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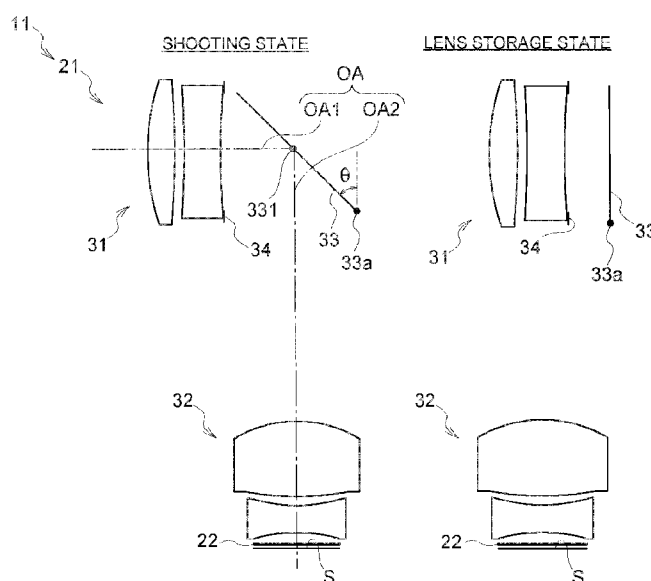


FIG. 1

(57) Abstract: An imaging lens assembly (21) includes a first lens group (31) including at least one positive refractive power lens, a second lens group (32) including at least one negative refractive power lens, a mirror (33) rotatable about one end (33a) on the second lens group (32) side of the mirror (33), and an aperture stop (34) positioned between a most object side disposed lens of the first lens group (31) and the mirror (33). The first lens group (31) is configured to change its position in an optical axis direction between a shooting state and a storage state. The mirror (33) is configured to form an optical path connecting the first lens group (31) and the second lens group (32) at the duration of switching to the shooting state. The mirror (33) secures a storage space for the first lens group (31) at the duration of switching to the storage state.

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IMAGING LENS ASSEMBLY, CAMERA MODULE AND IMAGING DEVICE

TECHNICAL FIELD

5 The present disclosure relates to an imaging lens assembly, a camera module, and an imaging device, and more specifically, to an imaging lens assembly, a camera module, and an imaging device that are small and enable good optical performance.

BACKGROUND

10 In recent years, portable imaging devices such as mobile phones and digital cameras are being widely used. With the recent miniaturization of imaging devices, the imaging lens assembly mounted on such imaging devices also requires downsizing. In order to meet such a demand for miniaturization, a conventional imaging lens assembly secures a focal length of the imaging lens assembly within a restricted space by disposing a prism on an object side of a lens group.

15 However, the conventional imaging lens assembly equipped with such prism is difficult to miniaturize as an imaging lens assembly mounted on a small digital device.

SUMMARY

20 The present disclosure aims to solve at least one of the technical problems mentioned above. Accordingly, the present disclosure needs to provide an imaging lens assembly, a camera module, and an imaging device.

In accordance with the present disclosure, an imaging lens assembly includes:

25 a first lens group comprising at least one lens having a positive refractive power;
a second lens group comprising at least one lens having a negative refractive power;
a mirror rotatable about one end on the second lens group side of the mirror; and
an aperture stop, which is configured to adjust amount of light passing through the aperture stop, positioned between a most object side disposed lens of the first lens group and the mirror, wherein

30 the first lens group is configured to change its position in an optical axis direction between a shooting state and a lens storage state by moving to an opposite side of the mirror at the duration of switching from the lens storage state to the shooting state, and moving to the mirror side at the duration of switching from the shooting state to the lens storage state,

35 the mirror is configured to form an optical path, which optically connects the first lens group and the second lens group, by rotating toward the first lens group side and tilting with respect to both of an optical axis direction of the first lens group and an optical axis direction of the second lens group at the duration of switching from the lens storage state to the shooting state,

40 the mirror is configured to secure a storage space for the first lens group by rotating toward an opposite side of the first lens group at the duration of switching from the shooting state to the lens storage state and being substantially perpendicular to the optical axis direction of the first lens group in the lens storage state.

In one example, the imaging lens assembly may further include:

$-0.6 < LG1 / LG2 < 0.6$,

45 where LG1 is a focal length of the first lens group, and LG2 is a focal length of the second lens group.

In one example, the imaging lens assembly may further include:

$\Sigma d / Yh \leq 22.0$,

50 where Σd is a distance on an optical axis of the imaging lens assembly from a vertex of an object side surface of a most object side disposed lens of the first lens group to an imaging surface, the optical axis of the imaging lens assembly comprising an optical axis of the first lens

group and an optical axis of the second lens group that are continuous with each other at an intersection with the mirror, and Y_h is an image height.

In one example, the imaging lens assembly may further include:

$$1.0 < LG1 / f < 2.0,$$

where f is a focal length of the imaging lens assembly.

In one example, the imaging lens assembly may further include:

$$\Sigma d / f < 1.8,$$

where Σd is a distance on an optical axis of the imaging lens assembly from a vertex of an object side surface of a most object side disposed lens of the first lens group to an imaging surface, the optical axis of the imaging lens assembly including an optical axis of the first lens group and an optical axis of the second lens group that are continuous with each other at an intersection with the mirror, and f is a focal length of the imaging lens assembly.

In one example, the first lens group may further include at least one lens having a negative refractive power, and

the second lens group may further include at least one lens having a positive refractive power.

In one example, the imaging lens assembly may further include:

$$\Sigma Ld1 < 9.0 \text{ mm},$$

where $\Sigma Ld1$ is a distance on an optical axis of the first lens group from a vertex of an object side surface of a most object side disposed lens of the first lens group to the mirror.

In one example, a most object side disposed lens of the second lens group may have a positive refractive power.

In one example, the first lens group may be positioned parallel to the optical axis of the second lens group in the lens storage state.

In one example, the optical axis direction of the first lens group may be substantially perpendicular to the optical axis direction of the second lens group. In accordance with the present disclosure, a camera module includes:

the imaging lens assembly; and

an image sensor including the imaging surface.

In one example, the camera module may further include an IR filter disposed between the imaging lens assembly and the image sensor.

In accordance with the present disclosure, an imaging device includes:

the camera module; and

a housing for storing the imaging lens assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects and advantages of the embodiments of the present disclosure will become apparent and more readily appreciated from the following descriptions made with reference to the drawings, in which:

FIG. 1 is a diagram of a camera module according to the present disclosure illustrating a front lens group, which changes its position in an optical axis direction between a shooting state and a lens storage state, and a mirror which changes its angle with respect to the optical axis direction between the shooting state and the lens storage state;

FIG. 2A is a diagram of a camera module according to the present disclosure illustrating a mechanism, which changes the position of the front lens group in the optical axis direction between the shooting state and the lens storage state, and a mechanism which changes the angle of the mirror with respect to the optical axis direction between the shooting state and the lens storage state;

FIG. 2B is a diagram of a camera module according to the present disclosure illustrating an example of the mechanism which changes the angle of the mirror with respect to the optical axis direction between the shooting state and the lens storage state;

FIG. 3 is a configuration diagram of a camera module according to a first example of the present disclosure;

FIG. 4 is an aberration diagram of the camera module according to the first example of the present disclosure;

5 FIG. 5 is a configuration diagram of a camera module according to a second example of the present disclosure;

FIG. 6 is an aberration diagram of the camera module according to the second example of the present disclosure;

10 FIG. 7 is a configuration diagram of a camera module according to a third example of the present disclosure;

FIG. 8 is an aberration diagram of the camera module according to the third example of the present disclosure;

FIG. 9 is a configuration diagram of a camera module according to a fourth example of the present disclosure;

15 FIG. 10 is an aberration diagram of the camera module according to the fourth example of the present disclosure;

FIG. 11 is a configuration diagram of a camera module according to a fifth example of the present disclosure, and

20 FIG. 12 is an aberration diagram of the camera module according to the fifth example of the present disclosure.

DETAILED DESCRIPTION

Embodiments of the present disclosure will be described in detail and examples of the embodiments will be illustrated in the accompanying drawings. The same or similar elements and elements having same or similar functions are denoted by like reference numerals throughout the descriptions. The embodiments described herein with reference to the drawings are explanatory and aim to illustrate the present disclosure, but they shall not be construed to limit the present disclosure.

30 <Outline of the disclosure>

First, an outline of the present disclosure will be described. As shown in FIG. 1, a camera module 11 to which the present disclosure is applied, is configured to change a position of a front lens group 31 (i.e. a first lens group) in an optical axis direction between a shooting state where a subject (object) is shot (recorded as an image) and a lens storage state where the imaging lens assembly 21 is stored in a housing of the camera module 11. The camera module 11 is also configured to change whether an optical path, which optically connects the front lens group 31 and a rear lens group 32 (i.e. a second lens group), is formed between the shooting state and the lens storage state. Whether the optical path is formed depends on an angle of a mirror 33 disposed between the front lens group 31 and the rear lens group 32 whose optical axis directions are perpendicular to each other. The mirror 33 is rotatable about one end 33a on the rear lens group 32 side of the mirror 33. In the FIG. 1, dash-dot lines represent the optical axes of the camera modules 11 (hereinafter the same applies).

For example, as shown in FIG. 2A, the camera module 11 pushes out the front lens group 31 stored in a housing 4 in a direction protruding from the housing 4, the direction being opposite to the mirror 33, by using a lens drive mechanism 24 such as a voice coil motor when a predetermined user operation, which starts a shooting mode, is performed. At this time, the camera module 11 drives the mirror 33 so as to form the optical path optically connecting the front lens group 31 and the rear lens group 32 by using a mirror drive mechanism 25. More specifically, the mirror driving mechanism 25 rotates the mirror 33 toward the front lens group 31 side and tilts the mirror 33 with respect to both of an optical axis direction of the front lens group 31 and an optical axis direction of the rear lens group 32 at the duration of switching from

the lens storage state to the shooting state. In the example shown in FIG. 1, a tilt angle θ of the mirror 33 is 45° . In FIG. 1, the reference of the tilt angle of 0° is the optical axis direction of the rear lens group 32. In view of suppressing the thickness of the camera module 11 and making alignment between the front lens group 31 and the rear lens group 32 easy, it is preferable that the tilt angle θ is in a range of 42° or more and 48° or less. As shown in FIG. 2B, the mirror drive mechanism 25 may be configured, for example, by a spring 251 and an abutting structure 252. The spring 251 applies an elastic force in a tilting direction to the mirror 33. The abutting structure 252 moves to the mirror 33 side with the front lens group 31 in a state of abutting against the mirror 33 to push back the mirror 33 at the duration of switching from the shooting state to the lens storage state. The spring 251 may be, for example, a torsion spring provided on a rotation axis of the mirror 33 or a leaf spring. The abutting structure 252 may be, for example, a protrusion extending from a barrel 26, which holds the front lens group 31, toward the mirror 33. In the example shown in FIG. 2B, the abutting structure 252 is disposed to be offset from the front lens group 31 in a depth direction of FIG. 2B, so that the abutting structure 252 does not interfere with the optical path while abutting against the mirror 33.

On the other hand, the camera module 11 retracts and stores the front lens group 31 in the housing 4 by using the lens drive mechanism 24 when a predetermined user operation, which ends the shooting mode, is performed. At this time, the mirror drive mechanism 25 drives the mirror 33 so as not to form the optical path optically connecting the front lens group 31 and the rear lens group 32. More specifically, the mirror drive mechanism 25 rotates the mirror 33 toward an opposite side of the front lens group 31 to make the mirror 33 perpendicular to the optical axis direction of the front lens group 31 at the duration of switching from the shooting state to the lens storage state. The mirror 33 being perpendicular to the optical axis direction of the front lens group 31 makes it possible to secure a storage space for the front lens group 31.

The front lens group 31 is positioned parallel to the optical axis of the rear lens group 32 in the lens storage state. Therefore, it is possible to secure a storage space for the front lens group 31 more effectively. Such a collapsible camera module 11, in which the front lens group 31 protrudes from the housing 4 during the shooting state, has excellent storability and portability when shooting is not performed. Further, by disposing a mirror 33, which is rotatable about one end 33a, between the front lens group 31 and the rear lens group 32, a focal length and an effective diameter of the imaging lens assembly 21 can be increased while allowing the front lens group 31 to collapse in a restricted installation space.

The camera module 11 to which the present disclosure is applied is configured as shown in FIG. 3, 5, 7, 9 and 11, for example.

The camera module 11 includes an imaging lens assembly 21, an optical filter 22 and an image sensor 23.

As described above, the imaging lens assembly 21 is configured to change the position of the front lens group 31 in the optical axis direction, and change whether the optical path connecting the front lens group 31 and the rear lens group 32 is formed between the shooting state and the lens storage state, and is designed to maintain its good optical performance despite its small size.

