

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CANFIELD SCIENTIFIC, INC.
Petitioner

v.

MELANOSCAN LLC
Patent Owner

Case IPR: Unassigned
Patent 7,359,748

**DECLARATION OF DR. JAN-PETER MULLER
REGARDING CLAIMS 1-8, 11, 30, 32- 34, 46, AND 51**

Canfield Scientific, Inc. - Exhibit 1016 Canfield Scientific, Inc. v. Melanoscan, LLC IPR2017-02125

I, Jan-Peter Muller, Ph.D., declare as follows:

I. ENGAGEMENT AND COMPENSATION

1. I am making this declaration at the request of Canfield Scientific, Inc. I am being compensated for my time at my usual hourly billing rate for consulting work. No part of my compensation depends on the outcome of this matter. I have no financial interest in the Petitioner.

2. A complete listing of the materials I reviewed in preparing this declaration is attached as Appendix A.

II. BACKGROUND AND QUALIFICATIONS

3. A description of my education, training, and experience is provided in my *Curriculum Vitae* (Ex.1010), and is summarized as follows.

4. I received a B.Sc. in Physics from the University of Sheffield in 1976, a M.Sc. from the University of London in Atmospheric Physics and Dynamics in 1977, and a Ph.D. in Physics and Astronomy from the University of London in 1982.

5. In 1979, I worked as a graduate intern at the NASA Jet Propulsion Laboratory in Pasadena, CA, developing measurement and analysis systems for understanding the weather systems in Jupiter's atmosphere based on images from the NASA Voyager spacecraft. I made measurements on the winds in the atmosphere in Jupiter and developed software to map the surface of Jupiter and track these winds through time.

6. When I returned to England after completing my Ph.D, I worked with IBM UK as an IBM research fellow. I spent a year there and worked in the area of image processing, including visiting and working with colleagues at IBM in Yorktown Heights, NY and Palo Alto, CA.

7. I joined the department of photogrammetry and surveying as a tenure-track professor (lecturer) at the University College London in 1984.

Photogrammetry is the use of photography to measure 3D distances between objects. In that role, I worked on the introduction of some of the first digital cameras and the application of automation to the extraction of 3D information from photographs. I gave lectures in image understanding and remote sensing. I received a large grant for the ALVEY project from 1986-1989 and worked on the development of extracting automatically 3d images from stereo images. I also worked with two companies and an UK Ministry of Defence research lab. We worked on an early version of cloud computing called transputer arrays. Ultimately, working with Thorn EMI, we built a close range cell for making 3d models of car bodies and a portable system for imaging architectural surfaces using digital cameras and pattern projection.

8. I began working with Kings College Hospital, London, in the late 80s and 90s to develop systems for making 3d measurement of facial features with respect to surgical intervention for orthodontic surgery. Prior to our work with

Kings College, doctors used an array of eight film cameras mounted on a semi-circular mounting bracket, 2 m in diameter, for image acquisition. Our goal was to allow rapid and accurate measurement of facial soft-tissue with a minimum of traditional photogrammetric training. We used a pair of CCD cameras to take pictures of the face projecting a random pattern onto the face. We used a standard x-ray cephalostat to position the object in a specified imaging position. During image capture, we used two different lighting scenarios. First, with ambient lighting dimmed, we projected a pattern onto the face. Second, another image was captured using ambient fluorescent lighting. In order to make spatial measurements from the stereo images the system needed to know where the cameras were positioned in space, and their orientation relative to a common frame of reference defined by the cephalostat. We determined this reference coordinate system using a calibration object. We subsequently created a 3d model of the face, and then manipulated that model to allow doctors to demonstrate proposed results of orthodontic surgery. Our technique allowed doctors to make surface measurements of various facial landmarks (such as the distance between the eyes, the width of the eye, the distance to the tip of the nose, the distance to the mouth) that were accurate to within 0.5 mm. The publication describing our work is attached as Exhibit 1011.

9. At the same time, I worked with an academic colleague at UCL who subsequently founded a company called As Built Solutions, Ltd. (“ABSL”) applying imaging technology to build computer representations of the interior of nuclear reactors, using multi-angle imaging to create CAD models.

10. I served as the Head of the Global Environmental Change Group, Reader (Associate Professor) of Image Understanding and Remote Sensing in the University College London Department of Photogrammetry and Surveying from 1989-1991. I was then promoted to a full Professor of Image Understanding and Remote Sensing in 1991 where I worked until 2006. From 2006 to the present, I have served as Professor of Image Understanding and Remote Sensing and serve as the Head of the Imaging Group in the Mullard Space Science Laboratory, University College London Department of Space and Climate Physics.

11. I have authored around 150 peer-reviewed publications and approximately 700 conference publication and 25 technical reports in areas including imaging, digital image processing, surface measurement using photogrammetry, generation of 3d models of the face, and data mining.

12. I have continued to develop new techniques in the field of close range photogrammetry of the Martian surface from NASA and ESA rovers.

13. I am an expert in the field of imaging and remote sensing, optical and thermal infrared instrumentation, photogrammetry (including

stereophotogrammetry), automated image analysis, and 3D modeling. As set forth in detail above, prior to 2000, I worked in the fields of optical imaging, photogrammetry, and 3D modeling. Having reviewed the patent-at-issue, these fields of imaging, photogrammetry, and modeling provide relevant prior art.

14. I have been asked to consider whether the imaging devices described in claims 1-8, 11, 30, 32-34, 46, and 51 of U.S. Patent No. 7,359,748 cover any new inventions that were not already known by, or obvious to those having ordinary skill in the field before the named inventor of the '748 filed the patent application at issue. I was asked to provide my opinion as to whether these claims were anticipated or obvious in light of certain published papers and patents ("prior art") and the level of ordinary skill in the art.

III. MATERIALS CONSIDERED

15. In forming the opinions expressed in this Declaration, I relied upon my education, technical knowledge, and experience in the relevant field of the art, and have considered the viewpoint of a person having ordinary skill in the art as of July 26, 2000.

16. I have reviewed the specification, claims, and file history of the '748 patent and the file history of application number 12/102, 810, a divisional of the '748 patent. I have also reviewed and understand Exhibits 1003 – 1009 and 1012-1017, including the following references:

- Holger Voigt M.D. and Richarda Classen M.D., “Topodermatographic Image Analysis for Melanoma Screening and the Quantitative Assessment of Tumor Dimension Parameters of the Skin,” *Cancer* 1995 Fed; 75(4):981-988 (“Voigt”) (Ex. 1003).
- Jeffrey D. Hurley, Michelle H. Demers, Richard C. Wulpern, John R. Grindon, “Body Measurement System Using White Light Projected Patterns for Made-to-Measure Apparel,” *SPIE* Vol. 3131, July 7, 1997, 212-223 (Hurley) (Ex. 1004).
- Heim A.M. Daanen and Jeroen van de Water, “Whole Body Scanners,” *Displays* 19 (1998) 111-120 (Ex. 1005)
- PCT published application WO 98/28908 (Crampton) (Ex. 1006)
- PCT published application WO 99/56249 (Dye) (Ex. 1007)
- “USB powers up for market thrust,” *Office World News*, September 1, 1998 (Ex. 1014)

17. The opinions I am expressing involve the application of my training and technical knowledge and experience in the evaluation of these prior art references with respect to the ‘748 patent. In my opinion, these references teach all of the subject matter found in claims 1-8, 11, 30, 32- 34, 46, and 51 of the ‘748 patent.

IV. RELEVANT LAW

18. I have been asked to provide my opinion as to whether the claims of the ‘748 patent would have been obvious to a person of ordinary skill in the art at the time of the alleged invention, in view of the prior art.

19. Although I have familiarity with patent law, I am not an attorney. For the purposes of this Declaration, the attorneys at Marshall, Gerstein & Borun LLP have provided me with guidance as to the applicable patent law in this matter. My understanding of the law is as follows:

A. Person of Ordinary Skill In The Art

20. I have been informed and understand that the content of a patent or other printed publication (e.g., prior art reference) should be interpreted the way a person of ordinary skill in the art would have interpreted the reference at the time the application for the '748 patent was filed in the United States.

21. I have been asked to assume that the person of ordinary skill is a hypothetical person who is assumed to be aware of all the pertinent information that qualifies as prior art. In addition, the person of ordinary skill in the art makes inferences and creative steps. He or she is not an automaton, and has ordinary creativity.

22. Based on my experience, I have an understanding of the capabilities of the ordinary person in this field prior to July 2000, and my opinions are provided from the perspective of such a person.

B. Standard for Claim Construction

23. I have been informed that claim construction is a matter of law and that the final claim construction will ultimately be determined by the Board. I have

been informed and understand that a claim in *inter partes* review is given the “broadest reasonable construction in light of the specification.” 35 C.F.R. § 42.100(b). I have also been informed and understand that any claim term that lacks a definition in the specification is therefore also given a broad interpretation. I have been informed and understand that limitations from the specification are not to be read into the claims.

24. For the purposes of my invalidity analysis in this proceeding and with respect to the prior art, I have construed each claim term in accordance with its plain and ordinary meaning under the required broadest reasonable interpretations as it would be understood by one of ordinary skill in the art.

25. I understand that certain claim limitations are described using the word “means,” which are referred to as “means-plus-function” claim elements. These elements must be construed according to 35 U.S.C. § 112(6). I understand that when claim language uses the word “means” and recites a function, the language is presumed to be a means-plus-function element under § 112(6). I understand that the presumption is overcome if the language recites sufficient structure to perform the function. To construe a means-plus-function element, I understand that the board will first define the function of the element and then look to the specification and identify the structure corresponding to that function and its equivalents.

C. Obviousness

26. It is my understanding that a claim is “obvious,” and therefore unpatentable, if the claimed subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time of the alleged invention.

27. I have been informed and understand that a determination of whether a claim would have been obvious should be based on several factors, including, among others:

- a. The level of ordinary skill in the art at the time the application was filed;
- b. The scope and content of the prior art; and
- c. What differences, if any, existed between the claimed invention and the prior art.

28. I have been informed and understand that the teachings of two or more references may be combined in the same way as disclosed in the claims, if such a combination would have been obvious to one having ordinary skill in the art. In determining whether a combination based on either a single reference or multiple references would have been obvious, it is appropriate to consider, among other factors:

- a. obvious to try – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success,
- b. common sense,
- c. combining or substituting known elements from the prior art to obtain predictable results,

- d. ordinary creativity,
- e. whether the need or problem addressed by the patent was known in the prior art,
- f. use of known techniques to improve similar devices in the same way,
- g. a teaching, suggestion, or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or combine reference teachings, and
- h. when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one.

29. In determining the scope and content of the prior art, it is my understanding that a reference is considered appropriate if it falls within the field of the inventor's endeavor. In addition, a reference is prior art if it is reasonably pertinent to the problem with which the inventor was involved. A reference is reasonably pertinent if it logically would have commanded itself to an inventor's attention in considering his problem. If a reference relates to the same problem as the claimed invention, that supports use of the reference as prior art in an obviousness analysis.

30. It is my further understanding that the law recognizes several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include: combining prior art elements according to known methods to yield predictable results; simple

substitution of one known element for another to obtain predictable results; a predictable use of prior art elements according to their established functions; applying a known technique to a known device (method or product) ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference

31. I also understand that an obviousness analysis must consider whether there are additional factors that would indicate that the invention would not have been obvious. These factors include whether there was: (i) a long-felt need in the industry; (ii) any unexpected results; (iii) skepticism of the invention; (iv) a teaching away from the invention; (v) commercial success; (vi) praise by others for the invention; and (vii) copying by others. I am not aware of any evidence that would suggest that the claims of the '748 patent would have been non-obvious.

32. I understand that in considering obviousness, it is important not to determine obviousness using the benefit of hindsight derived from the patent being considered.

V. ONE OF ORDINARY SKILL IN THE ART

33. I understand that, when interpreting the claims of the '748 patent, I must do so based on the perspective of "person having ordinary skill in the art" at

the relevant priority date. The application leading to the '748 patent was filed on July 26, 2000 and issued on April 15, 2008. I am informed that it does not claim priority to any earlier patent application. Thus, I understand that the relevant priority date is July 26, 2000.

34. I understand that “a person of ordinary skill” refers to a hypothetical person considered to have the normal skills and knowledge in the technical field pertinent to the claimed invention. I understand that factors to be considered in defining the person of ordinary skill in the art include the following: (1) the educational level of the inventor; (2) the type of problems encountered in the art; (3) prior art solutions to those problems; (4) the rapidity with which innovations are made; (5) the sophistication of the technology; and (6) the educational level of active workers in the field. This hypothetical person would have the capability of understanding the scientific and engineering principles applicable to the pertinent art.

35. Based upon my experience, I am familiar with the level of skill that a person of ordinary skill in this art would have had as of July 26, 2000. In my opinion, a person of ordinary skill in the art to which the '748 patent pertains would have possessed at the time the patent application was filed at least: (a) a university degree in physics, electrical engineering, photogrammetry, surveying, or optics; and (b) at least about two years of post-degree experience in the field of

imaging. This level of skill is based on my evaluation of the factors listed in Paragraph 29, above, including the education level and experience of Dr. Drugge, the inventor of the '748 patent. In my opinion, the person of ordinary skill having the relevant experience would understand the general principles for making measurements based upon images or scans (*i.e.*, photogrammetry), could acquire and analyze data gathered from digital cameras, and would be familiar with the literature discussing the use of photogrammetry and digital scanning in medicine as well as in other fields, such as the clothing, automotive, and entertainment industries.

36. Based on my educational background and experience, I possess at least ordinary skill in the art pertaining to the '748 patent, and did so at the time at which the application for the '748 patent was filed, in July 2000. I am considered an expert in the art pertaining to the '748 patent. Based upon my experience working with and teaching individuals of ordinary skill, I have an understanding of what one of ordinary skill would understand.

37. My opinions discussed in this declaration concerning what was known and would be understood by a person of ordinary skill in the art are based on the time at which the '748 patent application was filed (July 2000), which I understand is the appropriate time period for evaluation of the issues addressed in the Inter Partes Review.

38. In my opinion, as set forth in more detail below, a person having ordinary skill in the art prior to the filing of the application for the '748 patent would have considered the devices claimed in the '748 patent to be obvious in view of the prior art.

VI. '748 PATENT AND BACKGROUND OF THE TECHNOLOGY

39. The '748 patent relates generally to imaging a person or portions of the person. The '748 patent discloses and claims devices that use multiple cameras and multiple light sources within an enclosure to image a person or portions of a person.

40. Claim 1, in view of Figure 1 and as set forth below, provides a basic overview of the claimed invention of the '748 patent.

Claim 1:

A device for the identification of maladies that effect human tissue comprising:

an enclosure configured to receive a person or portion thereof for imaging the person or portion thereof, wherein the enclosure defines a specified imaging position for placing the person or portion thereof within the enclosure for imaging, and the specified imaging position defines a centerline;

a plurality of imaging devices, wherein a plurality of the imaging devices are vertically spaced relative to each other, a plurality of the imaging devices are

laterally spaced relative to each other, a plurality of the imaging devices are located on opposite sides of the centerline of the specified imaging position relative to each other, and each imaging device is located a predetermined distance relative to the specified imaging position; and

a plurality of light sources spaced relative to each other and peripheral to the plurality of imaging devices that illuminate the person or portion thereof located at the specified imaging position and generate refraction and reflectance light therefrom;

wherein each of said imaging devices generates an image of the illuminated person or portion thereof located at the specified imaging position, and defines respective coordinates and said respective predetermined distance relative to the specified imaging position, and defines a respective focal length and resolution information, allowing precise measurement of imaged features of the person or portion thereof located at the specified imaging position.

41. With respect to Fig. 1, reproduced below, the '748 patent describes a device sized such that a person could easily stand at the center 108 of the device, including panels 109 comprised of an imager array 102 comprising a vertical array of imaging devices (or cameras). (Ex. 1001 at Fig. 1; col. 18, ll. 32-55). Light sources 101 are used to optimize the performance of the cameras. (*Id.* at 18:55-60).

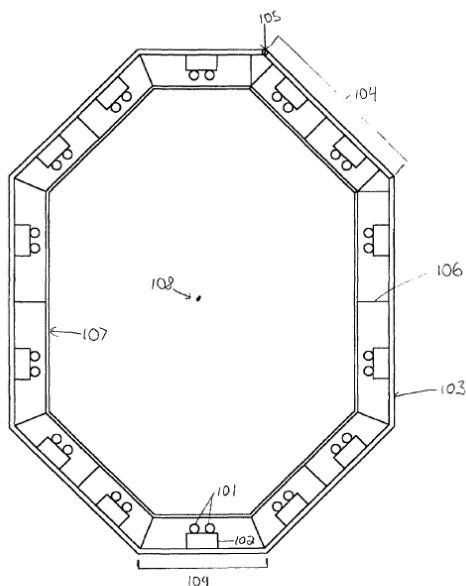


Fig. 1

42. Claim 1 of the '748 patent recites that the "enclosure defines a specified imaging position for placing the person." Each imaging device is "located a predetermined distance relative to the specified imaging position." In addition to being located a predetermined distance from the specified imaging position, each imaging device "defines respective coordinates [.]". One of ordinary skill in the art would understand this to mean that the distance from the front of the camera lens to the specified imaging position is known and the reference coordinates of each imaging device are known in a common reference system.

43. Claim 1 of the '748 patent also discloses that the imaging devices "define a respective focal length and resolution." One of ordinary skill in the art would understand this to mean that at the time of imaging, the physical size of the camera's pixels (i.e. resolution) was known, as was the distance, usually

represented in millimeters from the point in the camera's lens where light converges from the subject to the image sensor (i.e. focal length).

