Appeal decision

Appeal No. 2018-5895

U.S.A.
Appellant RICOH COMPANY LTD.

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The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2016-141049, entitled "PROJECTION OPTICAL SYSTEM AND IMAGE DISPLAY DEVICE" (the application published on October 27, 2016, Japanese Unexamined Patent Application Publication No. 2016-186659, 7 claims) has resulted in the following appeal decision.

Conclusion

The examiner's decision is revoked.

The invention of the present application shall be granted a patent.

Reason

No. 1 History of the procedures

Japanese Patent Application No. 2016-141049 (hereinafter referred to as "the Application") is a divisional application filed on July 19, 2016 from Japanese Patent Application No. 2014-230732 (which is a divisional application filed on November 13, 2014 from Japanese Patent Application No. 2011-223983 filed on October 11, 2011). The history of the procedures is outlined below.

as of July 19, 2016: Written amendment
as of May 31, 2017: Notification of reasons for refusal
as of August 7, 2017: Written opinion, Written amendment
as of January 30, 2018: Examiner's decision of refusal (hereinafter referred to as "the examiner's decision")
as of April 27, 2018: Request for appeal, Written amendment
as of December 13, 2018: Notification of reasons for refusal
as of February 5, 2019: Written opinion, Written amendment

No. 2 Outline of the examiner's decision

The reasons for refusal stated in the examiner's decision are outlined below.
Reason 1: The inventions according to Claims 1, 5, and 7 of the Application are described in Cited Document 1, which is a publication distributed in Japan or a foreign country before the filing of the application. Thus, the appellant should not be granted a patent for the inventions under the provisions of Article 29(1)(iii) of the Patent Act.
Reason 2: The inventions according to Claims 1 to 7 of the Application could have been easily invented by a person ordinarily skilled in the art of the invention (hereinafter referred to as "a person skilled in the art") before the filing of the application based on the invention described in Cited Document 1, which is a publication distributed in Japan or a foreign country before the filing of the application, and well-known arts (Known example: Cited Document 2-4). Thus, the appellant should not be granted a patent for the inventions under the provisions of Article 29(2) of the Patent Act.

< List of Cited Documents, etc.>
Cited Document 1: Japanese Unexamined Patent Application Publication No. 2008-96983
Cited Document 2: Japanese Unexamined Patent Application Publication No. 2008-225455
Cited Document 3: Japanese Unexamined Patent Application Publication No. 2008-96984
Cited Document 4: Japanese Unexamined Patent Application Publication No. 2008-292634

No. 3 Outline of the reasons for refusal notified in the notification of reasons for refusal as of December 13, 2018

The summary of the reasons for refusal notified in the notification of reasons for refusal as of December 13, 2018 is that the description of the scope of claims does not satisfy the requirements stipulated in Article 36(6)(ii) of the Patent Act.

No. 4 The Invention

The inventions according to Claims 1 to 7 of the Application (hereinafter referred to as "Invention 1" to "Invention 7", respectively) are as follows, and are as specified by the matters described in Claims 1 to 7 of the scope of claims amended by the written amendment as of February 5, 2019.

"[Claim 1]

A projection optical system used for an image display device that projects a projection image formed by an image display element onto a projection surface,

comprising a lens optical system including a plurality of lenses, and a mirror optical system including a first mirror, which is a plane mirror, and a second mirror, which is a concave mirror,

wherein the lens optical system is a co-axial optical system in which the plurality of lenses share the optical axis, and the lenses are arranged vertically along the direction of gravity,

an image display surface of the image display element is perpendicular to the projection surface,

in a plane perpendicular to the projection surface and including an optical axis of the co-axial optical system, a first projection light flux which reaches a position on the projection surface closest to the image display surface of the image display element and a second projection light flux which reaches a position on the projection surface farthest from the image display surface of the image display element once intersect with each other after being reflected by the second mirror, and are projected to the projection surface,

a position where the first projection light flux and the second projection light flux reflected by the second mirror intersect with each other is closer to the first mirror than to the second mirror,

among the plurality of lenses, the lens surface of the lens closest to the first mirror is a convex surface,

an intermediate image of a pixel relating to the image display element closest to the optical axis of the co-axial optical system is formed on an optical path from the first mirror to the second mirror, and an intermediate image of a pixel relating to the image display element farthest from the optical axis of the co-axial optical system is formed on an optical path from the lens optical system to the first mirror.

