Yc72/f<0.9。借此，可有效地压制离轴视场的光线入射于影像感测元件上的角度，使感光元件的响应效率提升，进而增加成像品质。

[0139] 光学影像拾取系统组的最大视角为 FOV，其满足下列条件：72 度 <FOV<95 度。借此，可提供较大视场角，以获得所需适当取像范围又可兼顾影像不变形的效果。

[0140] 第七透镜的像侧表面曲率半径为 R14，光学影像拾取系统组的焦距为 f，其满足下列条件：0.1<R14/f<1.0。借此，第七透镜像侧表面的曲率，有助于光学影像拾取系统组的主点 (Principal Point) 远离成像面，借以缩短光学影像拾取系统组的后焦长，有利于维持镜头的小型化。

[0141] 影像感测元件有效感测区域对角线长的一半为 ImgH，第一透镜的物侧表面至成像面于光轴上的距离为 TTL，其满足下列条件：1.00<TTL/ImgH<1.70。借此，可缩短光学影像拾取系统组的总长度，以维持其小型化，适合搭载于轻薄可携式的电子产品上。

[0142] 本实用新型光学影像拾取系统组中，透镜的材质可为塑胶或玻璃。当透镜的材质

为玻璃，可以增加光学影像拾取系统组屈折力配置的自由度。另当透镜材质为塑胶，则可以有效降低生产成本。此外，可于透镜表面上设置非球面，非球面可以容易制作成球面以外的形状，获得较多的控制变数，用以消减像差，进而缩减所需使用透镜的数目，因此可以有效降低本实用新型光学影像拾取系统组的总长度。

[0143] 本实用新型光学影像拾取系统组中，若透镜表面为凸面，则表示该透镜表面于近轴处为凸面；若透镜表面为凹面，则表示该透镜表面于近轴处为凹面。

[0144] 本实用新型光学影像拾取系统组中，可设置有至少一光阑，其位置可设置于第一透镜之前、各透镜之间或最后一透镜之后均可，该光阑的种类如耀光光阑（Glare Stop）或视场光阑（Field Stop）等，用以减少杂散光，有助于提升影像品质。

[0145] 本实用新型光学影像拾取系统组中，光圈可设置于被摄物与第一透镜间（即为前置光圈）或是第一透镜与成像面间（即为中置光圈）。光圈若为前置光圈，可使光学影像拾取系统组的出射瞳（Exit Pupil）与成像面产生较长的距离，使之具有远心（Telecentric）效果，可增加影像感测元件CCD或CMOS接收影像的效率；若为中置光圈，有助于扩大光学影像拾取系统组的视场角，使光学影像拾取系统组具有广角镜头的优势。

[0146] 本实用新型光学影像拾取系统组兼具优良像差修正与良好成像品质的特色可多方面应用于3D（三维）影像撷取、数字相机、移动装置、数字平板等电子影像系统中。

[0147] 根据上述实施方式，以下提出具体实施例并配合附图予以详细说明。

[0148] <第一实施例>

[0149] 请参照图1及图2，其中图1绘示依照本实用新型第一实施例的一种光学影像拾取系统组的示意图，图2由左至右依序为第一实施例的光学影像拾取系统组的球差、像散及歪曲曲线图。由图1可知，光学影像拾取系统组由物侧至像侧依序包含光圈100、第一透镜110、第二透镜120、第三透镜130、第四透镜140、第五透镜150、第六透镜160、第七透镜170、红外线滤除滤光片（IRFilter）190、成像面180以及影像感测元件181。

[0150] 第一透镜110具有正屈折力，其物侧表面111为凸面、像侧表面112为凹面，并皆为非球面，且第一透镜110为塑胶材质。

[0151] 第二透镜120具有负屈折力，其物侧表面121为凸面、像侧表面122为凹面，并皆为非球面，且第二透镜120为塑胶材质。

[0152] 第三透镜130具有正屈折力，其物侧表面131为凸面、像侧表面132为凹面，并皆为非球面，且第三透镜130为塑胶材质。

[0153] 第四透镜140具有正屈折力，其物侧表面141及像侧表面142皆为凸面，并皆为非球面，且第四透镜140为塑胶材质。

[0154] 第五透镜150具有负屈折力，其物侧表面151为凹面、像侧表面152为凸面，并皆为非球面，且第五透镜150为塑胶材质。

[0155] 第六透镜160具有正屈折力，其物侧表面161为凸面且由近光轴至边缘存在由凸面转凹面的变化，其像侧表面162为凸面，并皆为非球面，且第六透镜160为塑胶材质。

[0156] 第七透镜170具有负屈折力，其物侧表面171为凹面，像侧表面172为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜170为塑胶材质。另外，第七透镜170的像侧表面172具有反曲点。

[0157] 红外线滤除滤光片190为玻璃材质，设置于第七透镜170及成像面180之间，其不

影响光学影像拾取系统组的焦距。

[0158] 上述各透镜的非球面的曲线方程式表示如下：

[0159] $$X(Y)=(Y^2/R)/\left(1+sqrt\left(1-(1+k)\times(Y/R)^2\right)\right)+\sum_i(Ai)\times(Y^i)$$ ；

[0160] 其中：

[0161] X：非球面上距离光轴为 Y 的点，其与相切于非球面光轴上顶点的切面的相对距离；

[0162] Y：非球面曲线上的点与光轴的距离；

[0163] R：曲率半径；

[0164] k：锥面系数；以及

[0165] Ai：第 i 阶非球面系数。

[0166] 第一实施例的光学影像拾取系统组中，光学影像拾取系统组的焦距为 f，光学影像拾取系统组的光圈值（f-number）为 Fno，光学影像拾取系统组中最大视角的一半为 HFOV，其数值如下：f=4.01mm；Fno=2.00；以及 HFOV=44.3 度。

[0167] 第一实施例的光学影像拾取系统组中，第一透镜 110 的色散系数为 V1，第二透镜 120 的色散系数为 V2，其满足下列条件：V1-V2=32.6。

[0168] 第一实施例的光学影像拾取系统组中，第一透镜 110 至第七透镜 170 中于光轴上的厚度最小者为 CTmin，其满足下列条件：CTmin=0.230mm。

[0169] 第一实施例的光学影像拾取系统组中，第七透镜 170 的物侧表面 171 曲率半径为 R13、像侧表面 172 曲率半径为 R14，光学影像拾取系统组的焦距为 f，其满足下列条件：R14/R13=-0.03；以及 R14/f=0.27。

[0170] 第一实施例的光学影像拾取系统组中，光学影像拾取系统组的焦距为 f，第三透镜 130 的焦距为 f3，第四透镜 140 的焦距为 f4，第六透镜 160 的焦距为 f6，第七透镜 170 的焦距为 f7，其满足下列条件：|f/f3|+|f/f4|=0.67；|f/f6|+ f/f7|=4.17；以及 f/f7=-2.07。

[0171] 配合参照图 21，系绘示依照图 1 的第一实施例中光学影像拾取系统组的第五透镜 150 的参数示意图。由图 21 可知，第五透镜 150 的像侧表面 152 于最大有效径位置与光轴水平的位移距离为 SAG52，第五透镜 150 于光轴上的厚度为 CT5，其满足下列条件：SAG52+CT5=-0.19mm。

[0172] 再配合参照图 22，系绘示依照图 1 的第一实施例中光学影像拾取系统组的第七透镜 170 的参数示意图。由图 22 可知，第七透镜 170 像侧表面 172 上，除与光轴的交点外，像侧表面 172 垂直光轴的一切面，该切面与像侧表面 172 的一切点，该切点与光轴的垂直距离为 Yc72，光学影像拾取系统组的焦距为 f，第一透镜 110 的物侧表面 111 至第七透镜 170 的像侧表面 172 于光轴上的距离为 Td，其满足下列条件：Yc72/f=0.49；以及 Td/f=1.11。

[0173] 第一实施例的光学影像拾取系统组中，光学影像拾取系统组的最大视角为 FOV，其满足下列条件：FOV=88.6 度。

[0174] 第一实施例的光学影像拾取系统组中，影像感测元件 181 有效感测区域对角线长的一半为 ImgH，第一透镜 110 的物侧表面 111 至成像面 180 于光轴上的距离为 TTL，其满足下列条件：TTL/ImgH=1.43。

[0175] 配合参照下列表一以及表二。

[0176]

表一、第一实施例							
f(焦距) = 4.01 mm, Fno(光圈值) = 2.00, HFOV(半视角) = 44.3 度							
表面		曲率半径	厚度	材质	折射率	色散系数	焦距
0	被摄物	平面	无限				
1	光圈	平面	-0.232				
2	第一透镜	2.434710 (ASP)	0.432	塑胶	1.544	55.9	7.09
3		6.184400 (ASP)	0.129				
4	第二透镜	2.617130 (ASP)	0.230	塑胶	1.640	23.3	-18.39
5		2.067550 (ASP)	0.227				
6	第三透镜	8.427200 (ASP)	0.408	塑胶	1.544	55.9	18.55
7		50.097500 (ASP)	0.148				
8	第四透镜	8.616300 (ASP)	0.475	塑胶	1.544	55.9	8.83
9		-10.657500 (ASP)	0.369				
10	第五透镜	-1.135390 (ASP)	0.260	塑胶	1.640	23.3	-5.23
11		-1.871900 (ASP)	0.046				
12	第六透镜	5.095500 (ASP)	0.960	塑胶	1.544	55.9	1.92
13		-1.224510 (ASP)	0.260				
14	第七透镜	-39.871000 (ASP)	0.519	塑胶	1.544	55.9	-1.93
15		1.086250 (ASP)	0.800				
16	红外线滤除滤光片	平面	0.200	玻璃	1.517	64.2	-
17		平面	0.333				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0177]

表二、非球面系数					
表面	2	3	4	5	6
k =	8.27120E-01	4.62437E+00	-1.13191E+01	-6.38616E+00	0.00000E+00
A4 =	-1.74532E-03	-5.83063E-02	-1.16345E-01	-6.30254E-02	-3.22408E-03
A6 =	1.66444E-02	9.03971E-02	1.17622E-01	5.70756E-02	-2.88888E-03
A8 =	4.28968E-03	-3.60302E-02	-7.66726E-02	-2.83491E-02	4.75917E-04
A10 =	-3.07413E-02	-1.36439E-02	7.44823E-03	6.65499E-03	-2.13932E-03
A12 =	3.78197E-02	1.65731E-02	1.44225E-02	-8.04619E-03	
A14 =	-1.23654E-02	-1.71803E-03	-1.00255E-02	2.81404E-03	
表面	7	8	9	10	11
k =	0.00000E+00	-1.41923E+01	3.00000E+00	-1.91162E+00	-2.91712E+00
A4 =	-2.22211E-02	-4.89368E-02	-2.77627E-02	1.27682E-01	4.41976E-02
A6 =	1.62467E-03	-9.79475E-03	-2.66788E-02	-1.56846E-01	-4.96818E-02
A8 =	-2.71793E-03	8.35766E-03	4.86057E-03	9.93741E-02	2.88045E-02
A10 =	-1.57662E-03	-3.63072E-03	7.65106E-05	-4.10875E-02	-1.07348E-02
A12 =		-2.59001E-03	-1.00897E-04	1.33686E-02	2.93622E-03
A14 =		1.02823E-03	1.39343E-04	-2.16846E-03	-3.46573E-04
表面	12	13	14	15	
k =	1.52786E+00	-5.57551E+00	-1.12826E+01	-6.42535E+00	
A4 =	-6.23424E-02	-1.65595E-02	-5.43119E-02	-2.80684E-02	
A6 =	2.96152E-02	1.11540E-04	6.52054E-03	4.82354E-03	
A8 =	-8.05261E-03	9.36251E-03	-1.28046E-04	-6.50633E-04	
A10 =	7.04579E-04	-3.77558E-03	1.85706E-05	5.03266E-05	
A12 =	2.48481E-05	5.75870E-04	1.46128E-06	-2.63079E-06	
A14 =	-5.10512E-06	-3.18169E-05	-5.41596E-07	7.71151E-08	

[0178] 表一为图 1 第一实施例详细的结构数据，其中曲率半径、厚度及焦距的单位为 mm，且表面 0-18 依序表示由物侧至像侧的表面。表二为第一实施例中的非球面数据，其中，k 表非球面曲线方程式中的锥面系数，A1-A14 则表示各表面第 1-14 阶非球面系数。此外，以下各实施例表格乃对应各实施例的示意图与像差曲线图，表格中数据的定义皆与第一实施例的表一及表二的定义相同，在此不加赘述。

[0179] < 第二实施例 >

[0180] 请参照图 3 及图 4，其中图 3 绘示依照本实用新型第二实施例的一种光学影像拾取系统组的示意图，图 4 由左至右依序为第二实施例的光学影像拾取系统组的球差、像散及歪曲曲线图。由图 3 可知，光学影像拾取系统组由物侧至像侧依序包含第一透镜 210、光圈 200、第二透镜 220、第三透镜 230、第四透镜 240、第五透镜 250、第六透镜 260、第七透镜 270、红外线滤除滤光片 290、成像面 280 以及影像感测元件 281。

[0181] 第一透镜 210 具有正屈折力，其物侧表面 211 为凸面、像侧表面 212 为凹面，并皆为非球面，且第一透镜 210 为塑胶材质。

[0182] 第二透镜 220 具有负屈折力，其物侧表面 221 为凸面、像侧表面 222 为凹面，并皆为非球面，且第二透镜 220 为塑胶材质。

[0183] 第三透镜 230 具有负屈折力，其物侧表面 231 及像侧表面 232 皆为凹面，并皆为非球面，且第三透镜 230 为塑胶材质。

[0184] 第四透镜 240 具有正屈折力，其物侧表面 241 及像侧表面 242 皆为凸面，并皆为非球面，且第四透镜 240 为塑胶材质。

[0185] 第五透镜 250 具有负屈折力，其物侧表面 251 为凹面、像侧表面 252 为凸面，并皆为非球面，且第五透镜 250 为塑胶材质。

[0186] 第六透镜 260 具有正屈折力，其物侧表面 261 为凸面且由近光轴至边缘存在由凸面转凹面的变化，其像侧表面 262 为凸面，并皆为非球面，且第六透镜 260 为塑胶材质。

[0187] 第七透镜 270 具有负屈折力，其物侧表面 271 为凹面，像侧表面 272 为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜 270 为塑胶材质。另外，第七透镜 270 的像侧表面 272 具有反曲点。

[0188] 红外线滤除滤光片 290 为玻璃材质，设置于第七透镜 270 及成像面 280 之间，其不影响光学影像拾取系统组的焦距。

[0189] 请配合参照下列表三以及表四。

[0190]

表三、第二实施例							
f(焦距) = 4.69 mm, Fno(光圈值) = 2.00, HFOV(半视角) = 39.9 度							
表面		曲率半径	厚度	材质	折射率	色散系数	焦距
0	被摄物	平面	无限				
1	第一透镜	2.338420 (ASP)	0.661	塑胶	1.544	55.9	5.34
2		10.750800 (ASP)	0.040				
3	光圈	平面	0.016				
4	第二透镜	7.445700 (ASP)	0.240	塑胶	1.640	23.3	-17.26
5		4.391600 (ASP)	0.445				
6	第三透镜	-21.710900 (ASP)	0.381	塑胶	1.544	55.9	-39.74
7		5361.416200 (ASP)	0.147				
8	第四透镜	5.575000 (ASP)	0.529	塑胶	1.544	55.9	7.69
9		-16.175800 (ASP)	0.515				
10	第五透镜	-1.284340 (ASP)	0.300	塑胶	1.650	21.4	-8.44
11		-1.831180 (ASP)	0.035				
12	第六透镜	4.475500 (ASP)	1.150	塑胶	1.544	55.9	2.49
13		-1.763930 (ASP)	0.325				
14	第七透镜	-3.393300 (ASP)	0.420	塑胶	1.544	55.9	-2.12
15		1.819780 (ASP)	0.700				
16	红外线滤除滤光片	平面	0.200	玻璃	1.517	64.2	-
17		平面	0.272				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0191]

表四、非球面系数					
表面	1	2	4	5	6
k =	9.80773E-01	-1.92188E+01	8.90606E+00	-1.79159E+00	0.00000E+00

[0192]

A4 =	-2.18593E-03	-6.46057E-02	-1.10653E-01	-4.86404E-02	-3.93493E-02
A6 =	-1.54070E-02	7.63918E-02	1.13450E-01	5.13025E-02	-1.80331E-02
A8 =	3.05338E-02	-4.29638E-02	-6.80130E-02	-3.24642E-02	4.67850E-03
A10 =	-3.36226E-02	-2.10201E-03	8.54602E-03	1.32076E-02	-9.93176E-03
A12 =	1.79152E-02	1.22516E-02	1.21194E-02	-2.83179E-03	
A14 =	-4.00474E-03	-3.93519E-03	-4.15964E-03	1.09867E-03	
表面	7	8	9	10	11
k =	0.00000E+00	-5.00000E+01	-1.99836E+01	-2.35110E+00	-5.56653E+00
A4 =	-9.08185E-02	-4.85174E-02	-2.66060E-02	1.14859E-01	2.33258E-02
A6 =	1.74613E-02	-1.31630E-02	-3.07938E-02	-1.72783E-01	-5.37931E-02
A8 =	-1.60883E-02	5.98634E-03	6.93109E-03	9.45890E-02	2.74189E-02
A10 =	1.15200E-03	-1.00384E-03	7.89597E-04	-4.12706E-02	-1.10956E-02
A12 =		-1.22616E-03	-3.12044E-04	1.37733E-02	2.94183E-03
A14 =		5.23056E-04	1.91696E-05	-1.93858E-03	-2.89735E-04
表面	12	13	14	15	
k =	1.11152E-01	-5.90226E+00	-3.47383E+00	-9.89411E+00	
A4 =	-6.66847E-02	-2.36853E-02	-5.03202E-02	-2.43023E-02	
A6 =	2.67368E-02	-4.13868E-03	7.31438E-03	4.35401E-03	
A8 =	-7.42114E-03	9.41497E-03	-1.79551E-04	-6.10939E-04	
A10 =	5.58018E-04	-3.69867E-03	3.41602E-06	5.28792E-05	
A12 =	-1.77933E-05	5.80183E-04	1.46128E-06	-2.74531E-06	
A14 =	5.57785E-06	-3.25579E-05	-3.73207E-07	6.39095E-08	

[0193] 第二实施例中，非球面的曲线方程式表示如第一实施例的形式。此外，f、Fno、HFOV、V1、V2、CTmin、R13、R14、f3、f4、f6、f7、SAG52、CT5、Yc72、Td、FOV、TTL 以及 ImgH 的定义皆与第一实施例相同，在此不加以赘述。

[0194] 配合表三可推算出下列数据：

[0195]

第二实施例			
f (mm)	4.69	|f/f6|+|f/f7|	4.10
Fno	2.00	f/f7	-2.22
HFOV (度)	39.9	SAG52+CT5 (mm)	-0.44
V1-V2	32.6	Yc72/f	0.40
CTmin (mm)	0.240	Td/f	1.11
R14/R13	-0.54	FOV (度)	79.8
R14/f	0.39	TTL/ImgH	1.58
|f/f3|+|f/f4|	0.73		

