

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAVANT TECHNOLOGIES LLC d/b/a GE LIGHTING and
LEDVANCE LLC,
Petitioners,

v.

FEIT ELECTRIC COMPANY, INC.,
Patent Owner.

Case IPR2024-01357
U.S. Patent No. 8,604,678

SAVANT TECHNOLOGIES LLC d/b/a GE LIGHTING,
ELONG INTERNATIONAL USA INC., and
XIAMEN LONGSTAR LIGHTING CO. LTD.,
Petitioners,

v.

FEIT ELECTRIC COMPANY, INC.,
Patent Owner.

Case IPR2025-00260
U.S. Patent No. 8,604,678

**DECLARATION OF E. FRED SCHUBERT, PH.D. IN SUPPORT OF
PATENT OWNER'S RESPONSE TO IPR2025-00260**

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I, E. Fred Schubert, Ph.D., hereby declare the following:

I. INTRODUCTION

1. My name is E. Fred Schubert, Ph.D. I have been retained by counsel for Patent Owner as a technical expert in the above-captioned *Inter Partes* Review (“IPR”) matter. Specifically, I have been asked to study and provide my opinions on the technology described and claimed by U.S. Patent No. 8,604,678 (the “’678 Patent”). I previously provided my opinions on the claims challenged in IPR2024-01357 (claims 1-3, 6, 7, 9, 10, 16-21, 25, 26, and 29) in my declaration dated June 25, 2025 (Ex. 2026), which I incorporate herein by reference in its entirety. I understand that Petitioners filed a subsequent inter partes review proceeding (IPR2025-00260) which challenges additional claims of the ’678 Patent (claims 1 and 11-14). My opinions in this Declaration are limited to those challenged claims and issues presented in IPR2025-00260.

2. My compensation in this matter is not based on the substance of my opinions or the outcome of this matter. I have no financial interest in the Patent Owner. I am being compensated at an hourly rate of \$600 for my analysis and testimony in this case.

II. BACKGROUND AND QUALIFICATIONS

3. I incorporate Section II of my June 25, 2025 Declaration in this proceeding (Ex. 2026) by reference.

III. MATERIALS CONSIDERED

4. In writing this Declaration, I have considered my own knowledge and experience, including my work experience in the above fields; my experience in teaching those subjects; and my experience in working with others involved in those fields. In addition to those materials identified in my June 25, 2025 declaration (*see* Ex. 2026, ¶ 17), I have also reviewed the IPR2025-00260 Petition and the associated exhibits, the briefing in support of discretionary denial and associated exhibits, and the Board's Institution Decision.

IV. LEGAL FRAMEWORK

5. I incorporate Section IV of my June 25, 2025 Declaration in the consolidated proceeding (Ex. 2026) by reference.

V. TECHNOLOGY BACKGROUND

6. I incorporate Section V of my June 25, 2025 Declaration in the consolidated proceeding (Ex. 2026) by reference.

VI. THE '678 PATENT

7. I incorporate Section VI of my June 25, 2025 Declaration in the consolidated proceeding (Ex. 2026) by reference.

VII. OVERVIEW OF CITED REFERENCES

8. I incorporate Section VII of my June 25, 2025 Declaration in the consolidated proceeding (Ex. 2026) by reference.

VIII. OPINIONS

9. As described in more detail below, it is my opinion that none of the grounds asserted by the Petitioners render the Challenged Claims unpatentable.

10. Many of the opinions expressed in my June 25, 2025 Declaration are equally applicable to those grounds and other issues presented in the IPR2025-00260 Petition. As such, I incorporate the following Sections of my June 25, 2025 Declaration in the consolidated proceeding (Ex. 2026) by reference:

Section VIII.A.1 A POSITA Would Not Have Been Motivated to
Combine Basin-2007 and Basin-2005

Section VIII.A.3 A POSITA Would Not Have Been Motivated to
Combine Krummacher in view of Shimizu and
Stokes

Section VIII.B Secondary Considerations

A. A POSITA Would Not Have Been Motivated to Combine Stokes with any other Cited Reference to Arrive at the Subject Matter of Claims 11-14

11. I understand that Petitioners advance two grounds to challenge claims 11-14 in IPR2025-00260: Ground 2, which alleges that claims 11-14 are obvious over Basin-2007 in view of Basin-2005 and Stokes; and Ground 3, which alleges

that claims 11-14 are obvious over Krummacher in view of Shimizu and Stokes. IPR2025-00260 Pet. at 20. Each of these grounds specifically relies upon the Stokes reference for the particle size limitations of claims 11-14. *See* IPR2025-00260 Pet. at 38-39, 41-44, 46, 59-60, 63-65, 67.

