UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHENZHEN RONGLIDA TECHNOLOGY CO. LTD.

Petitioner,

v.

PATHWAY IP LLC

Patent Owner.

U.S. Patent No. 7,841,729

Case No. IPR2025-01231

Ex. 2038

SUPPLEMENTAL DECLARATION OF ERIC BRETSCHNEIDER, Ph.D.

I. Introduction

115. I am the same Eric Bretschneider who submitted the declaration in this proceeding as Exhibit 2036. My qualifications and experience are set forth in that declaration and my curriculum vitae attached thereto. I submit this supplemental declaration to address technical issues arising from the Board's Institution Decision.

116. The Board found that "naturally, some adaptation of Naghi's LED would be required to form a toroidal-shaped bulb with a reflector." Inst. Dec. at 27. Dr. Pattison's declaration provides no analysis supporting that characterization. I address below why the record does not support it and why the proposed combination fails on multiple independent technical grounds.

117. My opinions are based on my review of the Naghi patent (Ex. 1008), the Dine patent (Ex. 1006), the Pattison Declaration (Ex. 1017), and the Institution Decision, as well as my more than 30 years of experience in LED design, fabrication, optical engineering, and thermal management.

II. The Spectral Output and Luminous Efficacy of an LED Are Products of Its Semiconductor Architecture, Not Its External Physical Form

118. The spectral output and luminous efficacy of an LED are determined by its semiconductor architecture (layer sequence, composition, thickness) and phosphor coating. These parameters are established during fabrication of the LED chip and production of the LED package. A POSITA working in the LED field as

of January 2007 would understand that changing the external shape of an LED package, without altering its semiconductor junction or phosphor coating, does not change the spectral output or luminous efficacy produced by that junction. Those characteristics are products of the internal device structure. The external shape of the package is a housing, not a light source. Light is produced by the junction and phosphor, not the housing. These properties matter because Petitioner's stated motivation is achieving even, flattering illumination for webcam users. Pattison Decl. ¶ 64. Whether the combined device achieves that motivation depends on whether the adapted LED preserves the spectral output and luminous efficacy of Naghi's existing LED. Petitioner has not addressed that question. I have reviewed Dr. Pattison's declaration and find no analysis of this question. Pattison Decl. ¶¶ 59-65.

119. The light-emitting properties of an LED arise from a p-n junction formed by depositing precisely doped semiconductor materials on a substrate through epitaxial growth processes. The geometry of the light-emitting junction is typically determined at the fabrication stage by photolithographic processes operating at very tight tolerances. Changing the external geometry of an LED package does not alter the semiconductor junction inside it. Producing a toroidal LED would require fundamental alteration of the device's semiconductor architecture, not merely a change in external shape. A POSITA as of January 2007 would have understood this distinction clearly. Regardless of which specific LED Naghi uses, the wide-angle illumination Naghi discloses is a product of that LED's internal optical architecture, including its die geometry, reflector cup, and integrated lens. Petitioner has not identified what optical architecture Naghi's LED employs. Petitioner has not shown what adaptation would be required to preserve wide-angle performance in a toroidal configuration. Petitioner has not shown that

such an adaptation is feasible or that the result would match Naghi's existing wide-angle performance. The evidentiary gap exists regardless of which specific LED Naghi uses.

