

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MOBILEYE GLOBAL, INC.,

Petitioner,

v.

FACET TECHNOLOGY CORP.,

Patent Owner.

Case IPR2024-01111

Patent No. 9,671,328

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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I. INTRODUCTION

Patent Owner's Response (Paper 25, "POR") raises many arguments but none that overcome the evidence in the Petition (Paper 1, "Pet."). Patent Owner tries to introduce a sequence requirement into certain claimed functions. These functions do not logically require a particular sequence, and the specification does not require it. In such situations, it is improper to import a sequence into the claims. Even if Patent Owner's overly narrow construction applies, Gallagher still satisfies the claims.

Many arguments directly contradict the cited references. For example, Patent Owner argues that Gallagher does not disclose determining a road marker's location, even though Gallagher discloses using GPS "to pinpoint the position of the ... markers." POR 29, 33; Ex. 1005 ("Gallagher"), [0048]. Patent Owner also argues that Schofield does not disclose using pattern recognition to detect objects of interest, even though Schofield discloses that "[p]attern recognition may be used to further assist in the detection of ... objects of interest." POR 31-32; Ex. 1006 ("Schofield"), 10:66-11:1. Patent Owner's other arguments regarding the prior-art disclosures and motivations to combine fare no better, as explained below.

Patent Owner disclaimed claims 17-22 after seeing the Petition. For the reasons discussed in the Petition and further below, the Board should cancel the remaining claims.

II. CLAIM CONSTRUCTION

A. The “detect” and “determine” functions in claims 1 and 9

1. Patent Owner’s improper attempt to insert “previously detected” into the claims

Patent Owner improperly tries to rewrite “the object of interest” in claims 1 and 9 as the *previously detected* object of interest. POR 14. Importing the words “previously detected” is not supported by the plain language, the specification, or the law. Consistent with the Board’s preliminary determination, claims 1 and 9 broadly encompass detecting objects of interest and concurrently determining whether the same object of interest includes a reflective surface. Paper 14 (“DI”) 29-30.

a. The intrinsic evidence does not support a sequence limitation

The Board should apply the general rule that the functions do not require a particular sequence. *Altiris, Inc. v. Symantec Corp.*, 318 F.3d 1363, 1369-70 (Fed. Cir. 2003). The caselaw is clear: Claimed steps need not be performed in a particular order unless (1) the claim language, “as a matter of logic or grammar,” requires a particular order or (2) the specification “directly or implicitly requires such a narrow construction.” *Id.* (citation omitted). Following the law, neither the claims nor the specification requires that the “determine” functions in claims 1 and 9 be performed after the “detect” function. Ex. 1001, 17:32-53, 18:22-44; *see id.*, 5:41-6:2.

First, the claims do not support Patent Owner’s construction. Claims 1 and 9 recite “a computer processing system” that performs certain functions, including “detect objects of interest within the field of view.” Ex. 1001, 17:44-53, 18:34-44. These objects (e.g., road signs or pavement markers) exist in physical space along a roadway. *Id.*, 17:32-53, 17:54-56, 18:22-44; *see id.*, 9:19-29 (“objects of interest 460 disposed adjacent a highway 150”), 12:30-34 (light “striking the object of interest 460”). The claims also recite other functions “for each object of interest,” including “determine whether the object of interest includes a reflective surface based on the light intensity values” (claim 1) or “determine whether the object of interest includes at least one light intensity value associated with a reflective surface of a road marker in the field of view” (claim 9). *Id.*, 17:44-53, 18:34-44. Because the objects of interest exist in physical space, the computer processing system need not wait for an object to be detected before starting these “determine” functions. If the computer processing system ultimately detects an object and determines whether the *same* object includes a reflective surface or an intensity value associated with a reflective surface, these limitations are satisfied, regardless of the order performed.

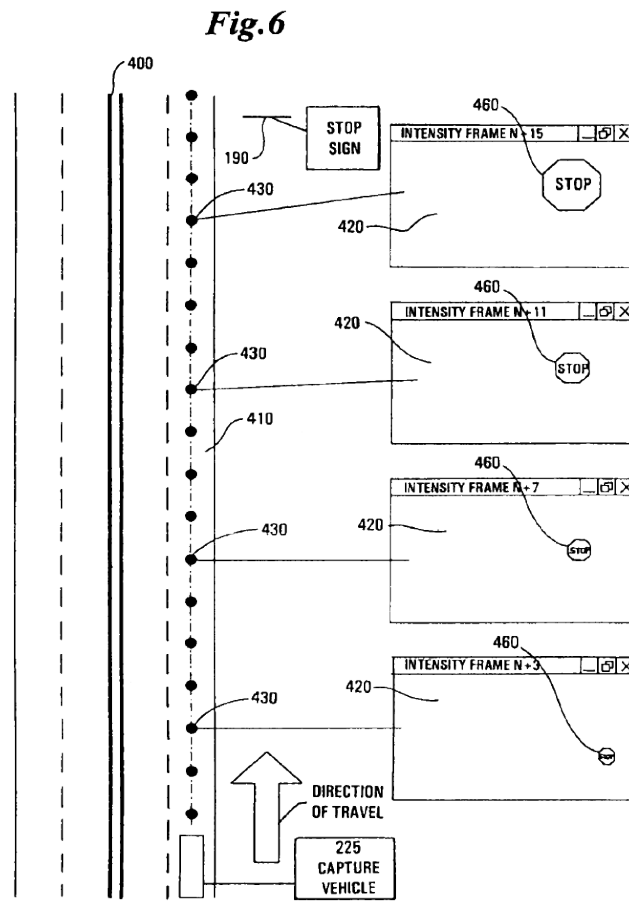
Patent Owner focuses on “the object of interest” to argue that the claims require a particular sequence. POR 14-15. This is a common error that courts have rejected. *See, e.g., Altiris*, 318 F.3d at 1368-71 (holding that “setting *said boot selection flag*” could “occur at any time” (emphasis added)); *Copy Protection LLC*

v. Netflix, Inc., No. 1:14-cv-00365, 2015 WL 4639954, at *8 (D. Del. Aug. 5, 2015) (requiring no particular order for the steps “(1) running a program portion to request access to *data*” and “(2) cryptographically protecting *the data*” (emphases added)). Where, as here, “the claim language does not tie” the steps together, such as by stating that one step is based on another step, the claim language does not require the steps to be performed in the order written. *Sunoco Partners Mktg. & Terminals L.P. v. U.S. Venture, Inc.*, 32 F.4th 1161, 1176-77 (Fed. Cir. 2022).