[0196] ＜第三实施例＞

[0197] 请参照图 5 及图 6，其中图 5 绘示依照本实用新型第三实施例的一种光学影像拾取系统组的示意图，图 6 由左至右依序为第三实施例的光学影像拾取系统组的球差、像散

及歪曲曲线图。由图 5 可知，光学影像拾取系统组由物侧至像侧依序包含光圈 300、第一透镜 310、第二透镜 320、第三透镜 330、第四透镜 340、第五透镜 350、第六透镜 360、第七透镜 370、红外线滤除滤光片 390、成像面 380 以及影像感测元件 381。

[0198] 第一透镜 310 具有正屈折力，其物侧表面 311 为凸面、像侧表面 312 为凹面，并皆为非球面，且第一透镜 310 为塑胶材质。

[0199] 第二透镜 320 具有负屈折力，其物侧表面 321 为凸面、像侧表面 322 为凹面，并皆为非球面，且第二透镜 320 为塑胶材质。

[0200] 第三透镜 330 具有负屈折力，其物侧表面 331 为凸面、像侧表面 332 为凹面，并皆为非球面，且第三透镜 330 为塑胶材质。

[0201] 第四透镜 340 具有正屈折力，其物侧表面 341 为凸面、像侧表面 342 为凹面，并皆为非球面，且第四透镜 340 为塑胶材质。

[0202] 第五透镜 350 具有负屈折力，其物侧表面 351 为凹面、像侧表面 352 为凸面，并皆为非球面，且第五透镜 350 为塑胶材质。

[0203] 第六透镜 360 具有正屈折力，其物侧表面 361 为凸面且由近光轴至边缘存在由凸面转凹面的变化，其像侧表面 362 为凸面，并皆为非球面，且第六透镜 360 为塑胶材质。

[0204] 第七透镜 370 具有负屈折力，其物侧表面 371 为凸面、像侧表面 372 为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜 370 为塑胶材质。另外，第七透镜 370 的像侧表面 372 具有反曲点。

[0205] 红外线滤除滤光片 390 为玻璃材质，设置于第七透镜 370 及成像面 380 之间，其不影响光学影像拾取系统组的焦距。

[0206] 请配合参照下列表五以及表六。

[0207]

表五、第三实施例							
f(焦距) = 5.20 mm, Fno(光圈值) = 2.20, HFOV(半视角) = 40.3 度							
表面		曲率半径	厚度	材质	折射率	色散系数	焦距
0	被摄物	平面	无限				
1	光圈	平面	-0.247				
2	第一透镜	2.767090 (ASP)	0.539	塑胶	1.544	55.9	6.38
3		12.665200 (ASP)	0.099				

[0208]

4	第二透镜	5.044800 (ASP)	0.270	塑胶	1.634	23.8	-15.43
5		3.259300 (ASP)	0.368				
6	第三透镜	10.920300 (ASP)	0.462	塑胶	1.544	55.9	-34.51
7		6.802200 (ASP)	0.085				
8	第四透镜	3.989400 (ASP)	0.419	塑胶	1.544	55.9	7.64
9		96.088900 (ASP)	0.646				
10	第五透镜	-2.064730 (ASP)	0.350	塑胶	1.634	23.8	-8.46
11		-3.577300 (ASP)	0.070				
12	第六透镜	10.886400 (ASP)	1.152	塑胶	1.535	56.3	2.85
13		-1.703910 (ASP)	0.097				
14	第七透镜	15.384600 (ASP)	0.923	塑胶	1.535	56.3	-2.80
15		1.336710 (ASP)	0.900				
16	红外线滤除滤光片	平面	0.300	玻璃	1.517	64.2	-
17		平面	0.422				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0209]

表六、非球面系数					
表面	2	3	4	5	6
k =	3.52553E-01	-3.37368E+01	-9.47575E+00	-6.02858E+00	3.00000E+00
A4 =	-1.85103E-03	-4.12408E-02	-8.08093E-02	-4.19419E-02	-9.49326E-03
A6 =	-3.40118E-03	4.54419E-02	6.96078E-02	3.07246E-02	-1.02428E-02
A8 =	7.83761E-03	-2.38616E-02	-3.13092E-02	-1.31529E-02	1.38652E-03
A10 =	-1.11780E-02	-2.36325E-03	5.29695E-04	2.75455E-03	-1.05695E-03
A12 =	7.49400E-03	7.59632E-03	5.01418E-03	-1.11157E-03	
A14 =	-2.25623E-03	-3.29843E-03	-2.22181E-03	2.12214E-04	
表面	7	8	9	10	11
k =	-6.24200E-01	-1.60325E+01	-2.00000E+01	-1.50067E+00	-8.18413E+00
A4 =	-4.44571E-02	-2.44682E-02	-1.02379E-02	8.48765E-02	2.22208E-02
A6 =	3.51367E-03	-1.31705E-02	-2.07363E-02	-8.98396E-02	-3.01459E-02
A8 =	-3.87828E-03	3.00348E-03	3.71865E-03	4.18718E-02	1.25384E-02
A10 =	-3.59950E-04	-6.35328E-04	2.26563E-04	-1.47834E-02	-3.88355E-03
A12 =		-4.41456E-04	-4.60637E-05	3.82222E-03	8.20642E-04
A14 =		1.91129E-04	5.60135E-05	-4.33119E-04	-6.93937E-05
表面	12	13	14	15	
k =	-1.55961E+01	-5.41368E+00	-1.00000E+00	-4.99510E+00	
A4 =	-3.68193E-02	-2.75200E-02	-5.52252E-02	-2.04338E-02	
A6 =	1.63940E-02	1.17221E-03	8.08138E-03	3.00855E-03	
A8 =	-4.13324E-03	4.36791E-03	-2.17936E-04	-3.08074E-04	
A10 =	3.21097E-04	-1.34050E-03	-2.60573E-05	1.95617E-05	
A12 =	1.44523E-05	1.57879E-04	-8.43969E-07	-7.52512E-07	
A14 =	-2.23880E-06	-7.06951E-06	1.80932E-07	1.29525E-08	

[0210] 第三实施例中，非球面的曲线方程式表示如第一实施例的形式。此外，f、Fno、HFOV、V1、V2、CTmin、R13、R14、f3、f4、f6、f7、SAG52、CT5、Yc72、Td、FOV、TTL 以及 ImgH 的定义皆与第一实施例相同，在此不加以赘述。

[0211] 配合表五可推算出下列数据：

[0212]

第三实施例			
f (mm)	5.20	|f/f6|+|f/f7|	3.68
Fno	2.20	f/f7	-1.85
HFOV (度)	40.3	SAG52+CT5 (mm)	-0.16
V1-V2	32.1	Yc72/f	0.49
CTmin (mm)	0.270	Td/f	1.05
R14/R13	0.09	FOV (度)	80.6
R14/f	0.26	TTL/ImgH	1.56
|f/f3|+|f/f4|	0.83		

[0213] 〈第四实施例〉

[0214] 请参照图 7 及图 8，其中图 7 绘示依照本实用新型第四实施例的一种光学影像拾取系统组的示意图，图 8 由左至右依序为第四实施例的光学影像拾取系统组的球差、像散及歪曲曲线图。由图 7 可知，光学影像拾取系统组由物侧至像侧依序包含第一透镜 410、第二透镜 420、光圈 400、第三透镜 430、第四透镜 440、第五透镜 450、第六透镜 460、第七透镜 470、红外线滤除滤光片 490、成像面 480 以及影像感测元件 481。

[0215] 第一透镜 410 具有正屈折力，其物侧表面 411 为凸面、像侧表面 412 为凹面，并皆为非球面，且第一透镜 410 为塑胶材质。

[0216] 第二透镜 420 具有负屈折力，其物侧表面 421 为凸面、像侧表面 422 为凹面，并皆为非球面，且第二透镜 420 为塑胶材质。

[0217] 第三透镜 430 具有负屈折力，其物侧表面 431 为凹面、像侧表面 432 为凸面，并皆为非球面，且第三透镜 430 为塑胶材质。

[0218] 第四透镜 440 具有正屈折力，其物侧表面 441 及像侧表面 442 皆为凸面，并皆为非球面，且第四透镜 440 为塑胶材质。

[0219] 第五透镜 450 具有负屈折力，其物侧表面 451 为凹面、像侧表面 452 为凸面，并皆为非球面，且第五透镜 450 为塑胶材质。

[0220] 第六透镜 460 具有正屈折力，其物侧表面 461 为凸面且由近光轴至边缘存在由凸面转凹面的变化，其像侧表面 462 为凸面，并皆为非球面，且第六透镜 460 为塑胶材质。

[0221] 第七透镜 470 具有负屈折力，其物侧表面 471 为凹面，其像侧表面 472 为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜 470 为塑胶材质。另外，第七透镜 470 的像侧表面 472 具有反曲点。

[0222] 红外线滤除滤光片 490 为玻璃材质，设置于第七透镜 470 及成像面 480 之间，其不影响光学影像拾取系统组的焦距。

[0223] 请配合参照下列表七以及表八。

[0224]

表七、第四实施例							
f(焦距) = 4.61 mm, Fno(光圈值) = 2.30, HFOV(半視角) = 37.5 度							
表面		曲率半径	厚度	材质	折射率	色散系数	焦距
0	被摄物	平面	无限				
1	第一透镜	2.389670 (ASP)	0.633	塑胶	1.544	55.9	4.60
2		46.838100 (ASP)	0.047				
3	第二透镜	8.712400 (ASP)	0.240	塑胶	1.640	23.3	-15.14
4		4.537300 (ASP)	0.091				
5	光圈	平面	0.208				
6	第三透镜	-12.471700 (ASP)	0.237	塑胶	1.640	23.3	-26.34
7		-48.317500 (ASP)	0.222				
8	第四透镜	6.178900 (ASP)	0.462	塑胶	1.544	55.9	8.37
9		-16.846700 (ASP)	0.521				
10	第五透镜	-1.097580 (ASP)	0.280	塑胶	1.650	21.4	-8.13
11		-1.524590 (ASP)	0.035				
12	第六透镜	4.355700 (ASP)	0.802	塑胶	1.544	55.9	3.20
13		-2.706150 (ASP)	0.504				
14	第七透镜	-4.028200 (ASP)	0.703	塑胶	1.535	56.3	-2.82
15		2.559930 (ASP)	0.500				
16	红外线滤除滤光片	平面	0.300	玻璃	1.517	64.2	-
17		平面	0.315				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0225]

表八、非球面系数

[0226]

表面	1	2	3	4	6
k =	1.57610E+00	0.00000E+00	2.24432E+01	-9.81610E+00	0.00000E+00
A4 =	-7.07207E-03	-2.87756E-02	-9.04706E-02	-6.10678E-02	-4.44285E-02
A6 =	-1.73645E-02	7.01684E-02	1.09158E-01	3.92193E-02	-2.89024E-03
A8 =	2.79532E-02	-4.79826E-02	-7.54503E-02	-9.10816E-03	3.45020E-03
A10 =	-3.14039E-02	-9.04108E-04	9.41003E-03	-1.62587E-02	-1.87971E-02
A12 =	1.74531E-02	1.24907E-02	1.80847E-02	1.36062E-02	
A14 =	-4.70458E-03	-3.66630E-03	-5.00907E-03	1.38208E-03	
表面	7	8	9	10	11
k =	0.00000E+00	-2.96150E+01	-2.00000E+01	-2.26652E+00	-4.54917E+00
A4 =	-6.62324E-02	-7.68638E-02	-5.17014E-02	1.10874E-01	1.52213E-02
A6 =	2.37827E-02	1.57132E-04	-3.08132E-02	-1.74659E-01	-5.08872E-02
A8 =	-3.96313E-03	6.90401E-03	6.97349E-03	9.48529E-02	2.77209E-02
A10 =	-1.35674E-02	-1.61108E-03	1.31243E-03	-4.06977E-02	-1.11489E-02
A12 =		-4.41316E-04	-2.05109E-04	1.37104E-02	2.97559E-03
A14 =		3.73746E-04	1.46854E-04	-2.37068E-03	-2.24668E-04
表面	12	13	14	15	
k =	1.18222E+00	-4.28114E+00	-1.42975E+00	-1.14325E+01	
A4 =	-6.34381E-02	7.42374E-03	-4.49002E-02	-2.28851E-02	
A6 =	2.49561E-02	-8.55673E-03	7.09692E-03	3.88514E-03	
A8 =	-7.40096E-03	8.95202E-03	-3.08539E-04	-6.48704E-04	
A10 =	5.43575E-04	-3.66943E-03	1.94081E-05	5.58332E-05	
A12 =	-2.86123E-05	5.92930E-04	7.86735E-06	-1.82732E-06	
A14 =	1.63381E-05	-2.99776E-05	-6.29814E-07	-9.15485E-09	

[0227] 第四实施例中，非球面的曲线方程式表示如第一实施例的形式。此外，f、Fno、HFOV、V1、V2、CTmin、R13、R14、f3、f4、f6、f7、SAG52、CT5、Yc72、Td、FOV、TTL 以及 ImgH 的定义皆与第一实施例相同，在此不加以赘述。

[0228] 配合表七可推算出下列数据：

[0229]

第四实施例			
f (mm)	4.61	|f/f6|+|f/f7|	3.07
Fno	2.30	f/f7	-1.63
HFOV (度)	37.5	SAG52+CT5 (mm)	-0.32
V1-V2	32.6	Yc72/f	0.37
CTmin (mm)	0.237	Td/f	1.08
R14/R13	-0.64	FOV (度)	75.0
R14/f	0.56	TTL/ImgH	1.67
|f/f3|+|f/f4|	0.73		

[0230] 〈第五实施例〉

[0231] 请参照图 9 及图 10，其中图 9 绘示依照本实用新型第五实施例的一种光学影像拾取系统组的示意图，图 10 由左至右依序为第五实施例的光学影像拾取系统组的球差、像散及歪曲曲线图。由图 9 可知，光学影像拾取系统组由物侧至像侧依序包含光圈 500、第一透镜 510、第二透镜 520、第三透镜 530、第四透镜 540、第五透镜 550、第六透镜 560、第七透镜 570、红外线滤除滤光片 590、成像面 580 以及影像感测元件 581。

[0232] 第一透镜 510 具有正屈折力，其物侧表面 511 及像侧表面 512 皆为凸面，并皆为非球面，且第一透镜 510 为塑胶材质。

[0233] 第二透镜 520 具有负屈折力，其物侧表面 521 为凸面、像侧表面 522 为凹面，并皆为非球面，且第二透镜 520 为塑胶材质。

[0234] 第三透镜 530 具有正屈折力，其物侧表面 531 及像侧表面 532 皆为凸面，并皆为非球面，且第三透镜 530 为塑胶材质。

[0235] 第四透镜 540 具有正屈折力，其物侧表面 541 为凸面、像侧表面 542 为凹面，并皆为非球面，且第四透镜 540 为塑胶材质。

[0236] 第五透镜 550 具有负屈折力，其物侧表面 551 为凹面、像侧表面 552 为凸面，并皆为非球面，且第五透镜 550 为塑胶材质。

[0237] 第六透镜 560 具有正屈折力，其物侧表面 561 为凸面且由近光轴至边缘存在由凸面转凹面的变化，其像侧表面 562 为凸面，并皆为非球面，且第六透镜 560 为塑胶材质。

[0238] 第七透镜 570 具有负屈折力，其物侧表面 571 为凹面，其像侧表面 572 为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜 570 为塑胶材质。另外，第七透镜 570 的像侧表面 572 具有反曲点。

[0239] 红外线滤除滤光片 590 为玻璃材质，设置于第七透镜 570 及成像面 580 之间，其不影响光学影像拾取系统组的焦距。

[0240] 请配合参照下列表九以及表十。

[0241]

表九、第五实施例

f(焦距) = 3.74 mm, Fno(光圈值) = 2.10, HFOV(半视角) = 38.7 度

表面		曲率半径	厚度	材质	折射率	色散系数	焦距
0	被摄物	平面	无限				
1	光圈	平面	-0.200				

[0242]

2	第一透镜	2.036410 (ASP)	0.498	塑胶	1.544	55.9	3.47
3		-23.551600 (ASP)	0.030				
4	第二透镜	2.627980 (ASP)	0.220	塑胶	1.650	21.4	-7.14
5		1.622050 (ASP)	0.426				
6	第三透镜	248.664500 (ASP)	0.508	塑胶	1.544	55.9	69.73
7		-44.742700 (ASP)	0.132				
8	第四透镜	4.625300 (ASP)	0.365	塑胶	1.544	55.9	10.43
9		24.281800 (ASP)	0.241				
10	第五透镜	-1.596190 (ASP)	0.250	塑胶	1.650	21.4	-8.74
11		-2.357310 (ASP)	0.030				
12	第六透镜	3.574000 (ASP)	0.825	塑胶	1.544	55.9	2.53
13		-2.063240 (ASP)	0.457				
14	第七透镜	-1.894410 (ASP)	0.320	塑胶	1.544	55.9	-2.04
15		2.837640 (ASP)	0.350				
16	红外线滤除滤光片	平面	0.145	玻璃	1.517	64.2	-
17		平面	0.204				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0243]

表十、非球面系数					
表面	2	3	4	5	6
k =	2.20625E+00	-1.00000E+00	7.37774E-01	-4.60870E+00	-8.50000E+00
A4 =	-1.75513E-02	3.06838E-02	-1.27831E-01	-3.67140E-02	-2.57989E-02
A6 =	-3.96576E-02	5.61015E-02	1.53096E-01	9.14770E-02	-1.55297E-02
A8 =	8.70611E-02	-1.17110E-01	-1.43188E-01	-1.02582E-01	2.26274E-02
A10 =	-1.76322E-01	9.72894E-02	-1.49053E-02	5.13291E-02	-3.91197E-02
A12 =	1.67677E-01	-2.38813E-02	1.03153E-01	-1.57919E-02	1.70202E-02
A14 =	-7.01622E-02	-9.74824E-03	-5.68855E-02	3.40552E-03	
表面	7	8	9	10	11
k =	-1.00000E+00	-1.25015E+01	-1.00000E+00	-3.56188E+00	-1.35942E+01
A4 =	-1.05499E-01	-1.38805E-01	-6.34312E-02	2.42110E-01	8.14332E-02
A6 =	3.32319E-02	4.14127E-03	-4.60031E-02	-3.21783E-01	-1.10006E-01
A8 =	-1.93231E-02	1.53781E-02	1.16320E-02	2.32868E-01	6.91190E-02
A10 =	-7.07693E-03	-1.01486E-02	-2.46831E-03	-1.42663E-01	-3.64787E-02
A12 =	2.21073E-03	-9.20265E-03	-8.59666E-04	5.87983E-02	1.28753E-02
A14 =		4.46565E-03	1.74660E-03	-9.87907E-03	-1.75963E-03
表面	12	13	14	15	
k =	-3.39853E+00	-4.40903E+00	-2.12503E+00	-2.00964E+01	
A4 =	-1.07531E-01	-1.45461E-02	-4.53039E-02	-2.63996E-02	
A6 =	4.54702E-02	-1.61418E-02	1.65877E-02	6.43803E-03	
A8 =	-1.84675E-02	2.48627E-02	-8.83767E-04	-1.44751E-03	
A10 =	2.21076E-03	-1.18993E-02	-8.66834E-05	1.61180E-04	
A12 =	-2.65924E-04	2.54456E-03	-3.82312E-06	-1.33173E-05	
A14 =	1.12042E-04	-2.06928E-04	1.23641E-06	6.78805E-07	

