UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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ams AG, AMS-TAOS USA INC.,
SAMSUNG ELECTRONICS AMERICA, INC., and
SAMSUNG ELECTRONICS CO. LTD.,
Petitioners

v.

JJL TECHNOLOGIES LLC and 511 INNOVATIONS, INC.,
Patent Owner

Case IPR2016-01810
U.S. Patent No. 6,307,629

PETITION FOR *INTER PARTES* REVIEW

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I. MANDATORY NOTICES

A. Real Parties-in-Interest

ams AG, AMS-TAOS USA Inc., Samsung Electronics America, Inc., and Samsung Electronics Co., Ltd. (collectively "Petitioners") are the real parties-in-interest to this proceeding.

U.S. Patent No. 6,307,629 (the "'629 Patent") is assigned to JJL Technologies LLC by an assignment dated July 27, 2007 and recorded on the same date at reel/frame 019597/0461. However, in the various court proceedings identified below, 511 Innovations, Inc. claims to be "the current owner by assignment of all rights, title, and interest in and under the '629 Patent."

B. Related Matters

The '629 Patent and other patents in the same patent family are currently being asserted against Petitioners in *511 Innovations, Inc. v. Samsung Telecommunications America, LLC*, No. 2:15-cv-01526 (E.D. Tex.). The '629 Patent and other patents in the same patent family are also currently being asserted in: *511 Innovations, Inc. v. HTC America, Inc.*, No. 2:15-cv-01524 (E.D. Tex.); *511 Innovations, Inc. v. Microsoft Mobility Inc.*, No. 2:15-cv-01525 (E.D. Tex.); and *511 Innovations, Inc. v. Apple, Inc.*, No. 2:16-cv-00868 (E.D. Tex.).

In addition to this Petition, Petitioner is seeking *inter partes* review of related U.S. Patent Nos. 6,490,038, 7,113,283, 6,915,955, 7,110,096, 7,397,541, 8,472,012 and 8,786,844.

C. Counsel

Lead Counsel: Daniel E. Venglarik (Registration No. 39,409);

Backup Counsel: Jamil N. Alibhai (*pro hac vice* to be filed), Kelly P. Chen (*pro hac vice* to be filed), and Jacob L. LaCombe (Registration No. 63,036).

D. Service Information

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E. Certification of Standing

Petitioners certify that the ’629 Patent is available for *inter partes* review and that Petitioners are not barred or estopped from requesting *inter partes* review on the grounds identified herein.

II. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Petitioners challenge Claims 1-2, 7, 30 and 98 of the ’629 Patent as indicated below:

Ground 1: Claims 1-2, 7 and 30 are obvious over Farrar in view of TSL230 Datasheet.

Ground 2: Claims 1-2, 7 and 30 are obvious over Zimmerman in view of the TSL230 Datasheet.

Ground 3: Claims 1-2, 7, 30 and 98 are obvious over JP ’028 in view of the TSL230 Datasheet.

Ground 4: Claims 1-2, 7, 30 and 98 are obvious over Eguchi.

The above grounds create a reasonable likelihood that Petitioners will prevail with respect to at least one challenged claim. The arguments, charts, and evidence demonstrate that the challenged claims are unpatentable as obvious under 35 U.S.C. § 103. Petitioners request cancellation of the challenged claims.

III. THE ’629 PATENT

A. Overview of the ’629 Patent

The challenged claims are directed to the well-known idea of using optical sensors to measure the intensity of light reflected from the object, and then using the intensity measurements to determine information about the object. The patent generally discusses measuring the intensity of reflected light and using the measured intensity in an algorithm (run on the microprocessor) to determine the optical characteristics of the object. Ex. 1001, 3:23-4:23.

The ’629 Patent describes a probe that measures the intensity of reflected light to determine optical characteristics (e.g., color, “reflectivity” or luminance) of teeth. Ex. 1001, 4:1-6. As shown in Figure 1, light emitted by a light source 11 is carried by fiber optic 5 to probe body 2 and probe tip 1 to illuminate a patient’s teeth 20:

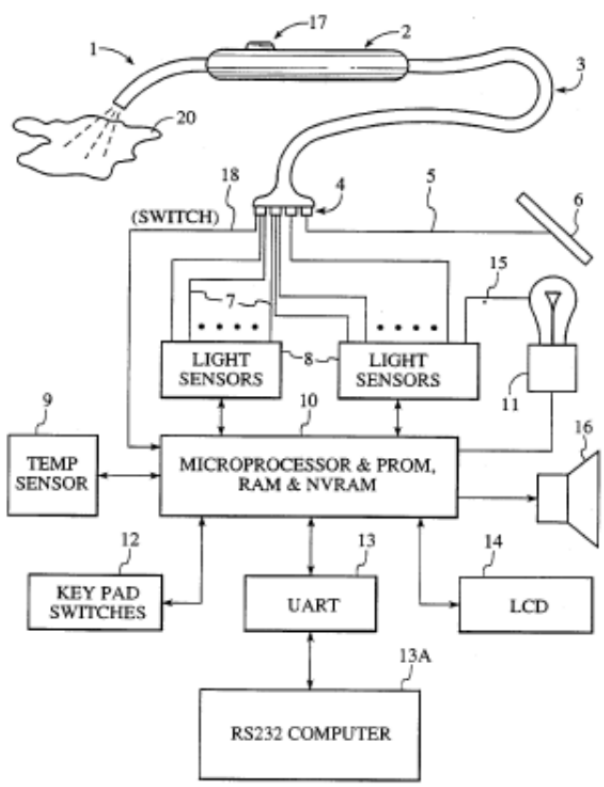

FIG. 1

Ex. 1001, Figure 1, 5:12-6:5; 6:12-19. “Light reflected from the object 20 passes through the receiver fiber optics in probe tip 1 to light sensors 8 (through probe body 2, fiber optic cable 3 and fibers 7).” Ex. 1001, 7:39-41. “Based on the information produced by light sensors [8], microprocessor 10 produces a color measurement result or other information to the operator." Ex. 1001, 7:41-49.

Light reflected from an object passes through filters 22 and is presented to multiple sensing elements 24 of the light sensors 8. Ex. 1001, Fig. 3, 8:60-62. The "sensing elements 24 include light-to-frequency converters, manufactured by Texas Instruments and sold under the part number TSL230." Ex. 1001, Fig. 3, 8:63-65. These converters integrate light and "output an AC signal with a frequency proportional to the intensity (not frequency) of the incident light" and "the outputs of the TSL230 sensors are TTL or CMOS compatible digital signals." Ex. 1001, 8:65-9-2, 9:5-6. These output signals have "frequencies dependent on the light intensity presented to the particular sensing elements, which are presented to processor 26," and processor 26 "measures the frequencies of the signals output from sensing elements 24." Ex. 1001, 9:8-17.

To measure the frequency of each signal, the processor 26 implements a timing loop and periodically reads the states of each signal output from sensing elements 24 and a counter is incremented each time. Ex. 1001, 9:18-22. For each signal, after each reading, the processor 26 performs an XOR operation with the last data read. Ex. 1001, 9:25-28. The timing loop and multiple XOR operations continue until all input signals have changed twice (i.e., from 0 to 1 to 0, or, from 1 to 0 to 1)—"which enables measurement of a full ½ period of each input." Ex.

1001, 9:28-38. From the stored input bytes and internal counter values, the processor 26 can determine the period (and frequency) of the signals received from the sensing elements 24. Ex. 1001, 9:43-46. "Such periods calculated for each of the outputs of sensing elements is provided by processor 26 to microprocessor 10" which then calculates "a measure of the received light intensities." Ex. 1001, 9:48-52.

B. Admitted Prior Art

The '629 Patent admits prior art knowledge that color is dependent on the wavelength(s) of reflected light and that light incident on an object will, when reflected, "vary in intensity and wavelength dependent upon the color of the surface of the object." Ex. 1001, 1:25-32. Admitted prior art color measurement devices ("colorimeters") shine "white" light on the object and measure the intensity of reflected light received through filters passing only bands of wavelengths, such as red, green, and blue color filters. Ex. 1001, 1:19-24, 1:33-61. The intensity measurements from the three (red/green/blue) "color sensors" represent the color. Ex. 1001, 1:65-2:6. Admitted prior art light sensors such as the commercially available TSL230 or TSL213 and admitted prior art filter materials such as Kodak filters are disclosed for such system components. Ex. 1001, Figures 1 & 3, 8:62-64, 10:5-14.

IV. ORDINARY SKILL IN THE ART

A person of ordinary skill in the art at the time of the claimed inventions would have had a bachelor's degree in electrical engineering, physics, or a closely related field, along with at least 2-3 years of experience in the design and development of optoelectronic measurement systems. An individual with an advanced degree in a relevant field, such as physics or electrical engineering, would require less experience in the design and development of optoelectronic measurement systems.

V. CLAIM CONSTRUCTION

The '629 Patent expired on January 2, 2016. In reviewing a patent that has expired or will expire before the final decision, the Board applies the "district court" or *Phillips* claim construction standard. 37 C.F.R. § 42.100(b). Under that standard, the "correct" construction—that most accurately delineating the scope of the invention—is identified. *PPC Broadband, Inc. v. Corning Optical Communications RF, LLC*, 815 F.3d 734, 740 (Fed. Cir. 2016).

As shown below, the prior art renders obvious claims 1-2, 7, 30 and 98 of the '629 Patent; accordingly, the Board need not construe any claim terms for purposes of invalidity.

VI. GROUND 1: Claims 1-2, 7 and 30 are obvious over Farrar in view of the TSL230 Datasheet.

A. Overview of Farrar

Farrar relates to a fiber optic range finder for determining a range 14 to the surface of an object 13. Ex. 1003, Title, 2:58-66. The range finder 10 includes a light transmitting optical fiber 26 together with light receiving optical fiber 15.

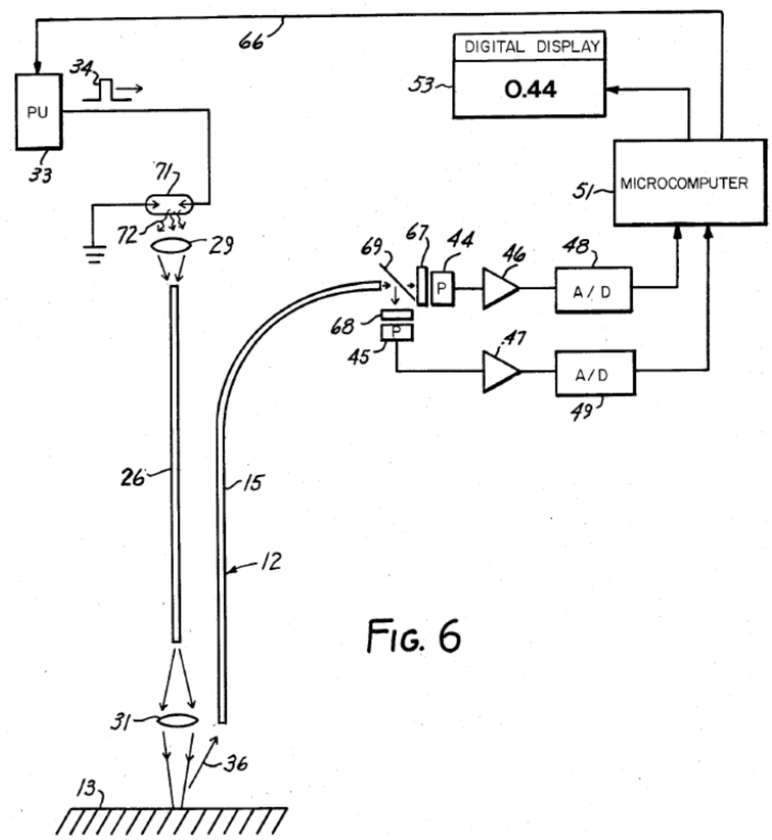

FIG. 6

Ex. 1003, Figure 6, 2:58-66, 3:49-51, 5:18-20, 7:51-54. The light transmitting optical fiber 26 projects light from a xenon flash tube 71 onto the object surface. Ex. 1003, 3:52-56, 7:41-54. At least part of that light will reflect off the object surface (reflected light 36) and be received by the light receiving optical fiber 15.