[Claim 2]

The projection optical system described in Claim 1, wherein the lens optical system includes an aperture diaphragm adjacent to a lens, which is closest to the image display element, among the plurality of lenses.

[Claim 3]

The projection optical system described in Claim 2, wherein the lens adjacent to the aperture diaphragm is formed as an aspherical lens configured so that a spot diameter of the intermediate image of the pixel relating to the image display element

closest to the optical axis of the co-axial optical system may be thick and a spot diameter of the pixel on the projection surface may be thin.

[Claim 4]

The projection optical system described in any of Claims 1 to 3, wherein the second mirror is a free-form surface mirror.

[Claim 5]

An image display device comprising:

an illumination optical system which irradiates an image display element with light emitted from a light source;

the image display element which is irradiated with the illumination light from the illumination optical system to form a projection image; and

a projection optical system having positive power as a whole, which projects the projection image formed by the image display element onto a projection surface,

wherein the projection optical system is a projection optical system described in any of Claims 1 to 4.

[Claim 6]

The image display device described in Claim 5, configured so that a dust-proof glass is arranged between the second mirror and the projection surface,

the dust-proof glass being parallel to a plane of the image display element.

[Claim 7]

The image display device described in Claim 5 or 6, wherein the image display element is a reflective image display element having a plurality of micromirrors arranged in a two-dimensional manner, and configured to emit/not to emit reflection light by changing inclination angle of the micromirrors between ON-state and OFF-state."

No. 5 Cited documents, Cited invention, and the like

1 Described matters in Cited Document 1

Japanese unexamined patent application publication No. 2008-96983 (hereinafter referred to as "Cited Document 1"), which is a publication cited as Cited Document 1 in the reasons for refusal of the examiner's decision and was distributed in Japan before the filing of the application, describes the following matters. The underlines were added by the body, and indicate the portions utilized for finding of the Cited Invention.

(1) "[Technical field]

[0001]

The present invention relates to a projection optical system and an image projecting apparatus.

... (Omitted) ...

[Problem to be solved by the invention]

[0016]

A first object of the Invention is to provide a more compact projection optical system."

(2) "[0025]

The first embodiment of the present invention is a projection optical system in which plural light beams emitted from an image forming element displaying image information on a conjugate plane A are allowed to be obliquely incident on a conjugate plane B so as to form an enlarged image of an image formed by the image forming element on the conjugate plane B, wherein the projection optical system comprises, at least, a first optical system, a second optical system, an intermediate image of the image forming element between the first optical system and the second optical system on which the plural light beams are generally converged, an optical system having a refractive power in the first optical system being composed of only a lens system transmitting the light beams, the intermediate image being formed by only a refractive power of the first optical system, the second optical system being a reflective optical system comprising a reflection mirror having a positive refractive power which reflects the light beams and is directly behind the intermediate image, and the first optical system being composed of lens groups having positive, positive, and negative refractive powers in sequence from the side of the conjugate plane A.

... (Omitted) ...

[0029]

The third embodiment of the present invention is the projection optical system according to the first or second embodiment of the present invention, wherein a curved surface of the mirror having a positive refractive power in the second optical system has a shape such that a curvature thereof becomes smaller from its intersection point with an optical axis of the first optical system to a perimeter thereof.

... (Omitted) ...

[0033]

The fifth embodiment of the present invention is the projection optical system according to the first, second, or third embodiment of the present invention, wherein the

mirror having a positive refractive power in the second optical system has a surface with a rotationally symmetric and aspherical shape.

[0034]

According to the fifth embodiment of the present invention, since its shape is rotationally symmetric with respect to an axis, it may be easy to process the mirror having a positive refractive power. Accordingly, an error of shape may be reduced and/or a processing time period may be reduced, which may lead to cost reduction.

... (Omitted) ...

[0041]

The ninth embodiment of the present invention is the projection optical system according to the first, second, third, fourth, fifth, sixth, seventh, or eighth embodiment of the present invention, wherein the intermediate image is curved and tilted with respect to a surface perpendicular to an optical axis of the first optical system."

(3) "[Practical Example 1]

[0053]

Practical Example 1 of the present invention is shown in FIG. 1.

[0054]

Herein, with regard to the coordinate system in the figures illustrating examples of the present invention, X is the direction of the major axis of a screen on a conjugate plane B, Y is the direction of the minor axis thereof, and Z is the direction of the normal of the screen.