[0244] 第五实施例中，非球面的曲线方程式表示如第一实施例的形式。此外，f、Fno、HFOV、V1、V2、CTmin、R13、R14、f3、f4、f6、f7、SAG52、CT5、Yc72、Td、FOV、TTL 以及 ImgH 的定义皆与第一实施例相同，在此不加以赘述。

[0245] 配合表九可推算出下列数据：

[0246]

第五实施例			
f (mm)	3.74	|f/f6|+|f/f7|	3.31
Fno	2.10	f/f7	-1.83
HFOV (度)	38.7	SAG52+CT5 (mm)	-0.05
V1-V2	34.5	Yc72/f	0.40
CTmin (mm)	0.220	Td/f	1.15
R14/R13	-1.50	FOV (度)	77.4
R14/f	0.76	TTL/ImgH	1.62
|f/f3|+|f/f4|	0.41		

[0247] 〈第六实施例〉

[0248] 请参照图 11 及图 12，其中图 11 绘示依照本实用新型第六实施例的一种光学影像拾取系统组的示意图，图 12 由左至右依序为第六实施例的光学影像拾取系统组的球差、像散及歪曲曲线图。由图 11 可知，光学影像拾取系统组由物侧至像侧依序包含光圈 600、第一透镜 610、第二透镜 620、第三透镜 630、第四透镜 640、第五透镜 650、第六透镜 660、第七透镜 670、红外线滤除滤光片 690、成像面 680 以及影像感测元件 681。

[0249] 第一透镜 610 具有正屈折力，其物侧表面 611 及像侧表面 612 皆为凸面，并皆为非球面，且第一透镜 610 为塑胶材质。

[0250] 第二透镜 620 具有负屈折力，其物侧表面 621 为凸面、像侧表面 622 为凹面，并皆为非球面，且第二透镜 620 为塑胶材质。

[0251] 第三透镜 630 具有负屈折力，其物侧表面 631 及像侧表面 632 皆为凹面，并皆为非球面，且第三透镜 630 为塑胶材质。

[0252] 第四透镜 640 具有正屈折力，其物侧表面 641 及像侧表面 642 皆为凸面，并皆为非球面，且第四透镜 640 为塑胶材质。

[0253] 第五透镜 650 具有负屈折力，其物侧表面 651 为凹面、像侧表面 652 为凸面，并皆为非球面，且第五透镜 650 为塑胶材质。

[0254] 第六透镜 660 具有正屈折力，其物侧表面 661 为凹面、像侧表面 662 为凸面，并皆为非球面，且第六透镜 660 为塑胶材质。

[0255] 第七透镜 670 具有负屈折力，其物侧表面 671 为凸面、像侧表面 672 为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜 670 为塑胶材质。另外，第七透镜 670 的像侧表面 672 具有反曲点。

[0256] 红外线滤除滤光片 690 为玻璃材质，设置于第七透镜 670 及成像面 680 之间，其不影响光学影像拾取系统组的焦距。

[0257] 请配合参照下列表十一以及表十二。

[0258]

表十一、第六实施例							
f(焦距) = 5.38 mm, Fno(光圈值) = 2.20, HFOV(半視角) = 39.1 度							
表面		曲率半径	厚度	材质	折射率	色散系数	焦距
0	被摄物	平面	无限				
1	光圈	平面	-0.240				
2	第一透镜	2.999970 (ASP)	0.606	塑胶	1.544	55.9	5.29
3		-67.612600 (ASP)	0.072				
4	第二透镜	8.567900 (ASP)	0.273	塑胶	1.634	23.8	-14.38
5		4.361700 (ASP)	0.509				
6	第三透镜	-26.055100 (ASP)	0.471	塑胶	1.544	55.9	-18.30
7		16.219900 (ASP)	0.098				
8	第四透镜	4.863200 (ASP)	0.586	塑胶	1.544	55.9	6.92
9		-15.971000 (ASP)	0.637				
10	第五透镜	-1.609130 (ASP)	0.330	塑胶	1.634	23.8	-8.17
11		-2.520100 (ASP)	0.070				
12	第六透镜	-25.286300 (ASP)	0.823	塑胶	1.535	56.3	3.27
13		-1.653350 (ASP)	0.051				
14	第七透镜	28.203800 (ASP)	1.235	塑胶	1.535	56.3	-3.15
15		1.564750 (ASP)	0.900				
16	红外线滤除滤光片	平面	0.300	玻璃	1.517	64.2	-
17		平面	0.376				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0259]

表十二、非球面系数

[0260]

表面	2	3	4	5	6
k =	4.01544E-01	-5.00000E+01	-8.42402E+00	-9.30597E+00	3.00000E+00
A4 =	-1.56440E-03	-3.80636E-02	-8.19776E-02	-4.68550E-02	-1.24630E-02
A6 =	-2.89629E-03	4.41253E-02	6.66015E-02	2.79083E-02	-7.20040E-03
A8 =	5.74626E-03	-2.40812E-02	-3.05395E-02	-1.33958E-02	6.99479E-04
A10 =	-9.82788E-03	-1.13343E-03	9.24213E-04	3.07751E-03	-1.24872E-03
A12 =	7.50285E-03	7.58909E-03	5.01905E-03	-1.11147E-03	
A14 =	-2.25574E-03	-3.29879E-03	-2.22159E-03	2.12328E-04	
表面	7	8	9	10	11
k =	-9.69905E+00	-2.00000E+01	-3.24011E+00	-1.08216E+00	-2.91816E+00
A4 =	-4.82613E-02	-2.98065E-02	-6.80002E-03	8.05669E-02	2.11134E-02
A6 =	3.37685E-03	-1.29738E-02	-2.28135E-02	-8.91292E-02	-3.01124E-02
A8 =	-2.79449E-03	2.81599E-03	3.46632E-03	4.20982E-02	1.24422E-02
A10 =	-9.37756E-05	-6.72440E-04	2.15464E-07	-1.47389E-02	-3.90392E-03
A12 =		-4.96332E-04	-1.38855E-04	3.81920E-03	8.23878E-04
A14 =		1.90099E-04	4.01335E-05	-4.44578E-04	-6.55653E-05
表面	12	13	14	15	
k =	5.00000E+00	-3.91428E+00	-1.00000E+00	-5.65225E+00	
A4 =	-3.12302E-02	-2.53693E-02	-4.42218E-02	-1.83434E-02	
A6 =	1.47040E-02	1.66451E-03	7.06313E-03	2.88292E-03	
A8 =	-4.37468E-03	4.26941E-03	-2.47434E-04	-3.18087E-04	
A10 =	3.12703E-04	-1.35527E-03	-2.49118E-05	2.05537E-05	
A12 =	1.96691E-05	1.57833E-04	-5.34985E-07	-7.48457E-07	
A14 =	-9.39014E-07	-6.65177E-06	1.89711E-07	1.10386E-08	

[0261] 第六实施例中，非球面的曲线方程式表示如第一实施例的形式。此外，f、Fno、HFOV、V1、V2、CTmin、R13、R14、f3、f4、f6、f7、SAG52、CT5、Yc72、Td、FOV、TTL 以及 ImgH 的定义皆与第一实施例相同，在此不加以赘述。

[0262] 配合表十一可推算出下列数据：

[0263]

第六实施例			
f (mm)	5.38	|f/f6|+|f/f7|	3.35
Fno	2.20	f/f7	-1.71
HFOV (度)	39.1	SAG52+CT5 (mm)	-0.41
V1-V2	32.1	Yc72/f	0.48
CTmin (mm)	0.273	Td/f	1.07
R14/R13	0.06	FOV (度)	78.2
R14/f	0.29	TTL/ImgH	1.61
|f/f3|+|f/f4|	1.07		

[0264] 〈第七实施例〉

[0265] 请参照图 13 及图 14，其中图 13 绘示依照本实用新型第七实施例的一种光学影像拾取系统组的示意图，图 14 由左至右依序为第七实施例的光学影像拾取系统组的球差、像散及歪曲曲线图。由图 13 可知，光学影像拾取系统组由物侧至像侧依序包含第一透镜 710、光圈 700、第二透镜 720、第三透镜 730、第四透镜 740、第五透镜 750、第六透镜 760、第七透镜 770、红外线滤除滤光片 790、成像面 780 以及影像感测元件 781。

[0266] 第一透镜 710 具有正屈折力，其物侧表面 711 及像侧表面 712 皆为凸面，并皆为非球面，且第一透镜 710 为塑胶材质。

[0267] 第二透镜 720 具有负屈折力，其物侧表面 721 及像侧表面 722 皆为凹面，并皆为非球面，且第二透镜 720 为塑胶材质。

[0268] 第三透镜 730 具有负屈折力，其物侧表面 731 为凹面、像侧表面 732 为凸面，并皆为非球面，且第三透镜 730 为塑胶材质。

[0269] 第四透镜 740 具有正屈折力，其物侧表面 741 及像侧表面 742 皆为凸面，并皆为非球面，且第四透镜 740 为塑胶材质。

[0270] 第五透镜 750 具有负屈折力，其物侧表面 751 为凹面、像侧表面 752 为凸面，并皆为非球面，且第五透镜 750 为塑胶材质。

[0271] 第六透镜 760 具有正屈折力，其物侧表面 761 为凸面且由近光轴至边缘存在由凸面转凹面的变化，其像侧表面 762 为凸面，并皆为非球面，且第六透镜 760 为塑胶材质。

[0272] 第七透镜 770 具有负屈折力，其物侧表面 771 为凹面，其像侧表面 772 为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜 770 为塑胶材质。另外，第七透镜 770 的像侧表面 772 具有反曲点。

[0273] 红外线滤除滤光片 790 为玻璃材质，设置于第七透镜 770 及成像面 780 之间，其不影响光学影像拾取系统组的焦距。

[0274] 请配合参照下列表十三以及表十四。

[0275]

表十三、第七实施例

f(焦距) = 4.70 mm, Fno(光圈值) = 2.05, HFOV(半视角) = 39.9 度

表面		曲率半径	厚度	材质	折射率	色散系数	焦距
0	被摄物	平面	无限				
1	第一透镜	2.552000 (ASP)	0.644	塑胶	1.544	55.9	4.51

[0276]

2		-59.234700 (ASP)	-0.019				
3	光圈	平面	0.087				
4	第二透镜	-36.697200 (ASP)	0.271	塑胶	1.650	21.4	-13.48
5		11.539200 (ASP)	0.443				
6	第三透镜	-9.405600 (ASP)	0.326	塑胶	1.544	55.9	-20.22
7		-65.634000 (ASP)	0.074				
8	第四透镜	5.508100 (ASP)	0.488	塑胶	1.544	55.9	8.43
9		-26.548500 (ASP)	0.512				
10	第五透镜	-1.455840 (ASP)	0.300	塑胶	1.650	21.4	-9.21
11		-2.080300 (ASP)	0.035				
12	第六透镜	5.526900 (ASP)	1.196	塑胶	1.544	55.9	2.63
13		-1.781640 (ASP)	0.381				
14	第七透镜	-3.779400 (ASP)	0.450	塑胶	1.530	55.8	-2.29
15		1.864430 (ASP)	0.700				
16	红外线滤除滤光片	平面	0.200	玻璃	1.517	64.2	-
17		平面	0.316				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0277]

表十四、非球面系数					
表面	1	2	4	5	6
k =	1.24996E+00	-5.00000E+01	-5.00000E+01	-5.00000E+01	-1.47280E+01
A4 =	-6.55257E-03	-5.28204E-02	-8.73850E-02	-5.59195E-02	-4.28602E-02
A6 =	-1.77310E-02	7.30552E-02	1.14595E-01	5.56109E-02	-1.89061E-02
A8 =	3.02431E-02	-4.28443E-02	-6.87772E-02	-3.99650E-02	6.43553E-03
A10 =	-3.30032E-02	-2.94210E-03	4.82093E-03	1.66795E-02	-4.33981E-03
A12 =	1.72237E-02	1.22346E-02	1.37324E-02	-3.82242E-03	-5.02596E-05
A14 =	-4.03478E-03	-3.93520E-03	-4.15965E-03	1.09866E-03	-4.36603E-09
表面	7	8	9	10	11
k =	-5.00000E+01	-5.00000E+01	3.00000E+00	-2.11829E+00	-7.16778E+00
A4 =	-8.75294E-02	-5.93688E-02	-3.06406E-02	1.22411E-01	2.60299E-02
A6 =	1.95170E-02	-8.93391E-03	-3.18133E-02	-1.71303E-01	-5.34072E-02
A8 =	-1.44992E-02	5.53314E-03	7.75816E-03	9.38898E-02	2.73223E-02
A10 =	2.16819E-03	-1.19246E-03	1.04262E-03	-4.15955E-02	-1.11730E-02
A12 =	4.65110E-04	-1.16400E-03	-4.08272E-04	1.36852E-02	2.93311E-03
A14 =	-4.14156E-04	5.27523E-04	-4.78330E-05	-1.99216E-03	-2.75785E-04
表面	12	13	14	15	
k =	2.13050E+00	-4.68712E+00	-1.92871E+01	-7.18320E+00	
A4 =	-5.78245E-02	-1.04836E-02	-5.71189E-02	-2.59797E-02	
A6 =	2.40501E-02	-7.74761E-03	6.98751E-03	4.42064E-03	
A8 =	-7.84867E-03	9.20324E-03	-1.87842E-04	-5.99594E-04	
A10 =	5.33907E-04	-3.68429E-03	5.07686E-06	5.25450E-05	
A12 =	-1.75044E-05	5.84664E-04	1.90670E-06	-2.78886E-06	
A14 =	1.26961E-05	-3.16505E-05	-2.77147E-07	6.51816E-08	

[0278] 第七实施例中，非球面的曲线方程式表示如第一实施例的形式。此外，f、Fno、HFOV、V1、V2、CTmin、R13、R14、f3、f4、f6、f7、SAG52、CT5、Yc72、Td、FOV、TTL 以及 ImgH 的定义皆与第一实施例相同，在此不加以赘述。

[0279] 配合表十三可推算出下列数据：

[0280]

第七实施例			
f (mm)	4.70	|f/f6|+|f/f7|	3.84
Fno	2.05	f/f7	-2.05
HFOV (度)	39.9	SAG52+CT5 (mm)	-0.32
V1-V2	34.5	Yc72/f	0.42
CTmin (mm)	0.271	Td/f	1.10
R14/R13	-0.49	FOV (度)	79.8
R14/f	0.40	TTL/ImgH	1.58
|f/f3|+|f/f4|	0.79		

[0281] 〈第八实施例〉

[0282] 请参照图 15 及图 16，其中图 15 绘示依照本实用新型第八实施例的一种光学影像拾取系统组的示意图，图 16 由左至右依序为第八实施例的光学影像拾取系统组的球差、像散及歪曲曲线图。由图 15 可知，光学影像拾取系统组由物侧至像侧依序包含第一透镜 810、光圈 800、第二透镜 820、第三透镜 830、第四透镜 840、第五透镜 850、第六透镜 860、第七透镜 870、红外线滤除滤光片 890、成像面 880 以及影像感测元件 881。

[0283] 第一透镜 810 具有正屈折力，其物侧表面 811 为凸面、像侧表面 812 为凹面，并皆为非球面，且第一透镜 810 为塑胶材质。

[0284] 第二透镜 820 具有负屈折力，其物侧表面 821 为凸面、像侧表面 822 为凹面，并皆为非球面，且第二透镜 820 为塑胶材质。

[0285] 第三透镜 830 具有正屈折力，其物侧表面 831 为凹面、像侧表面 832 为凸面，并皆为非球面，且第三透镜 830 为塑胶材质。

[0286] 第四透镜 840 具有正屈折力，其物侧表面 841 为凹面、像侧表面 842 为凸面，并皆为非球面，且第四透镜 840 为塑胶材质。

[0287] 第五透镜 850 具有负屈折力，其物侧表面 851 为凹面、像侧表面 852 为凸面，并皆为非球面，且第五透镜 850 为塑胶材质。

[0288] 第六透镜 860 具有正屈折力，其物侧表面 861 为凸面且由近光轴至边缘存在由凸面转凹面的变化，其像侧表面 862 为凸面，并皆为非球面，且第六透镜 860 为塑胶材质。

[0289] 第七透镜 870 具有负屈折力，其物侧表面 871 为凹面，其像侧表面 872 为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜 870 为塑胶材质。另外，第七透镜 870 的像侧表面 872 具有反曲点。

[0290] 红外线滤除滤光片 890 为玻璃材质，设置于第七透镜 870 及成像面 880 之间，其不影响光学影像拾取系统组的焦距。

[0291] 请配合参照下列表十五以及表十六。

[0292]

表十五、第八实施例							
f(焦距) = 5.08 mm, Fno(光圈值) = 2.20, HFOV(半视角) = 37.5 度							
表面		曲率半径	厚度	材质	折射率	色散系数	焦距
0	被摄物	平面	无限				
1	第一透镜	2.106050 (ASP)	0.727	塑胶	1.530	55.8	4.48
2		16.377300 (ASP)	0.058				
3	光圈	平面	0.042				
4	第二透镜	9.396400 (ASP)	0.240	塑胶	1.650	21.4	-11.76
5		4.171200 (ASP)	0.447				
6	第三透镜	-6.904700 (ASP)	0.449	塑胶	1.530	55.8	14.72
7		-3.745600 (ASP)	0.050				
8	第四透镜	-237.531700 (ASP)	0.364	塑胶	1.530	55.8	279.46
9		-91.271700 (ASP)	0.476				
10	第五透镜	-1.264930 (ASP)	0.300	塑胶	1.650	21.4	-10.79
11		-1.687700 (ASP)	0.090				
12	第六透镜	4.716500 (ASP)	0.612	塑胶	1.530	55.8	4.50
13		-4.604000 (ASP)	0.936				
14	第七透镜	-4.091400 (ASP)	0.460	塑胶	1.530	55.8	-3.60
15		3.720800 (ASP)	0.500				
16	红外线滤除滤光片	平面	0.200	玻璃	1.517	64.2	-
17		平面	0.294				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0293]