44. Claim 1 of the '748 patent further recites that these parameters of each imaging device "allow[s] precise measurement of imaged features of the person[.]" One of ordinary skill in the art would have recognized that in this respect Claim 1 was referring to the calculation of well-known and common practice, in this field.

VII. CLAIM TERMS

A. Imaging devices and imaging means

45. Claim 1 recites a plurality of "imaging devices" and claim 51 recites "a plurality of imaging means." The specification discloses that the imaging devices are "devices capable of 'photographing' the body in a static position (motion or time-lapsed photography is also provided for)." (col. 4, ll. 25-27). Such devices may "photograph" the body "through traditional photography means, and/or temperature, chemical or electromagnetic based means." (col. 4, ll. 28-30). The imaging devices "could comprise standard or digital cameras, or other devices capable of capturing light, temperature, chemical information, or other information of interest" (col. 18, ll. 50-53). "Imaging devices 203 may be a standard or digital camera, or any other type of device capable of capturing the desired information from the subject with the imaging system." (col. 19, ll. 25-28). Based upon this description, the state of the art as of July 2000, and the plain and ordinary meaning

of the term, one of ordinary skill in the art would understand that the term “imaging device” would be any type of device capable of capturing information that could be used to image objects, such as all or part of a person, including all types of cameras such as film, black and white, color, digital, CCD, thermal infrared, multi-spectral, video, and chemical detection (which is understood to refer to fluorescence). Similarly, one of ordinary skill in the art would understand the disclosed structure for the “imaging means” of claim 51 and its equivalents to have the same meaning.

B. Centerline

46. Claim 1 recites a specified imaging position that “defines a centerline.” The specification makes a number of references to the imaginary center of the device enclosure. For example, the system is “sized such that the person [being imaged] could easily stand at the center 108 of the device 100 with sufficient comfort.” Ex. 1001 at col. 18, ll. 37-39. Further, the specification discloses that in a device that is focused on imaging just a part of the body, the device could be made smaller such that “just [the body party being imaged] would fit comfortably at center 108.” In photogrammetry, one of ordinary skill in the art would understand the broadest reasonable construction of the term “centerline” in this context to refer to a line dividing the object to be imaged through its center. In the context of whole body imaging, one of ordinary skill in the art would generally

understand the broadest reasonable interpretation of that term to mean a line dividing the body along one of two planes, either the frontal plane of the person's body dividing the person from side to side and or the sagittal plane dividing the person from front to back. Accordingly, one of ordinary skill in the art would understand the broadest reasonable construction of centerline referenced in the '748 patent to be a line dividing the object to be imaged along the center of the object while it is positioned at the specified imaging position.

C. Light sources and illuminating means

47. Claim 1 recites "a plurality of light sources." Claim 51 recites "illuminating means." The specification discloses that "fluorescent tubes are the preferred means," but that "any type of illumination can be used." Ex. 1001 at col. 18, ll. 56-58. One of ordinary skill in the art would understand that in its broadest reasonable construction the light sources could include any type of illumination that could be used with imaging, such as LEDs, projectors, textured lighting, lasers, colored lights, theater or cinematic lights, Wood lights (ultraviolet), and fluorescent lights. One of ordinary skill in the art would understand that the structure disclosed in the specification for the "illuminating means" and its equivalents would have the same meaning.

D. The Wherein Clause

48. The clause of claim 1 that begins “wherein” states that each imaging device of the plurality “generates an image of the illuminated person or portion thereof located at” the specified imaging position. The clause further states that each imaging device “defines respective coordinates and respective predetermined distance” relative to the specified imaging position, and “defines a respective focal length and resolution information,” thereby “allowing precise measurement of imaged features of the person or portion thereof located at the specified imaging position.”

49. The specification of the ‘748 patent further emphasizes that these “distances, in combination with focal length and resolution information, allows for precise measurement of the human features of interest.” *Id.* at col. 4, ll. 42-46). The specification of the ‘748 patent points out that the purpose (*i.e.* “basis”) of the “panel-camera array” is “to accurately capture the physiological attributes desired from the subject patient.” (col. 4, ll. 40-42).

50. The broadest possible construction of this clause of the claim, that is not inconsistent with these disclosures, is that the device precisely measures the features of the person or portion thereof imaged by an imaging device by means of the predetermined distance between that imaging device and the specified imaging position, the device’s coordinates, its focal length, and its resolution.

E. Imaging array

51. Claim 5 recites “a first imaging array” and “a second imaging array.” The ‘748 patent states that “[i]maging arrays 205 and 206 comprise a plurality of imaging devices 203.” (‘748 Patent, 19: 24-25). In stereo-photogrammetry, it is common to use two or more cameras. Accordingly, based upon the definition in the ‘748 patent and the understanding that cameras are often used in pairs, one of ordinary skill in the art would understand that an imaging array is defined as at least two imaging devices.

F. First means for receiving and enclosing a person or portion thereof

52. Claim 51 recites “first means for receiving and enclosing a person or portion thereof to image the person or portion thereof.” I understand that this claim limitation identifies a “means” which requires that I look to the patent specification to identify the structure that is linked to the performance of the claimed function. I understand that the proper construction of such a “means” is limited to such structure and equivalents thereof known at the time of the filing of the application for the ‘748 Patent.

53. The function recited for the first means is receiving and enclosing a person or portion thereof to image the person or portion thereof.” Turning to the specification, the ‘748 patent discloses interconnected panels that form a fully surrounding enclosed structure supported by a perimeter wall 103 that can be made

of “plywood, particle board, or any other structural material capable of supporting the structure.” Ex. 1001 at col. 18, ll. 43-45; 60-63. Based upon this disclosure, one of ordinary skill in the art would understand the broadest reasonable construction of the “first means for receiving and enclosing a person” to be “a structure that fully surrounds (*i.e.* encloses) a person and that this structure is made of plywood, particle board, or any other structural material capable of supporting the structure and equivalents thereof known at the time of the filing of the application.”

G. Second means for specifying an imaging position

54. Claim 51 recites “second means located within the first means for specifying an imaging position for placing the person or portion thereof within the first means, wherein the second means defines a centerline.” I understand that this claim limitation identifies a “means” which requires that I look to the patent specification to identify the structure that is linked to the performance of the claimed function. I understand that the proper construction of such a “means” is limited to said structure and equivalents thereof known at the time of the filing of the application for the ‘748 Patent.

55. From my review of the claim, I understand that the function performed by the second means is “specifying an imaging position” and “defin[ing] a centerline.” The claim also indicates that this second means is located within the first means for receiving and enclosing a person, which I construed

above. Turning to the specification, the '748 patent discloses that the system will be "sized such that the person [being imaged] could easily stand at the center 108 of the device 100 with sufficient comfort." Ex. 1001 at col. 18, ll. 37-39. The shield 107 "protects the imager array 102 and light sources 101 from contact with the subject." Ex. 1001 at col. 18, ll. 65-66. The specification discloses use of standard 1/8" obscured plexiglass for shield 107. Ex. 1001 at col. 18, ll. 66-67. Thus, the shield is in close proximity to the person being imaged and physically confines the person being imaged to a specified location (the center of the enclosure) and compels a particular orientation of the subject. Effectively, the person can only stand at the specified imaging position. The location and orientation of the person's body defines a centerline along the body from side to side or front to back.

56. Accordingly, the structure disclosed in the '748 patent for performing the function of specifying an imaging position and defining a centerline is "a shield positioned in such proximity to the person being imaged that the person is physically confined to the specified imaging position, or equivalent structures known at the time of the filing of the application that would similarly physically confine the person."

57. I note that the specification of the '748 Patent makes reference to the center of the enclosure as "center 108." However, neither the specification's

indication of the center of the enclosure on Figure 1, nor the remainder of the specification's text, describes any structure associated with that geometric concept. However, as set forth below, I have provided an opinion, in the event it is determined that the specification does disclose use of a visual indication of the location where the person to be imaged is to be located, and that such also constitutes part of the structure for the "second means," and that such a "structure" would also have been obvious in light of the prior art.

VIII. SUMMARY OF OPINIONS

58. In my opinion, claims 1-8, 11, 30, 32-34, 46, and 51 are invalid because they would have been obvious to a person having ordinary skill in the art prior to the filing of the application for the '748 Patent.

A. General State of the Art

59. The '748 patent generally claims the use of body imaging to measure features of the imaged object by placing the object in a specific position, surrounding the object with multiple imaging devices, multiple light sources, and making measurements using information regarding the location of the cameras, the distance of the location where the person was being imaged to the cameras, and the focal length and resolution of the camera. Each of these elements was known as of July 26, 2000.

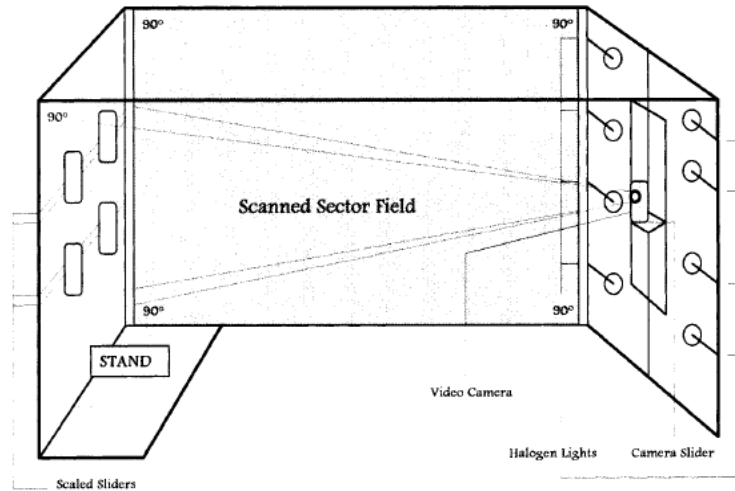
B. Measurement using camera coordinates

60. By July 26, 2000, it was well known that in photogrammetry the scale of the image relative to the object images is determined by the ratios of the focal length of the camera to the distance from the front camera lens to the object imaged. See Comer, R.P. *et al.*, Talking Digital, *Photogrammetric Engineering & Remote Sensing*, 1139 (December 1998) (Ex. 1012) (“The lens of an airborne digital camera forms an image of the ground on its focal plane at a certain scale. That *camera scale* is the ratio of focal length of the lens and the collection height above ground level (AGL), $\text{camera scale} = (\text{focal length})/(\text{height AGL})$. Where the image on the focal plane is captured using a charged couple device (CCD) array—such as was disclosed in the Voigt reference—then the scale is calculated with the addition of the image array size (*i.e.* resolution) by means of the following formula: $\text{scale} = (\text{array element size}) (\text{height AGL})/(\text{focal length})$. As Comer explains, “In general, GSD (Ground Sample Distance) [*i.e.* scale] is simply the linear dimension of a single pixel’s footprint on the ground.” *Id.* Using the physical size of a single pixel in the camera sensor’s footprint, one can measure the dimensions of an imaged object by identifying the number of pixels encompassing that object in the image.

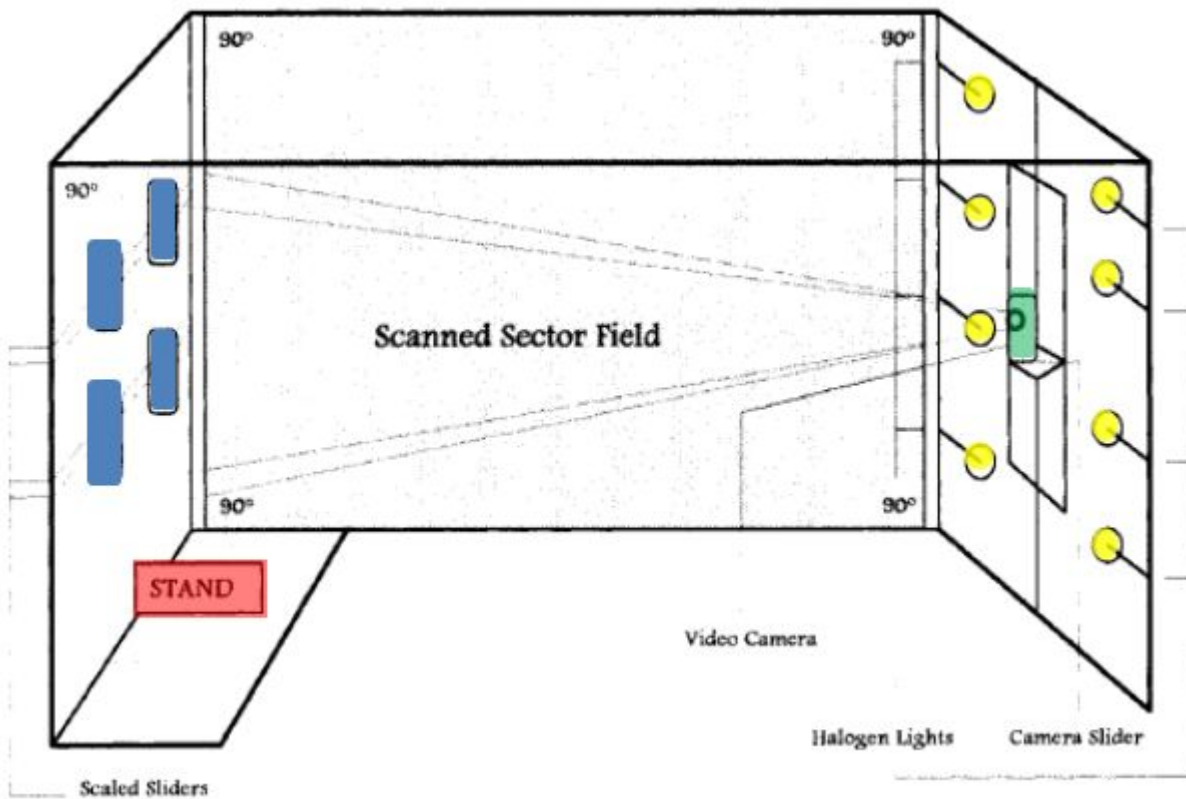
C. Use of body imaging technology to measure body features

61. By July 26, 2000, people of ordinary skill understood digital imaging had applications in a wide variety of fields, including the diagnosis of skin cancer. For example, the article “Topodermatographic Image Analysis for Melanoma Screening and the Quantitative Assessment of Tumor Dimension Parameters of the Skin” describes the use of images of a portion of the body (here, the front and back of the torso) to make quantitative measurements of the size of skin lesions over time to diagnose melanoma. (Voigt Ex. 1003 at p. 981 (describing “quantitative videographic image analysis of skin-lesion changes over time” to “identify and evaluate changes of cutaneous lesions in melanoma screening.”); 983 (explaining that the “total front (ventral) and back (dorsal) trunk areas were selected for computed videographic image analysis.”)). Imaging was also used to quantify other deviations in body shape such as warts and scars and to map the progress of gravity through regular body scans. *See* H.A.M. Daanen, *3-D Surface Anthropometry: accurate determination of body dimensions*, NATO Panel 8 RSG 24 Workshop on Emerging Technologies in Human Engineering and Testing & Evaluation, June 24-26, 1997 (Ex. 1008 at p. 6).

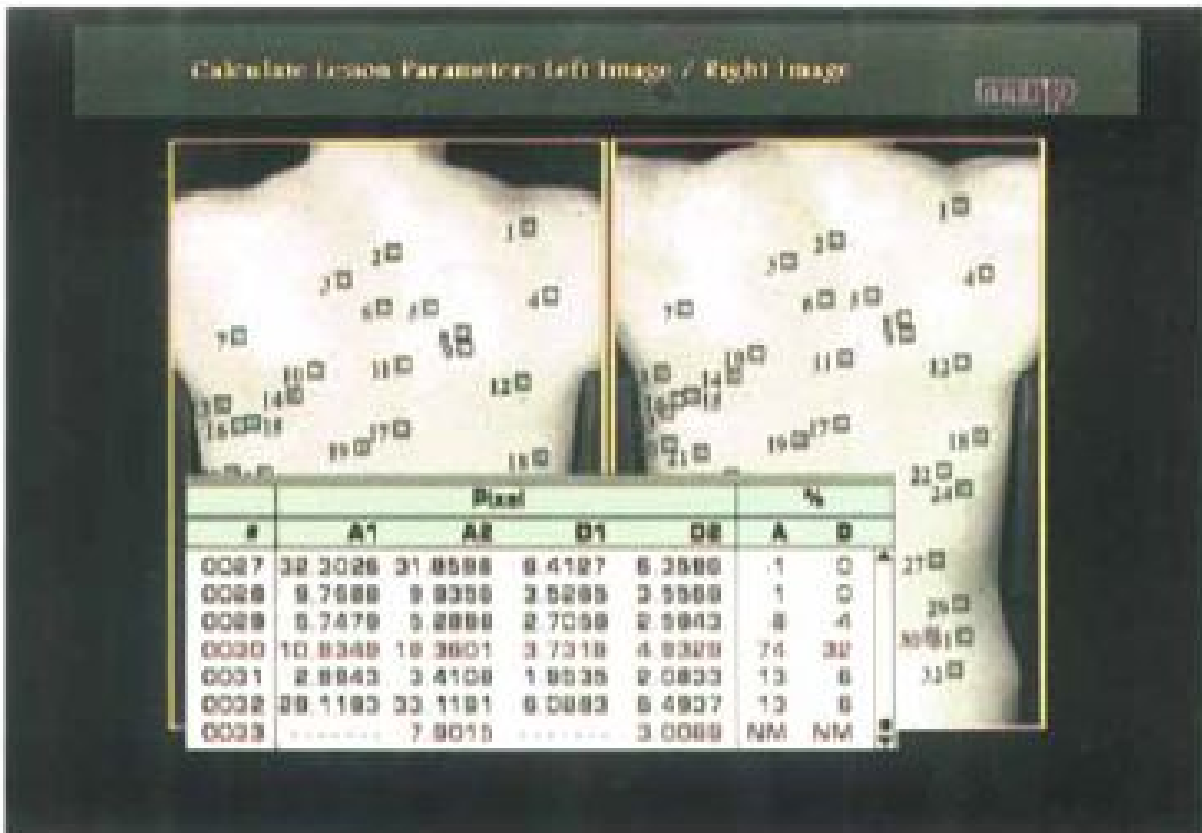
62. Voigt discloses a device for imaging a portion of the body for purposes of diagnosing skin cancer as shown in the Figure below. Ex. 1003 at p. 982.



