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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DAVID A. SMITH, RANDEL A. CROWE, and
GREGORY A. HARRISON

Appeal 2018-008935
Application 14/884,975
Technology Center 2800

Before BRADLEY R. GARRIS, CATHERINE Q. TIMM, and LILAN REN,
Administrative Patent Judges.

TIMM, *Administrative Patent Judge.*

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant¹ appeals from the Examiner's decision to reject claims 1–8 and 10–24. *See* Final Act. 1. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM IN PART.

¹ We use the word Appellant to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Lockheed Martin Corporation. Appeal Br. 1.

CLAIMED SUBJECT MATTER

The claims are directed to a head-wearable ultra-wide field of view (UWFOV) display device (*see, e.g.*, claims 1 and 16) and a method for presenting an image to an eye (*see, e.g.*, claim 8).

The display device includes a frame that, in one embodiment, resembles a pair of eyeglasses. Spec. ¶ 20; Fig. 1. Affixed to the frame is: a light source (22 in Fig. 1), a diverging reflective surface (24 in Fig. 1), and an ultra-wide field of view (UWFOV) reflective surface (20 in Fig. 1). Spec. ¶¶ 21–23.

Head-wearable display devices including a light source and a UWFOV reflective surface fixed to a frame were known in the art. *See, e.g.*, Spec. ¶ 18 (incorporating by reference U.S. Patent 8,625,200). Appellant adds a diverging reflective surface (24 in Fig. 1) to the head-wearable UWFOV display device to spread the light from the light source across the UWFOV reflective surface. Spec. ¶ 4. The diverging reflective surface receives light from the light source and reflects it toward the UWFOV reflective surface and the UWFOV reflective surface then reflects the light toward the eye of the user. Spec. ¶ 23. Appellant's display device uses a fixed light source configured to emit a stationary beam of light in combination with the diverging and UWFOV reflective surfaces. Claim 1, reproduced below, is illustrative of the claimed subject matter:

1. A head-wearable display device, comprising:
 - a frame;
 - a light source fixed with respect to the frame, the light source configured to emit a stationary diverging light beam of light;

an ultra-wide field of view (UWFOV) reflective surface fixed with respect to the frame; and

a diverging reflective surface having a negative optical power fixed with respect to the frame that is configured to receive the stationary diverging light beam of light emitted from the light source, to diverge the light to reduce a vergence of the light, and to reflect the light toward the UWFOV reflective surface and spread the light completely across the UWFOV reflective surface, wherein the UWFOV reflective surface is configured to collimate and reflect the light toward a predetermined location.

Appeal Br. 19 (Claims Appendix).

REFERENCES

The prior art relied upon by the Examiner is:

Name	Reference	Date
Lacroix	US 5,253,116	Oct. 12, 1993
Waldern	US 6,407,724 B2	June 18, 2002
Potin	US 6,788,442 B1	Sept. 7, 2004
Hilton	US 2009/0122385 A1	May 14, 2009
Harrison	US 2012/0154920 A1	June 21, 2012
Fujikawa	US 2013/0021224 A1	Jan. 24, 2013

REJECTIONS

The Examiner maintains the following rejections.

- A. Claim 23 is rejected under 35 U.S.C. § 112(a) as lacking written descriptive support.
- B. Claims 1, 3–6, 8, 11–14, 16, 18–20, and 24 are rejected under 35 U.S.C. § 103 as obvious over Potin in view of Hilton.

- C. Claims 1, 4–6, 8, 12–14, 16, 19² and 20 are rejected under 35 U.S.C. §103 as obvious over Hilton in view of Lacroix.
- D. Claims 3, 11, 18, and 24 are rejected under 35 U.S.C. § 103 as obvious over Hilton in view of Lacroix, and further in view of Potin.
- E. Claims 2, 10, and 17 are rejected under 35 U.S.C. § 103 as obvious over Potin in view of Hilton, or Hilton in view of Lacroix, and further in view of Fujikawa.
- F. Claims 7 and 15 are rejected under 35 U.S.C. § 103 as obvious over Potin in view of Hilton, or Hilton in view of Lacroix, and further in view of Waldern.
- G. Claims 21 and 22 are rejected under 35 U.S.C. § 103 as obvious over Potin in view of Hilton, or Hilton in view of Lacroix, and further in view of Harrison.
- H. Claim 23 is rejected under 35 U.S.C. § 103 as obvious over Potin in view of Hilton and Harrison, or Hilton in view of Lacroix and Harrison, and further in view of Fujikawa.