表十六、非球面系数					
表面	1	2	4	5	6
k =	8.90178E-01	-3.61096E-01	-3.83218E+01	-9.14738E+00	-1.98164E+01
A4 =	-4.95272E-03	-4.57358E-02	-9.83371E-02	-5.31829E-02	-3.94999E-02
A6 =	-1.44552E-02	5.29770E-02	1.11966E-01	6.97942E-02	-1.95451E-02
A8 =	2.49942E-02	-3.15473E-02	-6.31640E-02	-3.75623E-02	3.72584E-04
A10 =	-2.93336E-02	2.41746E-03	7.64209E-03	1.03095E-02	-8.46446E-03
A12 =	1.61703E-02	4.39750E-03	1.24249E-02	5.48284E-04	2.58665E-03
A14 =	-4.07081E-03	-1.46693E-03	-4.15965E-03	1.09866E-03	-1.17926E-08
表面	7	8	9	10	11
k =	-2.56555E+00	3.00000E+00	-1.03183E+00	-1.76852E+00	-3.42595E+00
A4 =	-6.18956E-02	-1.04186E-01	-5.10015E-02	1.55550E-01	3.32805E-02
A6 =	1.87497E-02	4.15342E-03	-2.98507E-02	-1.66325E-01	-5.00058E-02
A8 =	-1.53337E-02	8.38758E-03	9.54388E-03	9.12039E-02	2.70150E-02
A10 =	2.17052E-03	8.77193E-04	1.30623E-03	-4.24285E-02	-1.14852E-02
A12 =	1.95878E-03	-4.85466E-04	-4.86555E-04	1.37199E-02	2.89303E-03
A14 =	-4.05129E-04	1.22823E-05	8.10409E-06	-1.81567E-03	-2.38389E-04
表面	12	13	14	15	
k =	-6.58821E+00	-1.61451E+01	-2.62115E+00	-2.11643E+01	
A4 =	-6.25392E-02	-8.14410E-03	-4.42315E-02	-2.19259E-02	
A6 =	2.57139E-02	-7.65552E-03	7.71517E-03	3.60828E-03	
A8 =	-7.55747E-03	9.57982E-03	-2.57484E-04	-5.48595E-04	
A10 =	9.90623E-04	-3.64717E-03	-1.43974E-05	5.09581E-05	
A12 =	-1.45805E-04	5.80279E-04	7.50606E-07	-3.19315E-06	
A14 =	1.30850E-05	-3.36611E-05	-2.46540E-08	1.00041E-07	

[0294] 第八实施例中，非球面的曲线方程式表示如第一实施例的形式。此外，f、Fno、HFOV、V1、V2、CTmin、R13、R14、f3、f4、f6、f7、SAG52、CT5、Yc72、Td、FOV、TTL 以及 ImgH 的定义皆与第一实施例相同，在此不加以赘述。

[0295] 配合表十五可推算出下列数据：

[0296]

第八实施例			
f (mm)	5.08	|f/f6|+|f/f7|	2.54
Fno	2.20	f/f7	-1.41
HFOV (度)	37.5	SAG52+CT5 (mm)	-0.38
V1-V2	34.4	Yc72/f	0.30
CTmin (mm)	0.240	Td/f	1.03
R14/R13	-0.91	FOV (度)	75.0
R14/f	0.73	TTL/ImgH	1.54

[0297]

|f/f3|+|f/f4|	0.36		

[0298] <第九实施例>

[0299] 请参照图 17 及图 18，其中图 17 绘示依照本实用新型第九实施例的一种光学影像拾取系统组的示意图，图 18 由左至右依序为第九实施例的光学影像拾取系统组的球差、像散及歪曲曲线图。由图 17 可知，光学影像拾取系统组由物侧至像侧依序包含第一透镜 910、光圈 900、第二透镜 920、第三透镜 930、第四透镜 940、第五透镜 950、第六透镜 960、第七透镜 970、红外线滤除滤光片 990、成像面 980 以及影像感测元件 981。

[0300] 第一透镜 910 具有正屈折力，其物侧表面 911 为凸面、像侧表面 912 为凹面，并皆为非球面，且第一透镜 910 为塑胶材质。

[0301] 第二透镜 920 具有负屈折力，其物侧表面 921 为凸面、像侧表面 922 为凹面，并皆为非球面，且第二透镜 920 为塑胶材质。

[0302] 第三透镜 930 具有正屈折力，其物侧表面 931 为凹面、像侧表面 932 为凸面，并皆为非球面，且第三透镜 930 为塑胶材质。

[0303] 第四透镜 940 具有负屈折力，其物侧表面 941 及像侧表面 942 皆为凹面，并皆为非球面，且第四透镜 940 为塑胶材质。

[0304] 第五透镜 950 具有负屈折力，其物侧表面 951 为凹面、像侧表面 952 为凸面，并皆为非球面，且第五透镜 950 为塑胶材质。

[0305] 第六透镜 960 具有正屈折力，其物侧表面 961 为凸面且由近光轴至边缘存在由凸面转凹面的变化，其像侧表面 962 为凸面，并皆为非球面，且第六透镜 960 为塑胶材质。

[0306] 第七透镜 970 具有负屈折力，其物侧表面 971 为凹面，其像侧表面 972 为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜 970 为塑胶材质。另外，第七透镜 970 的像侧表面 972 具有反曲点。

[0307] 红外线滤除滤光片 990 为玻璃材质，设置于第七透镜 970 及成像面 980 之间，其不影响光学影像拾取系统组的焦距。

[0308] 请配合参照下列表十七以及表十八。

[0309]

表十七、第九实施例							
f(焦距) = 5.19 mm, Fno(光圈值) = 2.20, HFOV(半视角) = 36.9 度							
表面		曲率半径	厚度	材质	折射率	色散系数	焦距

[0310]

0	被摄物	平面	无限				
1	第一透镜	2.016660 (ASP)	0.778	塑胶	1.530	55.8	4.30
2		15.131600 (ASP)	0.073				
3	光圈	平面	0.030				
4	第二透镜	6.870700 (ASP)	0.240	塑胶	1.650	21.4	-10.88
5		3.436500 (ASP)	0.396				
6	第三透镜	-11.287400 (ASP)	0.443	塑胶	1.530	55.8	18.44
7		-5.309200 (ASP)	0.131				
8	第四透镜	-75.949000 (ASP)	0.275	塑胶	1.614	25.6	-28.98
9		23.276000 (ASP)	0.512				
10	第五透镜	-1.507460 (ASP)	0.306	塑胶	1.583	30.2	-30.36
11		-1.770930 (ASP)	0.090				
12	第六透镜	5.383000 (ASP)	0.640	塑胶	1.530	55.8	4.20
13		-3.638100 (ASP)	0.580				
14	第七透镜	-5.525900 (ASP)	0.460	塑胶	1.514	56.8	-3.47
15		2.704660 (ASP)	0.500				
16	红外线滤除滤光片	平面	0.200	玻璃	1.517	64.2	-
17		平面	0.574				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0311]

表十八、非球面系数					
表面	1	2	4	5	6
k =	7.06581E-01	1.43308E+00	-1.70988E+01	-6.76507E+00	-5.00000E+01
A4 =	-5.20571E-03	-4.45093E-02	-9.83870E-02	-5.12300E-02	-2.97615E-02
A6 =	-1.43494E-02	5.06872E-02	1.09598E-01	6.89375E-02	-1.00827E-02
A8 =	2.44478E-02	-2.98149E-02	-5.98233E-02	-3.70644E-02	-4.95992E-04
A10 =	-2.85733E-02	4.01557E-03	7.18376E-03	1.10013E-02	-1.06053E-02
A12 =	1.53650E-02	2.22862E-03	1.16900E-02	6.95250E-04	5.81239E-03
A14 =	-3.67572E-03	-7.58506E-04	-4.15965E-03	1.09866E-03	-1.37340E-08
表面	7	8	9	10	11
k =	-3.60203E+00	3.00000E+00	6.00756E-01	-1.33044E+00	-1.94664E+00
A4 =	-5.98240E-02	-1.39760E-01	-7.64183E-02	1.60132E-01	1.88715E-02
A6 =	1.66271E-02	-5.04354E-03	-2.27892E-02	-1.65334E-01	-4.82161E-02
A8 =	-1.72316E-02	7.79298E-03	1.09834E-02	8.79958E-02	2.72834E-02
A10 =	1.09129E-03	1.30186E-03	8.03602E-04	-4.25563E-02	-1.16685E-02
A12 =	2.17693E-03	-2.58667E-04	-4.59790E-04	1.38851E-02	2.87178E-03
A14 =	-2.13849E-04	3.54222E-04	1.04242E-04	-1.79214E-03	-1.95884E-04
表面	12	13	14	15	
k =	-3.16527E+01	-1.32837E+01	-2.00000E+01	-1.02392E+01	
A4 =	-7.21293E-02	-7.69920E-03	-4.22026E-02	-2.47789E-02	
A6 =	2.94689E-02	-8.05827E-03	7.35719E-03	3.72634E-03	
A8 =	-7.19999E-03	9.55590E-03	-2.91687E-04	-5.55536E-04	
A10 =	8.26684E-04	-3.64828E-03	-1.57467E-05	5.20424E-05	
A12 =	-1.98203E-04	5.79269E-04	8.72367E-07	-3.10945E-06	
A14 =	2.72684E-05	-3.34003E-05	1.39566E-08	9.28903E-08	

[0312] 第九实施例中，非球面的曲线方程式表示如第一实施例的形式。此外，f、Fno、HFOV、V1、V2、CTmin、R13、R14、f3、f4、f6、f7、SAG52、CT5、Yc72、Td、FOV、TTL 以及 ImgH 的定义皆与第一实施例相同，在此不加以赘述。

[0313] 配合表十七可推算出下列数据：

[0314]

第九实施例			
f (mm)	5.19	|f/f6|+|f/f7|	2.73
Fno	2.20	f/f7	-1.50
HFOV (度)	36.9	SAG52+CT5 (mm)	-0.48
V1-V2	34.4	Yc72/f	0.32
CTmin (mm)	0.240	Td/f	0.95
R14/R13	-0.49	FOV (度)	73.8
R14/f	0.52	TTL/ImgH	1.54
|f/f3|+|f/f4|	0.46		

[0315] 〈第十实施例〉

[0316] 请参照图 19 及图 20，其中图 19 绘示依照本实用新型第十实施例的一种光学影像拾取系统组的示意图，图 20 由左至右依序为第十实施例的光学影像拾取系统组的球差、像散及歪曲曲线图。由图 19 可知，光学影像拾取系统组由物侧至像侧依序包含光圈 1000、第一透镜 1010、第二透镜 1020、第三透镜 1030、第四透镜 1040、第五透镜 1050、第六透镜 1060、第七透镜 1070、红外线滤除滤光片 1090、成像面 1080 以及影像感测元件 1081。

[0317] 第一透镜 1010 具有正屈折力，其物侧表面 1011 为凸面、像侧表面 1012 为凹面，并皆为非球面，且第一透镜 1010 为玻璃材质。

[0318] 第二透镜 1020 具有负屈折力，其物侧表面 1021 及像侧表面 1022 皆为凹面，并皆为非球面，且第二透镜 1020 为塑胶材质。

[0319] 第三透镜 1030 具有负屈折力，其物侧表面 1031 为凸面、像侧表面 1032 为凹面，并皆为非球面，且第三透镜 1030 为塑胶材质。

[0320] 第四透镜 1040 具有正屈折力，其物侧表面 1041 为凸面、像侧表面 1042 为凹面，并皆为非球面，且第四透镜 1040 为塑胶材质。

[0321] 第五透镜 1050 具有负屈折力，其物侧表面 1051 为凹面、像侧表面 1052 为凸面，并皆为非球面，且第五透镜 1050 为塑胶材质。

[0322] 第六透镜 1060 具有正屈折力，其物侧表面 1061 为凸面且由近光轴至边缘存在由凸面转凹面的变化，其像侧表面 1062 为凸面，并皆为非球面，且第六透镜 1060 为塑胶材质。

[0323] 第七透镜 1070 具有负屈折力，其物侧表面 1071 为凸面、像侧表面 1072 为凹面且由近光轴至边缘存在由凹面转凸面的变化，并皆为非球面，且第七透镜 1070 为塑胶材质。另外，第七透镜 1070 的像侧表面 1072 具有反曲点。

[0324] 红外线滤除滤光片 1090 为玻璃材质，设置于第七透镜 1070 及成像面 1080 之间，其不影响光学影像拾取系统组的焦距。

[0325] 请配合参照下列表十九以及表二十。

[0326]

表十九、第十实施例							
f(焦距) = 4.88 mm, Fno(光圈值) = 2.15, HFOV(半视角) = 39.6 度							
表面		曲率半径	厚度	材质	折射率	色散系数	焦距
0	被摄物	平面	无限				
1	光圈	平面	-0.238				
2	第一透镜	2.545850 (ASP)	0.566	玻璃	1.566	61.1	5.15
3		18.457300 (ASP)	0.254				
4	第二透镜	-67.453600 (ASP)	0.270	塑胶	1.640	23.3	-9.77
5		6.896600 (ASP)	0.238				
6	第三透镜	14.079200 (ASP)	0.398	塑胶	1.544	55.9	-28.08
7		7.254400 (ASP)	0.050				
8	第四透镜	3.358300 (ASP)	0.391	塑胶	1.544	55.9	7.12
9		24.159000 (ASP)	0.620				
10	第五透镜	-2.101660 (ASP)	0.300	塑胶	1.640	23.3	-11.56
11		-3.099900 (ASP)	0.070				
12	第六透镜	10.558400 (ASP)	0.838	塑胶	1.544	55.9	3.12
13		-1.967170 (ASP)	0.402				
14	第七透镜	100.000000 (ASP)	0.613	塑胶	1.530	55.8	-2.72
15		1.418470 (ASP)	0.840				
16	红外线滤除滤光片	平面	0.250	玻璃	1.517	64.2	-
17		平面	0.278				
18	成像面	平面	-				
参考波长(d-line)为 587.6 nm							

[0327]

表二十、非球面系数					
表面	2	3	4	5	6
k =	2.61987E-01	3.00000E+00	0.00000E+00	-9.20422E+01	-2.83188E+00
A4 =	-3.63978E-03	-2.79071E-02	-7.95060E-02	-5.54800E-02	-2.96051E-02
A6 =	-3.09516E-03	3.95639E-02	9.01905E-02	5.13235E-02	-1.77213E-02
A8 =	1.03902E-02	-3.70198E-02	-5.81773E-02	-2.76094E-02	7.58927E-03
A10 =	-1.97431E-02	-8.45516E-05	5.72088E-03	7.40557E-03	-6.43235E-04
A12 =	1.60070E-02	1.62255E-02	1.07101E-02	-2.37428E-03	
A14 =	-5.53229E-03	-8.08778E-03	-5.44790E-03	5.20350E-04	
表面	7	8	9	10	11
k =	6.22360E-01	-1.95196E+01	-2.00000E+01	-1.44416E+00	-7.00358E+00
A4 =	-5.49905E-02	-3.10114E-02	-2.61120E-02	1.05443E-01	2.78749E-02
A6 =	1.85625E-03	-1.91982E-02	-2.68191E-02	-1.26072E-01	-4.36409E-02
A8 =	-6.56285E-03	5.12567E-03	8.18832E-03	6.70012E-02	2.00423E-02
A10 =	1.09821E-03	-7.72213E-04	2.09360E-04	-2.77086E-02	-7.25670E-03
A12 =		-1.17845E-03	-3.85316E-04	8.16094E-03	1.75013E-03
A14 =		4.68650E-04	1.37346E-04	-1.05290E-03	-1.58397E-04
表面	12	13	14	15	
k =	2.44764E+00	-7.56032E+00	-1.00000E+00	-5.83393E+00	
A4 =	-4.43411E-02	-2.49270E-02	-7.10947E-02	-2.94847E-02	
A6 =	2.32256E-02	1.35465E-03	1.19834E-02	5.04950E-03	
A8 =	-6.70400E-03	6.97483E-03	-2.89486E-04	-5.66326E-04	
A10 =	6.22040E-04	-2.49613E-03	-4.57341E-05	3.60309E-05	
A12 =	3.43416E-05	3.37937E-04	-2.10360E-06	-1.42065E-06	
A14 =	-8.28303E-06	-1.71240E-05	3.65101E-07	2.88039E-08	

[0328] 第十实施例中，非球面的曲线方程式表示如第一实施例的形式。此外，f、Fno、HFOV、V1、V2、CTmin、R13、R14、f3、f4、f6、f7、SAG52、CT5、Yc72、Td、FOV、TTL 以及 ImgH 的定义皆与第一实施例相同，在此不加以赘述。

[0329] 配合表十九可推算出下列数据：

[0330]

第十实施例			
f (mm)	4.88	|f/f6|+|f/f7|	3.36
Fno	2.15	f/f7	-1.79
HFOV (度)	39.6	SAG52+CT5 (mm)	-0.23
V1-V2	37.8	Yc72/f	0.43
CTmin (mm)	0.270	Td/f	1.03

[0331]

R14/R13	0.01	FOV (度)	79.2
R14/f	0.29	TTL/ImgH	1.54
|f/f3|+|f/f4|	0.86		

[0332] 虽然本实用新型已以实施方式揭露如上，然其并非用以限定本实用新型，任何熟悉此技艺者，在不脱离本实用新型的精神和范围内，当可作各种的更动与润饰，因此本实用新型的保护范围当视所附的权利要求书所界定的范围为准。