Ex. 1003, 3:64-4:6, 7:51-54. Photodetectors 44 and 45 receive light from the light receiving fiber 15, respectively, measure the intensity and generate corresponding electrical signals amplified by amplifiers 46, 47 and digitized by A/D converters 48, 49. Ex. 1003, 4:59-65, 7:51-54. A microprocessor 51 calculates a range 14 to the object surface based on a mathematical combination of the light intensities measured by the two photodetectors 44 and 45. Ex. 1003, 5:3-7, 7:51-54. By mathematically manipulating both measured light intensities, the range calculated by microprocessor 51 accounts for variations caused by surface texture, reflectivity, etc. of a specific object surface 13. Ex. 1003, 4:32-42, 5:67-6:10, 7:51-54.

B. Farrar and TSL230 Datasheet Render Claims 1-2, 7 and 30 Obvious

1. *Claim 1*

[1a] "*A method of determining a characteristic of an object or material comprising the steps of:*"

Farrar discloses fiber optic range finder systems that calculate or determine a distance or range [a characteristic] of an object or object's surface. Ex. 1003, Figure 6, Title, Abstract, 5:3-7.

[1b] "*receiving light from the object or material;*"

The light transmitting optical fiber 26 projects light from a light source 71 onto the object surface. Ex. 1003, Figure 6, 3:52-56, 7:51-54. That light reflects off the object surface (reflected light 36) and is received by the light receiving optical fibers 15. Ex. 1003, Figure 6, 3:64-4:6, 7:51-54.

[1c] "*coupling received light to one or more sensors;*"

Photodetectors 44 and 45 receive light from the light receiving fibers 15 via narrowband optical filters 67, 68. Ex. 1003, Figure 6, 4:59-65, 7:37-46, 7:51-54.

[1d] "*generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;*"

Photodetectors 44 and 45 receive light from the light receiving fibers 15, measure the light intensity of the received light, and generate measurements digitized by A/D converters 48, 49. Ex. 1003, 4:59-65, 7:51-54. The electrical signal output by photodetectors 44 and 45 is proportional to the light intensity received.

Admitted prior art TSL230 sensors generate and output a signal having a frequency proportional to the light intensity received. Ex. 1005, 5-3, 5-8.

When each of the photodetectors 44 and 45 in Farrar is implemented using the TSL230 sensor, the resulting photodetector sensors 44 and 45 will each output a signal having a frequency proportional to the intensity of light reflected from the object. Those having ordinary skill in the relevant art would be motivated to use the output of the TSL230 sensors for the same purpose as photodetector sensors 44 and 45 within the system of Farrar, to measure the intensity of light reflected from the object. Those having ordinary skill in the relevant art would also understand that the A/D converters 48, 49 could then be implemented using only digital components in accordance with the known techniques for converting the frequency output of the TSL230 sensors into digital values. *See, e.g.*, Ex. 1006, 8 (Figure 17). The TSL230 sensor digital signal outputs may be connected directly to digital counters implementing A/D converters 48, 49 without the need for amplifiers 46, 47. Ex. 1006, 8 (Figure 17); Ed. 1005, 5-3; Ex. 1015, ¶ 49. The design choice would require no more than ordinary skill and would produce the predictable result of an improved system requiring fewer analog components and taking advantage of the high resolution light intensity measurement and adjustable sensitivity of the TSL230 sensors. Ex. 1005, 5-3. The resulting system would operate to detect light reflected from an object as described by Farrar, based on signals each having a frequency proportional to the intensity of received reflected light. Ex. 1015, ¶ 50. Utilization of the TSL230 photo sensors as Farrar's photodetectors 44, 45 will expectedly produce—in accordance with an intended purpose of the TSL230 sensors—a signal having a frequency proportional to the intensity of light received.

[1e] "*determining the characteristic based on the at least one signal;*"

In implementing photodetectors 44, 45 using TSL230 sensors and A/D conversion in accordance with known techniques, the measured light intensity signal from photodetector 44 is digitized to produce the same digital values output by A/D converter 48, with the digital value for the measured light intensity provided to the microprocessor 51. Ex. 1003, 4:59-65. Similarly, the measured light intensity signal from photodetector 45 is digitized to produce the same output as A/D converter 49, with the digital value for the measured light intensity provided to the microprocessor 51. Ex. 1003, 4:59-65.

Microprocessor 51 uses the digital light intensity measurement values ("data") from photodetectors 44, 45 to determine a range [a characteristic] of the object's surface. Ex. 1003, Figure 6, 4:59-65, 5:3-10, 5:67-6:6, 7:51-54.

[1f] "*wherein the light passes through a filter prior to being coupled to one or more of the sensors.*"

"[P]hotodetectors 44 and 45 are equipped with different narrowband optical input filters 67 and 68, respectively." Ex. 1003, Figures 5 & 6, 7:16-28, 7:41-51.

2. *Claim 2*

[2a] "*The method of claim 1,*"

See discussion of Claim 1 above.

[2b] "*wherein the at least one signal comprises a digital signal.*"

The outputs of the TSL230 sensors are TTL or CMOS compatible—i.e., "digital." Ex. 1006, 5-3, 5-7. The outputs of photodetectors 44 and 45 are digitized for input to a processor. Ex. 1003, 4:59-65, 7:51-54. Those having ordinary skill in the art understand that the frequency signal output by the TSL230 sensors should be digitized to produce the same digital values output by A/D converters 48, 49. Ex. 1015, ¶ 48.

3. *Claim 7*

[7a] "*The method of claim 1,*"

See discussion of Claim 1 above.

[7b] "*wherein the step of generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors comprises integrating light coupled to the one or more sensors with an integrator.*"

The '629 Patent admits that the TSL230 sensors integrate light:

> [S]ensing elements 24 include light-to-frequency converters, manufactured by Texas Instruments and sold under the part number TSL230. Such converters constitute, in general, photo diode arrays that integrate the light received . . .

Ex. 1001, 8:62-66. In addition, the TSL230 sensors employ an integrator performing charge integration to convert the photodiode's intensity measurement into a digital frequency output. Ex. 1010, 19:23-29; Ex. 1004, (Berlien Decl.) ¶ 7.

4. *Claim 30*

For elements [30a]-[30f], see the discussion of elements [1a]-[1f] in Claim 1 above regarding where each of those claim elements is found in Farrar and/or the TSL230 Datasheet.

[30g] "*wherein the filter comprises a plurality of filter portions having a wavelength dependent optical transmission property.*"

"[P]hotodetectors 44 and 45 are equipped with different narrowband optical input filters 67 and 68, respectively." Ex. 1003, Figures 5 & 6, 7:16-28, 7:51-54. Narrowband filters 67 and 68 comprise a plurality of filter portions each having a wavelength dependent optical transmission property. Ex. 1003, 7:16-23.

C. Charts

Limitation		Farrar+TSL230 Datasheet
1a	A method for determining a characteristic of an object or material comprising the steps of:	Fiber optic range finder 10 calculates or determines a distance or range [a characteristic] of an object or object's surface. Ex. 1003, Figure 6, Title, Abstract, 5:3-7.
1b	receiving light from the object or material;	Reflected light 36 or 41 is received by the light receiving optical fibers 15. Ex. 1003, Figure 6, 3:52-56, 3:64-4:6, 7:51-54.
1c	coupling received light to one or more sensors;	Photodetectors 44 and 45 receive light from the light receiving fibers 15 via optical filters 67, 68. Ex. 1003, Figure 1, 4:59-65, 7:37-46, 7:51-54.

Limitation		Farrar+TSL230 Datasheet
1d	generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;	Photodetectors 44 and 45 receive light from the light receiving fibers 15, measure the light intensity of the received light, and generate measurements digitized by A/D converters 48, 49. Ex. 1003, 4:59-65, 7:51-54. The electrical signal output by photodetectors 44 and 45 is proportional to the light intensity received. Admitted prior art TSL230 sensors generate and output a signal having a frequency proportional to the light intensity received. Ex. 1005, 5-3, 5-8. When each of the photodetectors 44 and 45 in Farrar is implemented using the TSL230 sensor, the resulting photodetector sensors 44 and 45 will each output a signal having a frequency proportional to the intensity of light reflected from the object. Those having ordinary skill in the relevant art would be motivated to use the output of the TSL230 sensors for the same purpose as photodetector sensors 44 and 45 within the system of Farrar, to measure the intensity of light reflected from the object. Those having ordinary skill in the relevant art would also understand that the A/D converters 48, 49 could then be implemented using only digital components in accordance with the known techniques for converting the frequency output of the TSL230 sensors into digital values. *See, e.g.*, Ex. 1006, 8 (Figure 17). The TSL230 sensor digital signal outputs may be connected directly to digital counters implementing A/D converters 48, 49 without the need for amplifiers 46, 47. Ex. 1006, 8 (Figure 17); Ed. 1005, 5-3; Ex. 1015, ¶ 49. The design choice would require no more than ordinary

Limitation		Farrar+TSL230 Datasheet
1e		skill and would produce the predictable result of an improved system requiring fewer analog components and taking advantage of the high resolution light intensity measurement and adjustable sensitivity of the TSL230 sensors. Ex. 1005, 5-3. The resulting system would operate to detect light reflected from an object as described by Farrar, based on signals each having a frequency proportional to the intensity of received reflected light. Ex. 1015, ¶ 50.Utilization of the TSL230 photo sensors as Farrar's photodetectors 44, 45 will expectedly produce—in accordance with an intended purpose of the TSL230 sensors—a signal having a frequency proportional to the intensity of light received.
1e	determining the characteristic based on the at least one signal;	Microprocessor 51 uses the digital value ("data") of the light intensity measured by photodetectors 44 and 45 to determine a range [a characteristic] of the object. Ex. 1003, Figure 6, 4:59-65, 5:3-10, 5:67-6:6, 7:51-54.
1f	wherein the light passes through a filter prior to being coupled to one or more of the sensors,	"[P]hotodetectors 44 and 45 are equipped with different narrowband optical input filters 67 and 68, respectively." Ex. 1003, Figures 5 & 6, 7:16-28, 7:41-51.
2a	The method of Claim 1,	See [1a]-[1f].
2b	wherein the at least one signal comprises a digital signal.	The outputs of the TSL230 sensors are TTL or CMOS compatible—i.e., "digital." Ex. 1006, 5-3, 5-7. The outputs of photodetectors 44 and 45 are digitized for input to a processor. Ex. 1003, 4:59-65, 7:51-54. Those having ordinary skill in the art understand that the frequency signal output by the TSL230 sensors should be digitized to produce the same digital values output by A/D converters 48, 49. Ex. 1015, ¶ 50.
7a	The method of claim 1,	See [1a]-[1f].
7b	wherein the step of	The TSL230 sensors employ an integrator

Limitation		Farrar+TSL230 Datasheet
	generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors comprises integrating light coupled to the one or more sensors with an integrator.	performing charge integration to convert the photodiode's intensity measurement into a digital frequency output. Ex. 1010, 19:23-29; Ex. 1004, (Berlien Decl.) ¶ 7.
30a	A method for determining a characteristic of an object or material comprising the steps of:	See [1a].
30b	receiving light from the object or material;	See [1b].
30c	coupling received light to one or more sensors;	See [1c].
30d	generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;	See [1d].
30e	determining the characteristic based on the at least one signal;	See [1e].
30f	wherein the light passes through a filter prior to being coupled to one or more of the sensors,	See [1f].
30g	wherein the filter comprises a plurality of filter portions having a wavelength dependent optical transmission property.	"[P]hotodetectors 44 and 45 are equipped with different narrowband optical input filters 67 and 68, respectively." Ex. 1003, Figures 5 & 6, 7:16-28, 7:51-54. Narrowband filters 67 and 68 comprise a plurality of filter portions each having a wavelength dependent optical transmission property. Ex. 1003, 7:16-23.

VII. GROUND 2: Claims 1-2, 7 and 30 are obvious over Zimmerman in view of the TSL230 Datasheet.

This ground is not redundant with Ground 1 because Zimmerman discloses "a plurality of filter portions having a wavelength dependent optical transmission property." The term "a" carries the meaning of "one or more." *Baldwin Graphic Sys., Inc. v. Siebert*, 512 F.3d 1338, 1342-43 (Fed. Cir. 2008). Zimmerman discloses having *the same* wavelength dependent optical transmission property if the plurality of filter portions have "one" wavelength dependent optical transmission property, a feature not disclosed in the references of Ground 1.