Second, the specification does not support importing a sequence requirement because it discloses that the functions can happen concurrently. The '328 patent discloses an embodiment with “light intensity measurement system 230” and “color image capture system 250.” Ex. 1001, 7:65-8:3. The objects of interest are preferably identified from images “generated by the color image capture system 250.” *Id.*, 8:35-40; Ex. 2023, ¶83. This identification is used to “generate an asset management database 24” that ultimately has “attribute and location information.” *Id.*, 5:41-45, 6:35-44, 10:18-21, 10:35-43.

The separate light intensity measurement system 230 captures “reflected light intensity frames 420,” which “show very few objects.” *Id.*, 10:59-11:9. In Figure 6, below, light intensity frames 420 show one object of interest 460, a stop sign. *Id.*, FIG. 6. In one embodiment, “a single pixel intensity value is selected and utilized

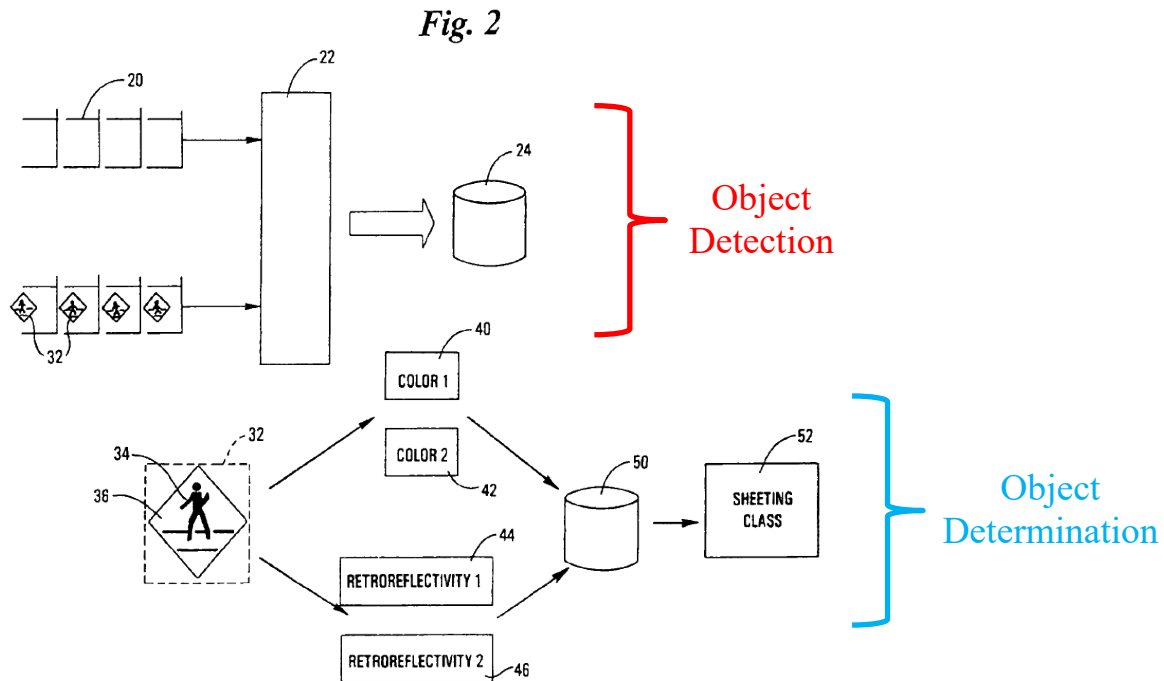
for the automated determination of a corresponding retroreflectivity value.” *Id.*, 11:45-50.



Id., FIG. 6.

Identifying an object from images need not occur before processing the light intensity frames. The image capture system and the light intensity measurement system “are preferably free running,” need not “be synchronized,” and even “could operate in completely different capture vehicles 225, if necessary.” *Id.*, 15:47-53. Even when they are in the same vehicle, the ’328 patent discloses that the processor

only “[p]referably” correlates image frames from the image capture system and intensity frames from the intensity measurement system, suggesting the processor can analyze frames from these separate systems independently. *Id.*, 8:40-43. As Figure 2 shows, the processor may “concurrent[ly]” (1) identify road signs and generate an asset management database 24 (top) and (2) determine retroreflectivity values for each road sign based on intensity measurements and classify the sheeting material (bottom). *Id.*, 5:34-6:44.



Id., Fig. 2 (annotated).

The '328 patent also discloses a separate configuration of determining retroreflectivity of reflective pavement markings. *Id.*, 1:7-27 (incorporating Exhibit 1011 by reference); Ex. 1011, 17:26-67, 18:28-30. For these objects of interest,

measuring intensity uses a different intensity sensor and must occur at “agreed-upon geometries” due to the lack of “correlation between pavement marking retroreflectivity (R_L) values with different geometries.” Ex. 1011, 17:36-58. The patent does not discuss the need for object detection to occur before the intensity values from this sensor can be analyzed.