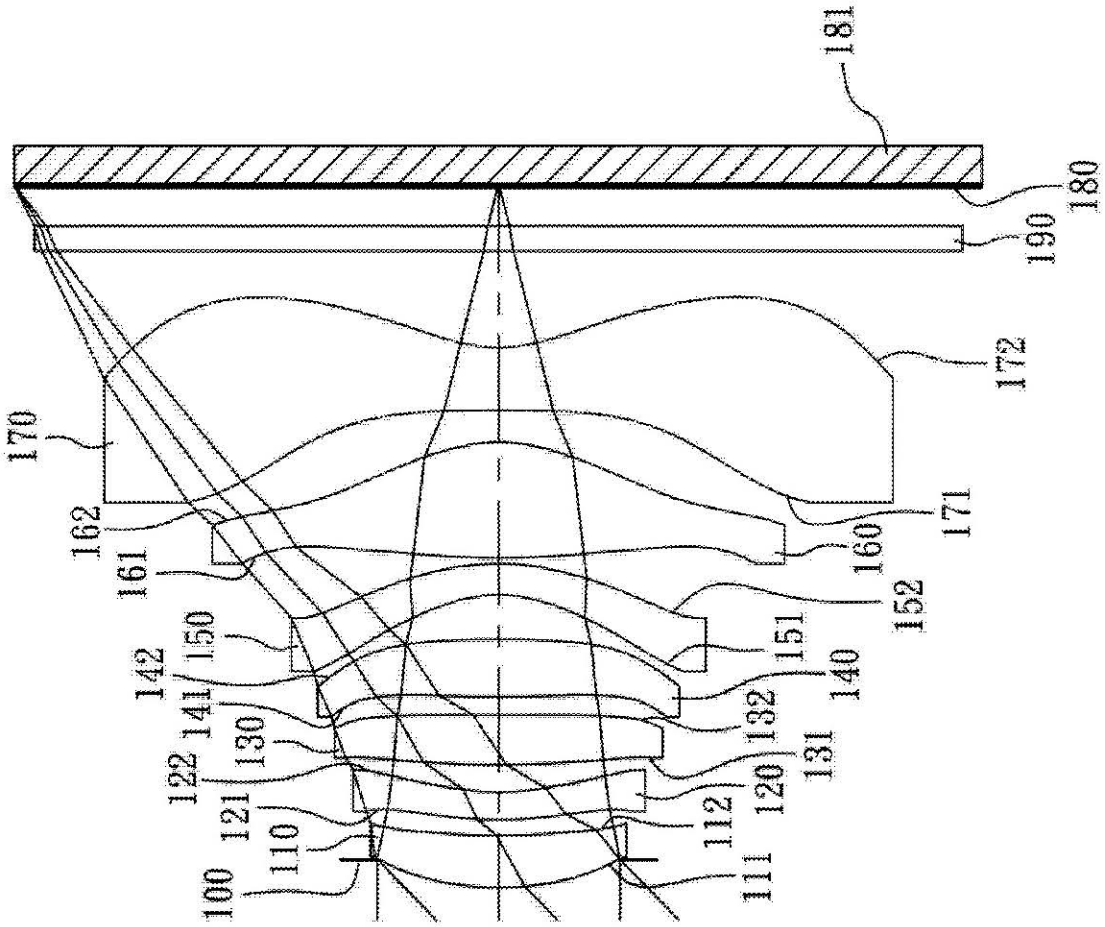

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110
111
100

图 1

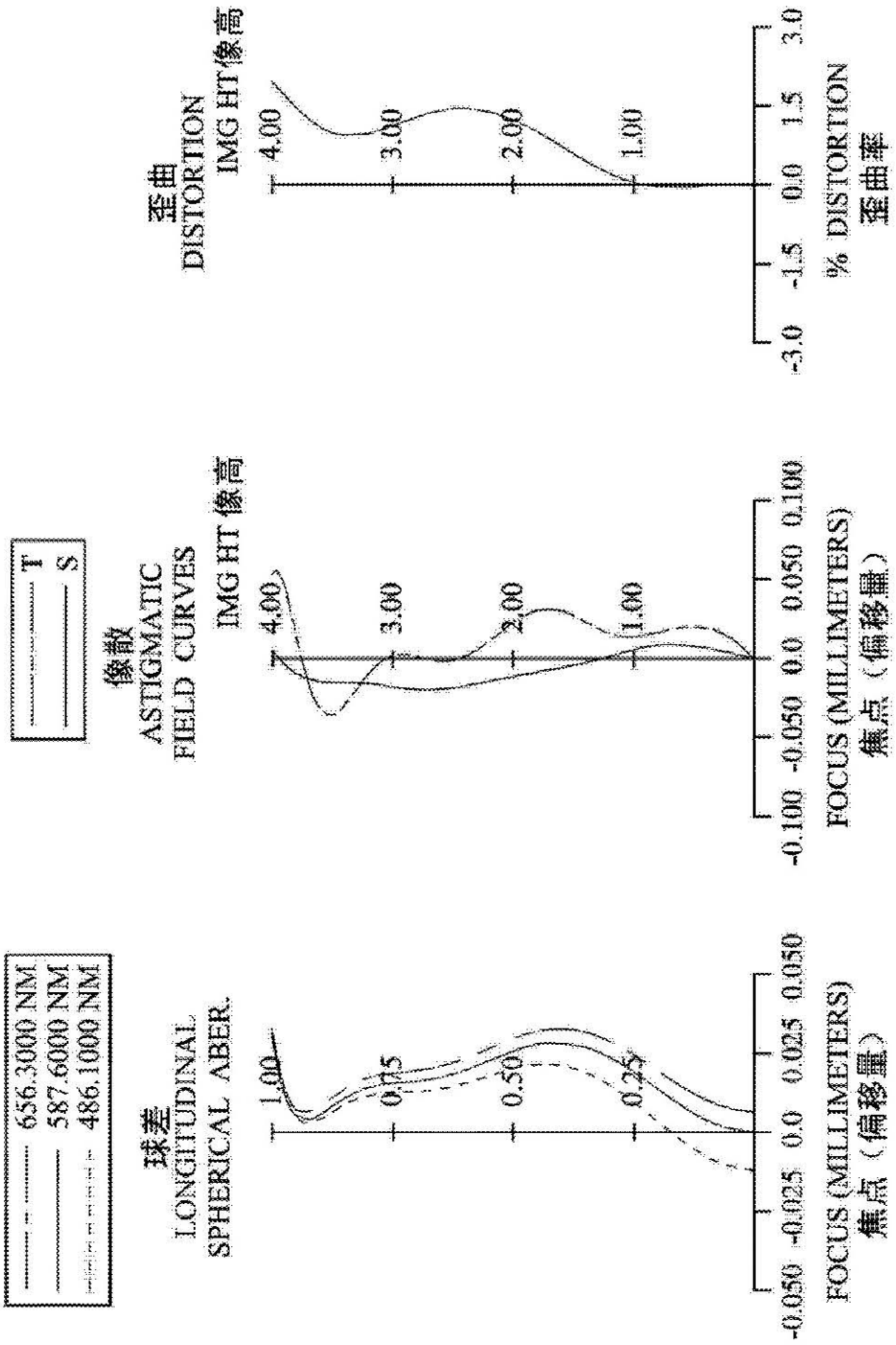

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL
SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC
FIELD CURVES
IMG HT 像高
4.00
3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
4.00
3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 2

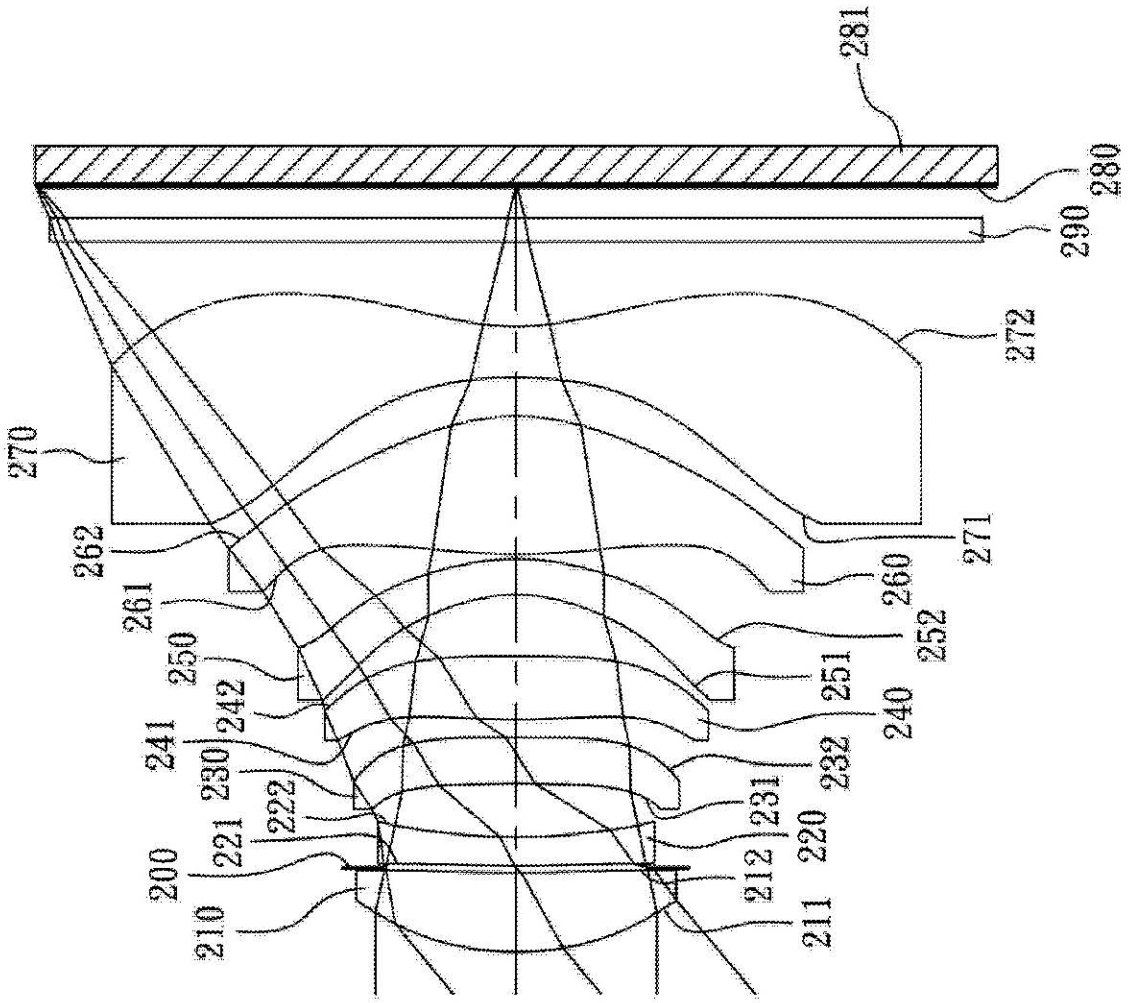

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图 3

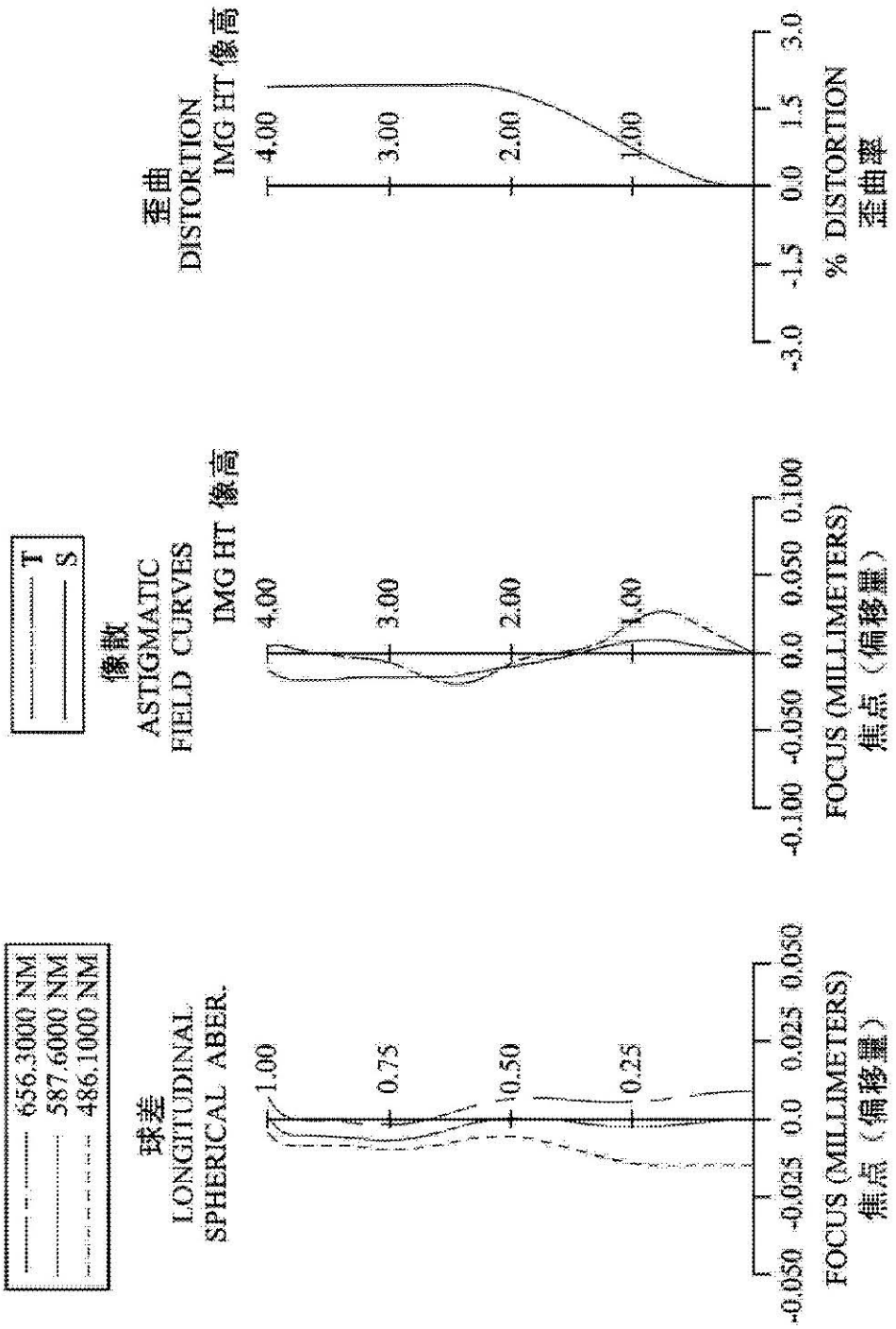

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC FIELD CURVES
IMG HT 像高
4.00
3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
4.00
3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 4

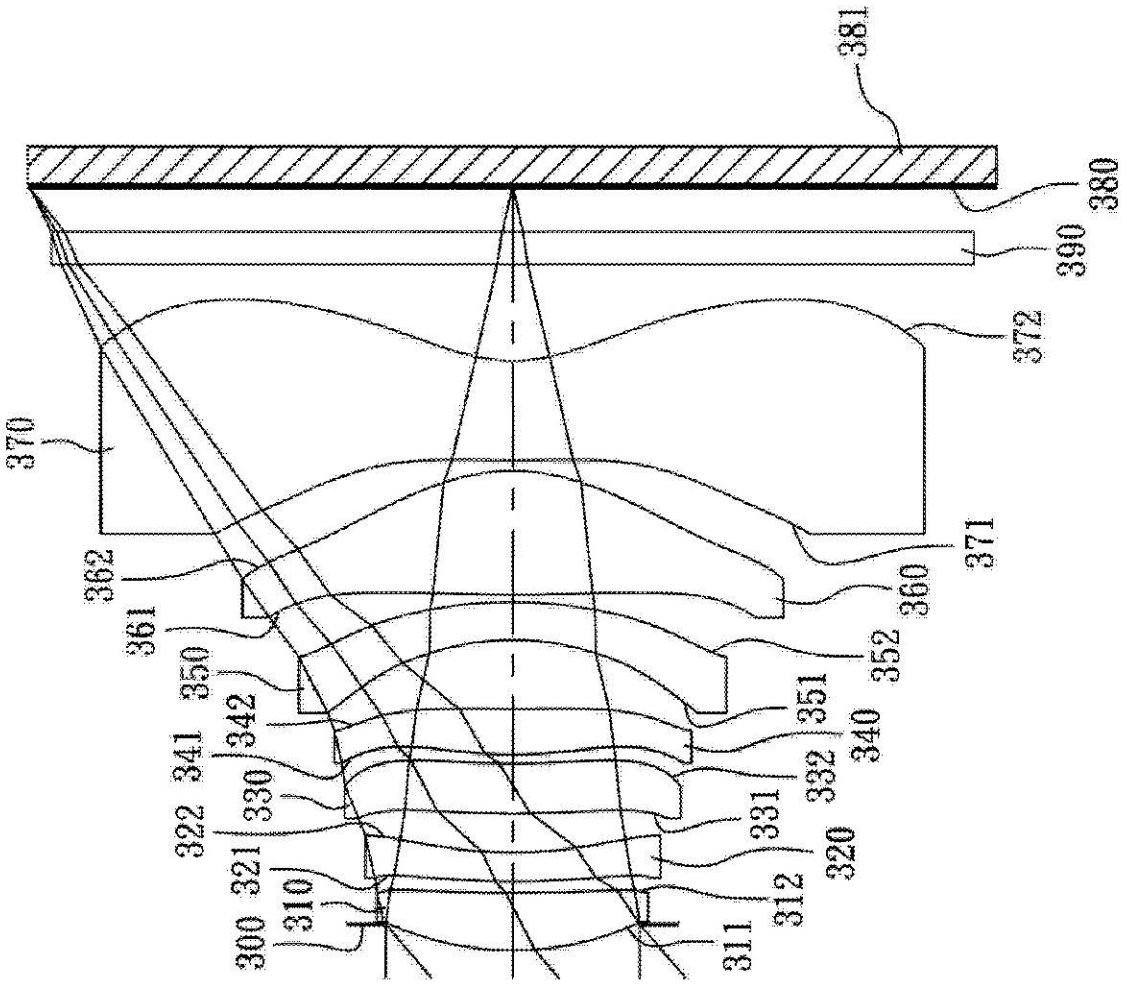

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300

图 5

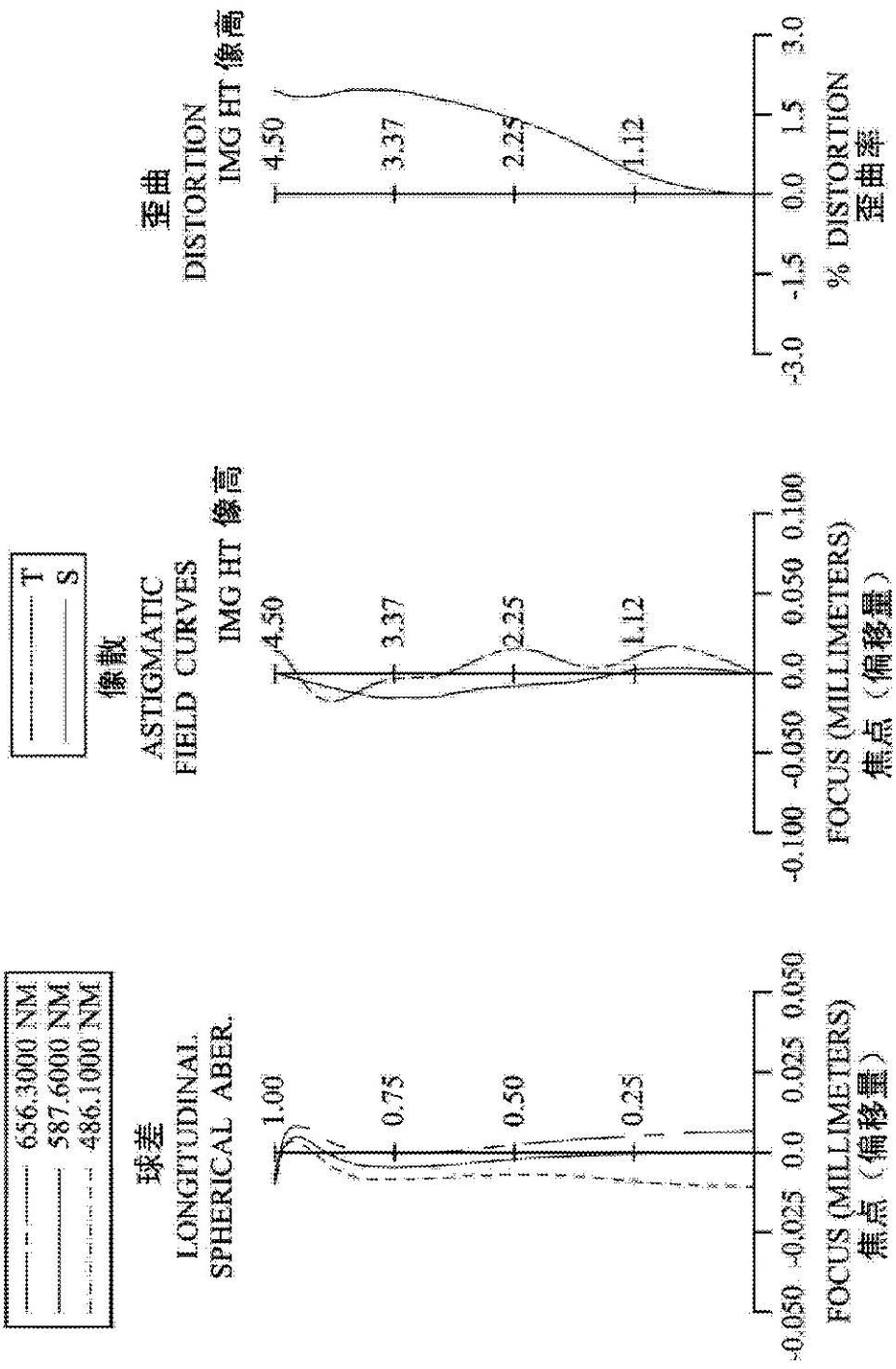

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC FIELD CURVES
IMG HT 像高
4.50
3.37
2.25
1.12
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
4.50
3.37
2.25
1.12
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 6