The image sensor 23 is, for example, a solid-state image sensor such as a CMOS (Complementary Metal Oxide Semiconductor) or a CCD (Charge Coupled Device). The image sensor 23 has the imaging surface S which is an imaging plane of the imaging lens assembly 21. The image sensor 23 receives incident light from the subject (object side) via the imaging lens assembly 21 and the optical filter 22, photoelectrically converts the light, and outputs an image data, obtained by photoelectric conversion of the light, to a subsequent stage. The optical filter 22 disposed between the imaging lens assembly 21 and the image sensor 23 may be, for example, an IR (infrared) filter which cuts infrared light from incident light.

The imaging lens assembly 21 will be described in more detail. The imaging lens assembly 21 includes a front lens group 31 including at least one lens having a positive refractive power, a

rear lens group 32 including at least one lens having a negative refractive power, and a mirror 33 disposed between the front lens group 31 and the rear lens group 32, and rotatable about one end 33a of the mirror 33.

At least one lens of the front lens group 31 having a positive refractive power focus the light onto the mirror 33. The mirror 33 can change the optical path of the light. After passing through the front lens group 31, the light reflected by the mirror 33 is incident on the rear lens group 32. At least one lens of the rear lens group 32 having a negative refractive power spread the incident light to get a larger imaging range and correct aberration. Finally, the light reaches the image sensor 23 through the rear lens group 32 for imaging.

The front lens group 31 is configured to change its position in the optical axis direction between the shooting state and the lens storage state, for example, by using the lens driving mechanism 24 mentioned above.

The mirror 33 is configured to form the optical path optically connecting the front lens group 31 and the rear lens group 32 at the duration of switching from the lens storage state to the shooting state, and is configured to secure the storage space for the front lens group 31 at the duration of switching from the shooting state to the lens storage state, for example, by using the mirror drive mechanism 25 mentioned above. An aperture stop 34, which adjusts the amount of light passing through the aperture stop 34, is positioned between a most object side disposed lens of the front lens group 31 and the mirror 33. Since the aperture stop 34 is disposed on the object side of the mirror 33, it is easier to design an optical configuration that takes into account optical performance including aberration correction, as compared with the case where the aperture stop 34 is not disposed on the object side of the mirror 33. That is, the layout of the aperture stop 34 is advantageous in terms of optical performance.

In addition, the aperture stop 34 has a function of adjusting the amount light passing through the aperture stop 34 as described above. Further, the aperture stop 34 is positioned between the most object side disposed lens of the front lens group 31 and the mirror 33, so that the exit pupil position can be located far from the imaging surface S. Since the exit pupil position is located far from the imaging surface S, telecentricity of the imaging lens assembly 21 is improved. The imaging lens assembly 21 having high telecentricity has a small change in imaging magnification due to a change in the position of the front lens group 31 in the optical axis direction. Since the change in the magnification due to the change in the position of the front lens group 31 is small, an image with a desired magnification can be obtained even if the amount of extension of the front lens group 31 at the duration of shooting is small. Since the amount of extension of the front lens group 31 can be reduced, it is not necessary to increase the size of the lens driving mechanism 24 in order to increase the amount of extension of the front lens group 31. Since the size of lens driving mechanism 24 can be suppressed, the aperture stop 34 can contribute to the miniaturization of the camera module 11.

By employing such a front group collapsible imaging lens assembly 21 which changes whether the optical path is formed by using the mirror 33, good optical performance can be obtained despite the small size.

The imaging lens assembly 21 can be miniaturized and its good optical performance can be maintained more effectively when the camera module 11 satisfies the following formula (1):

$$-0.6 < LG1 / LG2 < 0.6 \quad (1)$$

In the formula (1), LG1 is a composite focal length of the front lens group 31 (hereinafter the same applies). LG2 is a composite focal length of the rear lens group 32 (hereinafter the same applies).

If the value of LG1 / LG2 falls below the lower limit value of the formula (1), the manufacturability of the imaging lens assembly 21 decreases, and it is difficult to maintain the optical performance. On the other hand, if the value of LG1 / LG2 exceeds the upper limit value of the formula (1), it is difficult to miniaturize the imaging lens assembly 21.

Furthermore, the imaging lens assembly 21 can be miniaturized and its good optical performance can be maintained more effectively when the camera module 11 satisfies the following formula (2) in the shooting state:

$$\Sigma d / Y_h \leq 22.0 \quad (2)$$

In the formula (2), Σd is a distance on an optical axis of the imaging lens assembly 21 from a vertex of an object side surface of a most object side disposed lens of the front lens group 31 to the imaging surface S (hereinafter the same applies). That is, Σd is a full length of the imaging lens assembly 21. As shown in FIG. 1, the optical axis of the imaging lens assembly 21, which is represented by the reference character "OA" in FIG. 1, includes an optical axis OA1 of the front lens group 31 and an optical axis OA2 of the rear lens group 32. The optical axis OA1 of the front lens group 31 and the optical axis OA2 of the rear lens group 32 are continuous with each other at an intersection 331 with the mirror 33. Y_h is an image height (hereinafter the same applies). The image height is a half - diagonal length of the imaging surface S of the image sensor 23.

As the value shown in the formula (2) decreases, the storage space for the front lens group 31 can be secured, the imaging lens assembly 21 can be miniaturized, and good optical performance of the imaging lens assembly 21 can be maintained more effectively.

Furthermore, the imaging lens assembly 21 can be miniaturized and its good optical performance can be maintained more effectively when the camera module 11 satisfies the following formula (3) in the shooting state:

$$1.0 < LG1 / f < 2.0 \quad (3)$$

In the formula (3), f is a focal length of the imaging lens assembly 21 (hereinafter the same applies).

If the value of $LG1 / f$ falls below the lower limit value of the formula (3), the manufacturability of the imaging lens assembly 21 decreases, and it is difficult to maintain the optical performance. On the other hand, if the value of $LG1 / f$ exceeds the upper limit value of the formula (3), it is difficult to miniaturize the imaging lens assembly 21.

Furthermore, the imaging lens assembly 21 can be miniaturized and its good optical performance can be maintained more effectively when the camera module 11 satisfies the following formula (4) in the shooting state:

$$\Sigma d / f < 1.8 \quad (4)$$

If the value of $\Sigma d / f$ exceeds the upper limit value of the formula (4), it is difficult to miniaturize the imaging lens assembly 21.

Furthermore, the imaging lens assembly 21 can be miniaturized and its good optical performance can be maintained more effectively when the camera module 11 satisfies the following formula (5) in the shooting state:

$$\Sigma Ld1 < 9.0 \text{ mm} \quad (5)$$

In the formula (5), $\Sigma Ld1$ is a distance on the optical axis of the front lens group 31 from the vertex of the object side surface of the most object side disposed lens of the front lens group 31 to the mirror 33 (hereinafter the same applies).

If the value of $\Sigma Ld1$ exceeds the upper limit value of the formula (5), it is difficult to miniaturize the imaging lens assembly 21 in the lens storage state.

Furthermore, in view of lens forming, it is preferable that an aspheric lens in the imaging lens assembly 21, particularly an aspheric lens of aspheric shape having an inflection point, is formed of a plastic material. Regarding the lenses which constitute the imaging lens assembly 21, lenses having a size equal to or smaller than a specific size are preferably formed of a plastic material, and lenses larger than the specific size are preferably formed of a glass material. This is because it is difficult to form an aspheric lens or a relatively small lens using a material other than a plastic material.

Such a camera module 11 including the imaging lens assembly 21 can be used in compact digital devices (imaging devices) such as mobile phones, wearable cameras and surveillance cameras.

<Configuration examples of the camera module>

Next, more specific examples to which the present disclosure is applied will be described. In the following examples, “Si” indicates the ordinal number of the i-th surface which sequentially increases from the object side toward the imaging surface S side. Optical elements of the corresponding surfaces are indicated by the corresponding surface number “Si”.

Denotations of “first surface” or “1st surface” indicate a surface on the object side of the lens,

and denotations of “second surface” or “2nd surface” indicate a surface on the imaging surface S side of the lens. “R” indicates the value of a central curvature radius (mm) of the surface.

Regarding “R”, “E + i” indicates an exponential expression with a base of 10, i.e., “10ⁱ”. For example, “1.00 E +18” indicates “1.00 × 10¹⁸”. Such an exponential expression is also applied to an aspheric coefficient described later. “Di” indicates a value of a distance on the optical axis between the i-th surface and the (i + 1)-th surface (mm). “Ndi” indicates a value of a refractive index at d-line (wavelength 587.6 nm) of the material of the optical element having the i-th surface. “vdi” indicates a value of the Abbe number at d-line of the material of the optical element having the i-th surface.

The imaging lens assembly 21 used in the following examples includes lenses having aspheric surfaces. The aspheric shape of the lens is defined by the following formula (6):

$$Z = C \times h^2 / \{1 + (1 - K \times C^2 \times h^2)^{1/2}\} + \sum A_n \times h^n \quad (6)$$

(n = an integer greater than 3).

In the formula (6), Z is a depth of the aspheric surface, C is a paraxial curvature which is equal to 1 / R, h is a distance from the optical axis to a lens surface, K is a cone coefficient (second-order aspheric coefficient), and An is an nth-order aspheric coefficient.

[First example]

A first example in which specific numerical values are applied to the camera module 11 shown in FIG. 3, will be described.

In the first example, the imaging lens assembly 21 includes, in order from the object side toward the imaging surface S side, a first lens L1 belonging to the front lens group 31 and having a positive refractive power with convex surfaces facing the object side and the imaging surface S side, a second lens L2 belonging to the front lens group 31 and having a negative refractive power with concave surfaces facing the object side and the imaging surface S side, a mirror 33, a third lens L3 belonging to the rear lens group 32 and having a positive refractive power with convex surfaces facing the object side and the imaging surface S side, and a fourth lens L4 belonging to the rear lens group 32 and having a negative refractive power with concave surfaces facing the object side and the imaging surface S side. The aperture stop 34 is disposed on the front lens group 31.

Table 1 shows lens data of the first example. The unit of length or distance shown in each of the following tables is mm. Table 2 shows a focal length of each lens, a composite focal length LG1 of the front lens group 31, and a composite focal length LG2 of the rear lens group 32. Table 3 shows the focal length of the entire system f, the F number Fno, the angle of view 2ω, the full length of the imaging lens assembly 21 which is obtained when an object point is taken at infinity Σd, the distance ΣLd1 on the optical axis of the front lens group 31 from the vertex of the object side surface of the most object side disposed lens of the front lens group 31 to the mirror 33, a distance ΣLd2 on the optical axis of the rear lens group 32 from the mirror 33 to the imaging surface S, a flange back FB, the image height Yh, and values corresponding to the conditional expressions. Table 4 shows the aspheric coefficients of the imaging lens assembly 21.

TABLE 1

Si	Ri	Di	Ndi	$\nu d i$
1(Virtual Surface)				
2(L1 1st Surface)	13.238	1.508	1.5439	56.07
3(L1 2nd Surface)	-37.638	0.500		
4(L2 1st Surface)	-54.066	2.000	1.6349	23.97
5(L2 2nd Surface)	47.181	0.200		
6(Aperture Stop)		4.000		
7(Mirror)		15.000		
8(L3 1st Surface)	6.555	4.200	1.5439	56.07
9(L3 2nd Surface)	-13.965	0.500		
10(L4 1st Surface)	-6.839	1.500	1.6349	23.97
11(L4 2nd Surface)	9.508	0.590		
12(Optical Filter)		0.110	1.5168	64.20
13(Image Plane)		0.183		

TABLE 2

Lens	Focal Length
L1	18.22
L2	-39.38
L3	8.85
L4	-6.05
LG1	31.14
LG2	804.71

5

TABLE 3

f	21.00
Fno	2.83
2ω	13.25
Σd	30.29
$\Sigma Ld1$	8.21
$\Sigma Ld2$	22.08
FB	0.88
Yh	2.35
$\Sigma d / Yh$	12.89
LG1/f	1.48
$\Sigma d / f$	1.44
LG1/LG2	0.04
$\Sigma Ld1$	8.21

