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IMAGING LENS ASSEMBLY, IMAGING APPARATUS AND ELECTRONIC DEVICE

Abstract

An imaging lens assembly includes six lens elements, which are, in order from an object side to an image side, a first lens element, a second lens element, a third lens element, a fourth lens element, a fifth lens element and a sixth lens element. The sixth lens element has negative refractive power. At least one surface of an object-side surface and an image-side surface of at least one lens element of the six lens elements is aspheric.

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Background/Summary

RELATED APPLICATIONS [0001] The present application is a divisional patent application of U.S. application Ser. No. 18/046,257, filed on Oct. 13, 2022, which is a continuation of the U.S. application Ser. No. 16/994,759, filed on Aug. 17, 2020, U.S. Pat. No. 11,506,872 issued on Nov. 22, 2022, which is a continuation of the U.S. application Ser. No. 15/844,895, filed on Dec. 18, 2017, U.S. Pat. No. 10,782,505 issued on Sep. 22, 2020, which claims priority to Taiwan Application Ser. No. 106136761, filed Oct. 25, 2017, which are herein incorporated by references.

BACKGROUND
Technical Field
[0002] The present disclosure relates to an imaging lens assembly and an imaging apparatus. More particularly, the present disclosure relates to an imaging lens assembly and an imaging apparatus with a compact size applicable to electronic devices.
Description of Related Art
[0003] With the wider application of photographing modules, installing photographing modules in various smart electronic devices, portables, mobile devices, recognition devices, entertainment systems, sporting devices and smart home assisting systems is becoming a major trend in developments for the future technology, especially portables which are in high public demands. In order to obtain more extensive experiences in utilizations, smart devices with one, two or more than three lens assemblies are becoming the market mainstream, and various photographing modules with different features are developed in response to different demands.
[0004] However, conventional telephoto lens systems utilize mostly spherical glass lens elements, which are unfavorable for reducing the size of lens assemblies, and result in larger and thicker imaging apparatuses. Thus, it becomes difficult for miniaturization which cannot satisfy the size requirement of mobile electronic devices. Furthermore, conventional compact telephoto lens systems are mostly limited by size, and the aperture size in these optical systems is also limited, which causes insufficient image brightness. Currently, many compact imaging devices with high image quality available on the market have view angles not suitable for capturing detailed images from afar. Thus, conventional optical systems cannot satisfy the developing trend of current technology.
SUMMARY
[0005] According to one aspect of the present disclosure, an imaging lens assembly includes six lens elements, the six lens elements being, in order from an object side to an image side, a first lens element, a second lens element, a third lens element, a fourth lens element, a fifth lens element and a sixth lens element. The sixth lens element has negative refractive power and at least one of the six lens elements has at least one of an object-side surface and an image-side surface being aspheric. The imaging lens assembly further includes an aperture stop. When an axial distance between an object-side surface of the first lens element and an image surface is TL, a focal length of the imaging lens assembly is f, an entrance pupil diameter of the imaging lens assembly is EPD, a maximum image height of the imaging lens assembly is ImgH, an Abbe number of the second lens

element is V2, an Abbe number of the fifth lens element is V5, an axial distance between the aperture stop and an image-side surface of the sixth lens element is SD, and an axial distance between the object-side surface of the first lens element and the image-side surface of the sixth lens element is TD, the following conditions are satisfied:

[00001]
$$0.5 < TL / f < 1.15;$$
$$0.8 < f / EPD < 2.6;$$
$$1.85 < f / ImgH < 10.;$$
$$-70. < V5 - V2 < -10.; \text{ and}$$
$$0.55 < SD / TD < 1.1 .$$

[0006] According to another aspect of the present disclosure, an imaging apparatus includes the imaging lens assembly of the aforementioned aspect and an image sensor, wherein the image sensor is disposed on the image surface of the imaging lens assembly.

[0007] According to another aspect of the present disclosure, an electronic device includes the imaging apparatus of the aforementioned aspect.

[0008] According to one aspect of the present disclosure, an imaging lens assembly includes six lens elements, the six lens elements being, in order from an object side to an image side, a first lens element, a second lens element, a third lens element, a fourth lens element, a fifth lens element and a sixth lens element. The second lens element has positive refractive power, the third lens element has negative refractive power, and the sixth lens element has negative refractive power; at least one of an object-side surface and an image-side surface of at least one of the six lens elements includes at least one inflection point. When an axial distance between an object-side surface of the first lens element and an image surface is TL, a focal length of the imaging lens assembly is f, an entrance pupil diameter of the imaging lens assembly is EP D, a maximum image height of the imaging lens assembly is ImgH, a central thickness of the fourth lens element is CT4, and a central thickness of the fifth lens element is CT5, the following conditions are satisfied:

[00002]
$$0.3 < TL / f < 1.7;$$
$$0.8 < f / EPD \leq 2.4;$$
$$2. < f / ImgH < 10.; \text{ and}$$
$$0.1 < CT4 / CT5 < 0.9 .$$

[0009] According to one aspect of the present disclosure, an imaging lens assembly comprising six lens elements, the six lens elements being, in order from an object side to an image side: a first lens element, a second lens element, a third lens element, a fourth lens element, a fifth lens element, and a sixth lens element. The first lens element has an object-side surface being convex in a paraxial region thereof, the second lens element has positive refractive power, the third lens element has negative refractive power, and the fifth lens element has positive refractive power. At least one of an object-side surface and an image-side surface of at least one of the six lens elements includes at least one inflection point. When an axial distance between the object-side surface of the first lens element and an image surface is TL, a focal length of the imaging lens assembly is f, a maximum image height of the imaging lens assembly is ImgH, an Abbe number of the fifth lens element is V5, an Abbe number of the sixth lens element is V6, and the following conditions are satisfied:

[00003]
$$0.3 < TL / f < 4.;$$
$$2. < f / ImgH < 10.; \text{ and}$$
$$-55. < V5 - V6 < -17.. $$

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0010] The present disclosure can be more fully understood by reading the following detailed description of the embodiment, with reference made to the accompanying drawings as follows:
[0011] FIG. **1** is a schematic view of an imaging apparatus according to the 1st embodiment of the present disclosure;
[0012] FIG. **2** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 1st embodiment;
[0013] FIG. **3** is a schematic view of an imaging apparatus according to the 2nd embodiment of the present disclosure;
[0014] FIG. **4** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 2nd embodiment;
[0015] FIG. **5** is a schematic view of an imaging apparatus according to the 3rd embodiment of the present disclosure;
[0016] FIG. **6** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 3rd embodiment;
[0017] FIG. **7** is a schematic view of an imaging apparatus according to the 4th embodiment of the present disclosure;
[0018] FIG. **8** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 4th embodiment;
[0019] FIG. **9** is a schematic view of an imaging apparatus according to the 5th embodiment of the present disclosure;
[0020] FIG. **10** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 5th embodiment;
[0021] FIG. **11** is a schematic view of an imaging apparatus according to the 6th embodiment of the present disclosure;
[0022] FIG. **12** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 6th embodiment;
[0023] FIG. **13** is a schematic view of an imaging apparatus according to the 7th embodiment of the present disclosure;
[0024] FIG. **14** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 7th embodiment;
[0025] FIG. **15** is a schematic view of an imaging apparatus according to the 8th embodiment of the present disclosure;
[0026] FIG. **16** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 8th embodiment;
[0027] FIG. **17** is a schematic view of an imaging apparatus according to the 9th embodiment of the present disclosure;
[0028] FIG. **18** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 9th embodiment;
[0029] FIG. **19** is a schematic view of an imaging apparatus according to the 10th embodiment of the present disclosure;
[0030] FIG. **20** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 10th embodiment;
[0031] FIG. **21** is a schematic view of an imaging apparatus according to the 11th embodiment of the present disclosure;
[0032] FIG. **22** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 11th embodiment;
[0033] FIG. **23** is a schematic view of an imaging apparatus according to the 12th embodiment of the present disclosure;

[0034] FIG. **24** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 12th embodiment;
[0035] FIG. **25** is a schematic view of a parameter Yc11 according to the 1st embodiment of FIG. **1**;
[0036] FIG. **26** is a schematic view of a parameter Yc62 according to the 1st embodiment of FIG. **1**;
[0037] FIG. **27** is a schematic view of inflection points IP 22, IP 42, IP 51, IP 52, IP 61, and IP 62 according to the 1st embodiment of FIG. **1**;
[0038] FIG. **28** is a three-dimensional schematic view of an imaging apparatus according to the 13th embodiment of the present disclosure;
[0039] FIG. **29**A is a schematic view of one side of an electronic device according to the 14th embodiment of the present disclosure;
[0040] FIG. **29**B is a schematic view of another side of the electronic device of FIG. **29**A;
[0041] FIG. **29**C is a system schematic view of the electronic device of FIG. **29**A;
[0042] FIG. **30** is a schematic view of an electronic device according to the 15th embodiment of the present disclosure; and
[0043] FIG. **31** is a schematic view of an electronic device according to the 16th embodiment of the present disclosure.

DETAILED DESCRIPTION

[0044] An imaging lens assembly includes six lens elements, which are, in order from an object side to an image side, a first lens element, a second lens element, a third lens element, a fourth lens element, a fifth lens element and a sixth lens element.
[0045] At least one of an object-side surface and an image-side surface of at least one of the six lens elements can include at least one inflection point. Therefore, it is favorable for avoiding total reflection due to overly large surface angles of the lens elements, which generates unwanted light spots on the image.
[0046] The first lens element can have positive refractive power, so that the light converging ability of the imaging lens assembly can be provided for reducing the total track length thereof so as to obtain the compactness. The first lens element can have an object-side surface being convex in a paraxial region thereof, so as to avoid light projecting through the object-side surface with an overly large incident angle as well as preventing stray light. The first lens element with the object-side surface being convex in the paraxial region thereof can have an image-side surface being concave in a paraxial region thereof, so as to allow light rays converging between tangential direction and sagittal direction for correcting astigmatism of the imaging lens assembly.
[0047] The second lens element can have positive refractive power. Therefore, it is favorable for light converging on the object side of the imaging lens assembly and avoiding excessive aberrations generated due to overly large refractive power of any single lens element of the imaging lens assembly. The second lens element can have an object-side surface being convex in a paraxial region thereof and an image-side surface being convex in a paraxial region thereof. Thus, it is favorable for enhancing the converging ability of the second lens element while balancing curvatures of the object-side surface and the image-side surface thereof, and excessive spherical aberration can be avoided.
[0048] The third lens element can have negative refractive power. Therefore, it is favorable for correcting chromatic aberration of the imaging lens assembly and avoiding image overlaps due to imaged position variation of captured images in different colors. The third lens element can have an object-side surface being convex in a paraxial region thereof and an image-side surface being concave in a paraxial region thereof. Therefore, it is favorable for balancing aberrations generated by the second lens element and improving image quality.
[0049] The fourth lens element can have negative refractive power. Therefore, it is favorable for balancing negative refractive power with the third lens element, avoiding overly large refractive

power from any single lens element of the imaging lens assembly while improving symmetry of lens configuration as well as image quality. The fourth lens element can have an image-side surface being concave in a paraxial region thereof. Thus, it is favorable for controlling the outgoing angle of refracted ray from the fourth lens element and limiting the range of the effective diameter on the image side of the imaging lens assembly to obtain compactness thereof.

[0050] The fifth lens element can have positive refractive power. Therefore, it is favorable for providing sufficient converging power on the image side of the imaging lens assembly and maintaining a desirable size of the imaging lens assembly. The fifth lens element can have an image-side surface being convex in a paraxial region thereof so as to improve symmetry of the lens configuration of the imaging lens assembly for reducing aberrations. The image-side surface of the fifth lens element can include at least one convex shape in an off-axis region thereof so as to reduce the outgoing angle of refracted ray from the image-side surface of the fifth lens element for correcting distortion and field curvature.

[0051] The sixth lens element can have negative refractive power, so that it is favorable for balancing the refractive power distribution on the image side of the imaging lens assembly, correcting aberrations of the fifth lens element, and avoiding the back focal length of the imaging lens assembly being excessively long along with the imaging lens assembly being overly large. The sixth lens element can have an object-side surface being concave in a paraxial region thereof, so that it is favorable for controlling the back focal length of the imaging lens assembly effectively and being applicable in the compact electronic device. The object-side surface of the sixth lens element can include at least one convex surface in an off-axis region thereof along with the object-side surface being concave in the paraxial region. Therefore, it is favorable for correcting off-axis aberrations and enhancing Petzval Field with effective size reduction and high image quality. An image-side surface of the sixth lens element can include at least one convex shape in an off-axis region thereof so as to reduce the outgoing angle of refraction on the image-side surface of the sixth lens element for correcting distortion and field curvature. The sixth lens element can have the image-side surface being concave in a paraxial region thereof while including at least one convex shape in the off-axis region thereof so as to control the back focal length of the imaging lens assembly for maintaining compactness, correcting off-axis aberrations, and improving image quality. At least one of the object-side surface and the image-side surface of the sixth lens element can include at least one inflection point, so that it is favorable for reducing distortion and avoiding dark corners on the image while correcting off-axis aberrations of the imaging lens assembly.

[0052] At least one of the six lens elements of the imaging lens assembly can have at least one of the object-side surface and image-side surface being aspheric, so that it is favorable for correcting aberrations, limiting the total track length of the imaging lens assembly, and obtaining compactness. Preferably, each of the six lens elements of the imaging lens assembly has at least one of the object-side surface and image-side surface being aspheric.

[0053] There is an air gap between every adjacent lens elements of the six lens elements, so that it is favorable for reducing assembling complexity of the imaging lens assembly and improving manufacturing yield rates.

[0054] The six lens elements of the imaging lens assembly can be made of plastic materials, so that it is favorable for reducing the weight of the imaging lens assembly while providing higher degree of freedom in lens designs for size reduction of the imaging lens assembly.

[0055] When an axial distance between the object-side surface of the first lens element and an image surface is TL, and a focal length of the imaging lens assembly is f, the following condition is satisfied: $0.30<TL/f<4.0$. Therefore, it is favorable for balancing the total track length and field of view of the imaging lens assembly while obtaining improved image quality and higher specifications. Preferably, the following condition can be satisfied: $0.30<TL/f<1.7$. More preferably, the following condition can be satisfied: $0.50<TL/f<1.15$. Even more preferably, the following condition can be satisfied: $0.50<TL/f<1.0$.

[0056] When the focal length of the imaging lens assembly is f, and an entrance pupil diameter of the imaging lens assembly is EPD, the following condition is satisfied: $0.80<f/EPD<2.60$. Therefore, it is favorable for increasing received light rays of the imaging lens assembly so as to generate images with higher clarity. Preferably, the following condition can be satisfied: $0.80<f/EPD\leq 2.40$. More preferably, the following condition can be satisfied: $0.80<f/EPD<2.25$. Even more preferably, the following condition can be satisfied: $0.80<f/EPD<2.0$.
[0057] When the focal length of the imaging lens assembly is f, and a maximum image height of the imaging lens assembly is ImgH, the following condition is satisfied: $1.85<f/ImgH<10.0$. Therefore, it is favorable for effectively controlling the imaging range of the imaging lens assembly so as to satisfy the needs for a wider range of applications. Preferably, the following condition can be satisfied: $2.0<f/ImgH<10.0$. More preferably, the following condition can be satisfied: $2.25<f/ImgH<6.5$.
[0058] When an Abbe number of the second lens element is V2, and an Abbe number of the fifth lens element is V5, the following condition is satisfied: $-70.0<V5-V2<-10.0$. Therefore, it is favorable for balancing chromatic aberrations between the second lens element and the fifth lens element so as to provide sufficient image magnification as well as image brightness. Preferably, the following condition can be satisfied: $-50.0<V5-V2<-20.0$. More preferably, the following condition can be satisfied: $-45.0<V5-V2<-25.0$.
[0059] The imaging lens assembly can further include an aperture stop. When an axial distance between the aperture stop and the image-side surface of the sixth lens element is SD, and an axial distance between the object-side surface of the first lens element and the image-side surface of the sixth lens element is TD, the following condition is satisfied: $0.55<SD/TD<1.10$. Therefore, it is favorable for positioning the aperture stop, balancing field of view and the total track length of the imaging lens assembly so as to obtain compactness of the electronic device while enhancing its practical usefulness.
[0060] When a central thickness of the fourth lens element is CT4, and a central thickness of the fifth lens element is CT5, the following condition is satisfied: $0.10<CT4/CT5<0.90$. Therefore, it is favorable for balancing the central thicknesses of the fourth lens element and the fifth lens element so as to avoid overly thin lens element being misshaped or overly thick lens element being unevenly formed. Preferably, the following condition can be satisfied: $0.10<CT4/CT5<0.65$.
[0061] When the Abbe number of the fifth lens element is V5, and an Abbe number of the sixth lens element is V6, the following condition is satisfied: $-55.0<V5-V6<-17.0$. Therefore, the material configuration on the image side of the imaging lens assembly can be balanced, so as to enhance the light convergence thereof as well as obtaining the telephoto characteristic.
[0062] When a curvature radius of the object-side surface of the first lens element is R1, and the focal length of the imaging lens assembly is f, the following condition is satisfied: $0<R1/f<0.35$. Therefore, it is favorable for reducing an incident angle of light rays on the object-side surface of the first lens element, and avoiding excessive aberrations or possible total reflection.
[0063] When a focal length of the second lens element is f2, and a focal length of the fifth lens element is f5, the following condition is satisfied: $0<f2/f5<5.50$. Therefore, it is favorable for balancing the distribution of refractive power so as to reduce overall manufacturing sensitivity. Preferably, the following condition can be satisfied: $0.50<f2/f5<5.50$.
[0064] When a maximum refractive index of the six lens elements of the imaging lens assembly is Nmax, the following condition is satisfied: $1.640<Nmax<1.750$. Therefore, it is favorable for balancing the configuration of lens materials of the imaging lens assembly so as to improve image quality while reducing the total track length of the imaging lens assembly for obtaining compactness. Preferably, the following condition can be satisfied: $1.650\leq Nmax<1.730$.
[0065] When the focal length of the imaging lens assembly is f, the focal length of the fifth lens element is f5, and a focal length of the sixth lens element is f6, the following condition is satisfied: $1.50<|f/f5|+|f/f6|<4.0$. Therefore, it is favorable for enhancing the ability to control light path on the

image side of the imaging lens assembly so as to reduce the total track length and correct aberrations.