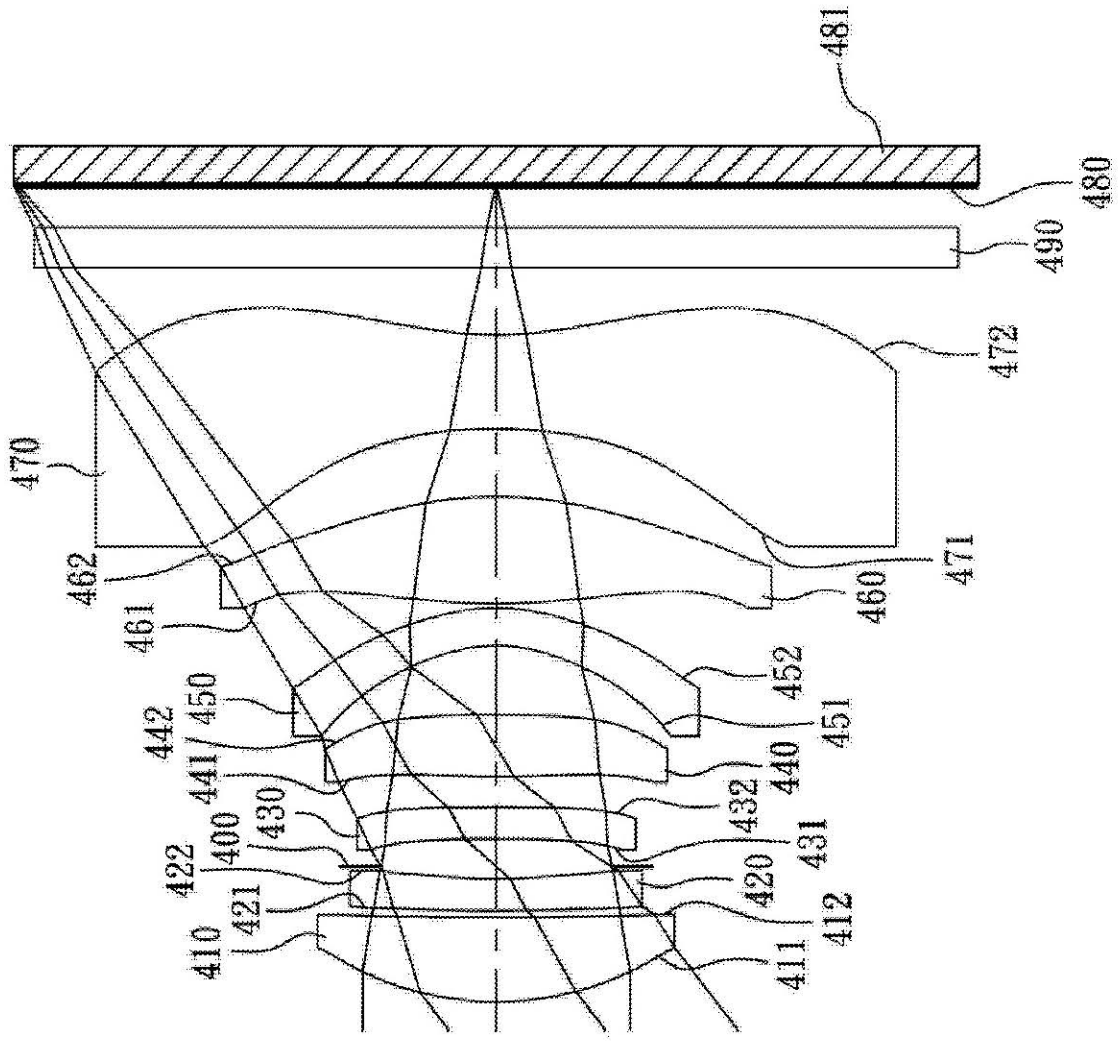

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图 7

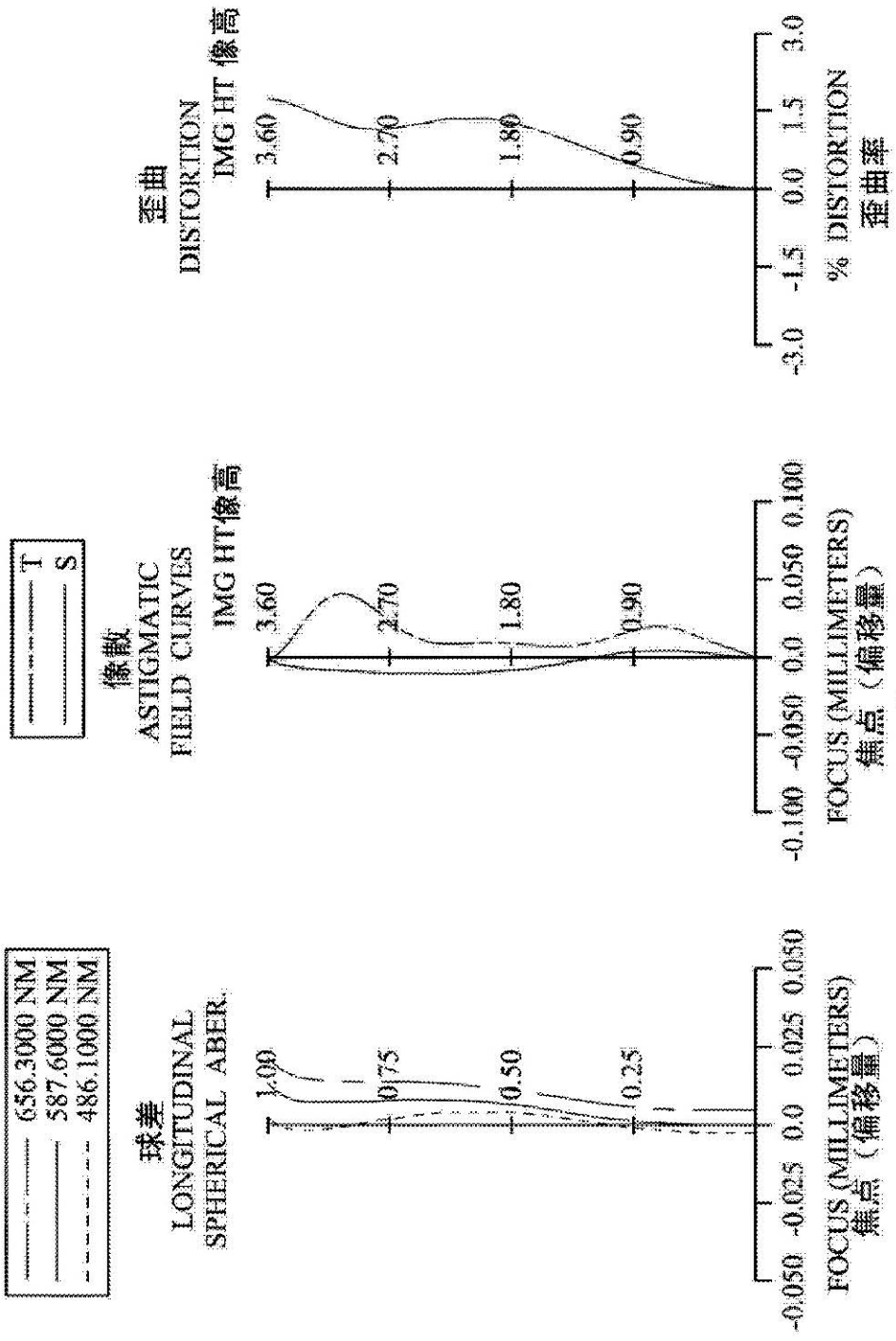

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL
SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC
FIELD CURVES
IMG HT像高
3.60
2.70
1.80
0.90
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
3.60
2.70
1.80
0.90
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 8

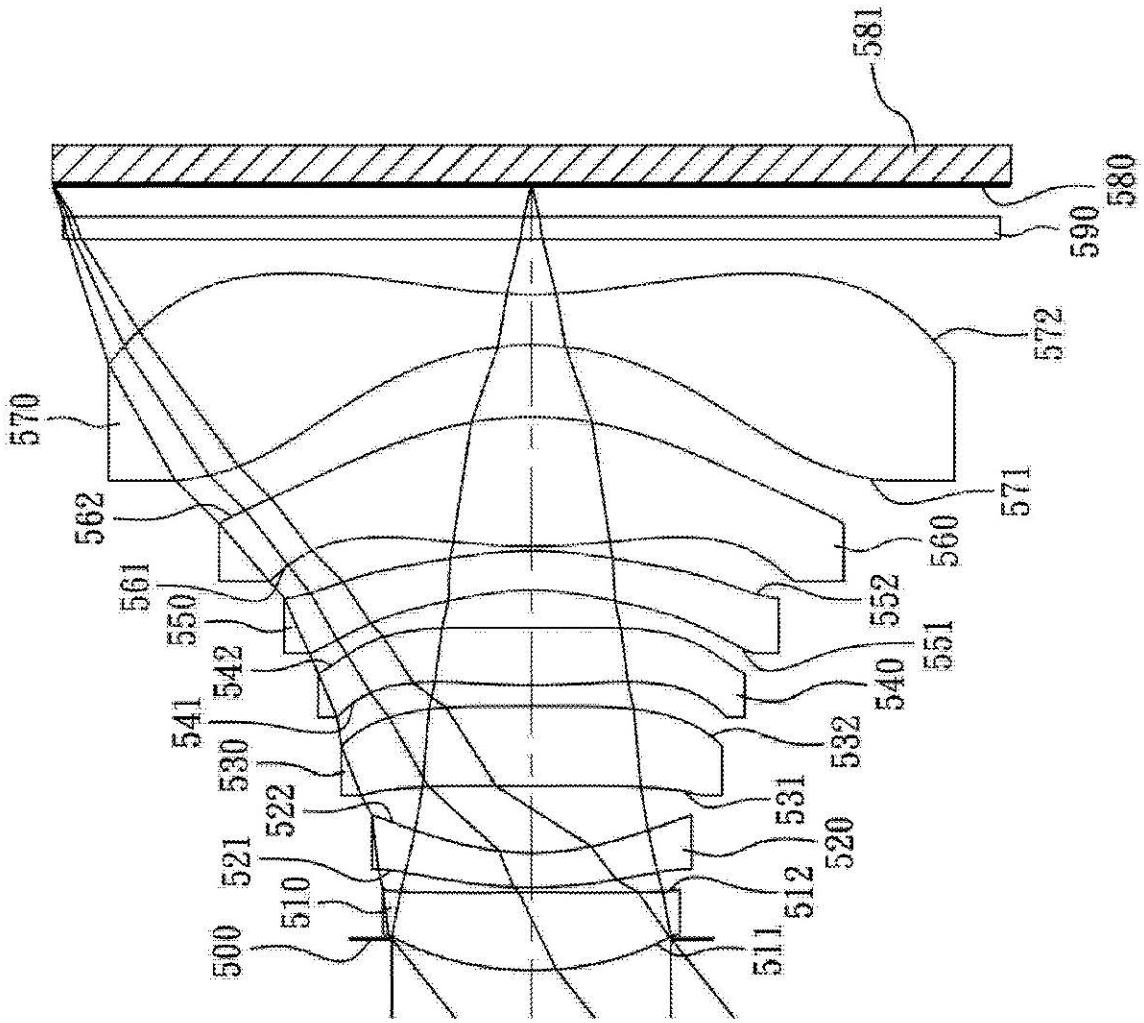

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500

图 9

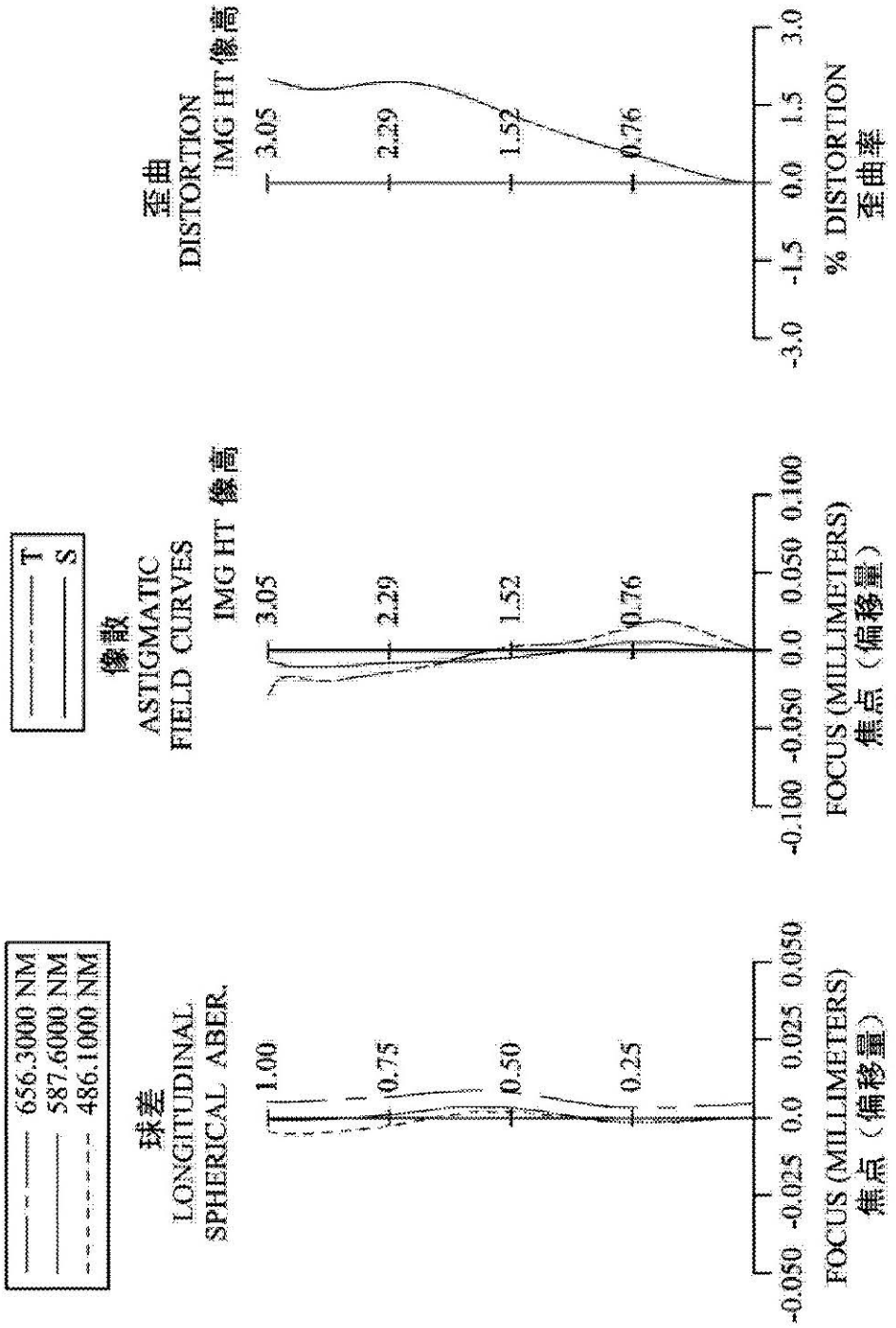

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC FIELD CURVES
IMG HT 像高
3.05
2.29
1.52
0.76
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
3.05
2.29
1.52
0.76
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 10