A. Overview of Zimmerman

Zimmerman explains that infrared light sensors are commonly used in the industry to detect the presence of an object—they measure the reflection of infrared light from the object for detection. Ex. 1010, 1:38-44.

Zimmerman describes a proximity detection system configured to detect a finger's proximity to a touch switch. Ex. 1010, Abstract. The photoelectric proximity detector 5 includes infrared (IR) light emitting diodes (LEDs) 6 and an IR phototransistor (IRPT) 13 for determining proximity of finger 15 to the respective photoelectric proximity switch:

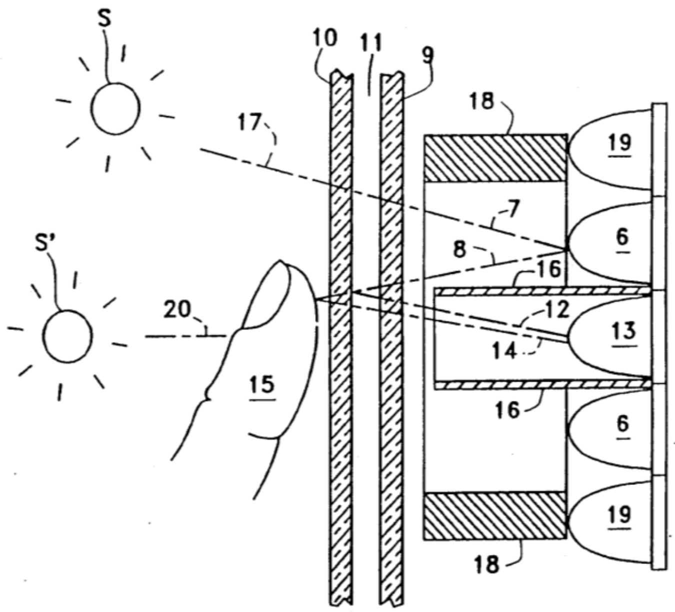

Fig. 1B

Ex. 1010, Figure 1B, 5:67-6:12. "Some of the [infrared light] beam [from an IR LED 6], as indicated at 14, is reflected back into the IRPT 13 by a finger 15 in proximity to the top or outer glass pane 10." Ex. 1010, Figure 1B, Figure 2, 6:9-11. IRPT 13 "converts reflected . . . infrared radiation into an electric signal" that is further processed into "a proximity signal 28 proportional to the amplitude of the modulated infrared radiation received by the IRPT 13." Ex. 1010, Figure 2, 6:36-44, 7:26-33; *see also* 3:62-4:5.

Touch switch panel 150 includes three photoelectric proximity switches (the optical components in FIGURE 1A), each including IR LEDs 6 and an IRPT 13. Ex. 1010, Figure 6, Figure 1A, 9:44-55. The IRPT 13 devices are "furnished with a black IR filter package (not shown)." Ex. 1010, 4:2-4, 6:11-12, 7:26-30.

The three photoelectric proximity switches are mounted inside a store window 156, so that a customer outside the store may use the photoelectric proximity switches to control items inside the store, such as a video disk player 153 connected to a monitor 154 displaying, for example, a store's merchandise catalog:

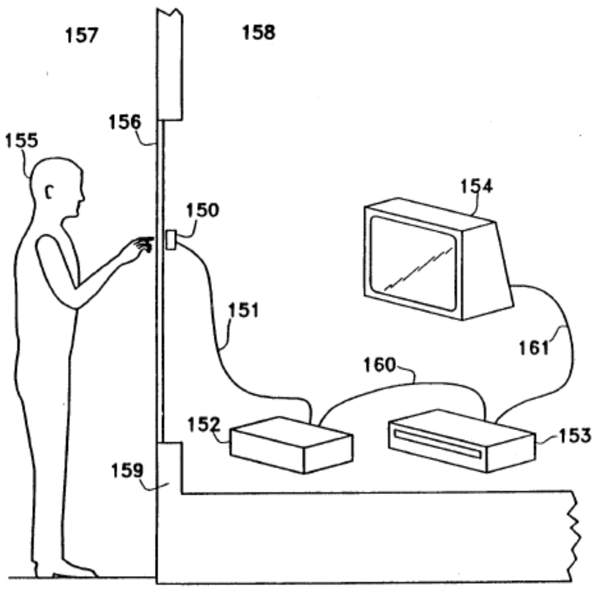

Fig. 4

Ex. 1010, Figure 4, 8:54-9:20. The system may "function as a touch switch or object-present switch." Ex. 1010, 6:58-59. As a person's finger 15 moves toward one of the proximity switches, the light reflected from the person's finger 15 is received by the respective IRPT 13 which generates a proximity signal 28 having an amplitude that is proportional to the amplitude of reflected IR light received. Ex. 1010, 6:36-44; *see also* 3:62-4:5. When the value of the proximity signal 35 is greater than a detection reference 36, proximity of the finger is signaled. Ex. 1010, 6:61-63.

B. Zimmerman and TSL230 Datasheet Render Obvious Claims 1-2, 7 and 30

1. *Claim 1*

[1a] "*A method of determining a characteristic of an object or material comprising the steps of:*"

The touch panel determines proximity [a characteristic] of a finger [object]. Ex. 1010, Abstract, Figure 1B, 5:67-6:62.

[1b] "*receiving light from the object or material;*"

Emitted IR light reflected from a finger is received by an IRPT 13. Ex. 1010, Figure 1B, 3:62-4:1, 6:36-44, 7:26-32.

[1c] "*coupling received light to one or more sensors;*"

Received light is coupled to the IRPT 13 by an opaque tube 16 surrounding the IRPT 13 and restricting the acceptance angle for light to the IRPT 13. Ex. 1010, Figure 1B, 3:62-4:1, 6:36-44, 7:26-32.

[1d] "*generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;*"

IRPT 13 outputs an electric signal proportional to an intensity of IR light fromIR LEDs 6 reflected off the finger and received by the respective IRPT 13.

Ex. 1010, 6:32-44. "An infrared phototransistor (IRPT) 13 converts reflected (and in some cases scattered and direct-transmitted) infrared radiation into an electric signal," on which signal processing is performed "to produce a proximity signal 28 proportional to the amplitude of the modulated infrared radiation received by IRPT 13." Ex. 1010, Figure 2, 6:36-44, 7:26-33; *see also* 3:62-4:5.

Admitted prior art TSL230 sensors generate a signal having a frequency proportional to the light intensity received. Ex. 1005, 5-3, 5-8. The TSL2XX family of sensors are suitable for use with infrared light, and some models include an integral visible light cut-off filter to respond only to IR light. Ex. 1005, 5-6 (Figure 2); Ex. 1008, 1, 3 (Figure 3). The output of the TSL230 signals may be processed by the timer port of a microprocessor measuring the frequency output. Ex. 1005, 5-8; Ex. 1006, 7 (Figure 15); Ex. 1007, 5-5; Ex. 1008, 5. In substituting TSl230 sensors for the IRPTs 13 of Zimmerman, the outputs may be interfaces directly with the microprocessor based control logic for the proximity switches. Ex. 1010, 7:17-22; Ex. 1015, ¶ 54.

When TSL230 sensors are substituted for each of the IRPTs 13 in Zimmerman, the TSL230 sensors will each output a signal having a frequency proportional to the intensity of light reflected from an object. Those having ordinary skill in the relevant art would be motivated to use the TSL230 sensor for the same purpose as the IRPTs 13, to a measure of the intensity of light reflected from the finger. The design choice would require no more than ordinary skill and would produce the predictable result of an improved system in which fewer components and fewer analog devices are required with simpler and more predictable operation, while operating to detect light reflected from an object as described by Zimmerman, based on signals each having a frequency proportional to the intensity of received reflected light. Ex. 1015, ¶ 54.

Substituting the TSL230 sensors for Zimmerman's IRPTs 13 will expectedly produce—in accordance with an intended purpose of the TSL230 sensors—a signal having a frequency proportional to the intensity of light received. Ex. 1015, ¶ 54.

[1e] "*determining the characteristic based on the at least one signal;*"

A proximity signal indicates touch by or proximity of [a characteristic] the finger 15 to one of the photoelectric proximity switches including the IRPT 13. Ex. 1010, Abstract, 6:32-44, 9:9-20.

[1f] "*wherein the light passes through a filter prior to being coupled to one or more of the sensors.*"

"The IRPT 13 is furnished with a black IR filter package (not shown)." Ex. 1010, 6:11-12, 4:2-4, 7:26-30. TSL230 sensors are suitable for use with optical filters. Ex. 1005, 5-6 (Figure 2); Ex. 1008, 1, 3 (Figure 3).

2. *Claim 2*

[2a] "*The method of claim 1,*"

See discussion of Claim 1 above.

[2b] "*wherein the at least one signal comprises a digital signal.*"

See the discussion of [2b] in Ground 1. This limitation is satisfied by the TSL230 in the same manner as discussed in [2b] of Ground 1 for the combination of Zimmerman and the TSL230 Datasheet. Ex. 1015, ¶ 54.

3. *Claim 7*

[7a] "*The method of claim 1,*"

See discussion of Claim 1 above.

[7b] "*wherein the step of generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors comprises integrating light coupled to the one or more sensors with an integrator.*"

See the discussion of [7b] in Ground 1. This limitation is satisfied by the TSL230 in the same manner as discussed in [7b] of Ground 1 for the combination of Zimmerman and the TSL230 Datasheet. Ex. 1015, ¶ 54.

4. *Claim 30*

For elements [30a]-[30f], see the discussion of elements [1a]-[1f] in Claim 1 above for identification and explanation regarding where each of those claim elements is found in Zimmerman and/or the TSL230 Datasheet.

[30g] "*wherein the filter comprises a plurality of filter portions having a wavelength dependent optical transmission property.*"

The IR filters of the three photoelectric proximity switches form a plurality of filter elements (one for each IRPT 13), which couple the light to the IRPTs 13 in the three photoelectric proximity switches. Ex. 1010, Figure 6, 9:45-56. An IR filter has a wavelength dependent optical transmission property in that the filter filters light in the infrared wavelengths of the spectrum. Similar IR filters (visible light cut-off filters) are suitable for use with TSL2XX sensors. Ex. 1005, 5-6 (Figure 2); Ex. 1008, 1, 3 (Figure 3).

C. Charts

Limitation		**Zimmerman+TSL230 Datasheet**
1a	A method for determining a characteristic of an object or material comprising the steps of:	The touch panel determines proximity [a characteristic] of a finger [object]. Ex. 1010, Abstract, Figure 1B, 5:67-6:62.
1b	receiving light from the object or material;	Emitted IR light reflected from a finger is received by an IRPT 13. Ex. 1010, Figure 1B, 3:62-4:1, 6:36-44, 7:26-32.
1c	coupling received light to one or more sensors;	Received light is coupled to the IRPT 13 by an opaque tube 16 surrounding the IRPT 13 and restricting the acceptance angle for light to the IRPT 13. Ex. 1010, Figure 1B, 3:62-

Limitation		Zimmerman+TSL230 Datasheet
		4:1, 6:36-44, 7:26-32.
1d	generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;	IRPT 13 outputs an electric signal proportional to an intensity of IR light from IR LEDs 6 reflected off the finger and received by the respective IRPT 13. Ex. 1010, 6:32-44. "An infrared phototransistor (IRPT) 13 converts reflected (and in some cases scattered and direct-transmitted) infrared radiation into an electric signal," on which signal processing is performed "to produce a proximity signal 28 proportional to the amplitude of the modulated infrared radiation received by IRPT 13." Ex. 1010, Figure 2, 6:36-44, 7:26-33; *see also* 3:62-4:5. Admitted prior art TSL230 sensors generate a signal having a frequency proportional to the light intensity received. Ex. 1005, 5-3, 5-8. The TSL2XX family of sensors are suitable for use with infrared light, and some models include an integral visible light cut-off filter to respond only to IR light. Ex. 1005, 5-6 (Figure 2); Ex. 1008, 1, 3 (Figure 3). The output of the TSL230 signals may be processed by the timer port of a microprocessor measuring the frequency output. Ex. 1005, 5-8; Ex. 1006, 7 (Figure 15); Ex. 1007, 5-5; Ex. 1008, 5. In substituting TSl230 sensors for the IRPTs 13 of Zimmerman, the outputs may be interfaces directly with the microprocessor based control logic for the proximity switches. Ex. 1010, 7:17-22. Ex. 1015, ¶ 54. When TSL230 sensors are substituted for each of the IRPTs 13 in Zimmerman, the TSL230 sensors will each output a signal having a frequency proportional to the intensity of light reflected from an object.