[0066] There are at least two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25. Therefore, it is favorable for providing stronger refractive power to achieve sufficient refraction within smaller space by utilizing the characteristic of larger density difference from air in high dispersion lens materials (High Dispersion implies lower Abbe number), in order to reduce the size of the imaging apparatus. Preferably, there are at least two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 22. More preferably, there are at least two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 20.

[0067] When the entrance pupil diameter of the imaging lens assembly is EPD, and the axial distance between the object-side surface of the first lens element and the image surface is TL, the following condition is satisfied: $0.40<EPD/TL<1.0$. Therefore, it is favorable for increasing incoming light of the imaging lens assembly while maintaining compactness. Preferably, the following condition can be satisfied: $0.45<EP D/TL<0.80$.

[0068] When a vertical distance between a maximum effective diameter position of the object-side surface of the first lens element and an optical axis is Y11, and a vertical distance between a maximum effective diameter position of the image-side surface of the sixth lens element and the optical axis is Y62, the following condition is satisfied: $0.65<Y11/Y62<1.20$. Therefore, it is favorable for controlling the size of openings on the object side and the image side of the imaging apparatus so as to improve relative illumination while avoiding dark corners on the image.

[0069] When the focal length of the imaging lens assembly is f, and a composite focal length of the first lens element and the second lens element is f12, the following condition is satisfied: $1.50<f/f12<3.0$. Therefore, it is favorable for providing sufficient converging power on the object side of the imaging lens assembly and satisfying the specification of a telephoto system.

[0070] When the axial distance between the object-side surface of the first lens element and the image surface is TL, and the maximum image height of the imaging lens assembly is ImgH, the following condition is satisfied: $1.50<TL/ImgH<3.50$. Therefore, it is favorable for miniaturizing the imaging lens assembly while providing sufficient light receiving area so as to avoid dark corners on the image.

[0071] When the entrance pupil diameter of the imaging lens assembly is EPD, and the maximum image height of the imaging lens assembly is ImgH, the following condition is satisfied: $1.0<EPD/ImgH<2.0$. Therefore, it is favorable for providing sufficient range of incoming light (directly related to the entrance pupil diameter) and light receiving area (directly related to the maximum image height) so as to enhance image brightness and image quality.

[0072] When the Abbe number of the fifth lens element is V5, the following condition is satisfied: $10.0<V5<38.0$. Therefore, it is favorable for controlling the material property of the fifth lens element, increasing the density difference between the fifth lens element and air, improving refractive power of the fifth lens element, and achieving sufficient refraction within smaller space, so as to reduce the total track length of the imaging lens assembly for a wider range of applications.

[0073] When an Abbe number of the third lens element is V3, the following condition is satisfied: $10.0<V3<22.0$. Therefore, it is favorable for correcting chromatic aberration of the imaging lens assembly while increasing the density difference between the third lens element and air for improving the aberration correction ability of the third lens element.

[0074] When an axial distance between the first lens element and the second lens element is T12, an axial distance between the second lens element and the third lens element is T23, an axial distance between the third lens element and the fourth lens element is T34, an axial distance between the fourth lens element and the fifth lens element is T45, and an axial distance between the fifth lens element and the sixth lens element is T56, the following condition is satisfied: $0\leq(T12+T23+T56)/(T34+T45)<1.0$. Therefore, it is favorable for balancing the distances between adjacent lens elements and avoiding assembling interference due to overly small distances between adjacent lens elements, so as to improve assembling yield rates. Preferably, the following condition can be satisfied: $0 \leq (T12+T23+T56)/(T34+T45) < 0.50$.

[0075] When the axial distance between the third lens element and the fourth lens element is T34, the axial distance between the fourth lens element and the fifth lens element is T45, a central thickness of the third lens element is CT3, and the central thickness of the fourth lens element is CT4, the following condition is satisfied: $2.70 < (T34+T45)/(CT3+CT4) < 15.0$. Therefore, it is favorable for balancing between lens thicknesses and distances between adjacent lens elements so as to avoid uneven molded lens elements due to overly large thickness while effectively reducing the manufacturing sensitivity of the imaging lens assembly.

[0076] The minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface of the third lens element. Therefore, it is favorable for controlling the dimension of the imaging lens assembly and avoiding overly large outer diameter of a lens barrel member which makes it difficult to reduce the size of the imaging apparatus.

[0077] Each of the aforementioned features of the imaging lens assembly can be utilized in numerous combinations, so as to achieve the corresponding functionality.

[0078] According to the present disclosure, the lens elements of the imaging lens assembly can be made of either glass or plastic materials. When the lens elements are made of glass materials, the refractive power distribution of the imaging lens assembly may be more flexible to design. The glass lens element can either be made by grinding or molding. When the lens elements are made of plastic materials, the manufacturing cost can be effectively reduced. Furthermore, surfaces of each lens element can be arranged to be aspheric, which allows for more controllable variables for eliminating the aberration thereof, the required number of the lens elements can be decreased, and the total track length of the imaging lens assembly can be effectively reduced. The aspheric surfaces may be formed by plastic injection molding or glass molding.

[0079] According to the present disclosure, when a lens surface is aspheric, it means that the lens surface has an aspheric shape throughout its optically effective area, or a portion(s) thereof.

[0080] According to the imaging lens assembly of the present disclosure, each of an object-side surface and an image-side surface has a paraxial region and an off-axis region. The paraxial region refers to the region of the surface where light rays travel close to an optical axis, and the off-axis region refers to the region of the surface away from the paraxial region. Particularly unless otherwise stated, when the lens element has a convex surface, it indicates that the surface can be convex in the paraxial region thereof; when the lens element has a concave surface, it indicates that the surface can be concave in the paraxial region thereof. According to the imaging lens assembly of the present disclosure, the refractive power or the focal length of a lens element being positive or negative may refer to the refractive power or the focal length in a paraxial region of the lens element.

[0081] According to the imaging lens assembly of the present disclosure, the imaging lens assembly can include at least one stop, such as an aperture stop, 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 resolution thereof.

[0082] According to the imaging lens assembly of the present disclosure, the image surface, depending on the corresponding image sensor, can be a planar surface or a curved surface with any curvature, particularly a curved surface being concave toward the object side. According to the imaging lens assembly of the present disclosure, at least one image correcting element (such as a field flattener) can be selectively disposed between a lens element closest to the image surface and the image surface so as to correct image aberrations (such as the field curvature). Properties of the image correcting element, such as curvature, thickness, refractive index, position, surface shape (convex/concave, spherical/aspheric/diffractive/Fresnel etc.) can be adjusted according to the

requirements of the imaging apparatus. In general, the image correcting element is preferably a thin plano-concave element having a concave surface toward the object side and is disposed close to the image surface.
[0083] According to the imaging lens assembly of the present disclosure, an aperture stop can be configured as a front stop or a middle stop. A front stop disposed between an object and the first lens element can provide a longer distance between an exit pupil of the imaging lens assembly and the image surface, and thereby obtains a telecentric effect and improves the image-sensing efficiency of the image sensor, such as CCD or CMOS. A middle stop disposed between the first lens element and the image surface is favorable for enlarging the field of view of the imaging lens assembly and thereby provides a wider field of view for the same.
[0084] According to the present disclosure, an inflection point is a changing point where the curvature center of a lens surface changing from the object side to the image side (or from image side to the object side) along the range from the paraxial region to the off-axis region.
[0085] According to the imaging lens assembly of the present disclosure, the imaging lens assembly can be applied to 3D (three-dimensional) image capturing applications, and in products such as digital cameras, mobile devices, digital tablets, smart TVs, surveillance systems, motion sensing input devices, driving recording systems, rearview camera systems, wearable devices, and unmanned aerial vehicles.
[0086] According to the present disclosure, an imaging apparatus is provided. The imaging apparatus includes the aforementioned imaging lens assembly and an image sensor, wherein the image sensor is disposed on the image side of the aforementioned imaging lens assembly that is, the image sensor can be disposed on or near the image surface of the aforementioned imaging lens assembly. When specific conditions are satisfied, it is favorable for the imaging lens assembly to satisfy the requirements of lens miniaturization, small field of view, and a large aperture, so as to capture detailed images from afar. Preferably, the imaging apparatus can further include a barrel member, a holder member or a combination thereof. Furthermore, the imaging apparatus of the present disclosure can also include a reflective element such as a prism or a mirror, so as to provide advantages of a light path directional change for further reducing the total track length of the imaging apparatus.
[0087] According to the present disclosure, an electronic device is provided, which includes the aforementioned imaging apparatus. Preferably, the electronic device can further include but not limited to a control unit, a display, a storage unit, a random access memory unit (RAM) or a combination thereof. Furthermore, the electronic device of the present disclosure can also provide a photographing apparatus, wherein the photographing apparatus includes a photographing lens assembly with a maximum field of view larger than the field of view of the imaging lens assembly of the present disclosure, and both lens assemblies (the photographing lens assembly and the imaging lens assembly of the present disclosure) can be utilized to by the electronic device to achieve a zoom function.
[0088] According to the above description of the present disclosure, the following 1st-16th specific embodiments are provided for further explanation.
1st Embodiment
[0089] FIG. **1** is a schematic view of an imaging apparatus according to the 1st embodiment of the present disclosure. FIG. **2** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 1st embodiment. In FIG. **1**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **190**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **100**, a first lens element **110**, a second lens element **120**, a third lens element **130**, a fourth lens element **140**, a fifth lens element **150**, a sixth lens element **160**, a filter **170** and an image surface **180**, wherein the image sensor **190** is disposed on the image surface **180** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**110**, **120**, **130**, **140**, **150**, **160**)

with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **110** and the sixth lens element **160**.

[0090] The first lens element **110** with positive refractive power has an object-side surface **111** being convex in a paraxial region thereof and an image-side surface **112** being concave in a paraxial region thereof. The first lens element **110** is made of a plastic material, and has the object-side surface **111** and the image-side surface **112** being both aspheric.

[0091] The second lens element **120** with positive refractive power has an object-side surface **121** being convex in a paraxial region thereof and an image-side surface **122** being concave in a paraxial region thereof. The second lens element **120** is made of a plastic material, and has the object-side surface **121** and the image-side surface **122** being both aspheric.

[0092] The third lens element **130** with negative refractive power has an object-side surface **131** being convex in a paraxial region thereof and an image-side surface **132** being concave in a paraxial region thereof. The third lens element **130** is made of a plastic material, and has the object-side surface **131** and the image-side surface **132** being both aspheric.

[0093] The fourth lens element **140** with negative refractive power has an object-side surface **141** being concave in a paraxial region thereof and an image-side surface **142** being concave in a paraxial region thereof. The fourth lens element **140** is made of a plastic material, and has the object-side surface **141** and the image-side surface **142** being both aspheric.

[0094] The fifth lens element **150** with positive refractive power has an object-side surface **151** being concave in a paraxial region thereof and an image-side surface **152** being convex in a paraxial region thereof. The fifth lens element **150** is made of a plastic material, and has the object-side surface **151** and the image-side surface **152** being both aspheric. Furthermore, the image-side surface **152** of the fifth lens element **150** includes at least one convex shape in an off-axis region thereof.

[0095] The sixth lens element **160** with negative refractive power has an object-side surface **161** being concave in a paraxial region thereof and an image-side surface **162** being convex in a paraxial region thereof. The sixth lens element **160** is made of a plastic material, and has the object-side surface **161** and the image-side surface **162** being both aspheric. Furthermore, the object-side surface **161** of the sixth lens element **160** includes at least one convex shape in an off-axis region thereof and the image-side surface **162** of the sixth lens element **160** includes at least one convex shape in an off-axis region thereof.

[0096] The filter **170** is made of a glass material and located between the sixth lens element **160** and the image surface **180**, and will not affect the focal length of the imaging lens assembly.

[0097] The equation of the aspheric surface profiles of the aforementioned lens elements of the 1st embodiment is expressed as follows:

[00004] $X(Y) = (Y^2 / R) / (1 + \mathrm{sqrt}(1 - (1 + k) \times (Y / R)^2)) + \sum_i (Ai) \times (Y^i)$,

where, [0098] 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 on the optical axis; [0099] Y is the vertical distance from the point on the aspheric surface to the optical axis; [0100] R is the curvature radius; [0101] k is the conic coefficient; and [0102] Ai is the i-th aspheric coefficient.

[0103] In the imaging lens assembly according to the 1st embodiment, when a focal length of the imaging lens assembly is f, an f-number of the imaging lens assembly is Fno, and half of a maximum field of view of the imaging lens assembly is HFOV, these parameters have the following values: f=6.54 mm; Fno=2.44; and HFOV=18.8 degrees.

[0104] In the imaging lens assembly according to the 1st embodiment, when an Abbe number of the second lens element **120** is V2, an Abbe number of the third lens element **130** is V3, an Abbe number of the fifth lens element **150** is V5, and an Abbe number of the sixth lens element **160** is V6, the following conditions are satisfied: V3=19.5; V5=23.2; V5-V2=−32.8, and V5-V6=−32.8.

[0105] In the imaging lens assembly according to the 1st embodiment, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25, wherein the two lens elements are the third lens element **130** and the fifth lens element **150**.
[0106] In the imaging lens assembly according to the 1st embodiment, when a refractive index of the first lens element **110** is N1, a refractive index of the second lens element **120** is N2, a refractive index of the third lens element **130** is N3, a refractive index of the fourth lens element **140** is N4, a refractive index of the fifth lens element **150** is N5, a refractive index of the sixth lens element **160** is N6, a maximum refractive index of the six lens elements of the imaging lens assembly is Nmax (which is the maximum of N1, N2, N3, N4, N5, and N6; in the first embodiment, Nmax=N3), the following condition is satisfied: Nmax=1.669.
[0107] In the imaging lens assembly according to the 1st embodiment, when a central thickness of the fourth lens element **140** is CT4, and a central thickness of the fifth lens element **150** is CT5, the following condition is satisfied: CT4/CT5=0.38.
[0108] In the imaging lens assembly according to the 1st embodiment, when an axial distance between the third lens element **130** and the fourth lens element **140** is T34, an axial distance between the fourth lens element **140** and the fifth lens element **150** is T45, a central thickness of the third lens element **130** is CT3, and the central thickness of the fourth lens element **140** is CT4, the following condition is satisfied: (T34+T45)/(CT3+CT4)=4.57.
[0109] In the imaging lens assembly according to the 1st embodiment, when an axial distance between the first lens element **110** and the second lens element **120** is T12, an axial distance between the second lens element **120** and the third lens element **130** is T23, the axial distance between the third lens element **130** and the fourth lens element **140** is T34, the axial distance between the fourth lens element **140** and the fifth lens element **150** is T45, and an axial distance between the fifth lens element **150** and the sixth lens element **160** is T56, the following condition is satisfied: (T12+T23+T56)/(T34+T45)=0.07.
[0110] In the imaging lens assembly according to the 1st embodiment, when a curvature radius of the object-side surface **111** of the first lens element **110** is R1, and the focal length of the imaging lens assembly is f, the following condition is satisfied: R1/f=0.26.
[0111] In the imaging lens assembly according to the 1st embodiment, when the focal length of the imaging lens assembly is f, a composite focal length of the first lens element **110** and the second lens element **120** is f12, a focal length of the second lens element **120** is f2, a focal length of the fifth lens element **150** is f5, and a focal length of the sixth lens element **160** is f6, the following conditions are satisfied: f/f12=2.04; f2/f5=2.21; and |f/f5|+|f/f6|=3.05.
[0112] In the imaging lens assembly according to the 1st embodiment, when the focal length of the imaging lens assembly is f, a maximum image height of the imaging lens assembly is ImgH, an axial distance between the object-side surface **111** of the first lens element **110** and the image surface **180** is TL, and an entrance pupil diameter of the imaging lens assembly is EPD, the following conditions are satisfied: f/ImgH=2.91; TL/ImgH=2.58; EPD/ImgH=1.19; EPD/TL=0.46; TL/f=0.89; and f/EPD=2.44.
[0113] In the imaging lens assembly according to the 1st embodiment, when an axial distance between the aperture stop **100** and the image-side surface **162** of the sixth lens element **160** is SD, and an axial distance between the object-side surface **111** of the first lens element **110** and the image-side surface **162** of the sixth lens element **160** is TD, the following condition is satisfied: SD/TD=0.87.
[0114] FIG. **25** is a schematic view of a parameter Y11 according to the 1st embodiment of FIG. **1**, and FIG. **26** is a schematic view of a parameter Y62 according to the 1st embodiment of FIG. **1**. In FIG. **25** and FIG. **26**, when a vertical distance between a maximum effective diameter position on the object-side surface **111** of the first lens element **110** and an optical axis is Yc11, and a vertical distance between a maximum effective diameter position on the image-side surface **162** of the sixth lens element **160** and the optical axis is Y62, the following condition is satisfied: Y11/Y62=0.68.