120. Dine's shadow-free illumination is not a product of toroidal geometry alone. Dine expressly attributes that advantage to the combination of circular tube geometry and concentric coaxial mounting around the camera lens axis. Dine describes the light as "produced in full circle about the camera lens" and "projected forwardly of the camera lens axis to provide shadow-free illumination…." Dine col. 3, l. 65-col. 4, l. 5. That result depends on both the generally circular tube geometry and the coaxial alignment of the tube with the camera lens axis working together. Circular geometry without coaxial mounting does not eliminate shadows; it changes their direction. Dine does not disclose toroidal geometry as an abstract design principle. In Dine's disclosure, toroidal geometry derives from a single physical object: gaseous discharge tube 10. Dine col. 2, ll. 8-16; Fig. 1. That tube is the only toroidal element Dine discloses. Dine teaches no process for applying toroidal geometry to a different light source technology. Petitioner's combination does not replicate Dine's shadow-free illumination advantage. Additionally, the spectral characteristics of Dine's light, its actinic, blue-heavy output, are consequences of the plasma discharge process occurring within the gaseous medium. They are not consequences of the circular shape of the tube. Changing the external geometry of an LED package does not alter the semiconductor junction or the spectral parameters determined by that junction. In my opinion, a toroidal LED would not replicate Dine's spectral output regardless of its shape, because that output is a product of gaseous discharge technology, not external geometry.

121. Petitioner has not shown that reshaping Naghi's LED into toroidal geometry would replicate Dine's illumination advantage. Dr. Pattison's declaration

identifies Dine’s illumination advantage as the motivation for the combination. Pattison Decl. ¶¶ 60–61. Dr. Pattison provides no analysis of whether a toroidal LED would produce the same spectral output or illumination characteristics as Dine’s gaseous discharge tube. I have reviewed Dr. Pattison’s declaration and find no analysis of this question. Pattison Decl. ¶¶ 59-65.

122. The Board’s Institution Decision relied on Dine’s illumination advantages to justify the combination while simultaneously holding that Dine contributes nothing physical to the combination. Inst. Dec. at 27. Those two positions are irreconcilable. Dine’s illumination advantage is a property of its gaseous discharge tube technology combined with its concentric coaxial mounting geometry, not of toroidal geometry in the abstract. In my opinion, reshaping Naghi’s LED into toroidal geometry would not replicate Dine’s illumination advantage, because that advantage arises from the gaseous discharge technology and the coaxial mounting, not from the circular shape of the tube alone. Additionally, no modifications to Naghi are required to achieve “the very uniform lighting effect that Dine taught.” Pattison Decl. ¶ 63. Dr. Pattison states “A POSITA would have appreciated that, to optimize the laptop user’s on-camera appearance, Naghi’s lighting apparatus should be capable of illuminating their face with ample, uniform light, without casting unflattering shadows (as disclosed by Dine).” Pattison Decl. ¶ 60. Dr. Pattison also opines that a POSITA would understand all types of cameras and that it is important to provide light that evenly illuminates the target subject or object to minimize reflected glare and shadows. Pattison Decl. ¶35. This necessitates that a POSITA understand the principles of lighting for cameras.

III. Shared Lighting Goals Between Camera Types Do Not Mean Shared Technology

123. Dr. Pattison opines that a POSITA would apply illumination technology from film photography to webcam imaging because cameras generally share the same lighting considerations. Pattison Decl. ¶ 35; Inst. Dec. at 27. In my opinion, shared lighting goals do not justify transferring specific technology from one imaging system to another without considering whether that technology is compatible with the image capture method. The goal of illuminating a subject evenly is common to many imaging applications. The technology appropriate for achieving that goal differs significantly depending on the image capture method. Indeed, one of the most common methods of optimizing a person's appearance on camera is the use of a key light and a fill light. Ex. 2038 ("Millerson") pp 74-77. As discussed and demonstrated below, this approach is inherent in the embodiments of Naghi and requires no modification and therefore a POSITA would have no motivation to modify Naghi.