63. This device, as shown in Fig. 1 on p. 982 of Ex. 1003, contains an enclosure with a stand where the person being imaged is located (highlighted in red below). Horizontal sliders (highlighted in blue below) identify the exact location of the person by fitting the lateral extent of the trunk's shape into the sliders. *Id.* at 982. There is a single camera (highlighted in green) is vertically adjustable. *Id.* Eight halogen lights (highlighted in yellow) are located to the left and right of the camera. *Id.*



64. The resulting images from the Voigt device are shown on a monitor display. Exemplary images as shown in Ex. 1003, Fig. 3 on p. 983 are reproduced below.



65. To make measurements of the skin lesions pictured, Voigt recorded the positions of the sliders which, along with the known location of the stand, served to identify the location of the individual being imaged. Voigt at p. 982. Voigt also recorded the location of the camera. *Id.* (“the vertical height of the video camera was adjusted on a scaled-camera slider, and its framework position was recorded”). Voigt calculated a scale represented by each pixel. *Id.* at 983. One of ordinary skill would understand that the scale of each pixel was calculated using the formula described above taking into account the camera’s focal length, its distance to the object, and its resolution. Voigt used the computer to calculate the area and dimensions of the lesions shown in the photograph. Ex. 1003 at p. 983. As

discussed further in subsequent paragraphs of this Declaration, one of ordinary skill would have understood that the Voigt methodology of measurement applies the same inputs and uses the measurement method claimed in the Drugge patent.

D. Use of Multiple Cameras to image objects

66. By 2000, the use of multiple, digital cameras in order to obtain all around coverage of an object to be imaged was well-known. Several prior art examples describing such use are identified below.

67. For example, one treatise on close range photogrammetry explained that, “when all around coverage is needed, multiple cameras or an array of synchronized cameras may be used.” *See* Atkinson, Whittles Publishing, “Close Range Photogrammetry and Machine Vision” Ch. 11 “Medical photogrammetry,” pp. 303-327 (1996) (Ex. 1009). This synchronized photography is particularly helpful when trying to capture images of a human being. (Ex. 1009 at p. 306). The availability of digital cameras which, as of 1996 had become “cheaply and easily obtainable” encouraged the use of multiple cameras. (Ex. 1009 at p. 306).

68. A 1998 article titled “Whole Body Scanners” provides a survey of eight commercially available products, each of which constitute an “optical 3D measuring system that produces a digital copy of the surface geometry of the human body.” Daanen, Hein and van de Water, Jeroen, “Whole Body Scanners,” *Displays* 19 (1998) 111-120. (Ex. 1005 at 111). Daanen notes that such devices

were applicable to anthropometric research, the clothing industry (to create individually tailored clothing), the entertainment industry (to create special effects), computer animation, and medicine. *Id.* The article describes a whole body scanner as consisting of:

- One or more light sources
- Cameras that capture the image of the projected light on the body;
- Software to extract the depth structure of the body surface from the images
- And a computer and screen to visualize the 3D surfaces.

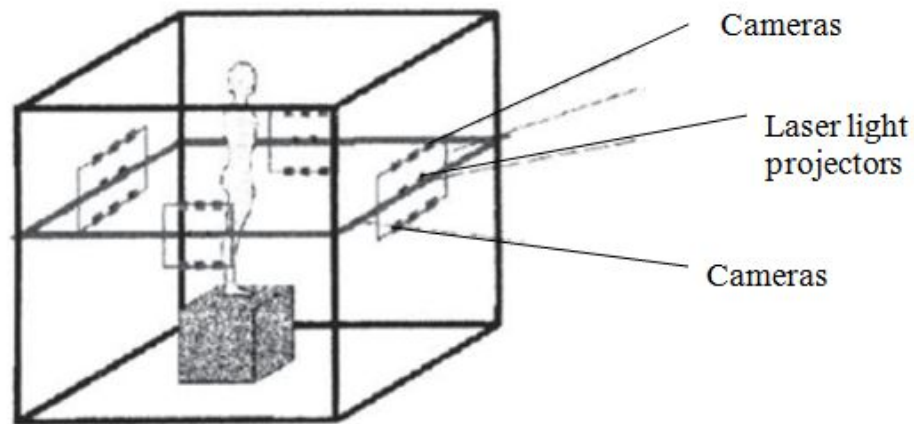
(Ex 1005 at 112). Each of the described systems contains multiple light sources and multiple cameras. Most of the described systems also employ enclosures.

69. Daanen identifies several advantages of using multiple cameras in a whole body scanner. Daanen explains that “in order to cover the entire body, multiple scan heads [containing at least one light and camera] have to be used.” (Ex. 1005 at p. 119). As compared to scanners that have moving cameras, Daanen explains that use of steady mounted cameras allows for systems that have no moving components which “increases the life cycle of the scanning system and also increases the safety of the scanned subjects.” *Id.* Daanen also notes that the use of a large number of cameras allows for relatively high resolution when describing one of the systems disclosed that contains 16 to 24 cameras. *Id.* at p.

115. It is my opinion that each of these advantages, among others, would provide a rationale for one of ordinary skill in the art to modify a single camera reference, particularly a reference containing a sliding single camera with a reference describing the use of multiple cameras to image the body.

70. One system described in Daanen (Ex. 1005), is the Vitronic viro 3D product, available in two formats which use 16 CCD cameras or 24 CCD cameras, respectively. The cameras are arranged in four scanning heads, one on each of the four walls of the enclosure. (Ex. 1005 at p. 115). The person being imaged stands on a raised block in the center of the enclosure. Each of the four scanning heads include two lasers to illuminate the body. *Id.* The cameras in each of the scanning heads are arranged in two, vertically spaced, horizontal rows of three cameras each, with the lasers in a row sandwiched between those rows. *Id.* A representation from Daanen of the system is shown below (Ex. 1005 at Fig. 4a p. 113):

(a)



71. Another system described in the Daanen article, the Cyberware WB4 has four scanning heads mounted on a rigid frame. The user has the ability to adjust software settings. (Ex 1005 at 114-115). The person being imaged stands on a raised platform in the middle of the frame. A photograph of the system is shown below.

H.A.M. Daanen, G.J. van de Water / Displays 19 (1998) 111-120

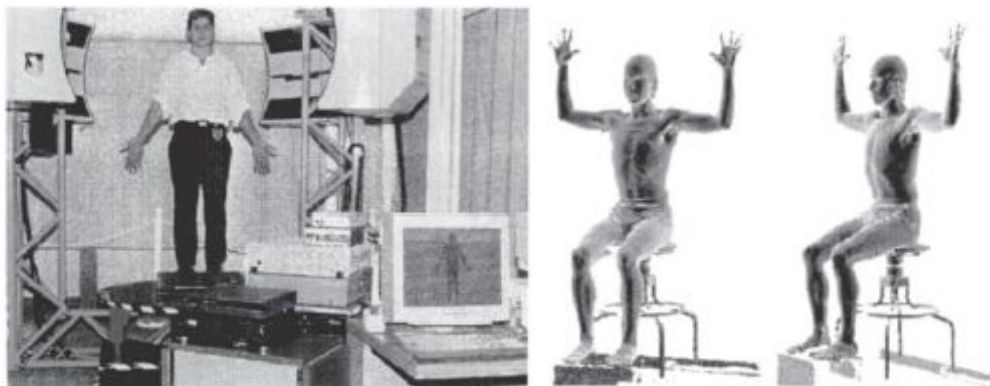
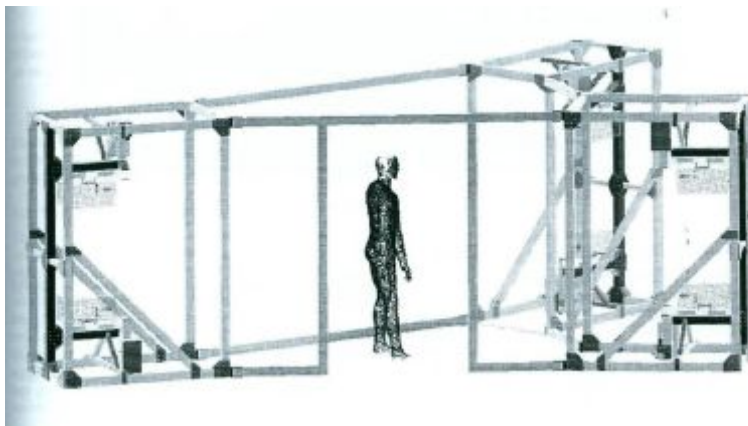


Fig. 3. The Cyberware WB4 with a scan example.

72. Another system described in Daanen (Exhibit 1005) and further in a 1997 article titled “Body Measurement System Using White Light Projected Patterns for Made-to-Measure Apparel” describes the TC² product disclosed in Daanen in greater detail. SPIE Vol. 3131, July 7, 1997, 212-223 (Hurley Ex. 1004), was offered by the company TC², for use in the apparel industry. The system has six sensors, each consisting of a projector and a camera. The sensors are placed on a frame, two sets of four sensors (each set consisting of two spaced sensors, one spaced vertically above the other) facing the front of the body and a set of sensors facing the back of the body. The system is shown in the figure below from Hurley (Ex. 1004 at 213).



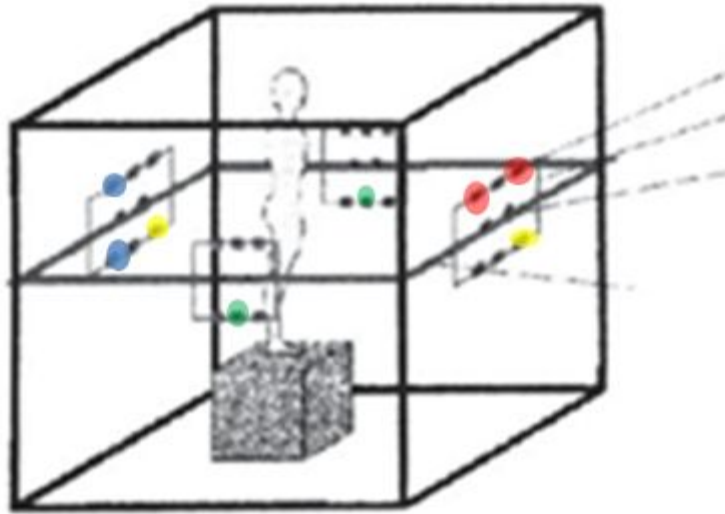
E. Location of Cameras and lights within an enclosure

73. Many of the claims of the ‘748 Patent are directed to the specific location of cameras and lights within an enclosure. One of ordinary skill in the art would have understood that, as long as the cameras were located in positions allowing full coverage of the body within the cameras’ depth of field and the light

sources were sufficient to ensure uniformity of illumination and prevent shadowing, any specific locations of the cameras and lights within the enclosure constitute an obvious design choice. However, certain of the prior art references that I reviewed also specifically disclose the locations of cameras and lights claimed in the '748 patent.

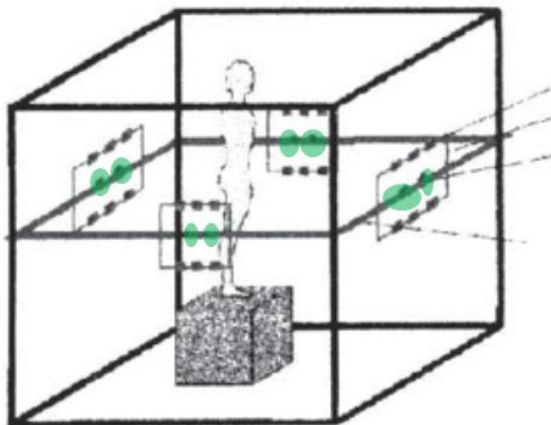
74. The Vitronic Viro 3D system described in Daanen (Ex. 1005) discussed above, discloses a plurality of imaging devices are vertically spaced relative to one another (one example highlighted in blue in the image below), a plurality of imaging devices spaced laterally to one another (one example shown in red in the image below), and a plurality of imaging devices located on opposite sides of the centerline of the specified imaging position (one example shown in yellow in the image below in the instance wherein the centerline divides along the frontal plane and another example shown in green in the image below in the instance wherein the centerline divides along the sagittal plan). Ex. 1005 at p. 115; Fig. 4a p. 113.

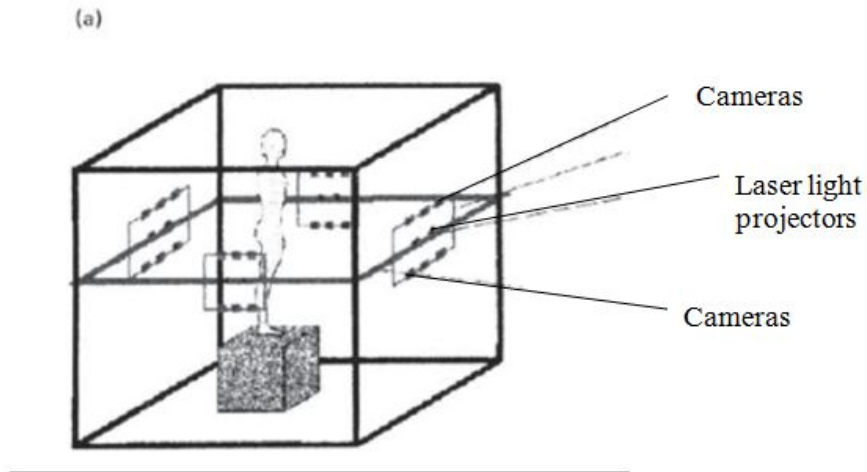
(a)



75. The same system also discloses that the light sources (highlighted in green) are spaced relative to each other and peripheral to the imaging devices. Ex. 1005 at p. 115; Fig. 4a p. 113. These light sources are also located symmetrically relative to the center line of the specified imaging position.

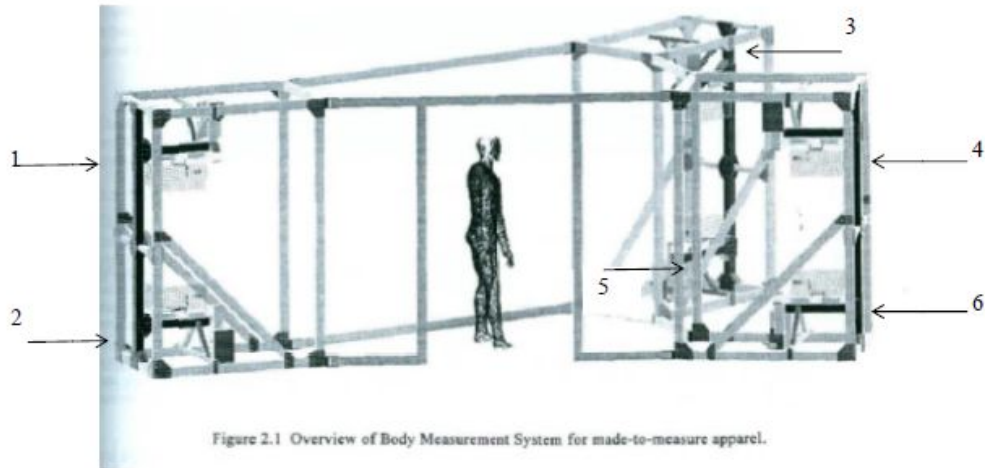
(a)





76. As discussed above, Hurley (Ex. 1004) discloses a body measurement system for use in making made-to-measure apparel. Ex. 1004 at 212. The system uses six sensors located on three separate towers, each tower containing an upper and lower sensor. *Id.* Each sensor contains an area sensing CCD camera and a structured light projector. *Id.* at 213. These six sensors are located in stationary positions within a structure built with a black anodized aluminum extrusion that is then covered with non-reflective black theater cloth. *Id.* at 213-214.

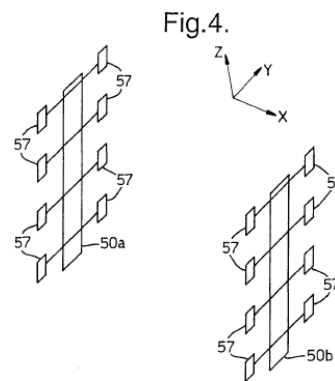
77. The Figure below shows the structure and location of each sensor (labeled 1-6 below). *Id.* at 213. Depending on which centerline is chosen, at least two imaging devices such as 1 and 4 or 5 and 6 are located on opposite side of the centerline relative to each other. Imaging devices 2 and 6, as well as devices 3 and 4, are laterally spaced (or located to the side) from one another. Imaging devices 1 and 2, 3 and 5, and 4 and 6 are vertically spaced from one another.



78. Each sensor head is made up of “a structured light projector and an area sensing CCD camera.” Ex. 1004 at p. 213. Thus, the light projector of sensor heads 1 through 6 are spaced relative to each other and are peripheral to the plurality of imaging devices.

