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 IPR2016-01788
U.S. Patent No. 8,786,844

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.

No assignment specific to U.S. Patent No. 8,786,844 (the "'844 Patent") has been recorded. The '844 Patent claims priority to a series of continuation and continuation-in-part applications assigned to JJL Technologies LLC by an assignment dated July 27, 2007 and recorded on the same date at reel/frame 019597/0461, which assignment encompasses "any other patents (including continuations, divisionals and reexaminations)" of the specifically-assigned patents and patent applications. 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 '844 Patent."

B. Related Matters

The '844 Patent and other patents in the same patent family are currently asserted against Petitioners in *511 Innovations, Inc. v. Samsung Telecommunications America, LLC*, No. 2:15-cv-01526 (E.D. Tex.), filed September 14, 2015. The '844 Patent and other patents in the same patent family are also currently 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, Petitioners are seeking *inter partes* review of related U.S. Patents Nos. 6,307,629, 6,490,038, 7,113,283, 6,915,955, 7,110,096, 7,397,541, and 8,472,012.

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).

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E. Certification of Standing

Petitioners certify that the ’844 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.

I. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Petitioners challenge claims 1-4, 7-13 and 18-19 as indicated below:

Ground 1: Claims 1-4, 7-9 and 19 are obvious over Farrar in view of O'Rourke.

Ground 2: Claims 1-4, 7-13 and 18-19 are obvious over JP '028.

Ground 3: Claims 1-4, 7-11, 13 and 19 are obvious over Zimmerman.

Ground 4: Claims 1-4 and 7-8 are obvious over Mills.

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.

II. THE '844 PATENT

A. Overview of the '844 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 '844 Patent generally discusses measuring the intensity of reflected light to determine the optical characteristics of the object. Ex. 1001, 3:50-61.

The '844 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, 4:35-40. 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:

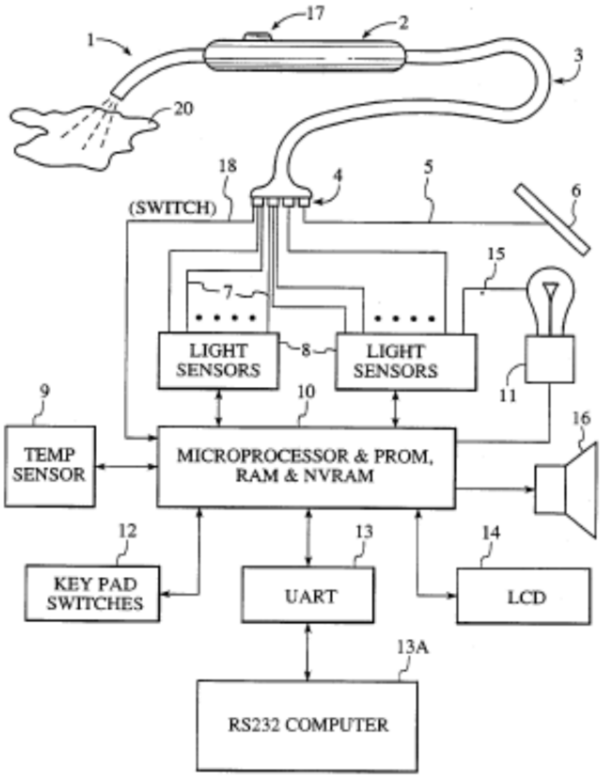
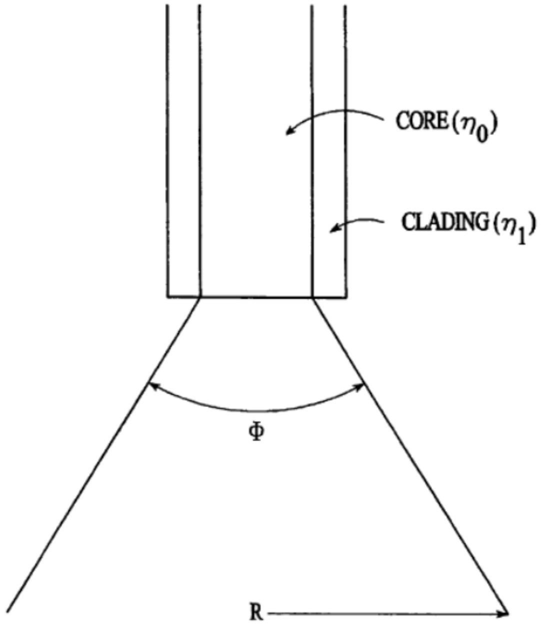


FIG. 1

Ex. 1001, Figure 1, 6:50-7:52, 7:53-60. "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, 9:9-12. "Based on the information produced by light sensors 8, microprocessor 10 produces a color measurement result or other information to the operator." Ex. 1001, 9:12-14.

The patent explains that when one end of a fiber optic is illuminated by a light source, "[t]he fiber optic will emit a cone of light":



Ex. 1001, Figure 4A, 14:16-19. "If the fiber optic is held perpendicular to a surface it will create a circular light pattern on the surface." Ex. 1001, 14:19-21. As the fiber optic is raised from the surface, the circle of light grows larger, and as it is lowered the circle grows smaller. Ex. 1001, 14:21-23. The intensity of light "in the illuminated circular area increases as the fiber optic is lowered and will decrease as the fiber optic is raised." Ex. 1001, 14:23-26.

"The same principle generally is true for a fiber optic being utilized as a receiver." Ex. 1001, 14:27-28. As shown below, "[a]s . . . two [parallel] fiber optics are held perpendicular to a surface, the source fiber optic emits a cone of light that illuminates a circular area of radius r":

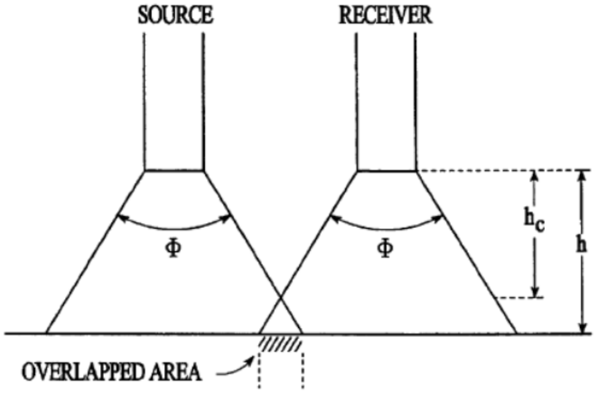


FIG. 4B

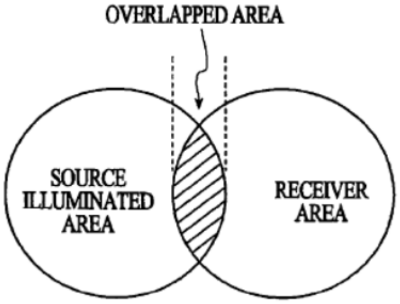


FIG. 4C

Ex. 1001, Figures 4B-4C, 14:45-47. A receiver fiber optic also has an acceptance cone within which it can receive light. Ex. 1001, 14:47-49. Light reflected from an object's surface will only be received or propagated by the receiver fiber optic where light emitted from the source fiber optic strikes the object's surface in the "overlapped area." Ex. 1001, Figure 4C, 14:47-53.

As the source and receiver fiber optics are moved closer to an object's surface, they reach a point where their cones do not intersect, and the circular areas projected onto the object's surface do not intersect. There is thus no "overlapped area," and source light reflected by the object cannot be received or propagated by the receiver fiber optic. The height at which the source and receiver cones cease to intersect is referred to as the "minimal height." Ex. 1001, 19:41-43. To account for the effects of distance and other variables of the probe, the patent describes a "critical height,"—the distance from the probe to a specific object at which the intensity of reflected light is at its peak. Ex. 1001, 15:8-11. The patent teaches that when determining the optical characteristics of the object, values taken at the critical height should be used to eliminate the effect of distance on determination of such characteristics. See, e.g., Ex. 1001, 1:20-26, 2:40-44, 3:50-53,4:26-29, 15:12-24, 18:23-26.

B. Admitted Prior Art

The ’844 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, 1:36-39. 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, 1:30-35, 1:64-2:23. The intensity measurements from the three (red/green/blue) “color sensors” represent the color. Ex. 1001, 2:29-35. 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, 10:29-54, 11:46-55.

III. 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.

IV. CLAIM CONSTRUCTION

The ’844 Patent has not expired. In an *inter partes* review of a non-expired patent, the PTAB gives a claim “its broadest reasonable construction in light of the specification of the patent in which it appears.” 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S.Ct. 2131, 2142-46 (2016).

As shown below, the prior art renders obvious claims 1-4, 7-13, and 18-19 of the ’844 Patent; accordingly, the Board need not consider any claim terms besides “minimal distance” for purposes of invalidity.

A. “Minimal Distance”

The ’844 Patent explains a minimal distance (and “minimal height”) created by a light source and light receiver fiber optic pair and how such characteristic is determined. Ex. 1001, Figure 4B-4C, 14:45-49. When the source and receiver cones intersect, the receiver receives light reflected from the surface; when those cones no longer intersect, the receiver does not receive light. *Id*. The patent describes minimal height as the height below which a cone of emitted light does not intersect with a cone for receiving light. Ex. 1001, 14:56-62.

V. GROUND 1: Claims 1-4, 7-9, and 19 are obvious over Farrar in view of O’Rourke.

B. Overview of Farrar

Farrar describes fiber optic rangefinders determining a range 14 to the surface of an object 13. Ex. 1004, Title, 2:58-66. Figure 1 is generally representative:

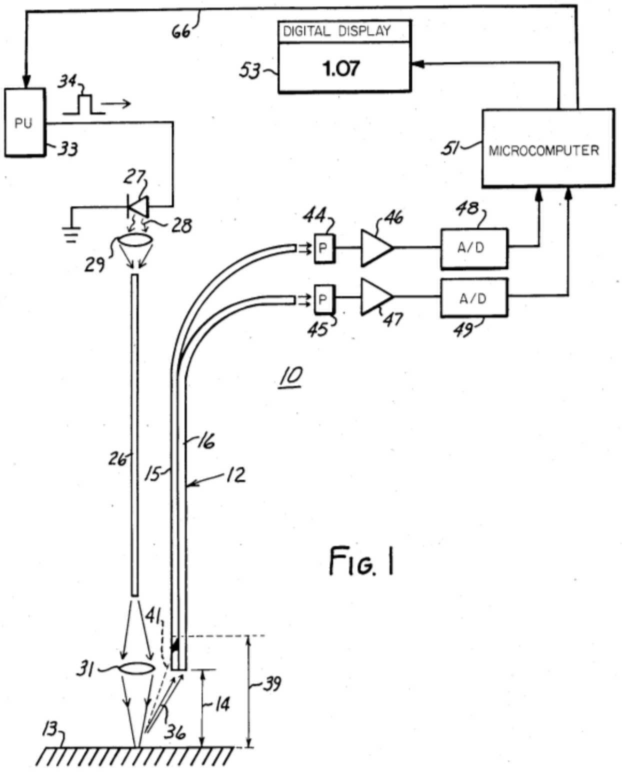


FIG. 1

Ex. 1004, Figure 1. The range finder 10 includes a light transmitting optical fiber 26 together with light receiving optical fibers 15 and 16. Ex. 1004, 2:58-66, 3:49-51, 5:18-20. The light transmitting optical fiber 26 projects light from a light source 27 onto the object surface. Ex. 1004, 3:52-56. Light receiving optical fibers 15 and 16 each receive a reflected portion 35 or 41of that light. Ex. 1004, 3:64-4:6. Photodetectors 44 and 45 receive light from fibers 15 and 16, respectively, measure the intensity, and generate corresponding electrical signals that are amplified by amplifiers 46, 47 and digitized by A/D converters 48, 49. Ex. 1004, 4:59-65. A microprocessor 51 calculates the range 14 to the object surface based on mathematical combination of the digitized light intensities from the two photodetectors 44 and 45. Ex. 1004, 5:3-7. By mathematically combining both measured light intensities (received through fibers 15 and 16 having different numerical apertures), the range calculated by microprocessor 51 accounts for variations in either overall light intensity or in the reflected light due to the specific texture or reflectivity of object surface 13. Ex. 1004, 4:32-42, 5:67-6:10.

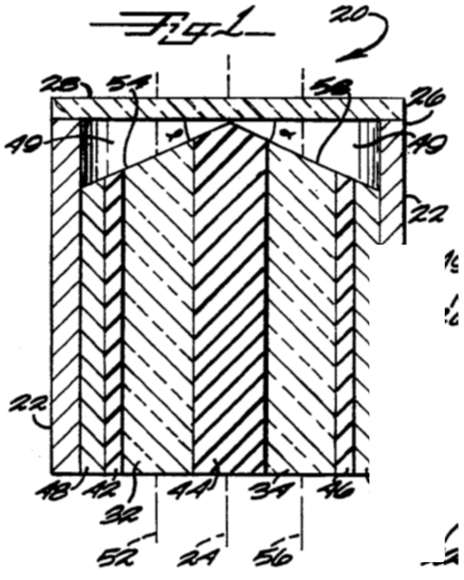
Figure 6 of Farrar is a rangefinder functionally similar to Figure 1. Ex. 1004, 7:27-32, 7:51-54. Instead of using two light receiving optical fibers with different numerical apertures, Figure 6 uses only one light receiving fiber 15 along with narrowband optical filters 67 and 68 corresponding to different wavelength ranges and positioned between the fiber 15 and photodetectors 44/45. Ex. 1004, Figure 6, 7:16-23. A broadband (xenon) light source 71 covering the wavelength transmission bands of filters 67 and 68 supplies light to light transmitting fiber 26. Ex. 1004, Figure 6, 7:37-46. With optical filters of different wavelength ranges covered by the broadband source, the electric signals output by photodetectors 44, 45 correspond to the reflectivity for one object relative to others. Ex. 1004, 7:47-

51. Ex. 1014, ¶ 26. Spectral response (i.e., "color") is a property of the object's response to light. *Id.*

B. Overview of O'Rourke

O'Rourke relates to a fiber optic probe. Ex. 1005, Abstract. O'Rourke is analogous to Farrar in the use of a light transmitting fiber to emit light and a light receiving fiber to receive reflected light.