[0055]

A projection optical system is to project an image formed by an image forming element 011 on a conjugate plane A onto a screen 016 on a conjugate plane B, and is composed of a first optical system 013 that is a coaxial system and includes at least one refractive optical system and a second optical system 015 that includes at least one reflective surface having a positive power, wherein the first optical system and the second optical system are arranged from the image forming element, and an intermediate image between the first optical system and the second optical system is once formed from the image formed from on the image forming element, while enlarging projection is made as a whole. Additionally, a folding mirror 014 is arranged between the first optical system and the second optical system so as to fold the optical path and to reduce the spatial occupancy in FIG. 1, but Practical Example 1 of the present invention can be implemented without arranging the folding mirror 014.

... (Omitted) ...

[0061]

FIG. 3 is an enlarged view of the first optical system and the second optical system of Practical Example 1.

[0062]

The light beams emitted from a first optical system 033, whose optical paths are folded by a folding mirror 034, are incident on a second optical system 035 and are enlarged and projected by a reflection mirror having a positive power in a third optical system. An intermediate image 036 of an image forming element, on which image the light beams are generally converged, is formed between the first optical system and the second optical system.

[0063]

The distortion aberration of an image of the image forming element 031 which is enlarged and projected onto the conjugate plane B by the positive power of the second optical system is generally proportional to the cube of an incident angle of view. That is, when the light rays emitted from object points that are arrayed at equal spaces on the image forming element form images on the conjugate plane B by the projection optical system, the formed images are not equally spaced and the degree of deviation increases with increasing distance between the image point and the optical axis. In the subject optical system, when a curved surface in the third optical system is a spherical surface, the space between the image points on the projected image increases with increasing angle of view of the light beam; that is, with increase in the distance thereof from the optical axis, and the image curves to the side of object points. In order to correct the distortion aberration in an enlarging projection system as described above, the reflection mirror having a positive power in the second optical system has a curved surface having a shape such that the positive power further decreases with increasing distance from the optical axis 037 (the third embodiment of the present invention). Also, when the reflection mirror having a positive power in the second optical system has a shape of an anamorphic and polynomial free-form surface, the freedom of design may increase and the capability of correcting an aberration, including the above distortion aberration, may be improved (the fourth embodiment of the present invention). Additionally, although a concave reflective surface is used in the descriptions, it is not limited to the surface and may be a Fresnel reflection mirror or a hologram reflection mirror so long as it is a reflective optical element having a light-condensing power.

... (Omitted) ...

[0065]

Furthermore, the positive power decreasing with increasing distance from the optical axis means that the focal length increases with increasing distance from the optical axis. Then, the intermediate image conjugate to an enlarged image formed by the reflection mirror having a positive power in the second optical system is tilted and curved such that the optical path length to the reflection mirror having a positive power in the second optical system increases with increasing distance of the light ray from the optical axis, since the focal length increases with increasing distance from the optical axis (the ninth embodiment of the present invention).

... (Omitted) ...

[Practical Example 3]

[0088]

Next, Practical Example 3 for the fifth embodiment of the present invention is described below.

[0089]

FIG. 13 shows Practical Example 3 and FIG. 14 shows an enlarged view of a first optical system in Practical Example 3.

[0090]

