IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Valeo North America, Inc., Valeo S.A., Valeo GmbH,
Valeo Schalter und Sensoren GmbH,
and Connaught Electronics Ltd.
Petitioners

v.

Magna Electronics, Inc.
Patent Owner

U.S. Patent No. 8,643,724
IPR2015-_______

Mail Stop PATENT BOARD
Patent Trial and Appeal Board
United States Patent and Trademark Office
Madison Building (East)
600 Dulany Street
Alexandria, VA 22313

PETITION FOR INTER PARTES REVIEW U.S. PATENT NO. 8,643,724
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EXHIBIT LIST

Ex. 1001 U.S. Pat. No. 8,643,724 to Schofield.
Ex. 1002 Japanese Publication No. JP H7-30149 assigned to Masatoshi Yamamoto
Ex. 1003 Certified English Translation of Japanese Publication No. JP H7-30149 assigned to Masatoshi Yamamoto ("Yamamoto")
Ex. 1004 Japanese Publication No. H2-117935 assigned to Mitsubishi Motors Corporation
Ex. 1005 Certified English Translation of Japanese Publication No. H2-117935 assigned to Mitsubishi Motors Corporation ("Mitsubishi")
Ex. 1006 U.S. Pat. No. 6,553,130 to Lemelson ("Lemelson").
Ex. 1008 Certified English Translation of Japanese Publication No. JPA64-14700 assigned to Aishin Warner Kabushiki-Kaisha ("Aishin").
Ex. 1010 Great Britain Patent No. GB 2233530 assigned to Fuji Jukogyo Kabushiki Kaisha ("Fuji").
Ex. 1012 Certified English Translation of Japanese Publication No. H2-36417 assigned to Niles Co., Ltd. ("Niles")
Ex. 1013 U.S. Patent No. 4,963,788 to King ("King").
Ex. 1014 U.S. Patent No. 4,966,441 to Conner ("Conner").
Ex. 1015 U.S. Patent No. 5,793,420 to Schmidt ("Schmidt").
Ex. 1016 SAE Paper No. 871288 to Otsuka ("Otsuka").
Ex. 1017 U.S. Patent No. 4,833,534 to Paff (“Paff”).
Ex. 1018 U.S. Patent No. 4,390,895 to Sato (“Sato”).
Ex. 1019 SAE Paper No. 890288 to Goesch (“Goesch”).
Ex. 1020 Expert Declaration of Dr. George Wolberg
Ex. 1021 Dr. George Wolberg Curriculum Vitae
Ex. 1022 Expert Declaration of Dr. Ralph Wilhelm
Ex. 1023 Dr. Ralph V. Wilhelm Curriculum Vitae
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Ex. 1032  SAE Paper No. 750364 to Nolan
Ex. 1033  SAE Paper No. 890282 to Corsi
Ex. 1034  SAE Paper No. 890283 to Brandt
Ex. 1035  SAE Paper No. 860173 to Ortega
Ex. 1036  SAE Paper No. 930456 to Gumkowski
Ex. 1037  U.S. Patent No. 6,693,524 to Payne
Ex. 1038  SAE Paper No. 770274 to Smith
Ex. 1039  Declaration of Gerard Grenier in Support of IEEE publication
          Wang, G., et al “CMOS Video Cameras”
Ex. 1040  Tremblay, M., et al. High resolution smart image sensor with
          integrated parallel analog processing for multiresolution edge
          extraction, Robotics and Autonomous Systems 11 (1993), pp. 231-
          242.
Ex. 1041  Abstract for the Publication of High Resolution Smart Image
          Sensor
Ex. 1042  Lu, M., et al. On-chip Automatic Exposure Control Technique,
          – Seventeenth European (Volume:1)
Ex. 1043  IEEE.org Abstract On-chip Automatic Exposure Control
          Technique
Ex. 1044  CMOS sensor page of University of Edinburgh
I. INTRODUCTION


The ’724 patent is generally directed to a vision system for a motor vehicle. More particularly, the ’724 patent is directed to a multi-camera vision system for a vehicle that includes two or three vehicle-mounted image capture devices (i.e., cameras), an image processor, and a display to provide the driver with perspective of the vehicle’s surroundings. (Ex. 1001 at 2:23-35; 2:59-3:22 and Fig. 8). The image processor synthesizes the image portions captured by each of the image capture devices, resulting in a “synthesized image” characterized by the absence of duplicate objects that might otherwise appear in images due to the cameras capturing images having overlapping fields of view. (*Id.* at 7:5-16; 7:44-57; Fig. 3). Ultimately, a reconfigurable display device inside the vehicle shows the driver a synthesized image on a display that may also show other auxiliary information. The driver (or another user) may select the types of information displayed on the reconfigurable display.
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As demonstrated by various prior art references and as discussed in Section VIII (below) and in the declarations of Dr. George Wolberg and Dr. Ralph Wilhelm, submitted in support of this petition, motor vehicle vision systems and methods for processing image data to display a synthesized image to a driver of the vehicle and reconfigurable displays were well known to a person having ordinary skill in the art (hereinafter “PHOSITA”) well before May 22, 1996, the earliest claimed priority date of the ’724 patent, and thus, the challenged claims of the ’724 patent are obvious.

**II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(B)**

A. **Real Party-In-Interest**

Pursuant to 37 C.F.R. § 42.8(b)(1), Petitioner certifies that Valeo North America, Inc., Valeo S.A., Valeo GmbH, Valeo Schalter und Sensoren GmbH, and Connaught Electronics Ltd. are the real parties-in-interest.

B. **Related Matters**

Pursuant to 37 C.F.R. § 42.8(b)(2), Petitioner states that the ’724 patent attached as Ex. 1001 is involved in the litigation styled *Magna Electronics Inc. v. Valeo North America, Inc., et al.*, No. 2:14-cv-10540 (E.D. Mich.). In November 2014, Petitioner filed two petitions requesting IPR of the ’724 patent in Case Nos. IPR2015-00252 and -00253 (denied on May 13, 2015 at Paper 7, collectively “the ’252/253 IPRs”), and moved to stay the district court litigation pending *inter
Petition for *Inter Partes* Review of U.S. Patent No. 8,643,724

*partes* review. The court has not ruled on that motion.

C. **Lead and Back-up Counsel**

Pursuant to 37 C.F.R. § 42.8(b)(3), Petitioner provides the following designation of counsel, and pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition:

<table>
<thead>
<tr>
<th>Lead Counsel</th>
<th>Back-up Counsel</th>
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<tbody>
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D. **Service Information**

Pursuant to 37 C.F.R. § 42.8(b)(4), papers concerning this matter should be served on lead and backup counsel whose service information is provided above. Petitioner consents to service of papers in this proceeding by e-mail.

III. **NONREDUNDANT GROUNDS**

On May 13, 2015, the Board denied institution in the ’252/253 IPRs, finding the primary prior art combination of Nissan and Hino deficient. This petition presents further, non-redundant grounds for IPR. Although some prior art references were presented in the ’252/253 IPRs, this Petition presents for the first time new and previously unknown reference(s) and combinations of references,
and new and different arguments that could not have been presented previously, based on the results of prior art searches previously performed and/or interpretations of those references then-available to Petitioner.

None of the grounds of unpatentability in the current Petition rely on exactly the same combination of prior art as the grounds of unpatentability asserted against the same claims in the ’252/253 IPRs. For example, unlike the Petitions in the ’252/253 IPRs, which relied on Nissan and Hino for disclosing “approximates a view from a single location,” as claimed, this Petition relies on Yamamoto and Mitsubishi, which are more robust in certain important respects, and, unlike Nissan, were not cited to the Examiner in the prosecution of the ’724 patent.

Thus, this petition does not present “the same or substantially the same prior art or arguments” as have been presented in any earlier proceeding. Therefore, to the extent the Board interprets 35 U.S.C. § 325(d), (which is found in the section of the AIA relating to post-grant reviews but not in the provisions applicable to inter partes reviews), to apply to this inter partes review, the Director should not exercise discretion to reject this Petition under § 325(d). This Petition presents combinations of prior art references and arguments not previously presented or considered by the Board and, therefore, includes sufficiently distinct grounds to warrant institution of inter partes review, the Director’s statutory discretion under
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35 U.S.C. § 325(d) notwithstanding.

**IV. PAYMENT OF FEES**

Petitioner authorizes the Office to charge Deposit Account No. 50-0591 for the fee required by 37 C.F.R. §42.15(a) for this Petition and further authorizes for any additional fees to be charged to this Deposit Account.

**V. REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104**

As set forth below and pursuant to 37 C.F.R. § 42.104, each requirement for *inter partes* review of the ’724 patent is satisfied.

**A. Grounds for Standing**

Pursuant to 37 C.F.R. § 42.104(a), Petitioner hereby certifies that the ’724 patent is available for *inter partes* review and that the Petitioner is not barred or estopped from requesting *inter partes* review challenging the claims of the ’724 patent on the grounds identified herein. The ’724 patent has not been subject to a previous estoppel based proceeding of the America Invents Act (AIA), and the complaint was served within the last twelve months.

**B. Identification of Challenge**

Pursuant to 37 C.F.R. §§ 42.104(b)(1), Petitioner requests IPR of the Challenged Claims on the grounds set forth in the table below, and requests that the Challenged Claims be found unpatentable. An explanation of unpatentability is provided, indicating where each element is found in the prior art. Additional
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explanation and support for each ground is set forth in Exs. 1020 and 1022, Declarations of Dr. George Wolberg and Dr. Ralph Wilhelm.

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C. **Identification of Prior Art**

Pursuant to 37 C.F.R. § 42.104(b)(2), Petitioner identifies the references on which this IPR is based, each of which is prior art to the ’724 patent under 35
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U.S.C. § 102(a), (b), and/or (e):¹

(1) Japanese Publication No. JP H7-30149, assigned to Masatoshi Yamamoto ("Yamamoto," Ex. 1002 (certified English translation at Ex. 1003)), published on June 6, 1995, less than one year before the earliest effective filing date for the '724 patent (May 22, 1996), and is therefore prior art to the '724 patent under 35 U.S.C. § 102(a). *See also* Ex. 1020 at ¶¶ 62-69.