O'Rourke describes a fiber optic probe for spectral analysis, providing light from a source fiber and receiving reflected light by a receiving fiber for comparison of the received, reflected light with the source light. Ex. 1005, 1:14-15, 1:19-29. Fiber optic probe 20 includes a light transmitting fiber 32 and a light receiving fiber 34 within a housing 22:



Ex. 1005, Figure 1, 3:36-38, 3:46-51, 5:66-51. The light transmitting and receiving fibers 32 and 34 are held by epoxy 42, 44 and 46, which contains a lightabsorber such as carbon black to inhibit direct coupling ("crosstalk") between fibers 32 and 34. Ex. 1005, 3:46-51, 5:46-51, 7:5-12. A thin sapphire window 28 extends over the ends of fibers 32 and 34 to protect the fibers. Ex. 1005, Abstract, 3:59-63, 5:51-58. "[W]indow 28 must be positioned close enough to transmitting and receiving fibers 32, 34 so that direct reflection from transmitting fiber 32 to receiving fiber 34 is avoided." Ex. 1005, 3:63-66.

C. Farrar in view of O'Rourke Renders Claims 1-4, 7-9 and 19 Obvious

1. *Claim 1*

[1a] "*An apparatus comprising:*"

Farrar discloses fiber optic rangefinders (apparatus). Ex. 1004, Figure 6, Title, Abstract.

[1b] "*a processor;*"

Figure 6 in Farrar includes a microprocessor 51. Ex. 1004, Figure 6, 2:58, 4:63-65; 7:51-54.

[1c] "*a display coupled to the processor and displaying information to a user of the apparatus;*"

Figure 6 in Farrar includes a digital display 53 coupled to the microprocessor 51 and displaying a measured range. Ex. 1004, Figure 6, 5:3-10, 5:67-6:6; 7:51-54. The digital display 53 in each figure of Farrar "displays a different combination of digits to indicate a given range or distance measured in inches, millimeters or other units of length or range, or in small fractions thereto." Ex 1004, 5:3-10, 6:60-64. The digital display shows

> [1d] "*at least a first optical sensor making a first measurement, wherein data based on the first measurement is coupled to the processor;*"

Figure 6 in Farrar includes a photodetector 44 measuring an intensity of light from light receiving fiber 15. Ex. 1004, Figure 6, 4:63-65, 7:27-32, 7:47-54. An electrical signal from photodetector 44 corresponding to the measured light intensity is amplified by amplifier 46 and digitized by A/D converter 48, with the digital value for the measured light intensity provided to the microprocessor 51. Ex. 1004, 4:59-65, 7:27-32, 7:51-54.

> [1e] *"at least a second optical sensor making a second measurement, wherein data based on the second measurement is coupled to the processor;"*

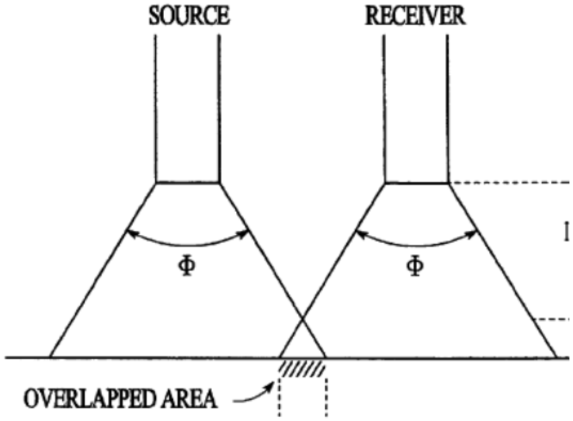
Figure 6 in Farrar includes a photodetector 45 measuring an intensity of light from light receiving fiber 15. Ex. 1004, Figure 6, 4:63-65, 7:27-32, 7:47-54. An electrical signal from photodetector 45 corresponding to the measured light intensity is amplified by amplifier 47 and digitized by A/D converter 49, with the digital value for the measured light intensity provided to the microprocessor 51. Ex. 1004, 4:59-65, 7:27-32, 7:47-54.

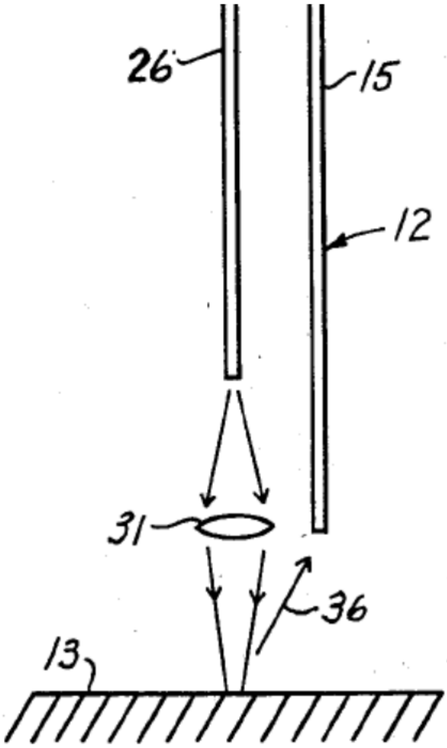
[1f] "*at least one source of illumination operating in the IR range of illumination under control of the processor;*"

Figure 6 includes a broadband light source 71 and a line 66 connecting microprocessor 51 to pulsing unit 33 controlling the pulsing of the light source. Ex. 1004, 3:52-68, 6:42-54, 6:1-52, 6:65-7:2, 7:27-32, 7:47-54. The microprocessor's timing control over pulses 34 from pulsing unit 33 allows the range finder to exploit modulation of the light source 27 to reduce ambient light effects. Ex. 1004, 3:61-63, 7:27-32, 7:47-54. Farrar is not limited to any particular light source, as long as the light output 72 of the source is broad enough to cover transmission bands of filters 67 and 68. Ex. 1004, 7:41-46. The light source can be a xenon light source (e.g., a xenon flash tube) which necessarily includes light in the infrared (IR) range. Ex. 1004, 7:41-46, Ex. 1014, ¶ 27.

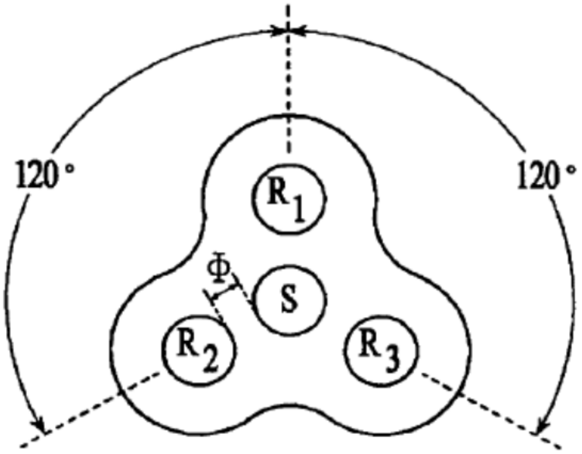
[1g] "*wherein the source of illumination and the first optical sensor in part determine a minimal distance between the apparatus and an external object such that illumination in the IR range emitted by the source is not received by the first optical sensor when the apparatus is less than the minimal distance from the external object;*"

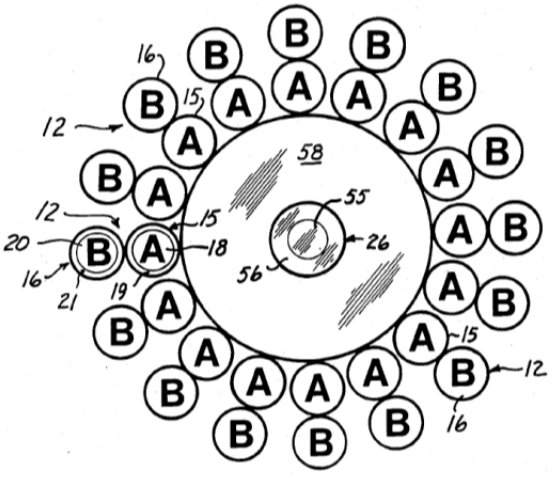
The "minimal distance" characteristic described and claimed in the '844 Patent is based on fiber optic pairs used to shine light onto an object and receive light reflected from the object. Ex. 1001, Figure 4B-4C, 13:2-14, 13:18-26, 17:57-59. Figure 4B of the ’844 Patent and Figure 6 of Farrar each show a source fiber and receiver fiber:





Ex. 1001, Figure 4B, 12:59-65; Ex. 1004, Figure 6, 3:49-51, 7:37-40, 7:51-54. The light source fiber and receiver fiber are spaced apart from each other:





Ex.1001, Figure 3, 8:38-39; Ex. 1004, Figure 3, 5:26-46. In the respective patents, the receiving fiber is at a height or range away from the object. Ex. 1001, Figure 4B, 12:65-13:14; Ex. 1004, Figure 6, 3:49-51, 7:37-40, 7:51-54.

O'Rourke teaches that the source fiber 32 forms an emission cone 86 and the receiver fiber 34 has an acceptance cone 88. Ex. 1005, 5:59-61. The minimum crossing point 96 of cones 86 and 88 is based on the direction of central rays 92 and 94 and half-angle ω for the cones 86/88. Ex. 1005, Figure 3, 5:61-6:13, 6:44-67. The minimum crossing point 96 corresponds to the distance below which emitted light cone 86 does not intersect with cone 88 for receiving light ("minimum distance," relative to the ends of fibers 32 and 34). Ex. 1012, ¶ 50. When the probe is closer to an object than minimum crossing point 96, light emitted by the source fiber 32 and reflected off the object is not received by the receiver fiber 34.

O'Rourke teaches that the fiber ends are preferably beveled ("slanted") rather than perpendicular to the fiber's optical axis to control the direction of cones 86/88. Ex. 1005, 4:1-15, 5:64-6:9. Cone direction changes as a function of the end face bevel angle γ. Ex. 1005, Figure 3, 5:61-6:13, 6:44-67. One skilled in the relevant art would be motivated by O'Rourke to deliberately establish the minimal distance for fibers 26/15 in Farrar by beveling ends of the light receiving fibers 15, altering the direction of the respective acceptance cones. Ex. 1014, ¶¶ 49-50.

Such modification to light receiving fibers 15 would improve the light coupling efficiency of fibers 26/15 and possibly eliminate any need for lens 31. Ex. 1005, 7:31-41; Ex. 1014, ¶ 52.

> [1h] "*wherein data based on the first measurement made with the first optical sensor determines a position of the apparatus with respect to an object;*"

Microprocessor 51 "develop[s] the input signal for the display 53 from the output signal[] of photodetector[] 44" (combined with the output of photodetector 45) in calculating the range from the receiving fiber 15 to the object surface. Ex. 1004, Figure 1, 4:59-65, 5:3-10, 5:67-6:6, 7:27-32, 7:47-54. That input signal ("data") allows display of digits indicating the measured range. Ex. 1004, Figure 6, 5:3-10, 7:27-32, 7:47-54.

> [1i] "*wherein data based on the second measurement made with the second optical sensor determines an optical property of light received by the apparatus.*"

Photodetector 45 measures an intensity of light 36 reflected from object surface 13 and passed through narrowband optical filter 68, which measurement is amplified by amplifier 47 and digitized by analog-to-digital converter 49. Ex. 1004, Figure 6, 4:59-65, 7:16-23, 7:27-32, 7:47-54. The digitized value of the light intensity measurement by photodetector 45 reflectivity within the wavelength transmission band of filter 68. Ex. 1014, ¶ 26.

2. *Claim 2*

[2b] "*wherein the display is controlled responsive to the first measurement.*"

The digits displayed on digital display 53 indicate a range to object 13 calculated by microprocessor 51 based on the light intensity measurement by photodetector 44. Ex. 1004, Figure 1, 2:58, 4:43-5:10, 5:67-6:6, 7:16-23, 7:27-32, 7:47-54.

3. *Claim 3*

[3b] "*wherein the display is controlled responsive to the second measurement.*"

The digits displayed on digital display 53 indicate a range to object 13 calculated by microprocessor 51 based on the light intensity measurement by photodetector 45. Ex. 1004, Figure 1, 2:58, 4:43-5:10, 5:67-6:6, 7:16-23, 7:27-32, 7:47-54.

4. *Claim 4*

[4b] "*wherein the display is controlled responsive to the first and second measurements.*"

The digits displayed on digital display 53 indicate a range to object 13 calculated by microprocessor 51 based on the light intensity measurement by photodetectors 44 and 45. Ex. 1004, Figure 1, 2:58, 4:43-5:10, 5:67-6:6, 7:16-23, 7:27-32, 7:47-54.

5. *Claim 7*

[7b] "*wherein the apparatus further comprises a transparent member through which the source provides illumination external to the apparatus and through which the at least one first optical sensor receives light from external to the apparatus.*"

Farrar states that only schematic illustrations and only description of the principal or essential structure for the range finder 10 are provided, stating that "secondary details" from other patents may be employed together with the components explicitly depicted and described. Ex. 1004, 5:11-17, 5:52-56.

O'Rourke teaches a thin sapphire window 28 across the end 26 of a housing 22 within which fibers 32 and 34 are held. Ex. 1009, 3:59-63. The sapphire window 28 is a structure that separates the source/receiver fibers and the object, and protects the source/receiver fibers ("protective barrier"). Ex. 1005, Abstract Source fiber 32 provides light through window 28 to external objects and receiver fiber 34 receives light originating outside probe 20 through window 28. Ex. 1005, Figure 3, 5:59-6:9, 6:44-66.