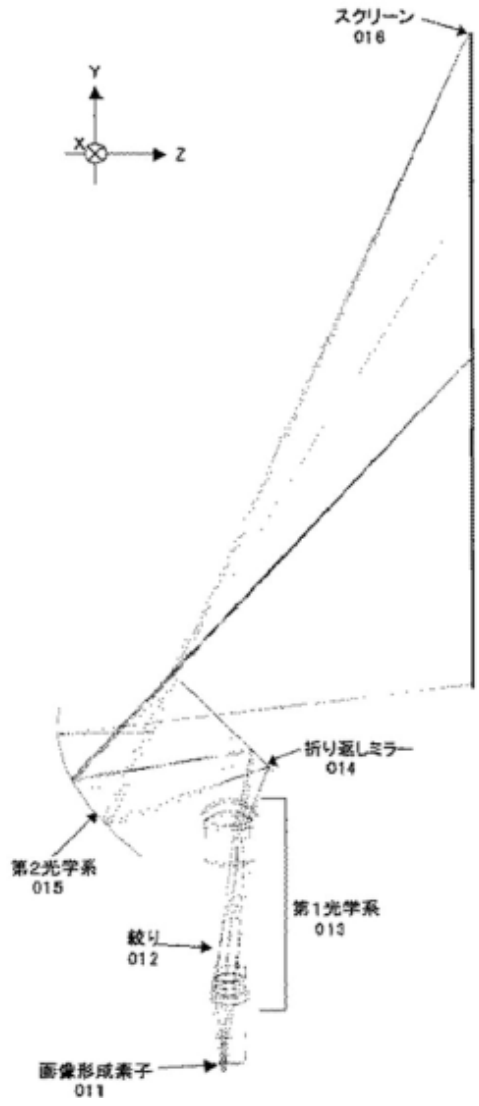
Similar to Practical Example 1 of the present invention, a projection optical system is to project an image formed by an image forming element on a conjugate plane A onto a screen on a conjugate plane B, and is composed of a first optical system that is a coaxial system and includes at least one refractive optical system and a second optical system that includes at least one reflective surface having a positive power, wherein the first optical system and the second optical system are arranged from the image forming element, and an intermediate image between the first optical system and the second optical system is once formed from the image formed from on the image forming element. It is an optical system for enlarging projection as a whole. Herein, the reflective surface having a positive power in the second optical system has a shape of a rotationally symmetric aspherical surface.

[0091]

Also, the optical path is folded by a folding mirror, and with regard to the folding direction, the first optical system is folded to the direction of the height of the conjugate plane B; that is, the Y-direction, in FIG. 13 but it is obvious that the first optical system may be folded to, for example, the direction of the depth in the figure; that is, the X-direction, so as to further reduce the spatial occupancy of the optical system."

(4) "[FIG. 1]

本発明の実施例1を示す図である



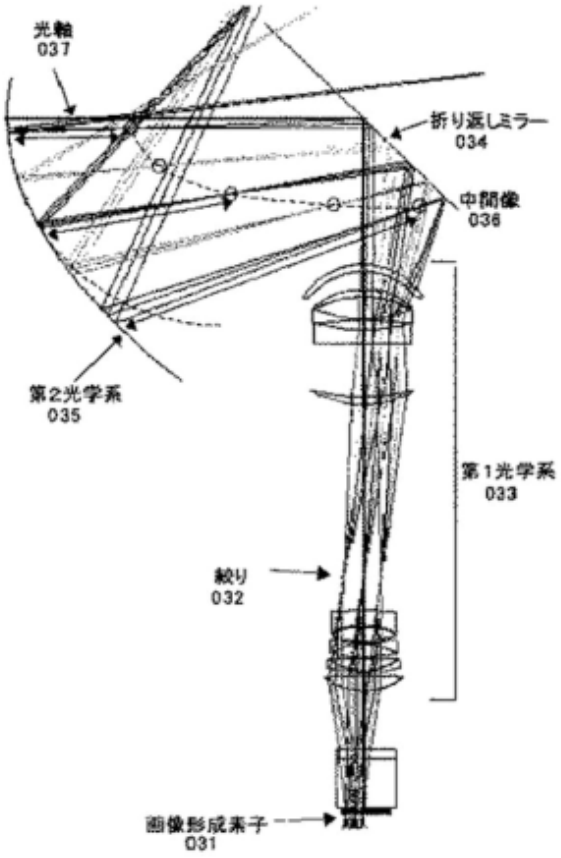
本発明の実施例１を示す図である　　Figure showing Practical Example 1 of the present invention

スクリーン	screen
折り返しミラー	folding mirror
第１光学系	first optical system
第２光学系	second optical system
絞り	diaphragm
画像形成素子	image forming element

"

(5) "[FIG. 3]