124. Film photography relies on chemical reactions triggered by light striking a photosensitive surface. The entire frame is exposed simultaneously. A single high-intensity flash is sufficient to expose the film because the chemical reaction occurs across the entire surface at once. Webcam video capture relies on an array of electronic sensors that read out sequentially. The sequential readout means that a flash event illuminates some rows of pixels while others are not yet exposed, producing horizontal banding artifacts across the image. A POSITA who understood both technologies would recognize immediately that Dine's flash technology is unsuitable for webcam illumination for reasons that have nothing to do with the shape of the light source. Shared lighting goals do not establish that a

1952 film photography flash unit can supply illumination to an LED laptop webcam device in the January 2007 timeframe. Unlike a film camera, a webcam captures continuous frames using a digital image sensor. There is no shutter event. The sensor reads out continuously throughout a live video session. Adapting Dine's flash technology for continuous webcam illumination would require, at minimum, replacing Dine's flash gun with a regulated AC power supply capable of driving repeated plasma discharges at the frame rate of a digital video camera. Dine's enclosure is necessarily large because it must house a spark coil, high-voltage electrode, three-wire cable assembly, and gaseous discharge tube. That assembly is inconsistent with the small, lightweight construction that Naghi's design requires.

IV. Petitioner Has Not Identified Naghi's LED, and the LED Naghi Most Likely Uses Cannot Be Reshaped into Toroidal Geometry

125. Petitioner has not identified which LED Naghi uses. Naghi describes only "a wide-angle, white LED" without specifying form factor, die geometry, package type, or semiconductor architecture. Naghi col. 3, ll. 18–19. This matters because the feasibility of any modification to Naghi's LED depends entirely on the specific LED being modified. Without identifying which LED Naghi uses, Petitioner cannot show that modification is feasible. Petitioner has not made that identification, and neither has the Board.

126. Based on my review of Naghi's figures, the patent's technical description, and my more than 30 years of experience with LED technology, the LED depicted in Naghi is most consistent with a T1-3/4 (5 mm diameter) through-hole LED. I reach this conclusion for four specific reasons. First, Naghi's figures depict a small, bullet-shaped light source at the end of the flexible arm, consistent

with the T1-3/4 package geometry. Second, Naghi's power source is a single AA, AAA, or watch battery, Naghi col. 3, ll. 54–57, delivering milliamps of current at 1.5 volts or less; the T1-3/4 through-hole LED is among the LED form factors designed to operate at these low power levels. Third, Naghi describes no circuit board, no thermal management, and no optical diffusion elements, all of which would be required for any LED configuration more complex than a simple through-hole device. Fourth, Naghi emphasizes small size (less clumsy), low power, and simple construction throughout, Naghi col. 3, ll. 18–31, 54–57, all of which are defining characteristics of the T1-3/4 through-hole LED. A T1-3/4 LED is a bullet-shaped component with two wire leads and an epoxy lens molded directly over the semiconductor die. It has no circuit board. It is not a surface-mount device. It is one of the simplest and lowest-cost LED configurations available. That epoxy lens works together with the die geometry and reflector cup to determine the angular distribution of emitted light. Together these elements produce the wide-angle illumination Naghi specifically discloses. Naghi col. 3, ll. 18-19. Changing the external form factor of the device does not preserve that optical architecture or the wide-angle performance it produces. It is further noted that Dine's toroidal tube light is significantly larger and more cumbersome than Naghi's small and compact light source. It therefore follows that modifying Naghi's LED to match the size and bulk of Dine's light source would directly contravene one of Naghi's stated desirable features.

127. Naghi also discloses fuel cells as an alternative power source. Naghi col. 3, ll. 54–57. Fuel cells are electrochemical devices that produce low-voltage direct current output, typically in the range of 0.5 to 1.0 volts per cell. Like batteries, fuel cells operate at voltages orders of magnitude below the hundreds to thousands of volts required to ionize xenon or krypton in Dine's gaseous discharge

tube. No fuel cell configuration disclosed or suggested by Naghi approaches Dine's ionization threshold. Similarly, multiple AA or AAA batteries connected in series deliver DC voltage measured in single digits. No series combination of Naghi's disclosed batteries approaches the hundreds to thousands of volts required to ionize xenon or krypton in Dine's gaseous discharge tube. A POSITA with experience in both LED lighting and gaseous discharge technology would immediately recognize that none of Naghi's disclosed power sources can operate Dine's gaseous discharge tube.