The '328 patent does not support importing a sequence requirement. It discloses that object detection and determination of information about the object may be performed independently of each other and can execute concurrently. *E.g.*, Ex. 1001, 5:34-6:44. These functions could be satisfied, for example, if the computer processing system is configured to detect an object of interest along the roadway for one purpose (e.g., generate an asset management database) and to determine information about the same object of interest for another purpose (e.g., measure the retroreflectivity of a reflective surface of the object). The Board should reject Patent Owner’s invitation to add a sequence requirement where none is required. *Altiris*, 318 F.3d at 1370.

b. Patent Owner’s arguments do not support its construction

Patent Owner’s cited cases are readily distinguishable because they recite steps that logically cannot start until a prior step is complete. *See* POR 15-18. One case involved a method claim with two features “provid[ed]” in the first step and

needed to complete the second step. *Mantech Env't Corp. v. Hudson Env't Servs., Inc.*, 152 F.3d 1368, 1375-76 (Fed. Cir. 1998). Here, the “detect” function need not be completed before the “determine” function in the claims. In others, the claims referred to the completed results of the previous step (e.g., “transferring a data set” and then “storing *said transferred* data set”). *E-Pass Techs., Inc. v. 3COM Corp.*, 473 F.3d 1213, 1222 (Fed. Cir. 2007) (emphasis added); *see also Kaneka Corp. v. Xiamen Kingdomway Grp. Co.*, 790 F.3d 1298, 1306 (Fed. Cir. 2015). This is the language Patent Owner tries to improperly add to the claims by asking the Board to construe “the object of interest” as the *detected* object of interest. POR 14. Unlike *E-Pass* and *Kaneka*, the claimed “determine” functions do not refer to the output of the “detect” function.

Patent Owner alleges two cases “are particularly instructive.” POR 16-18 (citing *Mformation Techs., Inc. v. Rsch. in Motion Ltd.*, 764 F.3d 1392, 1399 (Fed. Cir. 2014); *Amgen Inc. v. Sandoz Inc.*, 923 F.3d 1023, 1028-29 (Fed. Cir. 2019)). Both are distinguishable. *Mformation* required a step to be first completed because to hold otherwise would read out the step. 764 F.3d at 1399. Petitioner’s interpretation does not read out the “detect” function, so *Mformation* is inapposite. *Amgen* relied on the logical sequence in the claims and the consistent description of the disputed steps in the specification as separate steps. 923 F.3d at 1028-29. Here, the claims do not logically require the “detect” step to be completed before the

“determine” step, and the specification allows the steps to be performed independently.

The DI correctly applied the legal standards and relied on *Cybersettle, Inc. v. National Arbitration Forum, Inc.*, 243 F. App’x 603 (Fed. Cir. 2007) to reject Patent Owner’s position. *See* DI 27-30. The Board’s discussion of *Cybersettle* and the ’328 patent’s disclosure of concurrent performance that follows the prior art shows the Board’s correct understanding of the claims. *See* DI 29-30. The claims do not preclude the computer processing system from concurrently determining whether an object of interest previously detected includes a reflective surface even as it continues to detect additional objects.

2. Patent Owner’s argument about the prior art simultaneously performing both steps

Separate from Patent Owner’s argument about the claims requiring a sequence, Patent Owner also argues that “the ‘detect’ and ‘determine’ steps cannot be simultaneously satisfied by the same act being performed on the same particular object of interest.” POR 14, 16, 23. Neither Petitioner nor the Board have ever contended that both steps can be satisfied with a single step.¹ Indeed, the Board

¹ Patent Owner’s infringement contentions conflict with its own interpretation here. Patent Owner did not identify any aspect of the accused products that allegedly

preliminarily found that the prior art separately satisfied both the “detect” and “determine” functions. DI 26, 34-36. Gallagher discloses both steps, as discussed below.

III. GROUND 1

A. The “detect” and “determine” functions ([1E]-[1F] and [9D]-[9E])

1. Gallagher discloses these features

Patent Owner incorrectly argues that the Petition does not show that Gallagher’s computer processing system is configured to perform both the “detect” and “determine” functions of claims 1 and 9. POR 23-27, 30-32. But even under Patent Owner’s overly narrow construction, which Patent Owner acknowledges does not require detecting “*all* objects of interest” “before the first determination take place,” POR 19, the Petition shows why Gallagher teaches these limitations. Pet. 20-23, 38-40.

Patent Owner mischaracterizes several disclosures from Gallagher. POR 23-25. Patent Owner argues Gallagher’s step d does not detect objects because the visual indicator only tells the driver which light sensor is reading the highest reflectance reading. POR 25-26. Patent Owner’s expert’s statement that object

performs the “detect” function and relied on Mobileye’s alleged “classification of light sources” for the “determine” functions. *See* Ex. 1035, 11-12, 30-31.

detection only “tells you that there is an object” belies this argument. Ex. 2023, ¶81. Gallagher’s computer in step d does that and more, by detecting the presence of an object of interest and providing a visual indicator of where in the field of view it was detected. Gallagher, [0010], [0060]-[0062]; *see also* Ex. 1030 (“Thorpe Suppl.”), ¶23.

For example, Gallagher’s Figure 2, below, depicts the vehicle 3 traveling along a roadway next to road markings that include raised pavement markers (red) and painted lines (light blue). Gallagher, [0033], FIG. 2; Ex. 1034 at 41:10-42:3, 46:25-50:19. Gallagher’s apparatus may “test the reflectivity” of both “reflective painted lines” and “raised pavement markers.” Gallagher, [0033]. As the vehicle moves, Gallagher discloses “determining the vehicle position on the road and providing” a “visual indicator means” that indicates “*the location of the said road markings* relative to the vehicle.” Gallagher, [0010] (emphasis added), [0060]-[0062]. This discloses detecting objects of interest. Thorpe Suppl., ¶¶26-29; Ex. 1034, 38:23-39:6 (Gallagher tests “do I have” a road marking).