79. Another prior art reference, WIPO Patent Application Number 98/28908 (Crampton), discloses a variety of locations for cameras and lights when used to image the whole body. Ex. 1006. Crampton was filed on December 22, 1997 claiming priority to an earlier application filed in Great Britain on December 24, 1996 and was published on July 2, 1998. This application discloses a booth used to capture a 3D image of the human body, specifically to create high-detail surface avatars of the person. It describes several options for the location of cameras and lights.

80. Crampton discloses several embodiments providing for different locations of cameras and lights. One embodiment includes two vertical columns of sensors (57) located on either side of the person, with each sensor consisting of colour cameras and flash lights. Ex. 1006 at pp. 7-8. Thus, Crampton discloses at least sixteen cameras and flash lights. Crampton further notes that the positions of the sensors can be optimized to recover the maximum amount of the surface area of the person. *Id.* at 14.

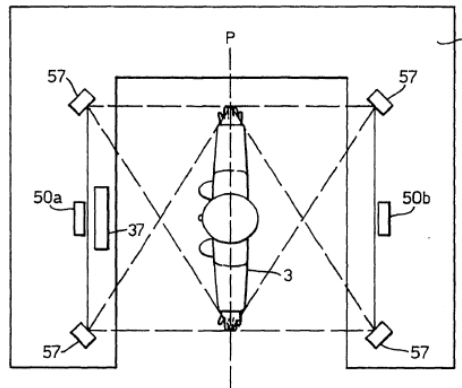


81. As shown in Figure 6 from Crampton, reproduced below, each corner of the booth or kiosk includes a set of sensors (57). In this example, then, there are at least four cameras and four flash lights located in each corner of the kiosk. Accordingly, this embodiment discloses at least a plurality of imaging devices that are spaced laterally relative to one another, a plurality of imaging devices that are spaced vertically relative to one another, and a plurality of imaging devices that are located on opposite sides of the centerline from each other. Additionally, this

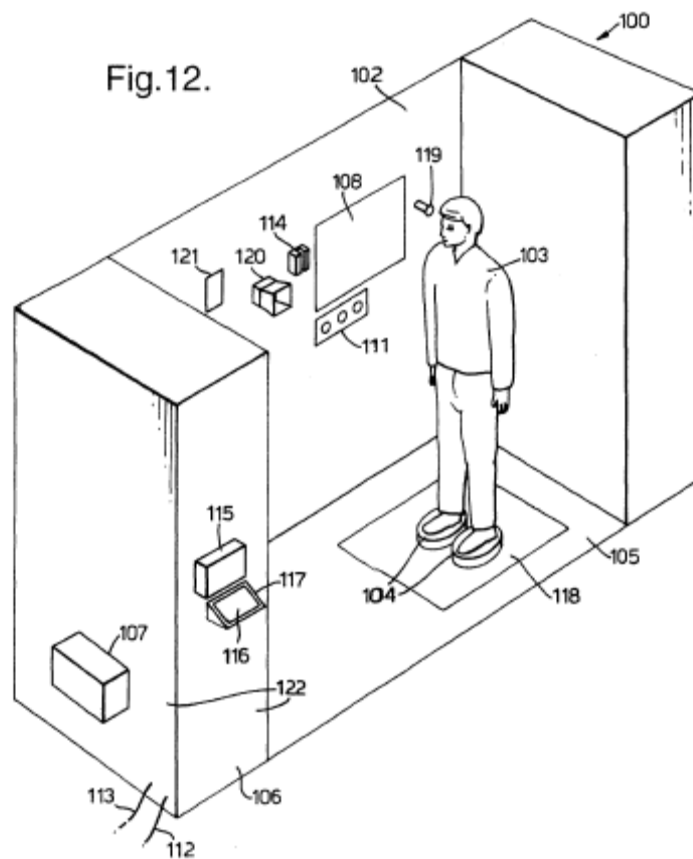
embodiment discloses a plurality of light sources spaced apart from one another and peripheral to the imaging devices.

5/9

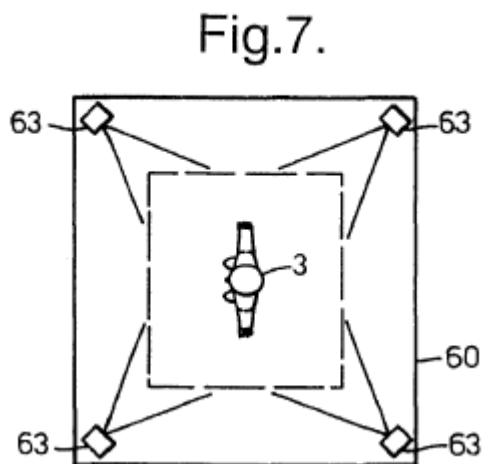
Fig.6.



82. The full kiosk is shown in Figure 12. This figure discloses the further use of additional interior lighting (121) located within the kiosk and between the rows of sensors.

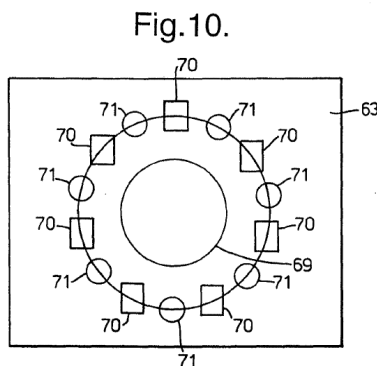


83. Crampton also discloses another embodiment in which cameras (63) may be placed on all 4 sides of a person. *Id.* at pp. 9-10.



84. Crampton further discloses that the number of cameras needed to capture the entire body will depend on the size of the kiosk. Crampton notes that the invention is not limited to any particular arrangement of cameras. *Id.* at p. 9-10.

85. With regard to lighting, Crampton discloses a variety of arrangements. In addition to the sensors containing both cameras and light sources discussed above, Crampton also discloses an embodiment in which the camera lens (69) is surrounded by two different wavelengths of LEDs (70, 71). *Id.* at Fig. 10; p. 10.

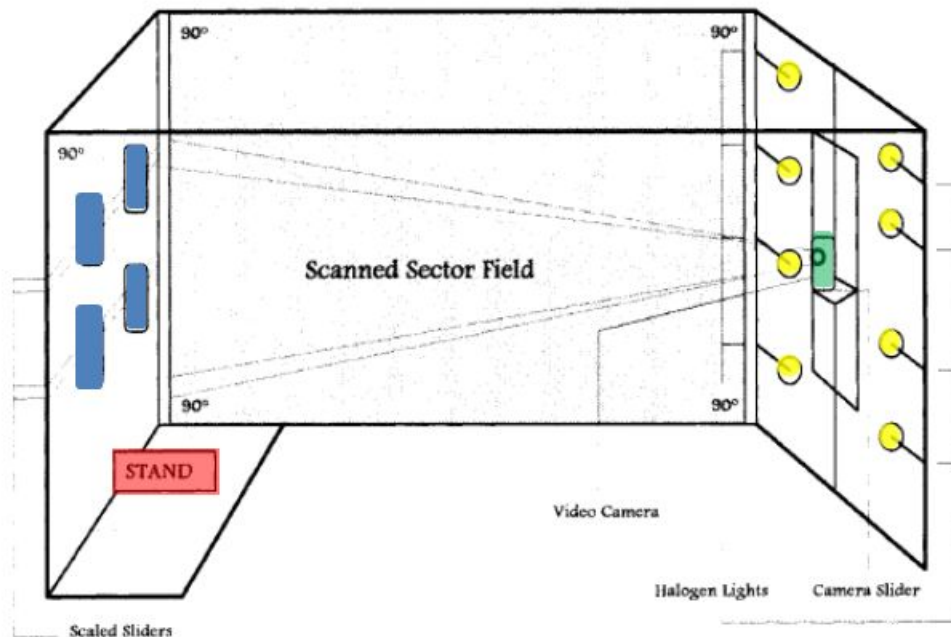


86. The disclosures of Daanen and Crampton demonstrate to one of ordinary skill in the art that a wide variety of locations of cameras and light sources are appropriate and can be used in imaging a person or a part of a person.

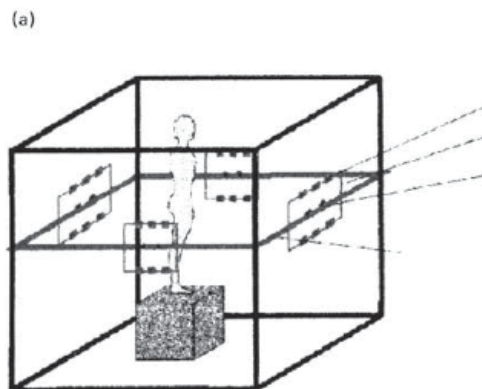
F. Specified Imaging Position that Defines a Centerline

87. As of July 2000, the use of a specified imaging position that defines a centerline where a person to be imaged would be located was well-known. Prior art references disclosing the use of a specified imaging position that defines a centerline are listed below.

88. Voigt discloses a stand (identified in red below) and horizontal sliders (identified in blue below) that identify the specified imaging position for the person to be imaged. Ex. 1003 at Fig. 1, p. 982.



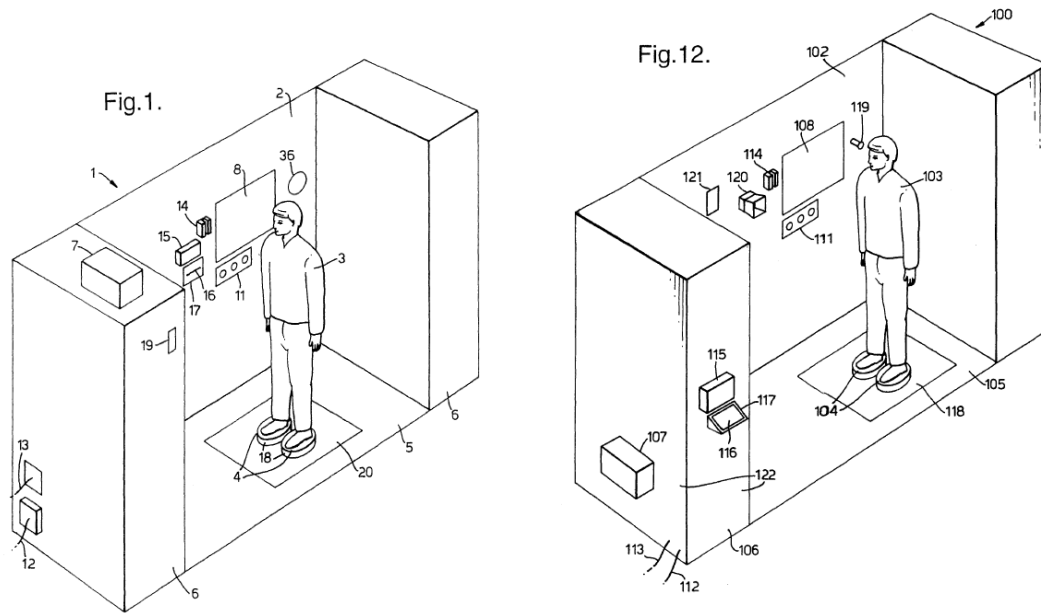
89. Similarly, the Vitronic Viro 3d system described in Daanen discloses a box located in the center of the enclosure where the person being imaged stands. Ex. 1005 at Fig. 4a, p. 113.



90. Hurley (Exhibit 1004) also discloses a specified position where the individual being imaged is located. Hurley uses a calibration process to predetermine the place where the individual is to stand and the coordinates (location and orientation) of each sensor relative to that location. The calibration ensures, among other things, that the subject is within the depth of field (defined in part by the focal length) of the sensor heads. Ex. 1004 at 221. One of ordinary skill in the art would understand that Hurley discloses that, after the calibration is completed, the distance from the object to be imaged to the sensor head is known.

91. Thus, measurements using the system described by Hurley require knowledge of the sensor head coordinates, the predetermined distance between the sensor head and the object to be imaged, and the field of view (i.e. knowledge of the focal length of the camera).

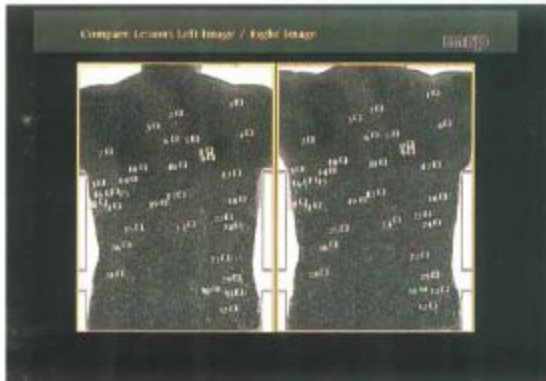
92. Similarly, Crampton specifies the imaging position by means of two footprints located on the floor in the center of the kiosk telling users where to stand. (Ex. 1006 at Fig. 1; Fig. 12). These elements, identified as 4 and 104 respectively in figures from Crampton, are variously described as “foot positioning guidance means,” or “markings (104),” or “two footmark graphics on the floor of the kiosk.” (Ex. 1006 at Abstract; p. 5).



G. The Use of Known Computer Technology to Manipulate and View Images

93. As of July 26, 2000, one of ordinary skill in the art knew that then known computer technology could be used to manipulate and view whole body images. The use of computers, televisions, monitors, and PDA (personal digital assistant) to view images was well known. The use of a mouse, keyboard, or cursor to control the manipulation of data was known. The use of a computer processor, computer cables, and USB interfaces was well-known.

94. For example, Voigt discloses the use of image processing software installed on a processor system embedded in a personal computer with an image-processing board. Ex. 1003 at p. 982. The images are displayed on a monitor as shown in Figures 2 and 3 reproduced below. *Id.* at p. 983.



95. The Daanen article above, Ex. 1005, explains that each body scanner described includes software to extract the depth structure of the body surface from the images and a computer and screen to visualize the 3D surface. Ex. 1005 at p. 112. An example of the visual output from the Vitronic system from Figure 4b of Exhibit 1005 at p. 113 is shown below.



96. Hurley, Ex. 1004, discloses that each sensor contains a projector, a camera, and necessary controls for both. The whole system is controlled by a personal computer and additional hardware and wiring necessary to interface the computer to the sensor heads is contained in an enclosure attached to the sensor head. The software program serves as the graphical user interface, processes the acquired images, calculates resulting data points, and displays graphical output.

Ex. 1004 at p. 214. An example of the resulting images from Figure 5.1 of Ex. 1004 is reproduced below.

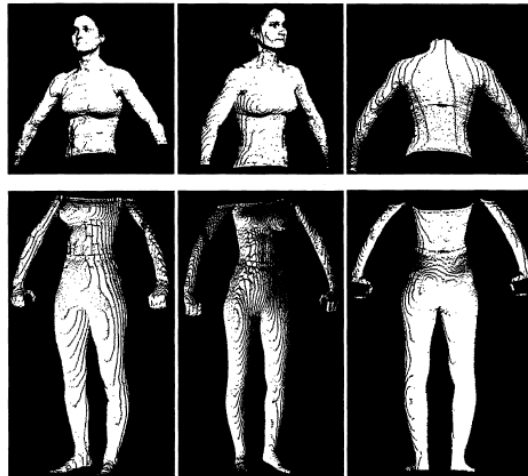


Figure 5.1 Six Individual Views of 3D Data Points

97. Crampton discloses that the sensing equipment is connected to a means for programmable processing (a computer) that is connected to a display monitor. Ex. 1006 at Abstract; p. 4. An operator panel controls the system, with input means that may be a touch screen, a keyboard, or other user interface means. *Id.* at p. 5. The display may be a computer monitor, a large LCD flatscreen, or any form of pixel display technology. *Id.* at p. 6.

98. PCT Application WO 99/56249 published on November 4, 1999 titled “Graphics System and Method for rendering independent 2D and 3D objects” (Dye Ex. 1007) describes a method for rendering and display of 3D graphical data on a display device. In describing the state of the art, the patent application discloses that standard input/output devices for use in a computer system for building and manipulating three dimensional objects include a keyboard, mouse,

floppy disk, hard drive, etc. (Ex. 1007 at p. 1, ll. 13-15). The patent application discloses that images can be displayed on computers, television screens, personal digital assistants (PDAs) and other types of display systems for displaying 2D/3D graphics. (Ex. 1007 at p. 6, ll. 15-24). Specifically, images can be conveyed to the display system through an I/O bus interface, including, for example, a Universal Serial Bus (USB). (Ex. 1007 at p. 7, ll. 21-23).

99. Similarly, press coverage from 1998 makes clear that USB hubs were an increasingly popular option for connecting a large number of peripheral devices, such as digital cameras, to a computer. “USB powers up for market thrust,” Office World News, September 1, 1998 Ex. 1014. The article explains that USB connectors and hubs were growing in importance as operating systems were upgraded to support their use in connection with peripheral devices. *Id.* USB hubs were known to allow users to connect up to 127 devices to a single computer and offered increased speed as compared to other options. *Id.* These USB hubs help to prevent power drain when using multiple devices. “What’s the big deal about USB,” Info-Tech Advisor Newsletter, January 12, 1999. (Ex. 1015). One of ordinary skill in the art would have understood that USB hubs were a known technological option to connect multiple digital cameras to a computer at the time the application leading to the ‘748 patent was filed.