One having ordinary skill in the art would have been motivated to use the housing 22 and window 23 of O'Rourke to house fibers 26 and 15 in Farrar's Figure 6 to protect the fibers. Ex. 1005, 3:10-21; Ex. 1012, ¶ 52.

6. *Claim 8*

[8b] "*wherein the transparent member has a thickness, wherein the thickness of the transparent member is less than the minimal distance.*"

O'Rourke teaches a window 28 across the end 26 of a housing 22 for the light source and receiver fibers 32 and 34, and one skilled in the art would have been motivated to use a similar housing and window for light transmitting and receiving fibers 26 and 15 in Farrar. O'Rourke also teaches that the window 28 should be thin and positioned closer to fibers 32, 34 than the minimum crossing point 96 to avoid direct reflection between transmitting fiber 32 and receiving fiber 34. Ex. 1005, Figure 3, 3:63-68, 6:16-25. In using the housing 22 and window 28 of O'Rourke to hold fibers 26 and 15 of Farrar, one skilled in the art would have been motivated to position the window within the minimal distance(s) for fiber pairs 26/15 to avoid direct reflection between fibers 26/15. Ex. 1014, ¶ 54.

7. *Claim 9*

[9b] "*wherein the object comprises human skin*"

This limitation does not define the claimed apparatus, but instead identifies the object on which the claimed apparatus is intended to operate. This mere statement of intended use cannot distinguish over a prior art apparatus disclosing all recited structure and capable of performing the recited use. *In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997); *Boehringer Ingelheim Vetmedica, Inc. v. Schering-Plough Corp.*, 320 F.3d 1339, 1345 (Fed. Cir. 2003). Farrar's rangefinder is operable on human skin. Ex. 1014, ¶ 91.

8. *Claim 19*

[19b] "*a non-reflective material positioned between the light source and the light receiving path*"

Light receiving fiber 15 is separated from light transmitting fiber 26 by a space 58. Ex. 1004, Figure 3, 5:34-48, 7:27-32, 7:47-54. "The space 58 between the central fiber 26 and the receiver fibers 12 may be provided or filled with *an optically inert* mounting material." Ex. 1004, 5:43-46 (emphasis added). In an analogous reference, O'Rourke describes using epoxy containing carbon black between transmitting/receiver fibers 32/34 to minimize undesirable direct coupling. Ex. 1005, 7:7-12. One skilled in the art would have been motivated to use a carbon black-containing epoxy as part of the "optically inert mounting material" between fibers 26/15 in Farrar, to minimize direct coupling. Ex. 1014, ¶ 56.

D. Charts

Limitation		Farrar+O’Rourke
1a	An apparatus comprising:	Fiber optic rangefinder systems are an apparatus. Ex. 1004, Figure 6, Title, Abstract.
1b	a processor;	Microprocessor 51 is a processor. Ex. 1004, Figure 6, 2:58, 4:63-65, 7:27-32, 7:47-54.
1c	a display coupled to the processor and displaying information to a user of the apparatus;	Digital display 53 is coupled to the microprocessor 51 and displays a measured range to object surface 13. Ex. 1004, Figure 6, 5:3-10, 5:67-6:6, 6:60-64, 7:27-32, 7:47-54.
1d	at least a first optical sensor making a first measurement, wherein data based on the first measurement is coupled to the processor;	Photodetector 44 measures an intensity of light from light receiving fiber 15 passed through optical filter 67. Ex. 1004, Figure 6, 4:63-65, 7:27-32, 7:47-54. The photodetector output is amplified and digitized, with the digital value provided to microprocessor 51. Ex. 1004, 4:59-65, 7:27-32, 7:47-54.
1e	at least a second optical sensor making a second measurement, wherein data based on the second measurement is coupled to the processor;	Photodetector 45 measures an intensity of light from light receiving fiber 15 passed through optical filter 68. Ex. 1004, Figure 6, 4:63-65, 7:27-32, 7:47-54. The photodetector output is amplified and digitized, and the digital value for the measured light intensity is provided to microprocessor 51. Ex. 1004, 4:59-65, 7:27-32, 7:47-54.
1f	at least one source of illumination in the IR range of illumination operating under control of the processor;	Pulsing unit 33 pulsing broadband light source 71 is controlled, via line 66, by microprocessor 51. Ex. 1004, Figure 6, 3:52-68, 6:42-54, 6:65-7:2, 7:27-32, 7:47-54. Broadband light source 71 is not limited to any particular type of light source and may include a xenon light source (e.g., a xenon flash tube), which necessarily emits light in the IR range. Ex. 1004, 7:33-46, Ex. 1014, ¶ 27.
1g	wherein the source of illumination and the first	O’Rourke discloses a source fiber 32 forming an emission cone 86 and a receiver fiber 34

Limitation		Farrar+O'Rourke
	optical sensor in part determine a minimal distance between the apparatus and an external object such that illumination in the IR range emitted by the source is not received by the first optical sensor when the apparatus is less than the minimal distance from the external object;	having an acceptance cone 88. Ex. 1005, 5:59-61. The minimum crossing point 96 of cones 86 and 88 is determined based on the direction of central rays 92 and 94 and half-angle ω. Ex. 1005, Figure 3, 5:61-6:13, 6:44-67; Ex. 1014, ¶ 28. When the probe is closer to an object than the distance to minimum crossing point 96, light emitted by the source fiber 32 and reflected off the object is not received by the receiver fiber 34. Ex. 1014, ¶ 28. One skilled in the art would have been motivated to adjust the minimal distance for fiber pairs 26/15 by beveling the end faces of the light receiving fibers 15, altering the direction of the respective acceptance cones, in order to improve the light coupling efficiency of the fibers and eliminate the need for lens 31. Ex. 1005, 7:31-41; Ex. 1014, ¶¶ 49-50.
1h	wherein data based on the first measurement made with the first optical sensor determines a position of the apparatus with respect to an object;	Microprocessor 51 "develop[s] the input signal for the display 53 from the output signals of photodetector[] 44" in calculating the range to the object surface. Ex. 1004, Figure 1, 4:59-65, 5:3-10, 5:67-6:6, 7:27-32, 7:47-54. That measured range is displayed in digits. Ex. 1004, Figure 6, 5:3-10, 7:27-32, 7:47-54.
1i	wherein data based on the second measurement made with the second optical sensor determines an optical property of light received by the apparatus.	Photodetector 45 measures an intensity of light 36 reflected from object surface 13 and passed through narrowband optical filter 68, which measurement is amplified by amplifier 47 and digitized by analog-to-digital converter 49. Ex. 1004, Figure 6, 4:59-65, 7:16-23, 7:27-32, 7:47-54. The digitized light intensity measurement is for the portion of reflected light 36 within the wavelength transmission band of filter 68.

Limitation		Farrar+O’Rourke
2a	The apparatus of claim 1,	See [1a]-[1i].
2b	wherein the display is controlled responsive to the first measurement.	The digits displayed on digital display 53 indicate a range to object 13 calculated by microprocessor 51 based on the light intensity measurement by photodetector 44. Ex. 1004, Figure 1, 2:58, 4:43-5:10, 5:67-6:6, 7:16-23, 7:27-32, 7:47-54.
3a	The apparatus of claim 1,	See [1a]-[1i].
3b	wherein the display is controlled responsive to the second measurement.	The digits displayed on digital display 53 indicate a range to object 13 calculated by microprocessor 51 based on the light intensity measurement by photodetector 45. Ex. 1004, Figure 1, 2:58, 4:43-5:10, 5:67-6:6, 7:16-23, 7:27-32, 7:47-54.
4a	The apparatus of claim 1,	See [1a]-[1i].
4b	wherein the display is controlled responsive to the first and second measurements.	The digits displayed on digital display 53 indicate a range to object 13 calculated by microprocessor 51 based on the light intensity measurement by photodetectors 44 and 45. Ex. 1004, Figure 1, 2:58, 4:43-5:10, 5:67-6:6, 7:16-23, 7:27-32, 7:47-54.
7a	The apparatus of claim 1,	See [1a]-[1i].
7b	wherein the apparatus further comprises a transparent member through which the source provides illumination external to the apparatus and through which the at least one first optical sensor receives light from external to the apparatus.	O’Rourke discloses a thin sapphire window 28 across the end 26 of a housing 22 within which fibers 32 and 34 are held. Ex. 1005, 3:59-63. Light from source fiber 32 is provided through window 28 to external objects and light originating outside probe 20 is received by receiver fiber 34 through window 28. Ex. 1005, Figure 3, 5:59-6:9, 6:44-66. One skilled in the art would have been motivated to use the housing 22 and window 23 of O’Rourke to house fibers 26 and 15, in order to protect the fibers. Ex. 1005, 3:10-21; Ex. 1012, ¶¶ 51-52.
8a	The apparatus of claim 7,	See [7a]-[7b].
8b	wherein the transparent member has a thickness,	O’Rourke teaches that the window 28 should be thin and positioned closer to fibers 32, 34

Limitation		Farrar+O'Rourke
	wherein the thickness of the transparent member is less than the minimal distance.	than the minimum crossing point 96 to avoid direct reflection between transmitting fiber 32 and receiving fiber 34. Ex. 1005, Figure 3, 3:63-68, 6:16-25. In using the housing 22 and window 28 of O'Rourke to protect fibers 26/15, one skilled in the art would have been motivated to position the window within the minimal distance for fiber pairs 26/15 to avoid direct reflection between fibers 26/15. Ex. 1014, ¶¶ 51-52.
9a	The apparatus of claim 7,	See [7a]-[7b].
9b	wherein the object comprises human skin.	The range finder is suitable for use with human skin.
19a	The apparatus of claim 7, further comprising	See [7a]-[7b].
19b	a non-reflective material positioned between the light source and the light receiving path.	"The space 58 between the central fiber 26 and the receiver fibers 12 may be provided or filled with *an optically inert* mounting material." Ex. 1004, 5:43-46 (emphasis added); *see also* Ex. 1004, Figure 3, 5:34-48, 7:27-32, 7:47-54. O'Rourke describes using epoxy containing carbon black between transmitting/receiver fibers 32/34 to minimize undesirable direct coupling. Ex. 1005, 7:7-12. One skilled in the art would have been motivated to use a carbon black-containing epoxy as part of the "optically inert mounting material" between fibers 26/15 in Farrar, to minimize direct coupling. Ex. 1014, ¶¶ 53-54.

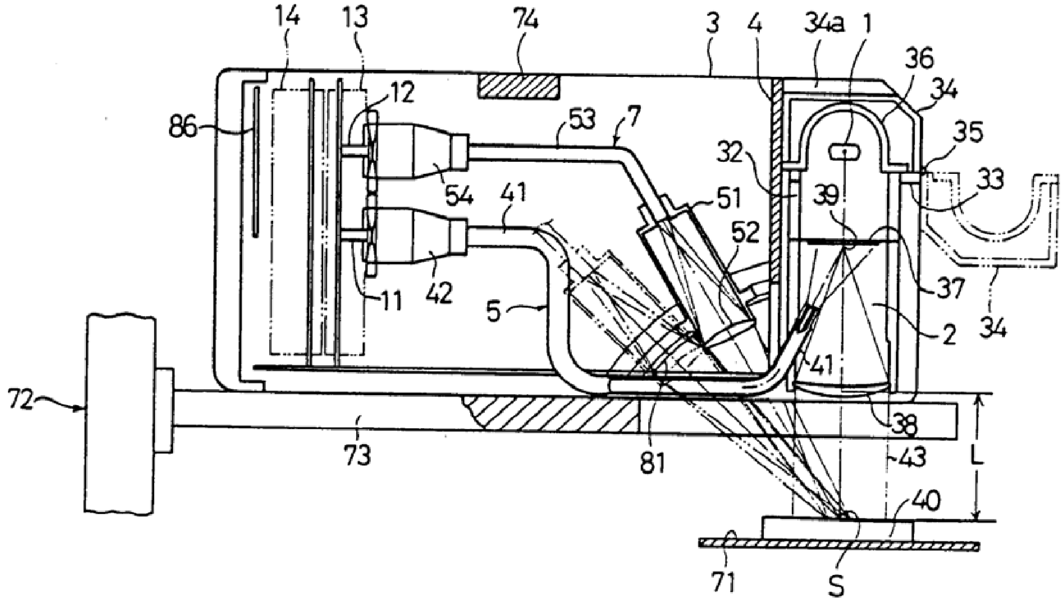
VI. GROUND 2: Claims 1-4, 7-13, and 18-19 are obvious over JP '028

This ground is not redundant with Ground 1 because JP '028 discloses determining object color, which is not disclosed by the references in Ground 1.

A. Overview of JP ’028

JP ’028 describes a non-contact colorimeter for automated color measurement, using optical means both to set a distance from the object to be measured (to avoid inaccurate color measurement) and to measure the object’s color. Ex. 1006, Figure 6, 214-l[1], 220-l. A xenon light source 1 emits light projected onto the object 40:

第 2 図



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[1] “l” and “r” designate the left and right columns, respectively, on the indicated page.