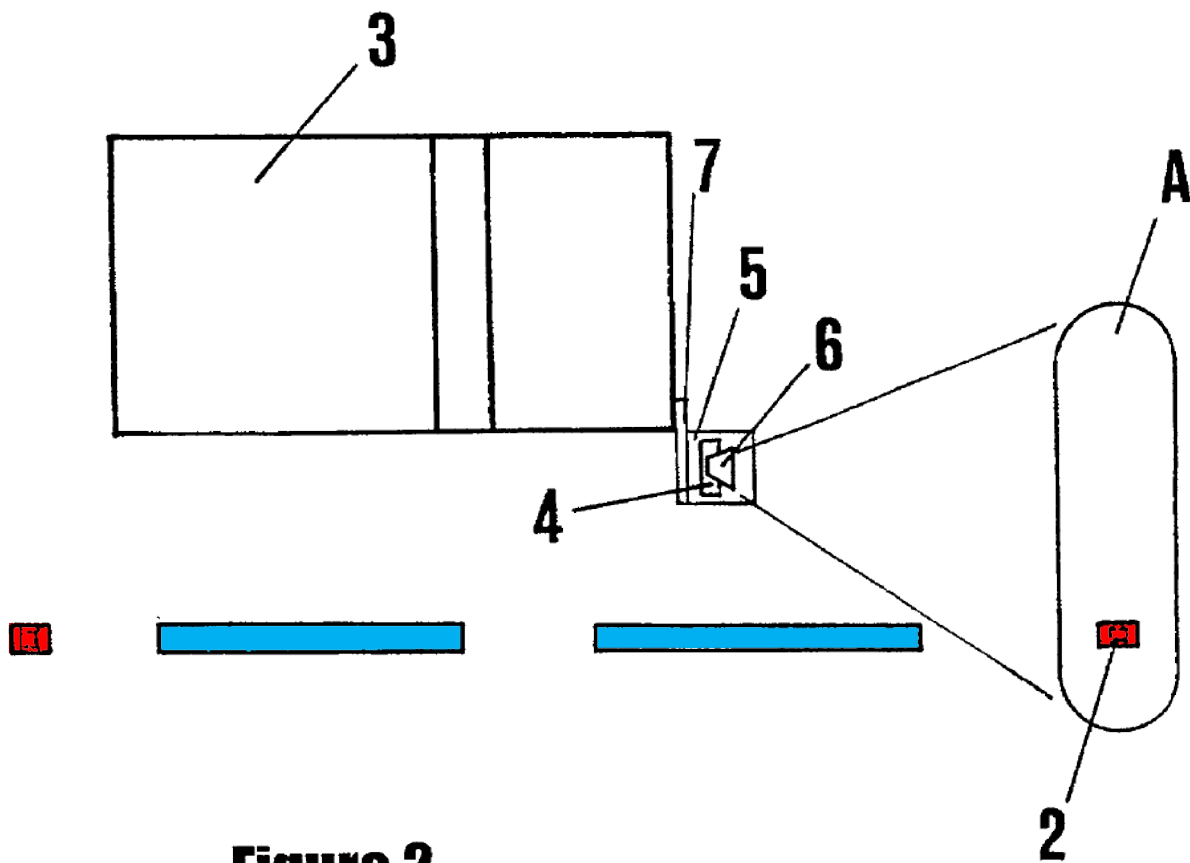


Figure 2

Gallagher, FIG. 2 (annotated).

Patent Owner contends that Gallagher’s visual indicator merely provides “the raw output of the sensor with the current highest intensity reading.” POR 25. Patent Owner overlooks that Gallagher discloses detecting the objects of interest for the visual indicator *after* filtering and calibrating the data in steps b-c, so this is not “the raw output” of data. Gallagher, [0057]-[0062]. When Gallagher’s computer “detect[s] which light sensor 6 is reading the highest reflecting reading,” it detects an object of interest because the computer distinguishes between “background

reflectance levels on non road marking sections of the road” and reflectance levels indicating a road marking. Gallagher, [0010], [0060]. The visual indicator’s purpose is to tell the driver where in the field of view each object of interest is located to help the driver maintain the vehicle’s positioning along the road. Gallagher, [0060]-[0062]; Thorpe Suppl., ¶30.

Patent Owner also overlooks part of step e. POR 24; Pet. 22 (citing Gallagher, [0063]-[0064]). Rather than “merely record[ing] the vehicle position,” POR 24, this step gets the vehicle position data and “determin[es] the distance travelled from the start position of the road marking test *so as to determine the location of each road marking.*” Gallagher, [0063] (emphasis added). This information is used to “tag or identify the road markers tested.” Gallagher, [0064]. This step, which occurs after the visual-indicator step, further undermines Patent Owner’s argument that the detected objects in the visual-indicator step are “never used again.” POR 25-26. Gallagher discloses that the computer detects the presence of each road marking and then uses the vehicle location data to determine their location. Gallagher, [0060]-[0064]. Indeed, Gallagher later discloses “storing ... the location and CIL levels of *each road marker.*” Gallagher, [0069] (emphasis added). The location of the detected road marker is determined in step e. Gallagher, [0063]-[0064]. Gallagher’s disclosure of detecting objects and storing the location information aligns with the ’328 patent’s embodiment of “identify[ing] each road sign 30 and generat[ing] an

asset management database 24 containing attribute and location information associated with each road sign 30.” Ex. 1001, 5:41-45; Thorpe Suppl., ¶31.

For the “determine” functions of [9E] and [1F], Patent Owner acknowledges that Gallagher’s step g performs these functions but argues this occurs only in a “single step approach.” POR 26-27, 30-31. Patent Owner’s “single step” argument is wrong because Gallagher’s computer detects objects of interest before step g, as previously discussed. Gallagher, [0060]-[0064]. Patent Owner and its expert fail to consider Figure 5, which illustrates the measured reflectance levels of road markings along a road. Gallagher, [0078]-[0079]. As Figure 5 shows, Gallagher’s computer stores the reflectance levels for the “Front Face” and “Rear Face” of *each* road marker tested, showing Gallagher’s computer detects road markers, determines their location, determines that they have front and rear reflective surfaces, determines the reflectance level in CIL of each reflective surface, and associates that information together in storage. Gallagher, [0060]-[0071], [0074], [0079], FIG. 5; Thorpe Suppl., ¶32.

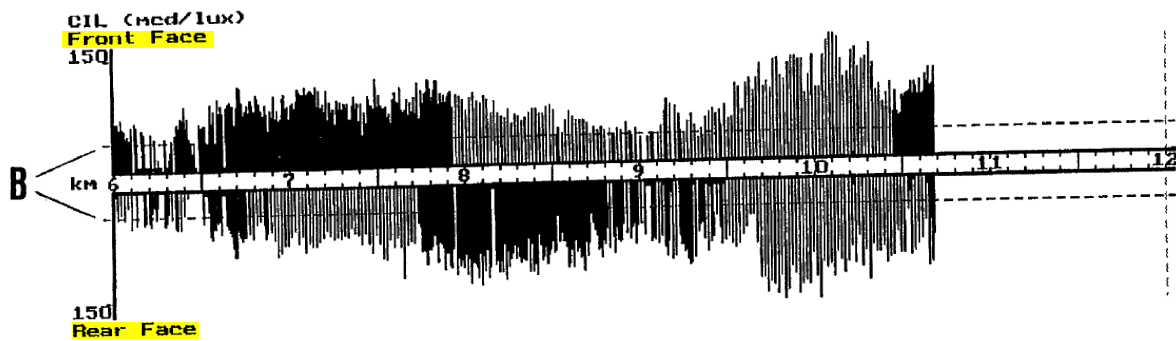


Figure 5

Gallagher, FIG. 5 (highlighted).