12. As described in more detail below, it is my opinion that a POSITA would not have a meaningful motivation to combine Stokes with the references cited in the Petition to arrive at the invention of claims 11-14 and would not have had a reasonable expectation that combining such references would lead to success. In my opinion, Petitioners have not shown: (1) that one of skill in the art would have sought to combine Stokes with the other primary references or (2) how one of skill in the art would have combined Stokes with the other cited references to arrive at a device with the claimed benefits of the '678 Patent.

13. Stokes describes a lamp containing a radiation source (*e.g.*, a blue LED chip), a luminescent material (*e.g.*, a phosphor) and a radiation scattering material located between the radiation source and the luminescent material. Ex. 1008 at Abst. The goal of Stokes is to improve the lamp by reducing the directionality of the light emission from the LED chip, thus reducing the “halo” or “penumbra” effect in the final emission product. Ex. 1008 at 1:37-38 (“white LED lamps suffer from the undesirable halo effect and the penumbra effect”), 1:48-50 (“when the light output

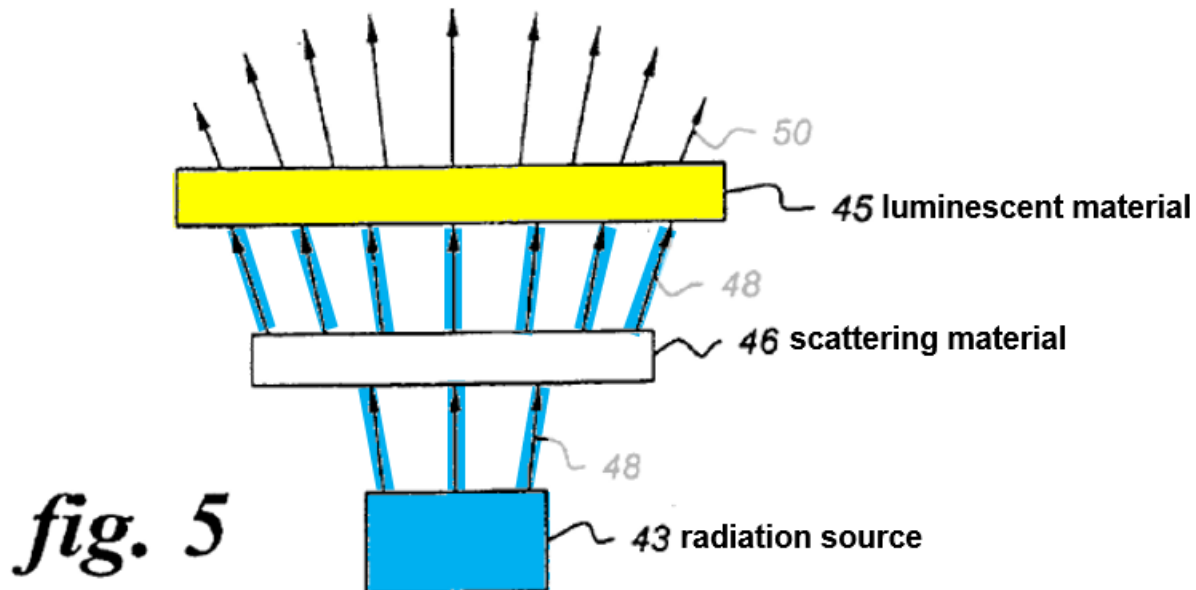
by such a system is directed onto a flat surface, it appears as a yellowish halo surrounding a bluish area”), 1:51-53 (“the penumbra effect is similar to the halo effect, except that the halo effect is a color separation effect, while the penumbra effect is a non-uniform intensity effect”), 2:62-63 (“the present invention is directed to overcoming or at least reducing the problems set forth above”). Whereas the light emission from LED chips is generally non-uniform (anisotropic), the light emission from phosphors is more uniform (isotropic). This mismatch results in the halo and penumbra effects described by Stokes.