Limitation		Zimmerman+TSL230 Datasheet
		Those having ordinary skill in the relevant art would be motivated to use the TSL230 sensor for the same purpose as the IRPTs 13, to a measure of the intensity of light reflected from the finger. The design choice would require no more than ordinary skill and would produce the predictable result of an improved system in which fewer components and fewer analog devices are required with simpler and more predictable operation, while operating to detect light reflected from an object as described by Zimmerman, based on signals each having a frequency proportional to the intensity of received reflected light. Substituting the TSL230 sensors for Zimmerman's IRPTs 13 will expectedly produce—in accordance with an intended purpose of the TSL230 sensors—a signal having a frequency proportional to the intensity of light received. Ex. 1015, ¶ 54.
1e	determining the characteristic based on the at least one signal;	A proximity signal indicates touch by or proximity of [a characteristic] the finger 15 to one of the photoelectric proximity switches including the IRPT 13. Ex. 1010, Abstract, 6:32-44, 9:9-20.
1f	wherein the light passes through a filter prior to being coupled to one or more of the sensors,	"The IRPT 13 is furnished with a black IR filter package (not shown)." Ex. 1010, 6:11-12, 4:2-4, 7:26-30. TSL230 sensors are suitable for use with optical filters. Ex. 1005, 5-6 (Figure 2); Ex. 1008, 1, 3 (Figure 3).
2a	The method of Claim 1,	See [1a]-[1f].
2b	wherein the at least one signal comprises a digital signal.	The output of the TSL230 photodetector sensor is TTL or CMOS compatible – i.e., "digital." Ex. 1005, 5-3, 5-8. Ex. 1015, ¶ 54.
7a	The method of claim 1,	See [1a]-[1f].
7b	wherein the step of generating at least one signal having a frequency	The TSL230 sensors employ an integrator performing charge integration to convert the photodiode's intensity measurement into a

Limitation		Zimmerman+TSL230 Datasheet
	proportional to the light intensity received by the one or more sensors comprises integrating light coupled to the one or more sensors with an integrator.	digital frequency output. Ex. 1010, 19:23-29; Ex. 1004, (Berlien Decl.) ¶ 7; Ex. 1015, ¶ 54.
30a	A method for determining a characteristic of an object or material comprising the steps of:	See [1a].
30b	receiving light from the object or material;	See [1b].
30c	coupling received light to one or more sensors;	See [1c].
30d	generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;	See [1d].
30e	determining the characteristic based on the at least one signal;	See [1e].
30f	wherein the light passes through a filter prior to being coupled to one or more of the sensors,	See [1f].
30g	wherein the filter comprises a plurality of filter portions having a wavelength dependent optical transmission property.	The IR filters of the three photoelectric proximity switches form a plurality of filter elements (one for each IRPT 13), which couple the light to the IRPTs 13 in the three photoelectric proximity switches. Ex. 1010, Figure 6, 9:45-56. An IR filter has a wavelength dependent optical transmission property in that the filter filters light in the infrared wavelengths of the spectrum. Similar IR filters (visible light cut-off filters) are suitable for use with TSL2XX sensors. Ex. 1005, 5-6 (Figure 2); Ex. 1008, 1, 3 (Figure

Limitation		Zimmerman+TSL230 Datasheet
		3).

VIII. GROUND 3: Claims 1-2, 7, 30 and 98 are obvious over JP ’028 in view of the TSL230 Datasheet.

This ground is not redundant with Grounds 1-2 because: an additional claim is challenged that is not challenged in Grounds 1-2; JP ’028 discloses color filters and determining object color, a feature not disclosed in the references of Grounds 1-2; and JP ’028 discloses A/D conversion suitable for direct connection with the TSL230, which is not described in the references of Grounds 1-2.

A. Overview of JP ’028

JP ’028 describes a non-contact colorimeter B to measure an object’s color and set a distance between the colorimeter and the object to be measured to a prescribed distance (to avoid inaccurate color measurement). Ex. 1011, Figure 6, 214-l[1], 220-l. A xenon light source 1 emits light projected by lens 38 onto an object 40:

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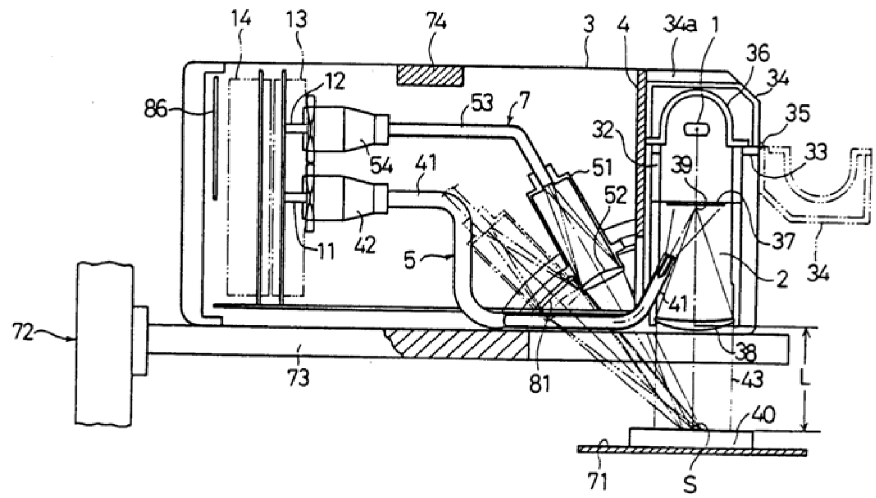
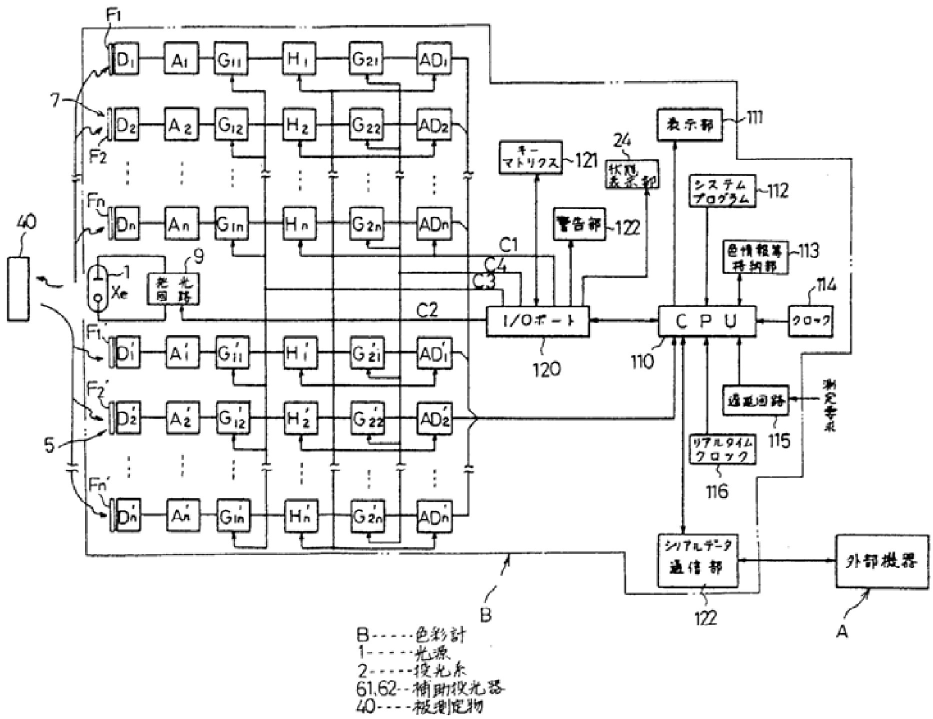
[1] For convenience, “l” and “r” are used to designate the left and right columns, respectively, on the indicated page.

第 2 図



Ex. 1011, Figures 2-4, 215-r. A light source monitor 5 includes an optical fiber 41 receiving light from the light source 1 and carrying the received light to a diffusion chamber 42, which guides that received light to sensor 11. Ex. 1011, Figure 2, 215-r to 216-l. A sample monitor 7 receives light (through a light receiving lens 52 and optical fiber 53) reflected light from the object 40 which is coupled via optical fiber 53 and diffusion chamber 54 to a sensor 12. Ex. 1011, Figure 2, 216-l. Sensor 12 includes color component filters F_1'-F_n' for filtering light reflected from the object 40 and light color component detectors D_1'-D_n' for measuring the intensity of the color components of the received filtered light:

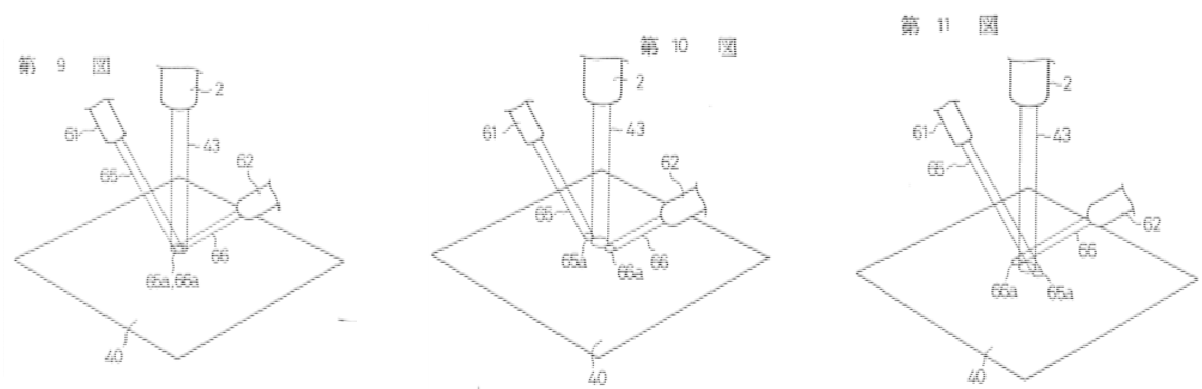
第 1 図



Ex. 1011, Figure 1, 217-r.

The color component detectors D_1'-D_n' generate and output an electric signals corresponding to the intensity of the basic color components. The electric signals are amplified by amplification circuits A_1'-A_n', connected by gate circuits G_{11}'-G_{1n}' to sample and hold circuits H_1'-H_n', and are connected by gate circuits G_{21}'-G_{2n}' to A/D conversion circuits AD_1'-AD_n'. Ex. 1011, Figure 1, 218-l. These AD conversion circuits convert the electric signals corresponding to light intensity measurements into digital values by pulse interval period measurement using a timer: "The A/D conversion circuits . . ., for example, convert the information from the sample holding into pulse duration information and counts the gated clock during the interval of this pulse by a digital counter to convert to a digital signal." Ex. 1011, 219-l. The CPU 110 receives the digital values for the measured color components of the reflected light (from the object). Ex. 1011, 218-r ("The photometric value of the respective basic color components converted into digital signals by the A/D conversion circuits AD_1-AD_n, AD_1'-AD_n' are input into the CPU 110.").

To ensure object 40 is at measurement position S that is a prescribed distance L from input lens tube 51, two auxiliary light projectors 61, 62 projecting light from optical fibers 61a and 62a are positioned so that the resulting optical paths 65, 66 intersect each other and the main optical path 43 at measurement position S:



Ex. 1011, Figures 9-11, 216-l to 216-r.

B. JP '028 and TSL230 Datasheet Render Claims 1-2, 7, 30 and 98 Obvious

1. *Claim 1*

[1a] "*A method of determining a characteristic of an object or material comprising the steps of:*"

A colorimeter determines color [a characteristic] of an object. Ex. 1011, Title, Figures 1-2, 10-13, 220-l to 220-r.