[0115] In the imaging lens assembly according to the 1st embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **132** of the third lens element **130**. In other words, among a maximum effective diameter of the object-side surface **111** of the first lens element **110**, a maximum effective diameter of the image-side surface **112** of the first lens element **110**, a maximum effective diameter of the object-side surface **121** of the second lens element **120**, a maximum effective diameter of the image-side surface **122** of the second lens element **120**, a maximum effective diameter of the object-side surface **131** of the third lens element **130**, a maximum effective diameter of the image-side surface **132** of the third lens element **130**, a maximum effective diameter of the object-side surface **141** of the fourth lens element **140**, a maximum effective diameter of the image-side surface **142** of the fourth lens element **140**, a maximum effective diameter of the object-side surface **151** of the fifth lens element **150**, a maximum effective diameter of the image-side surface **152** of the fifth lens element **150**, a maximum effective diameter of the object-side surface **160** of the sixth lens element **160**, and a maximum effective diameter of the image-side surface **162** of the sixth lens element **160**, the maximum effective diameter of the image-side surface **132** of the third lens element **130** is the smallest.

[0116] The detailed optical data of the 1st embodiment are shown in Table 1 and the aspheric surface data are shown in Table 2 below.

TABLE-US-00001 TABLE 1 1st Embodiment f = 6.54 mm, Fno = 2.44, HFOV = 18.8 deg. Focal Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Ape. Stop Plano −0.583 2 Lens 1 1.722 ASP 0.639 Plastic 1.545 56.0 4.40 3 5.317 ASP 0.061 4 Lens 2 5.139 ASP 0.426 Plastic 1.545 56.0 10.13 5 73.075 ASP 0.044 6 Lens 3 5.920 ASP 0.221 Plastic 1.669 19.5 −6.74 7 2.521 ASP 1.384 8 Lens 4 −5.907 ASP 0.233 Plastic 1.544 56.0 −8.76 9 25.053 ASP 0.696 10 Lens 5 −6.926 ASP 0.608 Plastic 1.639 23.2 4.59 11 −2.130 ASP 0.040 12 Lens 6 −2.024 ASP 0.278 Plastic 1.544 56.0 −4.02 13 −28.740 ASP 0.278 14 Filter Plano 0.102 Glass 1.517 64.2 — 15 Plano 0.795 16 Image Plano — Reference wavelength is 587.6 nm (d-line).

TABLE-US-00002 TABLE 2 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.9167E−01 −1.9502E−01 1.6170E−01 9.0000E+01 −6.1720E+01 −3.5820E+01 A4= 5.3172E−03 −1.8213E−04 1.8138E−04 −1.8491E−01 −1.9086E−01 1.8736E−01 A6= 1.1249E−03 −1.7289E−04 1.8089E−04 4.5454E−01 5.5173E−01 −1.8729E−01 A8= −2.8985E−03 −6.2382E−05 7.5868E−05 −5.1764E−01 −6.3093E−01 3.1704E−01 A10= 3.6127E−03 4.4628E−05 −2.0755E−05 3.0953E−01 3.7753E−01 −2.8617E−01 A12= −1.5810E−03 −9.6918E−02 −1.1486E−01 1.1410E−01 A14= 1.2553E−02 1.4912E−02 Surface # 8 9 10 11 12 13 k= 2.6611E+00 6.7330E+01 1.7632E+01 −3.5558E−01 −8.0952E+00 −2.6636E+01 A4= 3.6353E−03 5.0613E−02 −1.6355E−02 1.0582E−01 1.5898E−02 −4.1711E−02 A6= −2.5404E−02 7.5832E−03 −1.1992E−03 −1.8018E−01 −1.3032E−01 1.1326E−02 A8= 9.4959E−02 4.4749E−02 −1.3240E−02 1.4083E−01 1.4449E−01 5.6157E−03 A10= −1.7075E−01 −6.8084E−02 8.2745E−03 −6.3791E−02 −7.1270E−02 −7.3422E−03 A12= 1.0850E−01 3.1946E−02 1.9445E−03 1.6901E−02 1.8794E−02 2.8534E−03 A14= −2.8234E−02 −5.3369E−03 −1.1370E−03 −1.9389E−03 −2.5836E−03 −5.3028E−04 A16= 1.4597E−04 4.0414E−05

[0117] In Table 1, the curvature radius, the thickness and the focal length are shown in millimeters (mm). Surface numbers 0-16 represent the surfaces sequentially arranged from the object side to the image side along the optical axis. In Table 2, k represents the conic coefficient of the equation of the aspheric surface profiles. A4-A16 represent the aspheric coefficients ranging from the 4th order to the 16th order. The tables presented below for each embodiment correspond to schematic parameter and aberration curves of each embodiment, and term definitions of the tables are the same as those in Table 1 and Table 2 of the 1st embodiment. Therefore, an explanation in this regard will not be provided again.

[0118] Additionally, FIG. **27** shows the inflection points IP 11, IP 22, IP 42, IP 51, IP 52, IP 61, and IP 62 according to the 1st embodiment of FIG. **1**. From FIG. **27**, the object-side surface **111** of the first lens element **110** includes an inflection point IP 11, the image-side surface **122** of the second lens element **120** includes inflection points IP 22, the image-side surface **142** of the fourth lens element **140** includes an inflection point IP 42, the object-side surface **151** of the fifth lens element **150** includes inflection points IP 51, the image-side surface **152** of the fifth lens element **150** includes inflection points IP 52, the object-side surface **161** of the sixth lens element **160** includes an inflection point IP 61, and the image-side surface **162** of the sixth lens element **160** includes an inflection point IP 62. Furthermore, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00003 Numbers of inflection points of 1st Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 1 0 0 0 2 1 surface Image-side 0 3 0 1 2 1 surface

2nd Embodiment

[0119] FIG. **3** is a schematic view of an imaging apparatus according to the 2nd embodiment of the present disclosure. FIG. **4** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 2nd embodiment. In FIG. **3**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **290**. The imaging lens assembly includes, in order from an object side to an image side, a first lens element **210**, an aperture stop **200**, a second lens element **220**, a third lens element **230**, a fourth lens element **240**, a fifth lens element **250**, a sixth lens element **260**, a filter **270** and an image surface **280**, wherein the image sensor **290** is disposed on the image surface **280** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**210**, **220**, **230**, **240**, **250**, **260**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **210** and the sixth lens element **260**.

[0120] The first lens element **210** with positive refractive power has an object-side surface **211** being convex in a paraxial region thereof and an image-side surface **212** being concave in a paraxial region thereof. The first lens element **210** is made of a plastic material, and has the object-side surface **211** and the image-side surface **212** being both aspheric.

[0121] The second lens element **220** with positive refractive power has an object-side surface **221** being convex in a paraxial region thereof and an image-side surface **222** being concave in a paraxial region thereof. The second lens element **220** is made of a plastic material, and has the object-side surface **221** and the image-side surface **222** being both aspheric.

[0122] The third lens element **230** with negative refractive power has an object-side surface **231** being convex in a paraxial region thereof and an image-side surface **232** being concave in a paraxial region thereof. The third lens element **230** is made of a plastic material, and has the object-side surface **231** and the image-side surface **232** being both aspheric.

[0123] The fourth lens element **240** with negative refractive power has an object-side surface **241** being concave in a paraxial region thereof and an image-side surface **242** being concave in a paraxial region thereof. The fourth lens element **240** is made of a plastic material, and has the object-side surface **241** and the image-side surface **242** being both aspheric.

[0124] The fifth lens element **250** with positive refractive power has an object-side surface **251** being concave in a paraxial region thereof and an image-side surface **252** being convex in a paraxial region thereof. The fifth lens element **250** is made of a plastic material, and has the object-side surface **251** and the image-side surface **252** being both aspheric. Furthermore, the image-side surface **252** of the fifth lens element **250** includes at least one convex shape in an off-axis region thereof.

[0125] The sixth lens element **260** with negative refractive power has an object-side surface **261** being concave in a paraxial region thereof and an image-side surface **262** being concave in a paraxial region thereof. The sixth lens element **260** is made of a plastic material, and has the object-side surface **261** and the image-side surface **262** being both aspheric. Furthermore, the object-side surface **261** of the sixth lens element **260** includes at least one convex shape in an off-axis region thereof, and the image-side surface **262** of the sixth lens element **260** includes at least one convex shape in an off-axis region thereof.

[0126] The filter **270** is made of a glass material and located between the sixth lens element **260** and the image surface **280**, and will not affect the focal length of the imaging lens assembly.

[0127] The detailed optical data of the 2nd embodiment are shown in Table 3 and the aspheric surface data are shown in Table 4 below.

TABLE-US-00004 TABLE 3 2nd Embodiment f = 6.55 mm, Fno = 2.44, HFOV = 19.0 deg. Focal Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Lens 1 1.789 ASP 0.672 Plastic 1.545 56.0 3.86 2 10.480 ASP 0.205 3 Ape. Stop Plano −0.091 4 Lens 2 7.707 ASP 0.296 Plastic 1.545 56.0 18.74 5 31.073 ASP 0.037 6 Lens 3 5.915 ASP 0.218 Plastic 1.669 19.5 −7.06 7 2.588 ASP 1.394 8 Lens 4 −24.840 ASP 0.237 Plastic 1.544 56.0 −11.92 9 8.803 ASP 0.751 10 Lens 5 −5.259 ASP 0.633 Plastic 1.639 23.2 5.29 11 −2.154 ASP 0.040 12 Lens 6 −2.276 ASP 0.284 Plastic 1.544 56.0 −3.96 13 41.336 ASP 0.284 14 Filter Plano 0.104 Glass 1.517 64.2 — 15 Plano 0.757 16 Image Plano — Reference wavelength is 587.6 nm (d-line).

TABLE-US-00005 TABLE 4 Aspheric Coefficients Surface # 1 2 4 5 6 7 k= −3.7590E−01 −5.7703E+00 3.7692E+00 9.0000E+01 −6.1720E+01 −3.5453E+01 A4= 6.3586E−03 −4.5684E−04 1.2632E−04 −1.8577E−01 −1.8940E−01 1.7341E−01 A6= −5.2370E−03 −4.6376E−04 1.1715E−04 5.1008E−01 6.0594E−01 −1.5408E−01 A8= 7.3474E−03 −1.1908E−04 −1.4386E−04 −6.5874E−01 −8.1854E−01 2.2310E−01 A10= −4.3648E−03 1.2840E−04 −3.2197E−04 4.6001E−01 6.2351E−01 −1.7087E−01 A12= 7.9774E−04 1.3641E−04 −2.9461E−04 −1.7305E−01 −2.5961E−01 6.0324E−02 A14= 2.7423E−02 4.6611E−02 Surface # 8 9 10 11 12 13 k= 2.6611E+00 3.0245E+01 1.3078E+01 5.8196E−01 −8.0952E+00 −2.6636E+01 A4= −2.9814E−03 1.4709E−02 −3.5722E−02 1.4196E−02 −2.0545E−01 −1.7750E−01 A6= −6.5280E−02 −5.6375E−02 −4.0305E−02 −7.3757E−02 2.0829E−01 2.1105E−01 A8= 2.5433E−01 2.1187E−01 −8.7259E−02 3.8755E−02 −8.7220E−02 −1.4769E−01 A10= −3.0953E−01 −1.9289E−01 1.4148E−01 −1.7804E−04 −1.0173E−02 5.7728E−02 A12= 1.6581E−01 7.5884E−02 −8.2515E−02 −9.2870E−03 1.9617E−02 −1.3096E−02 A14= −3.6991E−02 −1.2237E−02 1.8596E−02 2.8627E−03 −5.4955E−03 1.5770E−03 A16= 4.9248E−04 −7.6817E−05

[0128] In the 2nd embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 2nd embodiment, so an explanation in this regard will not be provided again.

[0129] Moreover, these parameters can be calculated from Table 3 and Table 4 as the following values and satisfy the following conditions:

TABLE-US-00006 2nd Embodiment f [mm] 6.55 f/f12 2.00 Fno 2.44 f2/f5 3.54 HFOV [deg] 19.0 |f/f5| + |f/f6| 2.89 V3 19.5 f/ImgH 2.85 V5 23.2 TL/ImgH 2.53 V5-V2 −32.8 EPD/ImgH 1.17 V5-V6 −32.8 EPD/TL 0.46 Nmax 1.669 TL/f 0.89 CT4/CT5 0.37 f/EPD 2.44 (T34 + T45)/(CT3 + CT4) 4.72 SD/TD 0.81 (T12 + T23 + T56)/(T34 + T45) 0.09 Y11/Y62 0.73 R1/f 0.27

[0130] Furthermore, in the imaging lens assembly according to the 2nd embodiment, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25, wherein the two lens elements are the third lens element **230** and the fifth lens element **250**.

[0131] In the imaging lens assembly according to the 2nd embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **232** of the third lens element **230**.

[0132] In the imaging lens assembly according to the 2nd embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00007 Numbers of inflection points of 2nd Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 0 1 0 2 1 1 surface Image-side 0 3 0 1 1 1 surface

3rd Embodiment

[0133] FIG. **5** is a schematic view of an imaging apparatus according to the 3rd embodiment of the present disclosure. FIG. **6** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 3rd embodiment. In FIG. **5**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **390**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **300**, a first lens element **310**, a second lens element **320**, a third lens element **330**, a fourth lens element **340**, a fifth lens element **350**, a sixth lens element **360**, a filter **370** and an image surface **380**, wherein the image sensor **390** is disposed on the image surface **380** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**310**, **320**, **330**, **340**, **350**, **360**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **310** and the sixth lens element **360**.

[0134] The first lens element **310** with positive refractive power has an object-side surface **311** being convex in a paraxial region thereof and an image-side surface **312** being convex in a paraxial region thereof. The first lens element **310** is made of a plastic material, and has the object-side surface **311** and the image-side surface **312** being both aspheric.

[0135] The second lens element **320** with positive refractive power has an object-side surface **321** being concave in a paraxial region thereof and an image-side surface **322** being convex in a paraxial region thereof. The second lens element **320** is made of a plastic material, and has the object-side surface **321** and the image-side surface **322** being both aspheric.

[0136] The third lens element **330** with negative refractive power has an object-side surface **331** being concave in a paraxial region thereof and an image-side surface **332** being concave in a paraxial region thereof. The third lens element **330** is made of a plastic material, and has the object-side surface **331** and the image-side surface **332** being both aspheric.

[0137] The fourth lens element **340** with negative refractive power has an object-side surface **341** being convex in a paraxial region thereof and an image-side surface **342** being concave in a paraxial region thereof. The fourth lens element **340** is made of a plastic material, and has the object-side surface **341** and the image-side surface **342** being both aspheric.

