UNITED STATES PATENT AND TRADEMARK OFFICE

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte GARETH MORGAN and LUKE T. PETERSON

Appeal 2017-008705
Application 14/644,557[1]
Technology Center 2600

Before ALLEN R. MacDONALD, JOSEPH P. LENTIVECH, and
NABEEL U. KHAN, *Administrative Patent Judges*.

KHAN, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the Final Rejection
of claims 1–20. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

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[1] Appellants identify Imagination Technologies Limited as the real party in
interest. App. Br. 1.

BACKGROUND

THE INVENTION

According to Appellants, the invention relates to "systems, architectures, and methods for asynchronous and concurrent hybridized rendering, such as hybridized ray tracing and rasterization-based rendering." Spec. ¶ 2.

Exemplary independent claim 1 is reproduced below with the disputed limitation emphasized.

> 1. A process for rendering an image from a 3-D scene, comprising:
>
> identifying a respective visible surface, from a viewpoint, for pixels of a frame of pixels;
>
> *providing a sample pattern, wherein each sample of the sample pattern is associated with a respective ray direction determined for sampling occlusion of light, originating from an area light, on the identified visible surface;*
>
> sampling the pixels using an array of the sample pattern, the array providing that each pixel is associated with one sample of the sample pattern, the sampling comprising, for each pixel, tracing a ray, from the visible surface for that pixel in a direction determined according to the respective ray direction associated with the one sample of the sampling pattern associated with that pixel; and
>
> for each pixel,
>
> identifying a set of pixels around that pixel that, including that pixel, are congruent with the sample pattern,
>
> excluding from the identified set of pixels any pixel with a visible surface that has a respective value for one or more parameters that differs by more than a threshold amount from a respective value of those one or more parameters for the visible surface of that pixel of the frame, and

using a result of the ray tracing for any pixel remaining in the set of pixels in producing a value for that pixel.

REFERENCES AND REJECTIONS

1.   Claims 1, 3–8, 10–12, 14–18, and 20 stand rejected under 35 U.S.C. § 103 as unpatentable over Hempel (US 2008/0211804 A1, Sept. 4, 2008), McCombe (US 2010/0073369 A1, Mar. 25, 2010), and Gautron (US 2012/0001911 A1, Jan. 5, 2012). Final Act. 5–6.

2.   Claims 2, 13, and 19 stand rejected under 35 U.S.C. § 103 as unpatentable over Hempel, McCombe, Gautron, and Laine, S. et al., *Soft Shadow Volumes for Ray Tracing*, 24 ACM Transactions on Graphics 1156–1165 (July 2005). Final Act. 26–27.

3.   Claim 9 stands rejected under 35 U.S.C. § 103 as unpatentable over Hempel, McCombe, Gautron, Schmidt (US 2004/0239673 A1, Dec. 2, 2004). Final Act. 28.

DISCUSSION

Examiner's Findings and Appellants' Contentions

The Examiner finds the combination of Hempel and McCombe teaches or suggests the disputed limitation of "providing a sample pattern, wherein each sample of the sample pattern is associated with a respective ray direction determined for sampling occlusion of light, originating from an area light, on the identified visible surface." Final Act. 6. Specifically, the Examiner finds Hempel teaches or suggests "providing a sample pattern, wherein each sample of the sample pattern is associated with a respective ray direction." Final Act. 6 (citing Hempel ¶¶ 32–33). The Examiner finds McCombe teaches or suggests "determined for sampling occlusion of light,

originating from an area light, on the identified visible surface." Final Act. 7
(citing ¶¶ 115, 135).

Appellants take issue with the fact that the Examiner relies upon two
references for teaching the disputed limitation, which Appellants contend,
must be considered as a single, whole, claim limitation. *See* App. Br. 6.
Because the Examiner does not rely on Hempel alone as teaching the
entirety of the disputed claim limitation, Appellants argue "no *prima facie*
case of unpatentability has been shown." App. Br. 6.

Turning to the Examiner's reliance on McCombe for teaching or
suggesting the second half of the disputed limitation (relating to the
occlusion of light) Appellants argue the Examiner has not "adequately
established how one or ordinary skill in the art would have 'combined and
modified Hempel in view McCombe to include the above features of claim
1.'" App. Br. 7. Specifically, Appellants argue, "The rejection has not
explained or established any correspondence or correlation of the term
'color1' as used in McCombe with the array of directional rays from a
virtual camera created from the generation of a rasterized image in
paragraph 0032 of Hempel." App. Br. 7.

Finally, Appellants argue, "Gautron relates to a method of shadowing,
but as with Hempel and McCombe, Gautron does not disclose the unique
features of using a ray direction sample pattern to trace rays for an area light
source and shade occluded pixels by blending with ray tracing results of
surrounding pixels corresponding to the pattern." App. Br. 7.