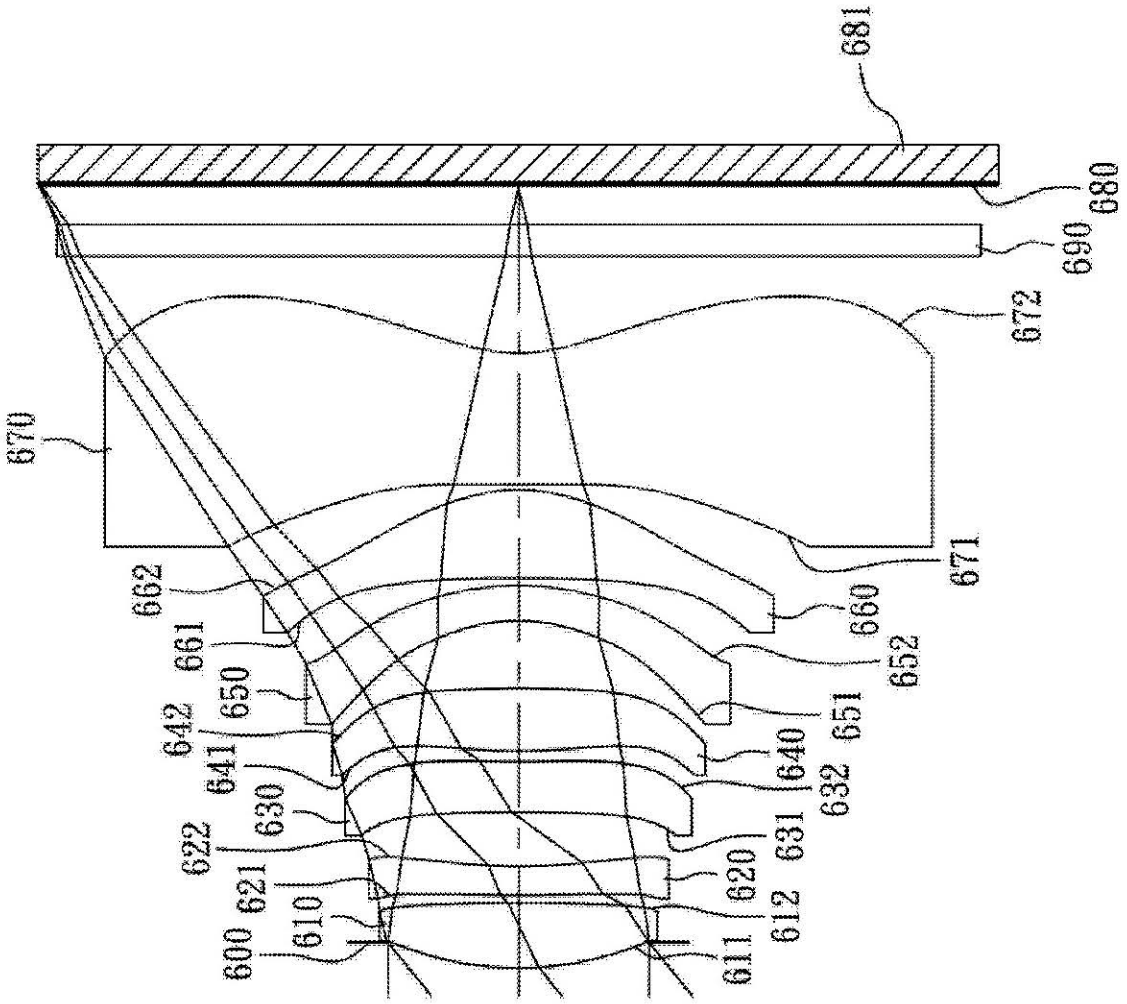

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600

图 11

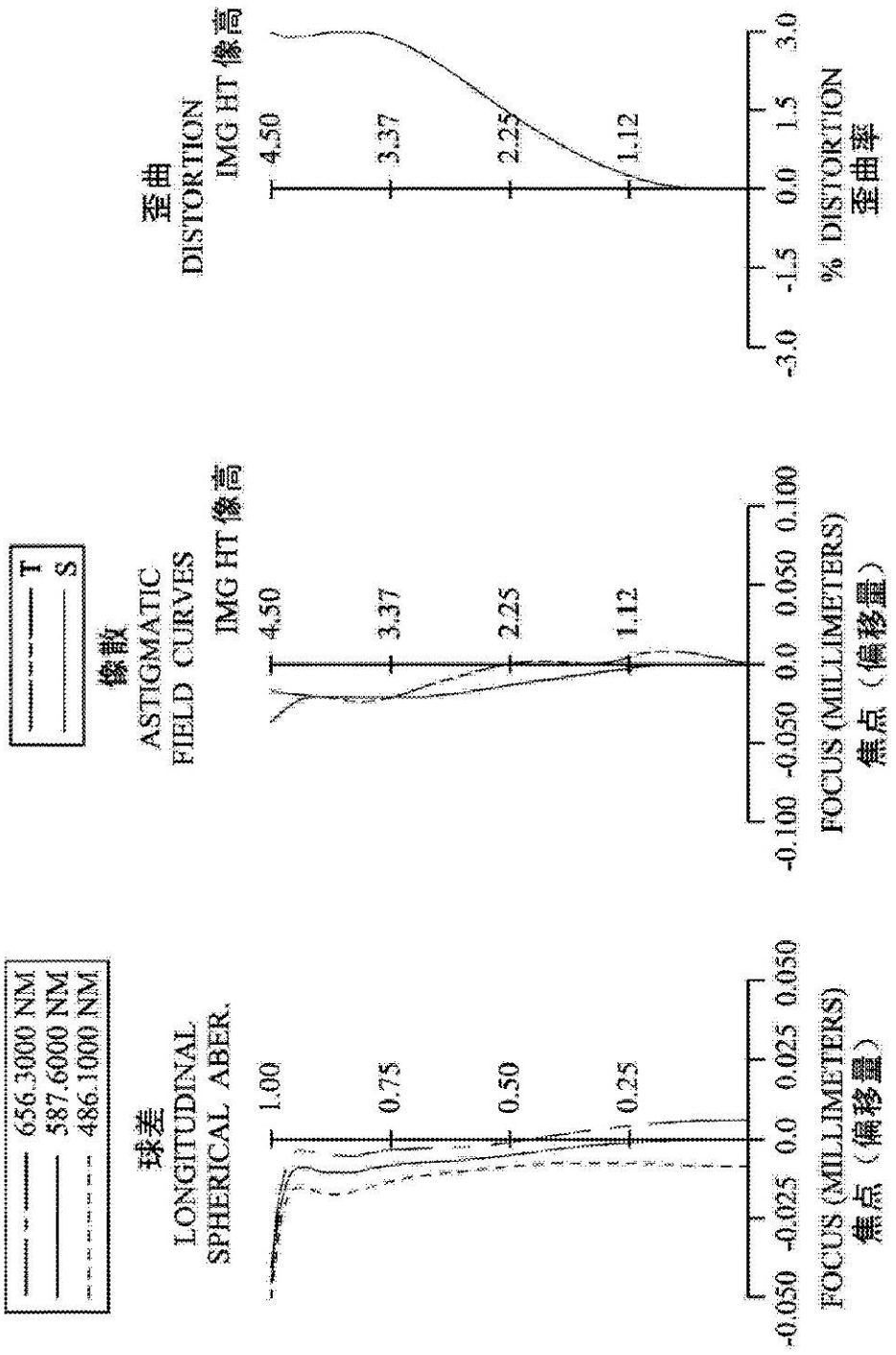

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC FIELD CURVES
IMG HT 像高
4.50
3.37
2.25
1.12
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
4.50
3.37
2.25
1.12
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 12

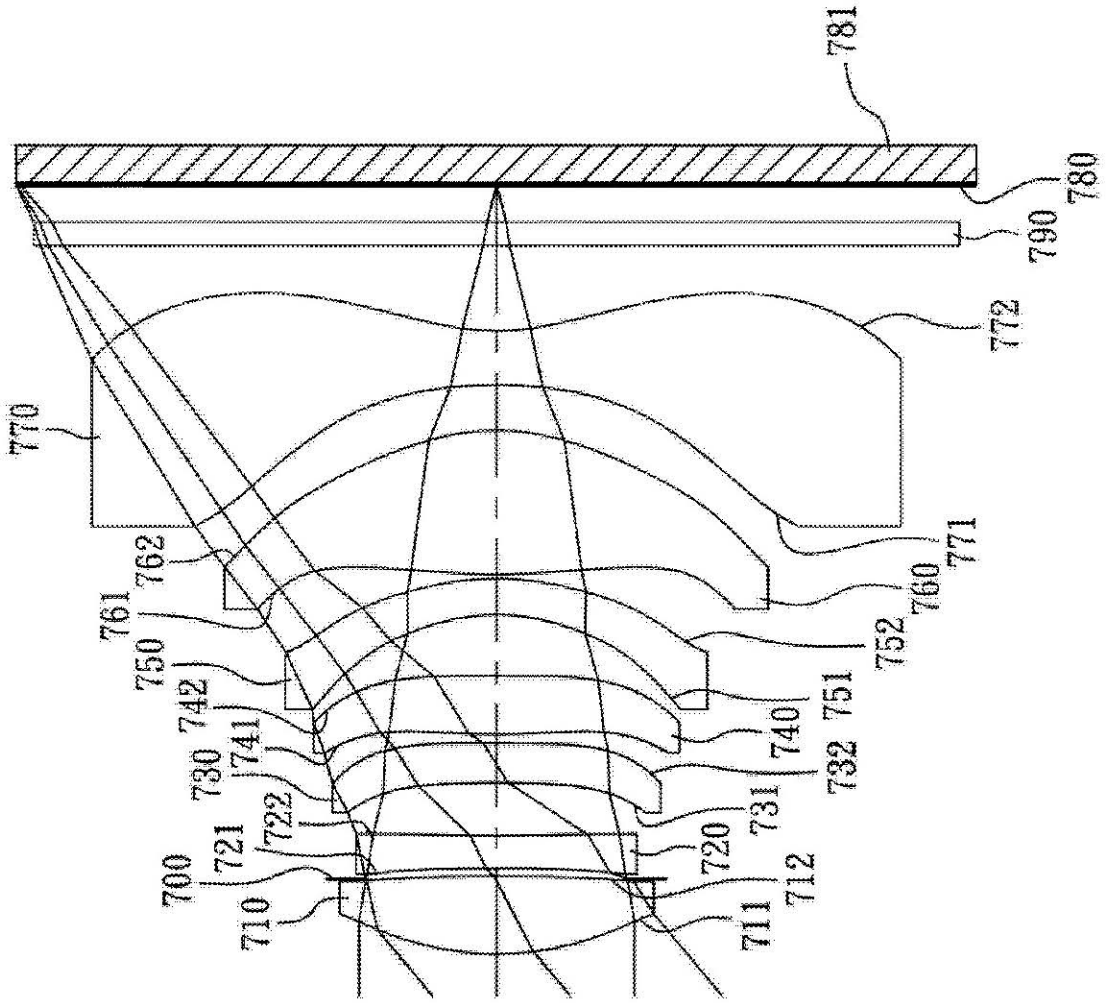

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721
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712
710
711

图 13

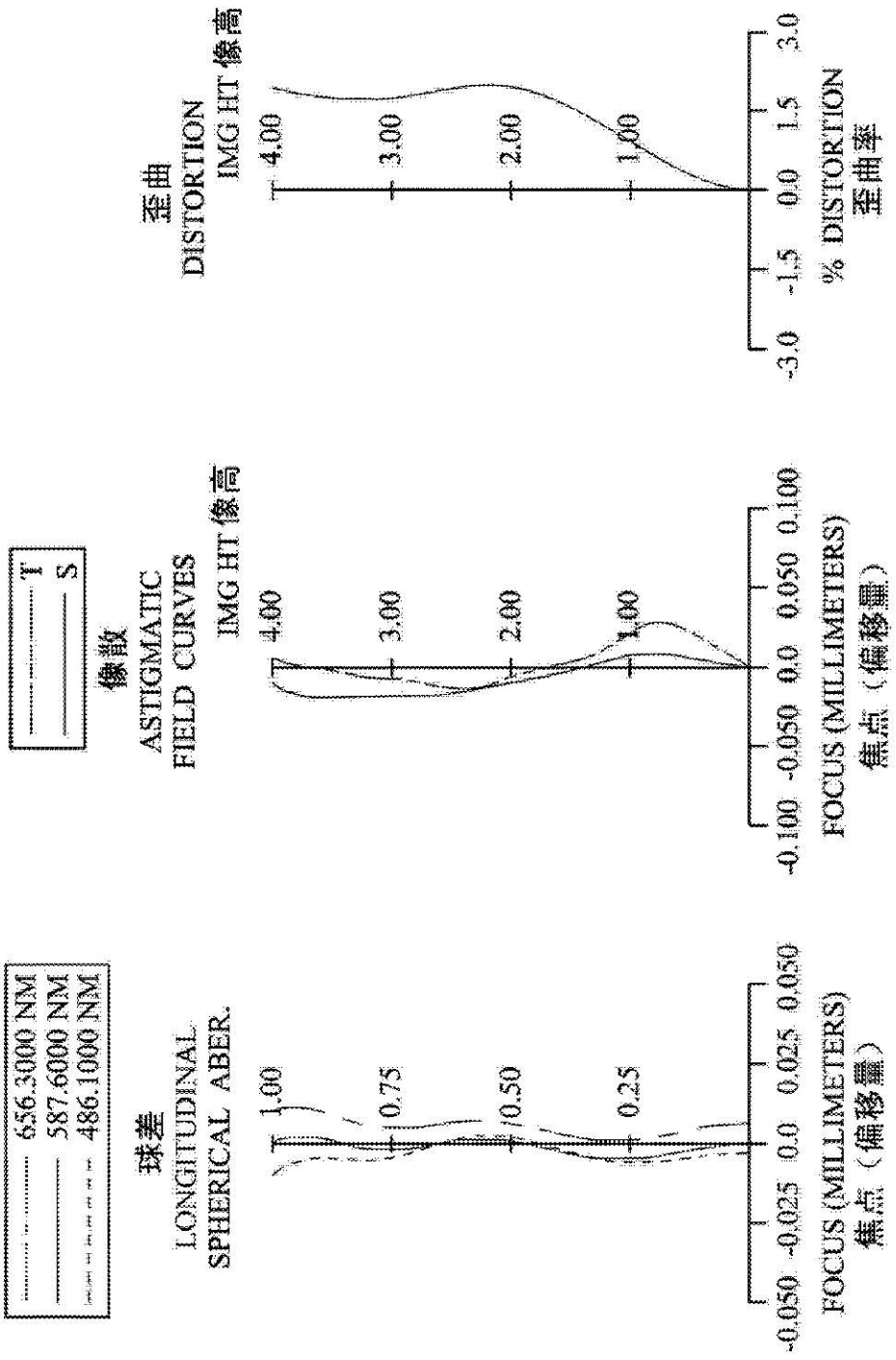

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC FIELD CURVES
IMG HT 像高
4.00
3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
4.00
3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 14

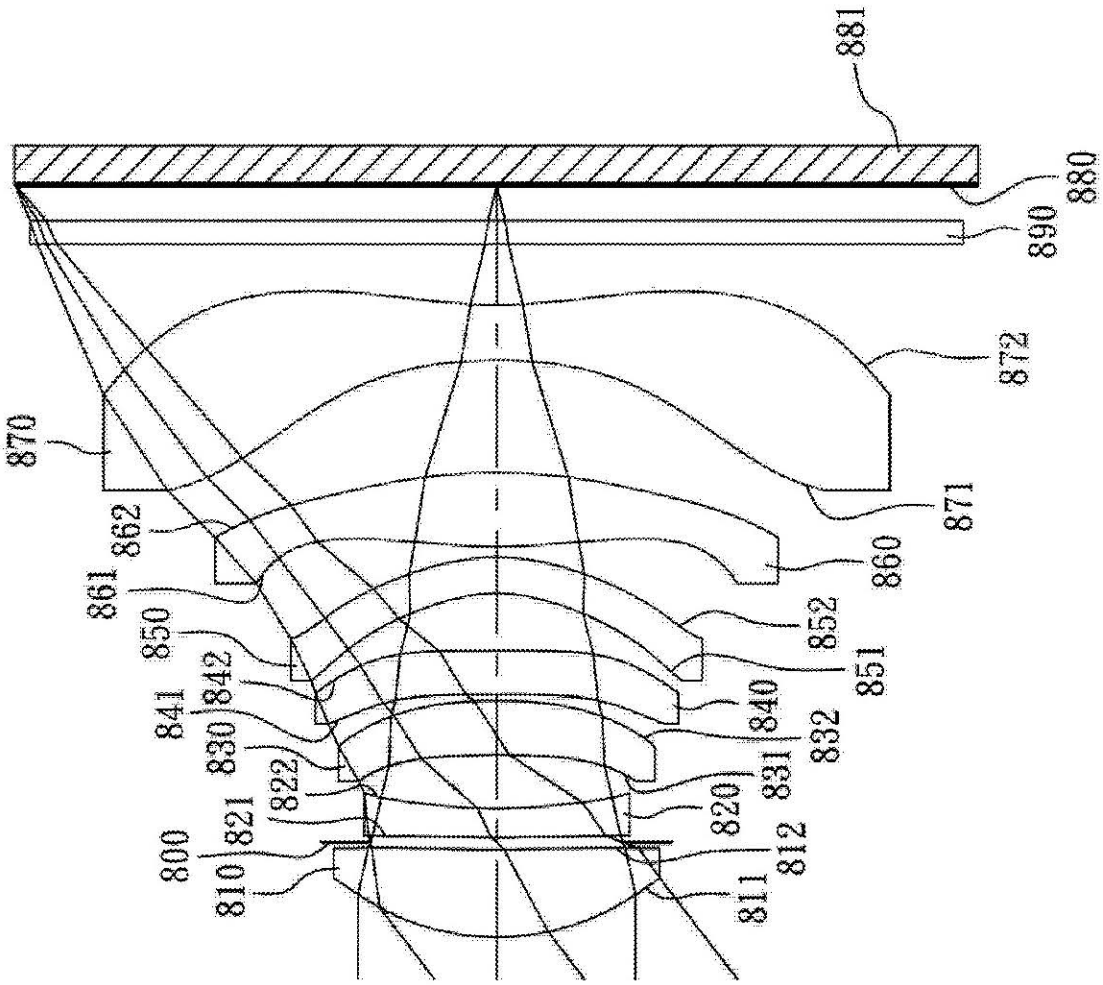

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812
810
811

图 15

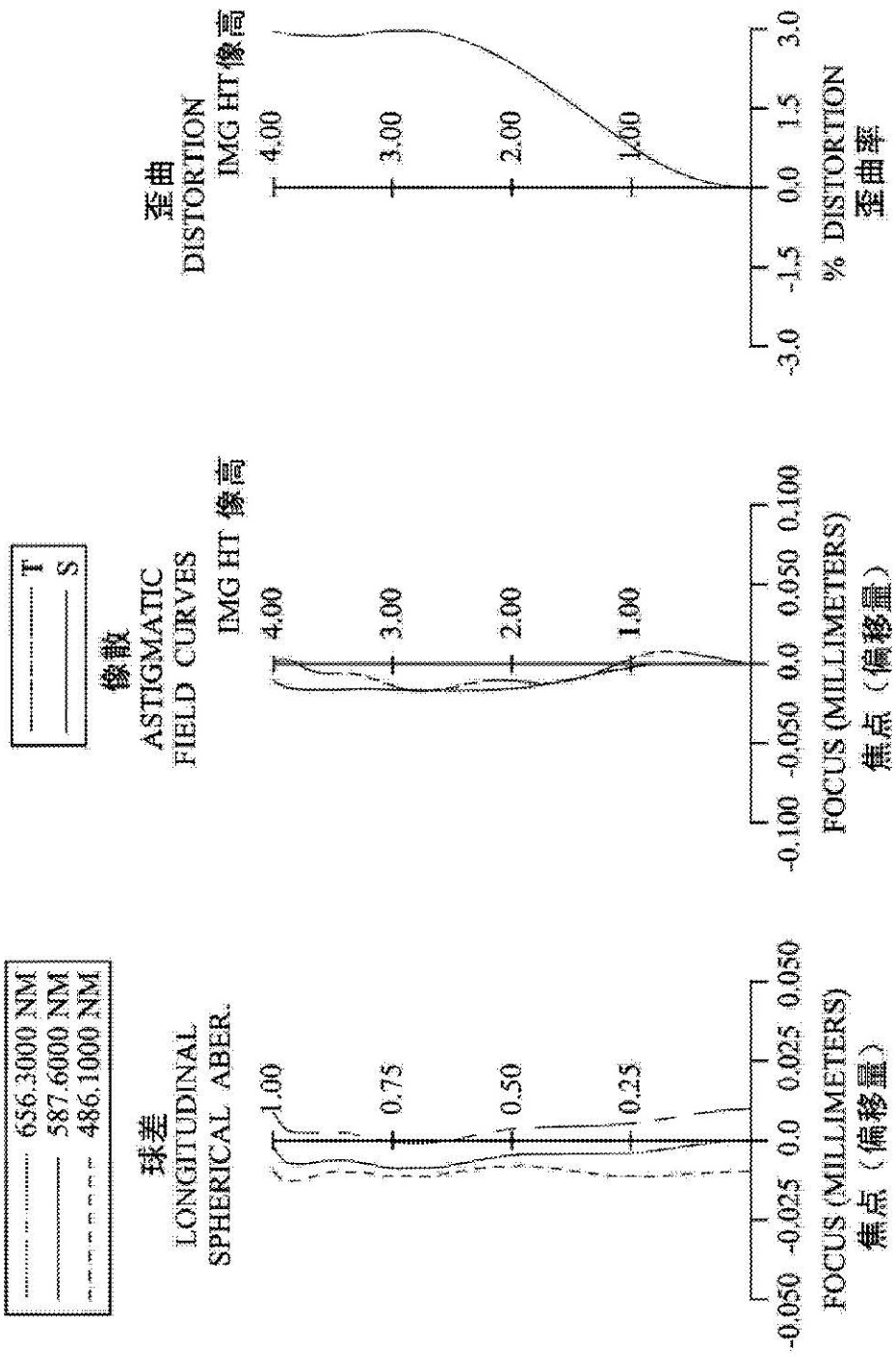

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC FIELD CURVES
IMG HT 像高
4.00
3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
4.00
3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 16