FIG. 3

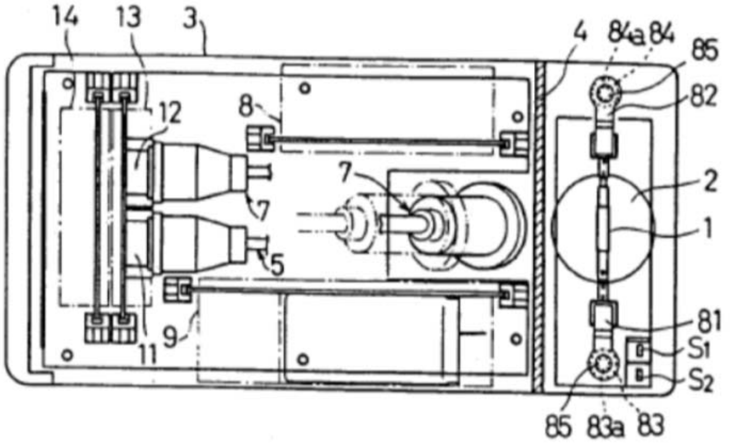
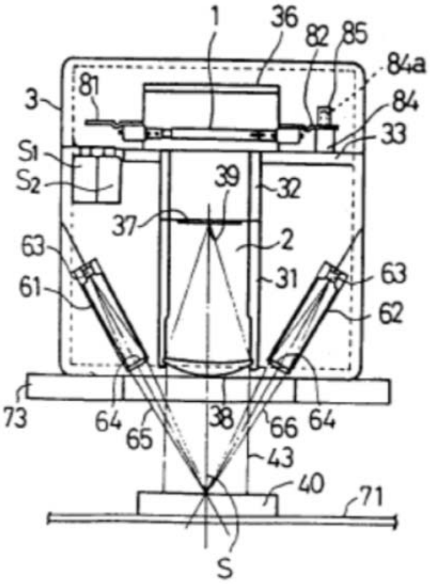


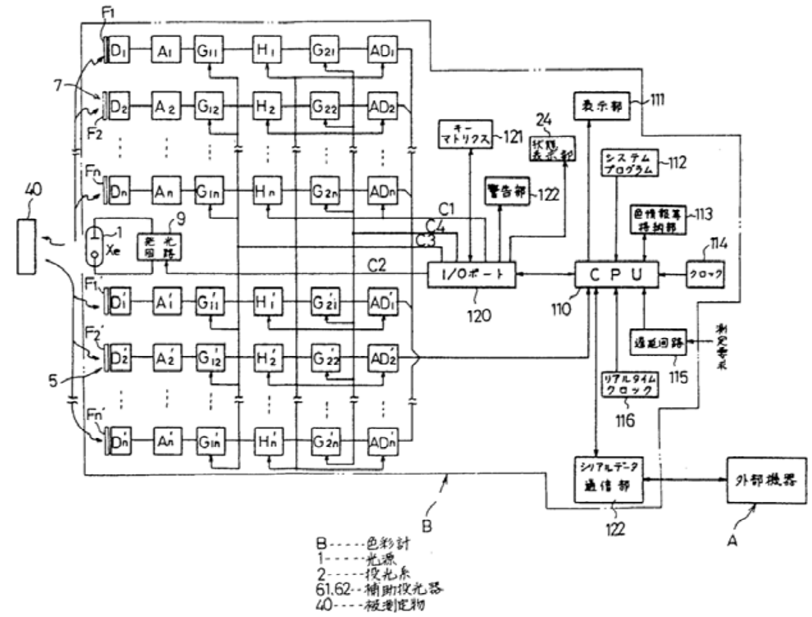
FIG. 4



Ex. 1006, Figures 2-4, 215-r. Light source monitor 5 includes an optical fiber 41 carrying light from the light source 1 to sensor 11. Ex. 1006, Figure 2, 215-r to 216-l. Sample monitor 7 has light receiving lens 52 focused on light receiving optical fiber 53 carrying light to for sensor 12. Ex. 1006, Figure 2, 216-l.

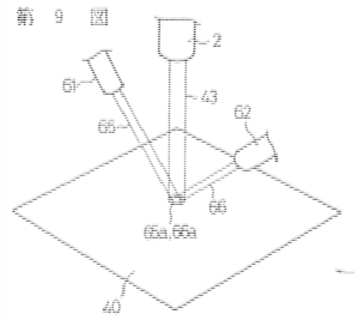
Sensor 11 in light source monitor 5 includes color component filters F_1-F_n through which light passes to detectors D_1-D_n measuring the intensity of the light source color components:

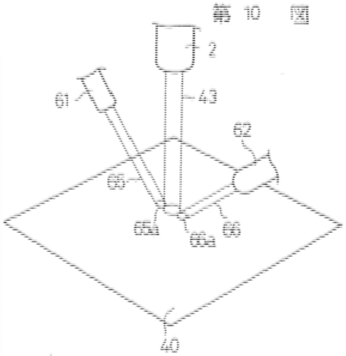
第 1 図

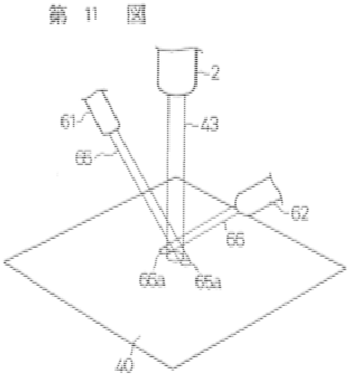


Ex. 1006, Figure 1, 217-r. Sensor 12 in sample monitor 7 includes color component filters F_1'-F_n' through which light passes to detectors D_1'-D_n' measuring the color component light intensity for the light reflected from object 40. Ex. 1006, Figure 1, 217-r. The outputs of detectors D_1-D_n and D_1'-D_n' are routed to A/D conversion circuits AD_1-AD_n and AD_1'-AD_n'. Ex. 1006, Figure 1, 218-l. Color component filters F_1'-F_n' filtering the received light passed to detectors D_1'-D_n' measuring the intensity of that light. Ex. 1010, Figure 1, 217-r. The outputs of detectors D_1'-D_n' are coupled to A/D conversion circuits AD_1'-AD_n'. Ex. 1010, Figure 1, 218-l.

CPU 110 receives digital values for the measured color components of both source and reflected light. Ex. 1006, 218-r. To ensure object 40 is at measurement position S located a prescribed distance L, two auxiliary light projectors 61, 62 are positioned so that the resulting optical paths 65, 66 intersect each other and the main optical path 43 at measurement position S:







Ex. 1006, Figures 9-11, 216-l to 216-r. Auxiliary projectors 61, 62 flash light of two colors to enable fine determination of when the object is at the correct measurement position. Ex. 1006, 214-r to 215-l, 216-r, 216-r to 217-l. Light color component measurements by sensor 12 allow determination of whether the object 40 is at the prescribed distance L, when the spots 65a and 66a coincide with each other and the spot for beam 43. Ex. 1006, Figure 9, 216-r to 217-l. The intensity, color, and separation or overlap of the projected images 65a, 66a indicates an offset direction from the prescribed distance. Ex. 1006, Figures 10-13, 216-r to 217-l. Light intensity measurements by the sensors 11, 12 also allow color determination of object 40. Ex. 1006, 220-l to 220-r.

B. JP ’028 Renders Claims 1-4, 7-12 and 19 Obvious

1. Claim 1

[1a] “*An apparatus comprising:*”

JP ’028 discloses colorimeter B (“apparatus”). Ex. 1006, Figure 6, 220-l.

> [1b] “*a processor;*”

JP ’028 discloses a CPU 110 (“processor”). Ex. 1006, Figure 1, 218-l.

> [1c] “*a display coupled to the processor and displaying information to a user of the apparatus;*”

CPU 110 outputs measurement data and color objective data to an LCD display 111 coupled to the CPU 110. Ex. 1006, 218-l. The display 111 “displays the distance of an object” and “displays color objective data.” Ex. 1006, 213-r, 218-l.

> [1d] “*at least a first optical sensor making a first measurement, wherein data based on the first measurement is coupled to the processor;*”

Sample monitor 7 includes a sensor 12 measuring light reflected from object 40 using detectors D_1'-D_n'. Ex. 1006, Figure 2, 215-l, 216-l. “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.” Ex. 1006, 218-l

> [1e] “*at least a second optical sensor making a second measurement, wherein data based on the second measurement is coupled to the processor;*”

Light source monitor 5 includes a sensor 11 measuring light from source 1. Ex. 1006, Figure 2, 215-l, 216-l. The CPU 110 receives digitized measurements by sensor 11. Ex. 1006, 218-l.

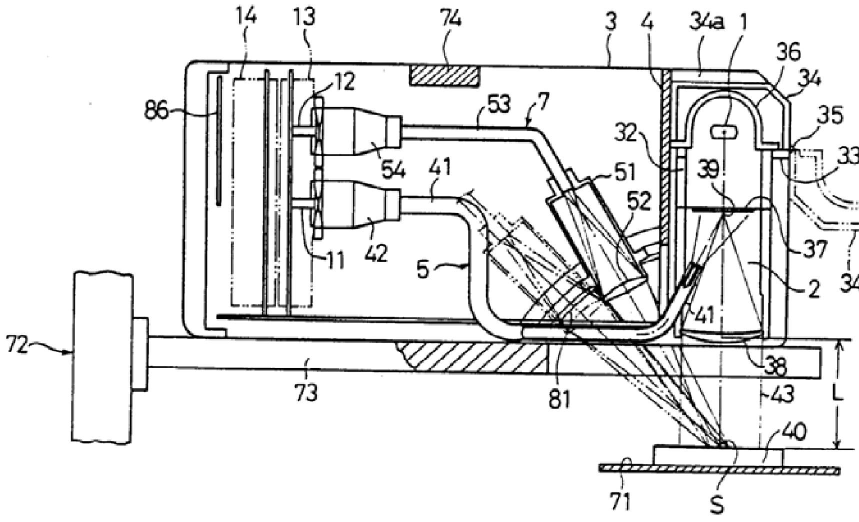
> [1f] "*at least one source of illumination operating in the IR range of illumination under control of the processor;*"

Two auxiliary light projectors 61, 62 alternately project light from optical fibers 61a, 62a coupled to light source 1 and auxiliary source 100 controlled by CPU 110 via light emitting circuit 9 and auxiliary circuit 86. Ex. 1006, Figures 1-2, 215-r, 216-l, 217-l, 217-r, 218-l. JP '028 also describes a xenon light source 1 controlled by CPU 110 via at least control signal C2 and light emitting circuit 9 and/or auxiliary circuit 86. Ex. 1014, ¶¶ 63-64. Xenon light includes IR wavelengths. Ex. 1014, ¶36.

> [1g] "*wherein the source of illumination and the first optical sensor in part determine a minimal distance between the apparatus and an external object such that illumination in the IR range emitted by the source is not received by the first optical sensor when the apparatus is less than the minimal distance from the external object;*"

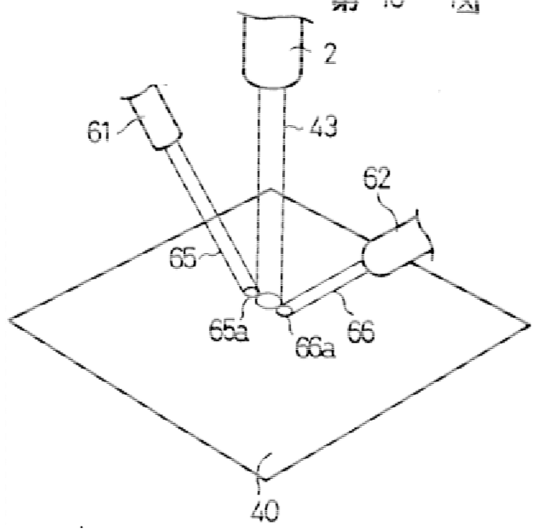
The sample monitor 7 includes a lens 52 focused to receive light reflected from an object surface that is a prescribed distance L from the colorimeter:

第 2 図



At some distance less than L, light from the two auxiliary light projectors 61, 62 is not projected onto the focal area of lens 52 and is not received by sensor 12 within sample monitor 7 via optical fiber 53:

第 10 図



Ex. 1006, Figure 10, 216-r. The (columnar) light cones 65 and 66 do not intersect with the focal area (cone) for light receiving lens 52 at some distance below prescribed distance L, as generally illustrated by Figure 10. Ex. 1014, ¶ 33.

[1h] "*wherein data based on the first measurement made with the first optical sensor determines a position of the apparatus with respect to an object;*"

Light intensity measurements by the sensor 12 of sample monitor 7 allow determination of when the object 40 is at the correct distance L. Ex. 1006, 216-l to 217-l, 220-l to 220-r.

[1i] "*wherein data based on the second measurement made with the second optical sensor determines an optical property of light received by the apparatus;*"

Sensor 11 in light source monitor 5 measures color components for light from light source 1, used "to cancel influences such as changes in the amount of emitted light of the light source itself" on the color component measurements. Ex. 1006, 219-r, 213-r.

2. Claim 2

[2b] "*wherein the display is controlled responsive to the first measurement.*"

Sensor 12 in sample monitor 7 determines color component measurements MS(i) of the light reflected from the object 40. Ex. 1006, 219-l. The object's color component measurements MS(i) are divided by the light source color component measurements MR(i) “to cancel influences such as changes in the amount of emitted light of the light source,” before calculating tristimulus values for the object color and displaying corresponding color values. Ex. 1006, 219-l.

3. Claim 3

[3b] “*wherein the display is controlled responsive to the second measurement.*”

Sensor 11 in light source monitor 5 determines color component measurements MR(i) of the light from the light source 1. Ex. 1006, 219-l. The object’s color component measurements MS(i) are divided by the light source color component measurements MR(i) “to cancel influences such as changes in the amount of emitted light of the light source,” before calculating tristimulus values for the object color and displaying corresponding color values. Ex. 1006, 219-l.

4. Claim 4

[4b] “*wherein the display is controlled responsive to the first and second measurements.*”

Sensor 12 in sample monitor 7 determines color component measurements MS(i) of the light reflected from the object 40, and sensor 11 in light source monitor 5 determines color component measurements MR(i) of the light from light source 1. Ex. 1006, 219-l. The object’s color component measurements MS(i) are divided by the light source color component measurements MR(i) “to cancel influences such as changes in the amount of emitted light of the light source," before calculating tristimulus values for the object color and displaying corresponding color values. Ex. 1006, 219-l.

