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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte LUKE T. PETERSON, JAMES ALEXANDER McCOMBE, RYAN R. SALSBURY, and STEVEN J. CLOHSET

Appeal 2019-006809
Application 14/936,986
Technology Center 2600

Before JOHN A. EVANS, JAMES W. DEJMEK, and RUSSELL E. CASS, *Administrative Patent Judges*.

CASS, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant[1] appeals under 35 U.S.C. § 134(a) from the Examiner's final rejection of claims 1–20 under 35 U.S.C. § 112, and claims 1, 2, 4–10, 14–19 under 35 U.S.C. § 103. Appeal Br. 5, 8.[2] We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42 (2018). Appellant lists Imagination Technologies Limited of Kings Langley, United Kingdom as the real party in interest. Appeal Brief filed April 11, 2019 ("Appeal Br.") at 1.

[2] Rather than repeat the Examiner's positions and Appellant's arguments in their entirety, we refer to the above mentioned Appeal Brief, as well as the following documents for their respective details: the Final Action mailed January 18, 2019 ("Final Act."); the Examiner's Answer mailed July 22, 2019 ("Ans."); and the Reply Brief filed September 17, 2019 ("Reply Br.").

BACKGROUND AND PROCEDURAL HISTORY

The present invention relates to using ray tracing to render two-dimensional representations of three-dimensional scenes. Spec. ¶ 2. Appellant's Specification explains that rendering photo-realistic 2-D images from 3-D scene descriptions with ray tracing is well-known in the computer graphics art. *Id.* ¶ 3. According to the Specification, ray tracing usually involves obtaining a scene description composed of geometric shapes, which describe surfaces of structures in the scene, called primitives. *Id.* Using ray tracing, virtual rays of light are traced into a scene from a view point ("a camera"), and each ray is issued to travel through a respective pixel of the 2-D representation, on which that ray can have an effect. *Id.* ¶ 4. The rays are tested for intersection with scene primitives to identify a first intersected primitive for each ray, if any. *Id.* After identifying an intersection for a given ray, a shader associated with that primitive determines what happens next, such as how the ray is reflected from a surface. *Id.* ¶ 5. According to the Specification, most conventional algorithms build a tree of rays in flight when ray tracing a scene, where the tree continues along each branch until it leaves the scene or hits a luminaire that does not issue new rays. *Id.* ¶ 6. Appellant's Specification describes a variety of purported improvements to ray tracing architectures. *Id.* ¶ 7.

The present application was the subject of a previous appeal to the Board. *Ex Parte Peterson*, Appeal No. 2017-009671 (PTAB Mar. 27, 2018) ("-9671 Appeal Dec."). Claim 1 in that decision is representative of the claims at issue in that appeal:

> 1. A method of rendering a plurality of images of a particular instance of a 3-D scene from a respective plurality of

> perspectives by ray tracing in a computer system, the method comprising:
>
> receiving shape data defining shapes to be rendered in the particular instance of the 3-D scene from said plurality of perspectives;
>
> defining rays for the plurality of perspectives to be tested for intersection in the particular instance of the 3-D scene;
>
> processing rays from the different perspectives together, the processing comprising at least one of:
>
> testing the rays against common geometric shapes within the particular instance of the 3-D scene, and
>
> performing shading operations using a common shader module.

-9671 Appeal Dec. 2.

In the previous appeal, the Examiner rejected the claims over Sven Woop et al., *RPU: A Programmable Ray Processing Unit for Realtime Ray Tracing*, ACM SIGGRAPH 2005 Papers (SIGGRAPH '05) 434–444 (2005) ("Woop"). In rejecting the claims, the Examiner relied on Woop's ray processing unit ("RPU") that performs real-time rendering of three dimensional scenes using real-time ray tracing. -9671 Appeal Dec. 3 (citing Final Action mailed Aug. 22, 2016, at 2–3; Woop at 434–35, 441–43, Figs. 1, 2, 6). On appeal, Appellant argued that Woop does not disclose "rendering a plurality of images of a particular instance of a 3-D scene from a respective plurality of perspectives by ray tracing" because "representations from different viewpoint perspectives in Woop are of <u>different</u> scenes, as a scene may change over time," and "[f]or any particular instance of a 3-D scene in Woop, there is only <u>one</u> image rendered from only <u>one</u> viewpoint." *Id.* (citing Appeal Brief filed Jan. 24, 2017 ("2017 Appeal Br.") at 5, 6).