Patent Owner mischaracterizes steps f and g when it argues that “[r]oad markers are identified as being road markers from the light sensor data based simply on the presence of peak responses in the collected light sensor data, without any prior detection of objects of interest.” POR 26. Rather, Gallagher’s step f discloses “determining the background reflectance level on the road *and establishing non-marker reflectance levels.*” Gallagher, [0065] (emphasis added). Gallagher then uses those established non-marker levels (plural) to select “which reflectance levels indicate” a reflective surface of a road marker. Gallagher, [0065]-[0066]; Ex. 1003, ¶113; *see* Ex. 2026, 17:15-18:12; Thorpe Suppl., ¶33. If the light intensity values do not show a reflective surface where one should be, Gallagher’s apparatus notes “the location of [the] missing road marker[.]” Gallagher, [0023], [0070]. Gallagher discloses detecting an object and then tracking reflectance levels above the established non-marker reflectance levels as the object moves through the field of

view to determine which reflectance levels correspond to a reflective surface. Gallagher, [0065]-[0066]; Thorpe Suppl., ¶33.

Thus, Gallagher discloses both the “detect” and the “determine” functions, even under Patent Owner’s construction.

2. Gallagher and Schofield render obvious the “detect” function of claim 1 ([1E])

Patent Owner argues that it would not have been obvious to combine Gallagher and Schofield to detect objects of interest, as argued in the Petition. POR 31-32; Pet. 35-39. The Petition provided ample evidence of a motivation to combine Gallagher and Schofield to detect objects of interest. Pet. 35-39. The Petition identified Schofield’s disclosure of “[p]attern recognition,” which “may be used to further assist in the detection of ... objects of interest.” Schofield, 10:66-11:12. This “[p]attern recognition identifies objects of interest based upon their shape, reflectivity, luminance, and spectral characteristics.” *Id.*, 11:1-3. As the Petition states, these disclosures would have motivated a POSITA to combine Gallagher and Schofield to detect objects of interest because Gallagher’s apparatus measures reflectivity, Schofield’s image capture system finds objects based on their shape and color, and Schofield discloses that putting these together improves object detection. Pet. 35-36. Combining Gallagher and Schofield would have improved the accuracy

of Gallagher’s visual indicator, thus improving the driver’s ability to position the vehicle. Gallagher, [0060]-[0062]; Schofield, 10:66-11:12; Thorpe Suppl., ¶35.

Patent Owner and its expert argue that “Schofield does not use ‘pattern recognition’ to *detect* objects of interest or to make a determination as to a reflective surface.” POR 31-32; Ex. 2023, ¶114; This argument is meritless. *See* Thorpe Suppl., ¶36. Not only does Schofield disclose using pattern recognition to detect objects of interest, it uses that *exact* language. Schofield, 10:66-11:1 (“Pattern recognition may be used to further assist in the detection of ... objects of interest.”). Patent Owner’s expert lacks credibility for contending otherwise. Indeed, he argues that Schofield only uses pattern recognition “to identify that a particular light source is one which may be ignored.” Ex. 2023, ¶114. Schofield discloses the opposite, stating that pattern recognition “could be used to assist in qualifying or disqualifying objects.” Schofield, 10:66-11:12. Regarding determining a reflective surface, the Petition relies on Gallagher for performing that function, not Schofield. Pet. 39-40.

Patent Owner argues against combining Gallagher and Schofield because there purportedly is not a “straightforward way” to integrate Schofield’s camera-based approach with Gallagher. POR 33-36. Patent Owner’s motivation arguments are legally incorrect because “[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference.” *Allied Erecting & Dismantling Co., Inc. v. Genesis Attachments, LLC*,

825 F.3d 1373, 1381 (Fed. Cir. 2016). Petitioner need not explain precisely how parts from Schofield would be integrated into Gallagher to show obviousness, as Patent Owner contends. POR 34. Though this is not the case with Gallagher and Schofield, “it is not necessary that [the two references] be physically combinable to render obvious” the challenged claims. *Allied*, 825 F.3d at 1381. Dr. Thorpe testified that “there’s multiple ways to combine them” and gave several examples of how to combine them and why it would have been beneficial to do so. Ex. 2026, 105:8-111:5; Thorpe Suppl., ¶37.

Patent Owner argues that a POSITA would have considered the combination unworkable because it would require “sensor fusion.” POR 34-35. Not so. Dr. Thorpe testified that “[h]aving multiple observations of the same object with different sensors and different algorithms” to “increase[] the confidence of your detection” was “pretty elementary image processing,” dating back to 1972 with a robot navigating “using both a laser rangefinder and a video camera” and even his own use of sensor fusion in 1988. Ex. 2026, 108:12-110:2; Thorpe Suppl., ¶38. Dr. Thorpe explains that a POSITA would have considered combining Gallagher and Schofield to be straightforward based on disclosures like Schofield’s pattern recognition. Schofield, 10:66-11:12; Thorpe Suppl., ¶¶38-41.

Patent Owner also argues that “Gallagher and Schofield operate at highway speeds,” making sensor fusion more difficult. POR 35-36. But a POSITA would

have expected no issues with the processing requirements for sensor fusion, even at highway speeds. Thorpe Suppl., ¶42. At lower speeds, the combined apparatus would still provide benefits. Gallagher, [0032] (“speeds of *up to* about 100kph” (emphasis added); *see Honeywell Int’l Inc. v. 3G Licensing, S.A.*, 124 F.4th 1345, 1355-56 (Fed. Cir. 2025).