(2) Japanese Publication No. H2-117935, assigned to Mitsubishi Motors Corporation ("Mitsubishi," Ex. 1004 (certified English translation at Ex. 1005)), published on September 21, 1990, more than one year before the filing date for the '724 patent, and is therefore prior art to the '724 patent under 35 U.S.C. § 102(b). *See also* Ex. 1020 at ¶¶ 70-75.

(3) U.S Patent No. 6,553,130 to Lemelson ("Lemelson," Ex. 1006) was filed on June 28, 1996, and claims benefit to a parent application filed on August 11, 1993. Because Lemelson’s effective filing date (August 11, 1993) was before the '724 patent’s earliest priority date (May 22, 1996), Lemelson is prior art to the '724 patent under 35 U.S.C. § 102(e). *See also* Ex. 1022 at ¶¶ 44-48.

(4) Japanese Publication No. JP A64-14700 assigned to Aishin Warner

¹ The pre-AIA versions of 35 U.S.C. §§ 102 and 103 apply to the claims of the '724 patent.
Kabushiki-Kaisha ("Aishin," Ex. 1005 (certified English translation at Ex. 1008)) published on January 18, 1989, from an application filed on July 8, 1987. Because it published more than one year before the filing date for the ’724 patent, Aishin is prior art under 35 U.S.C. § 102(b). See also Ex. 1020 at ¶¶ 76-82.


(6) Japanese Publication No. 59-114139 assigned to Niles Co., Ltd. ("Niles," Ex. 1011 (certified English translation attached as Ex. 1012)) published on July 2, 1984, as a result of a Japanese patent application filed on December 17, 1982. Because it published more than one year before the filing date for the ’724 patent, Niles is prior art to the ’724 patent under 35 U.S.C. 102(b). See also Ex. 1020 at ¶¶ 87-90.

(7) GB Patent No. 2,233,530, assigned to Fuji Jukogyo Kabushiki Kaisha ("Fuji," Ex. 1010), published on January 9, 1991, more than one year before the filing date for the ’724 patent, and is therefore prior art to the ’724 patent under 35 U.S.C. § 102(b). See also Ex. 1022 at ¶¶ 49-52.

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*See also* Ex. 1022 at ¶¶ 53-56.


(10) U.S. Patent No. 5,793,420 to Schmidt (“Schmidt,” Ex. 1015) issued on August 11, 1998, from an application filed on February 20, 1996. Because Schmidt’s filing date (February 20, 1996) was before the earliest priority date for the ’724 patent (May 22, 1996), Schmidt is prior art to the ’724 patent under 35 U.S.C. § 102(e). *See also* Ex. 1022 at ¶¶ 61-63.

(11) SAE Paper No. 871288 to Otsuka et al. (“Otsuka,” Ex. 1016) published on November 8, 1987. Because it published more than one year before the filing date for the ’724 patent, Otsuka is prior art to the ’724 patent under 35 U.S.C. § 102(b). *See also* Ex. 1020 at ¶¶ 67-69.


(14) SAE Paper No. 890288 to Goesch (“Goesch,” Ex. 1019) published on
February 1, 1989. Because it published more than one year before the filing date for the ’724 patent, Goesch is prior art to the ’724 patent under 35 U.S.C. § 102(b). See also Ex. 1020 at ¶¶ 73-77.

D. How The Construed Claims Are Unpatentable And Supporting Evidence Relied Upon To Support The Challenge

Pursuant to 37 C.F.R. § 42.104(b)(4), an explanation of how the Challenged Claims of the ’724 patent are unpatentable under the statutory grounds identified above, including the identification of where each element of the claim is found in the prior art, is provided in Section VIII below. Pursuant to § 42.104(b)(5), Section VIII also includes the Exhibit numbers of the supporting evidence relied upon to support the challenges, identifies specific portions of that evidence, and explains the relevance of the evidence to the challenges raised.

VI. FACTUAL BACKGROUND

A. Summary of the ’724 Patent

The ’724 patent generally describes a driver assist vision system for a motor vehicle. Ex. 1001 at 2:59-3:22 and Fig. 1. More particularly, the ’724 patent describes a multi-camera vision system in which three image capture devices (e.g., cameras) are mounted on a vehicle and an image processor processes captured images in such a way as to display the vehicle’s surroundings in a synthesized single image to the driver of as the driver operates the vehicle. Ex. 1001 at 2:59-3:22 and Fig. 8. These image capture devices capture scenes exterior of the
vehicle and have zones of overlap with each other. Ex. 1001 at Fig. 1; 6:66-7:5.

According to the ’724 patent, an image processor processes the captured images and the result is a “synthesized image,” which shown to the driver on a reconfigurable display that can selectively display camera images as well as various auxiliary information of interest to the driver. Ex. 1001, 12:49-64; Ex. 1020 at ¶¶ 40-41. This “synthesized image” shows the perspective of a virtual camera at a single location exterior of the equipped vehicle (Ex. 1001 at 5:64-6:2), and has little or no duplication of objects that might otherwise be present due to overlapping portions of the fields of views of the image capture devices. Ex. 1001 at 7:5-16.

The drafters of the ’724 patent wrote a very lengthy specification with many different embodiments directed to different aspects of a generally conventional driver assist vision system, and then filed a series of continuation applications to cover the various embodiments of this unpatentable automobile vision system, each with an unusually large number of claims. The ’724 patent has 86 claims, some of which recite several alternatives, and all of which add conventional, well-known features to an otherwise unpatentable core invention. Due to its length and the many embodiments in the ’724 patent, Exs. 1020 and 1022 explain in detail the state of the art of various features that were well-known much before the time of the ’724 patent. It is well known, however, that claiming a conventional feature
from standard product configurations does not lend to patentability. Indeed, the
PHOSITA would expect such features to be practical to include in a driver assist
system, to make the system useful. See Ex. 1020 at ¶¶ 43-47.

This Petition and supporting evidence demonstrate each and every claimed
feature was well-known prior to the ’724 patent’s earliest effective filing date.

B. Summary of the Prosecution History

The application for the ’724 Patent was filed on March 13, 2013 and claims
priority to a series of parent applications with an earliest effective filing date of
May 22, 1996. A notice of allowance was mailed without any substantive Office
Action being issued in the application on December 11, 2013. After the Applicant
corrected minor informalities, the ’724 Patent issued on February 4, 2014.

C. Level of Ordinary Skill in the Art

The person having ordinary skill in the art as of the Filing Date of the ’724
patent would have had a bachelor’s or master’s degree in engineering, computer
science, or physics with some experience in the automotive industry (e.g., two to
five years). This person would also have had a working understanding of
combining image data from multiple cameras and microprocessor driven controls
for displays, actuators, and elementary decision making.

D. Declaration Evidence

Additional explanation and support for each ground is set forth in Ex. 1020,
VII. CLAIM CONSTRUCTION

Pursuant to 37 C.F.R. § 42.100(b), the challenged claims of the unexpired ’724 Patent shall receive the “broadest reasonable construction in light of the specification of the patent in which [they] appear[.]” 37 C.F.R. § 42.100(b). All claim terms not specifically addressed below have been given their broadest reasonable interpretations in view of the patent specification, including plain and ordinary meanings to the extent a skilled artisan could determine them.

All of the claims of the ’724 Patent recite the phrase “without duplication of objects,” which means that “there is minimal multiple exposure of objects appearing in overlap zones in the synthesized image.” All disclosures in the specification support this construction. Ex. 1020 at ¶¶ 55-56.

All of the claims of the ’724 Patent recite the phrase “reconfigurable display,” which means “a display in which a portion of the display upon which the

2 In IPR2014-00220, which involves U.S. Patent No. 7,859,565, a substantially similar patent with a nearly identical specification to that of the ’724 Patent, the Board construed “without duplication of image information” to mean “there is minimal multiple exposure in the composite image.” Paper No. 18, p. 11 at ¶2.
driver views the synthesized image is used as a high-information content display to selectively display various types of auxiliary information.” All disclosures in the specification support this construction. Ex. 1001 at 12:49-64; Ex. 1022 at ¶ 38.

All of the claims also include the term “said synthesized image,” which refers to “the image generated by combining the received image data captured by the image capture devices.” Ex. 1001 at 7:5-16. This construction is supported by the ’724 patent and was also adopted by the Board in IPR2014-00252 (Paper 7, 8). Ex. 1020 at ¶ 57.

Many of the claims of the ’724 patent recite the term “seamless,” which at its narrowest means “lacking any visible demarcation or border.” The language in the ’724 Patent supports this construction. Ex. 1020 at ¶ 59.

Claims of the ’724 patent also recite the phrase “panoramic view,” which means “a wide or elongated field of view rearward of the vehicle.” Although the phrase “panoramic view” is not specifically defined in the ’724 patent, all disclosures in the specification support this construction. There is no mention of “panoramic view” in the ’724 Patent that refers to any view other than a wide rearward view. Ex. 1020 at ¶ 58.

Many of the claims of the ’724 patent recite the phrase “wherein at least one of (a) vvv, (b) www, (c) xxx,” or more items in a list of distinct elements.
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This claim format was used by Patent Owner at the time the claims of the ’724 Patent were filed, i.e., in 1996, in a manner that differs from what subsequently became its customary interpretation after the CAFC’s 2004 decision in SuperGuide Corp. v. DirecTV Enter., Inc., 358 F.3d 870 (Fed. Cir. 2004). More specifically, this claim format was held in SuperGuide to require “at least one” of each identified category (the categories being indicated by “vvv,” “www,” “xxx,” “yyy,” etc.), in other words, a conjunctive list. In reaching that conclusion, the CAFC relied, in part, on the fact that the specification and drawings of SuperGuide’s patent both described and illustrated the invention as requiring at least one selection from each of the recited categories, and that interpreting the phrase to mean “any one or more of” would have contradicted the purpose of the invention. SuperGuide, 358 F.3d at 885-88.