[1b] "*receiving light from the object or material;*"

The object 40 is illuminated by a light source 1 and auxiliary light projectors 61, 62, and the light reflected from the object 40 is received by light receiving lens 52 and optical fiber 53. Ex. 1011, Figures 1-2, 216-l.

[1c] "*coupling received light to one or more sensors;*"

Object measurement monitor 7 includes light sensor 12 having color component detectors D_1'-D_n' each receiving (through a light receiving lens tube 51 holding light receiving lens 52 coupled by optical fiber 53 to diffusion chamber 54 around sensor 12) reflected light from the object 40. Ex. 1011, Figures 1-2, 216-l, 217-r.

[1d] "*generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;*"

Each of the detectors D_1'-D_n' receive reflected light from the object 40, measure the intensity, and generate corresponding electric signals that are further processed and converted into digital values and input to the CPU 110. Ex. 1011,

Figure 1, 218-r to 219-l. Thus, JP ’028 discloses multiple photodetectors that each generate and output an electric signal that is proportional to the light intensity received by the respective photodetector:

> The A/D conversion circuits AD_1-AD_n, AD_1'-AD_n', for example, convert the information from the sample holding into pulse duration information and counts the gated clock during the interval of this pulse by a digital counter to convert to a digital signal.

Ex. 1011, 219. Photodetectors D_1'-D_n' output signals whose values are proportional to the light intensity received by each respective photodetector.

The TSL230 sensors are light sensors that generate a signal having a frequency proportional to the light intensity received. Ex. 1005, 5-3, 5-8. The pulse interval period measurement technique taught by JP “’028 for digitizing light intensity measurements is directly applicable to digitizing the output of TSL230 sensors. In implementing each of photodetectors D_1'-D_n' in JP ’028 using TSL230 sensors, the same A/D converters AD_1-AD_n, AD_1'-AD_n' may be employed to digitize the outputs of photodetectors D_1'-D_n', operating in the same manner to receive “pulse duration information and count[] the gated clock during the interval of this pulse by a digital counter to convert to a digital signal.” Ex. 1015, ¶¶ 58-59. Those having ordinary skill in the relevant art would be motivated to use the TSL230 sensor to implement photodetectors D_1-D_n and D_1'-D_n' in JP ’028 for the purpose described (to measure the intensity of light reflected from the object). The design choice would require no more than ordinary skill and would produce the predictable result of an improved system providing high resolution light measurement, while operating in the manner described to detect light reflected from an object. Ex. 1015, ¶¶ 58-59.

Utilization of the TSL230 sensors as each of photodetectors D_1-D_n and D_1'-D_n' will expectedly produce—in accordance with an intended purpose of the TSL230 devices—a signal having a frequency proportional to the intensity of light received.

[1e] "*determining the characteristic based on the at least one signal;*"

The digital values generated from light intensity color component measurements made by the photodetectors D_1-D_n and D_1'-D_n' are input to the CPU 110 which determines the color(s) reflected from the object. Ex. 1011, Figure 1, 219-l. The colorimeter of JP '028 "measures the numerical value of the color of an object to be measured from reflected light . . ." Ex. 1011, 213-r, 220-l ("and the resulting color values (L*a*b) are outputted externally.").

[1f] "*wherein the light passes through a filter prior to being coupled to one or more of the sensors.*"

Light reflected from the object 40 passes through color component filters F_1'-F_n' prior to being coupled to the light color component detectors D_1'-D_n'. Ex.

1011, Figure 1, 217-r.

2. *Claim 2*

[2a] "*The method of claim 1,*"

See discussion of Claim 1 above.

[2b] "*wherein the at least one signal comprises a digital signal.*"

The output of the TSL230 is TTL or CMOS compatible—"digital." Ex. 100[B], 5-3, 5-7. Moreover, JP '028 teaches that the output signals from the photodetectors D_1-D_n and D_1'-D_n' are converted to digital values in a manner suitable for digitizing the outputs of the TSL230 sensors. Ex. 1011, 218-r, 219-r.

3. *Claim 7*

[7a] "*The method of claim 1,*"

See discussion of Claim 1 above.

[7b] "*wherein the step of generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors comprises integrating light coupled to the one or more sensors with an integrator.*"

See the discussion of [7b] in Ground 1. This limitation is satisfied by the TSL230 in the same manner as discussed in [7b] of Ground 1 for the combination of JP '028 and the TSL230 Datasheet. Ex. 1015, ¶¶ 60-61.

4. *Claim 30*

For elements [30a]-[30f], see the discussion of elements [1a]-[1f] in Claim 1 above for identification and explanation regarding where each of those claim elements is found in JP ’028 and/or the TSL230 Datasheet.

[30g] “*wherein the filter comprises a plurality of filter portions having a wavelength dependent optical transmission property.*”

Light reflected from the object 40 passes through each of the color component filters F_1'-F_n' prior to being coupled to the light color component detectors D_1'-D_n'. Ex. 1011, Figure 1, 217-r. The filters F_1'-F_n' comprise a plurality of filter portions, with each filter having a wavelength dependent optical transmission property. Ex. 1015, ¶¶ 41 and 48.

5. *Claim 98*

[98a] “*A method comprising the steps of:*”

JP ’028 discloses a method of measuring an object’s color and setting a distance between the colorimeter input(s) and the object to be measured to a prescribed distance. Ex. 1011.

[98b] "*receiving light with one or more light receivers wherein the one or more light receivers receive light to be spectrally analyzed;*"

JP '028 describes that the object 40 is illuminated by a light source 1 and the light reflected from the object 40 is received by light receiving lens 52 for spectral measurement. Ex. 1011, Figures 1-2, 216-l.

[98c] "*coupling light received by the one or more light receivers to an optical sensor through a color filter,*"

Light sample monitor 7, which includes light sensor 12 having color component detectors D_1'-D_n' [an optical sensor], receives light (through a light receiving lens tube 51 and light receiving lens 52) reflected light from the object 40 which is coupled via optical fiber 53 and diffusion chamber 54. Ex. 1011, Figures 1-2, 216-l, 217-r. The received light is coupled to the light color component detectors D_1'-D_n' [optical sensor] through the color component filters F_1'-F_n' [a color filter]. Ex. 1011, Figure 1, 217-r.

[98d] "*wherein the color filter has a plurality of portions, wherein each of the plurality of portions has a wavelength dependent light transmission property covering a predetermined band or bands of wavelengths, wherein the predetermined bands of the plurality of portions cover a predetermined band of wavelengths to be spectrally analyzed*"

The color component filters F_1'-F_n' [color filter] are configured as n portions F_1' thru F_n'. Ex. 1011, Figure 1, 217-r. Each color component filter F_1'-F_n' has a wavelength dependent light transmission property that covers a predetermined band or bands of wavelengths. Ex. 1011, 218-l ("In the embodiment, n=3 is established and the three stimulus values, X,Y,Z, which are in the XYZ color specification.").

[98e] "*wherein light from the one or more light receivers is coupled to the plurality of portions of the color filter,*"

See [98c] above.

[98f] "*wherein the optical sensor has a plurality of sensing elements,*"

The light color component detector [optical sensor] has a plurality of photodetectors D_1'-D_n' for sensing light. Ex. 1011, Figure 1, 217-r.

[98g] "*wherein light received by the one or more light receivers is coupled to the sensing elements through the plurality of portions of the color filter;*"

See [98c] and [98f] above.

[98h] "*wherein light received by the one or more light receivers is spectrally analyzed without using a diffraction grating;*"

JP '028 does not describe or disclose any diffraction grating. JP '028 employs filters that attenuate some wavelengths of received light while transmitting other wavelengths without similar attenuation. JP '028 analyzes the filtered (not diffracted) components of the received light to determine spectral qualities. See the discussion of elements [98b] through [98g] above.

[98i] "*wherein the optical sensor comprises a plurality of light to frequency converter sensing elements.*"

Collectively, the photodetectors D_1'-D_n' are an optical sensor. See also [98c] above. Each of the plurality of photodetectors D_1'-D_n' receive reflected light from the object 40, measure the intensity, and generate corresponding electric signals that are further processed and converted into digital values and input to the CPU 110. Ex. 1011, Figure 1, 218-r to 219-l. Each photodetector generates and outputs an electric signal that is proportional to the light intensity received by the respective photodetector. JP '028 does not explicitly disclose or teach the photodetectors D_1'-D_n' are "light-to-frequency converter sensing elements." However, JP '028 photodetectors D_1'-D_n' are "light-to-signal" converter sensing elements or """light-to-digital signal" converter sensing elements (i.e., photodetectors D_1'-D_n' in combination with the related processing circuitry) whose output signals are proportional to the light intensity received by each respective photodetector.

The '629 Patent's admitted prior art—the commercially-available TSL230 devices manufactured by Texas Instruments—are "Programmable Light-To-Frequency Converter" sensors that convert light into an electric signal having a frequency proportional to the light intensity received. Ex. 100[B], Title, pages 5-3, 5-8 ("The output can be either a pulse train or a square wave (50% duty cycle) with frequency directly proportional to light intensity" and "High-Resolution Conversion of Light Intensity to Frequency").

Since the TSL230 sensor is a light-to-frequency converter, implementing each of photodetectors D_1'-D_n' in JP '028 results in an optical sensor having a plurality of light to frequency converter sensing elements. Those having ordinary skill in the relevant art would be motivated to use the TSL230 sensors for the same purpose as the photodetectors D_1'-D_n' within the system of JP '028, as a measure of the intensity of light reflected from the object. The design choice would require no more than ordinary skill and would produce the predictable result of an improved system in which fewer components and fewer analog devices are required with simpler and more predictable operation, while operating as an optical sensor using light-to-frequency converter sensing elements. Ex. 1015, ¶¶ 58-59.

Utilization of the TSL230 sensors as photodetectors D_1-D_n and D_1'-D_n' will expectedly produce—in accordance with an intended purpose of the TSL230 devices—an optical sensor having a plurality of light-to-frequency converter sensing elements. Ex. 1015, ¶¶ 58-59.

C. Charts

Limitation		JP '028+TSL230 Datasheet
1a	A method for determining a characteristic of an object or material comprising the steps of:	A colorimeter determines color [a characteristic] of an object. Ex. 1011, Title, Figures 1-2, 10-13, 220-l to 220-r.
1b	receiving light from the object or material;	The object 40 is illuminated by a light source 1 and auxiliary light projectors 61, 62, and the light reflected from the object 40 is received by light receiving lens 52 and optical fiber 53. Ex. 1011, Figures 1-2, 216-l.
1c	coupling received light to one or more sensors;	Object measurement monitor 7 includes light sensor 12 having color component detectors D_1'-D_n' each receiving (through a light receiving lens tube 51 holding light receiving lens 52 coupled by optical fiber 53 to diffusion chamber 54 around sensor 12) reflected light from the object 40. Ex. 1011, Figures 1-2, 216-l, 217-r.
1d	generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;	Each of the detectors D_1'-D_n' receive reflected light from the object 40, measure the intensity, and generate corresponding electric signals that are further processed and converted into digital values and input to the CPU 110. Ex. 1011, Figure 1, 218-r to 219-l.