B. The “analyze” function of claim 9 ([9F]) and the “determine a location” function of claim 1 ([1H])

1. Gallagher discloses determining a location of each road marker

For claim 9’s “analyze” function and claim 1’s location-determination function, Patent Owner argues Gallagher only discloses giving “the location of *the vehicle* at the time the road marker is detected.” POR 29, 33. Gallagher says otherwise, disclosing that its GPS “can be used to pinpoint the position of the vehicle” *and* the “markers 2 as measurements are being taken.” Gallagher, [0048], [0063]. Figure 5 shows that Gallagher determines each road marker’s location because it combines each marker’s location with the CIL level of the front and rear surfaces, determined using forward-facing and rear-facing arrays, respectively. Gallagher, [0074], [0079], FIG. 5; Thorpe Suppl., ¶¶43-44. Since these arrays measure reflected light from different areas, Gallagher’s computer determines the location of the road markers to combine the CIL data for each road marker in storage. Gallagher, [0069], [0074].

2. Gallagher and Schofield render obvious the “analyze” function of claim 9

For claim 9’s “analyze” function, Patent Owner improperly attacks Schofield and Gallagher individually, arguing that “Schofield’s spatially separated regions are used to eliminate some erroneous headlight/taillight detections,” rather than using light intensity to assess the location of a road marker in the field of view. POR 28-29. It is improper to attack the references individually when “the grounds for obviousness are based on a specific combination of references.” *Palo Alto Networks, Inc. v. Centripetal Networks, LLC*, 122 F.4th 1378, 1386 (Fed. Cir. 2024). Moreover, Patent Owner mischaracterizes Schofield, which discloses “identifying point sources of light in any particular location within the scene” and applying “[a]dditional discrimination” by accounting for “the relative location of the source of light within the scene.” Schofield, 2:26-41, 9:24-29. Schofield uses the light source’s location within the scene to help *confirm* its identification. *Id.* As the Petition argues, it would have been obvious “to implement Schofield’s determination of a light source’s location within a field of view” to help to measure side-by-side road markers and correctly identify which ones did not meet the required reflectance level. Pet. 28-29. This combination satisfies the requirements of claim 9’s “analyze” function; Thorpe Suppl., ¶45.

Patent Owner also argues against a motivation to combine Gallagher and Schofield. POR 33-36. The Board should reject these arguments for the reasons discussed in Section III.A.2. These arguments are premised on implementing Schofield's camera into Gallagher's apparatus. POR 33-36. But for claim 9, the Petition proposes implementing Schofield's disclosure of pattern recognition to help with precisely identifying the location of side-by-side road markers. Pet. 23-25. As the Petition states, Schofield discloses this processing works with an array of photodiodes, giving a POSITA a reasonable expectation of successfully implementing this processing technique. Pet. 25 (citing Schofield, 2:36-41, 8:38-45, 9:26-32, 10:51-11:12; Gallagher, [0039], [0041]; Ex. 1003, ¶79); Thorpe Suppl., ¶¶46-48.

C. The “determining whether the reflective surface is a road marker” function of claim 1 ([1G])

Patent Owner argues the Petition improperly points to Gallagher's step g for both determining a reflective surface ([1F]) and determining whether it is a road marker ([1G]). POR 32. This oversimplifies Gallagher, as step g includes multiple parts. In step g, Gallagher's computer selects “which reflectance levels indicate” a reflective surface of a lane marker using the established “non-marker reflectance levels.” Gallagher, [0065]-[0066]. The Petition explains how this process determines “whether lane markers, including the painted lines of the lane and raised pavement

markers fastened along the lane, include a reflective surface by distinguishing their reflectance levels from the ‘non-marker reflectance levels.’” Pet. 40. Gallagher then discloses determining which of those reflective surfaces are road markers by disclosing that, “[i]n the case of road markers[,] the peak responses sensed are determined as the highly reflective surfaces of a road marker.” Gallagher, [0066]; Ex. 1003, ¶115. This involves determining whether each reflective surface corresponds to a painted line or a raised pavement marker. Gallagher, [0033], [0066], FIG. 2 (depicting painted lines and raised pavement markers); Ex. 1003, ¶115; Thorpe Suppl., ¶49. Accordingly, Gallagher discloses [1F] and [1G].

IV. GROUND 2

A. Claim 15’s “as part of the assessment of the discrete location”

Patent Owner incorrectly argues that the Petition does not address claim 15’s requirement of determining exemplary angular displacements “as part of” [9F]’s “assessment of the discrete location of the road marker within the field of view.” POR 37-39. Patent Owner misunderstands the combination. The Petition shows the obviousness of implementing “Frank’s laser diode that outputs a pulse-modulated floodlight beam as Gallagher’s light source” and “Frank’s determination of the distance to each identified retroreflector to improve Gallagher’s determination of the observation angle.” Pet. 47-51. This combination only added to the previously discussed Gallagher-Schofield combination and did not change the functionality

discussed in [9F]. *Id.* The Petition did not need to repeat its analysis in [9F]. *See* Pet. 23-26. The “as part of” language is satisfied by performing the functionality from [9F] and the added functionality discussed in claim 15.

B. Claim 15’s “determine exemplary angular displacements ... for each light intensity measurement from a reference position”

Patent Owner incorrectly argues that the Petition does not address claim 15’s requirement of “determining multiple ‘exemplary angular displacements’—plural—*‘for each light intensity measurement from a reference location.’*” POR 39-41 (emphasis in original). Patent Owner disregards claim 16, which depends from claim 15, reciting “each of the exemplary angular displacements of incident light comprises an observation angle corresponding to one of a plurality of distances of the light source from the road marker.” Ex. 1001, 19:5-9. Because the Petition’s claim 15 analysis complies with the narrower definition of “exemplary angular displacements” in claim 16 by showing the obviousness of determining an observation angle “for each reference position relative to the field of view,” it complies with the broader definition in claim 15. Pet. 47-51; *see Littelfuse, Inc. v. Mersen USA EP Corp.*, 29 F.4th 1376, 1380 (Fed. Cir. 2022).