In contrast to SuperGuide, the ’724 patent specification makes clear the claim format was intended to signify a disjunctive list of alternatives, with the presence of any one or more in an accused instrumentality intended to give rise to infringement. For example, claim 31 of the ’724 patent recites “wherein content displayed by said display screen of said reconfigurable display device is user-selectable via at least one of a keypad and a trackball.” A specification passage (Ex. 1001 at 13:3-7) describing this aspect of the claimed invention states “[t]he content of the auxiliary information displayed may be user-selectable by a keypad,
trackball, or other input device on the dashboard, steering column, or other position readily accessible to the driver.” (Emphasis added.) Additional examples are in claims 28, 57, 72, and 83. Corresponding passages in the specification again makes clear that “at least one of” means one or the other of a list of alternatives. See, e.g., Ex. 1001 at 10:60-7:22 (“Ambient light input 104 may be produced by a separate ambient light sensor of the type which…Alternatively, ambient light input 103 may be produced by…[listing alternatives].”) (emphasis added).

Unlike the use of “at least one of” in SuperGuide, there is nothing to compel, let alone suggest, that each and every item in the claimed lists of alternatives is necessary, or is required by the purpose of the invention. In many instances, such an interpretation would lead to plainly nonsensical results. In sum, all of the variations of “at least one of” as used in the claims should be construed to mean the same thing, that is, to introduce disjunctive lists of alternatives. Accordingly, a teaching of any one of the listed alternatives in any of the claim elements which recite the “at least one of” language found in the prior art is sufficient to render that element of the claim, in its entirety, disclosed in the prior art regardless of whether any of the other listed alternatives are also disclosed.

VIII. GROUNDS OF UNPATENTABILITY ON WHICH PETITIONER IS LIKELY TO PREVAIL
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A. [Ground 1] – Claim 19 is obvious in view of Yamamoto, Mitsubishi, Lemelson and Wang

Yamamoto is a published Japanese patent application that discloses a multi-camera vision system for a vehicle that provides a monitor for a driver of the vehicle to check the rear of the vehicle for safety while operating the vehicle. Ex. 1003 at Abstract. Specifically, Yamamoto teaches three cameras 1-3 mounted on an equipped vehicle (Ex. 1003 at FIG. 1) with overlapping fields of views and a television monitor installed near the driver’s seat to display the rear view, as shown in FIG. 5 of Yamamoto, which depicts a view that is exactly the view shown in FIGs. 3, 8, and 10 of the ’724 patent. Although Yamamoto does not explicitly describe an image processor, it discloses trimming image data and composing a single image, which would inherently require an image processor.

Mitsubishi is another published Japanese patent application, similarly directed to a multi-camera vision system that provides a rearward view to the driver, and specifically addresses methods for synthesizing an image that take into account the overlap between the images in a manner that reduces multiple exposure in the image shown to the driver. Ex. 1005 at FIG 3. Mitsubishi describes a system with up to six cameras, three cameras mounted in the front and three positioned at the rear of the vehicle, in a variety of arrangements so that their fields of view overlap. Id. at 3-4. The cameras capture images that are transmitted
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to an image processing circuit in digital form and synthesized, and the system then outputs a series of synthesized images to an image display unit. *Id.* at 5.

Yamamoto and Mitsubishi do not explicitly teach a reconfigurable display device; however, Lemelson does. Lemelson is a U.S. patent that describes one of the first vehicular systems designed around video cameras that scanned the roadway ahead of the vehicle to assist the driver for safe operation on the roadway. This robust driver assistance system not only included a forward looking camera, but also reconfigurable displays in the vehicle for the driver’s information. Lemelson contemplates a wide variety of features and alternative embodiments, including the use of multiple sideward and rearward cameras. The Lemelson system also included electronic processing of video signals using an on-board image-processing computer to generate electronic codes that served to identify obstacles in front of the vehicle and warn the driver in real time and actually avoid the obstacles and accidents in the process. Ex. 1006 at Abstract; 1:10-17; 6:46-54; 15:45-53.

Yamamoto, Mitsubishi, and Lemelson render claim 19 of the ’724 patent obvious. Because claim 19 depends from claim 1, discussion begins with claim 1.

**Claim 1 – [1.0]**: A multi-camera vision system for a vehicle, said vehicular multi-camera vision system comprising:"

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Yamamoto teaches “A set of three cameras is installed to an automobile and a monitor television installed near the driver’s seat to display the rear view.” Ex. 1003 at p. 1. Three cameras are also shown in FIG. 1 of Yamamoto, depicting a multi-camera rear view vision system, in which cameras 1-3 are mounted on a vehicle as shown, and reference numerals 5-7 depict the field of views (FoVs) of each of the cameras, respectively, exterior of the vehicle. The primary purpose of Yamamoto is to “provide[s] a monitor television system of automobile with which a driver of the automobile may check the rear view for safety driving,” which is precisely what the preamble of claim 1 of the ’724 patent requires.

[1.1]: “at least three image capture devices disposed at a vehicle equipped with said vehicular multi-camera vision system;”

As described above, FIG. 1 of Yamamoto shows three image capture devices (or cameras) 1-3 disposed at a vehicle having the rear view vision system.

[1.2]: “said at least three image capture devices comprising a first image capture device disposed at a driver-side portion of the equipped vehicle at a first location;” and

[1.3]: “said at least three image capture devices comprising a second image capture device disposed at a passenger-side portion of the equipped vehicle at a second location;”

Yamamoto provides that “[T]wo miniature cameras (1) and (2) are installed at the positions of the side mirrors or nearby of an automobile…” Ex. 1003, Claim 1. Yamamoto’s camera 2 is the “first image capture device disposed at a driver-side portion of the equipped vehicle” of limitation 1.2. Camera 2 is shown at the
driver-side portion of the vehicle in Yamamoto (i.e., the left-hand side of the vehicle in FIG. 1), which is the “first location” recited in limitation 1.2.

Camera 1 is the “second image capture device disposed at a passenger-side portion of the equipped vehicle,” located at the passenger-side portion of the vehicle, shown on the right-hand side portion of the vehicle in FIG. 1. Camera 1’s location is the “second location” recited in limitation 1.3.

[1.4]: “said at least three image capture devices comprising a third image capture device disposed at a rear portion of the equipped vehicle at a third location;”

In Yamamoto, “another miniature camera (3) is installed at the center of back side of the automobile.” Camera 3, shown located at the rear portion of the vehicle in Yamamoto’s FIG. 1, is the “third image capture device disposed at a rear portion of the equipped vehicle at a third location” of limitation 1.4.

[1.5]: “wherein said first image capture device has a first field of view exterior of the equipped vehicle;”

In Yamamoto, camera 2’s field of view, shown as the shaded region “6” on the left-hand/driver side of the vehicle in FIG. 1, is exterior of the equipped vehicle.

[1.6]: “wherein said second image capture device has a second field of view exterior of the equipped vehicle;”

In Yamamoto, camera 1’s field of view, the shaded region “5” on the right-hand/passenger side of the vehicle in FIG. 1, is exterior of the equipped vehicle.
[1.7]: “wherein said third image capture device has a third field of view exterior of the equipped vehicle;

In Yamamoto, camera 3’s field of view, the shaded region “7” to the rear of the vehicle in Fig. 1, is also exterior of the equipped vehicle.

[1.8]: “wherein said first field of view of said first image capture device overlaps with said third field of view of said third image capture device defining a first overlap zone;

Although Yamamoto’s FIG. 1 illustrates fields of view 6 and 7 intersecting at the darkened line that extends diagonally from the center of the rear bumper of the vehicle down and to the left, a PHOSITA would have known that fields of view do not abruptly end at the diagonal lines, but rather, have continuous lines of sight as far as an observer can see. Ex. 1020 at ¶¶ 97-99. Therefore, a PHOSITA at the time of the ’724 patent would have known from Yamamoto’s Fig. 1 that fields of view 6 and 7 would have overlapped to the left and rear of the vehicle, forming a region or zone of overlap where objects from both fields of view would appear. Id.

Mitsubishi also teaches the claimed overlap zones. FIG. 3 of Mitsubishi illustrates the operations performed by the claimed image processing circuit that address overlapping portions of images captured from multiple cameras. The
upper portion of FIG. 3 (shown above) shows “the comparison extraction unit 11 extracts three image patterns (for example, PTA, PTB, PTC) including a x b pixels from P1 image 14 in the overlapping portions c, d of P1 image 14 from the image input unit 8 for camera 1 and P2 image 15 from the image input unit 9 for camera 2.” Ex. 1005, 5. The lower portion of Fig. 3 shows how the images are synthesized and illustrates overlapping fields of view with diagonal lines in the sections of overlap between P1 and P2, and again between P2 and P3. Id. at 6. Thus, Mitsubishi explicitly teaches defined overlap regions as required by claim 1 of the ’724 patent. More specifically, overlap region c in Mitsubishi is the “first overlap zone” required by limitation 1.8. See also Ex. 1020 at ¶ 100. A PHOSITA at the time of the ’724 patent would have understood that various aspects of the Mitsubishi driver aid system would have been highly useful to incorporate into Yamamoto. For example, Yamamoto teaches trimming overlapping image data from multiple images to create a composite image with minimal duplication. Meanwhile, Mitsubishi describes a more sophisticated process of synthesizing images by an image processing circuit to deal with the overlap among the images captured by multiple cameras. Incorporating Mitsubishi’s improvements into the Yamamoto design would have made the Yamamoto design more robust and capable. It would have been within the ability of a PHOSITA to combine Yamamoto and Mitsubishi, as discussed further infra. Ex. 1020 at ¶ 101-103.
[1.9]: “wherein said second field of view of said second image capture device overlaps with said third field of view of said third image capture device defining a second overlap zone;

In FIG. 1 of Yamamoto, fields of view 5 and 7 are shown as intersecting at the darkened line that extends diagonally from the center of the rear bumper of the vehicle down and to the right (on the passenger-side) of the vehicle. Because fields of view of the cameras in Yamamoto do not abruptly end, but rather, have lines of sight, it would have been obvious to a PHOSITA at the time of the ’724 patent that fields of view 5 and 7 overlap to the right and rear of the vehicle, forming a region or zone of overlap where objects from both fields of view would appear. Ex. 1020 at ¶¶ 97-99. As discussed above, Mitsubishi explicitly teaches overlap regions c and d as shown in FIG. 3. Overlap region d in Mitsubishi maps to the “second overlap zone” required by limitation 1.9.