128. Dr. Pattison describes LED fixtures as using "numerous individual LED devices integrated behind a diffusor and on a reflector to direct light towards a target." Pattison Decl. ¶ 43. Incorporating Dine's toroidal geometry into an LED configuration consistent with Dr. Pattison's own description would require arranging multiple discrete LED elements in a ring pattern on a substrate. That configuration raises a cascade of engineering questions that Petitioner has not addressed. A circuit board or equivalent substrate would likely be required to physically orient and interconnect multiple discrete LED elements around the ring, though the specific implementation would depend on design choices that Petitioner has not identified. Multiple LED elements operating simultaneously generate substantially more heat than a single LED element, and whether that thermal load requires a heatsink or other thermal management would need to be evaluated based on drive current, duty cycle, and junction temperature targets that Petitioner has not specified. A ring of discrete point sources produces visible hot spots and dark bands between sources without diffusion, and optical diffusion elements would likely be required to produce the uniform illumination that Petitioner attributes to the toroidal geometry. Naghi's disclosed power sources were designed to drive a single low-power LED. Whether any of those sources can supply the current

required for multiple simultaneously operating LED elements is a question Petitioner has not addressed. A heavier and larger assembly at the end of Naghi's flexible arm would also raise questions about whether that arm can maintain the position of the modified light source, which Petitioner has not addressed. These are not peripheral concerns. Each one bears directly on whether the modification the Board posits is feasible and whether the result would function as intended.

129. Dr. Pattison's own survey confirms that no toroidal LED appears anywhere in this record. In paragraph 43, Dr. Pattison describes LED fixtures as using "numerous individual LED devices integrated behind a diffusor and on a reflector," not a single toroidal LED element. Pattison Decl. ¶ 43. He identifies the toroidal light source options separately as "circular or toroidal shaped lamps such as the circline lamp type or compact fluorescent lamp (CFL) 'twister' lamps." Pattison Decl. ¶ 43. He places LEDs in a distinct category from toroidal light sources. In paragraph 44, when Dr. Pattison illustrates the prior art device most structurally similar to the claimed invention, his chosen example is "a fluorescent circline or toroidal lamp," not a toroidal LED. Pattison Decl. ¶ 44. Petitioner's own expert, when illustrating available toroidal light sources, relied exclusively on fluorescent devices.

V. Naghi's Own Disclosure Already Addresses the Shadow-Elimination Motivation Petitioner Attributes to Dine

130. Petitioner's stated motivation for reaching to Dine is illuminating the webcam user's face "without casting unflattering shadows." Pet. at 21; Pattison Decl. ¶ 60. Naghi's own disclosure already provides a path to that result without any secondary reference and without any modification to the primary reference. Naghi has not been shown to have a shadow problem. Further, the principle of

using multiple lights (e.g., key light and fill light) to provide optimal or uniform lighting was well known. Millerson pp 74-77 (Ex. 2038). This is clearly seen in the partial reproduction of Fig. 4.6 of Millerson below which demonstrates that a POSITA would be aware of the desirability of using two light sources on either side of the camera.