The Board rejected Appellant's argument, determining that "[a]n ordinarily skilled artisan would have understood that 'a particular instance of a 3-D scene' can persist over time, and nothing in Appellant['s] Specification contravenes this plain and ordinary meaning." -9671 Appeal Dec. 4. "Thus," the Board explained, "as the camera position in Woop moves around an otherwise unchanging instance of a scene, Woop discloses rendering a plurality of images of that particular instance of the 3D scene from a respective plurality of perspectives, as recited." *Id.*

Following the Board's decision, Appellant amended the claims to include additional language, which led to another final rejection and to the present appeal. *See* May 29, 2018 Amdt. 2–5; Final Act.; Appeal Br. Claim 1 is illustrative of the claims presently on appeal, and is reproduced below with italics indicating the language added to claim 1 in the -9671 Appeal.

> 1. A method of rendering a plurality of images of a particular instance of a 3-D scene from a respective plurality of perspectives by ray tracing in a computer system, ***wherein the particular instance of the 3-D scene is an instance of the 3-D scene at a particular instant of time,*** the method comprising:
>
> receiving shape data defining shapes to be rendered in the particular instance of the 3-D scene ***at the particular instant of time*** from said plurality of perspectives;
>
> defining rays for the plurality of perspectives to be tested for intersection in the particular instance of the 3-D scene; processing rays from the different perspectives together, the processing comprising at least one of:
>
> testing the rays against common geometric shapes within the particular instance of the 3-D scene, and

performing shading operations using a common shader module.

Appeal Br. 12 (Claims Appendix).

THE EXAMINER'S REJECTIONS

In the Final Office Action presently on appeal, the Examiner rejected claims 1–20 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Final Act. 2–3. The Examiner also rejected claims 1, 2, 4–10, 14, 15, and 17–19 under 35 U.S.C. § 103(a) as being unpatentable over Woop in view of Ard (US 2005/0017971 A1; published Jan. 27, 2005). *Id.* at 3. The Examiner further rejected claim 16 under § 103(a) as being unpatentable over Woop, Ard, and McGill (US 6,313,908 B1; issued Nov. 6, 2001). *Id.* at 6. The Examiner objected to claims 3, 11–13, and 20 as being dependent upon a rejected base claim, and indicated that they would be allowable if amended to overcome the § 112 rejection and rewritten in independent form. *Id.* at 7.

ANALYSIS

The Section 112 Rejection

In the § 112 rejection, the Examiner determines that the Specification does not sufficiently describe the limitation in claim 1 reciting "wherein the particular instance of the 3-D scene is an instance of the 3-D scene at a particular instant of time, the method comprising: receiving shape data defining shapes to be rendered in the particular instance of the 3-D scene at the particular instant of time from said plurality of perspectives." Final Act. 2.

Appellant argues that the Specification "clearly conveys to those skilled in the art that the invention relates to improvement in parallelization of ray tracing processing to increase efficiency, with respect to a scene, i.e. a single instance of a scene to be rendered," relying on paragraphs 7 and 116 of the Specification. Appeal Br. 7; *see* Reply Br. 3–4. Appellant relies on the following disclosure in paragraph 7:

> "Ray tracing can be naively parallelized by providing many processing resources that operate on different portions of pixels of a 2-D scene to be rendered. However, simply providing more computation capability does not necessarily allow a suitable scaling of ray tracing speed and efficiency. One reason for this is that such parallelization does not account for how data composing the scene, or an acceleration structure that increases tracing efficiency can be accessed in an efficient manner. . . ."