[0138] The fifth lens element **350** with positive refractive power has an object-side surface **351** being concave in a paraxial region thereof and an image-side surface **352** being convex in a paraxial region thereof. The fifth lens element **350** is made of a plastic material, and has the object-side surface **351** and the image-side surface **352** being both aspheric. Furthermore, the image-side surface **352** of the fifth lens element **350** includes at least one convex shape in an off-axis region thereof.

[0139] The sixth lens element **360** with negative refractive power has an object-side surface **361** being concave in a paraxial region thereof and an image-side surface **362** being concave in a paraxial region thereof. The sixth lens element **360** is made of a plastic material, and has the object-side surface **361** and the image-side surface **362** being both aspheric. Furthermore, the object-side surface **361** of the sixth lens element **360** includes at least one convex shape in an off-axis region thereof and the image-side surface **362** of the sixth lens element **360** includes at least one convex shape in an off-axis region thereof.

[0140] The filter **370** is made of a glass material and located between the sixth lens element **360** and the image surface **380**, and will not affect the focal length of the imaging lens assembly.

[0141] The detailed optical data of the 3rd embodiment are shown in Table 5 and the aspheric surface data are shown in Table 6 below.

TABLE-US-00008 TABLE 5 3rd Embodiment f = 6.26 mm, Fno = 2.06, HFOV = 19.7 deg. Focal Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Ape. Stop Plano −0.692 2 Lens 1 1.875 ASP 0.932 Plastic 1.545 56.0 3.42 3 −234.520 ASP 0.312 4 Lens 2 −44.780 ASP 0.302 Plastic 1.545 56.0 24.96 5 −10.452 ASP 0.049 6 Lens 3 −52.949 ASP 0.228 Plastic 1.688 18.7 −5.20 7 3.843 ASP 0.622 8 Lens 4 20.660 ASP 0.237 Plastic 1.544 56.0 −10.82 9 4.564 ASP 0.740 10 Lens 5 −7.918 ASP 0.563 Plastic 1.688 18.7 7.21 11 −3.138 ASP 0.559 12 Lens 6 −4.169 ASP 0.284 Plastic 1.544 56.0 −5.59 13 11.520 ASP 0.284 14 Filter Plano 0.104 Glass 1.517 64.2 — 15 Plano 0.697 16 Image Plano — Reference wavelength is 587.6 nm (d-line).

TABLE-US-00009 TABLE 6 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.8099E−01 −2.1398E−01 1.7346E−01 3.7038E+01 −6.1721E+01 −4.0767E+01 A4= 2.4961E−03 3.3599E−03 1.5969E−02 −1.1135E−01 −1.6947E−01 3.5013E−02 A6= 3.6462E−03 −4.9836E−04 −1.2591E−02 3.1899E−01 4.8947E−01 1.4980E−01 A8= −4.1635E−03 −9.4540E−04 −1.2308E−02 −4.1510E−01 −5.3938E−01 −6.8981E−02 A10= 2.6825E−03 −3.4910E−04 1.9833E−03 2.7154E−01 3.2208E−01 4.6495E−04 A12= −7.4082E−04 1.5053E−04 6.4492E−03 −8.7701E−02 −1.0207E−01 1.2505E−02 A14= −2.2170E−03 1.0937E−02 1.2878E−02 Surface # 8 9 10 11 12 13 k= 2.2722E+00 −2.7473E+01 1.6199E+01 1.7739E+00 −8.0952E+00 −2.6636E+01 A4= −3.6305E−02 2.5954E−02 −8.9820E−03 2.0933E−02 −8.3010E−02 −1.1420E−01 A6= 6.8713E−02 2.2282E−02 −6.5438E−02 −5.9852E−02 −3.0989E−03 4.1967E−02 A8= 3.6579E−02 3.9623E−02 4.2647E−02 3.4404E−02 2.7986E−02 −1.1797E−02 A10= −5.9897E−02 −3.5251E−02 −3.1728E−02 −1.6288E−02 −1.8011E−02 2.5825E−03 A12= 2.5742E−02 1.0669E−02 1.0735E−02 4.1795E−03 6.0059E−03 −6.2698E−04 A14= −4.2318E−03 −1.6599E−03 −1.8866E−03 −5.3398E−04 −1.0268E−03 1.1416E−04 A16= 7.0218E−05 −9.3984E−06

[0142] In the 3rd embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 3rd embodiment, so an explanation in this regard will not be provided again.

[0143] Moreover, these parameters can be calculated from Table 5 and Table 6 as the following values and satisfy the following conditions:

TABLE-US-00010 3rd Embodiment f [mm] 6.26 f/f12 1.99 Fno 2.06 f2/f5 3.46 HFOV [deg] 19.7 |f/f5| + |f/f6| 1.99 V3 18.7 f/ImgH 2.72 V5 18.7 TL/ImgH 2.57 V5-V2 −37.3 EPD/ImgH 1.32 V5-V6 −37.3 EPD/TL 0.51 Nmax 1.688 TL/f 0.95 CT4/CT5 0.42 f/EPD 2.06 (T34 + T45)/(CT3 + CT4) 2.93 SD/TD 0.86 (T12 + T23 + T56)/(T34 + T45) 0.68 Y11/Y62 0.77 R1/f 0.30

[0144] Furthermore, in the imaging lens assembly according to the 3rd embodiment, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25, 22, and 20, wherein the two lens elements are the third lens element **330** and the fifth lens element **350**.

[0145] In the imaging lens assembly according to the 3rd embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **332** of the third lens element **330**.

[0146] In the imaging lens assembly according to the 3rd embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00011 Numbers of inflection points of 3rd Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 1 0 2 0 0 1 surface Image-side 2 0 0 0 0 1 surface

4th Embodiment

[0147] FIG. **7** is a schematic view of an imaging apparatus according to the 4th embodiment of the present disclosure. FIG. **8** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 4th embodiment. In FIG. **7**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **490**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **400**, a first lens element **410**, a second lens element **420**, a third lens element **430**, a fourth lens element **440**, a fifth lens element **450**, a sixth lens element **460**, a filter **470** and an image surface **480**, wherein the image sensor **490** is disposed on the image surface **480** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**410**, **420**, **430**, **440**, **450**, **460**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **410** and the sixth lens element **460**.

[0148] The first lens element **410** with positive refractive power has an object-side surface **411** being convex in a paraxial region thereof and an image-side surface **412** being concave in a paraxial region thereof. The first lens element **410** is made of a plastic material, and has the object-side surface **411** and the image-side surface **412** being both aspheric.

[0149] The second lens element **420** with positive refractive power has an object-side surface **421** being convex in a paraxial region thereof and an image-side surface **422** being convex in a paraxial region thereof. The second lens element **420** is made of a plastic material, and has the object-side surface **421** and the image-side surface **422** being both aspheric.

[0150] The third lens element **430** with negative refractive power has an object-side surface **431** being convex in a paraxial region thereof and an image-side surface **432** being concave in a paraxial region thereof. The third lens element **430** is made of a plastic material, and has the object-side surface **431** and the image-side surface **432** being both aspheric.

[0151] The fourth lens element **440** with negative refractive power has an object-side surface **441** being convex in a paraxial region thereof and an image-side surface **442** being concave in a paraxial region thereof. The fourth lens element **440** is made of a plastic material, and has the object-side surface **441** and the image-side surface **442** being both aspheric.

[0152] The fifth lens element **450** with positive refractive power has an object-side surface **451** being convex in a paraxial region thereof and an image-side surface **452** being convex in a paraxial region thereof. The fifth lens element **450** is made of a plastic material, and has the object-side surface **451** and the image-side surface **452** being both aspheric. Furthermore, the image-side surface **452** of the fifth lens element **450** includes at least one convex shape in an off-axis region thereof.

[0153] The sixth lens element **460** with negative refractive power has an object-side surface **461** being concave in a paraxial region thereof and an image-side surface **462** being convex in a paraxial region thereof. The sixth lens element **460** is made of a plastic material, and has the object-side surface **461** and the image-side surface **462** being both aspheric. Furthermore, the object-side surface **461** of the sixth lens element **460** includes at least one convex shape in an off-axis region thereof and the image-side surface **462** of the sixth lens element **460** includes at least one convex shape in an off-axis region thereof.

[0154] The filter **470** is made of a glass material and located between the sixth lens element **460** and the image surface **480**, and will not affect the focal length of the imaging lens assembly.

[0155] The detailed optical data of the 4th embodiment are shown in Table 7 and the aspheric surface data are shown in Table 8 below.

TABLE-US-00012 TABLE 7 4th Embodiment f = 6.26 mm, Fno = 2.10, HFOV = 19.7 deg. Focal Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Ape. Stop Plano −0.667 2 Lens 1 1.898 ASP 0.805 Plastic 1.545 56.0 4.06 3 11.331 ASP 0.187 4 Lens 2 8.128 ASP 0.474 Plastic 1.545 56.0 9.16 5 −12.641 ASP 0.150 6 Lens 3 16599.196 ASP 0.218 Plastic 1.688 18.7 −4.90 7 3.373 ASP 0.634 8 Lens 4 24.535 ASP 0.237 Plastic 1.544 56.0 −7.65 9 3.546 ASP 0.712 10 Lens 5 344.238 ASP 0.562 Plastic 1.688 18.7 8.04 11 −5.620 ASP 0.890 12 Lens 6 −2.692 ASP 0.304 Plastic 1.534 55.9 −6.67 13 −11.444 ASP 0.284 14 Filter Plano 0.104 Glass 1.517 64.2 — 15 Plano 0.351 16 Image Plano — Reference wavelength is 587.6 nm (d-line).

TABLE-US-00013 TABLE 8 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.5980E−01 −2.1398E−01 1.7350E−01 2.7339E+01 −6.1664E+01 −3.7983E+01 A4= 2.6355E−03 3.5543E−03 8.3427E−03 −5.4389E−02 −1.6979E−01 −6.6948E−04 A6= 2.0717E−03 3.7244E−03 −4.6800E−03 1.2361E−01 4.8611E−01 2.9328E−01 A8= −1.3302E−03 −8.4484E−03 −1.1897E−02 −1.3702E−01 −5.4333E−01 −2.5498E−01 A10= 8.5373E−04 3.0485E−03 1.4505E−03 7.4817E−02 3.3005E−01 1.0086E−01 A12= −3.0793E−04 −2.3426E−04 3.6384E−03 −1.9256E−02 −1.0635E−01 −5.4534E−03 A14= −9.5898E−04 1.7691E−03 1.4018E−02 Surface # 8 9 10 11 12 13 k= 2.2722E+00 −2.9473E+01 9.0000E+01 5.3933E+00 −8.0952E+00 −2.6636E+01 A4= −1.2411E−01 −2.7143E−02 −5.8933E−02 −3.6384E−02 −1.2637E−01 −1.0602E−01 A6= 3.1816E−01 1.9384E−01 −3.0433E−02 −2.4458E−02 3.3102E−02 2.9077E−02 A8= −2.5230E−01 −1.2902E−01 5.4557E−02 2.8039E−02 3.3174E−03 −4.3725E−03 A10= 8.8317E−02 1.1766E−02 −5.9227E−02 −2.0402E−02 −5.9293E−03 −5.8141E−04 A12= −2.1999E−03 2.2633E−02 3.0387E−02 7.3223E−03 2.1671E−03 4.1420E−04 A14= −4.2260E−03 −7.4942E−03 −7.3523E−03 −1.2316E−03 −3.2079E−04 −8.3265E−05 A16= 1.5419E−05 6.4073E−06

[0156] In the 4th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 4th embodiment, so an explanation in this regard will not be provided again.

[0157] Moreover, these parameters can be calculated from Table 7 and Table 8 as the following values and satisfy the following conditions:

TABLE-US-00014 4th Embodiment f [mm] 6.26 f/f12 2.07 Fno 2.10 f2/f5 1.14 HFOV [deg] 19.7 |f/f5| + |f/f6| 1.72 V3 18.7 f/ImgH 2.72 V5 18.7 TL/ImgH 2.57 V5-V2 −37.3 EPD/ImgH 1.30 V5-V6 −37.2 EPD/TL 0.50 Nmax 1.688 TL/f 0.94 CT4/CT5 0.42 f/EPD 2.10 (T34 + T45)/(CT3 + CT4) 2.96 SD/TD 0.87 (T12 + T23 + T56)/(T34 + T45) 0.91 Y11/Y62 0.75 R1/f 0.30

[0158] Furthermore, in the imaging lens assembly according to the 4th embodiment, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25, 22, and 20; wherein the two lens elements are the third lens element **430** and the fifth lens element **450**.

[0159] In the imaging lens assembly according to the 4th embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **432** of the third lens element **430**.

[0160] In the imaging lens assembly according to the 4th embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00015 Numbers of inflection points of 4th Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 0 2 3 2 1 1 surface Image-side 2 0 0 0 0 0 surface

5th Embodiment

[0161] FIG. **9** is a schematic view of an imaging apparatus according to the 5th embodiment of the present disclosure. FIG. **10** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 5th embodiment. In FIG. **9**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **590**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **500**, a first lens element **510**, a second lens element **520**, a third lens element **530**, a fourth lens element **540**, a fifth lens element **550**, a sixth lens element **560**, a filter **570** and an image surface **580**, wherein the image sensor **590** is disposed on the image surface **580** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**510**, **520**, **530**, **540**, **550**, **560**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **510** and the sixth lens element **560**.

[0162] The first lens element **510** with negative refractive power has an object-side surface **511** being convex in a paraxial region thereof and an image-side surface **512** being concave in a paraxial region thereof. The first lens element **510** is made of a plastic material, and has the object-side surface **511** and the image-side surface **512** being both aspheric.

[0163] The second lens element **520** with positive refractive power has an object-side surface **521** being convex in a paraxial region thereof and an image-side surface **522** being convex in a paraxial region thereof. The second lens element **520** is made of a plastic material, and has the object-side surface **521** and the image-side surface **522** being both aspheric.

[0164] The third lens element **530** with negative refractive power has an object-side surface **531** being convex in a paraxial region thereof and an image-side surface **532** being concave in a paraxial region thereof. The third lens element **530** is made of a plastic material, and has the object-side surface **531** and the image-side surface **532** being both aspheric.

[0165] The fourth lens element **540** with negative refractive power has an object-side surface **541** being convex in a paraxial region thereof and an image-side surface **542** being concave in a paraxial region thereof. The fourth lens element **540** is made of a plastic material, and has the object-side surface **541** and the image-side surface **542** being both aspheric.

[0166] The fifth lens element **550** with positive refractive power has an object-side surface **551** being concave in a paraxial region thereof and an image-side surface **552** being convex in a paraxial region thereof. The fifth lens element **550** is made of a plastic material, and has the object-side surface **551** and the image-side surface **552** being both aspheric. Furthermore, the image-side surface **552** of the fifth lens element **550** includes at least one convex shape in an off-axis region thereof.

[0167] The sixth lens element **560** with negative refractive power has an object-side surface **561** being concave in a paraxial region thereof and an image-side surface **562** being convex in a paraxial region thereof. The sixth lens element **560** is made of a plastic material, and has the object-side surface **561** and the image-side surface **562** being both aspheric. Furthermore, the object-side surface **561** of the sixth lens element **560** includes at least one convex shape in an off-axis region thereof, and the image-side surface **562** of the sixth lens element **560** includes at least one convex shape in an off-axis region thereof.

[0168] The filter **570** is made of a glass material and located between the sixth lens element **560** and the image surface **580**, and will not affect the focal length of the imaging lens assembly.

[0169] The detailed optical data of the 5th embodiment are shown in Table 9 and the aspheric surface data are shown in Table 10 below.

TABLE-US-00016 TABLE 9 5th Embodiment f = 6.11 mm, Fno = 2.10, HFOV = 19.7 deg. Focal Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Ape. Stop Plano −0.590 2 Lens 1 2.001 ASP 0.176 Plastic 1.545 56.0 −78.76 3 1.852 ASP 0.019 4 Lens 2 1.656 ASP 1.102 Plastic 1.545 56.0 2.76 5 −12.629 ASP 0.207 6 Lens 3 105.753 ASP 0.216 Plastic 1.688 18.7 −4.89 7 3.257 ASP 0.611 8 Lens 4 18.407 ASP 0.232 Plastic 1.544 56.0 −8.66 9 3.735 ASP 0.712 10 Lens 5 −10.203 ASP 0.495 Plastic 1.688 18.7 8.79 11 −3.871 ASP 0.924 12 Lens 6 −3.126 ASP 0.301 Plastic 1.534 55.9 −6.66 13 −26.637 ASP 0.278 14 Filter Plano 0.102 Glass 1.517 64.2 — 15 Plano 0.416 16 Image Plano — Reference wavelength is 587.6 nm (d-line).