5. Claim 7

> [7b] "*wherein the apparatus further comprises a transparent member through which the source provides illumination external to the apparatus and through which the at least one first optical sensor receives light from external to the apparatus.*"

The general rule is that the term "a"—especially when used with the transitional phrase "comprising"—carries the meaning of "one or more." *Baldwin Graphic Sys., Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1342–43 (Fed. Cir. 2008). JP '028 describes a projection lens 38 through which light source 1 provides light external to the colorimeter, projection lenses 64 by which light from optical fibers 61a, 62a projects light, and a light receiving lens 52 coupled to optical fiber 53 through which sensor 12 receives light reflected off object 40 external to the colorimeter. Ex. 1006, Figure 2, 215-r, 216-l. Projection lens 38 and light receiving lens 52 are a transparent member.

6. Claim 8

[8b] "*wherein the transparent member has a thickness, wherein the thickness of the transparent member is less than the minimal distance.*"

The projection lenses 38, 64 and light receiving lens 52 are depicted in Figure 2 of JP '038 as having a thickness. Ex. 1006, Figure 2. The thickness must necessarily be less than the minimal height, to form the optical paths depicted and described in JP '028. Ex. 1014, ¶¶ 63-64.

7. Claim 9

See the discussion of Claims 1 and 7 above. This mere statement of intended use cannot distinguish over a prior art apparatus disclosing all recited structure and capable of performing the recited function. JP '028 may be used on human skin. Ex. 1012, ¶ 100.

8. Claim 10

[10b] "*further comprising a circuit coupled to the processor providing an interface to an external computer.*"

The non-contact colorimeter of JP '028 includes a serial data communications element 122 coupled to CPU 110 and provides an interface to external apparatus (computer) A. Ex. 1006, Figs. 1 & 6, 218-l.

9. Claim 11

[12b] "*wherein the circuit comprises a serial communication circuit.*"

As discussed in [10b], JP '028 includes a serial data communications element 122 coupled to CPU 110 and provides an interface to external apparatus (computer) A. Ex. 1006, Figs. 1 & 6, 218-l.

10. Claim 12

[12b] "wherein the display comprises an LCD."

"[D]isplay 111 outputs measurement data and displays color objective data by means of an LCD display." Ex. 1006, 218-l.

11. Claim 13

[13b] "*a speaker coupled to the processor and outputting audio information.*"

Warning element 122 provides a warning "when there is something unusual in the measurement operation." Ex. 1006, 218-r. Those having ordinary skill in the relevant art understood that the warning element may comprise a speaker providing an audible warning when something unusual occurs in the measurement operation. *See, e.g.*, Ex. 1007, 42:42. Those skilled in the art would have been motivated to use a speaker to provide JP '028's warning audibly. Ex. 1014, ¶ 65.

12. Claim 18

[18b] "*Flash memory coupled to the processor.*"

JP '028 describes storage part 113 coupled to the CPU and storing digitized color information measurements from the detectors in sensors 11, 12. Ex. 1006, Figure 1, 218-l. Those having ordinary skill in the relevant art would be motivated to implement storage 113 using flash memory. Ex. 1008, 9:62-10:3; Ex. 1014, ¶ 66.

13. Claim 19

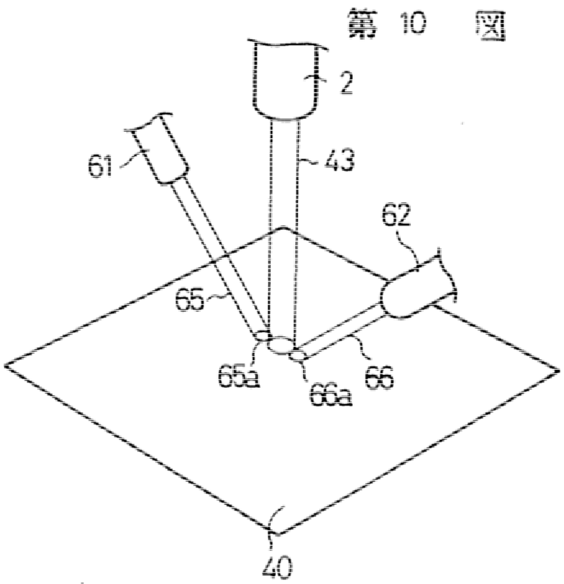
[19b] "*further comprising a non-reflective material positioned between the light source and the light receiving path*."

JP '028 describes a heat insulating wall 4 separating the light source 1 and its projection system 2 from the remainder of machine body 3, in which light source monitor 5 and sample monitor 7 and their respective light sensors 11, 12 are located. Ex. 1006, Figure 2, 215-l. Those skilled in the art understood that heat insulating wall 4 should necessarily be non-reflective to avoid reflection of light from light receiving lens tube 51 off heat insulating wall 4 into sensors 11, 12. Ex. 1014, ¶ 67.

C. Charts

Limitation		JP '028
1a	An apparatus comprising:	Colorimeter B is an apparatus. Ex. 1006, Figure 6, 220-l.
1b	a processor;	CPU 110 is a processor. Ex. 1006, Figure 1, 218-l.
1c	a display coupled to the processor and displaying information to a user of the apparatus;	Display 111 (e.g., LCD display) coupled to CPU 110 displays measurement data and color objective data output by CPU 110. Ex. 1006, 218-l.
1d	at least a first optical sensor	Sample monitor 7 includes sensor 12

Limitation		JP ’028
	making a first measurement, wherein data based on the first measurement is coupled to the processor;	measuring light reflected from object 40 using filtered detectors D_1'-D_n'. Ex. 1006, Figure 2, 215-l, 216-l. Digital signals from A/D converters AD_1'-AD_n' for color components of the measured reflected light are input into the CPU 110. Ex. 1006, 218-l.
1e	at least a second optical sensor making a second measurement, wherein data based on the second measurement is coupled to the processor;	Light source monitor 5 includes sensor 11 measuring light from light source 1 using filtered detectors D_1-D_n. Ex. 1006, Figure 2, 215-l, 216-l. Digital signals from A/D converters AD_1-AD_n for color components of the measured source light are input into the CPU 110. Ex. 1006, 218-l.
1f	at least one source of illumination operating in the IR range of illumination under control of the processor;	Xenon light source 1 and a light-emitting diode light source(s) 63/100 (for auxiliary light projectors 61, 62) each provide light, under control of CPU 110 via at least control signal C2 and light emitting circuit 9 and/or auxiliary circuit 86. Ex. 1006, Figures 1-2, 7, 9-11, 215-r, 216-l, 216-r, 217-l, 217-r, 218-l. It is well known that xenon light sources emit light in the IR range of illumination. Ex. 1014, ¶ 36.
1g	wherein the source of illumination and the first optical sensor in part determine a minimal distance between the apparatus and an external object such that illumination in the IR range emitted by the source is not received by the first optical sensor when the apparatus is less than the minimal distance from the external object;	Light source 1 emits light (e.g., from a xenon light source which emits light in the IR range) 43 focused by projection lens 38. Ex. 1006, Figure 2, 215-r, Ex. 1014, ¶36. Auxiliary light projectors 61, 62 each emit light, 65, 66 from optical fibers 61a, 62a by projection lenses 64. Ex. 1006, Figure 4, 216-l, Figure 14, 217-l. Light 65, 66 intersects with light 43 at position S that is a prescribed distance L from the projection lens 38, at which distance the light coincides with the focal area of light receiving lens 52. Ex. 1006, 216-l, 216-r. At some distance “below” the prescribed distance L, projected light 43, 65a, 66a is not projected onto the focal area of lens 52 and is not received by sensor 12 within sample

Limitation		JP ’028
		monitor 7:  Ex. 1006, Figure 10, 216-r; Ex. 1014, ¶¶ 59-60.
1h	wherein data based on the first measurement made with the first optical sensor determines a position of the apparatus with respect to an object;	Sample monitor data MS(i) from sensor 12 allow determination of when the object 40 is at the correct distance L for accurate color measurement of light reflected off the surface of the object 40. Ex. 1006, 216-l to 217-l, 219-r. When projected light 65a, 66a coincides with main optical path 43, the object 40 is at the prescribed distance. Ex. 1006, 218-l to 218-r. When flashing light of different colors is projected by auxiliary projectors 61, 62, the overlap and the position of different colors indicates whether the object is not at prescribed distance L and the direction in which the object 40 is offset from the prescribed distance L. Ex. 1006, Figures 12-13, 218-r.
1i	wherein data based on the second measurement made with the second optical sensor determines an optical property of light received by the apparatus.	ANS(i) color light intensity measurements indicate the color characteristics of the source light, allowing cancellation of influences by such source light on the sample color measurements. Ex. 1006, 219-r.

Limitation		JP ’028
2a	The apparatus of claim 1,	See [1a]-[1i].
2b	wherein the display is controlled responsive to the first measurement.	Tristimulus values X, Y, and Z for the object color, based on the color component measurements for object 40 by sensor 12, are calculated and displayed on the LCD display 111. Ex. 1006, 219-l.
3a	The apparatus of claim 1,	See [1a]-[1i].
3b	wherein the display is controlled responsive to the second measurement.	Tristimulus values X, Y, and Z for the object color, corrected using the color component measurements for the source light by sensor 11, are calculated and displayed on the LCD display 111. Ex. 1006, 219-l.
4a	The apparatus of claim 1,	See [1a]-[1i].
4b	wherein the display is controlled responsive to the first and second measurements.	Tristimulus values X, Y, and Z for the object color, based on the color component measurements for object 40 by sensor 12 and corrected using the color component measurements for the source light by sensor 11, are calculated and displayed on the LCD display 111. Ex. 1006, 219-l.
7a	The apparatus of claim 1,	See [1a]-[1i].
7b	wherein the apparatus further comprises a transparent member through which the source provides illumination external to the apparatus and through which the at least one first optical sensor receives light from external to the apparatus.	The colorimeter includes projection lenses 38 and 64 and light receiving lens 52 (“a transparent member”), through which light is provided external to the colorimeter and through reflected light is received from external to the colorimeter. Ex. 1006, Figure 2, 215-r, 216-l.
8a	The apparatus of claim 7,	See [7a]-[7b].
8b	wherein the transparent member has a thickness, wherein the thickness of the transparent member is less than the minimal distance.	Projection lenses 38, 64 and light receiving lens 52 have a thickness necessarily less that the distance (below the prescribed distance L) at which the optical paths no longer intersect. Ex. 1006, Figure 2; Ex. 1014, ¶ 64.
9a	The apparatus of claim 7,	See [7a]-[7b].
9b	wherein the object comprises	JP ’028 is operable on human skin.

Limitation		JP ’028
	human skin.	
10a	The apparatus of claim 1,	See [1a]-[1i].
10b	further comprising a circuit coupled to the processor providing an interface to an external computer.	Furthermore, a serial data communications element 122 is connected to the CPU 110 and data communication with the external apparatus A is carried out by this. The I/O port 120 is a circuit for carrying out input/output control between the CPU and peripheral circuits. Ex. 1006, Figs. 1 & 6, 218-l.
11a	The apparatus of claim 10,	See [10a]-[10b].
11b	wherein the circuit comprises a serial communication circuit.	See [10b].
12a	The apparatus of claim 1,	See [1a]-[1b].
12b	wherein the display comprises an LCD.	“Display 111 outputs measurement data and displays color objective data by means of an LCD display.” Ex. 1006, 218-l.
13a	The apparatus of claim 1, further comprising	See [1a]-[1b].
13b	a speaker coupled to the processor and outputting audio information.	Warning element 122 provides a warning “when there is something unusual in the measurement operation.” Ex. 1006, 218-r. It would have been obvious to implement the warning element as a speaker sounding an audible alarm. Ex. 1014, ¶ 67.
18a	The apparatus of claim 1, further comprising	See [1a]-[1b].
18b	further comprising Flash memory coupled to the processor.	Storage part 113 coupled to the CPU stores digitized color information measurements from the detectors in sensors 11, 12. Ex. 1006, Figure 1, 218-l. The storage part 113 could be implemented with Flash memory. Ex. 1014, ¶ 68.
19a	The apparatus of claim 7, further comprising	See [7a]-[7b].
19b	a non-reflective material positioned between the light	Heat insulating wall 4 separate the light source 1 and its projection system 2 from the

Limitation		JP ’028
	source and the light receiving path.	remainder of machine body 3, in which light source monitor 5 and sample monitor 7 and their respective light sensors 11, 12 are located. Ex. 1006, Figure 2, 215-l. The heat insulating wall 4 should necessarily be non-reflective to avoid reflection of light from light receiving lens tube 51 off heat insulating wall 4 into diffusion chambers 42, 54 around light sensors 11, 12. Ex. 101, ¶ 69.

VII. GROUND 3: Claims 1-4, 7-11, 13 and 19 are obvious over Zimmerman.

This ground is not redundant with Grounds 1-2 because Zimmerman describes an apparatus operating on human skin, which is not expressly disclosed by the references in Grounds 1-2.