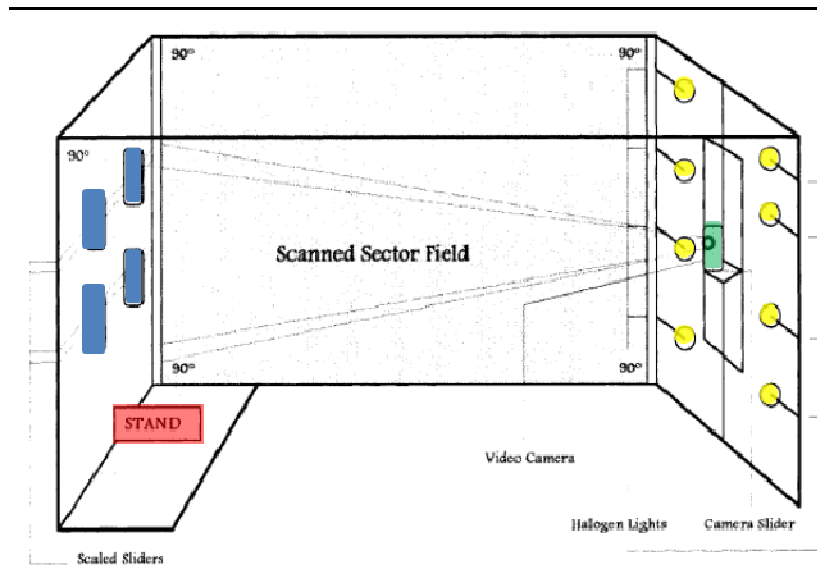
IX. CLAIMS 1-8, 11, 30, 32-34, 46, AND 51 WOULD HAVE BEEN OBVIOUS TO A PERSON OF ORDINARY SKILL IN THE ART

100. In view of the background provided above, and further in view of the reasons set forth below, it is my opinion that claims 1-8, 11, 30, 32-34, 46, and 51 would have been obvious to a person of ordinary skill in the art as of July 26, 2000.

A. Obviousness of Claims 1, 2, 3, 4, 5, 11, 30, 33, 34, 46, and 51 over Voigt in Combination with Hurley

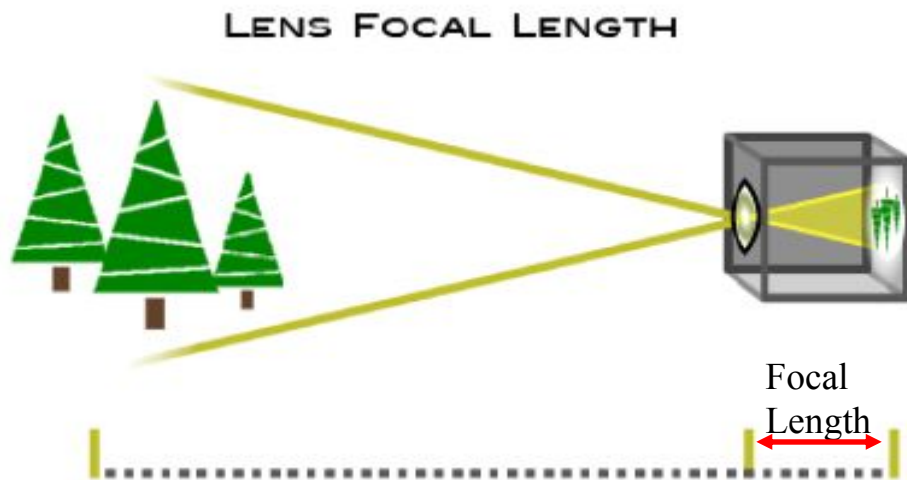
101. Voigt was published on February 15, 1995. Ex. 1003. Voigt identified a clinical need to identify and evaluate changes in cutaneous (*i.e.* skin) lesions in connection with melanoma cancer screening and follow-up. Ex. 1003 at p. 981. Voigt described a technique for doing so it called “topodermatography.” *Id.*

102. As detailed in Voigt, that technique employed use of an enclosure for taking digital images of a patient. *Id.* at 982. The enclosure defined a specified imaging position. *Id.* at 982; Fig. 1. As is depicted below in the annotated diagram from Voigt, the patient’s standing position was fixed at the thoracic and iliac level (*i.e.* from the neck to the hips) by “symmetrically fitting the lateral extent of the trunk shape into horizontally adjustable scaled sliders.” In other words, the patient stood on the stand (noted in red) in front of the camera (shown in green) between the brackets (shown in blue). The patient’s position was recorded prior to imaging. *Id.*

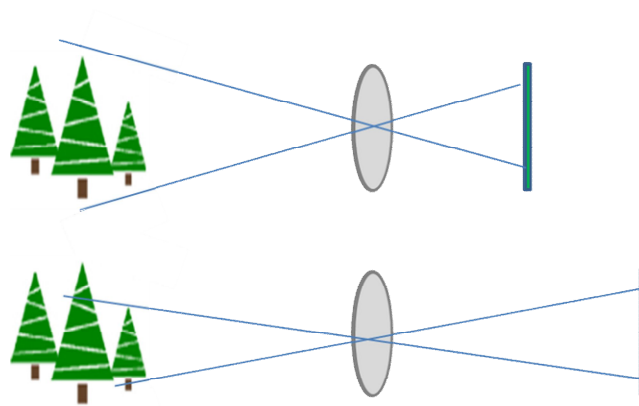


103. The enclosure described in Voigt included multiple light sources (yellow) to illuminate the patient spaced relative to one another in fixed positions. Ex. 1003 at p. 982 (“Illuminations conditions were provided by halogen lights fixed laterally at the position framework”). These light sources were peripheral to a camera (green). *Id.* The vertical position of the camera was adjustable, and its position was record prior to imaging. *Id.* As such, the distance of the camera from the specified imaging position was determined prior to imaging.

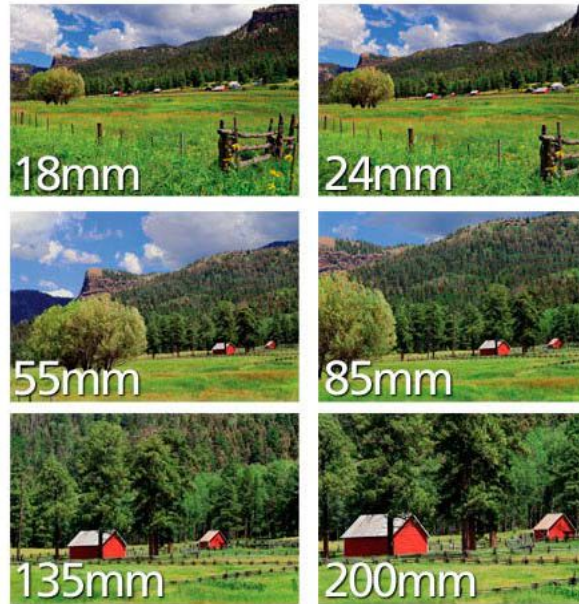
104. Voigt describes use of a Hitachi KP-Mlek black/white charge-coupled device camera. Ex. 1003 at p. 982. The Hitachi KP-Mlek would necessarily have had a lens that defined a focal length (*i.e.* the distance, usually represented in millimeters, from the point in the camera’s lens where light converges from the subject to the image sensor.) The concept of focal length is illustrated in the following diagram:



105. Focal length determines how much of the photographed subject will appear in the image. As illustrated in the following comparisons, the greater the focal length, the less of a photographic scene is captured on the sensor.



106. This effect is evident in the following examples depicting the same scene taken using lenses of different focal lengths.

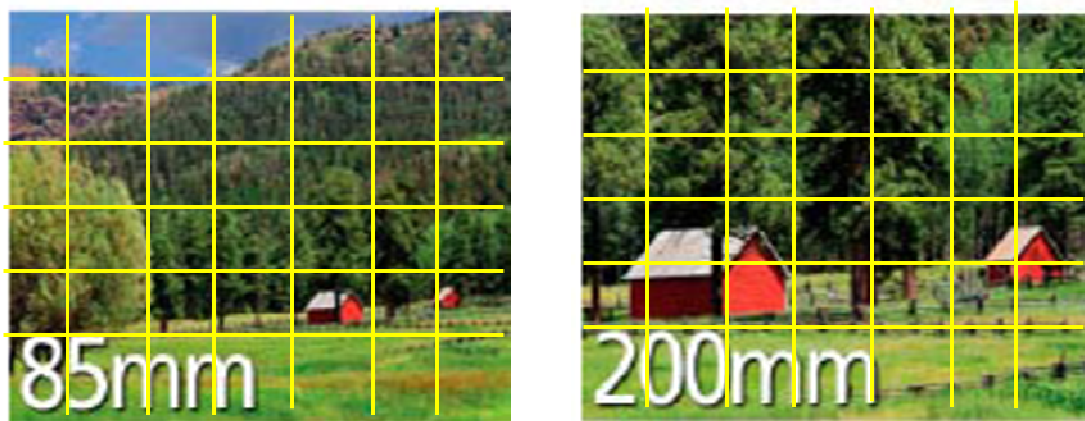


107. A person of ordinary skill in this art at the time of the application for the ‘748 Patent would have understood and appreciated these concepts concerning focal length.

108. Charged couple devices, such as those used in the Hitachi KP-Mlek, employ an integrated circuit etched onto a silicon surface forming light sensitive elements called pixels—a fact that one of ordinary skill in this art would have appreciated at the time of the application. To capture the image, these light sensitive elements detect photons striking this surface.

109. As illustrated above, the greater the focal length, the smaller the amount of the scene that is projected onto the CCD sensor. Comparing images taken using focal lengths of 85mm and 200mm, for example, each pixel in the image taken at a focal length of 85mm will represent a greater actual area of the scene than each pixel in the image captured at 200mm. Imaging each yellow

square in the illustrations below to represent a single pixel on the CCD sensor, the entire red barn fits within a single pixel at 85mm, whereas only a portion of the barn falls within a single pixel in the 200mm focal length image. A person of ordinary skill in this art at the time of the invention would have shared this understanding.



110. Thus, as one of ordinary skill in this art would have appreciated at the time of the application, the real dimensions represented by a single pixel are a function of the camera's resolution (*i.e.* how fine or coarse is each pixel), the focal length of the camera (which determines the ratio between the size of the objects shown on the image with their actual size), and the distance between the camera and those objects.

111. Voigt describes capturing the patient images at a specific image array size (*i.e.* 512 pixels horizontal and 768 pixels vertical). Ex. 1003 at p. 983. Voigt observes that the images thus captured have a resolution of the camera system in which each pixel translated into a 1mm area of the photographed subject. *Id.* For

the reasons discussed above, one of ordinary skill in the art would understand Voigt's reference to this measurement to reflect a calculation using the resolution of the camera system (*i.e.* the physical size of the pixel in the sensor), the focal length of the camera lens (*i.e.* the ratio between the actual dimensions of the imaged object to that of the object when represented in the image) and the distance of the camera from the subject. Thus, per Voigt, the camera captured a portion of the subject roughly one foot eight inches wide by two feet six inches high (*i.e.* 512mm x 768mm).

112. Employing images taken with the camera, Voigt made “digitized measurements” of lesions shown in the resulting images. Ex. 1003 at p. 983. Voigt calculated the “area and the dimensions” of selected objects from the pixels that made up those objects in the image, in order to permit a comparison of the estimated size of these objects with those same objects shown in earlier images of the same patient. *Id.*

113. Voigt demonstrates that it was known in the art in the mid-1990s that a dermatologist could measure cutaneous lesions to diagnose melanoma using digital images taken using an enclosure in which a camera and light sources were positioned at predetermined distances and coordinates from a specified imaging position, and where the measurements of such lesions were made using the dimensions represented by each pixel, calculable using the focal length and

resolution of the camera and its distance from the imaging position. Ex. 1003 at p. 982.

114. As set forth below, Voigt discloses most of the claim limitations of the '748 patent. However, Voigt does not disclose the use of multiple cameras, or cameras located on opposite sides of the subject.

115. The device disclosed in Voigt captured one side of a person's torso. *Id.* at 981-983. Thus, to capture both the front and back of the torso using the Voigt device, one would have to reposition the person being imaged.

116. However, Voigt itself acknowledges the usefulness of total body photography for melanoma screenings. *Id.* at 981 (noting that total body photography is a known method for extending both the quantity and quality of skin-surface information.)

117. To increase the quantity and quality of skin-surface information, while avoiding the time and inconvenience of having to reposition the person being imaged, the camera, or both, one of ordinary skill in the art would have been motivated to make an obvious modification to Voigt to employ the multiple cameras explicitly disclosed in Hurley (Ex. 1004) to cover more body surface area without having to reposition the subject.

118. Hurley was published on July 7, 1997. Ex. 1004. Hurley explains that its device uses six stationary sensors, each containing a camera and a light source

to shorten the acquisition time of the full body information, among other reasons. Ex. 1004 at p. 213. Hurley's use of multiple cameras positioned on either side of the subject also avoids the need to reposition the subject and/or the cameras (*i.e.* what Hurley refers to as "dynamic issues"). *Id.* These stationary sensors each capture an area segment of the surface of the body. *Id.* Hurley discloses a system including six sensors located on three towers, with two front towers and a back tower. *Id.* at 212.

119. These and other advantages of the system disclosed in Hurley were appreciated by those of skill in this art prior to the filing of the application for the '748 Patent. For example, in a 1998 article titled "Whole Body Scanners," which surveyed eight commercially available total body imaging devices including that described in Hurley, the authors noted that the use of a large number of cameras allows for substantially increased resolution of the imaged subject. See Ex. 1005 at pp. 115. As one of skill in this art at the time of the application would have appreciated, a larger number of cameras in a simultaneous acquisition system permits each camera to focus on a smaller area, increasing the number of pixels capable of capturing a particular surface feature (see discussion of the relation of focal length, distance and pixel resolution above).

120. So too, one of ordinary skill in this art would have appreciated, as was recognized in Daanen, that use of multiple cameras reduces the shading effects

encountered when attempting to scan the body surface using fewer cameras. *Id.* at 114 (“The use of multiple cameras reduces the shading effects, because of the captured surface area of the body increases.”)

121. Additionally, as Daanen also notes, the use of steady mounted cameras in Hurley provide additional advantages over systems having moveable cameras, such as Voigt, because configurations such as Hurley have no moving components which “increases the life cycle of the scanning system and also increases the safety of the scanned subjects.” *Id.* This again is an advantage of the Hurley configuration that one of ordinary skill in this art would have—and as shown by Daanen, did—appreciate prior to the time of the application.

122. It is my opinion that each of these advantages would provide a rationale for one of ordinary skill in the art to modify the Voigt device to a device containing multiple cameras that capture the entire body, as in Hurley.

123. Both Voigt and Hurley provide sufficient disclosure to enable one of skill in the art to modify the Voigt enclosure to incorporate multiple cameras, having associated light sources designed to illuminate the subject for imaging, that were positioned to image both the front and back of a subject that was located at a specified imaging position.

124. The addition of the multiple, vertically spaced imaging devices of Hurley, both in front of the subject of Voigt and behind, having known focal

lengths, coordinates and predetermined distances to a specified imaging position, would be well within both the skill of those in the art at the time of the filing of the application of the '748 Patent. As discussed above in connection with Voigt, it would also be within the skill of those persons in the art to calculate measurements of features depicting on the resulting images using those parameters.

125. Voigt refers to its enclosure as a “position framework” that is depicted in Figure 1 of Voigt. This description is not inconsistent with an understanding that, once positioned on the stand between the sliders, the surface of the subject opposite that facing the camera (*i.e.* a person’s back, if they were facing towards the camera) would be visible to a camera placed behind the subject. In any event, even if Figure 1 of Voigt is interpreted to show a solid wall behind the subject, a person of ordinary skill in the art, based upon the disclosures in Voigt and Hurley, would understand that removal of any such visual obstruction as routine. To the extent that the sliders referred to in Voigt were retained to position the subject, a person of ordinary skill in the art would understand that they could remain attached to the existing outer framework or, alternatively, to the stand.

126. Alternatively, the specified imaging position of Hurley could be substituted for the lateral sliders of Voigt. Hurley describes the designation of a specified position for the subject to stand using a calibration process undertaken before imaging. A “calibration object” is positioned where the subject is expected

to stand. Using this calibration object, the distance between each camera and the position that will be occupied by the subject is confirmed. *Id.* at 221 (“By scanning a calibration object of known size and orientation, we are able to calculate the orientation of each sensor head with respect to the object. . . . [not only to ensure] correct coverage but to make sure the subject is within the depth of focus of each of the sensor heads.”) Voigt describes a “stand” upon which the subject is to be positioned that is shown a set distance in front of its camera. For the further lateral positioning performed by the sliders in Voigt, a person of skill in the art would understand how to substitute the method employed in Hurley to locate a position on the ground at which the subject is to stand such that the subject would have these predetermined relationships with the multiple cameras. In fact, a person of skill in this art would have been motivated to employ the simpler technique of Hurley to establish a point on Voigt’s stand that would serve to place the subject in the correct position laterally to ensure adequate coverage by the cameras. The technique of Hurley in identifying a position on the floor within the enclosure where the subject is to stand avoids the need for additional structures, such as the sliders in Voigt.

127. Any additional functions identified in Voigt as being performed by its sliders are not functions required of the claims of the ‘748 Patent. Thus, the specified imaging position described in Hurley would suffice to meet the elements

of the claims. For example, Voigt's use of the "framework slider contours" to provide "fixed external match points" is relevant only to assisting in identifying the same lesion in images taken at different time periods. The claims of the '748 Patent, however, speak only of the precise measurement of features shown in a particular image, not a capability to ascertain if a lesion shown in one image is the same lesion as shown in an image taken at a later date.

128. For these reasons, and those addressed in the following discussion directed specifically to each claim, it is my opinion that the invention claimed in the following claims of the '748 Patent would have been obvious to one of ordinary skill in the art before the filing of the application for the '748 Patent based upon Voigt and Hurley, as discussed herein.

(i) Independent Claim 1

129. Claim 1 recites a device for imaging the body comprising an enclosure, a specified imaging position, multiple imaging devices in specified positions, and multiple light sources used to make precise measurement of objects that have been imaged. Such a device would have been obvious to a person of ordinary skill in the art and was disclosed in the prior art. Each claim limitation is addressed below.