TABLE-US-00017 TABLE 10 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.4755E−01 −1.8281E−01 1.0323E−02 −9.0000E+01 −6.5735E+01 −3.5792E+01 A4= −1.9752E−03 1.0401E−02 1.2072E−02 −1.6784E−02 −1.1005E−01 3.1402E−02 A6= 4.3369E−03 −4.0659E−02 −4.5312E−02 1.5765E−02 2.5024E−01 1.2039E−01 A8= 1.2596E−03 4.7444E−02 3.8229E−02 2.7856E−03 −1.5640E−01 7.6367E−02 A10= 3.4002E−04 −1.8086E−02 −1.3155E−02 −7.7414E−03 1.8075E−02 −1.6332E−01 A12= −6.9981E−04 1.4057E−03 1.8481E−04 2.4432E−03 1.9089E−02 8.3971E−02 A14= 3.3685E−04 6.9461E−05 −5.4720E−03 Surface # 8 9 10 11 12 13 k= 2.2728E+00 −3.0531E+01 3.8810E+01

4.3885E+00 −8.0952E+00 −2.6636E+01 A4= −1.1651E−01 −1.6991E−02 −6.1389E−02 −3.2645E−02 −1.2019E−01 −1.1438E−01 A6= 2.6839E−01 1.5787E−01 −3.2044E−02 −2.0953E−02 3.3627E−02 3.7021E−02 A8= −1.6116E−01 −6.5293E−02 2.7393E−02 1.5463E−02 6.6521E−03 −7.4968E−03 A10= 3.0100E−02 −3.0079E−02 −2.4002E−02 −8.6520E−03 −9.7286E−03 −1.2315E−04 A12= 1.1755E−02 3.8093E−02 5.2993E−03 1.3712E−03 3.5180E−03 3.7273E−04 A14= −5.3477E−03 −1.1115E−02 −1.3836E−03 −1.2212E−04 −5.2513E−04 −7.8330E−05 A16= 2.6258E−05 5.8744E−06

[0170] In the 5th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 5th embodiment, so an explanation in this regard will not be provided again.

[0171] Moreover, these parameters can be calculated from Table 9 and Table 10 as the following values and satisfy the following conditions:

TABLE-US-00018 5th Embodiment f [mm] 6.11 f/f12 2.07 Fno 2.10 f2/f5 0.31 HFOV [deg] 19.7 |f/f5| + |f/f6| 1.61 V3 18.7 f/ImgH 2.72 V5 18.7 TL/ImgH 2.57 V5-V2 −37.3 EPD/ImgH 1.29 V5-V6 −37.2 EPD/TL 0.50 Nmax 1.688 TL/f 0.95 CT4/CT5 0.47 f/EPD 2.10 (T34 + T45)/(CT3 + CT4) 2.96 SD/TD 0.88 (T12 + T23 + T56)/(T34 + T45) 0.87 Y11/Y62 0.75 R1/f 0.33

[0172] Furthermore, in the imaging lens assembly according to the 5th embodiment, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25, 22, and 20, wherein the two lens elements are the third lens element **530** and the fifth lens element **550**.

[0173] In the imaging lens assembly according to the 5th embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **532** of the third lens element **530**.

[0174] In the imaging lens assembly according to the 5th embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00019 Numbers of inflection points of 5th Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 1 0 2 2 0 1 surface Image-side 1 1 0 1 0 0 surface

6th Embodiment

[0175] FIG. **11** is a schematic view of an imaging apparatus according to the 6th embodiment of the present disclosure. FIG. **12** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 6th embodiment. In FIG. **11**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **690**. The imaging lens assembly includes, in order from an object side to an image side, a first lens element **610**, an aperture stop **600**, a second lens element **620**, a third lens element **630**, a fourth lens element **640**, a fifth lens element **650**, a sixth lens element **660**, a filter **670** and an image surface **680**, wherein the image sensor **690** is disposed on the image surface **680** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**610**, **620**, **630**, **640**, **650**, **660**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **610** and the sixth lens element **660**.

[0176] The first lens element **610** with negative refractive power has an object-side surface **611** being convex in a paraxial region thereof and an image-side surface **612** being concave in a paraxial region thereof. The first lens element **610** is made of a plastic material, and has the object-side surface **611** and the image-side surface **612** being both aspheric.

[0177] The second lens element **620** with positive refractive power has an object-side surface **621** being convex in a paraxial region thereof and an image-side surface **622** being convex in a paraxial region thereof. The second lens element **620** is made of a plastic material, and has the object-side surface **621** and the image-side surface **622** being both aspheric.

[0178] The third lens element **630** with negative refractive power has an object-side surface **631** being convex in a paraxial region thereof and an image-side surface **632** being concave in a paraxial region thereof. The third lens element **630** is made of a plastic material, and has the object-side surface **631** and the image-side surface **632** being both aspheric.

[0179] The fourth lens element **640** with negative refractive power has an object-side surface **641** being convex in a paraxial region thereof and an image-side surface **642** being concave in a paraxial region thereof. The fourth lens element **640** is made of a plastic material, and has the object-side surface **641** and the image-side surface **642** being both aspheric.

[0180] The fifth lens element **650** with positive refractive power has an object-side surface **651** being concave in a paraxial region thereof and an image-side surface **652** being convex in a paraxial region thereof. The fifth lens element **650** is made of a plastic material, and has the object-side surface **651** and the image-side surface **652** being both aspheric. Furthermore, the image-side surface **652** of the fifth lens element **650** includes at least one convex shape in an off-axis region thereof.

[0181] The sixth lens element **660** with negative refractive power has an object-side surface **661** being concave in a paraxial region thereof and an image-side surface **662** being convex in a paraxial region thereof. The sixth lens element **660** is made of a plastic material, and has the object-side surface **661** and the image-side surface **662** being both aspheric. Furthermore, the object-side surface **661** of the sixth lens element **660** includes at least one convex shape in an off-axis region thereof, and the image-side surface **662** of the sixth lens element **660** includes at least one convex shape in an off-axis region thereof.

[0182] The filter **670** is made of a glass material and located between the sixth lens element **660** and the image surface **680**, and will not affect the focal length of the imaging lens assembly.

[0183] The detailed optical data of the 6th embodiment are shown in Table 11 and the aspheric surface data are shown in Table 12 below.

TABLE-US-00020 TABLE 11 6th Embodiment f = 6.28 mm, Fno = 2.15, HFOV = 19.6 deg.

Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal Length
0	Object	Plano	Infinity				
1	Lens 1	2.046 ASP	0.241	Plastic	1.545	56.0	−79.13
2		1.872 ASP	0.683				
3	Ape. Stop	Plano	−0.663				
4	Lens 2	1.678 ASP	1.109	Plastic	1.545	56.0	2.78
5		−11.838 ASP	0.205				
6	Lens 3	328.821 ASP	0.218	Plastic	1.688	18.7	−4.90
7		3.334 ASP	0.652				
8	Lens 4	19.443 ASP	0.237	Plastic	1.544	56.0	−8.75
9		3.809 ASP	0.716				
10	Lens 5	−11.444 ASP	0.517	Plastic	1.688	18.7	8.95
11		−4.076 ASP	0.922				
12	Lens 6	−2.871 ASP	0.331	Plastic	1.534	55.9	−6.59
13		−16.225 ASP	0.284				
14	Filter	Plano	0.104	Glass	1.517	64.2	—
15		Plano	0.375				
16	Image	Plano	—				

Reference wavelength is 587.6 nm (d-line).

TABLE-US-00021 TABLE 12 Aspheric Coefficients

Surface #	1	2	4	5	6	7
k=	−3.4199E−01	−1.8522E−01	7.5498E−03	−8.9361E+01	−6.5735E+01	−3.6296E+01
A4=	−1.1303E−03	−6.7632E−03	−5.8966E−03	−1.7471E−02	−1.0040E−01	3.1950E−02
A6=	8.4947E−03	1.6796E−02	4.6422E−03	2.4316E−02	2.4177E−01	1.2319E−01
A8=	−5.3916E−03	−1.4034E−02	−9.9749E−03	−1.3728E−02	−2.0584E−01	−1.8414E−02
A10=	2.8217E−03	8.0651E−03	6.5804E−03	3.5410E−03	1.0457E−01	−2.8125E−02
A12=	−8.2679E−04	−2.3334E−03	−2.7466E−03	−3.7269E−04	−3.1461E−02	2.5556E−02
A14=	3.8996E−04	1.8720E−04	4.4118E−03			

Surface #	8	9	10	11	12	13
k=	2.2728E+00	−3.0197E+01	3.7430E+01	4.4079E+00	−8.0948E+00	−2.6636E+01
A4=	−1.0135E−01	−9.0897E−03	−5.4644E−02	−3.1504E−02	−1.1999E−01	−1.0640E−01
A6=	2.1107E−01	1.2229E−01	−3.7945E−02	−2.0298E−02	3.4002E−02	3.1984E−02
A8=	−1.0963E−01	−3.8286E−02	4.6558E−02	1.7252E−02	6.4776E−03	−4.0751E−03
A10=	9.9360E−03	−3.4077E−02	−4.9034E−02	−1.1117E−02	−9.7858E−03	−1.7403E−03
A12=	1.7766E−02	3.5805E−02	2.2471E−02	2.9460E−03	3.6730E−03	8.7516E−04
A14=	−6.7998E−03	−1.0202E−02	−5.5561E−03	−4.2598E−04	−5.9083E−04	−1.6596E−04
A16=	3.4775E−05	1.2340E−05				

[0184] In the 6th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these

parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 6th embodiment, so an explanation in this regard will not be provided again.
[0185] Moreover, these parameters can be calculated from Table 11 and Table 12 as the following values and satisfy the following conditions:
TABLE-US-00022 6th Embodiment f [mm] 6.28 f/f12 2.09 Fno 2.15 f2/f5 0.31 HFOV [deg] 19.6 |f/f5| + |f/f6| 1.66 V3 18.7 f/ImgH 2.73 V5 18.7 TL/ImgH 2.58 V5-V2 −37.3 EPD/ImgH 1.27 V5-V6 −37.2 EPD/TL 0.49 Nmax 1.688 TL/f 0.94 CT4/CT5 0.46 f/EPD 2.15 (T34 + T45)/(CT3 + CT4) 3.01 SD/TD 0.82 (T12 + T23 + T56)/(T34 + T45) 0.84 Y11/Y62 0.77 R1/f 0.33
[0186] Furthermore, in the imaging lens assembly according to the 6th embodiment, there are two of the six lens elements of the imaging lens assembly with an Abbe number smaller than 25, 22, and 20, wherein the two lens elements are the third lens element **630** and the fifth lens element **650**.
[0187] In the imaging lens assembly according to the 6th embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **632** of the third lens element **630**.
[0188] In the imaging lens assembly according to the 6th embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.
TABLE-US-00023 Numbers of inflection points of 6th Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 1 0 2 2 0 1 surface Image-side 1 1 0 0 0 0 surface
7th Embodiment
[0189] FIG. **13** is a schematic view of an imaging apparatus according to the 7th embodiment of the present disclosure. FIG. **14** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 7th embodiment. In FIG. **13**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **790**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **700**, a first lens element **710**, a second lens element **720**, a third lens element **730**, a fourth lens element **740**, a fifth lens element **750**, a sixth lens element **760**, a filter **770** and an image surface **780**, wherein the image sensor **790** is disposed on the image surface **780** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**710**, **720**, **730**, **740**, **750**, **760**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **710** and the sixth lens element **760**.
[0190] The first lens element **710** with positive refractive power has an object-side surface **711** being convex in a paraxial region thereof and an image-side surface **712** being concave in a paraxial region thereof. The first lens element **710** is made of a plastic material, and has the object-side surface **711** and the image-side surface **712** being both aspheric.
[0191] The second lens element **720** with positive refractive power has an object-side surface **721** being convex in a paraxial region thereof and an image-side surface **722** being convex in a paraxial region thereof. The second lens element **720** is made of a plastic material, and has the object-side surface **721** and the image-side surface **722** being both aspheric.
[0192] The third lens element **730** with negative refractive power has an object-side surface **731** being convex in a paraxial region thereof and an image-side surface **732** being concave in a paraxial region thereof. The third lens element **730** is made of a plastic material, and has the object-side surface **731** and the image-side surface **732** being both aspheric.
[0193] The fourth lens element **740** with positive refractive power has an object-side surface **741** being convex in a paraxial region thereof and an image-side surface **742** being concave in a paraxial region thereof. The fourth lens element **740** is made of a plastic material, and has the object-side surface **741** and the image-side surface **742** being both aspheric.
[0194] The fifth lens element **750** with positive refractive power has an object-side surface **751**

being concave in a paraxial region thereof and an image-side surface **752** being convex in a paraxial region thereof. The fifth lens element **750** is made of a plastic material, and has the object-side surface **751** and the image-side surface **752** being both aspheric. Furthermore, the image-side surface **752** of the fifth lens element **750** includes at least one convex shape in an off-axis region thereof.

[0195] The sixth lens element **760** with negative refractive power has an object-side surface **761** being concave in a paraxial region thereof and an image-side surface **762** being concave in a paraxial region thereof. The sixth lens element **760** is made of a plastic material, and has the object-side surface **761** and the image-side surface **762** being both aspheric. Furthermore, the object-side surface **761** of the sixth lens element **760** includes at least one convex shape in an off-axis region thereof, and the image-side surface **762** of the sixth lens element **760** includes at least one convex shape in an off-axis region thereof.

[0196] The filter **770** is made of a glass material and located between the sixth lens element **760** and the image surface **780**, and will not affect the focal length of the imaging lens assembly.

[0197] The detailed optical data of the 7th embodiment are shown in Table 13 and the aspheric surface data are shown in Table 14 below.

TABLE-US-00024 TABLE 13 7th Embodiment f = 8.50 mm, Fno = 2.17, HFOV = 19.7 deg. Abbe Focal Surface # Curvature Radius Thickness Material Index # Length 0 Object Plano Infinity 1 Ape. Stop Plano −0.893 2 Lens 1 2.452 ASP 0.748 Plastic 1.535 56.3 8.49 3 4.768 ASP 0.162 5 Lens 2 4.557 ASP 0.623 Plastic 1.545 56.0 7.99 6 −90.606 ASP 0.510 7 Lens 3 20.332 ASP 0.230 Plastic 1.688 18.7 −6.09 8 3.457 ASP 0.588 9 Lens 4 9.899 ASP 0.380 Plastic 1.566 37.4 113.85 10 11.534 ASP 1.682 11 Lens 5 −9.090 ASP 0.717 Plastic 1.688 18.7 8.14 12 −3.577 ASP 0.078 13 Lens 6 −9.657 ASP 0.466 Plastic 1.535 56.3 −5.53 14 4.333 ASP 0.386 15 Filter Plano 0.110 Glass 1.517 64.2 — 16 Plano 1.294 17 Image Plano — Reference wavelength is 587.6 nm (d-line).

TABLE-US-00025 TABLE 14 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.7163E−01 −3.6452E−01 2.7014E−01 8.1594E+00 −6.1720E+01 −2.6852E+01 A4= 1.1467E−03 −8.5579E−04 −2.2691E−03 −2.0680E−03 −5.8554E−02 3.3671E−03 A6= 2.7306E−04 −8.2415E−03 −1.0971E−02 −3.2640E−03 8.2159E−02 3.9480E−02 A8= −2.1060E−04 8.3950E−03 1.1031E−02 6.4715E−03 −4.0565E−02 −1.8647E−03 A10= 1.7356E−04 −2.7390E−03 −3.5844E−03 −3.2613E−03 9.9639E−03 −5.0849E−03 A12= −3.6375E−05 2.8656E−04 3.2784E−04 6.1585E−04 −1.1704E−03 1.5494E−03 A14= 1.0529E−05 −3.9852E−05 4.9333E−05 Surface # 8 9 10 11 12 13 k= 2.6611E+00 −2.1816E+01 −1.9268E+01 −7.7384E−01 −8.0953E+00 −2.6636E+01 A4= −3.9509E−02 −9.8488E−03 −1.3031E−02 4.3734E−03 −6.3981E−02 −4.5892E−02 A6= 2.5548E−02 1.4653E−02 −3.8902E−03 −1.5431E−02 1.6858E−02 1.6150E−02 A8= 1.5240E−02 1.2333E−02 6.9325E−04 6.8390E−03 −4.6835E−03 −4.5752E−03 A10= −1.2175E−02 −8.4174E−03 2.9684E−04 −1.8379E−03 2.0202E−03 8.8586E−04 A12= 3.2530E−03 2.2318E−03 −1.9120E−04 3.1720E−04 −6.9924E−04 −1.1575E−04 A14= −3.2926E−04 −2.5162E−04 2.7183E−05 −4.6196E−05 1.2151E−04 9.0071E−06 A16= 4.2625E−06 −7.8076E−06 −3.1370E−07

[0198] In the 7th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 7th embodiment, so an explanation in this regard will not be provided again.