OPINION

Written Descriptive Support for Claim 23

We turn first to the Examiner’s rejection of claim 23 under 35 U.S.C. § 112(a) as lacking written descriptive support. Claim 23 depends from

² Although claim 19 is not listed in the statement of the rejection, it is discussed in the body of the rejection. Final Act. 25–26. Appellant recognizes that claim 19 is rejected. Appeal Br. 13. Thus, the error is harmless.

claim 1. Claim 1 requires a light source “configured to emit a stationary diverging light beam of light.” Claim 23 further requires that “the stationary diverging light beam emits a cone of light of 22 degrees or less.”

The issue is: Has Appellant identified a reversible error in the Examiner’s finding that the original written description fails to reasonably convey to the ordinary artisan that Appellant was in possession of a head-wearable display with a light source configured to emit a stationary diverging beam of light where the “stationary diverging light beam emits a cone of light of 22 degrees or less.”

Appellant has not identified such an error.

The Examiner finds that the written description does not provide support for the entire range of 22 degrees or less. Final Act. 3. According to the Examiner, support is limited to the range of a cone of light of 10 degrees or less as recited in paragraph 22 of the Specification and to the specific example of 22.4 degrees in paragraph 34. *Id.*

Appellant points to the same paragraphs (paragraphs 22 and 34) and contends that written descriptive support for the range of 22 degrees or less is found in the use of the term “narrow-beam light source,” explicit examples of narrow beam light sources, and figures that graphically illustrate embodiments relating to spreading light from a narrow-beam light source across two reflective surfaces over a short distance. Appeal Br. 7. Appellant contends that, based on (1) the term “narrow-beam light source,” (2) the examples and (3) the figures, “those skilled in the art certainly would have appreciated that the inventor was in possession of the idea that narrow-beam light sources that emit a cone of light of less than 22.4 degrees could be utilized in Appellant’s recited embodiments.” *Id.*

The test for compliance with the written description requirement is “whether the *disclosure of the application relied upon* reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc) (emphasis added). Appellant’s argument fails because the *written description* does not reasonably convey possession of displays with narrow-beam light sources that emit light in cones of degree different than the degrees disclosed.

As found by the Examiner, paragraph 22 discloses that the light source “may emit light in a relatively narrow cone, such as a +/- 10-degree cone.” Spec. ¶ 22. The written description offers as examples specific types of light sources known in the art, such as “a Liquid Crystal on Silicon (LCoS) display, a digital light processing (DLP) display, or a laser display.” Spec. ¶ 4. According to the written description, “narrow-beam displays, such as an LCoS display, emit light in a relatively narrow +/- 10-degree cone.” Spec. ¶ 3. Thus, the Specification equates “narrow-beam” light sources with light sources that emit light in a cone of +/- 10 degrees.

Paragraph 34 does not provide a basis for reading paragraph 22 more broadly to encompass the entire range of cones of 22 degrees or less. This portion of the written description merely illustrates a method of calculating the radius of curvature for the UWFOV reflective surface 20 given an assumption “that a half angle of a cone of light emitted from the narrow-beam light source 22 is 11.2 degrees, per specifications of the narrow-beam light source 22.” Spec. ¶ 34. At best, this disclosure provides evidence that narrow-beam light sources that emit a cone of 22.4 degree light, per specifications, may be used to calculate the radius of curvature of a UWFOV reflective surface.

The written description first conveys that “narrow-beam displays, such as an LCoS display, emit light in a relatively narrow +/- 10-degree cone.” Spec. ¶ 3. Then the written description discusses a mathematical calculation based on a narrow-beam light source that, per specifications, emits a narrow-beam cone of light of 22.4 degrees. Appellant has not persuaded us that what is conveyed is broader in scope than the specifically stated values for the cones. The written description fails to reasonably convey possession of the entire range of 22 degrees or less.

Moreover, claim 23 does not recite what the Examiner and Appellant assume it recites. Specifically, claim 23 does not recite that the *light source* emits a cone of light of 22 degrees or less. Instead, claim 23 recites that *the stationary diverging light beam* emits a cone of light. Because it is the light source, according to the written description, that emits the cone of light, not the beam of light, claim 23 lacks written descriptive support for this reason as well.

Obviousness over Potin in view of Hilton

The Examiner rejects claims 1, 3–6, 8, 11–14, 16, 18–20, and 24 under 35 U.S.C. § 103 as obvious over Potin in view of Hilton and adds further prior art references to reject claims 2, 7, 10, 15, 17, and 21–23.

All of the claims require “a *diverging* reflective surface having a *negative optical power*.”