[1.10]: “wherein said first image capture device captures first image data;”
[1.11]: “wherein said second image capture device captures second image data;” and,
[1.12]: “wherein said third image capture device captures third image data;”

In Yamamoto, “three images captured by the television cameras (1), (2), and (3) is [sic] displayed…” and “…images captured by the three cameras are trimmed by the television monitor (4) to compose a single image to display.” Ex. 1003, ¶¶ 4-5. Yamamoto’s camera 1 is the “first image capture device” and it “captures first image data” as required by limitation 1.10. Camera 2 is the “second image
capture device” and it “captures second image data,” as required by limitation 1.11. Camera 3 is the “third image capture device” and it “captures third image data,” as required by limitation 1.12.

[1.13]: “and image processor;”

Yamamoto describes displaying the images captured by the three cameras 1-3 as a single image on a monitor for viewing by the driver. The driver is shown an image composed from the three camera images captured by cameras 1-3. The image shown to the driver is depicted in FIG. 5 of Yamamoto, as shown here.

A PHOSITA would have readily understood that to display images from cameras, some amount of processing of the raw image data from three cameras is inherently (and otherwise obviously) required before the image can be displayed as a single, composed image of a rearward view of the vehicle, as shown in FIG. 5 of Yamamoto. Ex. 1020 at ¶¶ 118-119. Yamamoto also describes image trimming, which is a form of image processing. Id.; Ex. 1003 at 5 (“images captured by the three cameras are trimmed by the television monitor (4) to compose a single image to display.”). Accordingly, Yamamoto inherently (and obviously) employs an image processor which processes the images from the three cameras to obtain the image shown in FIG. 5.
Further, Mitsubishi specifically teaches processing of images captured by cameras of a vehicular vision system. A PHOSITA would readily appreciate that the image processing circuit 4 of Mitsubishi is an image processor for processing the image data from the cameras. See FIG. 2 of Mitsubishi (shown here). Mitsubishi further states:

[A]s shown in FIG. 2, the digital video output from each camera (imaging device) is sent to the image processing circuit 4 described below, digital video processing is performed by the image processing circuit 4, and a series of synthesized images are outputted to an image display unit (display means) 7 such as a cathode ray tube or liquid crystal panel via a display output unit (the drive circuit functioning as the output interface) 6.

Ex. 1005 at 5:1-6. It would have been obvious to a PHOSITA that synthesizing images from the video output from each camera requires an image processor. Ex. 1020 at ¶ 120. Mitsubishi also describes an “image correcting unit 13,” which “corrects the images in order to join (synthesize) them by performing a coordinate conversion…”; another function that would require an image processor. Id.
As discussed, a PHOSITA would have found it obvious to combine Yamamoto and Mitsubishi to apply the image processing described in Mitsubishi to the image data captured by the cameras in Yamamoto. Further, such a combination would have been obvious at the time of the ’724 patent because a PHOSITA would have appreciated that both Yamamoto and Mitsubishi provide a rearward view to the driver operating a vehicle for enhanced driver safety. Further, Yamamoto and Mitsubishi each provide the driver with a synthesized image, *i.e.*, a single image composed from image data captured by each of the cameras. Ex. 1020, ¶¶ 101-102.

[1.14]: “wherein first image data captured by said first image capture device is received at said image processor via at least one of an analog data stream and a digital data stream;”

[1.15]: “wherein second image data captured by said second image capture device is received at said image processor via at least one of an analog data stream and a digital data stream;” and,

[1.16]: “wherein third image data captured by said third image capture device is received at said image processor via at least one of an analog data stream and a digital data stream;”

Yamamoto does not explicitly state the form of the data received by the processor. However, a PHOSITA would have known at the time of the ’724 patent that data could only be sent via analog or digital form because there was no other known form of receiving data. Ex. 1020 at ¶¶ 89-90. Accordingly, it would have been obvious to a PHOSITA that the vision system of Yamamoto sent image
data to be processed via either an analog or a digital data stream.

Further, Mitsubishi explicitly teaches “[T]he image processing circuit 4 functions as an image synthesizing means which synthesizes a series of synthesized images from the digital video output of the cameras 1-3 by digitally processing the digital video output from the cameras 1-3.” Ex. 1005 at 5. Because the data captured by each of Mitsubishi’s three cameras is output from the cameras in digital form and is received at the image processing circuit 4 in digital form, the data is received as a “digital data stream” as in limitation [1.16]. Ex. 1020, ¶¶ 89-90.

[1.17]: “wherein, responsive to processing by said image processor of received image data, a synthesized image is generated without duplication of objects present in said first overlap zone and in said second overlap zone…;”

In FIG. 5, Yamamoto shows a rearward view to the driver that has no duplication of objects in the regions of overlap between fields of view 6 and 7, and 5 and 7, respectively. Yamamoto also explicitly states that “cameras (1), (2), and (3) may be adjusted stepwise vertically, and at each step, images captured by the three cameras are trimmed by the television monitor (4) to compose a single image to display. Ex. 1003 at ¶ 5(i).” That is, Yamamoto reduces duplication by trimming the image data captured by each of the cameras before displaying the image data as a single composed image to the driver. See also Ex. 1020 at ¶¶ 104-109. That single image in Yamamoto is a “synthesized image,” as required by
limitation 1.17, and shows substantially the same view as shown in the '724 patent. Ex. 1003 at Claim 1; ¶ 5. The view shown in FIG. 5 of Yamamoto, without any explanation, would have informed a PHOSITA at the time that the Yamamoto system removed duplication in the same manner as later described in the '724 patent, and as claimed in 1.17. Ex. 1020, ¶ 106.

Mitsubishi also explicitly teaches reducing duplication in the overlap regions c and d of FIG. 3 by comparing the image data to identify matching patterns within the overlap regions. Ex. 1020 at ¶ 110. Mitsubishi states “[T]he image correcting unit 13 corrects the images in order to join (synthesize) them by performing a coordinate conversion on data with the same patterns (for example, PTA and PTA’) retrieved from overlapping portions c, d in P1 image 14 and P2 image 15.” Ex. 1005 at 6:1-10.

Modifying Yamamoto to apply the reduction of multiple exposure or duplication taught in Mitsubishi would have improved the image shown to the driver. It would have been obvious to a PHOSITA at the time to reduce duplication of objects appearing in the zones of overlap to avoid driver confusion and to depict the scene rearward of the vehicle in the safest manner. Ex. 1020 at ¶ 111.

[1.18]: “and wherein said synthesized image approximates a view as would be seen by a virtual camera at a single location exterior of the equipped vehicle;”
Yamamoto depicts the scene rearward of the equipped vehicle shown to the driver in exactly the same view shown to the driver in the ’724 patent:

<table>
<thead>
<tr>
<th>Yamamoto Fig. 5</th>
<th>’724 Patent Fig. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Yamamoto Fig. 5" /></td>
<td><img src="image" alt="’724 Patent Fig. 3" /></td>
</tr>
</tbody>
</table>

See also FIGs. 8 and 10.

As described in the ’724 patent, a PHOSITA would have readily appreciated that the rearward view shown to the driver in Yamamoto is from the perspective of a virtual camera located forward of the driver exterior of the equipped vehicle, looking rearward to capture the scene behind the driver. Yamamoto describes a system having three cameras, yet, the image in Fig. 5 shows one single rearward view as though it was captured by one camera located in a different place than any one of cameras 1-3. Thus, Yamamoto clearly shows a view from the perspective of a virtual camera at a single location. A PHOSITA would have readily appreciated that the virtual position could vary depending on the vehicle body type, yet nevertheless would have understood that the position that makes the most sense looking at Yamamoto’s FIG. 5 is one that is forward of and exterior to the vehicle cabin, aimed rearward of the vehicle. Ex. 1020 at ¶¶ 113-116.
Specifically, because objects captured sideward and rearward of the vehicle would be shown to the driver in FIG. 5 of Yamamoto, the virtual camera position that is most straightforward to a PHOSITA would be forward of the driver. *Id.*

[1.19]: “and wherein said synthesized image is displayed by a single display screen of a reconfigurable display device that is viewable by a driver of the equipped vehicle when normally operating the equipped vehicle.

Yamamoto teaches displaying the composed single image on a television monitor to the driver of the vehicle when the driver is normally operating the vehicle: “A driver may watch a television screen on which an image composed from three images captured by the television cameras (1), (2), and (3) is displayed, whereby it is easy to see behind the car at once using the television cameras in lieu of the side mirrors and the rear-view mirror.” See Ex. 1003 at ¶ 4.

Lemelson teaches that the display is a reconfigurable display:

[A]ctual image data can be displayed in real time using video display 55 via analog-to-digital converter 54. The image display may include highlighting of hazards, special warning images such as flashing lights, alpha-numeric messages, distance values, speed indicators and other hazard and safety related messages. Simulated displays of symbols representing the hazard objects as well as actual video displays may also be used to enhance driver recognition of dangerous situations.

Ex. 1006 at 6:46-54; Ex. 1022 at ¶ 83. It would have been obvious to a PHOSITA at the time of the ’724 patent to enhance the image shown to the driver in
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Yamamoto to include the wide variety of reconfigurable options taught in Lemelson to provide the driver with any other type of vehicular information in addition to a camera image. Ex. 1022 at ¶¶ 84-88.