[0199] Moreover, these parameters can be calculated from Table 13 and Table 14 as the following values and satisfy the following conditions:

TABLE-US-00026 7th Embodiment f [mm] 8.50 f/f12 1.93 Fno 2.17 f2/f5 0.98 HFOV [deg] 19.7 |f/f5| + |f/f6| 2.58 V3 18.7 f/ImgH 2.73 V5 18.7 TL/ImgH 2.56 V5-V2 −37.3 EPD/ImgH 1.26 V5-V6 −37.6 EPD/TL 0.49 Nmax 1.688 TL/f 0.94 CT4/CT5 0.53 f/EPD 2.17 (T34 + T45)/(CT3 + CT4) 3.72 SD/TD 0.86 (T12 + T23 + T56)/(T34 + T45) 0.33 Y11/Y62 0.74 R1/f 0.29

[0200] Furthermore, in the imaging lens assembly according to the 7th embodiment, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25, 22, and 20, wherein the two lens elements are the third lens element **730** and the fifth lens element **750**.
[0201] In the imaging lens assembly according to the 7th embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **732** of the third lens element **730**.
[0202] In the imaging lens assembly according to the 7th embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00027

Numbers of inflection points of 7th Embodiment						
	Lens 1	Lens 2	Lens 3	Lens 4	Lens 5	Lens 6
Object-side surface	1	2	2	1	1	1
Image-side surface	2	2	0	1	1	1

8th Embodiment
[0203] FIG. **15** is a schematic view of an imaging apparatus according to the 8th embodiment of the present disclosure. FIG. **16** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 8th embodiment. In FIG. **15**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **890**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **800**, a first lens element **810**, a second lens element **820**, a third lens element **830**, a fourth lens element **840**, a fifth lens element **850**, a sixth lens element **860**, a filter **870** and an image surface **880**, wherein the image sensor **890** is disposed on the image surface **880** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**810**, **820**, **830**, **840**, **850**, **860**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **810** and the sixth lens element **860**.
[0204] The first lens element **810** with positive refractive power has an object-side surface **811** being convex in a paraxial region thereof and an image-side surface **812** being concave in a paraxial region thereof. The first lens element **810** is made of a plastic material, and has the object-side surface **811** and the image-side surface **812** being both aspheric.
[0205] The second lens element **820** with positive refractive power has an object-side surface **821** being convex in a paraxial region thereof and an image-side surface **822** being convex in a paraxial region thereof. The second lens element **820** is made of a plastic material, and has the object-side surface **821** and the image-side surface **822** being both aspheric.
[0206] The third lens element **830** with negative refractive power has an object-side surface **831** being convex in a paraxial region thereof and an image-side surface **832** being concave in a paraxial region thereof. The third lens element **830** is made of a plastic material, and has the object-side surface **831** and the image-side surface **832** being both aspheric.
[0207] The fourth lens element **840** with negative refractive power has an object-side surface **841** being convex in a paraxial region thereof and an image-side surface **842** being concave in a paraxial region thereof. The fourth lens element **840** is made of a plastic material, and has the object-side surface **841** and the image-side surface **842** being both aspheric.
[0208] The fifth lens element **850** with positive refractive power has an object-side surface **851** being concave in a paraxial region thereof and an image-side surface **852** being convex in a paraxial region thereof. The fifth lens element **850** is made of a plastic material, and has the object-side surface **851** and the image-side surface **852** being both aspheric. Furthermore, the image-side surface **852** of the fifth lens element **850** includes at least one convex shape in an off-axis region thereof.
[0209] The sixth lens element **860** with negative refractive power has an object-side surface **861** being concave in a paraxial region thereof and an image-side surface **862** being concave in a paraxial region thereof. The sixth lens element **860** is made of a plastic material, and has the object-side surface **861** and the image-side surface **862** being both aspheric. Furthermore, the object-side

surface **861** of the sixth lens element **860** includes at least one convex shape in an off-axis region thereof, and the image-side surface **862** of the sixth lens element **860** includes at least one convex shape in an off-axis region thereof.
[0210] The filter **870** is made of a glass material and located between the sixth lens element **860** and the image surface **880**, and will not affect the focal length of the imaging lens assembly.
[0211] The detailed optical data of the 8th embodiment are shown in Table 15 and the aspheric surface data are shown in Table 16 below.
TABLE-US-00028 TABLE 15 8th Embodiment f = 8.26 mm, Fno = 2.17, HFOV = 20.2 deg. Focal Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Ape. Stop Plano −0.804 2 Lens 1 2.558 ASP 0.872 Plastic 1.535 56.3 6.53 3 8.451 ASP 0.060 4 Lens 2 5.859 ASP 0.631 Plastic 1.545 56.0 9.99 5 −73.356 ASP 0.425 6 Lens 3 65.636 ASP 0.230 Plastic 1.660 20.4 −5.69 7 3.548 ASP 0.551 8 Lens 4 9.955 ASP 0.436 Plastic 1.566 37.4 −142.80 9 8.723 ASP 1.456 10 Lens 5 −14.791 ASP 0.988 Plastic 1.656 21.3 8.13 11 −4.023 ASP 0.192 12 Lens 6 −15.241 ASP 0.522 Plastic 1.535 56.3 −5.86 13 3.986 ASP 0.386 14 Filter Plano 0.110 Glass 1.517 64.2 — 15 Plano 1.166 16 Image Plano — Reference wavelength is 587.6 (d-line).
TABLE-US-00029 TABLE 16 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.5419E−01 −5.9585E−01 3.1116E−01 −8.9128E+01 −6.1720E+01 −2.4707E+01 A4= 4.2367E−04 −1.1273E−02 −1.0883E−02 −3.0201E−03 −6.2709E−02 −8.0177E−03 A6= 9.2354E−04 7.3235E−03 4.8797E−03 −1.3205E−03 9.0262E−02 5.8143E−02 A8= −5.0282E−04 −8.2490E−05 1.8155E−03 5.3990E−03 −4.6184E−02 −1.3428E−02 A10= 2.0118E−04 −8.0372E−04 −1.3678E−03 −3.2410E−03 1.1581E−02 −1.6591E−03 A12= −2.9038E−05 1.2986E−04 8.7937E−05 6.8219E−04 −1.3712E−03 9.6389E−04 A14= 2.3817E−05 −4.3841E−05 6.0065E−05 Surface # 8 9 10 11 12 13 k= 2.6611E+00 −2.4606E+01 −9.0000E+01 −1.8355E+00 −8.0953E+00 −2.6636E+01 A4= −3.4070E−02 −3.2438E−03 −6.9975E−03 6.7887E−03 −7.2120E−02 −4.6404E−02 A6= 2.3703E−02 1.0787E−02 −4.2729E−03 −1.4718E−02 1.9075E−02 1.1480E−02 A8= 1.3839E−02 1.0748E−02 6.4669E−04 6.4135E−03 −6.6528E−03 −2.0682E−03 A10= −1.1259E−02 −7.4668E−03 2.7213E−04 −1.7072E−03 3.2491E−03 2.3544E−04 A12= 2.9994E−03 2.0665E−03 −1.7226E−04 2.9032E−04 −1.0511E−03 −2.2507E−05 A14= −2.9602E−04 −2.3002E−04 2.4069E−05 −4.1662E−05 1.6159E−04 1.8777E−06 A16= 3.7878E−06 −8.9504E−06 −8.5690E−08
[0212] In the 8th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 8th embodiment, so an explanation in this regard will not be provided again.
[0213] Moreover, these parameters can be calculated from Table 15 and Table 16 as the following values and satisfy the following conditions:
TABLE-US-00030 8th Embodiment f [mm] 8.26 f/f12 1.98 Fno 2.17 f2/f5 1.23 HFOV [deg] 20.2 |f/f5| + |f/f6| 2.43 V3 20.4 f/ImgH 2.65 V5 21.3 TL/ImgH 2.57 V5-V2 −34.7 EPD/ImgH 1.22 V5-V6 −35.0 EPD/TL 0.47 Nmax 1.660 TL/f 0.97 CT4/CT5 0.44 f/EPD 2.17 (T34 + T45)/(CT3 + CT4) 3.01 SD/TD 0.87 (T12 + T23 + T56)/(T34 + T45) 0.34 Y11/Y62 0.71 R1/f 0.31
[0214] Furthermore, in the imaging lens assembly according to the 8th embodiment, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25 and 22; wherein the two lens elements are the third lens element **830** and the fifth lens element **850**.
[0215] In the imaging lens assembly according to the 8th embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **832** of the third lens element **830**.
[0216] In the imaging lens assembly according to the 8th embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The

inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00031 Numbers of inflection points of 8th Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 0 2 2 0 1 1 surface Image-side 2 3 0 0 1 1 surface

9th Embodiment

[0217] FIG. **17** is a schematic view of an imaging apparatus according to the 9th embodiment of the present disclosure. FIG. **18** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 9th embodiment. In FIG. **17**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **990**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **900**, a first lens element **910**, a second lens element **920**, a third lens element **930**, a fourth lens element **940**, a fifth lens element **950**, a sixth lens element **960**, a filter **970** and an image surface **980**, wherein the image sensor **990** is disposed on the image surface **980** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**910**, **920**, **930**, **940**, **950**, **960**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **910** and the sixth lens element **960**.

[0218] The first lens element **910** with positive refractive power has an object-side surface **911** being convex in a paraxial region thereof and an image-side surface **912** being concave in a paraxial region thereof. The first lens element **910** is made of a plastic material, and has the object-side surface **911** and the image-side surface **912** being both aspheric.

[0219] The second lens element **920** with positive refractive power has an object-side surface **921** being convex in a paraxial region thereof and an image-side surface **922** being convex in a paraxial region thereof. The second lens element **920** is made of a plastic material, and has the object-side surface **921** and the image-side surface **922** being both aspheric.

[0220] The third lens element **930** with negative refractive power has an object-side surface **931** being convex in a paraxial region thereof and an image-side surface **932** being concave in a paraxial region thereof. The third lens element **930** is made of a plastic material, and has the object-side surface **931** and the image-side surface **932** being both aspheric.

[0221] The fourth lens element **940** with negative refractive power has an object-side surface **941** being concave in a paraxial region thereof and an image-side surface **942** being convex in a paraxial region thereof. The fourth lens element **940** is made of a plastic material, and has the object-side surface **941** and the image-side surface **942** being both aspheric.

[0222] The fifth lens element **950** with positive refractive power has an object-side surface **951** being concave in a paraxial region thereof and an image-side surface **952** being convex in a paraxial region thereof. The fifth lens element **950** is made of a plastic material, and has the object-side surface **951** and the image-side surface **952** being both aspheric. Furthermore, the image-side surface **952** of the fifth lens element **950** includes at least one convex shape in an off-axis region thereof.

[0223] The sixth lens element **960** with negative refractive power has an object-side surface **961** being convex in a paraxial region thereof and an image-side surface **962** being concave in a paraxial region thereof. The sixth lens element **960** is made of a plastic material, and has the object-side surface **961** and the image-side surface **962** being both aspheric. Furthermore, the object-side surface **961** of the sixth lens element **960** includes at least one convex shape in an off-axis region thereof, and the image-side surface **962** of the sixth lens element **960** includes at least one convex shape in an off-axis region thereof.

[0224] The filter **970** is made of a glass material and located between the sixth lens element **960** and the image surface **980**, and will not affect the focal length of the imaging lens assembly.

[0225] The detailed optical data of the 9th embodiment are shown in Table 17 and the aspheric surface data are shown in Table 18 below.

TABLE-US-00032 TABLE 17 9th Embodiment f = 8.12 mm, Fno = 1.67, HFOV = 20.5 deg. Focal

Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Ape. Stop Plano −1.287 2 Lens 1 2.760 ASP 1.636 Plastic 1.545 56.0 5.63 3 22.008 ASP 0.073 4 Lens 2 8.208 ASP 0.750 Plastic 1.545 56.0 12.78 5 −44.393 ASP 0.134 6 Lens 3 70.828 ASP 0.230 Plastic 1.688 18.7 −7.05 7 4.531 ASP 0.748 8 Lens 4 −5.518 ASP 0.370 Plastic 1.544 56.0 −254.33 9 −5.883 ASP 0.344 10 Lens 5 −5.651 ASP 1.446 Plastic 1.688 18.7 25.12 11 −4.702 ASP 0.448 12 Lens 6 143.447 ASP 0.787 Plastic 1.544 56.0 −8.60 13 4.520 ASP 0.386 14 Filter Plano 0.110 Glass 1.517 64.2 — 15 Plano 1.093 16 Image Plano — Reference wavelength is 587.6 nm (d-line).
TABLE-US-00033 TABLE 18 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.2545E−01 1.7947E+01 −3.1282E+00 −3.7429E+00 −6.1720E+01 −3.0457E+01 A4= 5.5528E−04 6.2277E−03 8.7688E−03 8.2088E−03 −6.7152E−03 2.8981E−02 A6= 1.9511E−04 −4.5016E−03 −5.4233E−03 −9.6198E−03 1.5158E−02 2.8445E−03 A8= 1.1289E−05 4.5683E−04 −1.2898E−03 3.4939E−03 −4.8814E−03 4.9034E−03 A10= −2.2263E−05 2.4827E−04 1.1226E−03 −5.9667E−04 7.4927E−04 −2.9957E−03 A12= 6.1950E−06 −7.2065E−05 −2.3554E−04 3.3219E−05 −5.9472E−05 7.3101E−04 A14= −6.0889E−07 5.8670E−06 1.7714E−05 1.9009E−06 1.3205E−06 Surface # 8 9 10 11 12 13 k= 2.6604E+00 9.9960E+00 8.7261E+00 −2.2827E+00 −8.0953E+00 −2.6636E+01 A4= −1.0569E−02 −1.5158E−03 −6.6504E−03 −1.9464E−02 −8.1132E−02 −3.7519E−02 A6= 1.9728E−02 2.1582E−02 6.2336E−03 1.1490E−02 3.4348E−02 9.7280E−03 A8= −6.1329E−03 −1.2856E−02 −9.0677E−03 −6.6970E−03 −1.3971E−02 −2.5868E−03 A10= 3.7425E−04 3.7666E−03 3.9137E−03 2.2048E−03 4.0820E−03 4.7040E−04 A12= 3.9614E−04 −6.5471E−04 −1.2324E−03 −4.8028E−04 −8.3603E−04 −5.6368E−05 A14= −5.3833E−05 6.9160E−05 1.5987E−04 6.2245E−05 1.0273E−04 3.9569E−06 A16= −3.4780E−06 −5.5572E−06 −1.2328E−07
[0226] In the 9th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 9th embodiment, so an explanation in this regard will not be provided again.
[0227] Moreover, these parameters can be calculated from Table 17 and Table 18 as the following values and satisfy the following conditions:
TABLE-US-00034 9th Embodiment f [mm] 8.12 f/f12 1.93 Fno 1.67 f2/f5 0.51 HFOV [deg] 20.5 |f/f5| + |f/f6| 1.27 V3 18.7 f/ImgH 2.60 V5 18.7 TL/ImgH 2.74 V5-V2 −37.3 EPD/ImgH 1.56 V5-V6 −37.3 EPD/TL 0.57 Nmax 1.688 TL/f 1.05 CT4/CT5 0.26 f/EPD 1.67 (T34 + T45)/(CT3 + CT4) 1.82 SD/TD 0.82 (T12 + T23 + T56)/(T34 + T45) 0.60 Y11/Y62 0.90 R1/f 0.34
[0228] Furthermore, in the imaging lens assembly according to the 9th embodiment, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25, 22, and 20, wherein the two lens elements are the third lens element **930** and the fifth lens element **950**.
[0229] In the imaging lens assembly according to the 9th embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **932** of the third lens element **930**.
[0230] In the imaging lens assembly according to the 9th embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.
TABLE-US-00035 Numbers of inflection points of 9th Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 0 2 1 1 0 1 surface Image-side 2 1 0 0 0 1 surface
10th Embodiment
[0231] FIG. **19** is a schematic view of an imaging apparatus according to the 10th embodiment of the present disclosure. FIG. **20** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 10th embodiment. In FIG. **19**, the

imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **1090**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **1000**, a first lens element **1010**, a second lens element **1020**, a third lens element **1030**, a fourth lens element **1040**, a fifth lens element **1050**, a sixth lens element **1060**, a filter **1070** and an image surface **1080**, wherein the image sensor **1090** is disposed on the image surface **1080** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**1010**, **1020**, **1030**, **1040**, **1050**, **1060**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **1010** and the sixth lens element **1060**.