Appeal Br. 7 (quoting Spec. ¶ 7).

With respect to paragraph 116 of the Specification, Appellant argues as follows:

> [P]aragraph [0116] of the original application specifically discloses methods used in rendering representation of a 3-D scene for use in **holographic** imaging systems wherein a plurality of images of a given scene are to be rendered, each from a different perspective. This clearly signifies to a person having skill in the art that the "given scene" is a static set of geometry, i.e. a "snapshot" at an instant of time. Viewing the static scene from a plurality of different perspectives is what enables a holographic image to be rendered. A holographic image cannot be obtained by combining different viewpoints of different temporal instances of scenes (such as in Woop where different views of a scene as the scene changes over time are obtained).

Appeal Br. 7.

The Examiner responds that Appellant's "mere mention of a 'scene'" in paragraph 7 of the Specification "does not provide sufficient subject matter to clearly convey to one skilled in the art at the time of invention that a ‘scene’ is equivalent to a ‘particular instance of time’ or an ‘instant of time,’” as recited in claim 1. Ans. 8. The Examiner further states that although paragraph 116 “mentions that rays of each perspective are collected together for intersection testing, [Appellant’s] Specification fails to mention an ‘*instant of time*’ or a ‘*particular instance of the 3-D scene*’ in which the intersection would be performed,” as recited in claim 1. Final Act. 7–8.

In order for a claim to satisfy the written description requirement of § 112, the written description “‘must clearly allow persons of ordinary skill in the art to recognize that [the inventor] invented what is claimed.’” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir 2010) (en banc) (citing *In re Gosteli*, 872 F.2d 1008, 1012 (Fed. Cir. 1989)). “[T]he test for sufficiency is whether the disclosure of the application relied upon conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Id.*

We agree with the Examiner’s finding that the Specification fails to provide an adequate written description of the claim limitation at issue. Appellant has not persuaded us that paragraphs 7 and 116, upon which Appellant relies, adequately describe these claim limitations. Paragraph 7 describes the use of ray tracing for a “scene,” but fails to disclose receiving shape data defining shapes to be rendered in “an instance of the 3-D scene at a particular instant of time” from a “plurality of perspectives.” Appellant appears to rely on the use of the term “scene” in paragraph 7, but fails to point to any evidence in the Specification or elsewhere that a “scene” must be interpreted to mean something that exists for only a particular “instant in time,” as opposed to something that can persist for a period of time.

Turning to paragraph 116, that paragraph states as follows:

> In one application, these systems and methods can be used in rendering representations of a 3-D scene for use in holographic imaging systems. In an example approach to rendering for holographic imaging systems, a plurality of images of a given scene are to be rendered, each from a different perspective. In rendering such images, each perspective can be considered to be an origin of rays to be intersection tested. The rays of each perspective can be collected together for intersection testing, such as collecting rays of different origins and their progeny together, without regard to their origins, but rather with respect to commonality of intersection testing and/or shading to be performed. Allowing collection of rays from a plurality of such origins allows systems and methods to provide for setup of the 3-D scene once, so that such scene setup is amortized over a large number of image renderings. Also, combining rays to be traced from different origins may allow for greater coherence and overall processor utilization. Thus, in the above examples, where collections of rays are formed, outputted, or otherwise handled according to the disclosures, these rays can be attributed to a plurality of camera positions. For example, rays of a given collection can be tested against child nodes of a parent node of a common acceleration structure.

Spec. ¶ 116.

We find that paragraph 116 discloses holographic imaging systems in which a plurality of images of a scene are to be rendered from a different perspective, but fails to disclose rendering images from a plurality of perspectives "at a particular instant in time." Indeed, paragraph 116 says nothing about the particular timing for the various actions described. Appellant's argument that the discussion of "holographic imaging systems" "clearly signifies" that images from multiple perspectives are being rendered at a particular instant in time lacks sufficient evidentiary support in the Specification or otherwise.