実施例1の第1光学系、第2光学系の拡大図

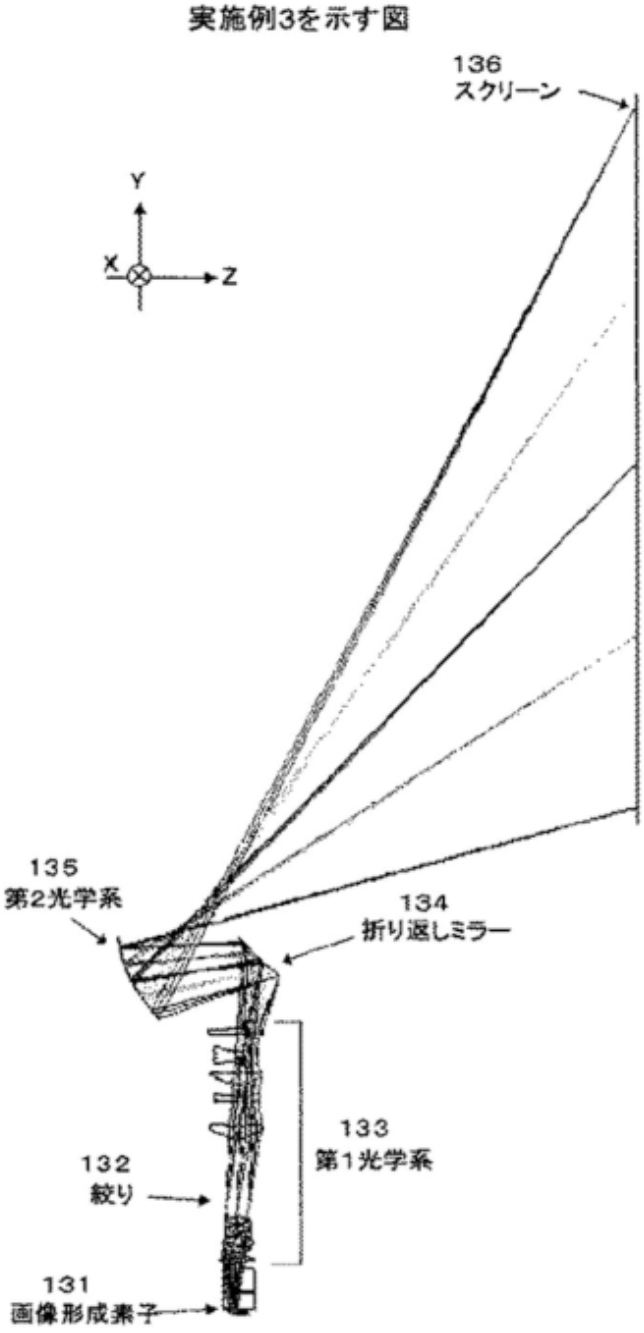


実施例１の第１光学系、第２光学系の拡大図　　Enlarged view of the first optical system and second optical system of Practical Example 1

光軸	optical axis
折り返しミラー	folding mirror
第１光学系	first optical system
第２光学系	second optical system
中間像	intermediate image
絞り	diaphragm
画像形成素子	image forming element

"

(6) [FIG. 13]



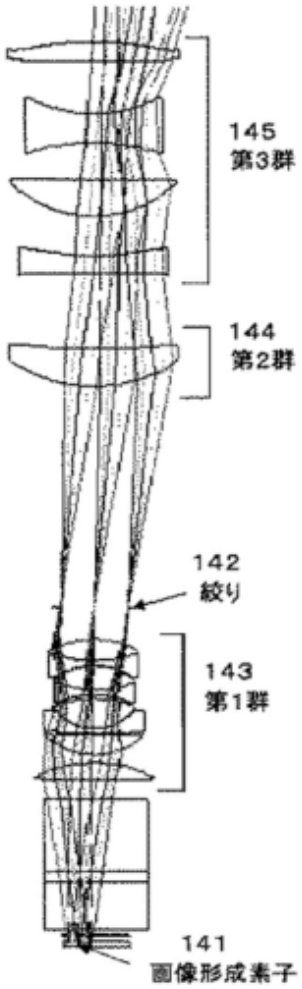
実施例３を示す図	Figure showing Practical Example 3
スクリーン	screen
折り返しミラー	folding mirror
第１光学系	first optical system

第２光学系　　second optical system
絞り　　diaphragm
画像形成素子　　image forming element

"

(7) "[FIG. 14]

実施例3の第1光学系拡大図を示す図



実施例３の第１光学系拡大図を示す図　　Figure showing an enlarged view of the first optical system of Practical Example 3
第１群　　first group
第２群　　second group

第３群	third group
絞り	diaphragm
画像形成素子	image forming element

"

2 Cited invention

A　According to FIG. 13 of Cited Document 1, in Practical Example 3, it is found that the "first optical system includes a plurality of lenses" and "a folding mirror 134 is arranged between the first optical system and the second optical system".

B　Cited Document 1 [0063] describes that an image of the image forming element 31 is enlarged and projected by the positive power of the second optical system.　Thus, it can be said that the second optical system technically has a concave surface shape. Therefore, "the second optical system 135 has a concave surface".