[0232] The first lens element **1010** with positive refractive power has an object-side surface **1011** being convex in a paraxial region thereof and an image-side surface **1012** being concave in a paraxial region thereof. The first lens element **1010** is made of a plastic material, and has the object-side surface **1011** and the image-side surface **1012** being both aspheric.

[0233] The second lens element **1020** with positive refractive power has an object-side surface **1021** being convex in a paraxial region thereof and an image-side surface **1022** being convex in a paraxial region thereof. The second lens element **1020** is made of a plastic material, and has the object-side surface **1021** and the image-side surface **1022** being both aspheric.

[0234] The third lens element **1030** with negative refractive power has an object-side surface **1031** being convex in a paraxial region thereof and an image-side surface **1032** being concave in a paraxial region thereof. The third lens element **1030** is made of a plastic material, and has the object-side surface **1031** and the image-side surface **1032** being both aspheric.

[0235] The fourth lens element **1040** with positive refractive power has an object-side surface **1041** being concave in a paraxial region thereof and an image-side surface **1042** being convex in a paraxial region thereof. The fourth lens element **1040** is made of a plastic material, and has the object-side surface **1041** and the image-side surface **1042** being both aspheric.

[0236] The fifth lens element **1050** with positive refractive power has an object-side surface **1051** being concave in a paraxial region thereof and an image-side surface **1052** being convex in a paraxial region thereof. The fifth lens element **1050** is made of a plastic material, and has the object-side surface **1051** and the image-side surface **1052** being both aspheric. Furthermore, the image-side surface **1052** of the fifth lens element **1050** includes at least one convex shape in an off-axis region thereof.

[0237] The sixth lens element **1060** with negative refractive power has an object-side surface **1061** being concave in a paraxial region thereof and an image-side surface **1062** being concave in a paraxial region thereof. The sixth lens element **1060** is made of a plastic material, and has the object-side surface **1061** and the image-side surface **1062** being both aspheric. Furthermore, the object-side surface **1061** of the sixth lens element **1060** includes at least one convex shape in an off-axis region thereof, and the image-side surface **1062** of the sixth lens element **1060** includes at least one convex shape in an off-axis region thereof.

[0238] The filter **1070** is made of a glass material and located between the sixth lens element **1060** and the image surface **1080**, and will not affect the focal length of the imaging lens assembly.

[0239] The detailed optical data of the 10th embodiment are shown in Table 19 and the aspheric surface data are shown in Table 20 below.

TABLE-US-00036 TABLE 19 10th Embodiment f = 8.03 mm, Fno = 1.56, HFOV = 20.7 deg. Focal Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Ape. Stop Plano −1.217   2 Lens 1 3.169 ASP 2.160 Plastic 1.545 56.0 6.14 3 45.693 ASP 0.188 4 Lens 2 8.228 ASP 0.845 Plastic 1.545 56.0 12.43 5 −36.758 ASP 0.025 6 Lens 3 115.379 ASP 0.230 Plastic 1.688 18.7 −8.02 7 5.264 ASP 0.800 8 Lens 4 −5.245 ASP 0.453 Plastic 1.544 56.0 221.16 9 −5.179 ASP 0.156 10 Lens 5 −11.155 ASP 1.937 Plastic 1.688 18.7 331.46 11 −11.388 ASP 0.224 12 Lens 6 −49.637 ASP 1.680 Plastic 1.544 56.0 −8.42 13 5.107 ASP 0.386 14 Filter Plano 0.110 Glass 1.517 64.2 — 15 Plano 0.285 16 Image Plano — Reference wavelength is 587.6

nm (d-line).

TABLE-US-00037 TABLE 20 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.3226E−01 9.0000E+01 −4.4249E+00 8.9524E+01 −6.1720E+01 −3.3431E+01 A4= 3.3189E−04 3.0900E−03 2.0030E−03 1.5642E−02 2.2570E−02 4.0116E−02 A6= 2.9693E−04 −1.9967E−03 −3.1375E−03 −2.0561E−02 −1.1594E−02 −9.3848E−03 A8= −1.3109E−04 4.0856E−04 1.0737E−04 9.8677E−03 3.9850E−03 3.1615E−03 A10= 3.3812E−05 −1.5245E−05 1.8556E−04 −2.4715E−03 −3.4516E−04 −7.2844E−04 A12= −4.3967E−06 −7.3732E−06 −4.1890E−05 3.1306E−04 −8.9432E−05 1.6595E−04 A14= 2.0982E−07 1.0264E−06 3.7169E−06 −1.5144E−05 1.2678E−05 Surface # 8 9 10 11 12 13 k= 3.3852E+00 6.1686E+00 7.1825E+00 −2.7193E+00 −8.0953E+00 −2.6636E+01 A4= 2.2221E−03 −1.7671E−03 −1.7538E−02 −2.3003E−02 −3.8915E−02 −2.6972E−03 A6= 8.7451E−03 2.0013E−02 1.0347E−02 1.2105E−02 1.9375E−02 −8.8776E−04 A8= −6.0020E−03 −1.6699E−02 −1.0916E−02 −5.1202E−03 −6.8476E−03 4.8839E−04 A10= 1.8919E−03 6.2696E−03 4.0087E−03 1.1759E−03 1.4684E−03 −1.1693E−04 A12= −1.8817E−04 −1.1303E−03 −8.0245E−04 −1.5754E−04 −1.9241E−04 1.5001E−05 A14= 1.6752E−05 9.0933E−05 6.3826E−05 1.1599E−05 1.4558E−05 −1.0124E−06 A16= −3.4148E−07 −4.7839E−07 2.8425E−08

[0240] In the 10th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 10th embodiment, so an explanation in this regard will not be provided again.

[0241] Moreover, these parameters can be calculated from Table 19 and Table 20 as the following values and satisfy the following conditions:

TABLE-US-00038 10th Embodiment f [mm] 8.03 f/f12 1.77 Fno 1.56 f2/f5 0.04 HFOV [deg] 20.7 |f/f5| + |f/f6| 0.98 V3 18.7 f/ImgH 2.57 V5 18.7 TL/ImgH 3.04 V5-V2 −37.3 EPD/ImgH 1.65 V5-V6 −37.3 EPD/TL 0.54 Nmax 1.688 TL/f 1.18 CT4/CT5 0.23 f/EPD 1.56 (T34 + T45)/(CT3 + CT4) 1.40 SD/TD 0.86 (T12 + T23 + T56)/(T34 + T45) 0.46 Y11/Y62 0.86 R1/f 0.39

[0242] Furthermore, in the imaging lens assembly according to the 10th embodiment, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25, 22, and 20, wherein the two lens elements are the third lens element **1030** and the fifth lens element **1050**.

[0243] In the imaging lens assembly according to the 10th embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **1032** of the third lens element **1030**.

[0244] In the imaging lens assembly according to the 10th embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00039 Numbers of inflection points of 10th Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 0 2 1 1 0 1 surface Image-side 2 1 0 0 1 2 surface

11th Embodiment

[0245] FIG. **21** is a schematic view of an imaging apparatus according to the 11th embodiment of the present disclosure. FIG. **22** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 11th embodiment. In FIG. **21**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **1190**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **1100**, a first lens element **1110**, a second lens element **1120**, a third lens element **1130**, a fourth lens element **1140**, a fifth lens element **1150**, a sixth lens element **1160**, a filter **1170** and an image surface **1180**, wherein the image sensor **1190** is disposed on the image surface **1180** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**1110**, **1120**, **1130**, **1140**, **1150**, **1160**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **1110** and the sixth lens element **1160**.

[0246] The first lens element **1110** with positive refractive power has an object-side surface **1111** being convex in a paraxial region thereof and an image-side surface **1112** being concave in a paraxial region thereof. The first lens element **1110** is made of a plastic material, and has the object-side surface **1111** and the image-side surface **1112** being both aspheric.

[0247] The second lens element **1120** with positive refractive power has an object-side surface **1121** being convex in a paraxial region thereof and an image-side surface **1122** being concave in a paraxial region thereof. The second lens element **1120** is made of a plastic material, and has the object-side surface **1121** and the image-side surface **1122** being both aspheric.

[0248] The third lens element **1130** with negative refractive power has an object-side surface **1131** being convex in a paraxial region thereof and an image-side surface **1132** being concave in a paraxial region thereof. The third lens element **1130** is made of a plastic material, and has the object-side surface **1131** and the image-side surface **1132** being both aspheric.

[0249] The fourth lens element **1140** with negative refractive power has an object-side surface **1141** being convex in a paraxial region thereof and an image-side surface **1142** being concave in a paraxial region thereof. The fourth lens element **1140** is made of a plastic material, and has the object-side surface **1141** and the image-side surface **1142** being both aspheric.

[0250] The fifth lens element **1150** with positive refractive power has an object-side surface **1151** being convex in a paraxial region thereof and an image-side surface **1152** being convex in a paraxial region thereof. The fifth lens element **1150** is made of a plastic material, and has the object-side surface **1151** and the image-side surface **1152** being both aspheric. Furthermore, the image-side surface **1152** of the fifth lens element **1150** includes at least one convex shape in an off-axis region thereof.

[0251] The sixth lens element **1160** with negative refractive power has an object-side surface **1161** being concave in a paraxial region thereof and an image-side surface **1162** being concave in a paraxial region thereof. The sixth lens element **1160** is made of a plastic material, and has the object-side surface **1161** and the image-side surface **1162** being both aspheric. Furthermore, the object-side surface **1161** of the sixth lens element **1160** includes at least one convex shape in an off-axis region thereof, and the image-side surface **1162** of the sixth lens element **1160** includes at least one convex shape in an off-axis region.

[0252] The filter **1170** is made of a glass material and located between the sixth lens element **1160** and the image surface **1180**, and will not affect the focal length of the imaging lens assembly.

[0253] The detailed optical data of the 11th embodiment are shown in Table 21 and the aspheric surface data are shown in Table 22 below.

TABLE-US-00040 TABLE 21 11th Embodiment f = 10.40 mm, Fno = 2.16, HFOV = 14.7 deg. Focal Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Ape. Stop Plano −1.321 2 Lens 1 2.716 ASP 1.415 Plastic 1.534 55.9 6.02 3 14.367 ASP 0.090 4 Lens 2 7.620 ASP 0.461 Plastic 1.530 55.8 33.42 5 13.086 ASP 0.374 6 Lens 3 9.711 ASP 0.210 Plastic 1.669 19.5 −9.44 7 3.792 ASP 0.777 8 Lens 4 11.247 ASP 0.210 Plastic 1.669 19.5 −16.87 9 5.590 ASP 2.220 10 Lens 5 53.897 ASP 0.798 Plastic 1.656 21.3 6.33 11 −4.475 ASP 0.045 12 Lens 6 −14.615 ASP 0.210 Plastic 1.534 55.9 −5.70 13 3.866 ASP 0.386 14 Filter Plano 0.110 Glass 1.517 64.2 — 15 Plano 2.023 16 Image Plano — Reference wavelength is 587.6 nm (d-line).

TABLE-US-00041 TABLE 22 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.0541E−01 −1.3550E+00 5.5434E−01 −4.0528E+01 −6.1720E+01 −2.3703E+01 A4= 3.3735E−04 −4.5316E−03 −1.1436E−03 5.6208E−03 −2.7916E−02 2.0088E−02 A6= 4.0415E−04 2.3189E−03 2.0996E−03 −9.1294E−03 2.4191E−02 2.6720E−03 A8= −9.1012E−05 −6.3084E−04 −3.5058E−03 3.3325E−03 5.9429E−03 2.9096E−02 A10= 3.3120E−05

6.2404E−05 1.5847E−03 3.6745E−05 −8.9680E−03 −1.7707E−02 A12= −3.9586E−06 −1.0855E−06 −3.0644E−04 −2.1255E−04 2.5606E−03 3.0088E−03 A14= 2.2865E−05 2.9494E−05 −2.3149E−04 6.7013E−05 Surface # 8 9 10 11 12 13 k= 2.6611E+00 −2.3939E+01 5.0832E+01 −1.6046E+00 −8.0953E+00 −2.6636E+01 A4= −4.4231E−02 −1.9775E−02 −1.7932E−02 −8.7348E−04 −8.3593E−02 −5.5660E−02 A6= 4.9600E−02 3.9137E−02 2.9051E−03 −1.4540E−02 3.1311E−02 2.4128E−02 A8= −6.8524E−03 −5.5404E−03 −1.5031E−03 7.5180E−03 −1.2127E−02 −7.9634E−03 A10= −4.3321E−03 −3.6524E−03 6.8085E−04 −2.1418E−03 4.6110E−03 1.8023E−03 A12= 1.9039E−03 1.7586E−03 −1.7707E−04 3.8114E−04 −1.2607E−03 −2.6351E−04 A14= −2.2628E−04 −2.3961E−04 1.8130E−05 −5.7232E−05 1.8134E−04 2.2458E−05 A16= 5.4449E−06 −9.5809E−06 −8.5264E−07

[0254] In the 11th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 11th embodiment, so an explanation in this regard will not be provided again.

[0255] Moreover, these parameters can be calculated from Table 21 and Table 22 as the following values and satisfy the following conditions:

TABLE-US-00042 11th Embodiment f [mm] 10.40 f/f12 2.00 Fno 2.16 f2/f5 5.28 HFOV [deg] 14.7 |f/f5| + |f/f6| 3.47 V3 19.5 f/ImgH 3.69 V5 21.3 TL/ImgH 3.31 V5-V2 −34.5 EPD/ImgH 1.71 V5-V6 −34.6 EPD/TL 0.52 Nmax 1.669 TL/f 0.90 CT4/CT5 0.26 f/EPD 2.16 (T34 + T45)/(CT3 + CT4) 7.14 SD/TD 0.81 (T12 + T23 + T56)/(T34 + T45) 0.17 Y11/Y62 1.00 R1/f 0.26

[0256] Furthermore, in the imaging lens assembly according to the 11th embodiment, there are three of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25 and 22, wherein the three lens elements are the third lens element **1130**, the fourth lens element **1140** and the fifth lens element **1150**. Moreover, there are two of the six lens elements of the imaging lens assembly having an Abbe number smaller than 20, wherein the two lens elements are the third lens element **1130** and the fourth lens element **1140**.

[0257] In the imaging lens assembly according to the 11th embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **1132** of the third lens element **1130**.

[0258] In the imaging lens assembly according to the 11th embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00043 Numbers of inflection points of 11th Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 0 0 0 0 2 1 surface Image-side 2 0 0 1 1 1 surface

12th Embodiment

[0259] FIG. **23** is a schematic view of an imaging apparatus according to the 12th embodiment of the present disclosure. FIG. **24** shows spherical aberration curves, astigmatic field curves and a distortion curve of the imaging apparatus according to the 12th embodiment. In FIG. **23**, the imaging apparatus includes an imaging lens assembly (its reference numeral is omitted) and an image sensor **1290**. The imaging lens assembly includes, in order from an object side to an image side, an aperture stop **1200**, a first lens element **1210**, a second lens element **1220**, a third lens element **1230**, a fourth lens element **1240**, a fifth lens element **1250**, a sixth lens element **1260**, a filter **1270** and an image surface **1280**, wherein the image sensor **1290** is disposed on the image surface **1280** of the imaging lens assembly. The imaging lens assembly includes six lens elements (**1210**, **1220**, **1230**, **1240**, **1250**, **1260**) with air gaps between every adjacent lens elements, and without additional one or more lens elements inserted between the first lens element **1210** and the sixth lens element **1260**.