14. As described in Stokes, “[t]he halo effect occurs due to the separation of blue and yellow light. The LED emits blue light in a directional, anisotropic fashion. However, the phosphor emits yellow light isotropically (*i.e.*, in all directions). Therefore, when the light output by the system is viewed straight on (*i.e.*, along the LED surface-normal emission direction), the light appears bluish white. In contrast, when the emitted light output by the system is viewed at an angle to the LED surface-normal emission direction, the emitted light appears yellowish due to the predominance of the yellow phosphor emission. When the light output by such a system is directed onto a flat surface, it appears as a yellowish halo surrounding a bluish area. The penumbra effect is similar to the halo effect, except that the halo effect is a color separation effect, while the penumbra effect is a non-

uniform intensity effect. The penumbra effect also causes the white LED lamp emission to appear brighter at the center than at the edges.” Ex. 1008 at 1:38-55.

15. Stokes addresses the halo / penumbra effect by making the blue LED light emission less directional (*i.e.*, more isotropic). Ex. 1008 at 3:51-57 (“the present inventors have realized that one of the causes of the halo effect is that due to the directional nature of the blue LED emission, a non-uniform source of blue light is incident on the phosphor layer.”). Stokes explains that this is accomplished by placing a radiation scattering material between the radiation source (*e.g.*, the blue LED chip) and the luminescent material (*e.g.*, the phosphor). Ex. 1008 at 3:63-4:2 (“When the radiation scattering material is placed between the radiation source and the luminescent material, the radiation source radiation being scattered isotropically, is made substantially uniform and diffuse prior to being incident on the phosphor Thus, the lamp emits white light with high far field color and intensity uniformity.”), 3:57-62 (“In order to obtain a significant decrease in the halo and/or penumbra effects, the radiation scattering material [46] is placed between the radiation source [43], such as an LED [], and the luminescent material [45], such as a phosphor [].”).

16. This configuration is demonstrated in Stokes Figure 5, which I have annotated below:



Ex. 1008 at FIG. 5 (annotated).

17. Stokes is critical of prior art embodiments in which the light scattering material 46 is positioned above, rather than below, the luminescent material 45. For example, Stokes acknowledges the Shimizu reference (Ex. 1010, Pat. 6,069,440) as one method that discloses placing the light scattering material above the luminescent (phosphor) material and expressly criticizes the resulting penumbra effect. Ex. 1008 at 2:23-64. Stokes similarly criticizes other prior art embodiments that placed the light scattering material above the luminescent material. *Id.* at 1:36 – 2:22.

18. Stokes cites multiple reasons why it is more advantageous to place the luminescent (phosphor) layer above the light scattering material:

- Stokes indicates that “one purpose of the scattering layer between the radiation source, such as the LED or a laser diode, and the luminescent

material, such as a phosphor, is to make the blue light source appear more similar to the yellow light source. Thus, the blue light source effectively loses the memory of the LED or laser diode chip geometry, and the resulting collimation, by virtue of having been scattered by the scattering layer.” Ex. 1008 at 4:3-10.

- Additionally, “[i]f the radiation source is a higher intensity laser diode, then the scattering layer serves the additional purpose of lowering the intensity of the radiation incident on the phosphor, so as not to allow the intense, highly collimated and coherent laser radiation to damage the phosphor layer.” Ex. 1008 at 4:10-15.
- Another stated benefit of placing the scattering material 46 between the LED chip and the phosphor is to maintain the integrity of the phosphor itself. Stokes explains that “[b]y placing material 46 between the phosphor 45 and the LED 43, the phosphor 45 will remain cooler than if the phosphor 45 was in direct contact with the heat emitting LED 43. Stokes explains that this configuration is advantageous because it reduces or eliminates the reversible thermal quantum efficiency degradation of the phosphor 45 during the operation of the lamp 41.” Ex. 1008 at 6:13-19.