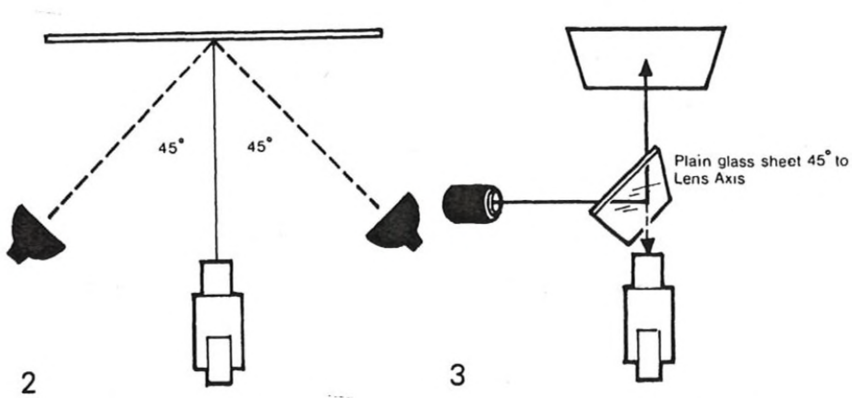
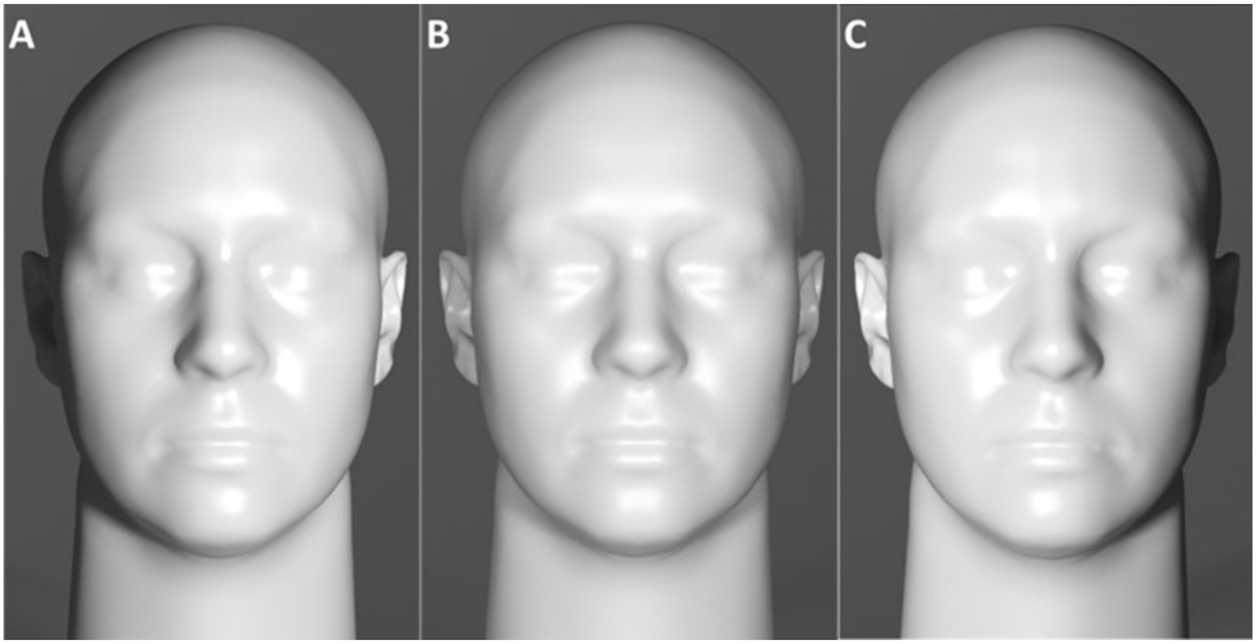


Fig. 4.6 Lighting a flat surface
1. Light from a frontal position near the camera (B), may reflect to produce hotspots, flares. Offset at (A) will overcome reflections, but may cause uneven illumination.
2. For critical work, dual lighting from either side (30–45° offset) is preferable. Soft-light sources reduce spurious surface texture or irregularities (blisters, wrinkles).
3. Shadowless lighting (along the lens axis) is necessary for multi-layer graphics (Pepper's ghost).