TABLE 4

	S2(L1 1st Surface)	S3(L1 2nd Surface)	S4(L2 1st Surface)
R	1.323776283065030E+01	-3.763779474947650E+01	-5.406617947650900E+01
K	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A3	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A4	3.329974829621160E-05	8.892392550756920E-05	2.049151190227060E-05
A5	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A6	5.195494667721640E-06	5.731558277220220E-06	-6.421793274378100E-07
A7	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A8	-1.058488387640590E-07	-2.551217085074700E-07	2.993081732686290E-07
A9	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A10	-1.671241918278390E-08	-1.479009047848220E-09	-1.629565295780560E-09
A11	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A12	1.030822486601640E-09	7.122130919098520E-10	-2.647161938455330E-10
A13	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A14	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A15	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A16	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A17	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A18	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A19	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A20	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
	S5(L2 2nd Surface)	S8(L3 1st Surface)	S9(L3 2nd Surface)
R	4.718110979533100E+01	6.554542691132000E+00	-1.396543409360000E+01
K	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A3	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A4	1.045823517923870E-05	8.750000000000000E-06	2.011530000000000E-04
A5	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A6	2.520497933608820E-06	1.060000000000000E-06	-1.930000000000000E-05
A7	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A8	-8.939599516266390E-08	-6.100000000000000E-07	-4.890000000000000E-06
A9	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A10	2.739557071820520E-08	2.980000000000000E-08	1.530000000000000E-07
A11	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A12	-1.288178175561500E-09	4.760000000000000E-10	2.120000000000000E-07
A13	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A14	0.000000000000000E+00	0.000000000000000E+00	-1.320000000000000E-08
A15	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A16	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A17	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A18	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A19	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A20	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00

	S10(L4 1st Surface)	S11(L4 2nd Surface)
R	-6.838697283123000E+ 00	9.508359073685000E+ 00
K	0.000000000000000E+ 00	0.000000000000000E+ 00
A3	0.000000000000000E+ 00	0.000000000000000E+ 00
A4	2.659832000000000E-03	8.242080000000000E-04
A5	0.000000000000000E+ 00	0.000000000000000E+ 00
A6	-8.970000000000000E-05	3.562820000000000E-04
A7	0.000000000000000E+ 00	0.000000000000000E+ 00
A8	-7.880000000000000E-06	-4.730000000000000E-05
A9	0.000000000000000E+ 00	0.000000000000000E+ 00
A10	1.710000000000000E-06	-1.210000000000000E-05
A11	0.000000000000000E+ 00	0.000000000000000E+ 00
A12	2.020000000000000E-07	4.040000000000000E-06
A13	0.000000000000000E+ 00	0.000000000000000E+ 00
A14	-2.140000000000000E-08	-2.820000000000000E-07
A15	0.000000000000000E+ 00	0.000000000000000E+ 00
A16	0.000000000000000E+ 00	0.000000000000000E+ 00
A17	0.000000000000000E+ 00	0.000000000000000E+ 00
A18	0.000000000000000E+ 00	0.000000000000000E+ 00
A19	0.000000000000000E+ 00	0.000000000000000E+ 00
A20	0.000000000000000E+ 00	0.000000000000000E+ 00

Aberrations in the first example are shown in FIG. 4. FIG. 4 shows, as examples of aberrations, spherical aberration, astigmatism (field curvature) and distortion. Each of these aberration diagrams shows aberrations with d-line (587.56 nm) as a reference wavelength. In the spherical aberration diagram, aberrations with respect to g-line (435.84 nm) and C-line (656.27 nm) are also shown. In the graph showing astigmatism, “S” indicates a value of aberration on a sagittal image surface and “T” indicates a value of aberration on a tangential image surface. “IMG HT” indicates an image height. The same applies to aberration diagrams in other examples.

As can be seen from the aberration diagrams in FIG. 4, it is clear that the camera module 11 in the first example can satisfactorily correct various aberrations to obtain superior optical performance despite being small in size.

[Second example]

Next, a second example in which specific numerical values are applied to the camera module 11 shown in FIG. 5, will be described.

In the second example, the imaging lens assembly 21 includes, in order from the object side toward the imaging surface S side, a first lens L1 belonging to the front lens group 31 and having a positive refractive power with convex surfaces facing the object side and the imaging surface S side, a second lens L2 belonging to the front lens group 31 and having a negative refractive power with concave surfaces facing the object side and the imaging surface S side, a mirror 33, a third lens L3 belonging to the rear lens group 32 and having a positive refractive power with a convex surface facing the object side, and a fourth lens L4 belonging to the rear lens group 32 and having a negative refractive power with concave surfaces facing the object side and the imaging surface S side. The aperture stop 34 is disposed on the front lens group 31.

Table 5 shows lens data of the second example. Table 6 shows a focal length of each lens, a composite focal length LG1 of the front lens group 31, and a composite focal length LG2 of the rear lens group 32. Table 7 shows the focal length of the entire system f, the F number Fno, the angle of view 2ω , the full length of the imaging lens assembly 21 which is obtained when an object point is taken at infinity Σd , the distance $\Sigma Ld1$ on the optical axis of the front lens group 31 from the vertex of the object side surface of the most object side disposed lens of the front lens group 31 to the mirror 33, the distance $\Sigma Ld2$ on the optical axis of the rear lens group 32

from the mirror 33 to the imaging surface S, the flange back FB, the image height Yh, and values corresponding to the conditional expressions. Table 8 shows the aspheric coefficients of the imaging lens assembly 21.

TABLE 5

Si	Ri	Di	Ndi	$\nu d i$
1(Virtual Surface)				
2(L1 1st Surface)	12.284	1.226	1.5439	56.07
3(L1 2nd Surface)	-48.935	0.475		
4(L2 1st Surface)	-95.191	1.413	1.6349	23.97
5(L2 2nd Surface)	33.698	0.200		
6(Aperture Stop)		4.000		
7(Mirror)		15.000		
8(L3 1st Surface)	6.692	4.200	1.5439	56.07
9(L3 2nd Surface)	89.040	0.500		
10(L4 1st Surface)	-16.406	1.500	1.6349	23.97
11(L4 2nd Surface)	9.012	0.590		
12(Optical Filter)		0.110	1.5168	64.20
13(Image Plane)		0.744		

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TABLE 6

Lens	Focal Length
L1	18.21
L2	-39.03
L3	13.09
L4	-8.96
LG1	31.47
LG2	-735.38

TABLE 7

f	22.00
Fno	2.92
2ω	12.53
Σd	29.96
$\Sigma Ld1$	7.31
$\Sigma Ld2$	22.64
FB	1.44
Yh	2.35
$\Sigma d / Yh$	12.75
LG1/f	1.43
$\Sigma d / f$	1.36
LG1/LG2	-0.04
$\Sigma Ld1$	7.31

TABLE 8

	S2(L1 1st Surface)	S3(L1 2nd Surface)	S4(L2 1st Surface)
R	1.228438972960850E+ 01	-4.893508604710390E+ 01	-9.519054168282540E+ 01
K	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A3	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A4	2.649046192623080E-05	9.084488451408200E-05	2.467873372470160E-05
A5	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A6	5.405760776368880E-06	5.615284721610720E-06	-8.469127461964840E-08
A7	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A8	-1.077118728705790E-07	-2.381064848936710E-07	3.196936823324590E-07
A9	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A10	-1.746156909746220E-08	-1.305889137327320E-09	-1.695764369687850E-09
A11	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A12	1.030482962205500E-09	4.972393973664750E-10	-4.572117142317190E-10
A13	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A14	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A15	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A16	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A17	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A18	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A19	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A20	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00

	S5(L2 2nd Surface)	S8(L3 1st Surface)	S9(L3 2nd Surface)
R	3.369782042363760E+ 01	6.691777470888000E+ 00	8.903965977103000E+ 01
K	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A3	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A4	7.694949667156940E-06	-1.110000000000000E-05	6.616070000000000E-04
A5	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A6	3.437309907770490E-06	-1.370000000000000E-06	-1.004020000000000E-04
A7	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A8	-7.107768112023310E-08	-4.280000000000000E-07	-5.710000000000000E-06
A9	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A10	2.362916650625940E-08	1.230000000000000E-08	1.150000000000000E-07
A11	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A12	-1.143452933365970E-09	3.170000000000000E-10	2.490000000000000E-07
A13	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A14	0.000000000000000E+ 00	0.000000000000000E+ 00	-6.660000000000000E-09
A15	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A16	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A17	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A18	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A19	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A20	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
	S10(L4 1st Surface)	S11(L4 2nd Surface)	
R	-1.640593634688000E+ 01	9.011502646525000E+ 00	
K	0.000000000000000E+ 00	0.000000000000000E+ 00	
A3	0.000000000000000E+ 00	0.000000000000000E+ 00	
A4	1.009750000000000E-03	-1.258520000000000E-04	
A5	0.000000000000000E+ 00	0.000000000000000E+ 00	
A6	-1.194680000000000E-04	-2.450000000000000E-05	
A7	0.000000000000000E+ 00	0.000000000000000E+ 00	
A8	-8.350000000000000E-06	3.520000000000000E-05	
A9	0.000000000000000E+ 00	0.000000000000000E+ 00	
A10	2.320000000000000E-06	-1.910000000000000E-05	
A11	0.000000000000000E+ 00	0.000000000000000E+ 00	
A12	2.350000000000000E-07	4.210000000000000E-06	
A13	0.000000000000000E+ 00	0.000000000000000E+ 00	
A14	-2.030000000000000E-08	-2.820000000000000E-07	
A15	0.000000000000000E+ 00	0.000000000000000E+ 00	
A16	0.000000000000000E+ 00	0.000000000000000E+ 00	
A17	0.000000000000000E+ 00	0.000000000000000E+ 00	
A18	0.000000000000000E+ 00	0.000000000000000E+ 00	
A19	0.000000000000000E+ 00	0.000000000000000E+ 00	
A20	0.000000000000000E+ 00	0.000000000000000E+ 00	

Aberrations in the second example are shown in FIG. 6. As can be seen from the aberration diagrams in FIG. 6, it is obvious that the camera module 11 in the second example can satisfactorily correct various aberrations to obtain superior optical performance despite being small in size.

[Third example]

Next, a third example in which specific numerical values are applied to the camera module 11 shown in FIG. 7, will be described.

In the third example, the imaging lens assembly 21 includes, in order from the object side toward the imaging surface S side, a first lens L1 belonging to the front lens group 31 and having

a positive refractive power with convex surfaces facing the object side and the imaging surface S side, a second lens L2 belonging to the front lens group 31 and having a negative refractive power with concave surfaces facing the object side and the imaging surface S side, a mirror 33, a third lens L3 belonging to the rear lens group 32 and having a positive refractive power with a convex surface facing the object side, a fourth lens L4 belonging to the rear lens group 32 and having a positive refractive power with convex surfaces facing the object side and the imaging surface S side, and a fifth lens L5 belonging to the rear lens group 32 and having a negative refractive power with concave surfaces facing the object side and the imaging surface S side. The aperture stop 34 is disposed on the front lens group 31.

Table 9 shows lens data of the third example. Table 10 shows a focal length of each lens, a composite focal length LG1 of the front lens group 31, and a composite focal length LG2 of the rear lens group 32. Table 11 shows the focal length of the entire system f , the F number F_{no} , the angle of view 2ω , the full length of the imaging lens assembly 21 which is obtained when an object point is taken at infinity Σd , the distance $\Sigma Ld1$ on the optical axis of the front lens group 31 from the vertex of the object side surface of the most object side disposed lens of the front lens group 31 to the mirror 33, the distance $\Sigma Ld2$ on the optical axis of the rear lens group 32 from the mirror 33 to the imaging surface S, the flange back FB, the image height Y_h , and values corresponding to the conditional expressions. Table 12 shows the aspheric coefficients of the imaging lens assembly 21.