19. In my opinion, one of skill in the art could not have combined Stokes with any of the other cited references in order to arrive at the '678 Patent claims because the phosphor is the exterior coating of the Stokes filament. *See* Ex. 1008 at FIG. 5. An observer looking at the Stokes filament would see the phosphor layer on the outside. By contrast, the '678 Patent sought to avoid placing the phosphor layer on the outside of the filament because the yellowish appearance of an off-state phosphor “may be undesirable to the potential purchaser or customer that is seeking a white-appearing light.” Ex. 1001 at 11:17-18; *see also id.* at 2:47-51 (there is “a need for an improved approach to implement LED lighting apparatuses which . . . addresses the non-white color appearance of the LED lighting apparatuses while in an OFF state.”). Placing the phosphor on the outside of the LED filament, as Stokes suggests, would not serve the stated purpose of the '678 Patent because an observer would not see an improved OFF-state white appearance. Instead, an observer would see the same traditional phosphor color, frequently yellow, that the '678 Patent described and criticized in the prior art embodiments.

20. Additionally, based on my review of the Petition, it is unclear how one of skill in the art would have modified the primary references in light of Stokes to arrive at the invention recited in claims 11-14. For example, claim 11 requires that “the light scattering material has an average particle size that is selected such that

the light scattering material will scatter the excitation light relatively more than the light scattering material will scatter light generated by the at least one photoluminescence material.” But, as shown in Stokes Figure 5, the light scattering material 46 in Stokes cannot effectively scatter any light from the photoluminescent material because it is between the radiation source 43 and the photoluminescent material 45. Ex. 1008 at FIG. 5.

21. Claim 12 requires that “the light scattering material scatters the excitation light at least twice as much as light generated by the at least one photoluminescence material.” For the same reasons discussed above, this does not occur with the Stokes arrangement (*see* Stokes’ Figure 5) because the scattering material is between the LED chip and the luminescent material.

22. In addition to the language recited in claims 11 and 12 discussed above, attempting to combine Stoke with the other cited references runs counter to the ’678 Patent’s stated purpose for these claims. In particular, the ’678 Patent explains that the purpose of these limitations is to “substantially reduce the quantity of phosphor material required to generate a selected color of emitted light, since the light diffusing layer increases the probability that a photon will result in the generation of photoluminescence light *by directing light back into the wavelength conversion layer.*” Ex. 1001 at 3:24-28 (emphasis added). But the Stokes arrangement cannot

accomplish this purpose because the scattering material 46, which is between the radiation source 43 and the luminescent material 45, cannot “direct light back into” the luminescent material. In the Stokes configuration, light from the luminescent material 45 does not pass through the scattering material 46 (as shown in Stokes’ Figure 5).

23. There is no sensible way for a POSITA to have combined Stokes with Basin-2007 or Krummacher and arrived at the invention of claims 11-14. Positioning the scattering material 46 on the outside, as the Petition seems to suggest, would have run contrary to the express teaching in Stokes that the scattering material should be positioned between the radiation source 43 and the luminescent material 45. Conversely, positioning the scattering material 46 between the radiation source 43 and the luminescent material 45, as Stokes suggests, would not improve the OFF-state white color of the wavelength conversion component because the luminescent material (whether yellow, red, or green) would remain on the outside layer and visible to an observer in the OFF state. The Petition fails to explain how either of these options would have motivated a POSITA to combine Stokes with Basin-2007 or Krummacher. In my opinion, that is because Stokes provided no such motivation. On the contrary, Stokes explicitly taught away from positioning the scattering material on the outside.

24. Thus, in my opinion, a POSITA would not have been motivated or had a reasonable expectation of success to arrive at claims 11-14 of the '678 Patent by combining Stokes with the other cited references in Grounds 2 and 3 of the IPR2025-00260 Petition.

IX. CONCLUSION

25. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: July 25, 2025

By:



E. Fred Schubert