Further, it would have been obvious to combine Yamamoto, Mitsubishi, and Lemelson, because a PHOSITA would have been motivated to enhance the multi-camera vision system of Yamamoto to include the better handling of overlapping regions, as taught by Mitsubishi, and to include the robust driver assist/awareness features that Lemelson describes. See Exs. 1020 at ¶¶ 101-102; 1022 at ¶¶ 82-89. Yamamoto and Mitsubishi are directed to exactly the same solution for showing the driver rearward view of the vehicle’s surroundings. *Id.* In addition, Lemelson describes the type of overall driver assist system in which a depiction such as that shown in Yamamoto and Mitsubishi would be used. *Id.*

**Claim 19 – [19.0]**: “The vehicular multi-camera vision system of claim 1, wherein each of said at least three image capture devices comprises a CMOS imaging array.”

Turning to claim 19, Mitsubishi teaches that the “imaging devices can be any type of imaging device able to output video images, such as video cameras, ITVs, and CCDs.” Ex. 1005, 7. Lemelson also teaches the use of CCD cameras. Ex. 1006, 6:30-33. However, Yamamoto, Mitsubishi, and Lemelson do not explicitly mention a CMOS video camera. Given Mitsubishi’s explicit mention of video cameras, it would be obvious to a PHOSITA to employ known types of
video cameras available at the time of the ’724 patent. Wang, a scholarly IEEE publication from 1991, discloses CMOS imaging arrays in video cameras for smart vision systems. Ex. 1009; see also In Re: Magna Electronics, Inc., No. 14-1798, 2015 U.S. App. LEXIS 7521, *8 (Fed. Cir. 2015) (finding “substantial evidence supports the Board’s finding that Wang teaches the use of CMOS cameras in “smart vision systems.”). A PHOSITA would have appreciated the claimed improvement of replacing Yamamoto’s, Mitsubishi’s, or Lemelson’s CCD cameras with the CMOS camera of Wang as a merely predictable use of prior art elements. Ex. 1020, ¶¶ 144-145.

B. [Ground 2] – Claims 7-9 and 20-22 are obvious in view of Yamamoto, Mitsubishi, Lemelson, Aishin

Claims 7 and 20 depend from claim 1, and claims 8-9 and 21-22 depend from claims 7 and 20, respectively.

Claim 7 – [7.0]: “The vehicular multi-camera vision system of claim 1, wherein the image displayed by said display screen includes a visual indication of the location of the equipped vehicle in said view.”

Claim 7 adds another obvious feature to the system of claim 1—“a visual indication of the location of the equipped vehicle”—which simply means that the synthesized image on the display shows the driver where the vehicle being driven would appear with respect to whatever is shown in the synthesized image. Yamamoto, Mitsubishi, and Lemelson do not explicitly discuss such a “visual
indication;” however, Aishin, a patent directed to a rearward view system, provides this additional feature. In describing a system that provides a rearward view to the driver, Aishin explains that to create perspective, frames set at regular intervals may be depicted along the path as shown in Fig. 3(b), or the vehicle body may be drawn as a box at a certain position according to the path of the front and rear wheels, as shown in Fig. 3(c). Ex. 1008, 7:11-20; Ex. 1020, ¶ 81.

It would have been obvious to a PHOSITA to combine Aishin with Yamamoto, Mitsubishi, and Lemelson because Aishin is directed to providing the driver with a view rearward of the vehicle, which is what Yamamoto and Mitsubishi aimed to accomplish, and Lemelson describes an overall robust driver assist system into which the features of Yamamoto, Mitsubishi, and Aishin would have been easily incorporated. Ex. 1020, ¶¶ 149-151. Moreover, Aishin explicitly states that the predicted path is displayed on a screen at the time of reverse travel of the vehicle (Ex. 1008 at p. 7), a feature obviously aimed to increase driver safety while backing up a vehicle. A PHOSITA at the time of the ’724 patent would have appreciated that aspects of Aishin’s design would have been highly useful to incorporate into Yamamoto, and the PHOSITA would have been motivated to improve Yamamoto accordingly. For example, Aishin’s feature of showing the predicted path of the vehicle to the driver when driving in reverse would have made the Yamamoto design more capable and provided more safety
information to the driver. These types of safety-enhancing improvements were common sense in the industry at the time. See also Ex. 1020 at ¶¶ 149-151; 176-177.

**Claim 8** – [8.0]: “The rearview multi-camera vision system of claim 7, wherein said visual indication approximates the footprint occupied by the equipped vehicle.”

**Claim 9** – [9.0]: “The vehicular multi-camera vision system of claim 7, wherein said visual indication comprises an outline of an area substantially occupied by the equipped vehicle.”

Aishin describes a multi-camera rearward view vision system in which the equipped vehicle body may be drawn on the display screen as a box. Ex. 1008 at 7:11-20. Aishin thus discloses a visual indication that both “approximates the footprint occupied by the equipped vehicle” and “comprises an outline of an area substantially occupied by the vehicle” as claimed in claims 8 and 9. Ex. 1008 at 7:11-20 and Fig. 3(c). Any difference between the drawn box shown in Fig. 3(c) of Aishin, and a “footprint” or “outline,” would not have been meaningful to a PHOSITA at the time of the ’724 patent because a footprint or outline of a vehicle would have been an obvious and predictable variation of Aishin’s drawn box. See also Ex. 1020 at ¶¶ 176-178.

**Claim 20** – [20.0]: “The vehicular multi-camera vision system of claim 1, wherein the image displayed by said display screen comprises a graphic overlay.”

A “graphic overlay” is any additional information electronically overlaid or
superimposed onto the synthesized image displayed to the driver. Lemelson explicitly mentions highlighting or flashing colors to visually distinguish obstacles that are close to the vehicle. Ex. 1006 at 2:50-63. These are forms of graphic overlays superimposed on top of the vehicle surroundings that are shown to the driver. Meanwhile, Aishin discloses a display device for superposing and displaying a projected image by the camera and an image of a predicted path by the image processing device:

Path superposition device 6 takes as input the image of a field of rear or lateral vision from the video camera 7 on the vehicle, and the predicted locus read by the computer 2 for locus calculation to superpose and display (superimpose) the image and the predicted locus on a display 8.

Ex. 1008 at 2:5-18; 6:17-22. The motivation to combine these references is discussed above with respect to claim 7 and in Ex. 1020 at ¶¶ 149-151.

Claim 21 – [21.0]: “The vehicular multi-camera vision system of claim 20, wherein said graphic overlay comprises indicia of the anticipated path of travel of the equipped vehicle.”

As described above with respect to claim 20, the image of the predicted path in Aishin that is superimposed on the display is a “graphic overlay.” Because it shows the predicted path of the vehicle in reverse, Aishin’s graphic overlay includes “indicia of the anticipated path of travel of the equipped vehicle” as claimed. Ex. 1020 at ¶¶ 147-152.
Claim 22 – [22.0]: “The vehicular multi-camera vision system of claim 20, wherein said graphic overlay comprises indicia indicating distance to objects exterior the equipped vehicle.”

As described above with respect to claim 20, both Lemelson and Aishin teach graphic overlays. Further, Lemelson discloses overlaying distance to objects on the displayed image:

The image display may include highlighting of hazards, special warning images such as flashing lights, alpha-numeric messages, distance values, speed indicators and other hazard and safety related messages. Simulated displays of symbols representing the hazard objects as well as actual video displays may also be used to enhance driver recognition of dangerous situations.

Ex. 1006 at 6:49-55. Distance values are described in Lemelson as distance to objects exterior of the vehicle:

The preferred form of the invention provides audible and/or visual display means to cooperate in indicating to the driver of a motor vehicle both normal and hazardous road conditions ahead as well as driving variables such as distances to stationary objects, and other vehicles; the identification, direction of travel and speed of such other vehicles, and the identification of and distances to stationary or slowly moving objects such as barriers, center islands, pedestrians, parked cars poles, sharp turns in the road and other conditions.

Ex. 1002 at 2:23-32. Given that both Aishin and Lemelson disclose graphic overlays, it would have been obvious to a PHOSITA to provide distance to objects
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on the graphic overlay of the combined vision system of Yamamoto, Mitsubishi, Lemelson and Aishin. Ex. 1022, ¶ 103.

C. **[Ground 3] – Claim 24 is obvious over Yamamoto, Mitsubishi, Lemelson and Niles**

**Claim 24** – [24.0]: “The vehicular multi-camera vision system of claim 1, wherein the image displayed by said display screen comprises indicia and wherein said indicia responds to at least one of the vehicle's steering system, the vehicle's differential system and a compass.”

As described above, Lemelson teaches a robust system that displays indicia providing information to the driver. Although it would have been obvious to have information be responsive to the direction of travel of the vehicle, Lemelson does not explicitly discuss indicia responsive to the vehicle’s steering system. Such indicia are taught by Niles, a patent for a vehicle rearview monitoring device that electrically superimposes markers on a television monitor screen. Ex. 1012 at 0002. Specifically, Niles teaches markers 4 electronically superimposed on a displayed image, and a distance sensor 6 for measuring distance between the vehicle and objects to the rear. Ex. 1012 at 0002; Fig. 3. Niles also discloses a tire direction sensor and explains that the markers (indicia) displayed on the screen are dynamically adjustable based on the tire direction sensor:

When the steering angle data is inputted from the tire direction sensor, the marker position data may be retrieved from the ROM 9...Moreover, the marker position data that has been retrieved may be sent to the monitor television 2 through the interface 10, to be
displayed superimposed on the screen as a line of markers 3. Ex. 1012 at 0002. Because backing up is one of the most dangerous maneuvers in a vehicle, and is prone to many accidents, it would have been obvious to a PHOSITA to combine Yamamoto, Mitsubishi, Lemelson, and Niles to provide the driver with more information overlaid on the synthesized image when traveling in reverse. Ex. 1020 at ¶¶ 153-157. Similarly, it would have been obvious to a PHOSITA at the time of the '724 patent to enhance the driver assist vision system of Yamamoto to include a graphic overlay showing distance indicia indicating the distance to obstacles, where the distance indicia respond to parameters such as the vehicle’s steering system as described in Niles. Ex. 1012 at 0002, col. 2. A PHOSITA reading Lemelson would have found it obvious to turn to Niles to provide more information using such an overlay on the image displayed to the driver. Ex. 1020 at ¶¶ 153-157.