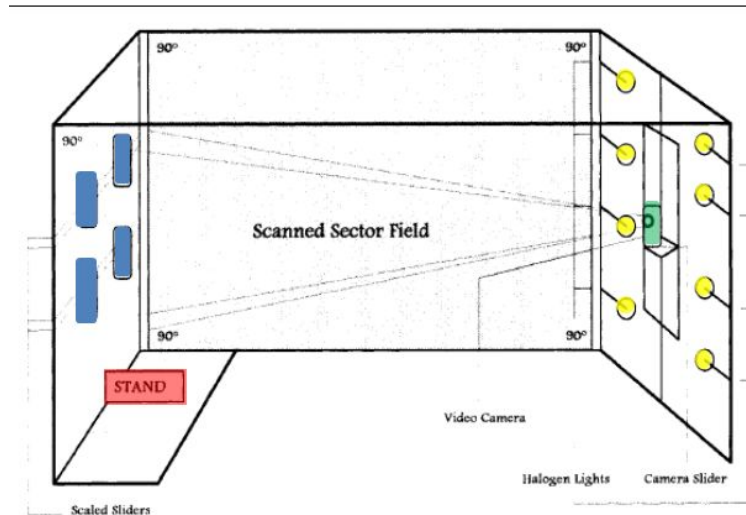
(a) PREAMBLE: A device for the identification of maladies that effect human tissue comprising:

130. To the extent this is deemed a limitation, Voigt discloses a device “to identify and evaluate changes of cutaneous lesions in melanoma screenings.” Ex. 1003 at p. 981. Use of the device allows for “digitized measurements of skin-surface image parameters” and quantitative image analysis of skin-lesion changes over time. *Id.* This constitutes a device for the identification of maladies that effect human tissue. Thus, it would have been obvious to one of ordinary skill in the art to use such a device to identify maladies that effect human tissue.

(b) An enclosure configured to receive a person or portion thereof for imaging the person or portion thereof, wherein the enclosure defines a specified imaging position for placing the person or a portion thereof within the enclosure for imaging, and the specified imaging position defines a centerline.

131. Voigt discloses a schematic of a “position framework” shown in Figure 1 of Ex. 1003. This Figure shows an enclosure in which the person being imaged is located. Using this position framework, the “patient’s standing position was fixed at the thoracic and iliac level by symmetrically fitting the lateral extent of the trunk shape into horizontally adjustable scaled sliders of the position framework.” Ex. 1003 at p. 982. The positions of the adjustable sliders were recorded and identically readjusted for future measurements of the patient to ensure that the position was in the same specified imaging position. The stand

where the person is located for imaging is highlighted in red below and the adjustable sliders are highlighted in blue. These elements define a specified imaging position. The lateral sliders are placed symmetrically about the person being imaged, defining a centerline passing through the subject from front to back.



- (c) **A plurality of imaging devices, wherein a plurality of the imaging devices are vertically spaced relative to each other, a plurality of the imaging devices are laterally spaced relative to each other, a plurality of the imaging devices are located on opposite sides of the centerline of the specified imaging position relative to each other and each imaging device is located a predetermined distance relative to the specified imaging position.**

132. Voigt discloses an imaging device located a predetermined distance relative to the specified imaging position. Ex. 1003 at p. 982. Voigt, however, does not disclose the use of multiple cameras, or cameras located on opposite sides of the subject. The camera in Voigt captures one side of a person's torso. *Id.* at 983.

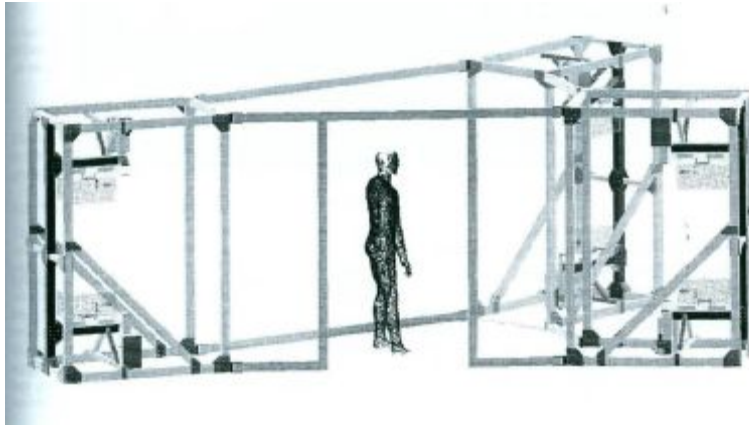
133. However, Voigt itself acknowledges the usefulness of total body photography for melanoma screenings. *Id.* at 981 (noting that total body photography is a known method for extending both the quantity and quality of skin-surface information.)

134. To increase the quantity and quality of skin-surface information, while avoiding the time and inconvenience of having to reposition the person being imaged, the camera, or both, one of ordinary skill in the art would have been motivated to make an obvious modification to Voigt to employ the multiple cameras explicitly disclosed in Hurley (Ex. 1004) to cover more body surface area without having to reposition the subject. Hurley was published on July 7, 1997. Ex. 1004.

135. There are a number of reasons a person of ordinary skill in the art would have been motivated to consider the disclosures of Hurley in connection with improvements and modifications to the system described in Voigt. The device depicted in Hurley was specifically discussed in a 1998 article titled “Whole Body Scanners,” which surveyed eight commercially available total body imaging devices including that described in Hurley. See Daanen, Hein and van de Water, Jeroen, “Whole Body Scanners,” *Displays* 19 (1998) at p. 115 (Ex. 1005). That article acknowledged that whole body scanners had applicability in the

medical field, among others, describing their use in medicine as “typical.” *Id.* at p. 111.

136. In addition, Hurley shares a number of other similarities with Voigt that would have prompted a person of ordinary skill in the art to look to Hurley for improvement upon Voigt. For example, like Voigt, Hurley discloses an enclosure (shown in Fig. 2.1 of Ex. 1004 below) to receive a person being imaged. Ex. 1004 at p. 213. In a manner similar to the “framework” shown in Voigt, the Hurley enclosure is designed “with an ‘erector set’ approach” built with a black anodized aluminum extrusion.” *Id.* at p. 213. The extrusion is covered with black theater cloth for light tightness and to reduce spurious reflections inside the enclosure. *Id.* This enclosure is defined by “three towers; each tower consisting of an upper and lower sensor” with two towers located in front of the person’s body and one tower located behind the person being captured. Ex. 1004 at p. 212. The location of the person being imaged defines a centerline of the device along at least two planes, one along the frontal plane of the person’s body dividing the person from side to side and one along the sagittal plane dividing the person from front to back.



137. Hurley also discloses that the location of the person being imaged is specified. Specifically, Hurley describes that the device is calibrated by placing a calibration object “approximately where the subject will be standing.” Ex. 1004 at p. 221.

138. In addition, the applicant for the ‘748 Patent himself acknowledged the relevance to his invention of systems, such as Hurley ostensibly directed to total body imaging for purposes of precisely measuring a person and their features for purposes of custom fitting clothing:

Below are some examples, but not limited to, in regards to the invention’s scope and intended applications of TIP [Total Immersion Photography]: . . .

Body Morphology Analysis—Shape Evaluation

. . . This invention allows for total body evaluation on several dimensions. Measurements and comparisons of body contours, fat deposit analysis, asymmetry, etc. with volume measurements will be valuable for the cosmetic surgeon, the physician, the physical trainer, **the clothier,** **etc.**

‘748 Patent, 5:61-61, 6:54-66 (emphasis added.)

139. A person of skill in the art would have been motivated to combine elements of Hurley with the system described in Voigt because of the obvious advantages of doing so. The authors of the 1998 article noted that because systems like Hurley used multiple stationary cameras (*e.g.* “in order to cover the entire body, multiple scan heads [containing at least one light and camera] have to be used”), they allowed for substantially increased resolution of the imaged subject—a capability of particular importance to those seeking to identify and measure skin defects, such as melanoma.

140. As one of skill in this art at the time of the application would have appreciated, a larger number of cameras in a simultaneous acquisition system permits each camera to focus on a smaller area, increasing the number of pixels capable of capturing a particular surface feature (see discussion of the relation of focal length, distance and pixel resolution above).

141. So too, one of ordinary skill in this art would have appreciated, as was recognized in Daanen, that use of multiple camera reduces the shading effects encountered when attempting to scan the body surface using fewer cameras. *Id.* at 114 (“The use of multiple cameras reduces the shading effects, because of the captured surface area of the body increases.”)

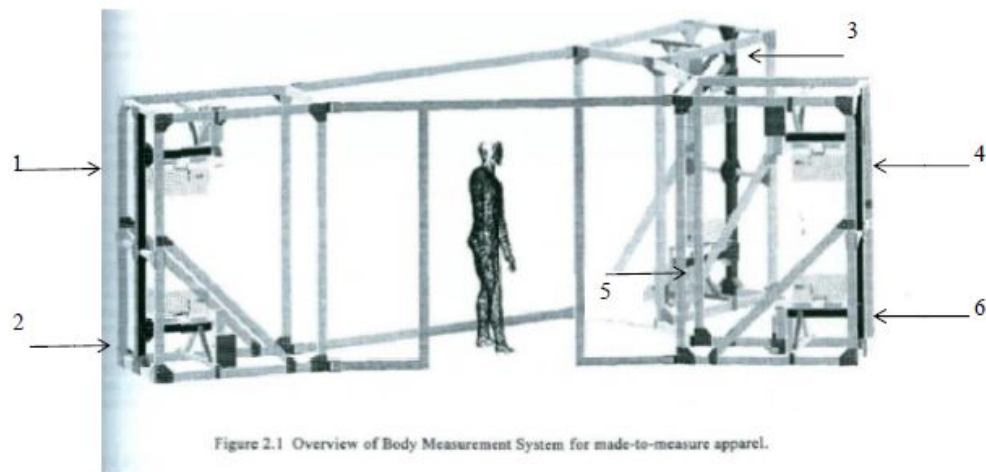
142. In addition, a person of ordinary skill in this art would have appreciated prior to the filing of the application for the ‘748 Patent that the time

involved in obtaining full body information would be greatly reduced through use of Hurley's multiple imaging device. Hurley explains that its device used six stationary sensors, each containing a camera and a light source to shorten the acquisition time of the full body information, among other reasons. Ex. 1004 at p. 213. Hurley's use of multiple cameras positioned on either side of the subject also avoids the need to reposition the subject and/or the cameras (*i.e.* what Hurley refers to as "dynamic issues"). *Id.*

143. Additionally, as Daanen also notes, the use of steady mounted cameras in Hurley provide additional advantages over systems having moveable cameras, such as Voigt, because configurations such as Hurley have no moving components which "increases the life cycle of the scanning system and also increases the safety of the scanned subjects." *Id.* This again is an advantage of the Hurley configuration that one of ordinary skill in this art would have—and as shown by Daanen, did—appreciate prior to the time of the application. It is my opinion that each of these advantages would provide a rationale for one of ordinary skill in the art to modify the Voigt to a device containing multiple cameras that capture the entire body, as in Hurley.

144. Hurley discloses a device using six imaging devices, including at least a plurality that are spaced vertically, laterally, or opposite the centerline of the specified imaging position from one another. Specifically, Hurley describes six

sensor heads, with an upper and lower sensor heads located on each tower. Ex. 1004 at p. 212. These sensor heads are numbers one through six in the annotated reproduction of Figure 2.1 of Ex. 1004 below. Ex. 1004 at p. 212-213.



145. Each sensor head consists of “a structured light projector and an area sensing CCD camera” which form “a vertical triangulation with the object or body.” Ex. 1004 at p. 213. Cameras 1 and 2 constitute a plurality of imaging devices that are vertically spaced relative to each other. Cameras 3 and 4 constitute a plurality of imaging devices that are laterally spaced relative to each other. Cameras 2 and 6 constitute a plurality of imaging devices that are located on opposite sides of the centerline of the specified imaging position (defining the centerline as the frontal plane of the body dividing the person from side to side). Hurley also discloses a plurality of imaging devices, cameras 3 and 4, located on

opposite sides of the centerline of the specified imaging position (defining the centerline as the sagittal plane of the body dividing the person from front to back).

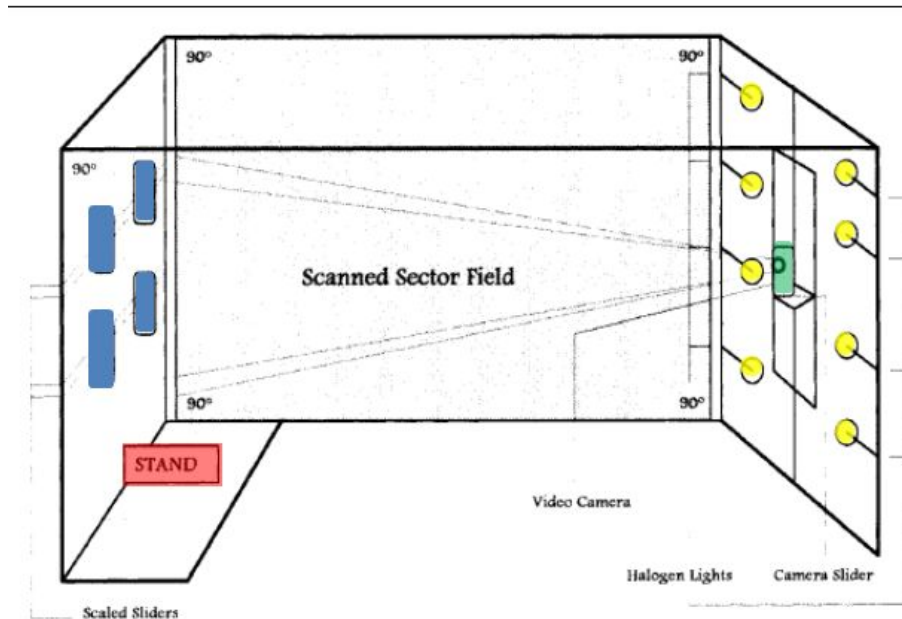
146. Even if Hurley did not disclose the specific locations of the imaging devices claimed in the ‘748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate imaging devices in any position that would allow capture of the surface area of the body sought to be imaged. One of skill in this art would have been motivated to arrange cameras vertically because that would permit the capture of the entire height of the subject, without sacrificing resolution, while further permitting accurate imaging of curved surfaces of both the upper and lower body without occlusion. A vertical arrangement of additional cameras makes efficient use of available space within the enclosure. *Id.* Also, use of fixed upper and lower cameras would have simplified Voigt’s design by eliminating any need for a vertically adjustable camera. Locating cameras lateral to another would have been obvious to a person of ordinary skill in the art in order to capture greater detail of curved surfaces of the body—an advantage which Hurley acknowledges had motivated its design. Hurley discloses that greater detail may be acquired using sensor devices spaced laterally at an angle to the subject. Ex. 1004, pp. 212-213 (“With this [60 degree] separation angle, there is overlap between the viewing areas of the [front] towers where detail is needed[.]”);

147. As discussed above, one of ordinary skill in the art would have had a reason to combine Voigt and Daanen to capture the entire body without repositioning the person to be imaged. Thus, it would have been obvious to one of skill in the art to use a plurality of imaging devices located in positions around a person to be imaged, including those specific positions claimed in claim 1 of the ‘748 patent.

(d) A plurality of light sources spaced relative to each other and peripheral to the plurality of imaging devices that illuminate the person or portion thereof located at the specified imaging position and generate refraction and reflectance light therefrom.

148. Voigt discloses the use of a plurality of halogen light sources spaced relative to each other and peripheral to an imaging device that illuminate the person or portion thereof located at the specified imaging positions. This plurality of light sources is identified in yellow below in the annotated representation of Figure 1 of Ex. 1003. Ex. 1003 at p. 982. These light sources illuminate the person located at the specified imaging position as disclosed in Voigt’s explanation that “total object illumination was given special attention to prevent any artificial shadowing.” Ex. 1003 at p. 983. One of ordinary skill in the art would recognize that the halogen lights used in Voigt generate refraction and reflectance light from the person or portion thereof located at the specified imaging position. “Reflectance” light refers to light that reflects off a surface. “Refraction” occurs

when light strikes a substance, such as human skin, penetrates and is then reflected with a changed direction. Halogen light or white light striking skin naturally results in both reflectance and refraction. These lights were located peripherally to the single camera and were spaced relative to each other.



149. Similarly, Hurley discloses the use of a plurality of light sources spaced relative to each other and peripheral to the plurality of imaging devices that illuminate the person or portion thereof located at the specified imaging position and that generate refraction and reflectance light therefrom. Specifically, Hurley discloses that each of the six sensor heads consists of “a structured light projector and an area sensing CCD camera.” Ex. 1004 at pp. 212-213. One of ordinary skill in the art that has chosen to incorporate the Hurley multi-camera format into the Hurley imaging device would understand that each of the additional cameras would also require lighting. Thus, it would be obvious to one of ordinary skill in

the art to include light sources similar to those disclosed for use in connection with the single Voigt camera with each additional camera added.

150. A person of ordinary skill in the art would understand that, when using a plurality of cameras, light sources would need to be located peripheral to each of the cameras to avoid the artificial shadowing that Voigt sought to prevent.

151. Even if Hurley and Voigt did not disclose the specific locations of the light sources claimed in the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate light sources in any position that would prevent artificial shadowing when imaging a person or portion thereof.

152. Thus, it would have been obvious to one of ordinary skill in the art to locate multiple light sources around the enclosure, including light sources spaced relative to one another and peripheral to the imaging device or devices as claimed in claim 1 of the '748 patent.

