NOTE: This disposition is nonprecedential.

United States Court of Appeals for the Federal Circuit

IN RE: NELSON GEORGE PUBLICOVER, LEWIS JAMES MARGGRAFF, ELIOT FRANCIS DRAKE, SPENCER JAMES CONNAUGHTON,
Appellants

2019-1883

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. 15/131,273.

Decided: May 15, 2020

THERESA H. NGUYEN, Perkins Coie, LLP, Seattle, WA, argued for appellants. Also represented by DAN L. BAGATELL, Hanover, NH.

MAUREEN DONOVAN QUELER, Office of the Solicitor, United States Patent and Trademark Office, Alexandria, VA, argued for appellee Andrei Iancu. Also represented by THOMAS W. KRAUSE, BENJAMIN T. HICKMAN, MEREDITH HOPE SCHOENFELD.

Before O'MALLEY, BRYSON, and CHEN, *Circuit Judges*.

CHEN, *Circuit Judge*.

Appellants Nelson George Publicover, Lewis James Marggraff, Eliot Francis Drake, and Spencer James Connaughton (collectively, Publicover) appeal the determination of the Patent Trial and Appeal Board that claims 43–51 of their patent application, No. 15/131,273 (the '273 Application), would have been obvious under 35 U.S.C. § 103(a). *See Ex Parte Publicover et al.*, No. 2018–005362, 2019 WL 1453980 (P.T.A.B. Mar. 8, 2019). For the reasons explained below, we *affirm* the Board's decision.

BACKGROUND

I. The '273 Application

The '273 Application relates generally to methods of tracking eye movements in a graphical user interface environment such as wearable virtual- or augmented-reality display devices, using those movements to determine the user's intent, and performing an action based on that intent. '273 Application ¶¶ 17–21. The eye-tracking technology thereby enables the user to interact with and control the device with his or her eye movements, rather than using traditional tools such as a computer mouse, joystick, or touch-sensitive displays. *Id.* ¶¶ 4–6. According to Publicover, the purported invention seeks to solve certain unique challenges associated with discerning user intent based on eye movements. Appellant's Br. at 4 (citing '273 Application ¶ 6).

One such challenge, and stated goal of the purported invention, is to accurately discern user intent by distinguishing the user's *involuntary* movements from *voluntary* movements intended to interact with, and control, the device. '273 Application ¶¶ 6, 87. Two types of "[v]oluntary movements that may [be used to] convey purposeful intent" are saccadic eye movements and voluntary head movements that produce vestibulo-ocular eye movements. *Id.* ¶¶ 89, 115.

The appealed claims rely on identifying vestibulo-ocular eye movements to discern user intent.[1] *Id.* ¶¶ 89, 98, 179. Vestibulo-ocular eye movements are "generally accepted" as one of "four fundamental types of eye movements." *Id.* ¶ 115. In order for a person's eyes to remain focused on a particular target while his or her head is moving, vestibulo-ocular eye movements "compensate for head movements by" rapidly and reflexively "moving the eye[s] through the same angle as a head rotation, but in the opposite direction." *Id.* ¶¶ 116, 222. The eye and head movements "correspond" "approximate[ly] . . . in movement magnitudes." *Id.* ¶ 224, Fig. 4. "This has the effect of" keeping the eyes on a fixation point and "stabilizing an image of the external world." *Id.* ¶ 116. Although the head movements that produce the vestibulo-ocular movement are generally voluntary, "the vestibulo-ocular [eye] movement itself is involuntary." *Id.* ¶ 182.

Vestibulo-ocular movements can occur in conjunction with another fundamental type of eye movement, saccadic eye movements. "Saccadic eye movements are rapid movements that abruptly change the fixation point of the eye[s]." *Id.* ¶ 119; *see also id.* ¶¶ 217–18. After a person performs a saccadic eye movement, he or she may naturally rotate the head to align it with the new fixation point of the eyes. As the specification explains, "any shift in gaze greater than about 20° . . . is usually associated with a head movement." *Id.* ¶ 179. If the eyes were to remain still as the head moves, the head would carry the eyes off target. The involuntary vestibulo-ocular reflex of the eyes keeps the eyes on target by moving the eyes in the opposite direction of the head rotation. *Id.* ¶ 116.

---

[1] The Board affirmed the examiner's rejection of all pending claims, claims 31–39, 41–56, and 58–61, but Publicover's appeal is limited to claims 43–51.

II. Procedural History

The examiner rejected claims 43 and 46–51 of the '273 Application as obvious over the combination of U.S. 2014/0380230 A1 (Venable) and U.S. 2012/0081666 A1 (Kiderman). J.A. 1147–50. Additionally, the examiner rejected claims 44–45 as obvious over the combination of Venable, Kiderman, and U.S. 6,932,090 (Reschke). J.A. 1161–63. Publicover appealed to the Board, which affirmed the examiner's rejections.