D. [Ground 4] – Claim 26 is obvious over Yamamoto, Mitsubishi, Lemelson, Aishin and Schmidt

Claim 26 – [26.0]: “The vehicular multi-camera vision system of claim 1, wherein the image displayed by said display screen comprises a graphic overlay that includes indicia of the anticipated path of travel of the equipped vehicle and wherein said graphic overlay is disabled when the vehicle's gear actuator is not in reverse gear.”

As described above with respect to claim 21 in Ground 2, Aishin teaches a graphic overlay that includes indicia of the anticipated path of travel of the vehicle. Ex. 1008 at 4:17-19. Although it would have been obvious to disable
features when they are not being used, the references discussed so far do not explicitly discuss disabling features when the vehicle’s gear actuator is not in reverse. Schmidt, a patent directed to a vehicle video recording system in which video recording is activated by a turn signal, discloses:

the system serves primarily as a means for displaying areas about the vehicle that are not normally viewable by the driver. As such, an additional circuit is supplied such that when a person puts the vehicle in "reverse", images received at the rear camera are automatically relayed to the display 34. It is well known to utilize the transmission of a vehicle as a switch and one skilled in the art is able to connect the rear camera to the display if the vehicle is placed in reverse.

Ex. 1016 at 9:16-26. It would have been obvious to combine Schmidt with Yamamoto, Mitsubishi, Lemelson, and Aishin, because Yamamoto, Mitsubishi and Lemelson, describe rearward travel and rear views being shown to the driver (Ex. 1003 at Abstract, 1005 at FIG. 3 and 1006 at 6:36-41). It would have been obvious to enhance these driver assist systems to include more information when reversing the vehicle, such as a predicted path of the vehicle, as described in Aishin. Ex. 1022 at ¶¶ 102-105. As Schmidt is directed toward a multi-camera video recording and display system for use in a passenger vehicle, it would have been obvious for a PHOSITA to look to Schmidt, particularly because it specifically addresses providing a means for viewing the blind spots of a vehicle,
means for deterring passengers’ inappropriate behavior and motorists’ unlawful behavior, as well as deterring vandalism. Ex. 1015 at 10:39-44.

Because Aishin explicitly provides for the display of a predicted path of the vehicle during reverse travel, which requires the vehicle to be in reverse gear, and Lemelson discloses a wide variety of information that can be presented to a driver at a given time to minimize collisions and assist the driver in avoiding hazards, it would have been obvious to disable certain information, such as the graphic overlay of the predicted path of the vehicle, when the vehicle is not in reverse gear, to allow more pertinent information to be displayed instead of a rearward scene, which is not required when the direction of travel is not rearward. Ex. 1022 at ¶ 103.

E. [Ground 5] – Claims 27 and 28 are obvious in view of Yamamoto, Mitsubishi, Lemelson, and Fuji

Claim 27 – [27.0]: “The vehicular multi-camera vision system of claim 1, wherein the display luminance of said display screen of said reconfigurable display device is variable responsive to a sensing of an ambient light level.”

Claim 28 – [28.0]: “The vehicular multi-camera vision system of claim 1, wherein the display luminance of said display screen of said reconfigurable display device is variable responsive to at least one of… (ii) an ambient light sensor…”

Both Yamamoto and Lemelson teach a display operable to provide the driver safety information in various environmental conditions. Ex. 1003 at ¶ 3(iv); Ex. 1006 at 4:8-15; FIG. 1 and Abstract. The references do not disclose, however,
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adjusting the display luminance of the reconfigurable display response to ambient light. Fuji, a patent directed to vehicular display technology, discloses a display screen having a display luminance variably responsive to sensing ambient light levels. Ex. 1010 at 7:25 – 8:25. Fuji therefore establishes that such adjustments were well-known in the art as necessary when a display in a vehicle operates under varying environmental conditions. *Id.* Fuji discloses sensing means for sensing ambient light levels outside of the vehicle and for producing corresponding output signals. Ex. 1010 at 2:19-21. This sensing means in Fuji is the same as the ambient light sensor of claim 28(ii). Fuji also discloses control circuits for controlling the image of the television set 2, for displaying a rearward view of the vehicle, dependent on the light level outside of the vehicle: “The image on the display of the television set is automatically controlled in response to the intensity of the light outside the motor vehicle. Ex. 1010 at 8:5-25.

A PHOSITA would have readily appreciated that the systems of Yamamoto and Lemelson were designed to provide the driver with the maximum amount of useful information on a reconfigurable display under all types of environmental conditions. It would have been obvious to combine Yamamoto, Mitsubishi, Lemelson, and Fuji because a PHOSITA would have readily appreciated that a reconfigurable display of any type would only be useful if it was viewable to the driver at all times, *i.e.*, in the daytime and at night. Ex. 1022 at ¶¶ 106-111.
Because a driver would need to view the information on the display under all light conditions, it would have been obvious to a PHOSITA to ensure that brightness (luminance) of the display would be adaptable for the reconfigurable display to be viewable under all environmental conditions. *Id.* An obvious way to achieve this in the vision system achieved by the combination of Yamamoto, Mitsubishi, and Lemelson is to have the display luminescence be responsive to the ambient light exterior of the vehicle, as taught by Fuji. *Id.*

**F. [Ground 6] – Claims 33, 35, and 36-38 are obvious in view of Yamamoto, Mitsubishi, Lemelson, and Otsuka**

**Claim 33 [33.0]: “The vehicular multi-camera vision system of claim 1, where-in said reconfigurable display device comprises a flat-panel display device.”**

As described above, Yamamoto and Mitsubishi teach use of TV monitor displays and Lemelson discloses a reconfigurable display. The references do not disclose specifically that the TV monitor is a flat-panel display device; however, Otsuka discloses various types of displays for vehicle instrumentation that use a minimal amount of dashboard space. Ex. 1016 at Abstract. Among the display types discussed in Otsuka are flat-panel displays such as a flat dot matrix LCD, LEDs, plasmas, etc. *Id.* See also Ex. 1016 at Table 1, characterizing display characteristics of various display technology types.

It would have been an obvious design choice for a PHOSITA to implement
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a flat panel or other type of display that takes up less space inside the vehicle and still provides a clear image to the driver. Ex. 1022 at ¶¶ 112-116. It also would have been obvious to vary and aesthetically improve the interior design of a vehicle for different vehicle models and types, and a PHOSITA would readily turn to a reference such as Otuska to determine types of displays feasible to implement as design options for the interior cabins of vehicles prior to May 1996. *Id.*

**Claim 35** – [35.0]: “The vehicular multi-camera vision system of claim 33, wherein said flat-panel display device comprises a light-emitting diode display device.”

As described above with respect to claim 33, Otsuka discloses the types of flat-panel displays that were well-known at the time of the ’724 patent. “LED” is an abbreviation for “light-emitting diode.” Therefore, the disclosure of “LED” in Table 1 of Otsuka is a disclosure of a light-emitting diode display device as recited in claim 35. Ex. 1015 at Table 1.

**Claim 36** – [36.0]: “The vehicular multi-camera vision system of claim 33, wherein said flat-panel display device comprises a plasma display device.”

As described above with respect to claim 33, Otsuka discloses the types of flat-panel displays that were well-known at the time of the ’724 patent. The abbreviation “PDP” for display type in Table 1 of Otsuka stands for “plasma display panel.” Therefore, Otsuka meets claim 35. Ex. 1015 at 288.1 and Table 1.

**Claim 37** – [37.0]: “The vehicular multi-camera vision system of claim 33, wherein said flat-panel display device is mounted at a dashboard of the
Claim 38 – [38.0]: “The vehicular multi-camera vision system of claim 33, wherein said flat-panel display device is mounted at a facia of the equipped vehicle.”

“Facia” is another term for a vehicle’s dashboard. Yamamoto discloses a TV monitor positioned near the driver’s seat. Ex. 1003, Abstract. Given that the purpose of the TV monitor in Yamamoto is to show the driver images to enhance driver safety, and considering the limited space within the vehicle where a monitor could be installed without obstructing the driver’s view, the dashboard or facia would have been an obvious choice for a PHOSITA to mount Yamamoto’s monitor at the time of the ’724 patent. The obviousness of a dashboard or facia-mounted display is further confirmed by Mitsubishi and Otuska, which discuss a TV monitor on a vehicle dashboard, and examples of flat panel display units that use a minimal amount of dashboard space, respectively. Ex. 1005, 5:8-10; Ex. 1015, 288.1.

G. [Ground 7] – Claim 34 is obvious in view of Yamamoto, Mitsubishi, Lemelson, Otsuka, and Conner

Claim 34 – [34.0]: “The vehicular multi-camera vision system of claim 33, wherein said flat-panel display device comprises a back-lit liquid crystal display device.”

As described above with respect to claim 33 in Ground 6, Otsuka establishes that use of flat-panel display devices were well known in art at the time of the ’724 patent. Thus, based on Lemelson’s description of a reconfigurable
display, a PHOSITA would have looked to Otsuka to make design choices on what type of reconfigurable display device to install in a vehicle. Ex. 1022 at ¶¶ 113-114.

Further, it would have been obvious in view of Yamamoto, Mitsubishi, Lemelson, and Otsuka that information displayed to the driver was adaptable to the environment both outside and inside the vehicle. For example, information could be displayed in color, using various visual cues, by adjusting the brightness based on ambient light. Although the references do not specifically disclose employing a back-lit LCD display device, a 1990 patent to Conner for a hybrid color display system that relied on a plurality of stacked light transmissive panels cooperating with a color mosaic filter establishes that back-lit LCDs were well known in the art. Ex. 1014 at Abstract.