131. Figure 10 of Naghi discloses reading light 700 with a bendable body 704 having light sources 708 located at opposite terminal portions 712. Naghi col. 6, ll. 15–20; Fig. 10. Two light sources positioned to illuminate from two opposing directions substantially eliminate directional shadows because each light source fills the shadows cast by the other. This principle was well understood in the field of lighting design well before January 2007 and was known even to practitioners of lesser skill than a POSITA. It requires no secondary reference to implement. It requires only a second Naghi device of the type already disclosed and follows

standard lighting practices developed for television and film. To demonstrate this, I used SolidWorks which is a common CAD software package that includes photorealistic rendering capabilities. I imported a 3D model of a human head and then created two opposing light sources (key and fill) directed towards the front of the face. I then rendered three different scenarios[1]: (A) a single light source located on the right, (B) two light sources located to the right and left, (C) a single light source located on the left. The total amount of light emitted by the sources was kept constant for all three scenarios. Shadows are evident in the renderings opposite the light source in the renderings with a single light source (key light only). Notably, the rendering with light sources on opposing sides (key light and fill light) is shadow-free. This is fully equivalent to the well-known practice of using a key light and a fill light to provide optimal lighting. Thus, Naghi is inherently capable of providing even, flattering light (for better on-camera appearance) and thus would not be motivated to modify Naghi to achieve uniform lighting.

[1] Directions are based on the camera viewpoint, not the anatomical perspective of the head.



132. A POSITA seeking to eliminate shadows from a Naghi-type laptop illumination device would recognize that clipping a second Naghi light 800 on the opposite side of the webcam from the first achieves the shadow elimination Petitioner attributes to Dine. Naghi col. 7, ll. 18–37; Fig. 11. That solution requires no new technology, no redesign of the light source, no change in power system, and no secondary reference. Rather, it uses well-known practices in lighting for film and television. It uses the same LED, the same flexible arm, and the same clamp that Naghi already discloses. Petitioner has not addressed this simpler path anywhere in the record. The two-unit solution also carries a significant cost advantage. A second Naghi light 800 is an existing device requiring no development and no custom fabrication. The Board's shape-modification theory, by contrast, has not been shown to be achievable without, at minimum, a circuit board, heatsink, optical diffusion elements, and a larger power source, each of which adds cost and complexity. By necessity, modification of an existing device

or design requires expenditure of time and money and would thus be avoided unless actually necessary. A POSITA comparing these two paths to the same goal would not reach for the more costly and technically uncertain option when a lower-cost solution is already disclosed in the primary reference. Naghi itself is fully capable of achieving the desired results without modification and Petitioner's premise for modification is based on a desire to invalidate a patent (i.e., working backwards from the end result) and constitutes impermissible hindsight.

133. The two-unit Naghi solution carries an additional advantage over a toroidal ring that makes it the more logical choice for a POSITA. Unflattering facial shadows on webcam video are directional shadows that result from single-source lighting striking the face from one angle. They are not the complex geometric shadows produced in close-up photography of objects with deep recesses or irregular surfaces. Opposing light sources eliminate directional facial shadows without requiring the geometric precision of coaxial ring illumination. Each Naghi light 800 is mounted on a flexible arm that the user can independently position. Naghi col. 7, ll. 18–37. Two independently adjustable Naghi arms allow the user to direct more light towards the shadowed side and follow standard lighting practices well-known to a POSITA. That capability is not available with a fixed toroidal configuration. A POSITA comparing these two solutions would recognize that two adjustable Naghi units achieve the shadow elimination Petitioner's stated motivation requires, without any modification to the primary reference.