Analysis

We are unpersuaded by Appellants' arguments. Hempel relates to a
method for hybrid rasterization and raytracing. *See* Hempel Title. Hempel

explains that although rasterization may be faster, it has the disadvantage of not being able to effectively compute non-local effects such as "reflections, refractions, and indirect (global) illumination." Hempel ¶ 5. Hempel explains that raytracing may be more flexible and better suited for indirect illumination and also for calculating accurate soft shadows. Hempel ¶ 9. Thus, Hempel proposes a "[a] hybrid method that uses mainly rasterization but invokes raytracing when necessary would address the needs of many practical applications." Hempel ¶ 11. As part of this hybrid method, Hempel teaches generating an image using rasterization with polygon vertices but then also creating an array "that contains a directional vector from a virtual camera that is associated with each polygon vertex." Hempel ¶ 32. For foreground polygon vertices, "a secondary ray is generated . . . using the directional vector associated with the polygon vertex." Hempel ¶ 32. The Examiner, thus, accurately finds Hempel's array of directional vectors teaches or suggests "providing a sample pattern, wherein each sample of the sample pattern is associated with a respective ray direction." *See* Ans. 3 (finding Hempel's array of directional vectors, as the claimed sample pattern associated with respective ray directions).

Hempel explains that this hybrid rasterization/raytracing technique may be used for reflections, refractions (Hempel ¶ 32), indirect illumination, and soft shadows (Hempel ¶ 33). Although Hempel describes using its hybrid method for indirect illumination and for soft shadows, it does not explicitly mention that these soft shadows are created from *occlusion* of the indirect illumination (i.e., occlusion of an area light). The Examiner thus, relies upon McCombe's occlusion rays as teaching that raytracing can be applied to occlusion. Final Act. 7 (citing McCombe ¶¶ 115, 135). The

Examiner finds the combination teaches or suggests the entirety of the disputed limitation where the sample pattern associated with a ray direction of Hempel contains occlusion information of McCombe that can be used for sampling occlusion of light. Final Act. 7. We find no error in the Examiner's findings and conclusions.

We agree with Appellants that the claims must be read as a whole, but disagree that doing so precludes the Examiner from relying on more than one reference for teaching the disputed limitation. Appellants have not provided sufficiently persuasive evidence of a claim interpretation requiring the disputed limitation to be read as an indivisible limitation that cannot be taught by multiple references, nor have Appellants pointed to any case law requiring such a result.

Appellants' argument that the combination of Hempel and McCombe is improper because it does not explain how McCombe's "color1" attribute would be combined with Hempel's hybrid method, misunderstands the combination and assumes bodily incorporation of McCombe's technique into Hempel. "The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference. . . . Rather, the test is what the combined teachings of those references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (citations omitted). As the Examiner explains, the rejection does not rely on incorporating the color1 attribute from McCombe into Hempel. Ans. 5–7. Rather the rejection relies upon Hempel's own suggestion that its hybrid rasterization/raytracing method may be used for indirect global illumination and soft shadows, with McCombe's explicit teaching that rays can include occlusion information,

thus teaching to the ordinary artisan that Hempel's hybrid method may be used for soft shadows created by occlusion of the indirect global illumination ("area light"). This is similar to Appellants' description of their own invention. Spec. ¶ 20 ("An area light is a light that is not modeled as a single point in 3-D space. . . . Faithfully representing occlusion from an area light involves modeling soft shadows"); ¶ 21 ("Some aspects of the disclosure relate to techniques for rendering images that include soft shadows caused by objects occluding surfaces.")

Appellants' argument that "Gautron does not disclose the unique features of using a ray direction sample pattern to trace rays for an area light source and shade occluded pixels by blending with ray tracing results of surrounding pixels corresponding to the pattern" (App. Br. 7) attacks the references individually. The Examiner does not rely on Gautron for teaching "a ray direction sample pattern to trace rays for an area light source and shade occluded pixels" (App. Br. 7) but rather, relies on Hempel and McCombe. Final Act. 6–8. To the extent Appellants argue that Gautron does not teach "blending with ray tracing results of surrounding pixels corresponding to the pattern," this argument, without more, is conclusory and unpersuasive.

Conclusion

Accordingly, we sustain the Examiner's rejection of claims 1, 3–8, 10–12, 14–18, and 20 which were argued together as a group. *See* App. Br. 4. We also sustain the Examiner's rejection of claims 2, 13, and 19 for which Appellants do not present arguments of separate patentability. *See* App. Br. 7 (arguing only that Laine does not cure the deficiencies of

Hempel, McCombe, and Gautron). Finally, we summarily sustain the Examiner's rejection of claim 9, for which Appellants present no arguments.

DECISION

The Examiner's rejection of claims 1–20 is affirmed.

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. § 41.50(f).

AFFIRMED