Conner discloses LCD panels stacked and illuminated with white light. As the light passes through the stacked layers, pixels in each panel act as controllable control filters, selectively coloring the light exiting the display. Ex. 1014, 1:22-25. Conner also describes “the display assembly” being applied “as a backlit screen for a computer or the like.” Ex. 1014, 7:60-61 (emph. added). This description maps to the “back-lit liquid crystal display device” in claim 34. Because Lemelson’s reconfigurable display shows vehicle information to the driver in color (Ex. 1006 at 2:50-63), it would have been obvious to a PHOSITA
to look to Conner to improve the color display Lemelson as described in Conner. Ex. 1022, ¶¶ 117-119.


Claim 39 – [39.0]: “The vehicular multi-camera vision system of claim 33, wherein each of said at least three image capture devices comprises an array of photosensing pixels and wherein a mosaic spectral filter masks incident radiation in order to produce pixels which respond respectively to red, green and blue light.”

As described above with respect to claim 19 in Ground 1, Mitsubishi and Lemelson disclose cameras with an array of photosensing pixels (i.e., CCD cameras, video cameras, etc.). Ex. 1005 at 7; Ex. 1006 at 6:30-33. The references do not disclose, however, masking incident radiation to produce pixels that respond to red, green, and blue light. This was another well-known feature in the art, as evidenced by Sato, a 1983 patent for a color image pick-up apparatus. Sato discloses using a CCD camera with arrays of photosensing pixels. Specifically, Sato discloses a solid state image pick-up device 20, for example, CCD, which is a substantially single planar array of solid state light-sensitive element, and a color filter array 22 superposed in one-to-one registry on the light-sensitive elements of image pick-up device 20. Ex. 1018, Fig. 1; 2:30-36. Further, Sato employs a color filter array 22 that is a mosaic filter made up of individual filter elements, e.g., green (G), red (R) and blue (B) filters. Ex. 1018, 2:37-39, which maps to the
mosaic spectral filter and its function as claimed in claim 39 of the ’724 patent.

It would have been obvious for a PHOSITA to combine Yamamoto, Mitsubishi, Lemelson, Otsuka, and Sato to provide the driver with color images to view and easily recognize obstacles and objects and avoid potential hazardous situations while operating the vehicle. Ex. 1022 at ¶¶ 120-124. Accordingly, a PHOSITA would have looked to Sato to determine how to obtain color images for the driver by employing a mosaic spectral filter in a CCD camera. Id.


Claim 40 – [40.0]: “The vehicular multi-camera vision system of claim 33, wherein each of said at least three image capture devices comprises an array of photosensing pixels and comprises filtering to least one of (a) at least partially block near infrared radiation from pixels of said array…”

As described above with respect to claim 19 in Ground 1, Mitsubishi and Lemelson disclose cameras with an array of photosensing pixels (i.e., CCD cameras, video cameras, etc.). However, the references do not explicitly teach filtering to partially block infrared radiation. Paff is directed to various uses of surveillance assemblies to monitor areas under surveillance and establishes that use of IR filtering in cameras was well-known prior to May 1996. Paff discloses a surveillance assembly using a solid state camera having an optical IR filter 79. Ex. 1017, Fig. 4 and 5:68. The purpose of an IR filter is to block IR from the pixels of the camera, which reads on claim 40(a) of the ’724 patent. A PHOSITA
would have readily appreciated that surveillance cameras as disclosed in Paff may be used to survey a vehicle’s surroundings. Ex. 1022, ¶¶ 125-128. It also would have been obvious to a PHOSITA to employ IR filtering in the CCD cameras of Mitsubishi and Lemelson to keep the infrared from unduly influencing the image. Id.


Claim 44 – [44.0]: “The vehicular multi-camera vision system of claim 1, wherein said display device comprises a circular polarizer.”

Yamamoto, Mitsubishi, and Lemelson do not explicitly mention a circular polarizer. Like other features claimed in the ’724 patent, use of polarizers in displays was well known at the time for polarizing light as it enters, as taught by King, a 1990 patent for a thin film electroluminescent display with improved contrast. King discloses: “[I]f desired, a circularly polarized filter may be used with the structure of Fig. 1 to further reduce the reflected light and to achieve acceptable contrast in high ambient light conditions.” Ex. 1013, 5:9-15; 35-42.

As described above, Lemelson contemplates display of information on the reconfigurable display device under varying environmental conditions, including during the daytime when ambient light is high. Accordingly, it would have been obvious to combine Yamamoto, Mitsubishi, Lemelson, and King to provide the driver with a visible display device under high ambient light conditions, i.e., when
operating the vehicle during the daytime when more sunlight is present, by implementing a circular polarizer in the reconfigurable display device as disclosed by King. Ex. 1022, ¶¶ 134-139.

K. [Ground 11] – Claim 45 is obvious over Yamamoto, Mitsubishi, Lemelson, and Goesch

Claim 45 – [45.0]: “The vehicular multi-camera vision system of claim 1, wherein the image displayed by said display screen comprises a focal length that is substantially the depth of the field of the driver viewing objects beyond said equipped vehicle.”

Lemelson contemplates a head up display (HUD) which projects a virtual image on the front windshield. Ex. 1006 at 2:53-60. Although Yamamoto, Mitsubishi, and Lemelson do not explicitly define the focal length of the displays contemplated, this obvious feature is disclosed in Goesh, which describes a HUD that projects a virtual image at the front bumper. Ex. 1019 at Fig. 1. Goesh confirms that it was well known at the time that having the focal length of the display be the same as the depth of the field of view of the driver would provide perspective and eliminate the need for the driver to re-focus his/her eyes when looking at the display. Ex. 1022 at ¶¶ 141-142. Goesch states “the driver can keep his eyes looking toward the road ahead while accessing and responding to the information” shown. Ex. 1019 at p. 55, 1:35-38. The location of the HUD at the front bumper mimics the depth of the field of the driver viewing objects beyond the vehicle and thus reads on claim 45 of the ’724 patent.
It would have been obvious to a PHOSITA to combine Goesch with Yamamoto, Mitsubishi, and Lemelson because all references describe a driver assist system that displays an image to the driver. Ex. 1022 at ¶¶ 140-143. The explicit reference to a HUD and driver safety in Lemelson would have motivated a PHOSITA to look to Goesch to provide an image which does not require a driver to shift his/her focus from the road, resulting in a safer display of information. Id.

L. [Ground 12] – Claims 57, 72 and 83 are obvious in view of Yamamoto, Mitsubishi, Lemelson, Aishin, Wang, and Fuji

Claims 57, 72, and 83 depend from independent claims 49, 65, and 78, respectively. Each claim recites identical subject matter to claims 27 and 28 in the “at least one of” form, and are rendered obvious by Fuji for exactly the same reasons as discussed with respect to claims 27 and 28 in Ground 5. A discussion of the differences between independent claims 49, 65, and 78 and claim 1 follows.

Claim 49 of the ’724 patent is an independent claim directed to a multi-camera vision system for a vehicle that is substantially similar to claim 1. Specifically, claim 49 recites three image capture devices, the first being at a driver-side portion of the vehicle, the second being at a passenger-side portion of the vehicle, and the third being at a rear portion of the vehicle. Each image capture device has a field of view exterior of the vehicle, where the first and third fields of view overlap, creating a first overlap zone; and the second and third
fields of view overlap, creating a second overlap zone. Further, each image capture device captures image data, which is received at an image processor. The image processor processes the image data to produce a synthesized image without duplication of objects present in said first and second overlap zones, which approximates a view as would be seen by a virtual camera at a single location exterior of the equipped vehicle. The synthesized image is displayed by a single display screen of a reconfigurable display device that is viewable by the driver when normally operating the equipped vehicle. Ex. 1001 at 27:63-28:65. All claim 49’s recited limitations above are taught by Yamamoto, Mitsubishi, and Lemelson in exactly the same manner described above with respect to claim 1, supra.

Claim 49 of the ’724 patent differs from claim 1 in that it does not require that the image data from each of the cameras be received at the image processor in one of an analog or digital data stream. Claim 49 also recites four additional limitations, which are taught by Wang, Yamamoto, and Aishin. Wang, an IEEE publication, describes the design and implementation of a single chip CMOS video camera. Ex. 1009. Wang describes the achievement of having integrated significant hardware into a camera to achieve CCD performance with dramatically lower cost, power consumption, and size. Aishin is a Japanese patent application directed to a predictive path display apparatus that displays a rearward view on a
screen when the vehicle is backing up, to enhance driver safety. Ex. 1008 at 2.

The motivation to combine Yamamoto, Mitsubishi, and Lemelson is discussed above with respect to claim 1. A PHOSITA also would have been motivated to combine Wang and Aishin with Yamamoto, Mitsubishi, and Lemelson because all of these references refer to driver vision systems, and nearly all of them (except Wang), contemplate providing a rearward view to the driver, which is the primary purpose of the '724 patent. It would have been predictable for a PHOSITA to turn to any one of Mitsubishi, Lemelson, Wang, or Aishin to improve upon the vision system in Yamamoto. See also discussion of the motivation to combine these references in Ex. 1020, ¶¶ 144-151, 149-150, 170-172; Ex. 1022, ¶¶ 144-151.

[49.20]: “wherein each of said at least three image capture devices comprises a CMOS imaging array;”

This limitation of claim 49 is taught by Wang, as described with respect to claim 19 in Ground 3, supra.