VI. Placing a Toroidal Ring Enclosure Around Naghi's Display-Embedded Webcam Obstructs the Display

134. Naghi's webcam embodiment shows laptop light 800 clipped to display frame 804 of laptop computer 808, with digital camera 818 embedded in the display frame. Naghi col. 7, ll. 18–37; Fig. 11. In my opinion, placing a toroidal ring enclosure around a camera embedded in a laptop display frame would obstruct a portion of the laptop display and render that portion unusable. For that reason alone, it would be untenable and a POSITA would be strongly motivated not to attempt the modification. As shown in Naghi's Figure 11, camera 818 is embedded within display frame 804, surrounded by display area on all sides. A toroidal enclosure must have an inner diameter at least as large as the camera lens to surround it, and an outer diameter substantially larger to house the light source and reflector. A ring enclosure of that minimum size placed around camera 818 would extend inward over the visible display area in every direction. That extension would block a portion of the visible screen regardless of where within the frame the camera sits. A POSITA who had worked on laptop display integration would recognize this immediately as an unacceptable design outcome. The magnitude of this obstruction is illustrated below in the annotated reproduction of Fig. 11 of Naghi shown below. This is irreconcilable with Naghi's stated design premise of a simple, lightweight, energy-efficient, economical device that does not interfere with the user's computing experience. Naghi col. 1, ll. 33-38, col. 7, ll. 18–22. By itself, this issue provides strong motivation for a POSITA not to modify

Naghi as proposed by Dr. Pattison. Dr. Pattison's declaration does not address this problem. Pattison Decl. ¶¶ 59-65.

135. Even if a user could bend Naghi's flexible arm to approximate a concentric position around the webcam, that approximation would not replicate Dine's shadow-free illumination. Dine's shadow-free illumination requires that the lens axis pass precisely through the geometric center of the ring and that this coaxial relationship be maintained throughout the illumination event. Naghi's arm is bendable by design, which means it is also re-bendable. It does not lock into position. This is especially problematic given that Naghi's arm is designed for a