C　Cited Document 1 [0062] describes that the folding mirror folds an optical path. Thus, it can be said that the folding mirror technically includes a planar reflective surface.　Therefore, "the folding mirror 134" "includes a plane".

D　In addition, according to FIG. 14 of Cited Document 1, in Practical Example 3, it is found that "among a plurality of lenses of the first optical system", "the lens surface of the lens closest to the folding mirror 134 is a convex surface".

E　According to the description in the above 1 and the above A to D, Cited Document 1 describes, as Practical Example 3, the following invention (hereinafter referred to as "Cited Invention").　The description in Cited Document 1 [0090], "an intermediate image is once formed from the image", means that "an intermediate image of the image is once formed".

"A projection optical system to project an image formed by an image forming element onto a screen, composed of a first optical system that is a coaxial system and includes at least one refractive optical system, a second optical system that includes at least one reflective surface having a positive power, and a folding mirror 134,

wherein the first optical system and the second optical system are arranged from the image forming element,

the folding mirror 134 is arranged between the first optical system and the second optical system,

the first optical system includes a plurality of lenses,

among the plurality of lenses, the lens surface of the lens closest to the folding mirror 134 is a convex surface,

the second optical system 135 has a concave surface, the folding mirror 134 has a plane,

an intermediate image between the first optical system and the second optical system is once formed from the image formed from on the image forming element, while enlarging projection is made as a whole."

No. 6 Comparison/Judgment

1 Regarding Invention 1

(1) Comparison

Invention 1 and the Cited Invention are compared below.

A Image display device, Projection optical system

The "image forming element", "image", and "screen surface" of the Cited Invention technically correspond to the "image forming element", "projection image", and "projection surface" of Invention 1, respectively.

The "projection optical system" of the Cited Invention corresponds to the "projection optical system" of Invention 1 literally. The "projection optical system" of the Cited Invention is used "for projecting an image formed by an image forming element to a screen".

Accordingly, it can be said that the "projection optical system" of the Cited Invention satisfies the requirements in the "projection optical system" of Invention 1, "used for an image display device that projects a projection image formed by an image display element onto a projection surface".

B Lens optical system, Mirror optical system

According to the configuration of the "projection optical system" of the Cited Invention, the "first optical system" and a combination of the "folding mirror 134" and the "second optical system 135" of the Cited Invention correspond to the "lens optical system" and the "mirror optical system" in Invention 1, respectively.

Thus, the "projection optical system" of the Cited Invention satisfies the requirements in the "projection optical system" of Invention 1, "comprising" "a lens optical system" and "a mirror optical system".

C Lens

The "first optical system" of the Cited Invention "includes a plurality of lenses". Accordingly, the "first optical system" of the Cited Invention satisfies the requirements in the "lens optical system" of Invention 1, "including a plurality of lenses".

The "first optical system" of the Cited Invention is a "co-axial system". Accordingly, the "first optical system" of the Cited Invention technically satisfies the requirements in the "lens optical system" of Invention 1, "a co-axial optical system in which the plurality of lenses share the optical axis".

The "plurality of lenses" of the "first optical system" in the Cited Invention are "arranged vertically along the direction of gravity". Accordingly, the "first optical system" of the Cited Invention literally satisfies the requirements in the "lens optical system" of Invention 1, "the lenses are arranged vertically along the direction of gravity".

In addition, in the "first optical system" of the Cited Invention, "among the plurality of lenses, the lens surface of the lens closest to the folding mirror 134 is a convex surface". Accordingly, the "first optical system" of the Cited Invention satisfies the requirements in the "lens optical system" of Invention 1, "among the plurality of lenses, the lens surface of the lens closest to the folding mirror 134 is a convex surface".

D First mirror, Second mirror

The "folding mirror 134" and the "second optical system 135" of the Cited Invention include a "plane" and a "concave surface", respectively.

The "folding mirror 134" of the Cited Invention is a "mirror", obviously. The "second optical system 135" of the Cited Invention, which includes a "reflective surface", is considered a "mirror", technically.

In addition to the above points, if the structure of the "projection optical system" in the Cited Invention is taken into consideration, the "folding mirror 134" and the "second optical system 135" of the Cited Invention correspond to the "first mirror" and the "concave mirror" in Invention 1, respectively.