[49.21] “wherein said first image capture device is disposed at the equipped vehicle at substantially the same height relative to ground as is said second image capture device;”

Yamamoto teaches that cameras 1-3 are “installed at the same height so that the monitor television (4) may integrate captured images correctly.” Ex. 1003, 5(ii).
“wherein said third vehicular camera disposed at the rear of the equipped vehicle is operable as a backup camera;”

Although Yamamoto and Mitsubishi both teach rearward oriented cameras, the references do not explicitly teach that one or more is operable as a back-up camera. Aishin discloses “an image in a field of rear vision…and a predicted path are displayed on a screen at the time of reverse travel of a vehicle, characterized by a camera for photographing a field of rear vision…” Ex. 1006 at 2:5-10. It would have been obvious to a PHOSITA to use camera 3 disposed at the rear of the vehicle in Yamamoto as a back-up camera because a view of the immediate rear of the vehicle is almost always necessary when driving in reverse. Ex. 1020, ¶¶ 169-173. Incorporating the back-up camera feature of Aishin in the vision system of Yamamoto would have reduced the amount of processing necessary to display an image to the driver at the time of reverse travel, and therefore would have been an obvious improvement to the Yamamoto system. Id.

“The last limitation of claim 49 of the ’724 patent requires at least one of three alternatives. As discussed in the claim construction section, the “at least one” language requires Petitioner to show that only one listed alternative is taught by the prior art to invalidate the claim. With respect to alternative (a), as
discussed above, Yamamoto displays a rear view to the driver as shown in FIG. 5 that is from the perspective of a virtual camera located forward of the driver/vehicle, looking rearward. Ex. 1020 at ¶ 115. This rear view is achieved in Yamamoto by composing or joining the images from cameras 1-3 into a single image. The result is a panorama of the rear of the vehicle, i.e., a wide view rearward of the vehicle (see claim construction of panorama, supra), much in the same manner shown in FIGs. 3, 8, and 10 of the ’724 patent. Ex. 1020 at ¶¶ 158-163.

Claim 65 of the ’724 patent is an independent claim directed to a multi-camera vision system for a vehicle substantially similar to independent claim 49. Specifically, claim 65 recites three image capture devices, the first at a driver-side portion of the vehicle, the second at a passenger-side portion of the vehicle, and the third at a rear portion of the vehicle. Each image capture device has a field of view exterior of the vehicle, where the first and third fields of view overlap, creating a first overlap zone, and the second field and third fields of view overlap, creating a second overlap zone. Claim 65 also requires that each of the three image capture devices comprises a CMOS imaging array, and that the third image capture device disposed at the rear of the equipped vehicle is operable as a backup camera. Each image capture device also captures image data that is received at an image processor. The image processor processes the image data to produce a
“synthesized image” without duplication of objects present in said first and second overlap zones, and which approximates a view as would be seen by a virtual camera at a single location exterior of the equipped vehicle. The synthesized image is displayed by a single display screen of a reconfigurable display device, viewable by the driver when normally operating the equipped vehicle. Ex. 1001 at 31:17-32:4.

Claim 65 is broader than claim 49 in that it does not require the first and second cameras to be disposed on the equipped vehicle at substantially the same height relative to ground. Claim 65 also does not recite the alternative limitations of claim 49 and does not require that the displayed synthesized image shown to the driver be a panoramic view or a seamless view of any type. Accordingly, claim 65 is entirely taught by Yamamoto, Mitsubishi, Lemelson, Aishin, and Wang for all of the reasons described above with respect to both claims 1 and 49 of the ‘724 patent.

Claim 78 of the ‘724 patent is an independent claim directed to a multi-camera vision system for a vehicle substantially similar to independent claim 49. Specifically, claim 78 recites three image capture devices, the first at a driver-side, the second at a passenger-side, and the third at a rear portion of the vehicle. Each image capture device has a field of view exterior of the vehicle, where the first and third fields of view overlap, creating a first overlap zone; and the second and third
fields of view overlap, creating a second overlap zone. Claim 65 also requires that each of the three image capture devices comprises a CMOS imaging array, and that the third image capture device disposed at the rear of the equipped vehicle is operable as a backup camera. Again, each image capture device captures image data, which is received at an image processor. The image processor processes the image data to produce a synthesized image without duplication of objects present in the first and second overlap zones. The synthesized image also approximates a view as would be seen by a virtual camera at a single location exterior of the equipped vehicle, and is displayed by a single display screen of a reconfigurable display device that is viewable by the driver when normally operating the equipped vehicle. Further, claim 78 requires the last limitation of claim 49 which recites three alternatives. Alternative 78(a) is taught by Yamamoto in the same manner as discussed above with respect to claim 49(a). Ex. 1001 at 34:22-35:38.

Claim 78 of the ’724 patent differs from claim 49 in that it does not require that the first and second cameras be disposed on the equipped vehicle at substantially the same height relative to ground. In addition, claim 78 recites two additional limitations that are not found in claim 49, one of which has two alternatives (a) and (b). The additional limitations of claim 78 are taught by prior art references Yamamoto and Mitsubishi, as follows:
“wherein said first field of view said first image capture device is bounded by the side of the equipped vehicle it is disposed at and extends outwards therefrom and wherein said second field of view said second image capture device is bounded by the side of the equipped vehicle it is disposed at and extends outwards therefrom;”

In FIG. 1 of Yamamoto (left), first field of view 5 is bound by the driver-side of the vehicle (the driver-side is the right side of the vehicle here) and extends outward from the side of the vehicle at which the camera is disposed. Similarly, second field of view 6 is bound by the passenger-side of the vehicle and extends outwards from the side of the vehicle at which the camera is disposed.

“In Mitsubishi, the data captured by each of the three cameras is output in digital form, and received at the image processing circuit 4 in digital form, i.e., as a digital data stream. See also discussion of claim 3, supra, and Ex. 1005 at 5. Lemelson further shows that it was well known to send data from a camera to a processor in digital form. Ex. 1006 at 5:38-40; 6:30-33; Ex. 1022 at ¶¶91-94.

Claim 57 – [57.0]: “The vehicular multi-camera vision system of claim 49,
wherein at least one of (a) the display luminance of said display screen of said reconfigurable display device is variable responsive to a sensing of an ambient light level…”

**Claim 72** – [72.0]: “The vehicular multi-camera vision system of claim 65, wherein at least one of (a) [(same language as [57.0])]…”

**Claim 83** – [83.0]: “The vehicular multi-camera vision system of claim 78, wherein at least one of (a) [(same language as [57.0])]…”

For a discussion of the unpatentability of the specific limitations in claims 57, 72, and 83 in view of Fuji, see discussion of claim 27 in Ground 5, *supra*. It would have been obvious to combine Yamamoto, Mitsubishi, Lemelson, Wang, Aishin, and Fuji because each relates to displaying information to a driver of a vehicle. It would have been obvious to include various improvements as described in Wang (use of CMOS cameras), Aishin (graphic overlays and predicted path analysis), and Fuji (adjustment of display luminance based on ambient light), in Yamamoto’s system because a PHOSITA would have been motivated to enhance Yamamoto’s multi-camera vision system to include the robust driver assist/awareness features that Wang, Aishin and Fuji describe. 1022, ¶¶ 153-155.


**Claim 59** – [59.0]: “The vehicular multi-camera vision system of claim 49, wherein at least one of (a) said reconfigurable display device comprises a flat-panel display device…”

For a discussion of the unpatentability of the specific limitation in claim
59(a) in view of Otsuka, see discussion of claim 33 in Ground 6, supra. All of Yamamoto, Mitsubishi, Lemelson, and Aishin display information to a driver on a display device. Accordingly, it would have been obvious for a PHOSITA to look to Otsuka to determine which types of display devices were known at the time of the ’724 patent. Ex. 1022 at ¶¶ 156-159.


Claim 60 – [60.0]: “The vehicular multi-camera vision system of claim 49, wherein at least one of...(b)...(i) each of said at least three image capture devices comprises an array of photosensing pixels and comprises filtering to at least one of...at least partially block near infrared radiation from pixels of said array.”

Claim 74 – [74.0]: “The vehicular multi-camera vision system of claim 65, wherein at least one of...(b)...(i) [(same language as [60.0])].”

Claim 85 – [85.0]: “The vehicular multi-camera vision system of claim 78, wherein at least one of...(b)...(i) [(same language as [60.0])].”

Claims 60(b)(i), 74(b)(i), and 85(b)(i) depend from independent claims 49, 65, and 78, respectively. Each of these dependent claims recite identical subject matter to claim 40 in the “at least one of” form, and are rendered obvious by Paff for exactly the same reasons discussed above with respect to claim 40 in Ground 9. As described above, a PHOSITA would have readily appreciated that surveillance cameras as disclosed in Paff may be used to survey the area surrounding a vehicle. Ex. 1022 at ¶¶ 160-162. To enhance the features and capabilities of a CCD/CMOS camera as disclosed by Mitsubishi, Lemelson, and Wang, it also
would have been obvious to a PHOSITA to employ filtering to partially block near IR in such cameras to keep the infrared from unduly influencing the image. *Id.*


For a discussion of the unpatentability of the specific limitation in claim 63 in view of King, see discussion of claim 44 in Ground 10, *supra*. As described in Ground 5, *supra*, Yamamoto and Lemelson contemplate providing the driver with the maximum amount of useful information on a reconfigurable display under all types of environmental conditions. Ex. 1003 at ¶ 5; 1006 at 4:9-15. Accordingly, it would have been obvious to combine Yamamoto, Mitsubishi, Lemelson, Wang, Aishin, and King to provide the driver with a visible display device under high ambient light conditions, *i.e.*, when operating the vehicle during the daytime when more sunlight is present, by implementing a circular polarizer as disclosed in King in the reconfigurable display device of Lemelson. Ex. 1022 at ¶¶ 163-165.

IX. CONCLUSION

For the foregoing reasons, Petitioner respectfully requests *inter partes* review and cancellation of the challenged claims of U.S. Patent No. 8,643,724.

Dated: June 15, 2015

Respectfully submitted,

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**CERTIFICATE OF SERVICE**

The undersigned certifies service pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(a) of a copy of this Petition for *Inter Partes* Review on Magna Electronics, Inc. via FedEx next day delivery to the correspondence address of record for the ’724 patent as follows:

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