C. Motivation to combine Gallagher, Schofield, and Frank

Patent Owner repeats its arguments against a motivation to combine based on the combination purportedly requiring “sensor fusion.” POR 41. But Dr. Thorpe

explains why a POSITA would not have expected issues with the sensor fusion discussed in the proposed combination. *Supra* Section III.A.2; Thorpe Suppl., ¶¶38-42. Incorporating laser rangefinder data was well known. Thorpe Suppl., ¶¶51-52.

Contrary to Patent Owner's argument, there is nothing incompatible with the combination. POR 41-43. Patent Owner focuses on the resolution of Gallagher's photodiode array. *Id.* But determining distance using an array with lower resolution would simply be less precise than an array with higher resolution, not incompatible. Thorpe Suppl., ¶52. Patent Owner improperly tries to limit Gallagher's array to 5 or 10 photodiodes when it is not so limited. POR 41-42; Gallagher, [0039] ("variety of light sensors" are suitable); [0040] ("higher number of light sensors"). As the Petition explains, a POSITA would have reasonably expected success because "Frank discloses that its determination can be carried out using a 'photodiode array,' like the one disclosed in Gallagher, or any 'other type of photosensitive array,' like Schofield's array." Pet. 51 (citing Ex. 1007 ("Frank"), 10:67-11:4, 13:64-14:15). Using Gallagher's or Schofield's arrays would have been compatible with Frank. Thorpe Suppl., ¶52.

Patent Owner tries to treat a POSITA like an automaton, contrary to the law. POR 42-43; *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007). Matching the scanning rate with the sampling rate would have been a matter of routine

implementation. Thorpe Suppl., ¶52. To the extent Frank’s laser “increase[s] the intensity of reflections from the road markers,” this would have only required adjusting the calibrations. Gallagher, [0058]-[0059]; Thorpe Suppl., ¶52.

V. GROUND 3

A. Claim 14’s “as part of the assessment of the discrete location”

Patent Owner repeats the same “as part of the assessment” argument from claim 15. POR 43-44. For the reasons discussed in Section IV.A, the Petition shows the obviousness of this limitation.

B. Claim 14’s “entrance angle”

Patent Owner’s “entrance angle” argument is premised on a typo in the Petition. POR 44-45. The Petition cites Frank’s disclosures of determining angle θ but mistakenly referred to “angle α .” Pet. 59-60 (citing Frank, 10:67-11:4, 12:21-39). The citation in the Petition shows that Petitioner intended to refer to angle θ , depicted in Figure 2 below and discussed extensively in the summary of Frank, for “Frank’s determination of its angle.” Pet. 59-60; *see* Pet. 44-47 (summarizing Frank, including its determination of angle θ). Dr. Thorpe clarified this during his deposition. Ex. 2026, 140:10-17.

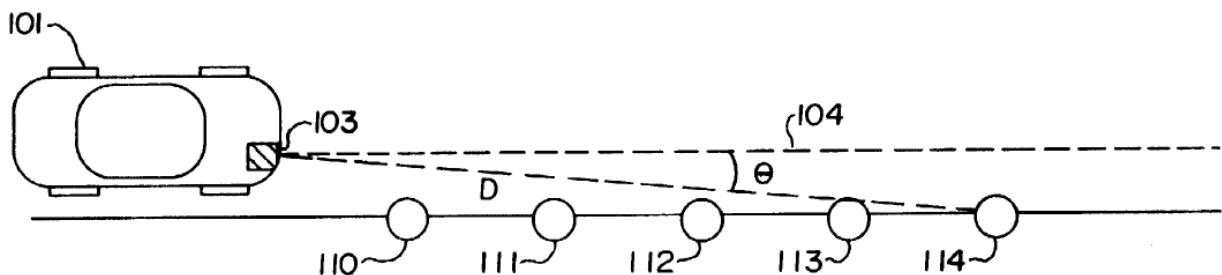
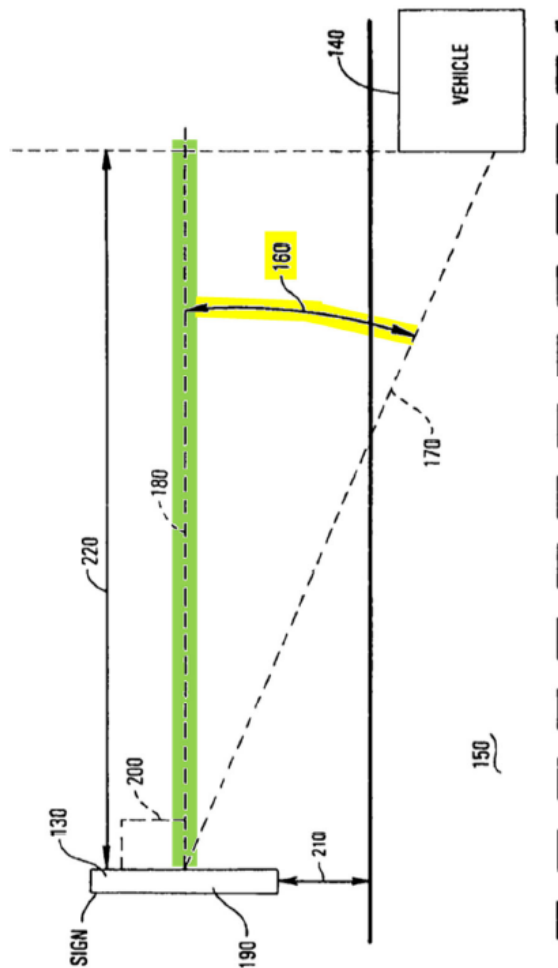


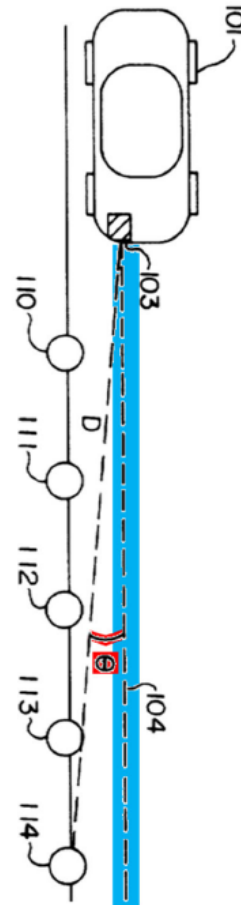
FIG. 2

Frank, FIG. 2.