TABLE 9

Si	Ri	Di	Ndi	$\nu d i$
1(Virtual Surface)				
2(L1 1st Surface)	18.624	1.183	1.5439	56.07
3(L1 2nd Surface)	-44.646	0.500		
4(L2 1st Surface)	-60.519	1.077	1.6349	23.97
5(L2 2nd Surface)	106.957	0.250		
6(Aperture Stop)		4.000		
7(Mirror)		16.499		
8(L3 1st Surface)	20.737	4.200	1.5439	56.07
9(L3 2nd Surface)	-372.925	0.300		
10(L4 1st Surface)	11.023	4.055	1.5439	56.07
11(L4 2nd Surface)	-11.628	0.180		
12(L5 1st Surface)	-8.686	4.200	1.6349	23.97
13(L5 2nd Surface)	8.328	0.500		
14(Optical Filter)		0.110	1.5168	64.20
15(Image Plane)		0.103		

TABLE 10

Lens	Focal Length
L1	24.35
L2	-60.72
L3	36.30
L4	11.12
L5	-6.11
LG1	39.28
LG2	84.90

TABLE 11

f	22.00
F_{no}	2.94
2ω	12.50
Σd	37.16
$\Sigma Ld1$	7.01
$\Sigma Ld2$	30.15
FB	0.71
Y_h	2.35
$\Sigma d / Y_h$	15.81
LG1/ f	1.79
$\Sigma d / f$	1.69
LG1/LG2	0.46
$\Sigma Ld1$	7.01

TABLE 12

	S2(L1 1st Surface)	S3(L1 2nd Surface)	S4(L2 1st Surface)
R	1.862354650375250E+01	-4.464597963613040E+01	-6.051893735243520E+01
K	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A3	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A4	5.102141089858570E-05	8.456274157642000E-05	2.216625041686290E-05
A5	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A6	5.573298691296730E-06	5.441229400728360E-06	-2.142405435455200E-07
A7	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A8	-1.366616331296500E-07	-2.129015277933060E-07	2.643020597836630E-07
A9	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A10	-1.426488067524150E-08	-4.355251472643210E-09	1.784542379128110E-09
A11	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A12	9.248253458175750E-10	6.421511743742360E-10	-5.144873731857120E-10
A13	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A14	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A15	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A16	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A17	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A18	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A19	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A20	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
	S5(L2 2nd Surface)	S8(L3 1st Surface)	S9(L3 2nd Surface)
R	1.069565207439360E+02	2.073690732985000E+01	-3.729245251494000E+02
K	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A3	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A4	9.434724729521350E-06	7.430000000000000E-05	6.850000000000000E-05
A5	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A6	2.453884782846180E-06	7.000000000000000E-07	2.660000000000000E-06
A7	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A8	-1.947150315685310E-08	3.330000000000000E-07	8.640000000000000E-09
A9	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A10	1.755194753144610E-08	-1.280000000000000E-08	-1.970000000000000E-09
A11	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A12	-9.078302746376950E-10	0.000000000000000E+00	0.000000000000000E+00
A13	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A14	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A15	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A16	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A17	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A18	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A19	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A20	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00

	S10(L4 1st Surface)	S11(L4 2nd Surface)	S12(L5 1st Surface)
R	1.102277378079000E+ 01	-1.162762343800000E+ 01	-8.685681634001000E+ 00
K	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A3	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A4	5.940000000000000E-05	9.105100000000000E-04	1.201820000000000E-03
A5	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A6	2.960000000000000E-07	-1.041770000000000E-04	-8.860000000000000E-05
A7	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A8	-9.010000000000000E-07	-6.910000000000000E-06	-8.430000000000000E-06
A9	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A10	-1.780000000000000E-08	3.590000000000000E-07	1.660000000000000E-06
A11	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A12	2.470000000000000E-09	2.870000000000000E-07	1.320000000000000E-07
A13	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A14	0.000000000000000E+ 00	-2.110000000000000E-08	-1.620000000000000E-08
A15	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A16	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A17	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A18	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A19	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A20	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
	S13(L5 2nd Surface)		
R	8.328197499645000E+ 00		
K	0.000000000000000E+ 00		
A3	0.000000000000000E+ 00		
A4	4.750940000000000E-04		
A5	0.000000000000000E+ 00		
A6	2.961680000000000E-04		
A7	0.000000000000000E+ 00		
A8	-6.410000000000000E-05		
A9	0.000000000000000E+ 00		
A10	-9.810000000000000E-06		
A11	0.000000000000000E+ 00		
A12	4.170000000000000E-06		
A13	0.000000000000000E+ 00		
A14	-2.820000000000000E-07		
A15	0.000000000000000E+ 00		
A16	0.000000000000000E+ 00		
A17	0.000000000000000E+ 00		
A18	0.000000000000000E+ 00		
A19	0.000000000000000E+ 00		
A20	0.000000000000000E+ 00		

5 Aberrations in the third example are shown in FIG. 8. As can be seen from the aberration diagrams in FIG. 8, it is obvious that the camera module 11 in the third example can satisfactorily correct various aberrations to obtain superior optical performance despite being small in size.

[Fourth example]

10 Next, a fourth example in which specific numerical values are applied to the camera module 11 shown in FIG. 9, will be described.

In the fourth example, the imaging lens assembly 21 includes, in order from the object side toward the imaging surface S side, a first lens L1 belonging to the front lens group 31 and having a positive refractive power with convex surfaces facing the object side and the imaging surface S side, a second lens L2 belonging to the front lens group 31 and having a negative refractive power with a concave surface facing the object side, a mirror 33, a third lens L3 belonging to the rear lens group 32 and having a positive refractive power with a convex surface facing the object side, a fourth lens L4 belonging to the rear lens group 32 and having a positive refractive power with convex surfaces facing the object side and the imaging surface S side, and a fifth lens L5 belonging to the rear lens group 32 and having a negative refractive power with concave surfaces facing the object side and the imaging surface S side. The aperture stop 34 is disposed on the front lens group 31.

Table 13 shows lens data of the fourth example. Table 14 shows a focal length of each lens, a composite focal length LG1 of the front lens group 31, and a composite focal length LG2 of the rear lens group 32. Table 15 shows the focal length of the entire system f , the F number F_{no} , the angle of view 2ω , the full length of the imaging lens assembly 21 which is obtained when an object point is taken at infinity Σd , the distance $\Sigma Ld1$ on the optical axis of the front lens group 31 from the vertex of the object side surface of the most object side disposed lens of the front lens group 31 to the mirror 33, the distance $\Sigma Ld2$ on the optical axis of the rear lens group 32 from the mirror 33 to the imaging surface S, the flange back FB, the image height Y_h , and values corresponding to the conditional expressions. Table 16 shows the aspheric coefficients of the imaging lens assembly 21.

TABLE 13

Si	Ri	Di	Ndi	$\nu d i$
1(Virtual Surface)				
2(L1 1st Surface)	19.270	1.233	1.5439	56.07
3(L1 2nd Surface)	-63.858	0.300		
4(L2 1st Surface)	-52.764	1.523	1.6349	23.97
5(L2 2nd Surface)	260.421	0.400		
6(Aperture Stop)		4.500		
7(Mirror)		20.270		
8(L3 1st Surface)	20.947	4.200	1.544	56.07
9(L3 2nd Surface)	-146.749	0.200		
10(L4 1st Surface)	10.998	4.044	1.544	56.07
11(L4 2nd Surface)	-18.143	0.150		
12(L5 1st Surface)	-10.412	4.200	1.635	23.97
13(L5 2nd Surface)	8.764	0.800		
14(Optical Filter)		0.110	1.517	64.20
15(Image Plane)		0.102		

TABLE 14

Lens	Focal Length
L1	27.39
L2	-68.98
L3	34.05
L4	13.25
L5	-6.91
LG1	44.30
LG2	86.15

TABLE 15

f	25.00
F_{no}	3.26
2ω	11.08
Σd	42.03
$\Sigma Ld1$	7.96
$\Sigma Ld2$	34.08
FB	1.01
Y_h	2.35
$\Sigma d / Y_h$	17.89
LG1/ f	1.77
$\Sigma d / f$	1.68
LG1/LG2	0.51
$\Sigma Ld1$	7.96

TABLE 16

	S2(L1 1st Surface)	S3(L1 2nd Surface)	S4(L2 1st Surface)
R	1.926971915169360E+01	-6.385829273193890E+01	-5.276422198980220E+01
K	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A3	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A4	6.108613169385300E-05	8.175015382649700E-05	2.072884296850040E-05
A5	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A6	5.334289519177060E-06	5.159592510244380E-06	-9.281623846664340E-08
A7	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A8	-1.896774772119910E-07	-2.018341591665740E-07	2.494051533504800E-07
A9	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A10	-1.482580391656440E-08	-6.837056432725200E-09	3.263798939430120E-09
A11	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A12	8.703163752501980E-10	5.224049564458520E-10	-6.180962709726270E-10
A13	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A14	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A15	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A16	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A17	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A18	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A19	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A20	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
	S5(L2 2nd Surface)	S8(L3 1st Surface)	S9(L3 2nd Surface)
R	2.604213629444670E+02	2.094675371426000E+01	-1.467490177695000E+02
K	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A3	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A4	1.180834231074400E-05	3.530000000000000E-05	1.027240000000000E-04
A5	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A6	2.028083542934690E-06	1.340000000000000E-06	4.690000000000000E-06
A7	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A8	-6.143474775392610E-09	1.560000000000000E-07	-3.560000000000000E-08
A9	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A10	1.405950286940820E-08	-1.080000000000000E-08	4.830000000000000E-09
A11	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A12	-7.669548916589860E-10	0.000000000000000E+00	0.000000000000000E+00
A13	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A14	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A15	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A16	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A17	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A18	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A19	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A20	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00

	S10(L4 1st Surface)	S11(L4 2nd Surface)	S12(L5 1st Surface)
R	1.099751876098000E+ 01	-1.814320666854000E+ 01	-1.041162674514000E+ 01
K	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A3	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A4	3.060000000000000E-05	5.675960000000000E-04	1.435103000000000E-03
A5	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A6	4.570000000000000E-07	-9.310000000000000E-05	-1.007510000000000E-04
A7	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A8	-5.240000000000000E-07	-7.610000000000000E-06	-7.610000000000000E-06
A9	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A10	1.390000000000000E-08	4.830000000000000E-07	1.570000000000000E-06
A11	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A12	2.770000000000000E-09	3.010000000000000E-07	1.040000000000000E-07
A13	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A14	0.000000000000000E+ 00	-2.440000000000000E-08	-1.550000000000000E-08
A15	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A16	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A17	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A18	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A19	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
A20	0.000000000000000E+ 00	0.000000000000000E+ 00	0.000000000000000E+ 00
	S13(L5 2nd Surface)		
R	8.763590887469000E+ 00		
K	0.000000000000000E+ 00		
A3	0.000000000000000E+ 00		
A4	1.540324000000000E-03		
A5	0.000000000000000E+ 00		
A6	-4.149250000000000E-04		
A7	0.000000000000000E+ 00		
A8	1.322500000000000E-04		
A9	0.000000000000000E+ 00		
A10	-2.920000000000000E-05		
A11	0.000000000000000E+ 00		
A12	4.170000000000000E-06		
A13	0.000000000000000E+ 00		
A14	-2.820000000000000E-07		
A15	0.000000000000000E+ 00		
A16	0.000000000000000E+ 00		
A17	0.000000000000000E+ 00		
A18	0.000000000000000E+ 00		
A19	0.000000000000000E+ 00		
A20	0.000000000000000E+ 00		

Aberrations in the fourth example are shown in FIG. 10. As can be seen from the aberration diagrams in FIG. 10, it is obvious that the camera module 11 in the fourth example can satisfactorily correct various aberrations to obtain superior optical performance despite being small in size.

[Fifth example]

Next, a fifth example in which specific numerical values are applied to the camera module 11 shown in FIG. 11, will be described.

In the fifth example, the imaging lens assembly 21 includes, in order from the object side toward the imaging surface S side, a first lens L1 belonging to the front lens group 31 and having

a positive refractive power with a convex surface facing the object side, a second lens L2 belonging to the front lens group 31 and having a negative refractive power with a concave surface facing the imaging surface S side, a mirror 33, a third lens L3 belonging to the rear lens group 32 and having a positive refractive power, a fourth lens L4 belonging to the rear lens group 32 and having a positive refractive power with convex surfaces facing the object side and the imaging surface S side, and a fifth lens L5 belonging to the rear lens group 32 and having a negative refractive power with concave surfaces facing the object side and the imaging surface S side. The aperture stop 34 is disposed on the front lens group 31.

Table 17 shows lens data of the fifth example. Table 18 shows a focal length of each lens, a composite focal length LG1 of the front lens group 31, and a composite focal length LG2 of the rear lens group 32. Table 19 shows the focal length of the entire system f , the F number F_{no} , the angle of view 2ω , the full length of the imaging lens assembly 21 which is obtained when an object point is taken at infinity Σd , the distance $\Sigma Ld1$ on the optical axis of the front lens group 31 from the vertex of the object side surface of the most object side disposed lens of the front lens group 31 to the mirror 33, the distance $\Sigma Ld2$ on the optical axis of the rear lens group 32 from the mirror 33 to the imaging surface S, the flange back FB, the image height Y_h , and values corresponding to the conditional expressions. Table 20 shows the aspheric coefficients of the imaging lens assembly 21.