On appeal before us, Publicover directs its argument solely to independent claim 43, from which claims 44–51 depend. Claim 43 recites a method for using a graphical user interface to determine a user's intent by detecting when there has been a vestibulo-ocular eye movement associated with a head movement, and then performing an action related to a viewed object or its location:

> 43. A method for providing a graphical user interface to determine intent of a user based at least in part on movement of the user's head and one or both of the user's eyes using a head movement detector and an eye movement detector, comprising:
>
> identifying, with the head movement detector, when the user's head moves at a head velocity;
>
> identifying, with the eye movement detector, when the one or both of the user's eyes move at an eye velocity;
>
> *identifying*, based at least in part on the head velocity and the eye velocity occurring concurrently, *a vestibulo-ocular movement* of the one or both of the user's eyes;
>
> confirming that the one or both of the user's eyes are directed at a viewed object at a viewed object location based at least in part

> on the determined vestibulo-ocular movement of the one or both of the user's eyes; and
>
> performing, in response to the confirming, an action related to one or more of the viewed object and the viewed object location.

'273 Application at claim 43 (emphases added).

We have jurisdiction pursuant to 28 U.S.C. § 1295(a)(4).

DISCUSSION

Obviousness is a question of law based on underlying factual findings. *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013). The factual findings include, inter alia, "the scope and content of the prior art" and "differences between the prior art and the claims at issue." *Id.* (citing *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007)).

This court reviews the Board's legal determinations de novo, and the Board's factual findings underlying those determinations for substantial evidence. *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015). A finding is supported by substantial evidence if a reasonable mind might accept the evidence to support the finding. *Consol. Edison Co. v. NLRB*, 305 U.S. 197, 229 (1938).

Publicover argues that the Board erred in finding that the prior art teaches the claim limitation of "identifying . . . a vestibulo-ocular movement." Publicover contends that neither Kiderman alone nor the combination of Venable and Kiderman teach this limitation. Appellant's Br. at 17. We disagree because substantial evidence supports the Board's finding that the combination of Venable and Kiderman would result in performing the "identifying . . . a vestibulo-ocular movement" limitation.

As the Board explained, Venable "teaches selecting user interface elements via position signals derived from sequential eye gestures that may include saccades." *Publicover*, 2019 WL 1453980, at *5 (citing Venable ¶ 26). Venable is directed to "an eye tracking system . . . configured to produce a periodically updated position signal based upon a determined location of a user's gaze on a . . . user interface" element. Venable ¶ 19. Venable discloses that some embodiments rely on identifying saccadic eye movements to determine the user's intent to select the user interface element. *Id.* ¶ 26. Once Venable's system "determin[es] that the user has selected the U[ser]I[nterface] element," it will perform an action such as, for example, "launching a program represented by the element." *Id.* ¶ 37.

As shown in Venable's figures, the eye tracking system is integrated with "a head-mounted display . . . configured to display augmented reality images." *Id.* ¶ 15; *see also id.* Figs. 1A–C, 4A–C, 5A–D, 6. Venable states that its system may comprise not only an eye tracking system but also "may include . . . motion sensors . . . and/or . . . image sensors" that may be "incorporated into [the] head-mounted display." *Id.* ¶¶ 19–20. Venable contemplates using several different types of components alone or together, including "a head tracker, eye tracker, accelerometer, and/or gyroscope for motion detection and/or intent recognition." *Id.* ¶ 51. Based on Venable's disclosure of the "head tracker, eye tracker, accelerometer, and/or gyroscope for motion detection and/or intent recognition," the Board and examiner reasonably found that Venable teaches concurrently tracking eye movements and head movements, and is not limited "to head-fixed saccades" for discerning user intent. J.A. 1501; *Publicover*, 2019 WL 1453980, at *8. We disagree with Publicover's arguments to the contrary.

Kiderman is directed to a head mounted goggle based video oculography system for recording and evaluating saccadic eye movements "for assisting in the diagnosis of"

certain brain injuries and disorders "that cause highly saccadic results." Kiderman ¶¶ 3, 5, 18. Importantly, with regard to vestibulo-ocular movements, Kiderman discloses that they occur in conjunction with saccadic eye movements. *Id.* ¶ 12. In the background of the invention, Kiderman explains that "[d]uring . . . saccades" with "shift[s] in gaze larger than about 20°," "first the eye produces a saccade to get gaze on target, whereas the head follows more slowly and the vestibulo-ocular reflex causes the eyes to roll back in the head to keep gaze on the target." *Id.* Kiderman further explains that "[t]he vestibular system stabilizes vision with head movement . . . , sensing the direction and speed of head acceleration and moving the eyes accordingly." *Id.* ¶ 7.

The examiner reasoned that the basis to combine Kiderman's disclosure of vestibulo-ocular movement with Venable's system for tracking saccadic eye movements to "identify[]. . . a vestibulo-ocular movement" was to "improve[] on the accuracy of" Venable's system "by considering the effect of head movement on the saccade." J.A. 1501–02; *see also* J.A. 1141. This is particularly so given Kiderman's teaching that vestibulo-ocular eye movements are commonly associated with and naturally follow from saccadic eye movements and Venable's disclosure of embodiments that already track both eye and head movements. Kiderman ¶ 12; Venable ¶ 51.