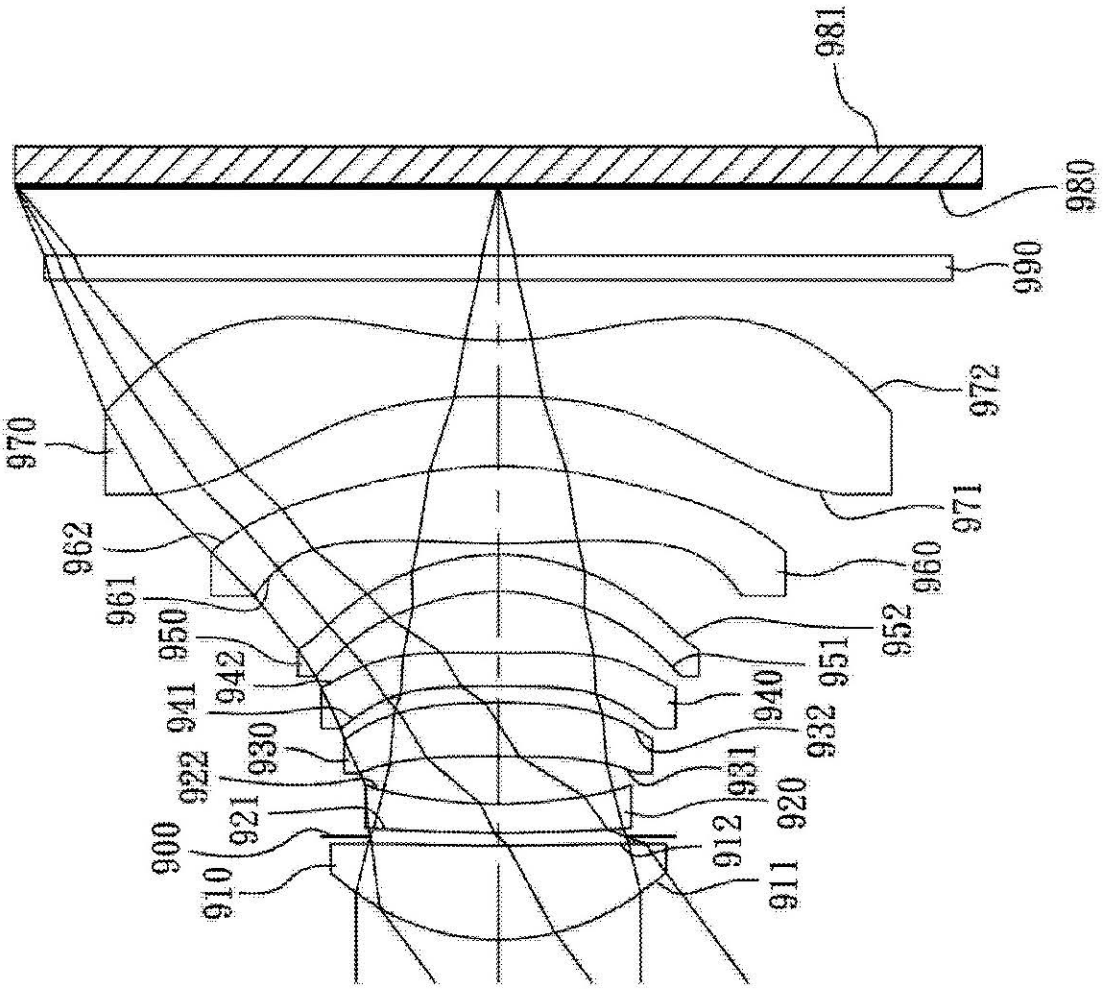

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921
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912
910
911

图 17

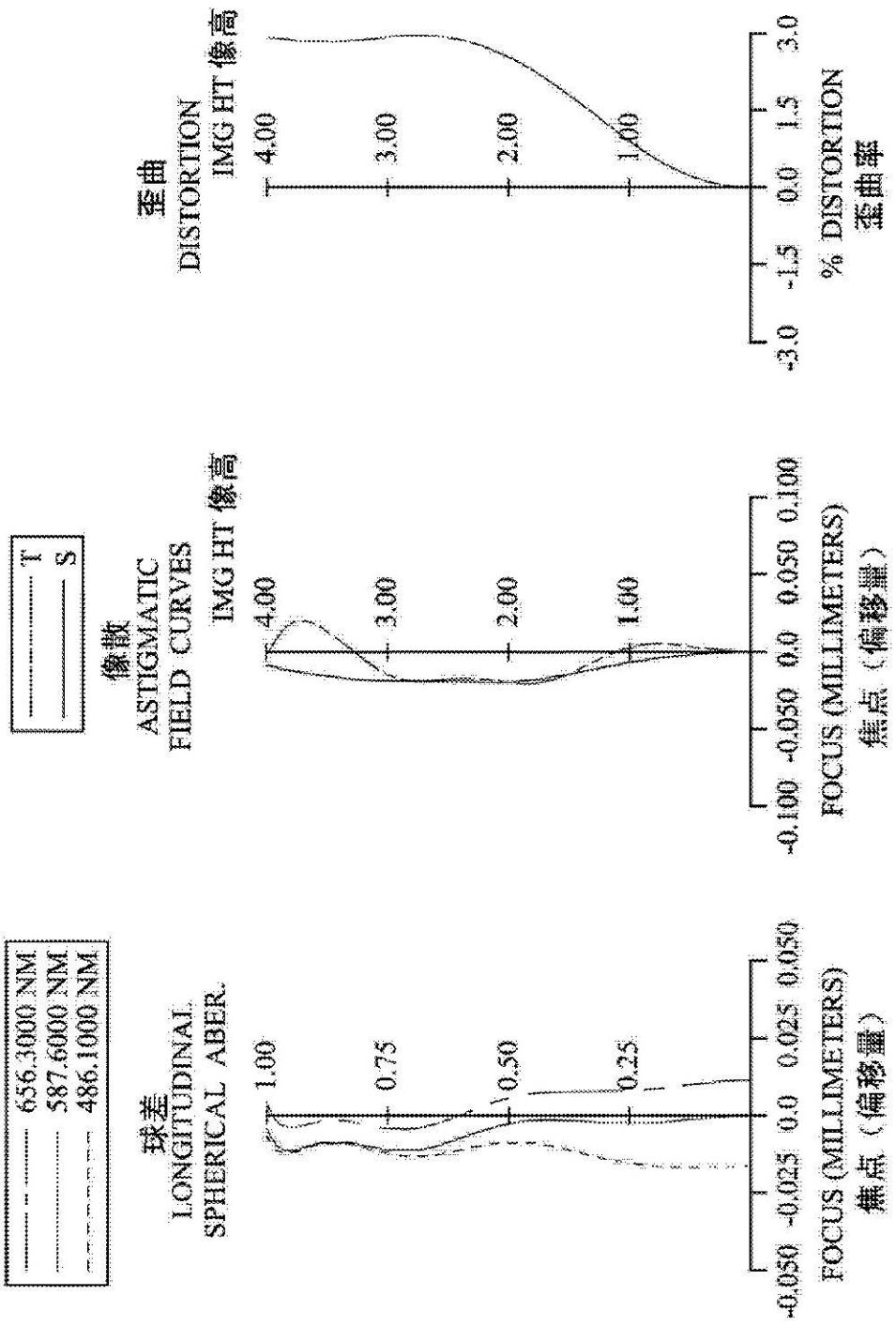

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL
SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC
FIELD CURVES
IMG HT 像高
4.00
3.00
2.00
1.00
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
4.00
3.00
2.00
1.00
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 18

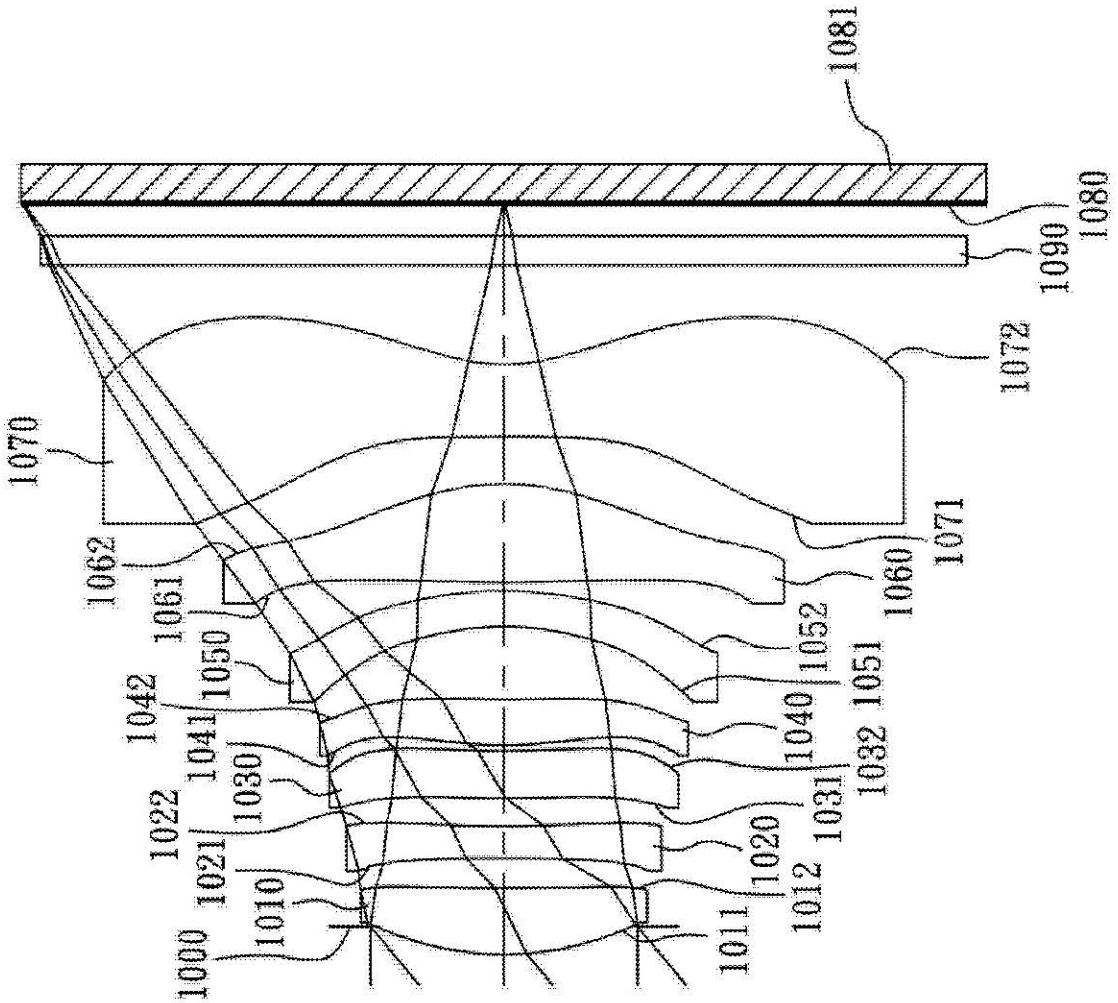

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1061
1060
1050
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1020
1010
1012
1000
1011

图 19

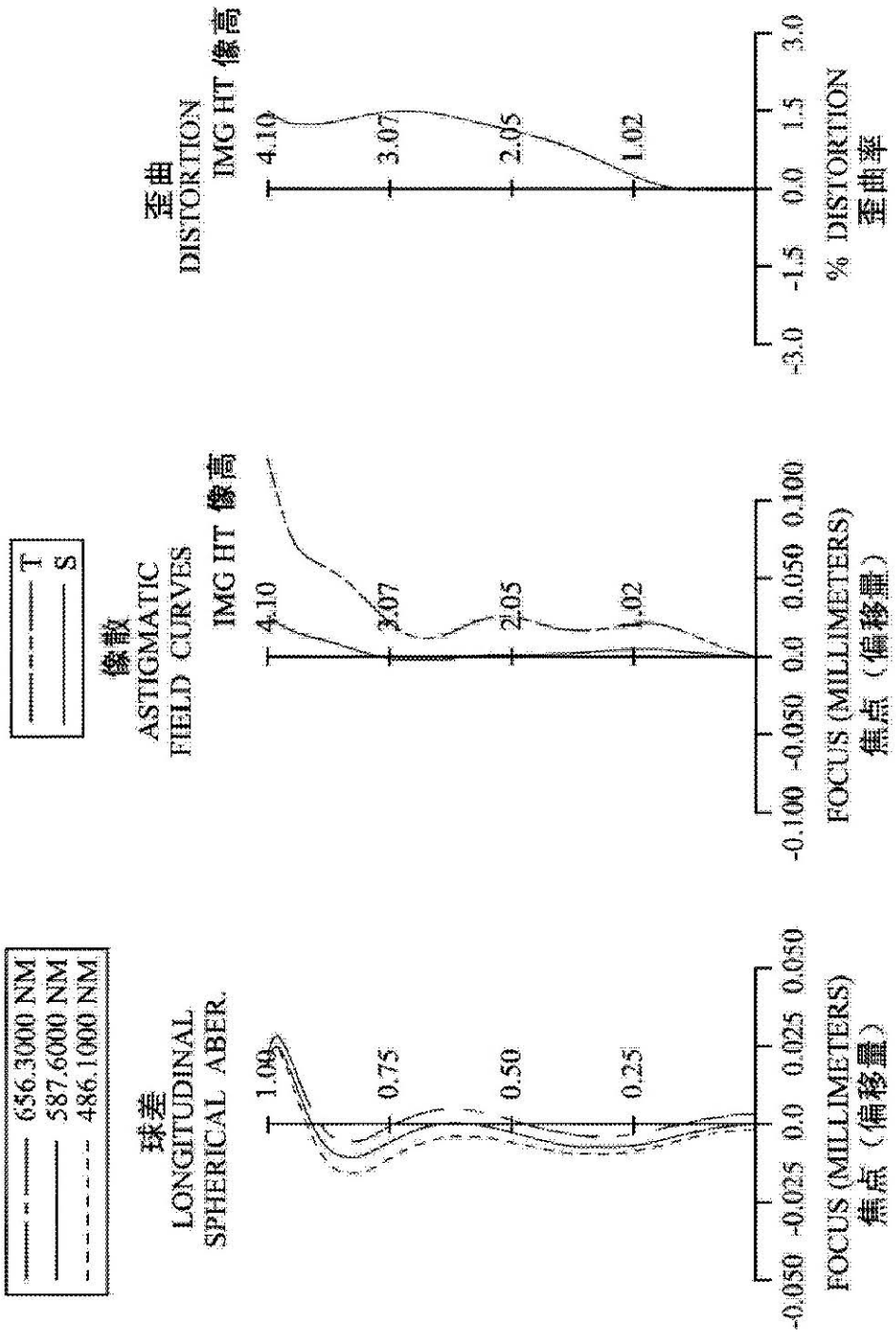

656.3000 NM
587.6000 NM
486.1000 NM
球差
LONGITUDINAL
SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.050 -0.025 0.0 0.025 0.050
FOCUS (MILLIMETERS)
焦点（偏移量）
T
S
像散
ASTIGMATIC
FIELD CURVES
IMG HT 像高
4.10
3.07
2.05
1.02
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
焦点（偏移量）
歪曲
DISTORTION
IMG HT 像高
4.10
3.07
2.05
1.02
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION
歪曲率

图 20

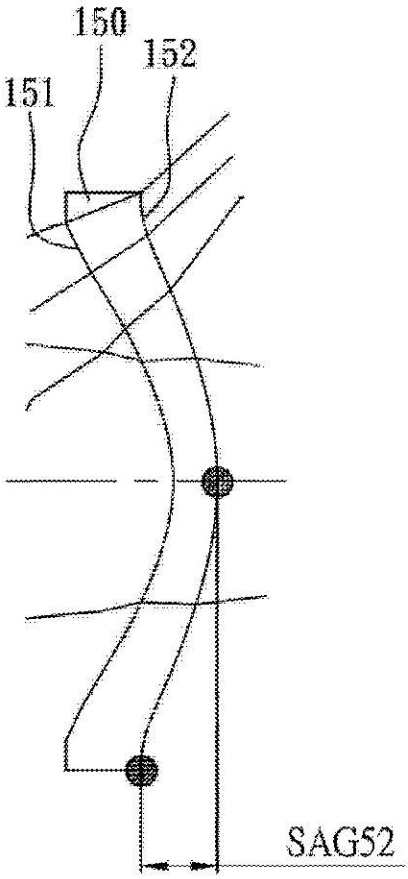


图 21

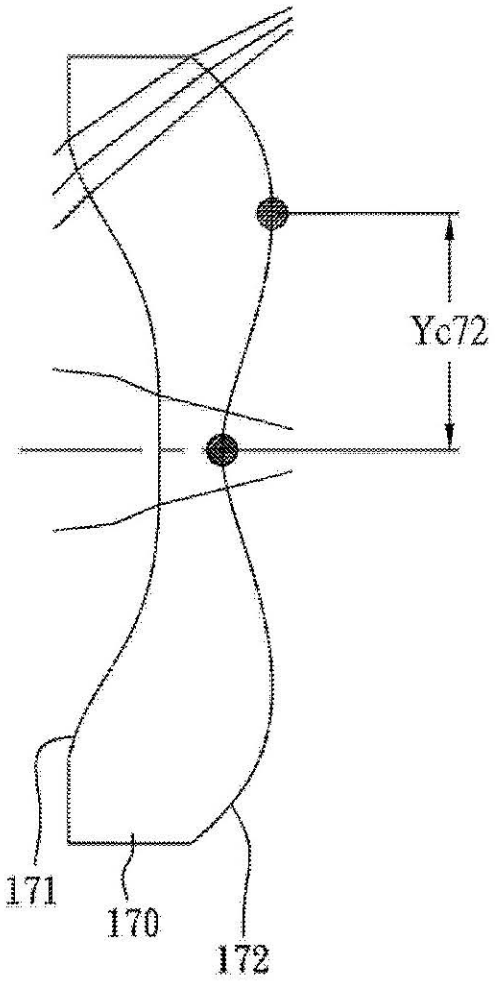


图 22

TARGEM TRANSLATIONS

T 718 384 8040
F 718 388 3516
E info@targemtranslations.com
W TargemTranslations.com

I, __LI-E LIu_____, declare as follows:

1. I am over eighteen years of age and fully competent to make this affidavit. I have personal knowledge of the information contained in this affidavit, and it is true and accurate to the best of my knowledge.

2. I am a translator fluent in the Chinese and English languages.

3. I translated the Chinese patent file ___CN202886720U__ into English and the English translation is a true and accurate translation of the Chinese patent file __CN202886720U__.

I declare under penalty of perjury of the laws of the United States of America that the foregoing information is true and accurate to the best of my knowledge. I understand that willful false statements and the like are punishable by fine or imprisonment, or both {18 U.S.C. § 1001) and may jeopardize the validity of the application or any patent issuing thereon.

Executed on:____March 7, 2024_____, at ____2796 E Coventry Lane, Salt Lake City, UT, 84121_____

(sigh here) 

Signed by ____Li-E Liu_