Consequently we sustain the Examiner's § 112 rejection of claim 1, and of independent claims 9 and 18, which include similar limitations, and are not separately argued. We also sustain the Examiner's § 112 rejection of claims 2–8, 10–17, and 19–20, which are dependent on claims 1, 9, or 18.

The Section 103 Rejections

In the § 103 rejections, the Examiner found, *inter alia*, that Woop teaches rendering a plurality of images of a 3-D scene from a plurality of perspectives by ray tracing in a computer system, including receiving shape data defining shapes to be rendered in the particular instance of the 3-D scene from the plurality of perspectives, defining rays for the plurality of perspectives to be tested for intersection in the particular instance of the 3-D scene, and processing rays from the different perspectives together, where the processing includes at least testing the rays against common geometric shapes within the particular instance of the 3-D scene, and performing shading operations using a common shader module. Final Act. 3–4.

The Examiner finds that Ard teaches providing a user "with the ability to generate an image of [a] three dimensional scene of models acquired from a real time interactive scene" and, therefore, "the image acquired during user interaction is an imaged instance of time of the real time 3D scene." *Id.* at 4 (citing Ard ¶¶ 45, 46) (italics omitted). The Examiner determines that it would have been obvious to one of ordinary skill to modify the ray tracing of Woop with the time instance image of Ard because this modification would enable a user to interactively improve the visualization of a complex three dimensional scene over any sequence of time through enabling a user to image the scene at a given selected viewpoint at a particular instance of time. *Id.* at 4–5.

Appellant argues that, unlike the claimed invention, "Woop is directed to rendering only a single image from a single perspective, for any particular instance of a 3-D scene." Appeal Br. 8. "In Woop," Appellant asserts, "representations from different viewpoint perspectives are of different scenes, i.e. as a scene may change over time," and thus, "[f]or any particular instance of a 3-D scene in Woop, there is only one image rendered from only one viewpoint." *Id.* Thus, Appellant argues, "[t]here is nothing in Woop that relates to rendering a plurality of images of the same instance of a scene from different perspectives (i.e. different viewpoints)." *Id.* at 9. Appellant further argues that the cited portions of Ard "do not disclose processing rays from different perspectives of an instance of a 3-D scene together." *Id.* Rather, according to Appellant, "Ard merely discloses rendering the scene from a single viewpoint after the objects are arranged." *Id.* at 9–10. Appellant further argues that the rejection does not explain how Woop would be modified by Ard to arrive at the claimed subject matter. *Id.* at 10.

The Examiner responds that "Woop does not merely rely upon rendering a scene from a single perspective or instance, but clearly teaches real time rendering of scenes, such as scenes generated from a video game." Ans. 9 (citing Woop Fig. 1 ("Realtime renderings on the RPU prototype using a single FPGA running at 66MHz . . . and UT2003 a scene from a current computer game (7.5 fps, precomputed illumination)" (italics omitted)), § 5, second paragraph ("More realistic examples are taken from computer games . . . such as Castle, UT2003, and Quake3. The latter one is used for two benchmarks: as a single object, and again with several moving players."), § 5.2, third paragraph ("as shown in Figure 3, is possible for scenes with a reasonable number of visible triangles as the RPU units are fed from primary caches . . . small changes in the set of visible scene parts must be transfer[r]ed per frame . . . the camera abruptly changes the view (e.g. by walking around a corner)")). Thus, the Examiner finds that "the scenes of Woop may be rendered from different perspectives of the scene as the view changes during traversal through the video game scene." *Id.* "Therefore," according to the Examiner, Appellant's arguments are unpersuasive because "one skilled in the art at the time of invention would have clearly recognized that the video game perspectives of a scene taught by Woop provides continual perspective change to the players during traversal through a real time video game scene." *Id.*

As to Appellant's argument that Ard fails to disclose "processing rays from the different perspectives together," the Examiner states that "Woop was relied upon to teach processing rays from the different perspectives together by processing several different perspectives from a plurality of players using a ray processing unit during movement together through a video game scene." *Id*. at 9–10.