Before the Board, Publicover argued that Kiderman taken individually does not teach the "identifying . . . a vestibulo-ocular movement" limitation. J.A. 1477–78; J.A. 1588. The Board rejected that argument, noting that "Kiderman only is relied upon to teach that vestibulo-ocular movement, such as that recited in claim 43, is one known type of head movement." *Publicover*, 2019 WL 1453980, at *9 (citing Kiderman ¶ 12). The Board found that "the eye tracking system of Venable may be combined with . . . Kiderman['s]" disclosure of vestibulo-ocular movement. *Id.* Like the examiner, whose Answer the Board

adopted as its own, the Board found that the accuracy of Venable's system which tracks both eye and head movements would be improved by identifying vestibulo-ocular movements in addition to saccadic eye movements. *Publicover*, 2019 WL 1453980, at *3, *9. Substantial evidence supports this finding, despite Publicover's arguments to the contrary.

Before this court, Publicover presents additional arguments that were not previously presented to the Board. For example, Publicover contends that neither reference, taken individually or together, disclose "identifying" that "the head velocity and eye velocity occur[] *concurrently*" during "a vestibulo-ocular movement," as the claims require. '273 Application at claim 43 (emphasis added); Appellant's Reply Br. at 5–6. Because Publicover did not raise these arguments to the Board, we conclude that they are waived. *See In re Watts*, 354 F.3d 1362, 1368 (Fed. Cir. 2004) ("declin[ing] to consider the appellant's new argument regarding the scope of [the prior art] raised for the first time on appeal"). Moreover, contrary to Publicover's argument, Kiderman teaches that the head velocity and eye velocity occur *concurrently* during vestibulo-ocular movement, as the claims require. Kiderman discloses that when the head moves, "the vestibulo-ocular reflex causes the eyes to" move "to keep the gaze on the target." Kiderman ¶ 12; *see also id.* ¶ 7 ("The vestibular system stabilizes vision with head movement," as opposed to allowing vision to "shift" "during head movement," by "sensing the direction and speed of head acceleration and moving the eyes accordingly."). In order "to keep the gaze on the target," as Kiderman discloses, the head and eyes must be moving concurrently in opposite directions with roughly the same movement magnitudes.[2]

---

[2] Kiderman "incorporated . . . by reference" certain related patent application publications "in their entirety":

We also note the examiner's finding, which was adopted by the Board, that Publicover's written description with respect to the "identifying . . . a vestibulo-ocular movement" limitation is rather thin in detail as to how the applicant's system identifies vestibulo-ocular movement. J.A. 1501; *Publicover*, 2019 WL 1453980, at *3, *8. The examiner explained that the limitation "is merely supported" by "paragraph [224]" of Publicover's specification, which provides the "well-known" definition of vestibulo-ocular movement. J.A. 1501. Paragraph 224 of Publicover's specification states:

> If the right and left eye move in the same direction . . . and this direction is opposite the direction of the head . . . with an approximate correspondence in movement magnitudes, then the eye movement is classified as vestibulo-ocular . . . .

'273 Application ¶ 224; *see also id.* ¶ 116 (providing a similar description of how vestibulo-ocular movement occurs).

Publicover argues that Venable and Kiderman's disclosures are too sparse to adequately explain to a skilled artisan how to modify Venable's system to identify vestibulo-ocular movement. But as the examiner and Board correctly found, Publicover's specification is just as sparse on how a system would identify this type of eye movement. Under the circumstances, we find this attorney argument as to the capabilities of a skilled artisan unpersuasive. *See Uber Techn., Inc. v. X One, Inc.*, No. 19-1164, 2020 WL 2123399, at *5 (Fed. Cir. May 5, 2020) ("The specification of the [patent-at-issue] is entirely silent on how to transmit user

---

U.S. 2005/0099601, U.S. 2007/0132841, U.S. 2008/0049186, U.S. 2008/0049187. Kiderman ¶ 22. The fact that these publications are directed to systems that concurrently track head movements and eye movements lends additional support to this reading of Kiderman.

locations and maps from a server to a user's mobile device, suggesting that a person of ordinary skill in the art was more than capable of selecting between the known methods of accomplishing this."); *In re Epstein*, 32 F.3d 1559, 1568 (Fed. Cir. 1994) ("[T]he Board's observation that appellant did not provide the type of detail in his specification that he now argues is necessary in prior art references supports the Board's finding that one skilled in the art would have known how to implement the features of the references and would have concluded that the reference disclosures would have been enabling."). Accordingly, the Board did not err in determining that the combination of Venable and Kiderman would result in the "identifying . . . a vestibulo-ocular movement" limitation.

CONCLUSION

We have considered Publicover's remaining arguments and find them unpersuasive. For the foregoing reasons, we *affirm* the decision of the Board.

AFFIRMED

COSTS

No costs.