- (e) **Wherein each of said imaging devices generated an image of the illuminated person or portion thereof located at the specified imaging position, and defines respective coordinates and said respective predetermined distance relative to the specified imaging position, and defines a respective focal length and resolution information, allowing precise measurement of imaged features of the person or portion thereof located at the specified imaging position.**

153. Voigt discloses that its device and methodology are used to “capture and process detailed surface information for instant metric determinations of shape

changes in multiple skin lesions in defined time periods.” Ex. 1003 at p. 987. The Voigt camera captured images of the front and back trunk areas. *Id.* at 983. This was accomplished by using a “specifically defined position framework for the patient’s positioning” and recording the locations of the camera and the position framework, thus defining the coordinates of the camera and the predetermined distance from the camera to the specified imaging position. *Id.* at 983; 987. Then, using the resolution of the camera and its focal length, the spatial image resolution was calculated to be 1 mm per pixel. *Id.* at 983. Based upon this information, the area and dimension of the skin lesions were measured. *Id.*

154. Even if Voigt did not disclose the specific methodology for precise measurement claimed in claim 1 of the ‘748 patent, it would have been obvious to one of ordinary skill in the art that Voigt employed those parameters to measure objects shown in the captured image. The calculations reflected in Voigt constitute an example of photogrammetry, the science and engineering of making measurements using images. Photogrammetry has long used the well-known relationship between distance of the camera from the subject, and the focal length and resolution of the camera, to measure features depicted in the image. There are a number of forms of photogrammetry. The most familiar is what is sometimes referred to as Topographic Photogrammetry, which involves the measurement of topographic structures (*i.e.* areas on the surface of the earth) from the air or space.

See generally Manual of Photogrammetry (4th Ed. 1980), published by the American Society of Photogrammetry. The same principles apply to what is called “Close-Range Photogrammetry. *See id.* at 801 (“With little or no modifications, many of the computational methods which were developed over the years for aerial mapping and areotriangulation can be applied in close-range photogrammetric projects.”) It is well known that in photogrammetry the scale of the image relative to the object images is determined by the ratios of the focal length of the camera to the distance to the object imaged. *See* Comer, R.P. *et al.*, Talking Digital, *Photogrammetric Engineering & Remote Sensing*, 1139 (December 1998) (“The lens of an airborne digital camera forms an image of the ground on its focal plane at a certain scale. That *camera scale* is the ratio of focal length of the lens and the collection height above ground level (AGL), $\text{camera scale} = (\text{focal length})/(\text{height AGL})$. Where the image on the focal plane is captured using a charged couple device (CCD) array—such as was disclosed in the Voigt reference—then the scale is calculated with the addition of the image array size (*i.e.* resolution) by means of the following formula: $\text{scale} = (\text{array element size}) (\text{height AGL})/(\text{focal length})$. As Comer explains, “In general, GSD (Ground Sample Distance) [*i.e.* scale] is simply the linear dimension of a single pixel’s footprint on the ground.” *Id.*

155. Thus, it would have been obvious to one of ordinary skill in the art to use the coordinates of the cameras, the distance between the cameras and the

specified imaging position, the resolution, and the focal length to measure as precisely as the patented invention features found in the captured images.

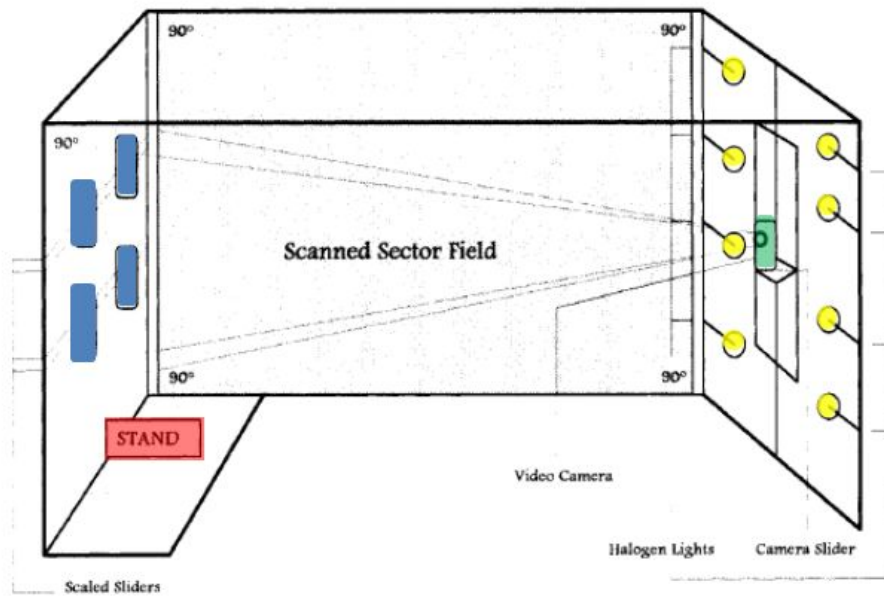
156. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 1 would have been obvious to a person of ordinary skill as of July 26, 2000.

(ii) Dependent Claim 2

(a) A device according to claim 1 wherein the plurality of light sources is located amongst the plurality of imaging devices.

157. As discussed above, it would have been obvious to one of ordinary skill in the art to combine Hurley's multiple imaging arrays with the enclosure described in Voigt. Both Voigt and Hurley couple their imaging devices with lights sources positioned so as to illuminate the area of the subject imaged by the imaging device.

158. Voigt discloses the use of a plurality of halogen light sources spaced relative to each other and peripheral to its imaging device that illuminate the person or portion thereof located at the specified imaging positions. This plurality of light sources is identified in yellow below in the annotated representation of Figure 1 of Ex. 1003. Ex. 1003 at p. 982. The camera in Voigt is shown in green.



159. Voigt explains that “total object illumination was given special attention to prevent any artificial shadowing.” Ex. 1003 at p. 983. The replication of this illumination scheme with respect to each of the additional imaging devices whose combination is suggested by Hurley, would ensure that a plurality of light sources was located amongst the plurality of imaging devices.

160. Similarly, Hurley discloses the importance of locating light sources amongst the plurality of imaging devices. Specifically, Hurley discloses that, within the enclosure, there are six sensor heads that consist of “a structured light projector and an area sensing CCD camera.” Ex. 1004 at pp. 213. The sensor heads are distributed about the enclosure at six different locations. Thus, because the cameras and light projectors are located on each respective sensor head, Hurley discloses a plurality of light sources located amongst the plurality of imaging devices.

161. Even if neither Voigt nor Hurley discloses the specific locations of the light sources claimed in claim 2 of the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate light sources in any location that would illuminate the person to be imaged to maximize uniform illumination and to avoid shadowing as noted in Voigt. Ex. 1003 at p. 983 ("Total in-depth object illumination was given special attention to prevent any artificial shadowing...").

162. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 2 would have been obvious to a person of ordinary skill as of July 26, 2000.

(iii) Dependent Claim 3

(a) A device according to claim 2 wherein at least two light sources are located lateral to at least two imaging devices.

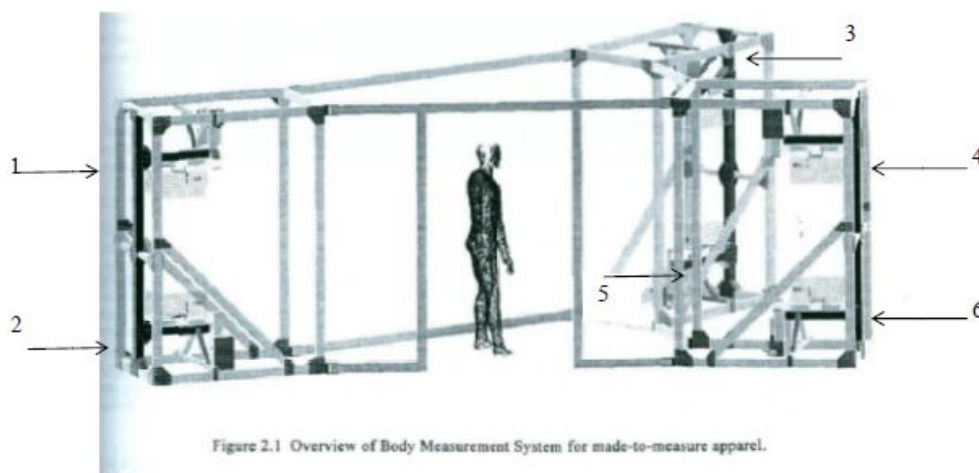
163. Claim 3 incorporates the limitations of claims 1 and 2.

164. Both Voigt and Hurley disclose at least two light sources that are located lateral to at least two imaging devices. As defined above, lateral means located at or issuing from the side.

165. As noted above in connection with the elements of Claim 2, it would have been obvious to one of ordinary skill in the art, in combining Hurley's multiple image devices with the enclosure in Voigt, to replicate Voigt's

illumination scheme with respect to those additional imaging devices. As a result, at least two light sources would be located lateral to at least two imaging devices.

166. For its part, Hurley discloses a device wherein at least two light sources are located lateral to at least two imaging devices. Specifically, Hurley describes six sensor heads located at the upper and lower portions of each tower that consist of “a structured light projector and an area sensing CCD camera.” Ex. 1004 at p. 212-213. As shown in the annotated reproduction of Figure 2.1 of Ex. 1004 below, at least the light source located on sensor head 3 is lateral to the camera located on sensor head 4 and the light source located on sensor head 5 is lateral to the camera located on sensor head six 6. Ex. 1004 at p. 212-213.



167. Even if Hurley did not disclose the specific locations of the light sources claimed in claim 3 of the ‘748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate light sources in any

location that would illuminate the person to be imaged to avoid shadowing as noted in Voigt. Ex. 1003 at p. 983 (“Total in-depth object illumination was given special attention to prevent any artificial shadowing...”).

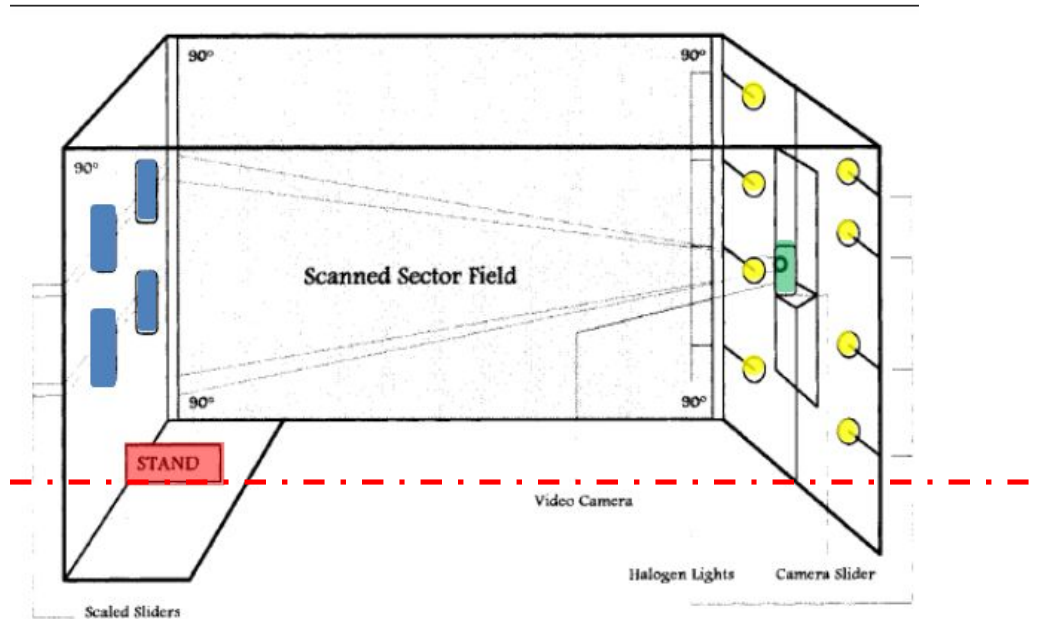
168. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 3 would have been obvious to a person of ordinary skill as of July 26, 2000.

(iv) Dependent Claim 4

169. Claim 4 incorporates the limitations of claims 1, 2, and 3. Claim 4 is directed to the specific locations of the light sources. Voigt in combination with Hurley discloses each of these claimed limitations and one of ordinary skill would have understood the locations of the light sources to constitute an obvious design choice.

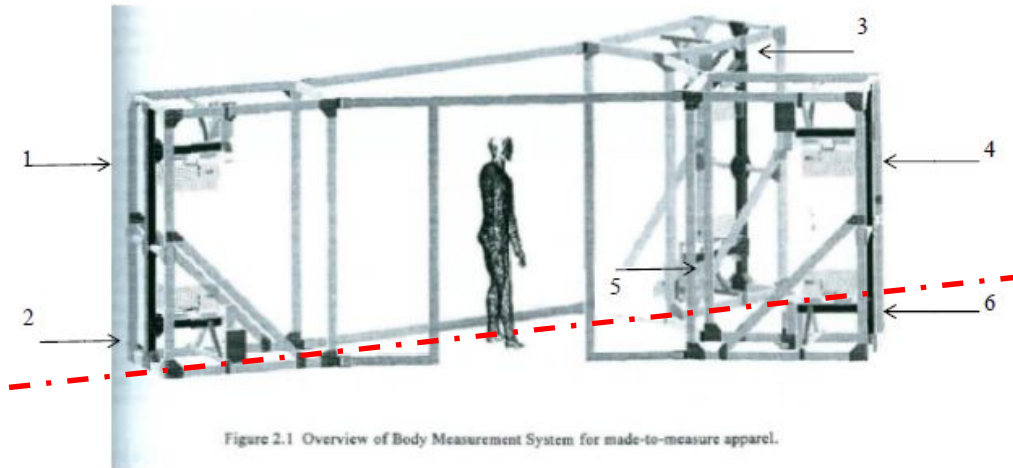
(a) A device according to claim 3 wherein at least two light sources are positioned symmetrically relative to the center line of the specified imaging position.

170. Voigt discloses at least two light sources (in yellow) that are positioned symmetrically relative to the center line of the specified imaging position, where the center line (red dashed line) passes from the stand on which the specified imaging position is located to the front wall where the camera is located:



171. As discussed above, the obvious combination of the multiple cameras of Hurley with the enclosure of Voigt, while maintaining Voigt's illumination scheme, would also result in at least two light sources positioned symmetrically relative to the center line.

172. Similarly, adopting the arrangement of light sources disclosed in Hurley would also result in an obvious combination in which at least two light sources were positioned symmetrically relative to the center line. As shown in the annotated reproduction of Figure 2.1 of Ex. 1004 below, at least the light source located on sensor heads 3 and 4 are positioned symmetrically relative to the center line of the specified imaging position. Ex. 1004 at pp. 212-213.



173. Even if Hurley did not disclose the specific locations of the light sources claimed in claim 4 of the '748 patent, it would have been an obvious design choice, for purposes of maintaining the consistency of the multiple images of the subjects body, for one of ordinary skill in the art to locate light sources intended to illuminate symmetric portions of the subject, such as front right oblique angle and front left oblique angle, in corresponding locations on either side of the centerline. As noted in Voigt. Ex. 1003 at p. 983 ("Total in-depth object illumination was given special attention to prevent any artificial shadowing...").

174. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 4 would have been obvious to a person of ordinary skill as of July 26, 2000.

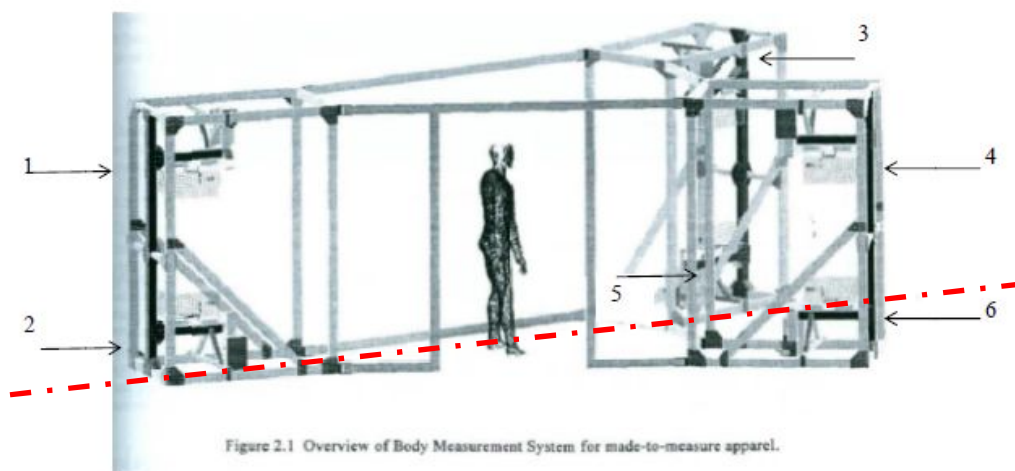
(v) Dependent claim 5

175. Claim 5 incorporates the limitations of claim 1 and identifies additional limitations regarding the locations of the imaging devices. Hurley

discloses each of these claimed limitations and one of ordinary skill in the art would have understood them to constitute an obvious design choice to use in the Voigt system to allow for imaging of a larger region. Each of the additional claim limitations of claim 5 are addressed below.