Limitation		JP ’028+TSL230 Datasheet
		Thus, JP ’028 discloses multiple photodetectors that each generate and output an electric signal that is proportional to the light intensity received by the respective photodetector. Ex. 1011, 219. Photodetectors D_1'-D_n' output signals whose values are proportional to the light intensity received by each respective photodetector. The TSL230 sensors are light sensors that generate a signal having a frequency proportional to the light intensity received. Ex. 1005, 5-3, 5-8. The pulse interval period measurement technique taught by JP “’028 for digitizing light intensity measurements is directly applicable to digitizing the output of TSL230 sensors. In implementing each of photodetectors D_1'-D_n' in JP ’028 using TSL230 sensors, the same A/D converters AD_1-AD_n, AD_1'-AD_n' may be employed to digitize the outputs of photodetectors D_1'-D_n', operating in the same manner to receive “pulse duration information and count[] the gated clock during the interval of this pulse by a digital counter to convert to a digital signal.” Ex. 1015, ¶¶ 58-59. Those having ordinary skill in the relevant art would be motivated to use the TSL230 sensor to implement photodetectors D_1-D_n and D_1'-D_n' in JP ’028 for the purpose described (to measure the intensity of light reflected from the object). The design choice would require no more than ordinary skill and would produce the predictable result of an improved system providing high resolution light measurement, while operating in the manner described to detect light reflected from an object. Ex. 1015, ¶¶ 58-59

Limitation		JP ’028+TSL230 Datasheet
		Utilization of the TSL230 sensors as each of photodetectors D_1-D_n and D_1'-D_n' will expectedly produce—in accordance with an intended purpose of the TSL230 devices—a signal having a frequency proportional to the intensity of light received.
1e	determining the characteristic based on the at least one signal;	The digital values generated from light intensity color component measurements made by the photodetectors D_1-D_n and D_1'-D_n' are input to the CPU 110 which determines the color(s) reflected from the object. Ex. 1011, Figure 1, 219-l. The colorimeter of JP ’028 “measures the numerical value of the color of an object to be measured from reflected light . . .” Ex. 1011, 213-r, 220-l (“and the resulting color values (L*a*b) are outputted externally.”).
1f	wherein the light passes through a filter prior to being coupled to one or more of the sensors,	Light reflected from the object 40 passes through color component filters F_1'-F_n' prior to being coupled to the light color component detectors D_1'-D_n'. Ex. 1011, Figure 1, 217-r.
2a	The method of Claim 1,	See [1a]-[1f].
2b	wherein the at least one signal comprises a digital signal.	The output of the TSL230 photodetector sensor is TTL or CMOS compatible – i.e., “digital.” Ex. 1005, 5-3, 5-8.
7a	The method of claim 1,	See [1a]-[1f].
7b	wherein the step of generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors comprises integrating light coupled to the one or more sensors with an integrator.	The TSL230 sensors employ an integrator performing charge integration to convert the photodiode’s intensity measurement into a digital frequency output. Ex. 1010, 19:23-29; Ex. 1004, (Berlien Decl.) ¶ 7; Ex. 1015, ¶¶ 60-61.
30a	A method for determining a characteristic of an object or material comprising the steps	See [1a].

Limitation		JP ’028+TSL230 Datasheet
	of:	
30b	receiving light from the object or material;	See [1b].
30c	coupling received light to one or more sensors;	See [1c].
30d	generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;	See [1d].
30e	determining the characteristic based on the at least one signal;	See [1e].
30f	wherein the light passes through a filter prior to being coupled to one or more of the sensors,	See [1f].
30g	wherein the filter comprises a plurality of filter portions having a wavelength dependent optical transmission property.	Light reflected from the object 40 passes through each of the color component filters F_1'-F_n' prior to being coupled to the light color component detectors D_1'-D_n'. Ex. 1011, Figure 1, 217-r. The filters F_1'-F_n' are a plurality of filter portions, with each filter having a wavelength dependent optical transmission property. Ex. 1011, 218-l (“In the embodiment, n=3 is established and the three stimulus values, X,Y,Z, which are in the XYZ color specification.”), 219-r; Ex. 1015, ¶¶ 41 and 48.
98a	A method comprising the steps of:	JP ’028 discloses a method. Ex. 1011.
98b	receiving light with one or more light receivers wherein the one or more light receivers receive light to be spectrally analyzed;	Light reflected from the object 40 is received by light receiving lens 52 for spectral measurement. Ex. 1011, Figures 1-2, 216-l.
98c	coupling light received by the one or more light	Light sample monitor 7, which includes light sensor 12 having color component detectors

	Limitation	JP ’028+TSL230 Datasheet
	receivers to an optical sensor through a color filter,	D_1'-D_n' [collectively, an optical sensor], receives light (through a light receiving lens tube 51 and light receiving lens 52) reflected light from the object 40 which is coupled via optical fiber 53 and diffusion chamber 54. Ex. 1011, Figures 1-2, 216-l, 217-r. The received light is coupled to the light color component detectors D_1'-D_n' [optical sensor] through the color component filters F_1'-F_n' [collectively, a color filter]. Ex. 1011, Figure 1, 217-r.
98d	wherein the color filter has a plurality of portions, wherein each of the plurality of portions has a wavelength dependent light transmission property covering a predetermined band or bands of wavelengths, wherein the predetermined bands of the plurality of portions cover a predetermined band of wavelengths to be spectrally analyzed,	The color component filters F_1'-F_n' [color filter] are configured as n portions F_1' thru F_n'. Ex. 1011, Figure 1, 217-r. Each color component filter F_1'-F_n' has a wavelength dependent light transmission property that covers a predetermined band or bands of wavelengths. Ex. 1011, 218-l (“In the embodiment, n=3 is established and the three stimulus values, X,Y,Z, which are in the XYZ color specification.”), 219-r.
98e	wherein light from the one or more light receivers is coupled to the plurality of portions of the color filter,	See [98c] above.
98f	wherein the optical sensor has a plurality of sensing elements,	The light color component detector [optical sensor] has a plurality of photodetectors D_1'-D_n' for sensing light. Ex. 1011, Figure 1, 217-r.
98g	wherein light received by the one or more light receivers is coupled to the sensing elements through the plurality of portions of the color filter;	See, [98c] and [98f] above.

Limitation		JP ’028+TSL230 Datasheet
98h	wherein light received by the one or more light receivers is spectrally analyzed without using a diffraction grating;	JP ’028 does not describe or disclose any diffraction grating. JP ’028 employs filters that filter some received light while transmitting other wavelengths. JP ’028 analyzes the filtered (not diffracted) components of the received light to determine spectral qualities. See the discussion of elements [98b] through [98g] above. Ex. 1015, ¶ 63.
98i	wherein the optical sensor comprises a plurality of light to frequency converter sensing elements.	Collectively, the photodetectors D_1'-D_n' are an optical sensor. See also [98c] above. Each of the plurality of photodetectors D_1'-D_n' receive reflected light from the object 40, measure the intensity, and generate corresponding electric signals that are further processed and converted into digital values and input to the CPU 110. Ex. 1011, Figure 1, 218-r to 219-l. Each photodetector generates and outputs an electric signal that is proportional to the light intensity received by the respective photodetector. JP ’028 does not explicitly disclose or teach the photodetectors D_1'-D_n' are “light-to-frequency converter sensing elements.” However, JP ’028 photodetectors D_1'-D_n' are “light-to-signal” converter sensing elements or “”light-to-digital signal” converter sensing elements (i.e., photodetectors D_1'-D_n' in combination with the related processing circuitry) whose output signals are proportional to the light intensity received by each respective photodetector. Admitted prior art TSL230 sensors are “Programmable Light-To-Frequency Converter” sensors that convert light into an electric signal having a frequency proportional to the light intensity received. Ex. 1005, Title, 5-3, 5-8 (“The output can be

Limitation		JP ’028+TSL230 Datasheet
		either a pulse train or a square wave (50% duty cycle) with frequency directly proportional to light intensity” and “High-Resolution Conversion of Light Intensity to Frequency”). Since the TSL230 sensor is a light-to-frequency converter, using a TSL230 sensor for each of the photodetectors D_1'-D_n' in JP ’028 results in an optical sensor having a plurality of light to frequency converter sensing elements. Those having ordinary skill in the relevant art would be motivated to use the TSL230 sensors for the same purpose as the photodetectors D_1'-D_n' within the system of JP ’028, as a measure of the intensity of light reflected from the object. The design choice would require no more than ordinary skill and would produce the predictable result of an improved system in which fewer components and fewer analog devices are required with simpler and more predictable operation, while operating as an optical sensor using light-to-frequency converter sensing elements. Ex. 1015, ¶¶ 58-59. Utilization of the TSL230 sensors in place of JP’s ‘028 photodetectors D_1'-D_n' will expectedly produce—in accordance with an intended purpose of the TSL230 devices—an optical sensor having a plurality of light-to-frequency converter sensing elements. Ex. 1015, ¶¶ 58-59.

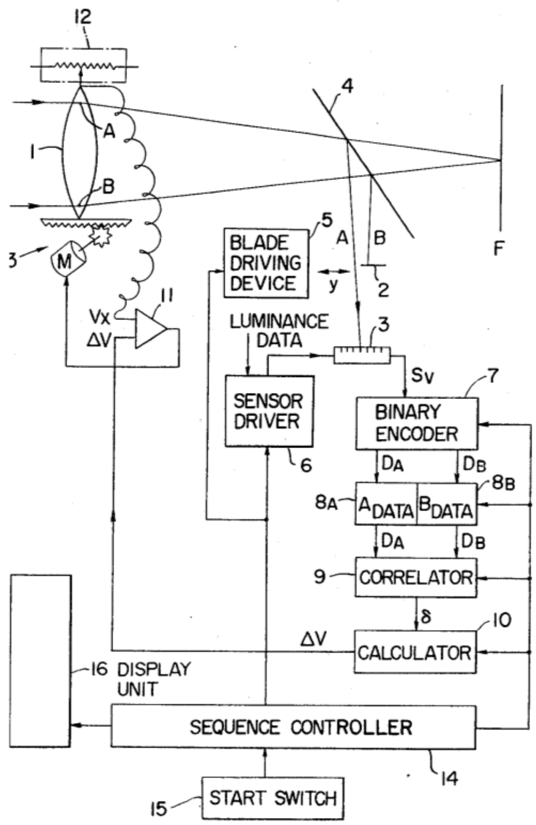
IX. GROUND 4: Claims 1-2, 7, 30 and 98 are obvious over Eguchi.

This ground is not redundant with Grounds 1-3 because Eguchi is a single reference disclosing each and every element recited in each claim.

A. Overview of Eguchi

Eguchi describes a camera with an autofocus feature for a camera that determines a distance (in the form of a focusing position or focal length of the camera lens) to an object Σ based in part on the intensity of light reflected from the object. Ex. 1006 5:40-62. The camera receives light from an object out of focus via a lens 1 and half-mirror 4. The light forms alternating light beams A and B at sensor array 3:

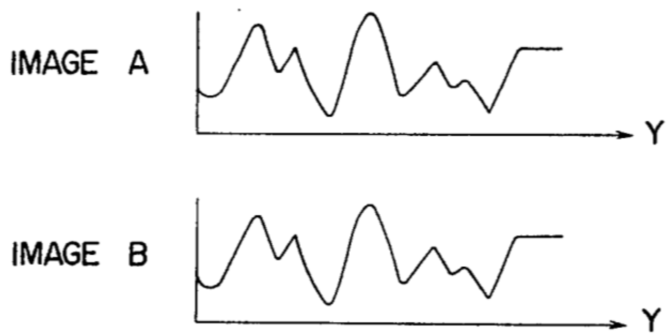
FIG. 9



Ex. 1006 Figures 1 & 9, 5:42-60. A color stripe or color division filter may be employed to form beams A and B. Ex. 1006, 5:60-62.