TABLE 17

Si	Ri	Di	Ndi	$\nu d i$
1(Virtual Surface)				
2(L1 1st Surface)	13.629	1.074	1.5439	56.07216495
3(L1 2nd Surface)	214.396	0.200		
4(L2 1st Surface)		0.100	1.6349	23.97
5(L2 2nd Surface)	49.993	0.573		
6(Aperture Stop)	22.136	4.900		
7(Mirror)		20.719		
8(L3 1st Surface)	19.908	4.200	1.544	56.07
9(L3 2nd Surface)	19.246	1.178		
10(L4 1st Surface)	8.121	4.200	1.544	56.07
11(L4 2nd Surface)	-27.322	0.093		
12(L5 1st Surface)	-13.681	4.200	1.635	23.97
13(L5 2nd Surface)	10.103	0.800		
14(Optical Filter)		0.110	1.517	64.20
15(Image Plane)		0.103		

TABLE 18

Lens	Focal Length
L1	26.74
L2	-63.08
L3	864.47
L4	12.03
L5	-8.57
LG1	44.38
LG2	286.58

TABLE 19

f	28.00
Fno	3.60
2ω	9.99
Σd	42.45
$\Sigma Ld1$	6.85
$\Sigma Ld2$	35.60
FB	1.01
Yh	2.35
$\Sigma d / Yh$	18.06
LG1/f	1.58
$\Sigma d / f$	1.52
LG1/LG2	0.15
$\Sigma Ld1$	6.85

TABLE 20

	S2(L1 1st Surface)	S3(L1 2nd Surface)	S4(L2 1st Surface)
R	1.362881829346560E+01	2.143959919501570E+02	4.999260234507500E+01
K	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A3	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A4	4.162059711607570E-05	8.042834887752580E-05	2.376311614265080E-05
A5	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A6	5.655500855294640E-06	5.090272018873370E-06	3.634635862822760E-08
A7	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A8	-1.294722452678220E-07	-2.195336458997560E-07	2.825425024388850E-07
A9	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A10	-1.520310269843250E-08	-4.184489750779860E-09	2.361854169537600E-09
A11	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A12	8.851159133829620E-10	5.707373250600600E-10	-5.831685476966200E-10
A13	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A14	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A15	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A16	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A17	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A18	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A19	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00
A20	0.000000000000000E+00	0.000000000000000E+00	0.000000000000000E+00

	S5(L2 2nd Surface)	S8(L3 1st Surface)	S9(L3 2nd Surface)
R	2.21362251229650E+ 01	1.99081606097300E+ 01	1.92457164825300E+ 01
K	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A3	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A4	1.33894887353450E-05	-6.87000000000000E-05	1.00266000000000E-04
A5	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A6	3.32776468709628E-06	-1.86000000000000E-06	3.97000000000000E-06
A7	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A8	1.90551052276679E-08	2.68000000000000E-07	1.96000000000000E-07
A9	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A10	1.60541270808199E-08	-1.33000000000000E-08	2.97000000000000E-08
A11	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A12	-9.09990485705314E-10	0.00000000000000E+ 00	0.00000000000000E+ 00
A13	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A14	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A15	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A16	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A17	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A18	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A19	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A20	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
	S10(L4 1st Surface)	S11(L4 2nd Surface)	S12(L5 1st Surface)
R	8.12078383945200E+ 00	-2.73215448740800E+ 01	-1.36809687399900E+ 01
K	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A3	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A4	7.58000000000000E-05	2.64294000000000E-04	1.33454100000000E-03
A5	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A6	3.84000000000000E-06	-8.65000000000000E-05	-7.83000000000000E-05
A7	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A8	-2.76000000000000E-07	-3.84000000000000E-06	-6.77000000000000E-06
A9	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A10	2.62000000000000E-08	5.92000000000000E-07	1.68000000000000E-06
A11	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A12	4.38000000000000E-09	2.93000000000000E-07	1.00000000000000E-07
A13	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A14	0.00000000000000E+ 00	-2.74000000000000E-08	-1.85000000000000E-08
A15	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A16	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A17	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A18	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A19	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00
A20	0.00000000000000E+ 00	0.00000000000000E+ 00	0.00000000000000E+ 00

	S13(L5 2nd Surface)
R	1.010270692483000E+ 01
K	0.000000000000000E+ 00
A3	0.000000000000000E+ 00
A4	8.718040000000000E-04
A5	0.000000000000000E+ 00
A6	-5.910000000000000E-05
A7	0.000000000000000E+ 00
A8	7.570000000000000E-05
A9	0.000000000000000E+ 00
A10	-2.220000000000000E-05
A11	0.000000000000000E+ 00
A12	4.170000000000000E-06
A13	0.000000000000000E+ 00
A14	-2.820000000000000E-07
A15	0.000000000000000E+ 00
A16	0.000000000000000E+ 00
A17	0.000000000000000E+ 00
A18	0.000000000000000E+ 00
A19	0.000000000000000E+ 00
A20	0.000000000000000E+ 00

Aberrations in the fifth example are shown in FIG. 12. As can be seen from the aberration diagrams in FIG. 12, it is obvious that the camera module 11 in the fifth example can satisfactorily correct various aberrations to obtain superior optical performance despite being small in size.

In the description of embodiments of the present disclosure, it is to be understood that terms such as "central", "longitudinal", "transverse", "length", "width", "thickness", "upper", "lower", "front", "rear", "back", "left", "right", "vertical", "horizontal", "top", "bottom", "inner", "outer", "clockwise" and "counterclockwise" should be construed to refer to the orientation or the position as described or as shown in the drawings in discussion. These relative terms are only used to simplify the description of the present disclosure, and do not indicate or imply that the device or element referred to must have a particular orientation, or must be constructed or operated in a particular orientation. Thus, these terms cannot be constructed to limit the present disclosure.

In addition, terms such as "first" and "second" are used herein for purposes of description and are not intended to indicate or imply relative importance or significance or to imply the number of indicated technical features. Thus, a feature defined as "first" and "second" may comprise one or more of this feature. In the description of the present disclosure, "a plurality of" means "two or more than two", unless otherwise specified.

In the description of embodiments of the present disclosure, unless specified or limited otherwise, the terms "mounted", "connected", "coupled" and the like are used broadly, and may be, for example, fixed connections, detachable connections, or integral connections; may also be mechanical or electrical connections; may also be direct connections or indirect connections via intervening structures; may also be inner communications of two elements which can be understood by those skilled in the art according to specific situations.

In the embodiments of the present disclosure, unless specified or limited otherwise, a structure in which a first feature is "on" or "below" a second feature may include an embodiment in which the first feature is in direct contact with the second feature, and may also include an embodiment in which the first feature and the second feature are not in direct contact with each

other, but are in contact via an additional feature formed therebetween. Furthermore, a first feature "on", "above" or "on top of" a second feature may include an embodiment in which the first feature is orthogonally or obliquely "on", "above" or "on top of" the second feature, or just means that the first feature is at a height higher than that of the second feature; while a first feature "below", "under" or "on bottom of" a second feature may include an embodiment in which the first feature is orthogonally or obliquely "below", "under" or "on bottom of" the second feature, or just means that the first feature is at a height lower than that of the second feature.

Various embodiments and examples are provided in the above description to implement different structures of the present disclosure. In order to simplify the present disclosure, certain elements and settings are described in the above. However, these elements and settings are only by way of example and are not intended to limit the present disclosure. In addition, reference numbers and/or reference letters may be repeated in different examples in the present disclosure. This repetition is for the purpose of simplification and clarity and does not refer to relations between different embodiments and/or settings. Furthermore, examples of different processes and materials are provided in the present disclosure. However, it would be appreciated by those skilled in the art that other processes and/or materials may also be applied.

Reference throughout this specification to "an embodiment", "some embodiments", "an exemplary embodiment", "an example", "a specific example" or "some examples" means that a particular feature, structure, material, or characteristics described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. Thus, the appearances of the above phrases throughout this specification are not necessarily referring to the same embodiment or example of the present disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples.

Any process or method described in a flow chart or described herein in other ways may be understood to include one or more modules, segments or portions of codes of executable instructions for achieving specific logical functions or steps in the process, and the scope of a preferred embodiment of the present disclosure includes other implementations, in which it should be understood by those skilled in the art that functions may be implemented in a sequence other than the sequences shown or discussed, including in a substantially identical sequence or in an opposite sequence.

The logic and/or step described in other manners herein or shown in the flow chart, for example, a particular sequence table of executable instructions for realizing the logical function, may be specifically achieved in any computer readable medium to be used by the instructions execution system, device or equipment (such as a system based on computers, a system comprising processors or other systems capable of obtaining instructions from the instructions execution system, device and equipment executing the instructions), or to be used in combination with the instructions execution system, device and equipment. As to the specification, "the computer readable medium" may be any device adaptive for including, storing, communicating, propagating or transferring programs to be used by or in combination with the instruction execution system, device or equipment. More specific examples of the computer readable medium comprise but are not limited to: an electronic connection (an electronic device) with one or more wires, a portable computer enclosure (a magnetic device), a random access memory (RAM), a read only memory (ROM), an erasable programmable read-only memory (EPROM or a flash memory), an optical fiber device and a portable compact disk read-only memory (CDROM). In addition, the computer readable medium may even be a paper or other appropriate medium capable of printing programs thereon, this is because, for example, the paper or other appropriate medium may be optically scanned and then edited, decrypted or processed with other appropriate methods when necessary to obtain the programs in an electric manner, and then the programs may be stored in the computer memories.

It should be understood that each part of the present disclosure may be realized by the hardware, software, firmware or their combination. In the above embodiments, a plurality of steps or methods may be realized by the software or firmware stored in the memory and executed by the appropriate instructions execution system. For example, if it is realized by the hardware, likewise in another embodiment, the steps or methods may be realized by one or a combination of the following techniques known in the art: a discrete logic circuit having a logic gate circuit for realizing a logic function of a data signal, an application-specific integrated circuit having an appropriate combination logic gate circuit, a programmable gate array (PGA), a field programmable gate array (FPGA), etc.

Those skilled in the art shall understand that all or parts of the steps in the above exemplifying method of the present disclosure may be achieved by commanding the related hardware with programs. The programs may be stored in a computer readable storage medium, and the programs comprise one or a combination of the steps in the method embodiments of the present disclosure when run on a computer.

In addition, each function cell of the embodiments of the present disclosure may be integrated in a processing module, or these cells may be separate physical existence, or two or more cells are integrated in a processing module. The integrated module may be realized in a form of hardware or in a form of software function modules. When the integrated module is realized in a form of software function module and is sold or used as a standalone product, the integrated module may be stored in a computer readable storage medium.

The storage medium mentioned above may be read-only memories, magnetic disks, CD, etc.

Although embodiments of the present disclosure have been shown and described, it should be appreciated by those skilled in the art that the embodiments are explanatory and cannot be construed to limit the present disclosure, and changes, modifications, alternatives and variations can be made in the embodiments without departing from the scope of the present disclosure.

CLAIMS

1. An imaging lens assembly, comprising:

a first lens group comprising at least one lens having a positive refractive power;

a second lens group comprising at least one lens having a negative refractive power;

a mirror rotatable about one end on the second lens group side of the mirror; and

an aperture stop, which is configured to adjust amount of light passing through the aperture stop, positioned between a most object side disposed lens of the first lens group and the mirror, wherein-

the first lens group is configured to change its position in an optical axis direction between a shooting state and a lens storage state by moving to an opposite side of the mirror at the duration of switching from the lens storage state to the shooting state, and moving to the mirror side at the duration of switching from the shooting state to the lens storage state,

the mirror is configured to form an optical path, which optically connects the first lens group and the second lens group, by rotating toward the first lens group side and tilting with respect to both of an optical axis direction of the first lens group and an optical axis direction of the second lens group at the duration of switching from the lens storage state to the shooting state,

the mirror is configured to secure a storage space for the first lens group by rotating toward an opposite side of the first lens group at the duration of switching from the shooting state to the lens storage state and being substantially perpendicular to the optical axis direction of the first lens group in the lens storage state.

2. The imaging lens assembly according to claim 1, further comprising:

$-0.6 < LG1 / LG2 < 0.6$,

where LG1 is a focal length of the first lens group, and LG2 is a focal length of the second lens group.

3. The imaging lens assembly according to claim 1, further comprising:

$\Sigma d / Yh \leq 22.0$,

where Σd is a distance on an optical axis of the imaging lens assembly from a vertex of an object side surface of a most object side disposed lens of the first lens group to an imaging surface, the optical axis of the imaging lens assembly comprising an optical axis of the first lens group and an optical axis of the second lens group that are continuous with each other at an intersection with the mirror, and Yh is an image height.

4. The imaging lens assembly according to claim 1, further comprising:

$1.0 < LG1 / f < 2.0$,

where f is a focal length of the imaging lens assembly.

5. The imaging lens assembly according to claim 1, further comprising:

$\Sigma d / f < 1.8$,

where Σd is a distance on an optical axis of the imaging lens assembly from a vertex of an object side surface of a most object side disposed lens of the first lens group to an imaging surface, the optical axis of the imaging lens assembly comprising an optical axis of the first lens group and an optical axis of the second lens group that are continuous with each other at an intersection with the mirror, and f is a focal length of the imaging lens assembly.

6. The imaging lens assembly according to claim 1, wherein

the first lens group further comprises at least one lens having a negative refractive power, and

the second lens group further comprises at least one lens having a positive refractive power.

7.The imaging lens assembly according to claim 1, further comprising:

$\Sigma Ld1 < 9.0$ mm,

where $\Sigma Ld1$ is a distance on an optical axis of the first lens group from a vertex of an object side surface of a most object side disposed lens of the first lens group to the mirror.

5

8.The imaging lens assembly according to claim 1, wherein a most object side disposed lens of the second lens group have a positive refractive power.

9.The imaging lens assembly according to claim 1, wherein the first lens group is positioned parallel to the optical axis of the second lens group in the lens storage state.