In its Reply, Appellant argues that "[r]endering a scene from different perspectives as the view changes during a real time traversal by a player through the scene" does not meet the claim language because "a traversal by a player through a scene requires the passage of time and cannot be accomplished during an instant of time." Reply Br. 4. Appellant agrees with the Examiner that "one skilled in the art 'would have clearly recognized that the video game perspectives of a scene taught by Woop provides continual perspective change to the players during traversal through a real time video game scene,'" but argues that this "fails to disclose rendering a plurality of images of an instance of a 3-D scene at a particular instant of time from a respective plurality of perspectives," as claim 1 requires. *Id.* at 5.

We are not persuaded that the rejection is in error. As we found in the -9671 Appeal Decision, Woop discloses the use of its RPU for efficiently rendering views of a particular scene, with a focus on the "realtime" rate of the rendering of each view. Woop 434 (Abstract), 441 (Results section, Table 4); *see* -9671 Appeal Dec. 3. A person of ordinary skill would have understood that Woop's use of spatial index structures and "global" shading effects to render those views discloses rendering views of a scene from different perspectives, particularly with Woop's contrasting of minor viewpoint changes with "abrupt" changes and dynamic scenes. *See* Woop 442 (describing that, as the camera position changes, "only small changes in the set of visible scene parts must be transferred [sic] per frame, unless the camera abruptly changes the view (e.g., by walking around a corner)"); *see also* Woop at 436 (Scalable Design section), Fig. 3. As we found in the -9671 Appeal Decision, these disclosures indicate the use of Woop's RPU for a scene in which the camera view has changed, separate and apart from changes to the scene itself—i.e., "a particular instance of a 3-D scene from a respective plurality of perspectives." *See* -9671 Appeal Dec. 4. Appellant does not appear to dispute this. *See* Reply Br. 5 ("The Answer goes on to state that one skilled in the art 'would have clearly recognized that the video game perspectives of a scene taught by Woop provides continual perspective change to the players during traversal through a real time video game scene.' . . . . Appellant agrees with this statement . . . .").

The question before us now is what effect should be given to the additional language added to claim 1 stating that the particular instance of the 3-D scene is “an instance of the 3-D scene at a particular instant of time.” Applying the broadest reasonable construction of the claim language, we determine that “an instance of the 3-D scene at a particular instant of time” encompasses a point in a graphical rendering (such as a video game) in which no action is occurring and the scene appears to be static (or “frozen in time”) to the user, but that the user can move their view and thereby see this scene from different angles or perspectives. We see nothing in the Specification or elsewhere that would limit the “particular instant in time” to time in the “real world” as opposed to time in the context of the video game or other graphical rendering being run on the system. Moreover, Appellant has not pointed to any evidence in the Specification or elsewhere that the “particular instant in time language” requires the production of a holographic image.

We find that Woop discloses that the 3-D scenes which a player can view from multiple perspectives may be static (or “frozen in time”). For example, Woop refers to “closed room scenes of low complexity,” including “a single object” and a “Conference scene [that] shows a conference room with several instantiated chairs.” Woop at 441 (§ 5). Figures 1 and 6 of Woop also show static scenes. *Id.*, Figs. 1, 6. That a user may move around a static scene is also consistent with Woop’s statement that “only small changes in the set of visible scene parts must be transferred per frame, unless the camera abruptly changes the view (e.g., by walking around a corner).”

For the above reasons, we sustain the Examiner’s § 103 rejections of claim 1, and of claims 2, 4–10, and 14–19, which Appellant does not separately argue.

CONCLUSION

We affirm the Examiner's § 112 rejection of claims 1–20, and the Examiner's § 103 rejections of claims 1, 2, 4–10, and 14–19.

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1–20	112	Written Description	1–20	
1, 2, 4–10, 14, 15, 17–19	103(a)	Woop, Ard	1, 2, 4–10, 14, 15, 17–19	
16	103(a)	Woop, Ard, McGill	16	
Overall Outcome			1–20	

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv). *See* 37 C.F.R. § 41.50(f).

AFFIRMED