The Examiner finds that Potin’s mirrors 21, 23, and 41, shown in Potin’s Figures 3 and 4, are diverging reflective surfaces, but acknowledges that those mirrors do not have negative optical power. Final Act. 4. The Examiner, however, concludes that it would have been obvious to the ordinary artisan to modify Potin’s display device with Hilton’s diverging

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reflector (12 in Fig. 1 or 54 in Fig. 11) having negative optical power “‘for reconstruction and display of the image on the retina with a wide field of view’ as it ‘produces a wide field of view from a relatively small angle input scan.’” Final Act. 5 (citation omitted) (quoting Hilton ¶¶ 25 and 58).

Appellant points to a number of differences between the display devices of Potin and Hilton, notes that the mirrors of Hilton have a different function than the mirrors of Potin, and contends that the ordinary artisan would not have considered combining the mirrors. Appeal Br. 9–11.

The issue is whether Appellant has identified a reversible error in the Examiner’s finding of a suggestion to combine.

Appellant has identified such an error.

Because Hilton’s device differs in meaningful ways from Potin’s device, and the mirrors have different functions, the Examiner was required to set forth an evidence-based explanation detailing why the ordinary artisan would have modified Potin’s mirrors to give them the hemispherical convex shape of Hilton. The Examiner did not provide the necessary basis.

Although both Potin and Hilton are directed to head-wearable display devices and both use a light source and a concave spherical mirror (UWFOV mirror) to relay the image to a user’s eye, Potin’s light source is a fixed display such as a cathode-ray tube screen or liquid crystal screen and conveys that image by a relaying optic that superimposes the image on the landscape at infinity. Potin col. 1, ll. 29–37. Potin uses the spherical (UWFOV) mirror 1 (Figs. 3 and 4) to collimate the image generated by the display screen and places the spherical mirror out of the user’s view. Potin col. 1, ll. 51–54.

Potin inclines the concave spherical (UWFOV) mirror so that it is not normal to the user’s eye and this results in optical aberrations and distortions

in the image that must be corrected. Potin col. 2, ll. 1–11; Figs. 3 and 4 (spherical mirror 1). Potin’s method of correcting the distortion involves using diffractive field mirrors (mirrors 21, 41) to displace points of light nonuniformly to form a hologram. Potin col. 2, l. 61–col. 3, l. 7; Fig. 3 (diffractive field mirror 21); Fig. 4 (diffractive mirror 41). Potin’s mirror 23 is an optional plane mirror that “enables the folding of the optical rays while preserving the plane of incidence of the optical axis on the spherical mirror 1.” Potin col. 6, ll. 32–38.

Hilton tackles a different problem in a different device. Hilton’s device is a direct retinal display (DRD). Hilton ¶ 1. Hilton’s DRD creates an image by scanning a light spot, such as from a laser, in a raster pattern across the retina of the user’s eye. Hilton ¶ 2. Hilton uses a diverging reflector to magnify a scanned beam angle from a scan source 14 in conjunction with a converging reflector 16 (UWFOV mirror) to converge the beam scan back towards the eye. Hilton ¶ 58. Hilton discloses that this arrangement “produces a wide field of view from a relatively small angle input scan.” *Id.*

The Examiner appears to be proposing that Hilton suggests either reshaping Potin’s diffractive mirrors so they diverge in the manner taught by Hilton or entirely replacing Potin’s diffractive mirrors with Hilton’s diverging mirrors. However, the exact proposed modification is unclear from the Examiner’s broad brush statement that the ordinary artisan would have modified Potin’s display device with Hilton’s reflecting surface having negative optical power. Final Act. 5. Either way, the Examiner provides no persuasive rationale supporting the modification beyond a quote of the reason Hilton uses the diverging/UWFOV mirror combination in the DRD device. The rejection fails because Potin’s diffractive mirrors function differently than Hilton’s diverging mirror and the Examiner’s rationale does

not take that difference into account. The bare statements in Hilton do not provide a reason to use the diverging mirror of the DRD display to modify the diffractive mirrors of Potin.

The Examiner's reliance on additional references to reject claims 2, 7, 10, 15, 17, and 21–23 fails to remedy the deficiency. Thus, we do not sustain the rejection of claims 1, 3–6, 8, 11–14, 16, 18–20, and 24 under 35 U.S.C. § 103 as obvious over Potin in view of Hilton, nor the rejections adding further prior art references to reject claims 2, 7, 10, 15, 17, and 21–23.

Obviousness over Hilton in view of Lacroix

The Examiner rejects claims 1, 4–6, 8, 12–14, 16, 19, and 20 under 35 U.S.C. §103 as obvious over Hilton in view of Lacroix and adds further prior art references to reject claims 2, 3, 7, 10, 11, 15, 17, 18, and 21–24.