10

10.The imaging lens assembly according to claim 1, wherein the optical axis direction of the first lens group is substantially perpendicular to the optical axis direction of the second lens group.

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11.A camera module, comprising:

an imaging lens assembly according to any one of claims 1-10; and

an image sensor comprising an imaging surface.

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12.The camera module according to claim 11, further comprising an IR filter disposed between the imaging lens assembly and the image sensor.

13.An imaging device, comprising:

a camera module according to claim 11 or 12; and

a housing for storing the imaging lens assembly.

25

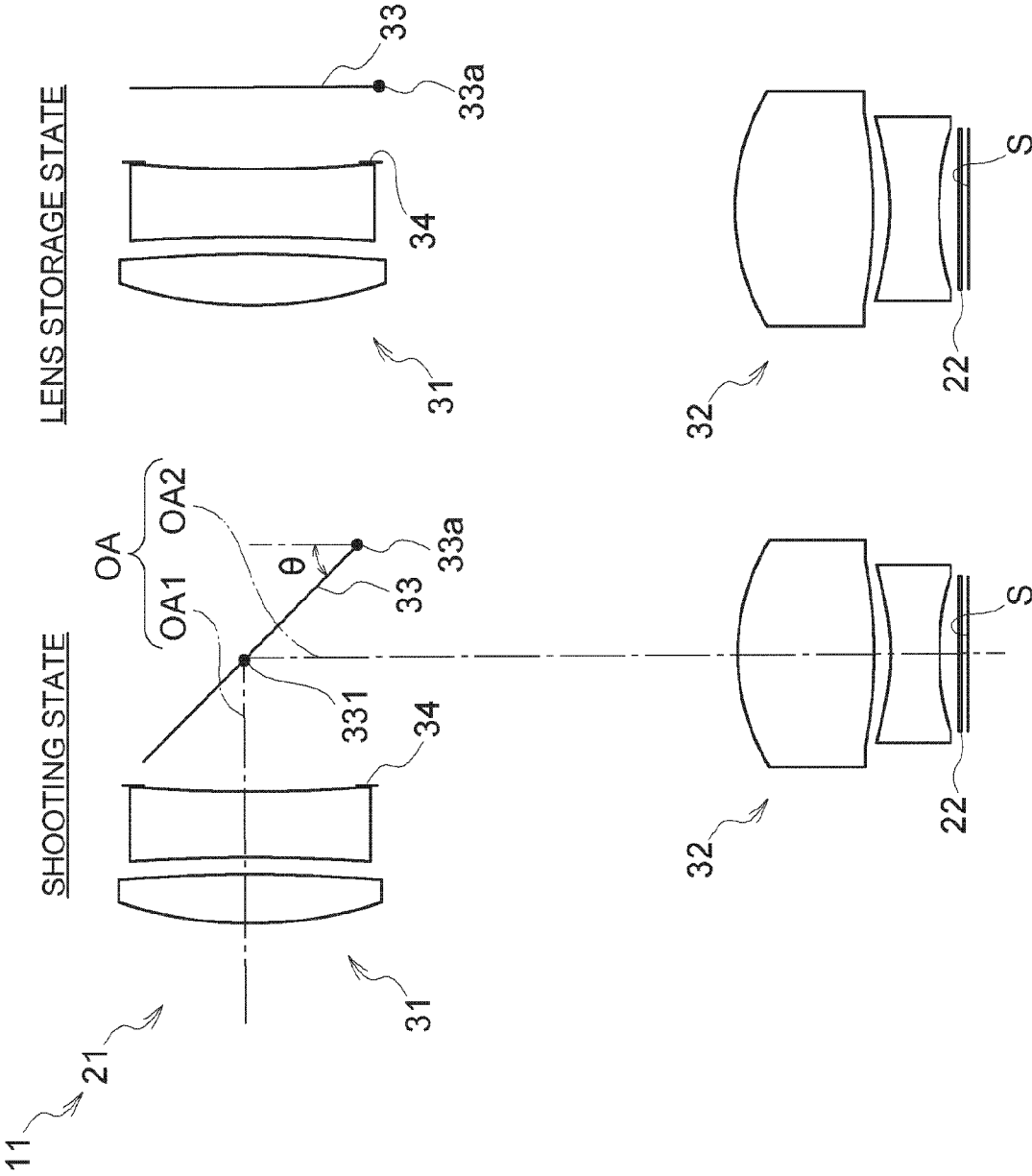


FIG. 1

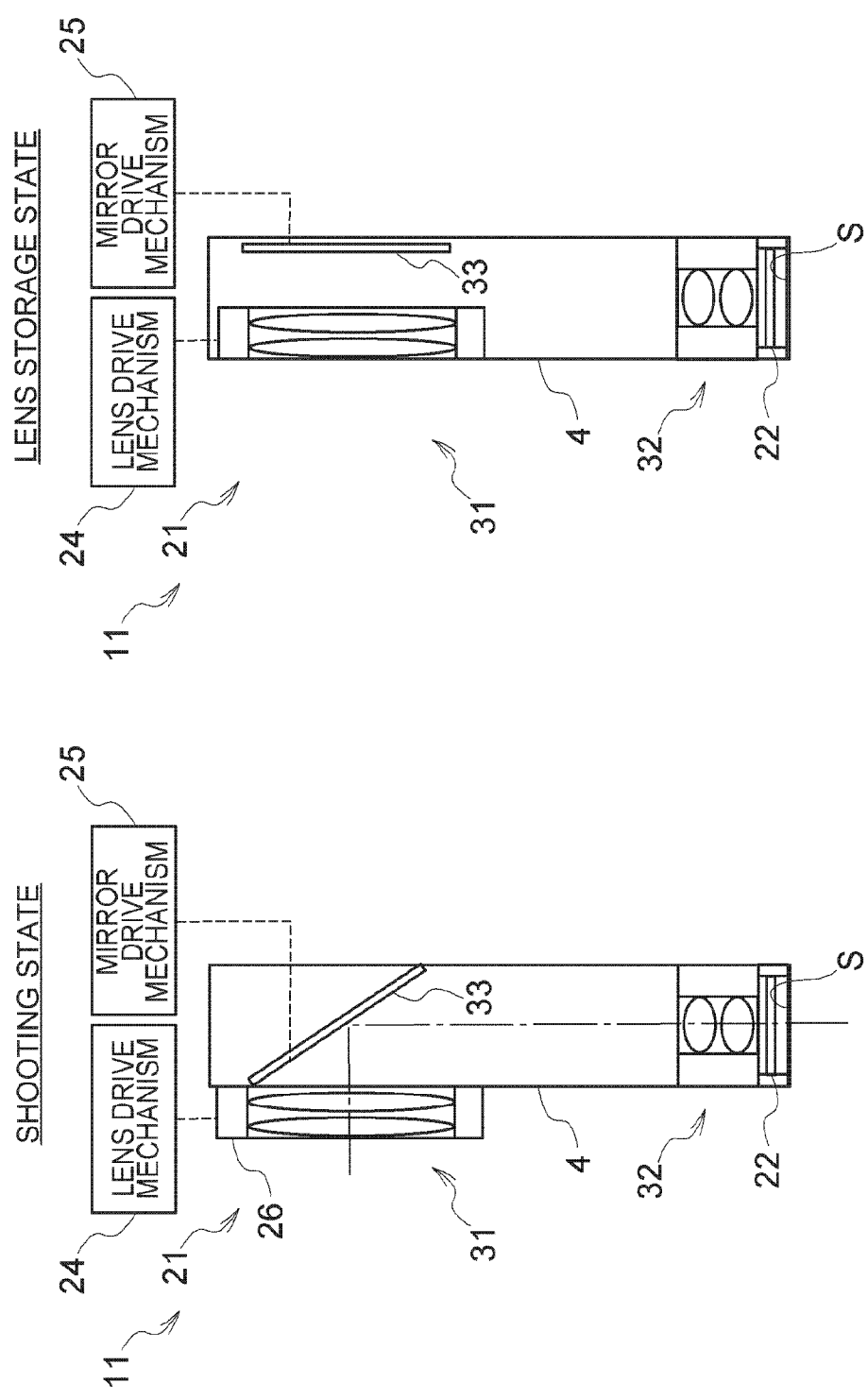


FIG. 2A

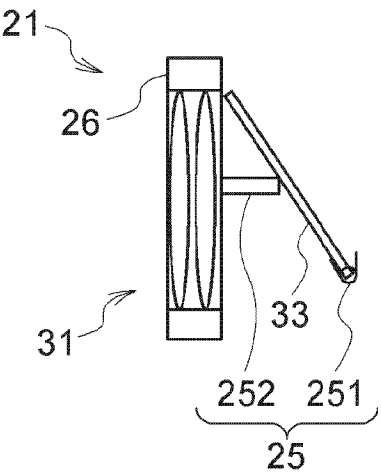


FIG. 2B

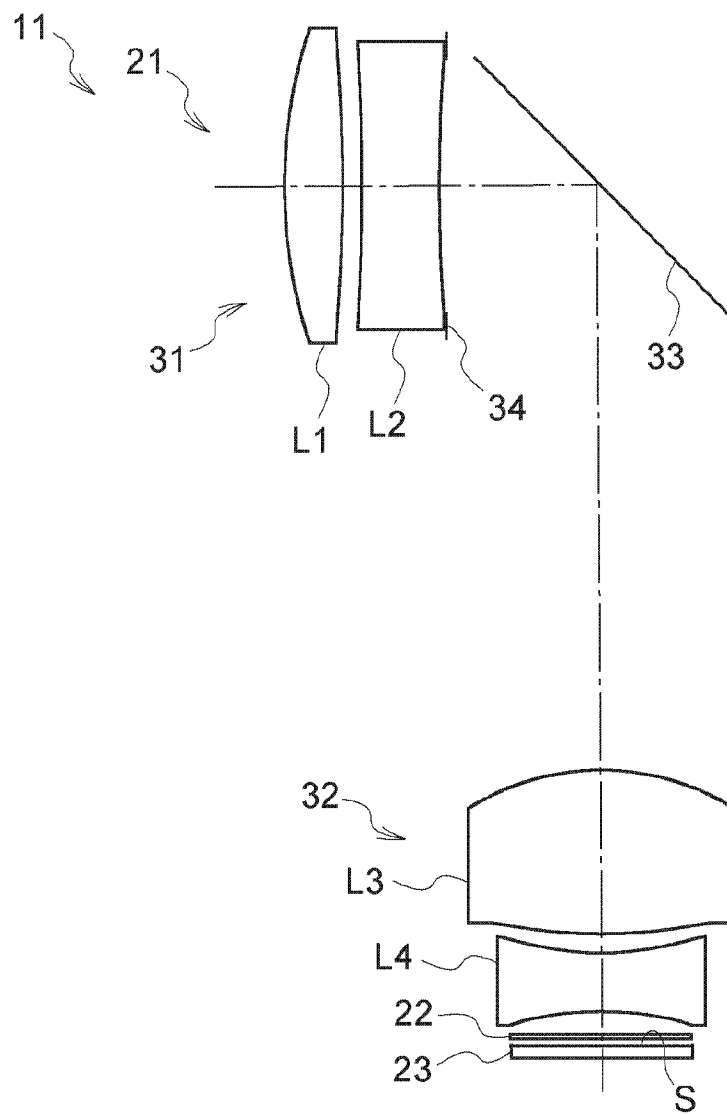


FIG. 3

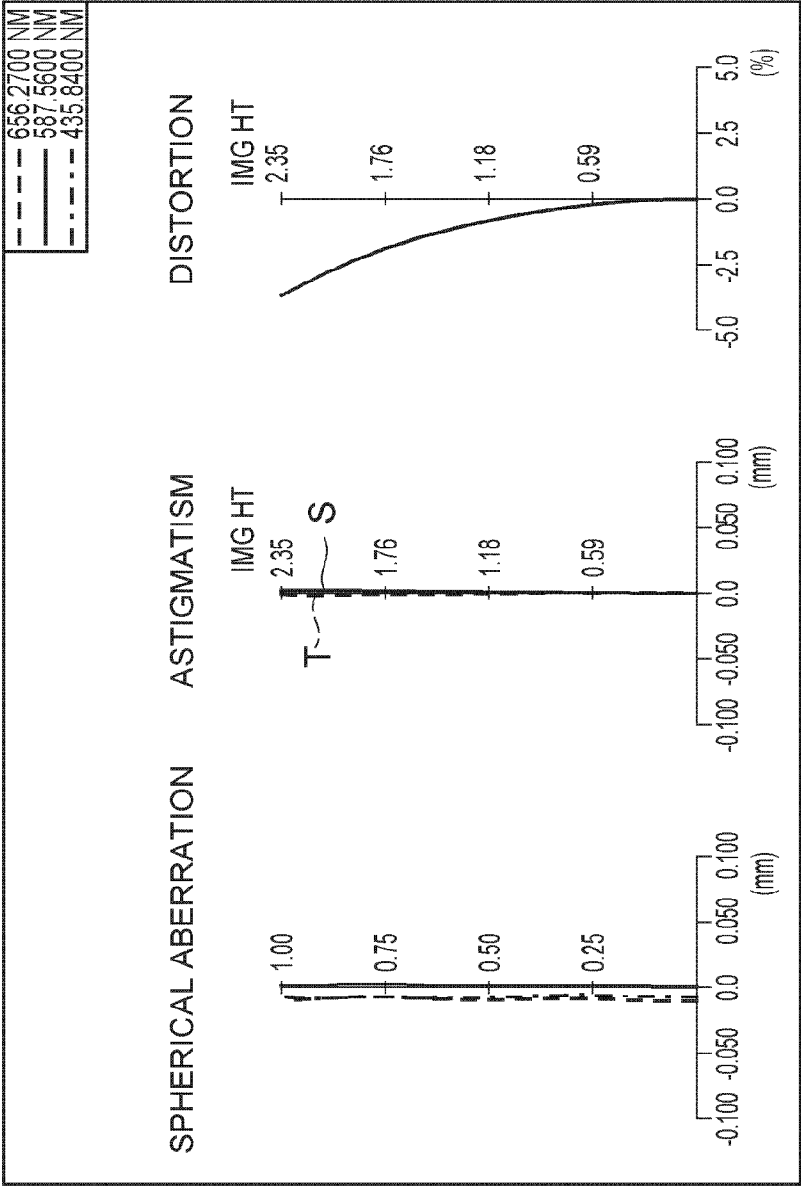