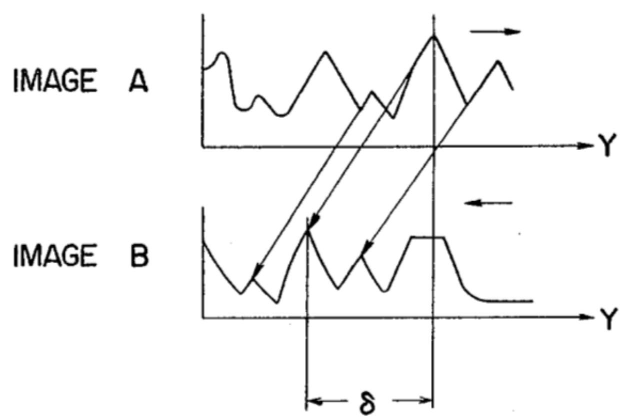
The sensor array 3 positioned along the focal plane determines distributions of light intensity (corresponding to light and dark regions of the object). When the lens is in the focus position, the images (light reflected from an object) passing through the edges A and B of the lens are aligned:

FIG. 6



Ex. 1006, Figure 6, 4:42-52. When the lens is not in the focus position, the images (light reflected from the object) passing through the edges A and B of the lens are offset, which offset can be used to determine the amount and direction of lens adjustment necessary to move the lens into the focus position:

FIG. 7

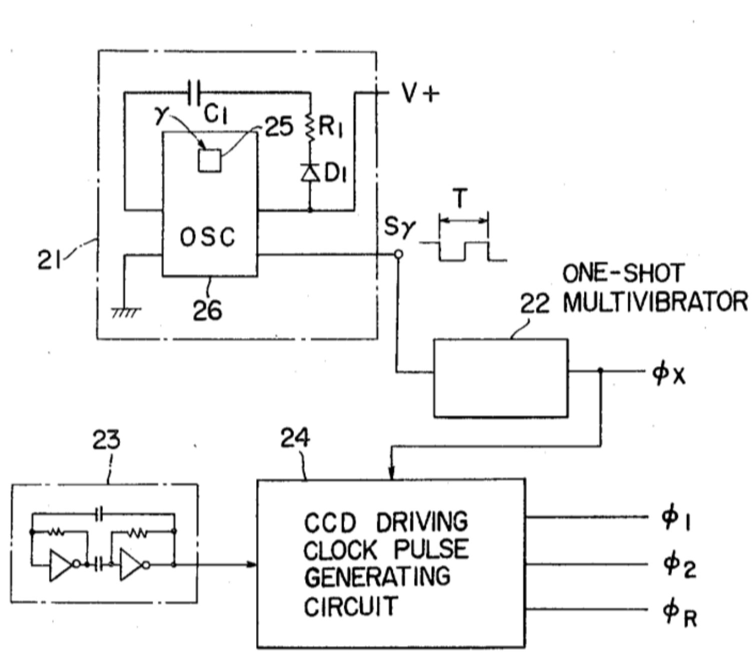


Ex. 1006, Figure 7, 4:53-5:41. The amount of movement of the lens is related directly to the amount of composite shift δ of the images A and B. Thus, the lens driving direction and distance to which the lens is moved for focusing can be detected.

The sensor array 3 (CCD image sensor array) converts light reflected from an object (the image of the object) into electrical signals which are output as a light intensity distribution signal (i.e., light intensity signal). The light intensity signal is converted into a digital binary signal and stored in data memory 8B. The sensor array 3 is driven by a sensor driver 6 to output the light intensity distribution signal that corresponds to the light intensity reflected from the object. Ex. 1006, 5:63-6:20.

The sensor driver 6 includes a light-to-frequency conversion circuit 21, a photocell 25 (light sensor), and various other circuit components:

FIG. 10



Ex. 1006, Figure 10, 6:60-7:13. The light-to-frequency conversion circuit 21 outputs "a square wave signal Sγ whose frequency varies with a quantity of incident light γ" wherein "the period T of the square wave signal Sγ decreases with an increasing [sic] the quantity of incident light γ or increases with a decreasing quantity of incident light." Ex. 1006, Figure 10, 6:67-7:13. The square wave signal Sγ is utilized to generate a shift pulse ϕ_x signal having period T that drives the sensor array 3. Ex. 1006, Figures 10 & 11, 7:8-13. As a result, the sensor array 3 outputs (frame rate) the light intensity distribution signal reflected from the object (received image) at a rate proportional to the intensity of light received at the photocell 25. Ex. 1006, 7:21-27.

Another embodiment is shown in Figure 30, which includes a sensor array 101 (equivalent to sensor arrays 3A, 3B in Figure 22), a sensor driver 102, and a light-to-frequency conversion circuit 103. Ex. 1006, Figures 30 & 22, 14:24-37.

B. Eguchi Renders Claims 1-2, 7, 30 and 98 Obvious

1. *Claim 1*

[1a] "*A method of determining a characteristic of an object or material comprising the steps of:*"

Eguchi discloses a camera and autofocus mechanism that determines the intensity of light reflected from an object. Ex. 1006, Figure 7, 4:53-5:41, 19:48-53.

[1b] "*receiving light from the object or material;*"

Light from the object of focus is received through a lens 1. Ex. 1006, Figure 9, 5:42-60. Light received from the object (i.e., the image) is also received at photocell 25. Ex. 1006, Figure 10, 6:60 to 7:13.

[1c] "*coupling received light to one or more sensors;*"

Eguchi describes some of the light ("bundles of rays passing through points A and B") received via the lens 1 and half-mirror 4 is directed toward sensor array 3. Ex. 1006, Figure 9, 5:46-60, 9:63-10:2.

[1d] "*generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;*"

Light-to-frequency conversion circuit 21 generates a signal having a frequency (period T) that is proportional to the light intensity received by the photocell 25 [light sensor].

In addition, Eguchi describes varying an accumulation time of the CCD sensor array 3 based on luminance (intensity) of light received from the object (the square wave signal Sγ output from light-to-frequency conversion circuit 21) and outputting an intensity distribution signal Sv corresponding to the intensity of received light:

> An object is greatly variable in luminance. It is preferable to employ an accumulation mode CCD image sensor array in order to obtain

signals in response to the variations in luminance of the object. Accordingly, in this embodiment, a CCD image sensor array is employed as the sensor array 3. The sensor array is driven by a sensor driver 6 (described later in detail) with its charge accumulation time being controlled so as to output serially an intensity distribution signal Sv corresponding to the intensity of each light receiving point over a wide luminance range.

Ex. 1006, 6:3-13. The square wave signal Sγ is used to control the accumulation time for the CCD sensor array 3. Ex. 1006, Figures 9 & 10, 7:8-13. The output frequency of the intensity distribution signal Sv from the CCD sensor array 3 is based upon the frequency of the square wave signal Sγ. Thus, the sensor array 3 successively outputs signals corresponding to the light intensity distribution of the light reflected from the object (i.e., the received image) at a frame rate or frequency that is proportional to the light intensity received at sensor 25. Ex. 1006, Figure 12, 7:14-27. The intensity distribution signal Sv is therefore produced by the CCD sensor array with a frequency based upon the accumulation time based on the intensity of the light received by the CCD sensor array 3.

[1e] "*determining the characteristic based on the at least one signal;*"

Eguchi describes determining the intensity of light (luminance) reflected from the object (i.e., the intensity distribution signal Sv) and deriving a focus adjustment ΔV for the lens 1 corresponding to a distance of the object from the lens 1 and the correct focus. Ex. 1006. Figure 9, 5:63-6:44. In other words, the intensity distribution signal Sv is used to determine the distance of the object [characteristic] which is then used to perform autofocusing, and the intensity distribution signal Sv is based on the output of the light-to-frequency conversion circuit 21.

[1f] "*wherein the light passes through a filter prior to being coupled to one or more of the sensors.*"

Eguchi describes the CCD sensor array 3 being alternately shielded from light beams A and B by a color stripe filter or a color division filter over the CCD sensor array 3, for effectively separating light beams A and B. Ex. 1006, Figure 9, 5:46-6:2. Those having ordinary skill in the relevant art understand that color stripe filters and color division filters separate (or "divide") light into its red, green and blue colored components. *See, e.g.*, Ex. 1013, 1:29-55.

2. *Claim 2*

[2a] "*The method of claim 1,*"

See discussion of Claim 1 above.

[2b] "*wherein the at least one signal comprises a digital signal.*"

Eguchi describes each of the output signals Sγ of light-to-frequency converter 21, the shift pulse ϕ_x produced by one-shot multivibrator 22, and data

DA and DB corresponding to the light intensity distribution signals Sv as digital signals. Ex. 1006, Figures 10-11 & 13-16, 6:14-19, 6:67-7:13, 7:28-60.

3. *Claim 7*

[7a] "*The method of claim 1,*"

See discussion of Claim 1 above.

[7b] "*wherein the step of generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors comprises integrating light coupled to the one or more sensors with an integrator.*"

Eguchi describes employing "an accumulation mode CCD sensor array" 3 for accumulating ("integrating") charge produced by the sensors within the sensor array 3 over a charge accumulation time that is determined based on the intensity of received light. Ex. 1006, 6:3-13. The accumulation time of the CCD sensor array 3 is based on a luminance (intensity) of light received from the object. Ex. 1006, 6:3-13. The square wave signal Sγ is used to control the accumulation time for the CCD sensor array 3. Ex. 1006, Figures 9 & 10, 7:8-13. The output frequency of the intensity distribution signal Sv from the CCD sensor array 3 is based upon the frequency of the square wave signal Sγ. Thus, the sensor array 3 successively outputs signals corresponding to the light intensity distribution of the light reflected from the object (i.e., the received image) at a frame rate or frequency that is proportional to the light intensity received at sensor 25. Ex. 1006, Figure 12, 7:14-27. The intensity distribution signal Sv is therefore produced by the sensors within the CCD sensor array at a frequency proportional to the intensity of the light received by the CCD sensor array 3.

4. *Claim 30*

For elements [30a]-[30f], see the discussion of elements [1a]-[1f] in Claim 1 above for identification and explanation regarding where each of those claim elements is found in Eguchi.

[30g] "*wherein the filter comprises a plurality of filter portions having a wavelength dependent optical transmission property.*"

As discussed above in connection with element [1f] of Claim 1, Eguchi describes using a color stripe filter or a color division filter over the CCD sensor array 3, for separating light beams A and B. Ex. 1006, 5:60-62. Those having ordinary skill in the relevant art understand that color stripe filters and color division filters separate (or "divide") light into its red, green and blue colored components. *See, e.g.*, Ex. 1013, 1:29-55. Color stripe filters and color division filters each comprise a plurality of filter portions having a wavelength dependent optical transmission property. Ex. 1015, ¶¶ 64 and 94.

5. *Claim 98*

[98a] "*A method comprising the steps of:*"

Eguchi discloses a method of determining focal distance to an object. Ex. 1006, Abstract.

[98b] "*receiving light with one or more light receivers wherein the one or more light receivers receive light to be spectrally analyzed;*"

Light from the object of focus is received via lens 1 and half-mirror 4. Ex. 1006, Figure 9, 5:42-60. Some of the light ("bundles of rays passing through points A and B") received via the lens 1 and half-mirror 4 is directed toward sensor array 3 (which includes a plurality of sensing elements) which are converted to intensity distributions of the images formed by the light beams A and B into electrical signals (intensity distribution signals) for detection. Ex. 1006, Figure 9, 5:46-60, 9:63-10:2.

[98c] "*coupling light received by the one or more light receivers to an optical sensor through a color filter,*"

Light received by the lens 1 and half-mirror 4 is directed to the CCD sensor array 3 [optical sensor] through a color stripe filter or color division filter. Ex. 1006, Figure 9, 5:46-60, 9:63-10:2. Those having ordinary skill in the art understand that light received via the lens 1 and half-mirror 4 is coupled to the sensor array 3 through the color stripe filter or color division filter.

[98d] "*wherein the color filter has a plurality of portions, wherein each of the plurality of portions has a wavelength dependent light transmission property covering a predetermined band or bands of wavelengths, wherein the predetermined bands of the plurality of portions cover a predetermined band of wavelengths to be spectrally analyzed*"

As discussed above in connection with element [98c] of Claim 30, Eguchi describes using a color stripe filter or a color division filter over the CCD sensor array 3, for separating light beams A and B. Ex. 1006, 5:60-62. Those having ordinary skill in the relevant art understand that color stripe filters and color division filters separate (or "divide") light into its red, green and blue colored components. *See, e.g.*, Ex. 1013, 1:29-55. Color stripe filters and color division filters each comprise a plurality of filter portions having a wavelength dependent optical transmission property. Ex. 1015, ¶¶ 64 and 95.

[98f] "*wherein light from the one or more light receivers is coupled to the plurality of portions of the color filter,*"

See [98c] above.

[98g] "*wherein the optical sensor has a plurality of sensing elements,*"

In one embodiment, the CCD sensor array 3 is a linear array of 128 sensors from which a series (128) of intensity measurements for each of light beam A and light beam B are generated and output. Ex. 1006, Figures 12 & 17, 6:6-13, 7:21-27. In other embodiments, the CCD sensor array has multiple sensor elements (e.g., sensor arrays 3A, 3B in Figure 22; sensor array 101 in Figure 30). Ex. 1006, Figures 30 & 22, 14:24-37.

[98h] "*wherein light received by the one or more light receivers is coupled to the sensing elements through the plurality of portions of the color filter;*"

See [98c] and [98g] above.