A. Overview of Zimmerman

Zimmerman discloses a touch switch panel 150 mounted inside a store window 156, so that a customer outside the window may use the touch switch panel 150 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:

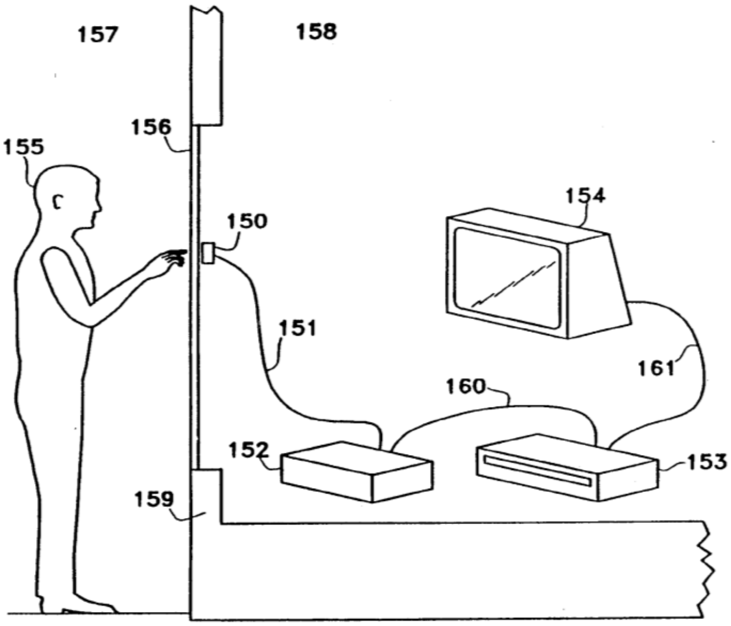


Fig. 4

Ex. 1011, Figure 4, 8:54 to 9:20. The touch panel includes optical components 5 for three photoelectric proximity switches numbered "1" through "3" by nomenclature indicators 302 and each surrounded by LED-illuminated target rings 18:

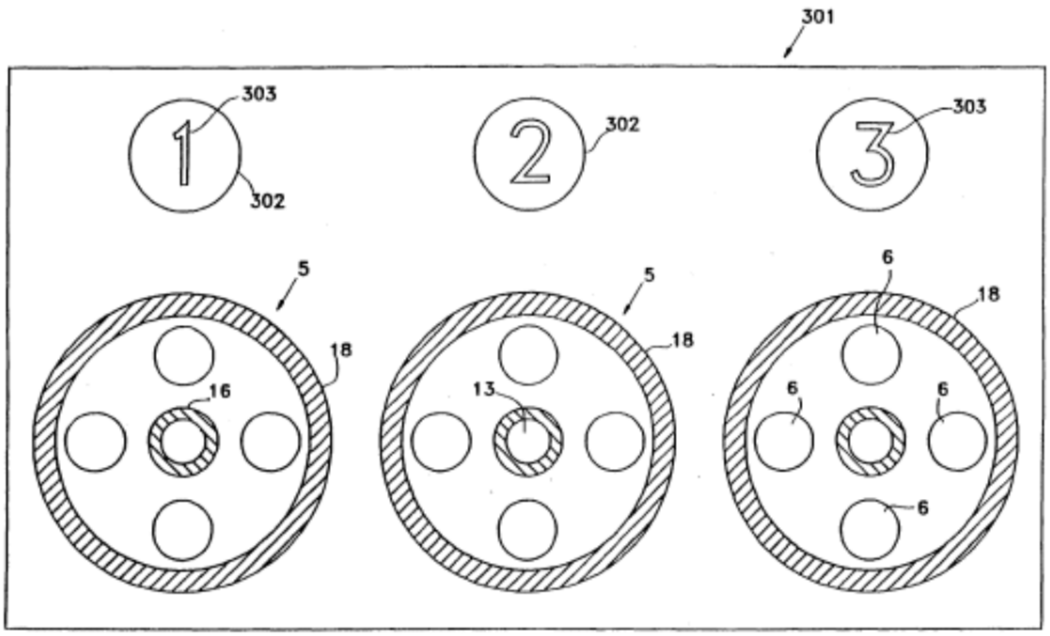


Fig. 6

Ex. 1011, Figure 6, 9:45-56. Each of the photoelectric proximity switches includes infrared (IR) light emitting diodes (LEDs) 6 and an IR phototransistor 13 determining proximity of a finger 15 to the respective photoelectric proximity switch:

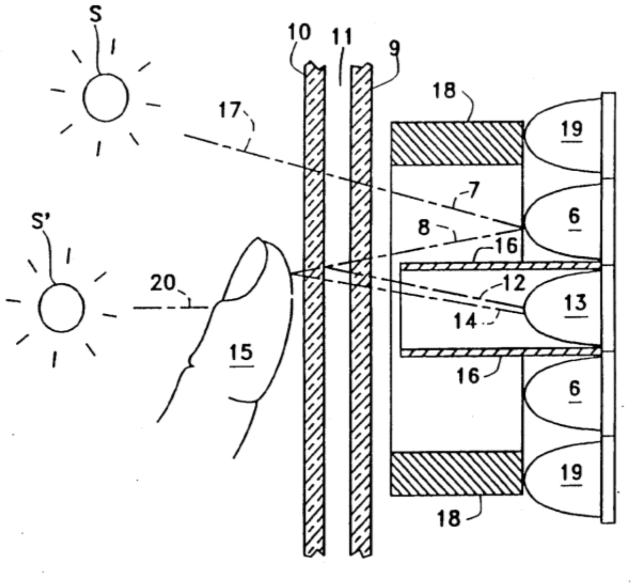


Fig. 1B

Ex. 1011, Figure 1B, 5:67 to 6:11. An IR phototransistor 13 measures an amplitude of reflected light 14 from the IR LEDs 6 reflected off finger 15 and received through the aperture of an opaque tube 16 restricting an acceptance angle for phototransistor 13. Ex. 1011, 6:9-16, 6:32-44.

B. Zimmerman Renders Claims 1-4, 7-11, 13 and 19 Obvious

1. Claim 1

[1a] "*An apparatus comprising:*"

Touch panel 150 is an apparatus. Ex. 1011, Figures 4 and 6.

[1b] "*a processor;*"

Three photoelectric proximity detectors/switches in a touch switch panel 150 are connected to control electronics 152 that may be implemented by a microprocessor. Ex. 1011, Figures 2-3 & 6, 7:13-22.

[1c] "*a display coupled to the processor and displaying information to a user of the apparatus;*"

Monitor 154, coupled via video disk player 153 and the microprocessor-based control electronics 152, displays, for example, a store's merchandise catalog to a user. Ex. 1011, Figure 4, 8:54 to 9:20.

[1d] "*at least a first optical sensor making a first measurement, wherein data based on the first measurement is coupled to the processor;*"

Each photoelectric proximity switch includes an IR phototransistor 13 measuring an amplitude of light reflected from glass pane 9 received in the absence of finger 15. Ex. 1011, 6:9-16, 6:32-44. The microprocessor-based control electronics 152 receives a current corresponding to the reflected IR light 12 received by IR phototransistor 13 in a second switch ("2") and generates a corresponding bias signal 29. Ex. 1011, 7:26-66, 8:26-34, 8:40-53.

[1e] "*at least a second optical sensor making a second measurement, wherein data based on the second measurement is coupled to the processor;*"

Each photoelectric proximity switch includes an IR phototransistor 13 measuring an amplitude of light reflected from glass pane 9 received in the absence of finger 15. Ex. 1011, 6:9-16, 6:32-44. The microprocessor-based control electronics 152 receives a current corresponding to the reflected IR light 12 received by IR phototransistor 13 in a second switch (“2”) and generates a corresponding bias signal 29. Ex. 1011, 7:26-66, 8:26-34, 8:40-53.

> [1f] “*at least one source of illumination operating in the IR range of illumination under control of the processor;*”

Each photoelectric proximity switch includes IR LEDs 6 providing light controlled by an oscillator in the microprocessor-based control electronics 152 turning transistor 60 on and off. Ex. 1011, 5:67 to 6:11, 7:23-26.

> [1g] “*wherein the source of illumination and the first optical sensor in part determine a minimal distance between the apparatus and an external object such that illumination in the IR range emitted by the source is not received by the first optical sensor when the apparatus is less than the minimal distance from the external object;*”

Each proximity/touch switch 5 in Zimmerman may be set to detect the proximity of the finger 15 to the outer store glass surface within a desired detection range including touch of the finger 15 on the glass. Ex. 1011, 8:35-39. In addition, the control system for each proximity/touch switch determines a bias amount 29 to subtract from the IRPT 13 output to compensate for light 12 of the inside store glass surface. Ex. 1011, 6:45-55, 8:9-13, 8:21-25. A binary signal indicates the presence of the finger 15 over the respective proximity/touch switch, generated by comparison of the compensated output from the IRPT 13 to a detection reference. Ex. 1011, 8:26-34, 8:40-53.

Setting the detection range and generating a bias amount compensating for light reflection off the glass establishes a minimal height, below which light from the IR LEDs 6 is reflected off the finger 15 is effectively not received by the IRPT 13 due to the bias amount 29. Those skilled in the art would be motivated to set the detection range to a point just over the glass to detect touches on the glass while minimizing the compensation necessary for reflected light 12 off the glass. No more than ordinary skill would be required for this modification, which would produce the predictable result of the IR LEDs 6 and the opaque tube 16 surrounding the IRPT 13 defining a minimal height below which light from the IR LEDs 6 reflected off the finger 15 on the store glass is effectively not received by the IRPT 13 via the opaque tube 16. Ex. 1014, ¶¶ 71-72.

[1h] "*wherein data based on the first measurement made with the first optical sensor determines a position of the apparatus with respect to an object;*"

A touch detection level signal output by the first switch ("1") indicates that finger 15 is over the respective photoelectric proximity switch. Ex. 1011, 6:32-44, 9:9-20.

[1i] "*wherein data based on the second measurement made with the second optical sensor determines an optical property of light received by the apparatus;*"

The bias signal 29 for the second switch ("2") indicates an intensity of light 12 reflected off inside glass surfaces. Ex. 1011, 6:1-8, 6:45-59, 7:51-59.

2. Claim 2

[2b] "*wherein the display is controlled responsive to the first measurement.*"

Monitor 154 displays information from video disk player 153 under the control of a detection level signal output by the first switch ("1"). Ex. 1011, Figure 4, 6:1-8, 6:45-59, 7:51-59, 8:54 to 9:20.

3. Claim 3

[3b] "*wherein the display is controlled responsive to the second measurement.*"

Monitor 154 displays information from video disk player 153 under the control of a detection level signal output by the second switch ("2") based on the bias signal. Ex. 1011, Figure 4, 6:1-8, 6:45-59, 7:51-59, 8:54-9:20.

4. Claim 4

[4b] "*wherein the display is controlled responsive to the first and second measurements.*"

Monitor 154 displays information from video disk player 153 under the control of detection level signals output by the first and second switches ("1" and "2") based on the bias signals produced for each switch. Ex. 1011, Figure 4, 6:1-8, 6:45-59, 7:51-59, 8:54-9:20.

5. Claim 7

> [7b] "*wherein the apparatus further comprises a transparent member through which the source provides illumination external to the apparatus and through which the at least one first optical sensor receives light from external to the apparatus.*"

The three photoelectric proximity switches are mounted inside a store window 156, behind glass panes 9 and 10 and intervening air gap 11 through which light 8 from IR LEDs 6 is provided to external finger 15 and IR phototransistor 13 receives light 14 reflected from finger 15. Ex. 1011, Figures 1B & 4, 6:1-8, 6:45-59, 7:51-59, 8:54-9:20.

6. Claim 8

> [8b] "*wherein the transparent member has a thickness, wherein the thickness of the transparent member is less than the minimal distance.*"

Each of glass panes 9 and 10 have a thickness, shown in Figure 1B, which is within the minimal distance determined by the outer glass surface over IR LEDs 6 and IR phototransistor 13 for each switch and less than the length of the opaque tube 16. Ex. 1011, Figure 1B.

7. Claim 9

This limitation mere statement of intended use cannot distinguish over a prior art apparatus that discloses all the recited limitations and is capable of performing the recited function. In addition, detected finger 15 comprises human skin. Ex. 1011, Figure 1B.

8. Claim 10

[10b] "*further comprising a circuit coupled to the processor providing an interface to an external computer.*"

Zimmerman describes a serial communication device 41 couples control unit 152 (that may be implemented by a microprocessor) via cable 160 to a computer 44 and/or modem 42 inside the store. Ex. 1011, Fig. 4, 3:23-25, 3:29-34, 5:25-36, 7:13-22.

9. Claim 11

[13b] "*wherein the circuit comprises a serial communication circuit.*"

Zimmerman describes several touch switches that have "serial communication with a computer" and "[a] serial communication device can be included to enable a computer to interrogate the state of each touch sensitive switch." Ex. 1011, 3:23-25, 3:29-34, 5:25-36.

10. Claim 13

[13b] "*a speaker coupled to the processor and outputting audio information.*"

Zimmerman describes the touch panel 150 as allowing a user to "operate search and play functions of a video disk player 153" and monitor 154 to watch "vacation information from a travel agent, [or] preview video movies." Ex. 1009, 9:9-20. Video disk monitors necessarily include a speaker for playing the audio portion of movie previews and travel sales information. *See, e.g.*, Ex. 1011, Abstract, 6:55-59.

11. Claim 19

[19b] "*further comprising a non-reflective material positioned between the light source and the light receiving path*."

Each photoelectric proximity switch includes an opaque tube 16 between LEDs 6 and transistor 13. Ex. 1009, Figure 1B, 6:12-16. The opaque tube 16 is necessarily non-reflective, to minimize erroneous output of the detection level signal. Ex. 1011, Figure 1B, 6:4-21; Ex. 1014, ¶ 72.