The Examiner finds that Hilton teaches a head-wearable display device including a light source on a frame and acknowledges that Hilton fails to teach that the light source is fixed with respect to the frame and configured to emit a stationary diverging beam of light. Final Act. 17. The Examiner bases the obviousness conclusion on Lacroix's teaching of a projector fixed above a cabin of a flight simulator. Final Act. 18–19 (citing Lacroix Figs. 1–5, col. 2, ll. 21–25, and col. 3, ll. 20–29).

Appellant contends that Lacroix teaches mounting three projectors above a cabin and does not suggest fixing those projectors to a frame of a head wearable display device. Appeal Br. 13. Appellant further contends that the ordinary artisan would not have fixed the projectors of Lacroix to the frame of Hilton's head-wearable display device. *Id.* We agree. Lacroix teaches fixing a projection device 1, generally of the three-projector type, above cabin 2. Lacroix col. 1, ll. 63–66. The user of the flight simulator sits

in the cabin. *Id.* The cabin is much larger than the frame of Hilton's head-wearable display device. The projector is also of much larger scale than the scan source 14 of Hilton, which is small enough to fit on head-mounted display device. Hilton ¶ 105. The Examiner has not provided the type of evidence or technical explanation that supports a finding of a suggestion within the prior art to use projectors meant to project an image into a simulator cabin on the frame of a head-wearable display device such as that of Hilton.

We do not sustain the Examiner's rejection of claims 1, 4-6, 8, 12-14, 16, 19, and 20 under 35 U.S.C. §103 as obvious over Hilton in view of Lacroix. Because the Examiner's reliance on further prior art references to reject claims 2, 3, 7, 10, 11, 15, 17, 18, and 21-24 does not cure the deficiency, we do not sustain those further rejections.

CONCLUSION

The Examiner's rejection is affirmed in part.

More specifically,

- A. we sustain the rejection of claim 23 under 35 U.S.C. § 112(a) as lacking written descriptive support;
- B. we do not sustain the rejection of claims 1, 3-6, 8, 11-14, 16, 18-20, and 24 under 35 U.S.C. § 103 as obvious over Potin in view of Hilton;
- C. we do not sustain the rejection of claims 1, 4-6, 8, 12-14, 16, 19 and 20 under 35 U.S.C. §103 as obvious over Hilton in view of Lacroix;

- D. we do not sustain the rejection of claims 3, 11, 18, and 24 under 35 U.S.C. § 103 as obvious over Hilton in view of Lacroix, and further in view of Potin;
- E. we do not sustain the rejection of claims 2, 10, and 17 under 35 U.S.C. § 103 as obvious over Potin in view of Hilton, or Hilton in view of Lacroix, and further in view of Fujikawa;
- F. we do not sustain the rejection of claims 7 and 15 under 35 U.S.C. § 103 as obvious over Potin in view of Hilton, or Hilton in view of Lacroix, and further in view of Waldern;
- G. we do not sustain the rejection of claims 21 and 22 under 35 U.S.C. § 103 as obvious over Potin in view of Hilton, or Hilton in view of Lacroix, and further in view of Harrison; and
- H. we do not sustain the rejection of claim 23 under 35 U.S.C. § 103 as obvious over Potin in view of Hilton and Harrison, or Hilton in view of Lacroix and Harrison, and further in view of Fujikawa.

DECISION SUMMARY

Claims Rejected	35 U.S.C. §	Basis	Affirmed	Reversed
23	112(a)	Written Description	23	
1, 3–6, 8, 11–14, 16, 18–20, 24	103	Potin, Hilton		1, 3–6, 8, 11–14, 16, 18–20, 24
2, 10, 17	103	Potin, Hilton, Fujikawa		2, 10, 17
7, 15	103	Potin, Hilton, Waldern		7, 15
21, 22	103	Potin, Hilton, Harrison		21, 22

Claims Rejected	35 U.S.C. §	Basis	Affirmed	Reversed
23	103	Potin, Hilton, Harrison, Fujikawa		23
1, 4–6, 8, 12–14, 16, 19, 20	103	Hilton, Lacroix		1, 4–6, 8, 12–14, 16, 19, 20
3, 11, 18, 24	103	Hilton, Lacroix, Potin		3, 11, 18, 24
2, 10, 17	103	Hilton, Lacroix, Fujikawa		2, 10, 17
7, 15	103	Hilton, Lacroix, Waldern		7, 15
21, 22	103	Hilton, Lacroix, Harrison		21, 22
23	103	Hilton, Lacroix, Harrison, Fujikawa		23
Overall Outcome			23	1–8, 10–22, 24

TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED IN PART