FIG. 4

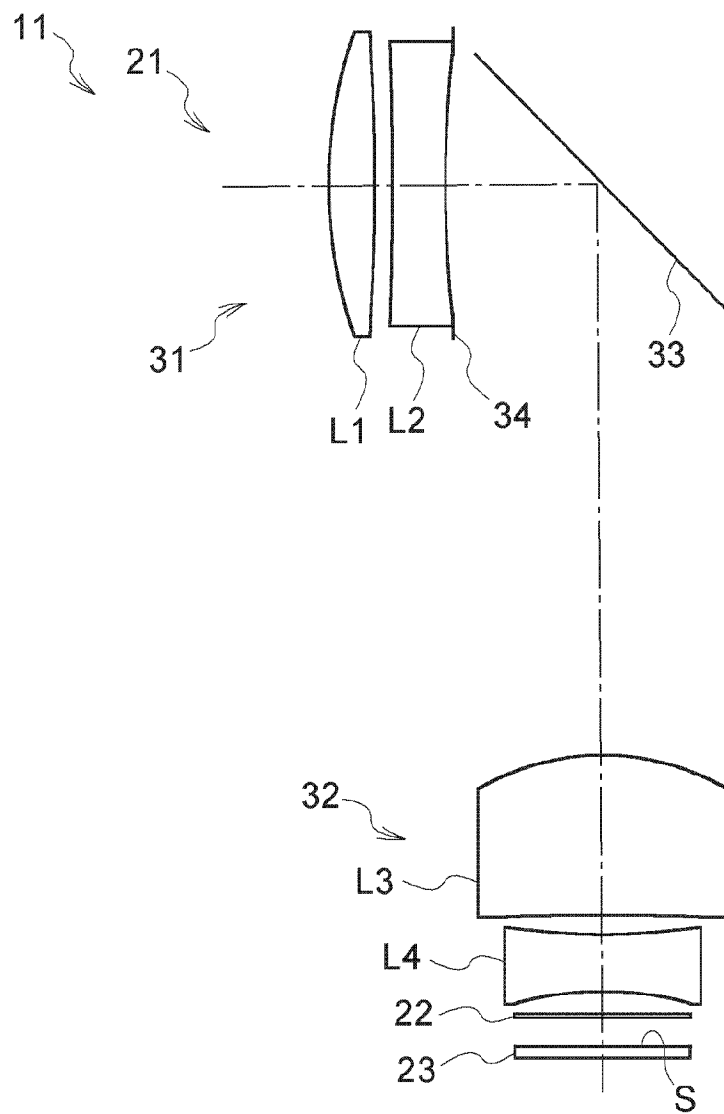


FIG. 5

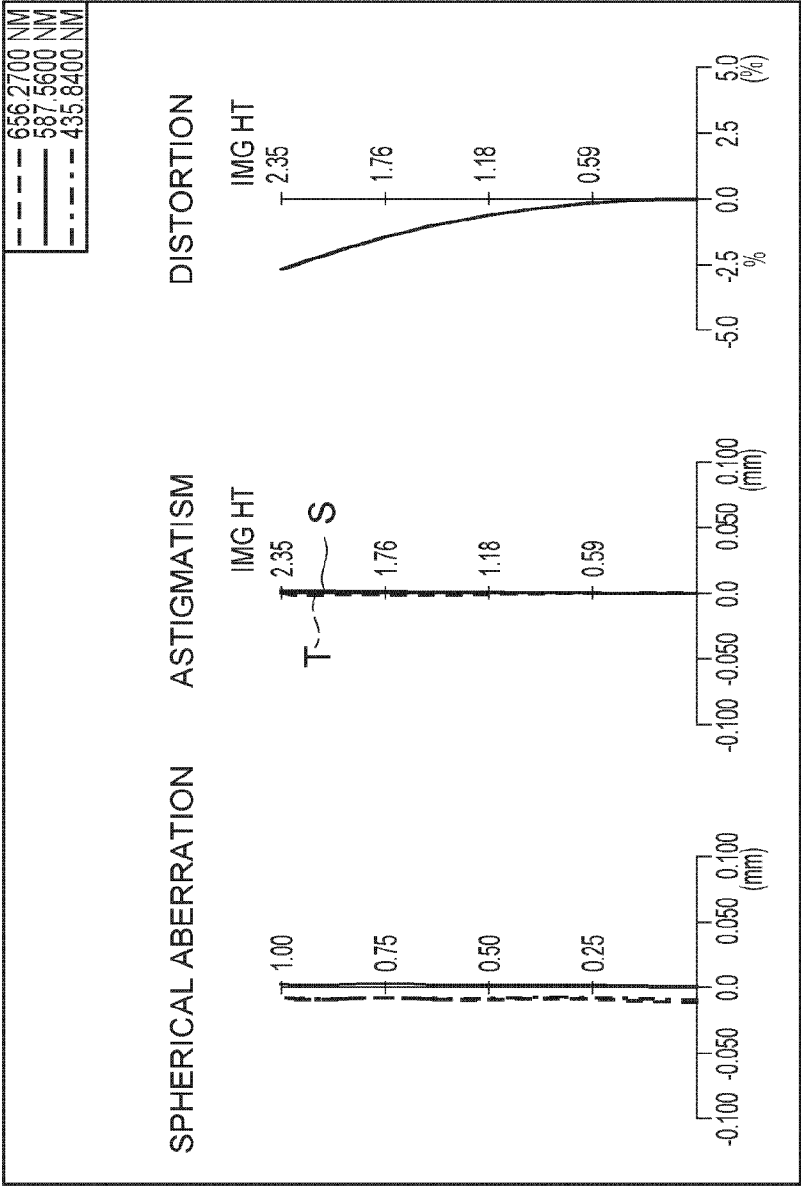


FIG. 6

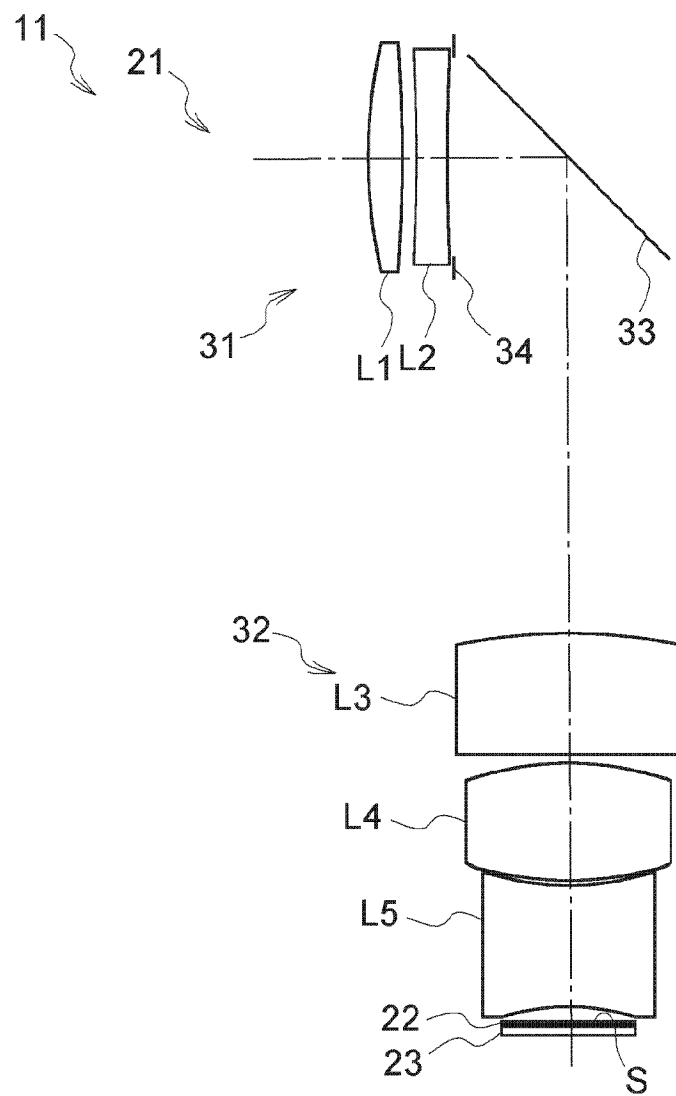


FIG. 7

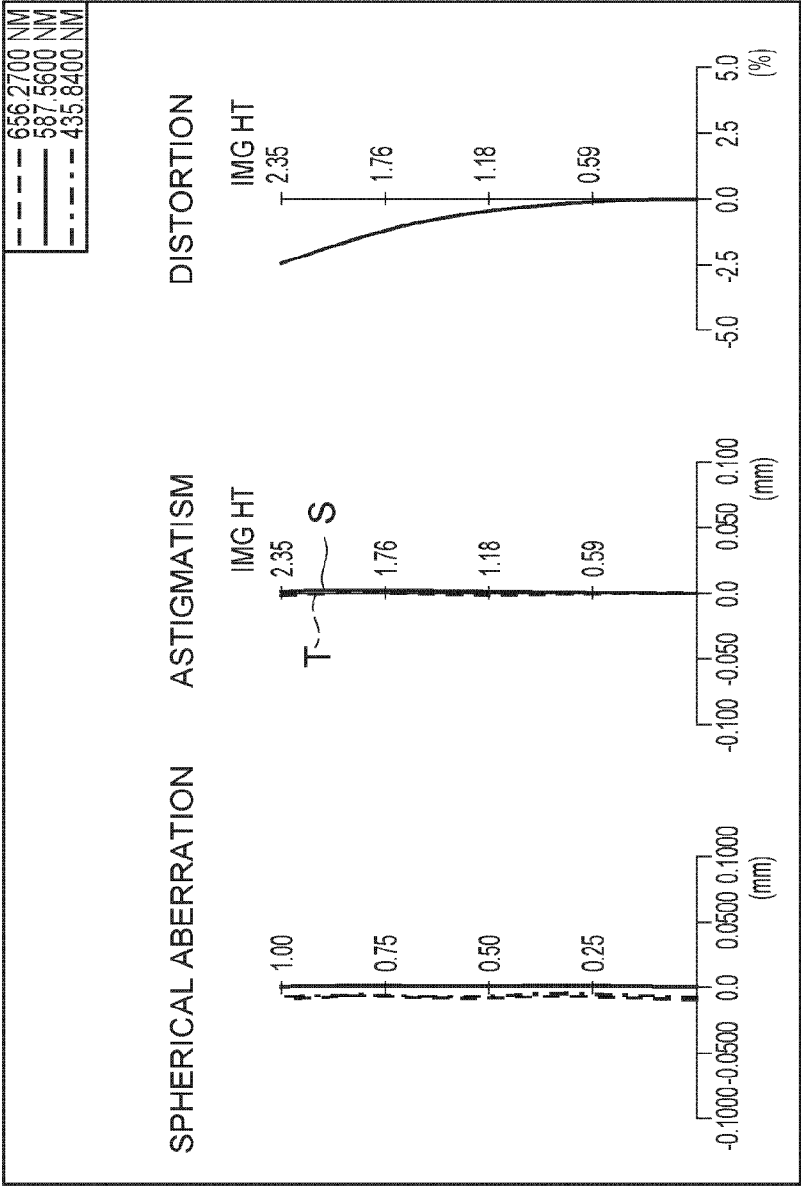


FIG. 8

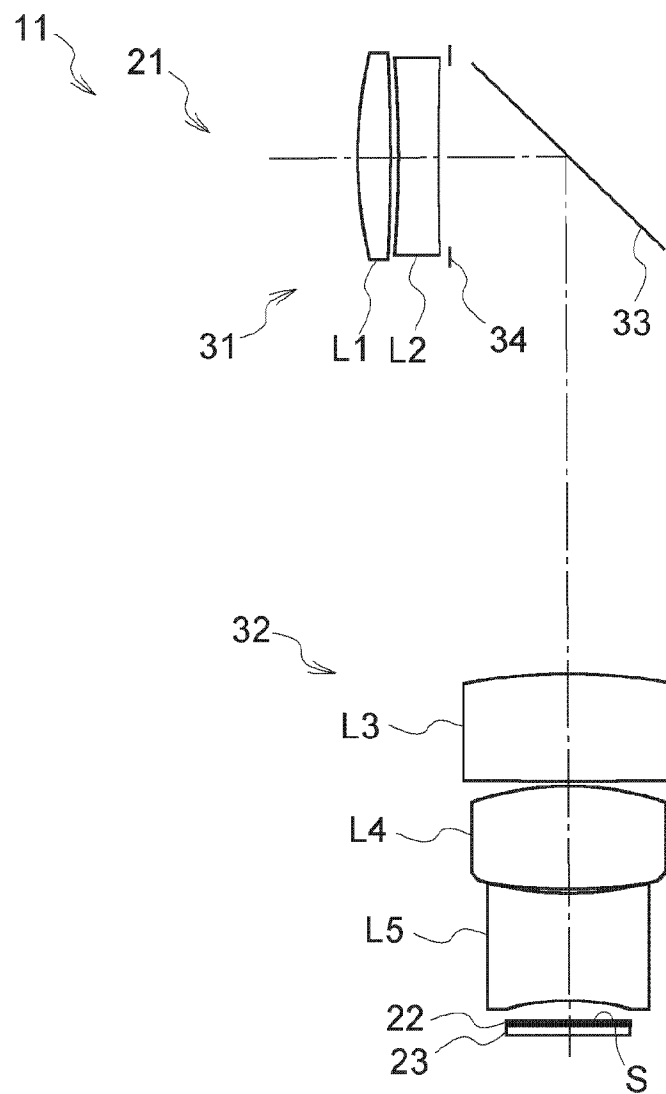


FIG. 9

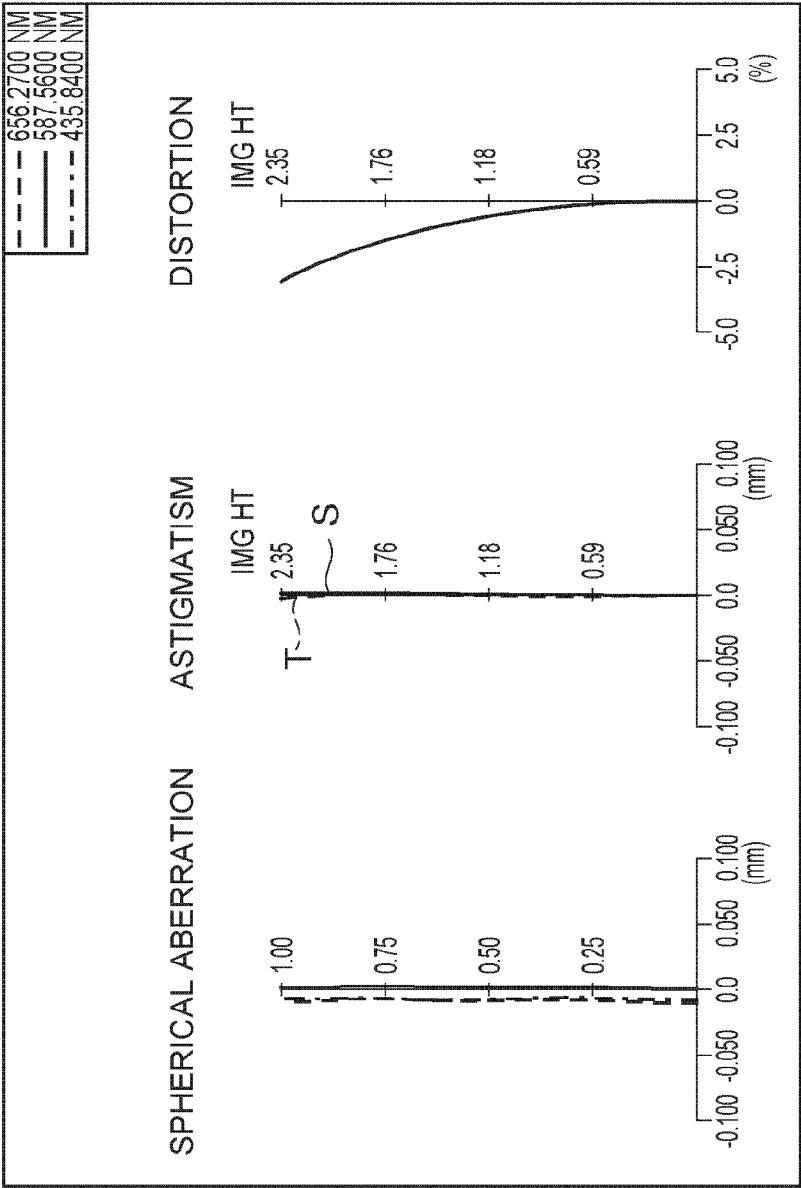


FIG.10

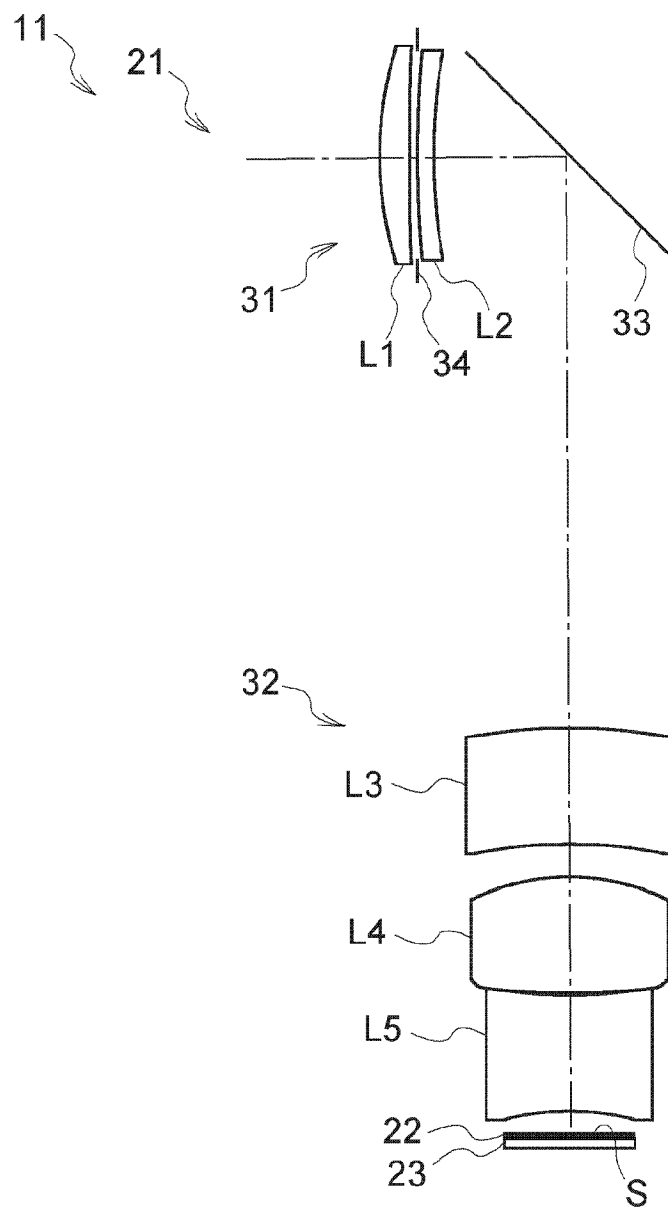


FIG.11

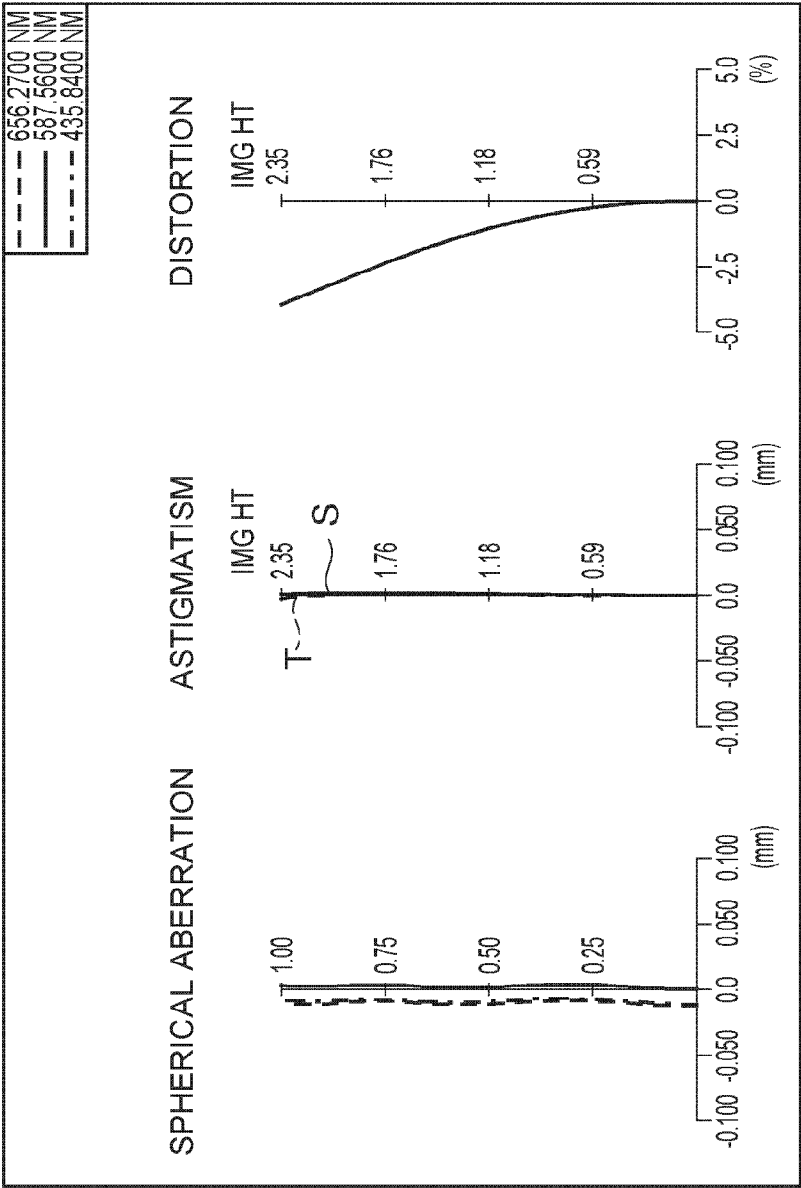


FIG.12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/092696

A. CLASSIFICATION OF SUBJECT MATTER

G02B 7/02(2021.01)i; G02B 7/18(2021.01)i; G03B 17/17(2021.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G02B,G03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT,ENTXT,CNKI,SIPOABS,DWPI: lens, mov+, stor+, reflector, mirror, rotat+, aperture, stop, diaphragm

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004099870 A1 (KONICA MINOLTA OPTO INC et al.) 18 November 2004 (2004-11-18) description, page 5 line 16 to page 9 line 21 and figures 3-4	1-13
X	CN 1740898 A (CANON KK) 01 March 2006 (2006-03-01) description, page 3 line 16 to page 5 line 23 and figures 1-2	1-13
X	JP H041623 A (OLYMPUS OPTICAL CO) 07 January 1992 (1992-01-07) description, page 2 paragraph 11 to page 5 paragraph 4 and figures 1-6	1-13
A	WO 2007141937 A1 (SHARP KK) 13 December 2007 (2007-12-13) the whole document	1-13
A	US 5253005 A (CANON KK) 12 October 1993 (1993-10-12) the whole document	1-13



Further documents are listed in the continuation of Box C.



See patent family annex.

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

07 February 2022

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2021/092696

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				US	2006045515	A1	02 March 2006
				US	7625139	B2	01 December 2009
JP	H041623	A	07 January 1992	JP	2888491	B2	10 May 1999
WO	2007141937	A1	13 December 2007	JP	2007328070	A	20 December 2007
				TW	200808042	A	01 February 2008
US	5253005	A	12 October 1993	None			