C. Charts

Limitation		**Zimmerman**
1a	An apparatus comprising:	System components 150-154 and 160-161 comprise an apparatus. Ex. 1011, Figure 4, 8:54 to 9:20.
1b	a processor;	Three photoelectric proximity detectors/ switches in a touch switch panel 150 include

Limitation		Zimmerman
		control electronics 152 that may be implemented by a microprocessor. Ex. 1011, Figures 2-3 & 6, 7:13-22.
1c	a display coupled to the processor and displaying information to a user of the apparatus;	Monitor 154, coupled via video disk player 153 and the microprocessor-based control electronics 152, displays (for example) a store's merchandise catalog to a user. Ex. 1011, Figure 4, 8:54 to 9:20. LED-backlit target rings 18 around each of three photoelectric proximity switches, connected to the microprocessor-based control electronics 152, visibly illuminate for a user, confirming switch activation. Ex. 1011, Figure 6, 6:26-31, 9:47-56.
1d	at least a first optical sensor making a first measurement, wherein data based on the first measurement is coupled to the processor;	A first (no. "1") of the three photoelectric proximity switches in the switch panel 150 includes an IR phototransistor 13 measuring an amplitude ("intensity") of reflected light from the IR LEDs 6 that is received through the aperture of the surrounding opaque tube 16. Ex. 1011, 6:9-16, 6:32-44. The microprocessor-based control electronics 152 receives a current corresponding to the reflected IR light received by the IR phototransistor 13 in the first photoelectric proximity switch. Ex. 1011, 7:26-66, 8:26-34, 8:40-53.
1e	at least a second optical sensor making a second measurement, wherein data based on the second measurement is coupled to the processor;	A second (no. "2") of the three photoelectric proximity switches in the switch panel 150 also includes an IR phototransistor 13 measuring an intensity of reflected light from the IR LEDs 6 that is received through the aperture of the surrounding opaque tube 16. Ex. 1011, 6:9-16, 6:32-44. The microprocessor-based control electronics 152 receive a current corresponding to the reflected IR light received by the IR phototransistor 13 in the second photoelectric proximity switch. Ex. 1011, 7:26-66, 8:26-

Limitation		Zimmerman
		34, 8:40-53.
1f	at least one source of illumination operating in the IR range of illumination under control of the processor;	Each photoelectric proximity switch includes IR LEDs 6 providing light controlled by an oscillator in the microprocessor-based control electronics 152 turning transistor 60 on and off. Ex. 1011, 5:67 to 6:11, 7:23-26.
1g	wherein the source of illumination and the first optical sensor in part determine a minimal distance between the apparatus and an external object such that illumination in the IR range emitted by the source is not received by the first optical sensor when the apparatus is less than the minimal distance from the external object;	Each proximity/touch switch 5 in Zimmerman may be set to detect the proximity of the finger 15 to the outer store glass surface, within a desired detection range including touch of the finger 15 on the glass. Ex. 1011, 8:35-39. In addition, the control system for each proximity/touch switch determines a bias amount 29 to subtract from the IRPT 13 output to compensate for light 12 of the inside store glass surface. Ex. 1011, 6:45-55, 8:9-13, 8:21-25. A binary signal indicates the presence of the finger 15 over the respective proximity/touch switch, generated by comparison (with hysteresis) of the compensated output from the IRPT 13 to a detection reference. Ex. 1011c, 8:26-34, 8:40-53. Setting the detection range and generating a bias amount compensating for light reflection off the glass establishes a minimal height, below which light from the IR LEDs 6 is reflected off the finger 15 is effectively not received by the IRPT 13 due to the bias amount 29. Those skilled in the art would have been motivated to set the detection range to a point just over the glass to detect touches on the glass while minimizing the compensation necessary for reflected light 12 off the glass. No more than ordinary skill would be required for this modification, which would produce the predictable result of the IR LEDs 6 and the opaque tube 16

Limitation		Zimmerman
		surrounding the IRPT 13 defining a minimal height below which light from the IR LEDs 6 reflected off the finger 15 on the store glass is effectively not received by the IRPT 13 via the opaque tube 16. Ex. 1014, ¶¶ 68-69.
1h	wherein data based on the first measurement made with the first optical sensor determines a position of the apparatus with respect to an object;	Each photoelectric proximity switch within the switch panel 150 produces a touch detection level signal indicating that finger 15 is over the respective photoelectric proximity switch. Ex. 1011, 6:32-44, 9:9-20. The detection level output by the first (no. "1") of the photoelectric proximity switches data, based on the first light intensity measurement made with the IR phototransistor 13 within that first photoelectric proximity switch determines a position of the switch panel 150 with respect to the finger.
1i	wherein data based on the second measurement made with the second optical sensor determines an optical property of light received by the apparatus.	Each photoelectric proximity switch within the switch panel 150 produces a bias signal 29 corresponding to an intensity of infrared light received by the IR phototransistor 13 due to reflection off the glass 9-10, in the absence of a finger on the glass over the respective photoelectric proximity switch. Ex. 1011, 6:1-8, 6:45-59, 7:51-59. The bias signal 29 produced within the second (no. "2") of the three photoelectric proximity switches corresponds to an intensity of infrared light received by the IR phototransistor 13 in that switch due to reflection off the glass 9-10.
2a	The apparatus of claim 1,	See [1a]-[1i].
2b	wherein the display is controlled responsive to the first measurement.	The three photoelectric proximity switches are mounted inside a store window 156, so that a customer outside the window may use the switches to control items inside the store, such as a video disk player 153 connected to a monitor 154. Ex. 1011, Figure 4, 8:54 to 9:20. Target rings around each switch are

Limitation		Zimmerman
		illuminated 18 responsive to activation of the respective switch by the customer. Ex. 1011, Figure 6, 6:26-31, 9:47-56. The first light intensity measurement by the first (no. "1") photoelectric proximity switch and the resulting detection level output by that switch is used to control the monitor 154 and illumination (e.g., flashing) of the target ring 18 around the respective switch.
3a	The apparatus of claim 1,	See [1a]-[1i].
3b	wherein the display is controlled responsive to the second measurement.	The three photoelectric proximity switches are mounted inside a store window 156, so that a customer outside the window may use the switches to control items inside the store, such as a video disk player 153 connected to a monitor 154. Figure 4, 8:54 to 9:20. Target rings around each switch are illuminated 18 responsive to activation of the respective switch by the customer. Ex. 1011, Figure 6, 6:26-31, 9:47-56. The bias signal 29 produced by the second light intensity measurement by the second (no. "2") photoelectric proximity switch and the resulting detection level output by that switch is used to control the monitor 154 and illumination (e.g., flashing) of the target ring 18 around the respective switch.
4a	The apparatus of claim 1,	See [1a]-[1i].
4b	wherein the display is controlled responsive to the first and second measurements.	The three photoelectric proximity switches are mounted inside a store window 156, so that a customer outside the window may use the switches to control items inside the store, such as a video disk player 153 connected to a monitor 154. Ex. 1011, Figure 4, 8:54 to 9:20. Target rings around each switch are illuminated 18 responsive to activation of the respective switch by the customer. Ex. 1011, Figure 6, 6:26-31, 9:47-56. The first light

Limitation		Zimmerman
		intensity measurement by the first (no. "1") photoelectric proximity switch and the resulting detection level output by that switch and the bias signal 29 produced by the second light intensity measurement by the second (no. "2") photoelectric proximity switch and the resulting detection level output by that switch are used to control the monitor 154 and illumination of the target rings 18 around the respective switches.
7a	The apparatus of claim 1,	See [1a]-[1i].
7b	wherein the apparatus further comprises a transparent member through which the source provides illumination external to the apparatus and through which the at least one first optical sensor receives light from external to the apparatus.	Switch panel 150 and the three photoelectric proximity switches are mounted inside a store window 156, behind glass panes 9 and 10 and intervening air gap 11 through which light 8 from IR LEDs 6 is provided to external finger 15 and IR phototransistor 13 receives light 14 reflected from finger 15. Ex. 1011, Figures 1B & 4, 6:1-8, 6:45-59, 7:51-59, 8:54 - 9:20.
8a	The apparatus of claim 7,	See [7a]-[7b].
8b	wherein the transparent member has a thickness, wherein the thickness of the transparent member is less than the minimal distance.	Each of glass panes 9 and 10 inherently have a thickness, which is within the minimal distance determined by the outer surface of glass pane 9 and less than the length of opaque tube 16. Ex. 1011, Figure 1B; Ex. 1014, ¶¶ 70-71.
9a	The apparatus of claim 7,	See [7a]-[7b].
9b	wherein the object comprises human skin.	Finger 15 comprises human skin. Ex. 1009, Figure 1B.
10a	The apparatus of claim 1,	See [1a]-[1i].
10b	further comprising a circuit coupled to the processor providing an interface to an external computer.	Serial communication device 41 couples control unit 152 (that may be implemented by a microprocessor) via cable 160 to a computer 44 and/or modem 42 inside the store. Ex. 1011, Fig. 4, 3:23-25, 3:29-34, 5:25-36, 7:13-22, 8:63-9:20.
11a	The apparatus of claim 10,	See [10a]-[10b].

Limitation		Zimmerman
11b	wherein the circuit comprises a serial communication circuit.	Another object of the invention is to include several touch switches, serial communication with a computer, touch response delay, relays to control electric devices with the touch switches, visual feedback to indicate switch state, calibration state, and where and when to touch the switch, in a self-contained system. Ex. 1011 3:29-34. A serial communication device can be included to enable a computer to interrogate the state of each touch sensitive switch, ... Ex. 1011, 5:25-36, see also 3:23-25, 3:56-61, 8:63 to 9:20.
13a	The apparatus of claim 1, further comprising.	See [1a]-[1i].
13b	a speaker coupled to the processor and outputting audio information.	Zimmerman describes the touch panel 150 as allowing a user to "operate search and play functions of a video disk player 153" and monitor 154 to watch "vacation information from a travel agent, [or] preview video movies." Ex. 1011, 9:9-20. Video disk players intrinsically include audio outputs, requiring video disk monitors to include a speaker outputting audio information to the user.
19a	The apparatus of claim 7, further comprising	See [7a]-[7b].
19b	a non-reflective material positioned between the light source and the light receiving path.	Each photoelectric proximity switch includes an opaque tube 16 between LEDs 6 and transistor 13. Ex. 1011, Figure 1B, 6:12-16

VIII. GROUND 4: Claims 1-4 and 7-8 are obvious over Mills.

This ground is not redundant with Grounds 1-3 because Mills explicitly depicts an apparatus operating using color filters.

A. Overview of Mills

An optical scanning unit 18 with a detector subsystem 22 for determining characteristics of fruit 10, including color, surface blemishes, size, and shape based on light reflected off the surface of the fruit:

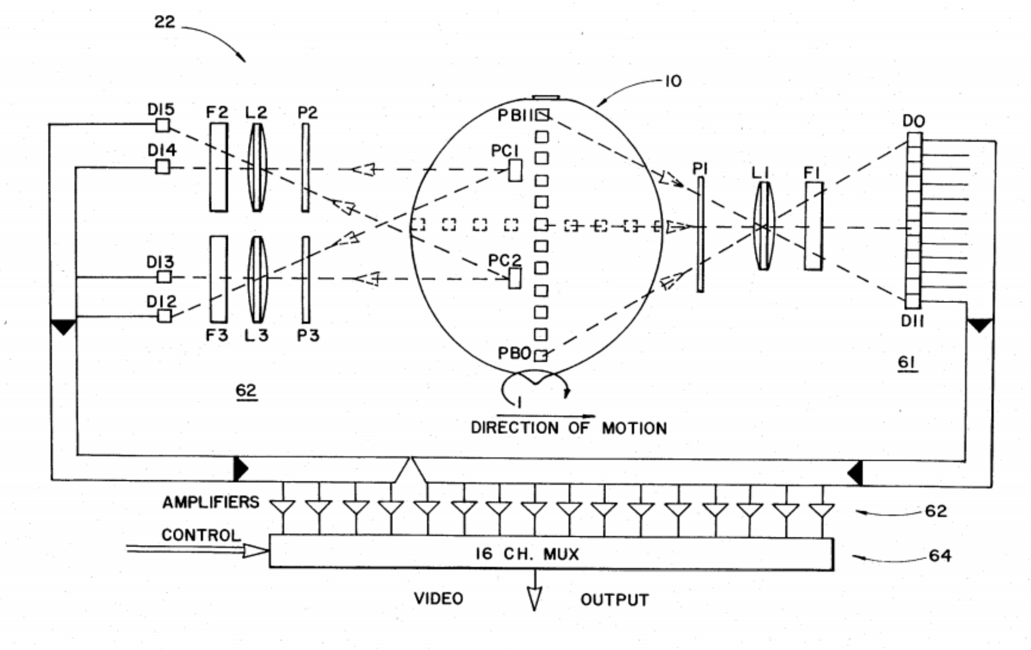


Fig. 3

Ex. 1013, Figure 3, 1:5-9, 2:17-22; 2:45-64, 3:47 to 4:26, 7:4-39; *see also* Figs. 1-2, 5, 6A-6B.

B. Mills Renders Claims 1-4 and 7-8 Obvious

1. Claim 1

[1a] "*An apparatus comprising:*"

An apparatus for processing fruit is disclosed. Ex. 1013, 3:32-35.

[1b] "*a processor;*"

Each scanning unit 18 includes a microcomputer 66 linked to a master processor microcomputer 72. Ex. 1013, Figures 6A-6B, 7:17-22.

[1c] "*a display coupled to the processor and displaying information to a user of the apparatus;*"

A video terminal 74 provides visual outputs to the operator, and is coupled to microcomputer 72 which processes computations. Ex. 1013, Figure 5, 7:4-39.

[1d] "*at least a first optical sensor making a first measurement, wherein data based on the first measurement is coupled to the processor;*"

Detector 22 includes twelve diodes D0-D11 arranged to detect reflected light from portions PB0-PB11 along a fruit surface. Ex. 1011, Figure 3, 5:15-18. Light intensity measurements by diodes D0-D11 are digitized and passed to scanning unit microcomputer 66 and master processor microcomputer 72 for size, volume and blemish calculations stored in microcomputer 72. Ex. 1013, 7:4-39, 7:45 to 8:21, 9:1-29.

[1e] "*at least a second optical sensor making a second measurement, wherein data based on the second measurement is coupled to the processor;*"

Detector 22 includes diode pairs D12-D13 and D14-D15 behind red and green filters F2 and F3. Ex. 1013, Figure 3, 5:61-6:8. Light intensity measurements by diodes D12-D15 are digitized and passed to scanning unit microcomputer 66 and master processor microcomputer 72 for color and variegation calculations stored in microcomputer 72. Ex. 1013, Figures 6A-6B, 7:4-39, 7:45 to 8:21, 7:17-28, 9:50 to 10:8.