Accordingly, a combination of the "folding mirror 134" and the "second optical system 135" of the Cited Invention satisfies the requirements in the "mirror optical system" of Invention 1, "including a first mirror, which is a plane mirror, and a second mirror, which is a concave mirror".

(2) Corresponding Feature and Different Feature

A Invention 1 and the Cited invention are identical in the following configuration.

(Corresponding Feature)

"A projection optical system used for an image display device that projects a projection image formed by an image display element onto a projection surface,

comprising a lens optical system including a plurality of lenses, and a mirror optical system including a first mirror, which is a plane mirror, and a second mirror, which is a concave mirror,

wherein the lens optical system is a co-axial optical system in which the plurality of lenses shares the optical axis,

among the plurality of lenses, the lens surface of the lens closest to the first mirror is a convex surface."

B Invention 1 and the Cited Invention are different from each other in the following points.

(Different Feature 1)

The "plurality of lenses" in Invention 1 are "arranged vertically along the direction of gravity", while the Cited Invention does not specify such configuration.

(Different Feature 2)

The "image display surface of the image display element" in Invention 1 is "perpendicular to the projection surface", while the Cited Invention does not specify such configuration.

(Different Feature 3)

In the "optical projection system" of Invention 1, "in a plane perpendicular to the projection surface and including an optical axis of the co-axial optical system, a first projection light flux which reaches a position on the projection surface closest to the image display surface of the image display element and a second projection light flux which reaches a position on the projection surface farthest from the image display surface of the image display element once intersect with each other after being reflected by the second mirror, and are projected to the projection surface, and a position where the first projection light flux and the second projection light flux reflected by the second mirror intersect with each other is closer to the first mirror than to the second mirror", while the Cited Invention does not specify such configuration.

(Different Feature 4)

The "optical projection system" of Invention 1 is configured so that "an intermediate image of a pixel relating to the image display element closest to the optical axis of the co-axial optical system is formed on an optical path from the first mirror to the second mirror, and an intermediate image of a pixel relating to the image display element farthest from the optical axis of the co-axial optical system is formed on an optical path from the lens optical system to the first mirror". The "projection optical system" of the Cited Invention is configured so that "an intermediate image between the

first optical system and the second optical system is once formed from the image formed from on the image forming element", and it is unclear whether the intermediate image of a pixel relating to the image display element farthest from the optical axis of the co-axial optical system is formed on an optical path from the lens optical system to the folding mirror 134.

(3) Judgment on the different features

In view of the case, the Different Feature 4 is examined below.

A Regarding Article 29(1)(iii) (novelty) of the Patent Act

The "intermediate image" of the Cited invention is "between the first optical system and the second optical system". However, Cited Document 1 does not describe a positional relation between the intermediate image and the folding mirror, and does not indicate or describe that the positional relation may be implemented as in Invention 1 relating to the Different Feature 4.

It is difficult to specify a position where the "intermediate image" is formed in the Cited Invention, from FIG. 13 of Cited Document 1.

In Cited Document 1 [0090], it is described that the Cited Invention (Practical Example 3) forms an intermediate image as with the first embodiment of the Invention.

According to FIG. 3 (enlarged view of the first optical system and the second optical system of Practical Example 1) showing the first embodiment, the position where an intermediate image is formed is indicated by circles and dotted line. According to FIG. 3, it is found that, in the projection optical system of Practical Example 1 of Cited Document 1, all of intermediate images formed by pixels from the pixel of the image forming element 031 (011) closest to the optical axis of the first optical system 033 (013) to the pixel of the farthest image forming element 031 (011) are formed between the folding mirror 034 (014) and the second optical system 035 (015) (especially, see convergence positions (positions of the circles in FIG. 3) of the light beams from pixels corresponding to the image forming positions of the intermediate images in FIG. 3). Since the "projection optical system" of the Cited Invention is the same as the projection optical system of Practical Example 1, the "intermediate images" of the Cited Invention are highly likely to be formed between the "folding mirror 134" and the "second optical system 135".

Thus, it cannot be said that the "projection optical system" of the Cited Invention satisfies the requirements in the configuration of Invention 1 relating to Different Feature 4, "an intermediate image of a pixel relating to the image display element

farthest from the optical axis of the co-axial optical system is formed on an optical path from the lens optical system to the first mirror".

Therefore, Different Feature 4 is a substantial different feature, and it cannot be said that Invention 1 and the Cited Invention are identical with each other with no need to make determinations on Different Features 1 to 3.