[0260] The first lens element **1210** with positive refractive power has an object-side surface **1211** being convex in a paraxial region thereof and an image-side surface **1212** being concave in a paraxial region thereof. The first lens element **1210** is made of a plastic material, and has the object-side surface **1211** and the image-side surface **1212** being both aspheric.
[0261] The second lens element **1220** with positive refractive power has an object-side surface **1221** being convex in a paraxial region thereof and an image-side surface **1222** being concave in a paraxial region thereof. The second lens element **1220** is made of a plastic material, and has the object-side surface **1221** and the image-side surface **1222** being both aspheric.
[0262] The third lens element **1230** with negative refractive power has an object-side surface **1231** being convex in a paraxial region thereof and an image-side surface **1232** being concave in a paraxial region thereof. The third lens element **1230** is made of a plastic material, and has the object-side surface **1231** and the image-side surface **1232** being both aspheric.
[0263] The fourth lens element **1240** with negative refractive power has an object-side surface **1241** being convex in a paraxial region thereof and an image-side surface **1242** being concave in a paraxial region thereof. The fourth lens element **1240** is made of a plastic material, and has the object-side surface **1241** and the image-side surface **1242** being both aspheric.
[0264] The fifth lens element **1250** with positive refractive power has an object-side surface **1251** being convex in a paraxial region thereof and an image-side surface **1252** being convex in a paraxial region thereof. The fifth lens element **1250** is made of a plastic material, and has the object-side surface **1251** and the image-side surface **1252** being both aspheric. Furthermore, the image-side surface **1252** of the fifth lens element **1250** includes at least one convex shape in an off-axis region thereof.
[0265] The sixth lens element **1260** with negative refractive power has an object-side surface **1261** being concave in a paraxial region thereof and an image-side surface **1262** being concave in a paraxial region thereof. The sixth lens element **1260** is made of a plastic material, and has the object-side surface **1261** and the image-side surface **1262** being both aspheric. Furthermore, the object-side surface **1261** of the sixth lens element **1260** includes at least one convex shape in an off-axis region thereof, and the image-side surface **1262** of the sixth lens element **1260** includes at least one convex shape in an off-axis region thereof.
[0266] The filter **1270** is made of a glass material and located between the sixth lens element **1260** and the image surface **1280**, and will not affect the focal length of the imaging lens assembly.
[0267] The detailed optical data of the 12th embodiment are shown in Table 23 and the aspheric surface data are shown in Table 24 below.
TABLE-US-00044 TABLE 23 12th Embodiment f = 9.91 mm, Fno = 1.88, HFOV = 15.8 deg. Focal Surface # Curvature Radius Thickness Material Index Abbe # Length 0 Object Plano Infinity 1 Ape. Stop Plano −1.595 2 Lens 1 2.795 ASP 1.712 Plastic 1.534 55.9 6.02 3 16.931 ASP 0.045 4 Lens 2 7.870 ASP 0.454 Plastic 1.529 45.4 26.07 5 17.959 ASP 0.297 6 Lens 3 13.552 ASP 0.230 Plastic 1.669 19.5 −8.71 7 4.046 ASP 0.756 8 Lens 4 11.615 ASP 0.230 Plastic 1.669 19.5 −16.54 9 5.620 ASP 1.892 10 Lens 5 116.242 ASP 0.748 Plastic 1.688 18.7 7.34 11 −5.268 ASP 0.052 12 Lens 6 −43.124 ASP 0.307 Plastic 1.529 45.4 −7.21 13 2.795 ASP 1.712 14 Filter Plano 0.110 Glass 1.517 64.2 — 15 Plano 2.097 16 Image Plano — Reference wavelength is 587.6 nm (d-line).
TABLE-US-00045 TABLE 24 Aspheric Coefficients Surface # 2 3 4 5 6 7 k= −3.0656E−01 −6.1867E−01 6.0770E−01 −4.0197E+01 −6.1720E+01 −2.3412E+01 A4= 4.4255E−04 −1.4016E−03 −3.8893E−03 −1.2200E−02 −4.2716E−02 1.4655E−02 A6= 1.5299E−04 −3.8580E−04 8.6702E−03 1.9546E−02 5.9458E−02 2.1640E−02 A8= −2.7032E−05 6.1514E−05 −7.3642E−03 −1.4036E−02 −2.7506E−02 9.0358E−03 A10= 1.4121E−05 7.5536E−06 2.4360E−03 4.9007E−03 5.9562E−03 −1.0369E−02 A12= −1.4822E−06 −1.0780E−06 −3.7238E−04 −8.3733E−04 −5.7901E−04 2.6703E−03 A14= 2.4908E−05 6.0921E−05 1.8576E−05 −1.5677E−04 A16= −3.5711E−07 −5.6853E−07 Surface # 8 9 10 11 12 13 k= 2.6611E+00 −2.7027E+01 −9.0000E+01 −2.5409E+00 −8.0953E+00 −2.6636E+01 A4=

−3.6048E−02 −1.2160E−02 −1.1525E−02 −1.6424E−03 −8.3415E−02 −5.5736E−02 A6= 4.0449E−02 2.7905E−02 −1.9419E−03 −1.2515E−02 3.4349E−02 2.4144E−02 A8= −4.4128E−03 −8.8508E−04 2.4817E−04 6.4141E−03 −1.5392E−02 −9.0945E−03 A10= −3.9262E−03 −4.5363E−03 2.9694E−04 −1.7630E−03 6.1106E−03 2.4106E−03 A12= 1.6028E−03 1.8276E−03 −1.3474E−04 3.0175E−04 −1.5977E−03 −4.1407E−04 A14= −1.8795E−04 −2.3592E−04 1.6474E−05 −4.3581E−05 2.1922E−04 4.0694E−05 A16= 3.9878E−06 −1.1481E−05 −1.7213E−06

[0268] In the 12th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in the following table are the same as those stated in the 1st embodiment with corresponding values for the 12th embodiment, so an explanation in this regard will not be provided again.

[0269] Moreover, these parameters can be calculated from Table 23 and Table 24 as the following values and satisfy the following conditions:

TABLE-US-00046 12th Embodiment f [mm] 9.91 f/f12 1.96 Fno 1.88 f2/f5 3.55 HFOV [deg] 15.8 |f/f5| + |f/f6| 2.72 V3 19.5 f/ImgH 3.39 V5 18.7 TL/ImgH 3.19 V5-V2 −26.7 EPD/ImgH 1.80 V5-V6 −26.7 EPD/TL 0.57 Nmax 1.688 TL/f 0.94 CT4/CT5 0.31 f/EPD 1.88 (T34 + T45)/(CT3 + CT4) 5.76 SD/TD 0.76 (T12 + T23 + T56)/(T34 + T45) 0.15 Y11/Y62 1.06 R1/f 0.28

[0270] Furthermore, in the imaging lens assembly according to the 12th embodiment, there are three of the six lens elements of the imaging lens assembly having an Abbe number smaller than 25, 22, and 20, wherein the three lens elements are the third lens element **1230**, the fourth lens element **1240**, and the fifth lens element **1250**.

[0271] In the imaging lens assembly according to the 12th embodiment, a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of the image-side surface **1232** of the third lens element **1230**.

[0272] In the imaging lens assembly according to the 12th embodiment, the inflection points of object-side surfaces and image-side surfaces of the six lens elements are listed in table below. The inflections mentioned are those disposed between the optical axis and the maximum effective diameter position of each lens element.

TABLE-US-00047 Numbers of inflection points of 12th Embodiment Lens 1 Lens 2 Lens 3 Lens 4 Lens 5 Lens 6 Object-side 0 2 0 1 2 1 surface Image-side 1 0 0 1 1 1 surface

13th Embodiment

[0273] FIG. **28** is a three-dimensional schematic view of an imaging apparatus **10** according to the 13th embodiment of the present disclosure. In FIG. **28**, the imaging apparatus **10** of the 13th embodiment is a camera module, the imaging apparatus **10** includes an imaging lens assembly **11**, a driving apparatus **12** and an image sensor **13**, wherein the imaging lens assembly **11** includes the imaging lens assembly of the 1st embodiment and a lens barrel (not shown in drawings) for carrying the imaging lens assembly **11**. The imaging apparatus **10** can focus light from an imaged object via the imaging lens assembly **11**, perform image focusing by the driving apparatus **12**, and generate an image on the image sensor **13**, and the imaging information can be transmitted.

[0274] The driving apparatus **12** can be an auto-focus module, which can be driven by driving systems, such as voice coil motors (VCM), micro electro-mechanical systems (MEMS), piezoelectric systems, and shape memory alloys etc. The imaging lens assembly can obtain a favorable imaging position by the driving apparatus **12** so as to capture clear images when the imaged object is disposed at different object distances.

[0275] The imaging apparatus **10** can include the image sensor **13** located on the image surface of the imaging lens assembly **11**, such as CMOS and CCD, with superior photosensitivity and low noise. Thus, it is favorable for providing realistic images with high definition image quality thereof.

[0276] Moreover, the imaging apparatus **10** can further include an image stabilization module **14**, which can be a kinetic energy sensor, such as an accelerometer, a gyroscope, and a Hall Effect sensor. In the 13th embodiment, the image stabilization module **14** is a gyro sensor, but is not limited thereto. Therefore, the variation of different axial directions of the imaging lens assembly can adjusted so as to compensate the image blur generated by motion at the moment of exposure, and it is further favorable for enhancing the image quality while photographing in motion and low light situation. Furthermore, advanced image compensation functions, such as optical image stabilization (OIS) and electronic image stabilization (EIS) etc., can be provided.

14th Embodiment

[0277] FIG. **29**A is a schematic view of one side of an electronic device **20** according to the 14th embodiment of the present disclosure. FIG. **29**B is a schematic view of another side of the electronic device **20** of FIG. **29**A. FIG. **29**C is a system schematic view of the electronic device **20** of FIG. **29**A. In FIGS. **29**A, **29**B and **29**C, the electronic device **20** according to the 14th embodiment is a smartphone, wherein the electronic device **20** includes the imaging apparatus **10**, a photographing apparatus **90**, a flash module **21**, a focusing assisting module **22**, an image signal processor **23**, a user interface **24** and an image software processor **25**, wherein the photographing apparatus **90** includes an imaging lens assembly **91**, a driving apparatus **92**, an image sensor **93** and a stabilization module **94**. The imaging lens assembly **91** includes a photographing lens assembly (reference number is omitted) with a maximum field of view larger than the field of view of the imaging apparatus **10**, and both lens assemblies (the photographing lens assembly and the imaging lens assembly) can be utilized by the electronic device **20** to achieve a zoom function. When the user captures images of an imaged object **26** via the user interface **24**, the electronic device **20** focuses and generates images via the imaging apparatus **10** and photographing apparatus **90** while compensating for low illumination via the flash module **21** when necessary. Then, the electronic device **20** quickly focuses on the imaged object according to its object distance information provided by the focusing assisting module **22**, and optimizes the image via the image signal processor **23** (ISP) and the image software processor **25**. Thus, the image quality can be further enhanced. The focusing assisting module **22** can adopt infrared or laser for obtaining quick focusing, and the user interface **24** can utilize a touch screen or a physical button for capturing and processing the image with various functions of the image processing software.

[0278] The imaging apparatus **10** according to the 14th embodiment is the same as the imaging apparatus **10** according to the 13th embodiment, and will not describe again herein.

15th Embodiment

[0279] FIG. **30** is a schematic view of an electronic device **30** according to the 15th embodiment of the present disclosure. The electronic device **30** of the 15th embodiment is a tablet personal computer, wherein the electronic device **30** includes an imaging apparatus **31**, wherein the imaging apparatus **31** is the same as stated in the 13th embodiment, and will not describe again herein.

16th Embodiment

[0280] FIG. **31** is a schematic view of an electronic device **40** according to the 16th embodiment of the present disclosure. The electronic device **40** of the 16th embodiment is a wearable device, wherein the electronic device **40** includes an imaging apparatus **41**, wherein the imaging apparatus **41** is the same as stated in the 13th embodiment, and will not describe again herein.

[0281] The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. It is to be noted that Tables 1-24 show different data of the different embodiments; however, the data of the different embodiments are obtained from experiments. The embodiments were chosen and described in order to best explain the principles of the disclosure and its practical applications, to thereby enable others skilled in the art to best utilize the disclosure and various embodiments with various modifications as are suited to the particular use contemplated. The embodiments depicted above and the appended drawings are exemplary and are not intended to be exhaustive or to limit the scope of the present disclosure to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings.

Claims

1. An imaging lens assembly comprising six lens elements, the six lens elements being, in order from an object side to an image side: a first lens element, a second lens element, a third lens element, a fourth lens element, a fifth lens element, and a sixth lens element; wherein at least one of the six lens elements is made of plastic material; a thickest lens element of the six lens elements is the first lens element or the second lens element; a curvature radius of an image-side surface of the second lens element, a curvature radius of an object-side surface of the fifth lens element and a curvature radius of an image-side surface of the fifth lens element have a same sign; a curvature radius of an image-side surface of the first lens element and a curvature radius of an image-side surface of the sixth lens element have a same sign; the curvature radius of the image-side surface of the first lens element and the curvature radius of the image-side surface of the second lens element have different signs; the first lens element has an object-side surface being convex in a paraxial region thereof; the image-side surface of the sixth lens element comprises at least one inflection point; wherein the imaging lens assembly further comprises an aperture stop, an axial distance between the aperture stop and the image-side surface of the sixth lens element is SD, a curvature radius of the object-side surface of the first lens element is R1, a focal length of the imaging lens assembly is f, a maximum refractive index of the six lens elements of the imaging lens assembly is Nmax, an axial distance between the object-side surface of the first lens element and the image-side surface of the sixth lens element is TD, and the following conditions are satisfied:

$0 < R1 / f < 0.35;$

$1.65 < N\max < 1.73;$ and

$0.82 \leq SD / TD < 1.1 .$

2. The imaging lens assembly of claim 1, wherein the third lens element has negative refractive power; a focal length of the fifth lens element and a focal length of the sixth lens element have different signs.

3. The imaging lens assembly of claim 1, wherein an axial distance between the object-side surface of the first lens element and an image surface is TL, the focal length of the imaging lens assembly is f, and the following condition is satisfied: $0.5 < TL / f < 1.$.

4. The imaging lens assembly of claim 1, wherein an entrance pupil diameter of the imaging lens assembly is EPD, a maximum image height of the imaging lens assembly is ImgH, and the following condition is satisfied: $1. < EPD / ImgH < 2.$.

5. The imaging lens assembly of claim 1, wherein the focal length of the imaging lens assembly is f, a composite focal length of the first lens element and the second lens element is f12, and the following condition is satisfied: $1.5 < f / f12 < 3.$.

6. The imaging lens assembly of claim 1, wherein a central thickness of the fourth lens element is CT4, a central thickness of the fifth lens element is CT5, and the following condition is satisfied: $0.1 < CT4 / CT5 < 0.9 .$

7. The imaging lens assembly of claim 1, wherein a focal length of the second lens element is f2, a focal length of the fifth lens element is f5, and the following condition is satisfied: $0.5 < f2 / f5 < 5.5 .$

8. The imaging lens assembly of claim 1, wherein the six lens elements are made of plastic material; there is an air gap between every adjacent lens elements of the six lens elements.

9. An imaging apparatus, comprising: the imaging lens assembly of claim 1; and an image sensor disposed on an image surface of the imaging lens assembly.

10. An electronic device, comprising: the imaging apparatus of claim **9**.

11. An imaging lens assembly comprising six lens elements, the six lens elements being, in order from an object side to an image side: a first lens element, a second lens element, a third lens element, a fourth lens element, a fifth lens element, and a sixth lens element; wherein at least one of an object-side surface and an image-side surface of at least one of the six lens elements comprises at least one inflection point; a curvature radius of an image-side surface of the second lens element and a curvature radius of an object-side surface of the third lens element have different signs; a curvature radius of an object-side surface of the fifth lens element and a curvature radius of an image-side surface of the fifth lens element have a same sign; a focal length of the first lens element and a focal length of the sixth lens element have a same sign; a focal length of the second lens element and a focal length of the fifth lens element have a same sign; the first lens element has an object-side surface being convex in a paraxial region thereof; wherein a curvature radius of the object-side surface of the first lens element is R1, a focal length of the imaging lens assembly is f, a maximum refractive index of the six lens elements of the imaging lens assembly is Nmax, an axial distance between the object-side surface of the first lens element and an image surface is TL, and the following conditions are satisfied:

$$0 < R1 / f < 0.35;$$

$$1.64 < N\max < 1.75; \text{ and}$$

$$0.5 < TL / f \leq 0.95.$$

12. The imaging lens assembly of claim 11, wherein the third lens element has negative refractive power; the sixth lens element has an image-side surface being convex in a paraxial region thereof.

13. The imaging lens assembly of claim 11, wherein a curvature radius of an image-side surface of the first lens element and a curvature radius of the object-side surface of the third lens element have a same sign.

14. The imaging lens assembly of claim 11, wherein a minimum of maximum effective diameters of object-side surfaces and image-side surfaces of the six lens elements is a maximum effective diameter of at least one of the object-side surface and an image-side surface of the third lens element.

15. The imaging lens assembly of claim 11, wherein the axial distance between the object-side surface of the first lens element and the image surface is TL, a maximum image height of the imaging lens assembly is ImgH, and the following condition is satisfied: $2.57 \leq TL / ImgH < 3.5$.

16. The imaging lens assembly of claim 11, wherein a vertical distance between a maximum effective diameter position of the object-side surface of the first lens element and an optical axis is Y11, a vertical distance between a maximum effective diameter position of an image-side surface of the sixth lens element and the optical axis is Y62, and the following condition is satisfied: $0.65 < Y11 / Y62 < 1.2$.

17. The imaging lens assembly of claim 11, wherein a central thickness of the fourth lens element is CT4, a central thickness of the fifth lens element is CT5, and the following condition is satisfied: $0.1 < CT4 / CT5 < 0.9$.