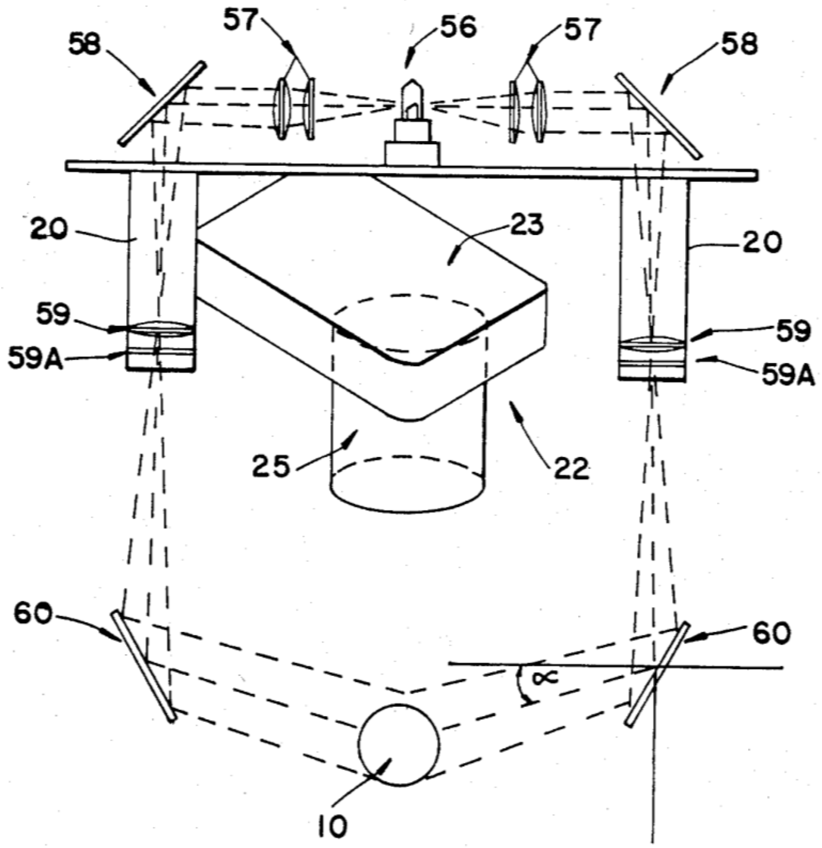
> [1f] "*at least one source of illumination operating in the IR range of illumination under control of the processor;*"

Each scanning unit 18 includes a lamp 56 providing illumination reflected by four illuminators 20 onto the upper fruit surface. Ex. 1011, 4:27-66. The illuminators 20 emit radiation in the visible, ultraviolet or infrared spectrum. Ex. 1013, 3:52-57. Microcomputer 72 performs zeroing and calibration of each detector 22. Ex. 1013, 8:21-36. Such zeroing and calibration requires coordinated control of the lamp 56 in the respective detector 22 by the microcomputer 72.

> [1g] "*wherein the source of illumination and the first optical sensor in part determine a minimal distance between the apparatus and an external object such that illumination in the IR range emitted by the source is not received by the first optical sensor when the apparatus is less than the minimal distance from the external object;*"

Each scanning unit 18 includes a lamp 56 emitting light coupled by four illuminators 20 onto the fruit 10. Ex. 1013, Figures 2A-2B, 4:29-34. Each detector 22 receives light reflected off the upper fruit surface via a lens portion 25:

Fig. 2B



Ex. 1013, Figure 2B, 4:67-68. Diodes D0-D15 in the sensor portion 23 of each detector 22 receive light reflected off the upper fruit surface via cylindrical housing of lens portion 25. Ex. 1013, Figures 2B & 3, 4:67-68, 5:15-18, 5:68-6:8. Each illuminator 20 projects light reflected by mirrors 60 toward the fruit 10 at an incident angle α. Ex. 1013, Figure 2B, 4:34-43. The light paths from mirrors 60 onto fruit 10 determine a minimal distance between the upper fruit surface and the diodes D0-D15 in sensor portion 23. Ex. 1014, ¶ 21. When the upper fruit surface is less than that minimal distance (i.e., closer to diodes D0-D15), it will be outside the light paths from mirrors 60 depicted in Figure 2B and defined by the incident angles described. Ex. 1014, ¶ 120. As a result, light from lamp 56 (directed toward fruit 10 by mirrors 60) will not be reflected off the upper fruit surface onto diodes D0-D15. Ex. 1014, ¶ 120.

> [1h] "*wherein data based on the first measurement made with the first optical sensor determines a position of the apparatus with respect to an object;*"

The light intensity measurements by the twelve diodes D0-D11 indicate a position relative to the upper fruit surface regions PB0-PB11, such that the leading and trailing edges of the fruit and indentations on the fruit surface are determined. Ex. 1013, Figures 3-4, 5:15-18, 6:32-53.

> [1i] "*wherein data based on the second measurement made with the second optical sensor determines an optical property of light received by the apparatus;*"

The light intensity measurements by diode pairs D12-D13 and D14-D15 determine an amount of red and green color within reflected light from portions PC1 and PC2 of the upper fruit surface. Ex. 1013, Figure 3, 5:11-15, 5:61-6:19, 9:1-29.

2. Claim 2

> [2b] "*wherein the display is controlled responsive to the first measurement.*"

Video terminal 74 provides visual outputs in response to analysis and processing performed by microcomputer 72 in response to measurements from size/blemish detector diodes D0-D11. Ex. 1013, Figure 5, 7:4-39.

3. *Claim 3*

[3b] "*wherein the display is controlled responsive to the second measurement.*"

Video terminal 74 provides visual outputs in response to analysis and processing performed by microcomputer 72 in response to measurements from color detector diodes D12-D15. Ex. 1013, Figure 5, 7:4-39.

4. *Claim 4*

[4b] "*wherein the display is controlled responsive to the first and second measurements.*"

Video terminal 74 provides visual outputs in response to analysis and processing performed by microcomputer 72 in response to measurements from size/blemish detector diodes D0-D11 and color detector diodes D12-D15. Ex. 1013, Figure 5, 7:4-39.

5. *Claim 7*

[7b] "*wherein the apparatus further comprises a transparent member through which the source provides illumination external to the apparatus and through which the at least one first optical*

sensor receives light from external to the apparatus."

Each illuminator 20 includes a projection lens 59 through which light illuminating the fruit passes, and each detector 22 includes lenses L1-L3 through which light reflected from the fruit passes prior to impinging on diodes D12-D15. Ex. 1013, Figures 2A-B and 3, 4:27-5:32. Lenses 59 and L1-L3 form a transparent member.

6. Claim 8

[8b] "*wherein the transparent member has a thickness, wherein the thickness of the transparent member is less than the minimal distance.*"

Lenses 59 and L1-L3 each have a thickness less than the length of lens portion 25 between diodes D0-D15 and fruit 10 and as within the minimal distance between the diodes D0-D15 and fruit 10. Ex. 1013, Figure 2B.

A. Charts

Limitation		Mills
1a	An apparatus comprising:	Mills describes an apparatus. Ex. 1013, 3:32-35.
1b	a processor;	Each scanning unit 18 includes a microcomputer 66 linked to a master processor microcomputer 72. Ex. 1013, Figures 6A-6B, 7:17-22.
1c	a display coupled to the processor and displaying information to a user of the apparatus;	A video terminal 74 provides visual outputs to the operator, and is coupled to microcomputer 72 which processes computations. Ex. 1013, Figure 5, 7:4-39.
1d	at least a first optical sensor	Detector 22 includes twelve diodes D0-D11

	Limitation	Mills
	making a first measurement, wherein data based on the first measurement is coupled to the processor;	arranged to detect reflected light from portions PB0-PB11 along fruit surface. Ex. 1011, Figure 3, 5:15-18. Light intensity measurements by diodes D0-D11 are digitized and passed to scanning unit microcomputer 66 and master processor microcomputer 72 for size, volume and blemish calculations stored in microcomputer 72. Ex. 1013, 7:4-39, 7:45 to 8:21, 9:1-29.
1e	at least a second optical sensor making a second measurement, wherein data based on the second measurement is coupled to the processor;	Detector 22 includes diode pairs D12-D13 and D14-D15 behind red and green filters F2 and F3. Ex. 1013, Figure 3, 5:61-6:8. Light intensity measurements by diodes D12-D15 are digitized and passed to scanning unit microcomputer 66 and master processor microcomputer 72 for color and variegation calculations stored in microcomputer 72. Ex. 1013, Figures 6A-6B, 7:4-39, 7:45 to 8:21, 7:17-28, 9:50 to 10:8.
1f	at least one source of illumination operating in the IR range of illumination under control of the processor;	The illuminator subsystem comprises a plurality of illuminators 20 for uniformly illuminating the surface areas of the fruit being tested, processed or evaluated with suitable radiation such as visible, ultraviolet or infrared, depending upon the specific application. Ex. 1013, 3:53-57. Each detector 22 includes a lamp 56 providing illumination reflected by four illuminators 20 onto the upper fruit surface. Ex. 1013, 4:27-66. Microcomputer 72 performs zeroing and calibration of each detector 22 using lamp 56. Ex. 1013, 8:21-36.
1g	wherein the source of illumination and the first optical sensor in part determine a minimal distance between the apparatus and an external object such that illumination	Each scanning unit 18 includes a lamp 56 emitting light coupled by four illuminators 20 onto the fruit 10. Ex. 1013, Figures 2A-2B, 4:29-34. The illuminators 20 may emit infrared light, depending upon the specific application. Ex. 1013, 3:53-57. Each detector 22 receives light reflected off the

Limitation		Mills
	in the IR range emitted by the source is not received by the first optical sensor when the apparatus is less than the minimal distance from the external object;	upper fruit surface via a lens portion 25. Ex. 1011, Figure 2B, 4:67-68. Diodes D0-D15 in the sensor portion 23 of each detector 22 receive light reflected off the upper fruit surface via cylindrical housing of lens portion 25. Ex. 1013, Figures 2B & 3, 4:67-68, 5:15-18, 5:68-6:8. Each illuminator 20 projects light reflected by mirrors 60 toward the fruit 10 at an incident angle α. Ex. 1013, Figure 2B, 4:34-43. The light paths from mirrors 60 onto fruit determine a minimal distance between the upper fruit surface and the diodes D0-D15 in sensor portion 23. Ex. 1014, ¶ 41. When upper fruit surface is less than that minimal distance (i.e., closer to lens portion 25), it will be outside the light paths from mirrors 60 depicted in Figure 2B and defined by the incident angles described. Ex. 1014, ¶ 120. As a result, light from lamp 56 (directed toward fruit 10 by mirrors 60) will not be reflected off the upper fruit surface onto diodes D0-D15 in sensor portion 23. *Id*.
1h	wherein data based on the first measurement made with the first optical sensor determines a position of the apparatus with respect to an object;	The light intensity measurements by the twelve diodes D0-D11 indicate a position of the diodes D0-D11 relative to the upper fruit surface regions PB0-PB11, such that the leading and trailing edges of the fruit and indentations on the fruit surface are determined. Ex. 1013, Figures 3-4, 5:15-18, 6:32-53.
1i	wherein data based on the second measurement made with the second optical sensor determines an optical property of light received by the apparatus.	Light measurements by diode pairs D12-D13 and D14-D15 determine an amount of red and green color within reflected light from portions PC1 and PC2 of the upper fruit surface. Ex. 1013, Figure 3, 5:11-15, 5:61-6:19, 9:1-29.
2a	The apparatus of claim 1,	See [1a]-[1i].
2b	wherein the display is	Video terminal 74 provides visual outputs in

Limitation		Mills
	controlled responsive to the first measurement.	response to analysis and processing performed by microcomputer 72 in response to measurements from size/blemish detector diodes D0-D11. Ex. 1013, Figure 5, 7:4-39.
3a	The apparatus of claim 1,	See [1a]-[1i].
3b	wherein the display is controlled responsive to the second measurement.	Video terminal 74 provides visual outputs in response to analysis and processing performed by microcomputer 72 in response to measurements from color detector diodes D12-D15. Ex. 1013, Figure 5, 7:4-39.
4a	The apparatus of claim 1,	See [1a]-[1i].
4b	wherein the display is controlled responsive to the first and second measurements.	Video terminal 74 provides visual outputs in response to analysis and processing performed by microcomputer 72 in response to measurements from size/blemish detector diodes D0-D11 and color detector diodes D12-D15. Ex. 1013, Figure 5, 7:4-39.
7a	The apparatus of claim 1,	See [1a]-[1i].
7b	wherein the apparatus further comprises a transparent member through which the source provides illumination external to the apparatus and through which the at least one first optical sensor receives light from external to the apparatus.	Each illuminator 20 includes a projection lens 59 and linear polarizing filter 59A through which light illuminating the fruit passes, and each detector 22 includes lenses L1-L3 and linear polarizers P1-P3 through which light reflected from the fruit passes prior to impinging on diodes D12-D15. Ex. 1013, Figures 2A-B and 3, 4:27-5:32. At least lenses 59 and L1-L3 collectively form a transparent member.
8a	The apparatus of claim 7,	See [7a]-[7b].
8b	wherein the transparent member has a thickness, wherein the thickness of the transparent member is less than the minimal distance.	Lenses 59 and L1-L3 each have a thickness less than the length of lens portion 25 between diodes D0-D15 and fruit 10 and as within the minimal distance between the diodes D0-D15 and fruit 10. Ex. 1013, Figure 2B.

IX. CONCLUSION

Claims 1-4, 7-13 and 18-19 of the ’844 Patent are unpatentable as obvious. 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 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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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 13,846.

Dated: September 14, 2016 /Daniel E. Venglarik/
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