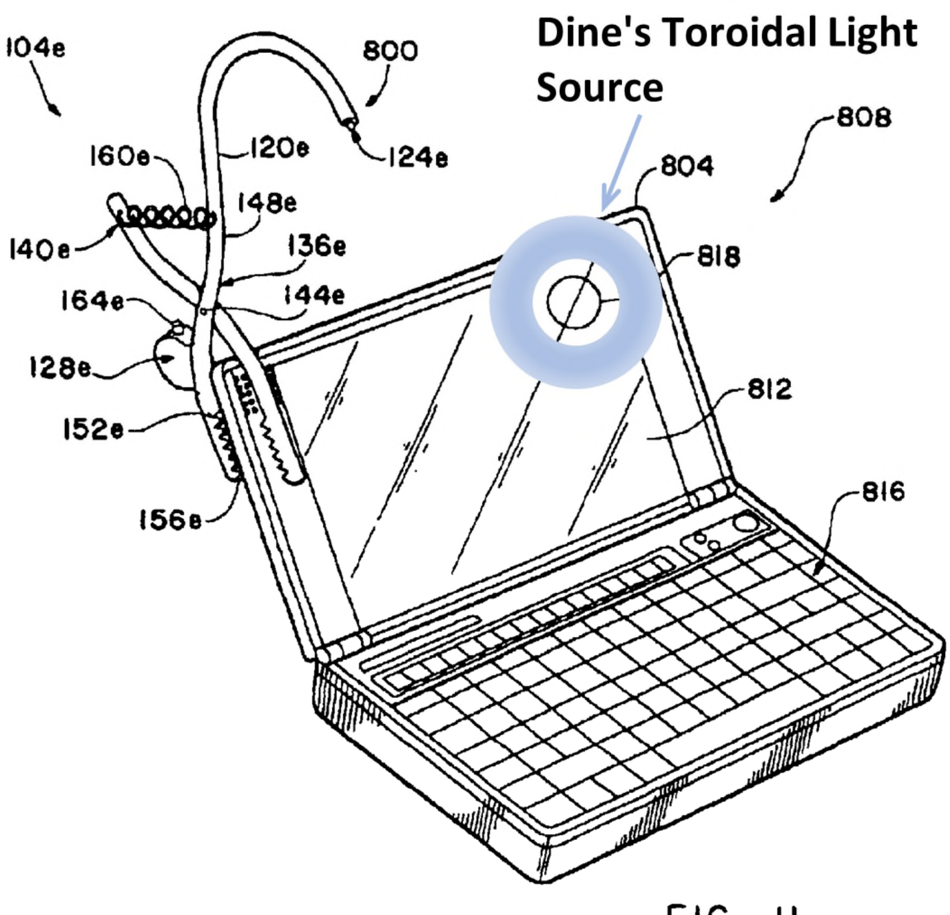


FIG. 11

small, less clumsy, light weight light source and not Dine's significantly larger, more cumbersome, and heavier light source. The modification would further preclude use of Naghi's modified light source as a reading light that could be clamped to the pliable pages and/or soft cover of a book or magazine. Naghi col. 4, ll. 18-31. Any incidental contact, vibration, or adjustment of the laptop would shift the arm and break whatever approximate concentricity the user achieved. Dine's threaded mounting mechanism is rigid and fixed precisely because the coaxial relationship must be maintained. Additionally, a user bending a flexible arm by eye cannot achieve the geometric precision that shadow-free ring illumination requires. An off-center ring light does not eliminate shadows. It changes their direction. Unlike two opposing light sources, which eliminate directional shadows across a range of positions, a toroidal ring depends on precise coaxial alignment. A slight shift off-center defeats the shadow-free principle. The functional benefit Petitioner relies upon disappears unless concentricity is both precise and maintained throughout use. Petitioner has not shown how Naghi's flexible arm configuration achieves or maintains that precision. Dr. Pattison's declaration does not address this question. Pattison Decl. ¶¶ 59-65.

VII. Converting Naghi's LED to a Toroidal Configuration Triggers a Cascade of Engineering Consequences That Violate Naghi's Design Objectives

136. Naghi's light source is a single, small, wide-angle LED powered by a low-voltage battery. Naghi col. 3, ll. 18–19, 54–57. As set forth in paragraph 128 above, converting that LED into a toroidal LED configuration would require consideration of, at minimum, a circuit board, a heatsink, optical diffusion

elements, a larger power source, a stiffer arm, and stronger clamps. Each of those engineering questions bears directly and independently on whether the modification is feasible and whether the resulting device would function as Naghi intends. The net impact of the proposed addition of Dine's toroidal light to Naghi's light source is not a modification, it is a complete redesign of virtually every component and feature.

137. Each of the engineering consequences identified in paragraph 128 above bears directly and independently on Naghi's explicit design objectives. Naghi describes laptop light 800 as "similar in construction to the reading light 100," Naghi col. 7, ll. 18–20, which is designed to produce a small reading light because "a low power draw allows for a small power source, and, hence, a small reading light." Naghi col. 3, ll. 23–26. To the extent a circuit board, heatsink, or diffusion elements would be required, each directly contradicts Naghi's small size objective. To the extent a larger power source would be required, it directly contradicts Naghi's low power draw objective. Naghi teaches that "a smaller reading light is also less clumsy than a larger reading light." Naghi col. 3, ll. 27–30. To the extent a stiffer arm would be required, it directly contradicts that objective. Naghi teaches that its LED is "small, lightweight." Naghi col. 3, ll. 29–31. To the extent a multi-element LED array would require a heatsink, the resulting thermal management assembly directly contradicts that objective. Naghi teaches that its LED "does not emit heat" and "can be formed into plastic without heat-warping effects." Naghi col. 3, ll. 33–36. To the extent a multi-element array generates substantially more heat than Naghi's single LED, that characteristic directly contradicts that objective. Naghi teaches that laptop light 800 clips to display frame 804 of laptop computer 808 (without damaging it). Naghi col. 7, ll. 18–22. To the extent stronger clamps would be required to support a heavier

assembly, they directly contradict that objective. Petitioner has not addressed any of these consequences. Dr. Pattison's declaration is silent on all of them. Pattison Decl. ¶¶ 59–65. Petitioner has not shown that a POSITA would have found any of these consequences acceptable or that the resulting device would have preserved any of the characteristics that define Naghi's invention.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct to the best of my knowledge.

Executed on: 10 April 2026

[signature]

Eric Bretschneider, Ph.D.