Acknowledging that Patent Owner was on notice of Petitioner’s reliance on Frank’s angle θ , Patent Owner argues that angle θ is not an entrance angle. POR 45-47. This argument ignores basic geometry. As Dr. Thorpe explains, when the road marker is properly mounted, “traveling parallel to the lanes of the road would set the vehicle’s axis 104 parallel to the road marker’s normal direction, making Frank’s angle $[\theta]$ and the entrance angle equivalent.” Ex. 1003, ¶155. In Patent Owner’s drawings, reproduced below, the two highlighted angles are the same. Nothing in the claims prevents “the ‘assumption’ method,” as Patent Owner puts it. POR 47; Ex. 1001, 14:6-18 (“knowing the normal vector 180 to a sign 190 face is not required”).



Ex. 1001 ('328 Patent), Fig. 2. (annotated)



Ex. 1007 (Frank), Fig. 12 (annotated & rotated)

POR 46.

C. Motivation to combine

Patent Owner rehashes its motivation-to-combine arguments from grounds 1 and 3. These arguments fail for the same reasons discussed in those sections. *Supra* Sections III.A.2, III.B.2, IV.C.

VI. GROUND 4

A. Popovich is analogous art

Contrary to Patent Owner's arguments, Popovich is analogous art for the reasons discussed in the Petition. POR 48-50; Pet. 64. Popovich is in the same field, and its system for identifying a retroreflective target's position is reasonably pertinent to several problems discussed in the '328 patent, including "automatically identifying objects of interest without relying solely on 'template matching of shape and color.'" Ex. 1010 ("Popovich"), 5-7; Ex. 1001, 1:39-47.

B. Motivation to combine

The Petition shows why combining Gallagher, Leonard, and Popovich would have been obvious for each limitation in claims 5-7. Pet. 64-73. Patent Owner's argument about different embodiments in Popovich are inapplicable where, as here, the Petition explains why it would have been obvious to incorporate these teachings into the combination. POR 50-51; Pet. 64-69. Patent Owner's cited cases are inapposite because they relate to combining different embodiments in a primary reference without explanation, not incorporating teachings from a secondary reference into a combination. *See* POR 50. Patent Owner improperly attacks the references individually. Pet. 64-71; *Palo Alto*, 122 F.4th at 1386.

Patent Owner contends the combination includes "contradictions" but fails to explain how incorporating the distinct teachings from Leonard and Popovich are

incompatible with the teachings of Schofield incorporated for claim 1. POR 54-56. Patent Owner's argument that Gallagher cannot measure multiple markers simultaneously disregards Gallagher's disclosure of using the apparatus to measure multiple markers at once, such as for side-by-side markers. POR 55-56; Gallagher, [0039]-[0040], claim 6. It also disregards Gallagher's disclosure of "[a] variety of light sensors" being suitable and Leonard's disclosure of light sensors suited for this application. Gallagher, [0039]; Ex. 1009 ("Leonard"), 1:7-9, 5:54-64, 8:52-64; Pet. 68. The Petition identifies several benefits that would have motivated this combination. Pet. 64-69.

C. Patent Owner's claim 5 arguments

For the reasons explained in the Petition and Dr. Thorpe's accompanying declaration, the combination of Gallagher, Leonard, and Popovich renders obvious claim 5. Pet. 64-72. Patent Owner improperly attacks Popovich individually to argue that Popovich does not disclose the claimed comparison. POR 52-54. The Petition, however, explains why it would have been obvious to incorporate Popovich's teachings regarding the light source's varying intensity based on the light source vector and Popovich's determination of a "ray vector" to perform the claimed comparison. *E.g.*, Pet. 70-71 (citing Ex. 1003, ¶¶177-179; Gallagher, [0066]; Popovich, 2-3, 6-7, 10).

VII. LEVEL OF SKILL IN THE ART

Petitioner maintains that four years of experience is proper for the level of ordinary skill, not two. Thorpe Suppl., ¶21; *see* POR 13-14. Patent Owner does not argue this difference matters. POR 14. But even under Patent Owner's definition, the claims are still obvious. *See* Thorpe Suppl., ¶¶20-22.

VIII. PRIOR PTO ADJUDICATION

When the challenged claims have already been adjudicated before the PTO, the Board must explain if it reaches a different outcome. *See* Memorandum, "PTAB consideration of prior findings of fact and conclusions of law" (Sept. 16, 2025), *available at* https://www.uspto.gov/sites/default/files/documents/Memo_re_prior_findings_of_fact_and_conclusions_of_law_9_16_25.pdf. Claims 1-4 and 8-13 of the '328 patent have been finally rejected as obvious in reexamination 90/019,546.

IX. CONCLUSION

Claims 1-16 of the '328 patent are unpatentable should be canceled.

Date: September 17, 2025

Respectfully submitted,

/Cory C. Bell/

Cory C. Bell, Lead Counsel
Reg. No. 75,096

CERTIFICATE OF WORD COUNT

Under 37 C.F.R. § 42.24, Petitioner certifies that the word count of Petitioner's Reply to Patent Owner's Response (exclusive of any table of contents, table of authorities, required notices under § 42.8, certificates of service and word count, and list of exhibits or claim listing) as measured by Microsoft Word is 5,587.

Date: September 17, 2025

Respectfully submitted,

/Cory C. Bell/

Cory C. Bell, Lead Counsel
Reg. No. 75,096

CERTIFICATE OF SERVICE

The undersigned certifies that a copy of the foregoing **Petitioner's Reply to Patent Owner's Response** was served electronically via email on September 17, 2025, in its entirety on:

Michael D. Saunders
msaunders@prinelobel.com

Bryan D. Atkinson
batkinson@prinelobel.com

Patent Owner has consented to service by email.

Date: September 17, 2025

By: /Daniel E. Doku/
Daniel E. Doku
Senior Litigation Paralegal

Finnegan, Henderson, Farabow,
Garrett & Dunner, LLP