[98i] "*wherein light received by the one or more light receivers is spectrally analyzed without using a diffraction grating;*"

Eguchi does not disclose diffraction or a diffraction grating. In one embodiment, the light received is directed through a color stripe or color division filter which employ filters blocking, absorbing, reflecting or causing interference between some wavelengths of incident light while transmitting other wavelengths.

Ex. 1006, 5:60-62. Eguchi analyzes the filtered (not diffracted) components of the received light to determine spectral qualities. Ex. 1015, ¶ 63.

[98j] "*wherein the optical sensor comprises a plurality of light to frequency converter sensing elements.*"

As discussed above in connection with element [98g], the CCD sensor array 3 includes multiple sensors. The accumulation time of the CCD sensor array 3 is based on a luminance (intensity) of light received from the object. Ex. 1006, 6:3-13. The square wave signal Sγ is used to control the accumulation time for the CCD sensor array 3. Ex. 1006, Figures 9 & 10, 7:8-13. The output frequency of the intensity distribution signal Sv from the CCD sensor array 3 is based upon the frequency of the square wave signal Sγ. Thus, the sensor array 3 successively outputs signals corresponding to the light intensity distribution of the light reflected from the object (i.e., the received image) at a frame rate or frequency that is proportional to the light intensity received at sensor 25. Ex. 1006, Figure 12, 7:14-27. The intensity distribution signal Sv is therefore produced by the sensors within the CCD sensor array at a frequency based upon the accumulation time based on the intensity of the light received by the CCD sensor array 3.

C. Charts

Limitation		Eguchi
1a	A method for determining a characteristic of an object or material comprising the steps	Eguchi discloses a camera and autofocus mechanism that determines the reflectance of (or light intensity reflected from) [a

Limitation		Eguchi
	of:	characteristic] an object. Ex. 1006, Figure 7, 4:53 to 5:41, 19:48-53.
1b	receiving light from the object or material;	Light from the object of focus is received through a lens 1. Ex. 1006, Figure 9, 5:42-60. Alternatively, light received from the object (i.e., the image) is received at photocell 25. Ex. 1006, Figure 10, 6:60-7:13.
1c	coupling received light to one or more sensors;	Eguchi describes some of the light ("bundles of rays passing through points A and B") received via the lens 1 and half-mirror 4 is directed toward sensor array 3. Ex. 1006, Figure 9, 5:46-60, 9:63-10:2.
1d	generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;	Light-to-frequency conversion circuit 21 generates a signal having a frequency (period T) that is proportional to the light intensity received by the photocell 25 [light sensor]. In addition, Eguchi describes varying an accumulation time of the CCD sensor array 3 based on luminance (intensity) of light received from the object (the square wave signal Sγ output from light-to-frequency conversion circuit 21) and outputting an intensity distribution signal Sv corresponding to the intensity of received light: "An object is greatly variable in luminance. It is preferable to employ an accumulation mode CCD image sensor array in order to obtain signals in response to the variations in luminance of the object. Accordingly, in this embodiment, a CCD image sensor array is employed as the sensor array 3. The sensor array is driven by a sensor driver 6 (described later in detail) with its charge accumulation time being controlled so as to output serially an intensity distribution signal Sv corresponding to the intensity of each light receiving point over a wide luminance range." Ex. 1006, 6:3-13. The square wave signal Sγ is used to control

Limitation		Eguchi
		the accumulation time for the CCD sensor array 3. Ex. 1006, Figures 9 & 10, 7:8-13. The output frequency of the intensity distribution signal Sv from the CCD sensor array 3 is based upon the frequency of the square wave signal Sγ. Thus, the sensor array 3 successively outputs signals corresponding to the light intensity distribution of the light reflected from the object (i.e., the received image) at a frame rate or frequency that is proportional to the light intensity received at sensor 25. Ex. 1006, Figure 12, 7:14-27. The intensity distribution signal Sv is therefore produced by the CCD sensor array with a frequency based upon the accumulation time based on the intensity of the light received by the CCD sensor array 3.
1e	determining the characteristic based on the at least one signal;	Eguchi describes determining the intensity of light (luminance) reflected from the object (i.e., the intensity distribution signal Sv) and deriving a focus adjustment ΔV for the lens 1 corresponding to a distance of the object from the lens 1 and the correct focus. Ex. 1006. Figure 9, 5:63-6:44. In other words, the intensity distribution signal Sv is used to determine the distance of the object [characteristic] which is then used to perform autofocusing, and the intensity distribution signal Sv is based on output of the light-to-frequency conversion circuit 21.
1f	wherein the light passes through a filter prior to being coupled to one or more of the sensors,	Eguchi describes a color stripe filter or a color division filter over the CCD sensor array 3, for effectively separating light beams A and B. Ex. 1006, Figure 9, 5:46-6:2. Those having ordinary skill in the relevant art understand that color stripe filters and color division filters separate (or "divide") light into its red, green and blue colored components. *See, e.g.*, Ex. 1013, 1:29-55. In

Limitation		Eguchi
		other embodiments, Eguchi describes the light shield as disposed to separate light beams A and B impinging upon separate sensor arrays 3A and 3B. Ex. 1006, Figure 22, 10:55-68.
2a	The method of Claim 1,	See [1a]-[1f].
2b	wherein the at least one signal comprises a digital signal.	Eguchi describes each of the output signals Sγ of light-to-frequency converter 21, the shift pulse ϕx produced by one-shot multivibrator 22, and data DA and DB corresponding to the light intensity distribution signals Sv as digital signals. Ex. 1006, Figures 10-11 & 13-16, 6:14-19, 6:67-7:13, 7:28-60.
7a	The method of claim 1,	See [1a]-[1f].
7b	wherein the step of generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors comprises integrating light coupled to the one or more sensors with an integrator.	Eguchi describes employing "an accumulation mode CCD sensor array" 3 for accumulating ("integrating") charge produced by the sensors within the sensor array 3 over a charge accumulation time that is determined based on the intensity of received light Ex. 1006, 6:3-13.
30a	A method for determining a characteristic of an object or material comprising the steps of:	See [1a].
30b	receiving light from the object or material;	See [1b].
30c	coupling received light to one or more sensors;	See [1c].
30d	generating at least one signal having a frequency proportional to the light intensity received by the one or more sensors;	See [1d].
30e	determining the characteristic based on the at least one signal;	See [1e].

Limitation		Eguchi
30f	wherein the light passes through a filter prior to being coupled to one or more of the sensors,	See [1f].
30g	wherein the filter comprises a plurality of filter portions having a wavelength dependent optical transmission property.	Eguchi '523 describes using a color stripe filter or a color division filter over the CCD sensor array 3, for separating light beams A and B. Ex. 1006, 5:60-62. Those having ordinary skill in the relevant art understand that color stripe filters and color division filters separate (or "divide") light into its red, green and blue colored components. *See, e.g.*, Ex. 1013, 1:29-55. Color stripe filters and color division filters each comprise a plurality of filter portions having a wavelength dependent optical transmission property. Ex. 1015, ¶¶ 64 and 94.
98a	A method comprising the steps of:	Eguchi discloses a method of determining a focal distance to an object. Ex. 1006, Abstract.
98b	receiving light with one or more light receivers wherein the one or more light receivers receive light to be spectrally analyzed;	Light from the object of focus is received via lens 1 and half-mirror 4. Ex. 1006, Figure 9, 5:42-60. Some of the light ("bundles of rays passing through points A and B") received via the lens 1 and half-mirror 4 is directed toward sensor array 3 (which includes a plurality of sensing elements) which are converted to intensity distributions of the images formed by the light beams A and B into electrical signals (intensity distribution signals) for detection. Ex. 1006, Figure 9, 5:46-60, 9:63-10:2.
98c	coupling light received by the one or more light receivers to an optical sensor through a color filter,	A color stripe filter or color division filter is utilized. Ex. 1006, Figure 9, 5:46-60, 9:63-10:2. Those having ordinary skill in the art understand that light received via the lens 1 and half-mirror 4 is coupled to the sensor

Limitation		Eguchi
		array 3 through the color stripe filter or color division filter.
98d	wherein the color filter has a plurality of portions, wherein each of the plurality of portions has a wavelength dependent light transmission property covering a predetermined band or bands of wavelengths, wherein the predetermined bands of the plurality of portions cover a predetermined band of wavelengths to be spectrally analyzed,	Eguchi describes using a color stripe filter or a color division filter over the CCD sensor array 3, for separating light beams A and B. Ex. 1006, 5:60-62. Those having ordinary skill in the relevant art understand that color stripe filters and color division filters separate (or "divide") light into its red, green and blue colored components. *See, e.g.*, Ex. 1013, 1:29-55. Color stripe filters and color division filters each comprise a plurality of filter portions having a wavelength dependent optical transmission property. Ex. 1015, ¶¶ 64 and 95.
98e	wherein light from the one or more light receivers is coupled to the plurality of portions of the color filter,	See [98c] above.
98f	wherein the optical sensor has a plurality of sensing elements,	In one embodiment, the CCD sensor array 3 is a linear array of 128 sensors from which a series (128) of intensity measurements for each of light beam A and light beam B are generated and output. Ex. 1006, Figures 12 & 17, 6:6-13, 7:21-27. In other embodiments, the CCD sensor array has multiple sensor elements (e.g., sensor arrays 3A, 3B in Figure 22; sensor array 101 in Figure 30). Ex. 1006, Figures 30 & 22, 14:24-37.
98g	wherein light received by the one or more light receivers is coupled to the sensing elements through the plurality of portions of the color filter;	See [98c] and [98f] above.
98h	wherein light received by the one or more light receivers is spectrally analyzed without	Eguchi does not disclose diffraction or a diffraction grating. In one embodiment, the light received is directed through a color

Limitation		Eguchi
	using a diffraction grating;	stripe or color division filter which employ filters blocking, absorbing, reflecting or causing interference between some wavelengths of incident light while transmitting other wavelengths. Eguchi analyzes the filtered (not diffracted) components of the received light to determine spectral qualities. Ex. 1015, ¶ 63.
98i	wherein the optical sensor comprises a plurality of light to frequency converter sensing elements.	As discussed above in connection with element [98g], the CCD sensor array 3 includes multiple sensors. The accumulation time of the CCD sensor array 3 is based on a luminance (intensity) of light received from the object. Ex. 1006, 6:3-13. The square wave signal Sγ is used to control the accumulation time for the CCD sensor array 3. Ex. 1006, Figures 9 & 10, 7:8-13. The output frequency of the intensity distribution signal Sv from the CCD sensor array 3 is based upon the frequency of the square wave signal Sγ. Thus, the sensor array 3 successively outputs signals corresponding to the light intensity distribution of the light reflected from the object (i.e., the received image) at a frame rate or frequency that is proportional to the light intensity received at sensor 25. Ex. 1006, Figure 12, 7:14-27. The intensity distribution signal Sv is therefore produced by the sensors within the CCD sensor array at a frequency based upon the accumulation time based on the intensity of the light received by the CCD sensor array 3.

X. CONCLUSION

Claims 1-2, 7, 30 and 98 of the ‘629 Patent are unpatentable as obvious and anticipated. Petitioner therefore requests *inter partes* review on Grounds 1-4 as well as cancellation of those claims.

Dated: September 14, 2016 Respectfully submitted,

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CERTIFICATE OF SERVICE UNDER 37 C.F.R. §§ 42.6(e)(4) and 42.105

The undersigned hereby certifies that a copy of the foregoing PETITION FOR INTER PARTES REVIEW and all exhibits identified herein are being served via Priority Mail Express on September 14, 2016 on:

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Dated: September 14, 2016

/Daniel E. Venglarik/
Daniel E. Venglarik
Registration No. 39,409

CERTIFICATE OF WORD COUNT UNDER 37 C.F.R. §§ 42.24(d)

The undersigned certifies that the word count of the foregoing PETITION FOR INTER PARTES REVIEW, starting with the "OVERVIEW OF CHALLENGE AND RELIEF REQUESTED" up to and including the last word of the "CONCLUSION," is 13,807.

Dated: September 14, 2016

/Daniel E. Venglarik/
Daniel E. Venglarik

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