B Regarding Article 29(2) (inventive step) of the Patent Act

(A) In Cited Document 1, the "intermediate image" of the Cited Invention is specified as being located "between the first optical system and the second optical system", while a positional relation with the "folding mirror 134" is not specified.

There is no description or indication that the intermediate image has a positional relation like the configuration of Invention 1 relating to Different Feature 4.

Thus, it cannot be said that, in the Cited Invention, there is a motivation to implement a configuration that satisfies the requirements in the configuration of Invention 1 relating to Different Feature 4, "an intermediate image of a pixel relating to the image display element farthest from the optical axis of the co-axial optical system is formed on an optical path from the lens optical system to the first mirror".

(B) If a physical distance between the "first optical system" and the "folding mirror 134" is made long, an intermediate image of a pixel of the image forming element 131 farthest from the optical axis, located close to the "folding mirror 134", may be located on an optical path between the first optical system 133 and the "folding mirror 134"; therefore, it can be said the configuration may satisfy the requirements in the configuration of Invention 1 relating to Different Feature 4, "an intermediate image of a pixel relating to the image display element farthest from the optical axis of the co-axial optical system is formed on an optical path from the lens optical system to the first mirror".

However, the object of the Invention in Cited Document 1 is "to provide a more compact projection optical system" ([0016]). In the Cited Invention, a longer physical distance between the "first optical system" and the "folding mirror 134" results in enlarging the projection optical system. Therefore, it can be said that, in the Cited Invention, there is a disincentive in implementing a configuration that satisfies the requirements in the configuration of Invention 1 relating to Different Feature 4, "an intermediate image of a pixel relating to the image display element farthest from the optical axis of the co-axial optical system is formed on an optical path from the lens optical system to the first mirror", with a longer physical distance between the "first optical system" and the "folding mirror 134".

The matters that [A] an aperture diaphragm is arranged adjacent to a lens, which is closest to the image display element, [B] the lens adjacent to the aperture diaphragm is formed as an aspherical lens, and [C] a free-form surface mirror is used as a concave mirror, are well-known matters of art (for example, see Practical Example 2 in Japanese Unexamined Patent Application Publication No. 2008-225455, which is a publication cited as Cited Document 2 in the reasons for refusal of the examiner's decision and was distributed in Japan before the filing of the application, and Practical Example 3 in Japanese Unexamined Patent Application Publication No. 2008-96984, which is a publication cited as Cited Document 3 in the reasons for refusal of the examiner's decision and was distributed in Japan before the filing of the application).

However, in the Cited Invention, even if the well-known arts are employed, the configuration satisfying the requirements in the configuration of Invention 1 relating to Different Feature 4, "an intermediate image of a pixel relating to the image display element farthest from the optical axis of the co-axial optical system is formed on an optical path from the lens optical system to the first mirror", cannot be implemented.

(C) In light of the above, it cannot be said that Invention 1 could have been easily made by a person skilled in the art based on the Cited Invention or the Cited Invention and the well-known arts with no need to make determinations on Different Features 1 to 3.

2 Regarding Invention 2 to Invention 4

Invention 2 to Invention 4 include the same configuration as the "projection optical system" of Invention 1. For the same reasons as those of Invention 1, it cannot be said that Inventions 2 to 4 could have been easily made by a person skilled in the art based on the Cited Invention or the Cited Invention and the well-known arts.

3 Regarding Invention 5 to Invention 7

Invention 5 to Invention 7 are inventions of an "image display device" having the "projection optical system" of Inventions 1 to 4, and include a configuration corresponding to the "projection optical system" of Invention 1. For the same reasons as those of Invention 1, it cannot be said that Inventions 5 to 7 could have been easily made by a person skilled in the art based on the Cited Invention or the Cited Invention and the well-known arts.

No. 7 Regarding the reasons in the notification of reasons for refusal as of December 13, 2018 (Article 36(6)(ii) of the Patent Act)

The reasons for refusal notified in the notification of reasons for refusal as of December 13, 2018 were resolved by the written amendment as of February 5, 2019.

No. 8 Closing

As described in No. 6, the application cannot be rejected due to the reasons for refusal of the examiner's decision.

No other reasons for refusal are found.

Therefore, the appeal decision shall be made as described in the conclusion.

April 15, 2019

Chief administrative judge: HIGUCHI, Nobuhiro

Administrative judge: KAWAMURA, Daisuke

Administrative judge: KAWAHARA, Tadashi