- (a) **A device according to claim 1 wherein the plurality of imaging devices includes: a first imaging array spaced a predetermined distance relative to the specified imaging position to a side of the enclosure, wherein the first imaging array includes a plurality of first imaging devices vertically spaced relative to each other;**

176. Hurley discloses six sensor heads, with an upper and lower sensor heads located on each tower. Ex. 1004 at p. 212. These sensor heads are numbers one through six in the annotated reproduction of Figure 2.1 of Ex. 1004 below. Ex. 1004 at p. 212-213. Each sensor head contains a CCD camera. *Id.*



177. The sensor heads identified by numbers 3 and 5, each containing a CCD camera, constitute a first imaging array spaced a predetermined distance relative to the specified imaging position to a side of the enclosure, wherein the first imaging array includes a plurality of first imaging devices vertically spaced relative to each other.

(b) A second imaging array spaced a predetermined distance relative to the specified imaging position, and laterally spaced adjacent to the first imaging array, wherein the second imaging array includes a plurality of second imaging devices vertically spaced relative to each other.

178. The sensor heads identified by numbers 4 and 6 portrayed above, each containing a CCD camera, constitute a second imaging array spaced a predetermined distance relative to the specified imaging position, and laterally spaced adjacent to the first imaging array, wherein the second imaging array includes a plurality of second imaging devices vertically spaced relative to each other.

179. Hurley discloses that the use of an upper and lower stationary sensor in each tower allows one to scan the majority of the population using a short acquisition time that avoids dynamic issues presented by moving sensors around a body or moving a body in front of a sensor. Ex. 1004 at p. 212-213. Hurley further discloses that its selected camera locations allow for the capture of detail in regions

of the body that have surfaces that are not smooth (such as the front of the body). *Id.* at 213. Thus, it would be obvious to one of ordinary skill in the art to adopt the camera positioning proposed by Hurley in the Voigt device to obtain these advantages.

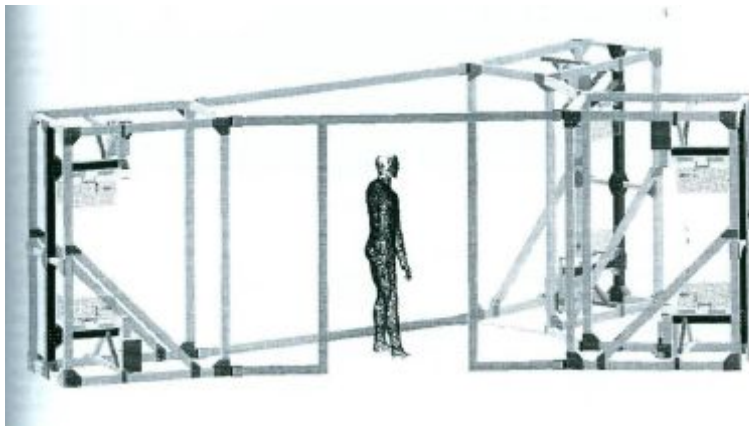
180. Even if Hurley did not disclose the specific locations of the imaging devices claimed in claim 5 of the '748 patent, it would have been an obvious design choice to use additional cameras in the Voigt system in any location that would allow for imaging of a larger region than the single camera system disclosed in Voigt.

(vi) In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 5 would have been obvious to a person of ordinary skill as of July 26, 2000. Dependent Claim 8

181. A device according to claim 1 wherein said enclosure is further comprised of panels that enclose said person or portion thereof in a radius selected from at least one of: 360 degrees on the vertical axis and 360 degrees on the horizontal axis.

182. Voigt discloses “positioning framework” that consisted of a four sided enclosure comprised of four square or rectangular frames joined at 90 degrees which enclose the person, having a 360 degree radius about a vertical axis.

183. Similarly, Hurley Ex. 1004 discloses an enclosure shown in Fig. 2.1 of Ex. 1004 below to receive a person being imaged. Ex. 1004 at p. 213. The enclosure is designed “with an ‘erector set’ approach” built with a black anodized aluminum extrusion that is covered with black theater cloth for light tightness and to reduce spurious reflection inside the system. *Id.* at p. 213. This enclosure is defined by “three towers; each tower consisting of an upper and lower sensor” with two towers located in front of the person’s body and one tower located behind the person being captured. Ex. 1004 at p. 212.



184. The fabric covered panels thus formed in Hurley enclosed a person on all sides (*i.e.* about 360 degrees from a vertical axis).

185. Even if neither Voigt nor Hurley is seen to disclose that the enclosure encompasses a person in a radius of 360 degrees on the vertical axis, it would have been an obvious design choice for one of ordinary skill in the art to do so. As Hurley notes, the creation of fabric panels that fully enclosed a person on all sides

would have provided the advantage of reducing spurious reflection within the enclosure.

186. An interpretation that a radius from a 360 degree vertical axis requires a static radius (*i.e.* meaning that the person is equidistant from each panel) would not be consistent with the broadest reasonable construction, given that during prosecution the applicant elected to pursue claims directed to Figure 1 of the patent, but not Figure 2. Even so, it would have been obvious to a person of ordinary skill to modify a multi-camera version of Voigt or Hurley to place panels having the imaging elements in such an arrangement in order to simplify the calculations for measuring features appearing in each image. Such an arrangement would ensure that the camera distances were consistent, allowing for similar focal lengths, and image scales.

187. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 8 would have been obvious to a person of ordinary skill as of July 26, 2000.

(vii) Dependent claim 11

188. Claim 11 incorporates the limitations of claims 1 and 8 and identifies additional limitations regarding the panels of the enclosure. Hurley discloses each of these claimed limitations and one of ordinary skill in the art would have understood them to constitute an obvious design choice to use in the Voigt system.

Each of these additional claim limitations of claim 11 are addressed individually below.

(a) A device according to claim 8 wherein said panels are further comprised of at least one imaging means.

189. As noted above, Voigt has a panel that includes at least one imaging means (shown in green).

190. Hurley discloses an enclosure according to claim 11 wherein the panels are further comprised of at least one imaging means. For example, in each of the panels described above that encompass one of the towers include two imaging means or cameras.

191. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 11 would have been obvious to a person of ordinary skill as of July 26, 2000.

(viii) Dependent Claim 30

192. Dependent claim 30 depends from claim 1.

(a) A device according to claim 1 further comprising a display device for displaying one or more images generated by the plurality of imaging devices.

193. Voigt discloses the use of a personal computer monitor to display the images generated by its single imaging device. Ex. 1003 at p. 982; Fig. 3.

194. Similarly, Hurley discloses individual views of the body generated by each of the six sensor heads in Figure 5.1 of Ex. 1004 reproduced below. Ex. 1004 at p. 221. Hurley also discloses that its system is controlled by a Pentium 133 personal computer. Ex. 1004 at p. 214. Hurley refers to the use of graphic *display* tools (*id.*) created using the OpenGL graphics library, and describes software that., among other things, performs the function of “displaying graphical output.” *Id.* One of ordinary skill in the art would understand that this personal computer would comprise a display device for displaying the images such as those shown in Fig. 5.1

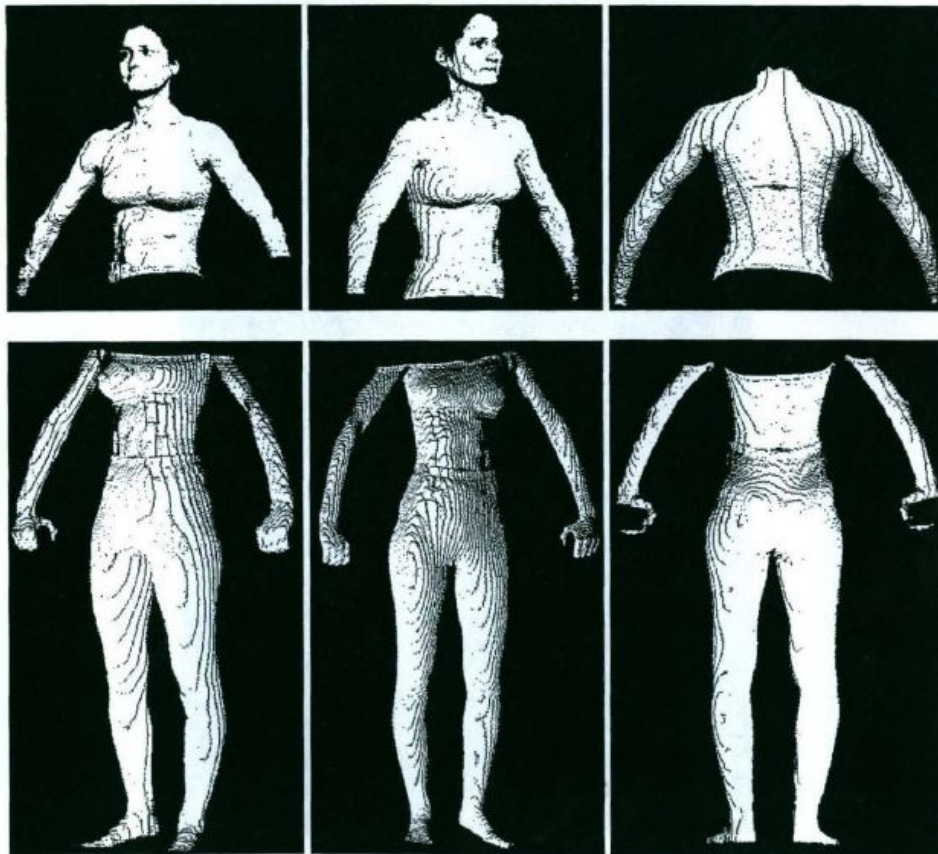


Figure 5.1 Six Individual Views of 3D Data Points

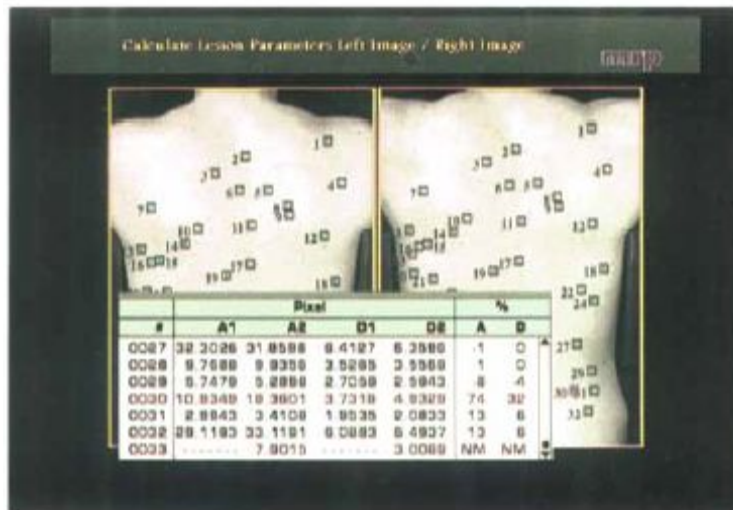
195. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 30 would have been obvious to a person of ordinary skill as of July 26, 2000.

(ix) Dependent claim 33

196. Claim 33 depends from claims 30, which depends from claim 1. Claim 33 is directed to a display device capable of displaying said person or portion thereof in a visually perceivable form. This limitation is disclosed in both Voigt and Hurley. For that reason, claim 33 would have been obvious to one of ordinary skill in the art as of July 2000. Each limitation of claim 33 is address individually below.

(a) A device according to claim 30 wherein said display device further comprises a device capable of displaying said person or portion thereof in visually perceivable form.

197. Voigt discloses the use of a computer monitor to display the imaged trunk of the body. Ex. 1003 at Fig. 3 (showing monitor display). Figure 3 is reproduced below.



198. Similarly, Hurley discloses individual views of the body generated by each of the six sensor heads in Figure 5.1 of Ex. 1004 reproduced below. Ex. 1004 at p. 221. Hurley also discloses that its system is controlled by a Pentium 133 personal computer. Ex. 1004 at p. 214. Hurley refers to the use of graphic *display* tools (*id.*) created using the OpenGL graphics library, and describes software that, among other things, performs the function of “displaying graphical output.” *Id.* One of ordinary skill in the art would understand that this personal computer would comprise a display capable of displaying the person that was located in the specified imaging position in visually perceivable form.

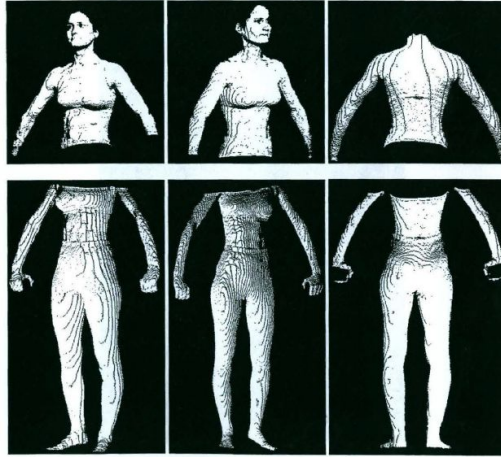


Figure 5.1 Six Individual Views of 3D Data Points

199. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 33 would have been obvious to a person of ordinary skill as of July 26, 2000.

(x) Dependent claim 34

200. Claim 34 depends from claim 1 and includes the additional limitation that the device allows for viewing of said person or portion thereof in 360 degrees. Hurley discloses this limitation and one of ordinary skill in the art would have understood that it was obvious when imaging the whole human body to view the person or portion thereof that is being imaged in 360 degrees.

201. Hurley discloses individual views of the body generated by each of the six sensor heads in Figure 5.1 of Ex. 1004 reproduced below. Ex. 1004 at p. 221. As shown in Figure 5.1, the Hurley device allows for multiple views of the entire body resulting in viewing the person in 360 degrees.

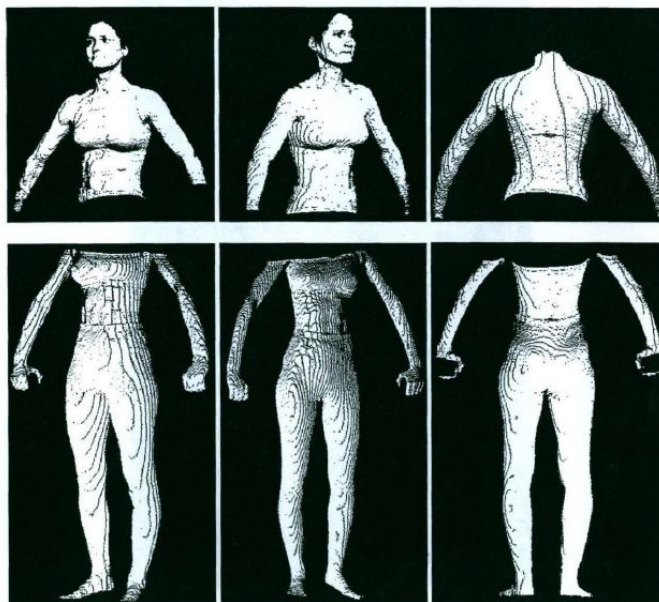


Figure 5.1 Six Individual Views of 3D Data Points

202. As discussed above, one of ordinary skill in the art would have had a reason to combine Voigt and Hurley to capture the entire body in 360 degrees without repositioning the person to be imaged for the purpose of viewing and measuring the features imaged. Thus, it would have been obvious to one of skill in the art to provide the capability to view the person or person imaged in 360 degrees.

203. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 34 would have been obvious to a person of ordinary skill as of July 26, 2000.

(xi) Dependent Claim 46

204. Dependent claim 46 depends from claim 1 but further comprises “a viewing device that includes at least one of a USB hub, an interfacing cable, a computer processor or like processor, a monitor, and a control device.”

205. Both Voigt and Hurley disclose each of these limitations either inherently or explicitly.

206. Voigt discloses that its device performs digitized measurements using a plug-in set of a high-speed processor with an on-board coprocessor, and a high-resolution video camera source, a specifically designed image processing software, and position framework. Ex. 1003 at p. 982. The image processing software was installed on a personal computer. *Id.* Resulting images were viewed in a monitor display. *Id.* at Fig. 3, p. 983. When viewing, the user can select the setting for the binary threshold focus – which determines which lesions will be measured, and can select the elements to be displayed. *Id.* at p. 983-984; Figs. 2-3. Thus, Voigt discloses the use of a camera that is connected in some way to a computer containing a computer processor, a monitor, and some method for a user to control the device. While Voigt does not explicitly disclose the types of connectors used between the elements of its system, by July 2000, one of ordinary skill would understand that standard technology such as interfacing cables and USB ports or

hubs, were obvious substitutions available to be used in a system such as the one described in Voigt.

207. Similarly, Hurley discloses that its system contains sensor heads including “a custom designed projector, a commercial CCD camera, and the necessary controls for both.” Ex. 1004 at p. 214. “The whole system is controlled by a Pentium 133 personal computer.” *Id.* . Hurley refers to the use of graphic *display* tools (*id.*) created using the OpenGL graphics library, and describes software that., among other things, performs the function of “displaying graphical output.” *Id.* Hurley discloses that the data set collected can be viewed as shown in Fig. 5.1. One of ordinary skill in the art would understand that Hurley discloses the use of a monitor. *Id.* at p. 221. Hurley discloses that “[a]dditional hardware and wiring necessary to interface the computer to the six sensor heads is contained in an enclosure attached to the sensor head.” *Id.* One of ordinary skill in the art would understand that the hardware and wiring necessary to interface the computer to the six sensors could encompass interfacing cables and USB ports or Hubs. Thus, Hurley discloses each limitation of claim 46.

208. Even if Voigt and Hurley did not inherently disclose that the hardware used to connect elements within the system to the computer included an interfacing cable and a USB hub as claimed in claim 46 of the ‘748 patent, it would have been an obvious design choice for one of ordinary skill in the art to use a USB hub and

interfacing cable to connect elements of the system. A person of ordinary skill in this art would understand the hardware and wiring necessary to interface the computer to the six sensors would encompass interfacing cables and USB ports or Hubs. A person of ordinary skill would have been familiar with the growing use and acceptance of USB ports and hubs, as reflected in the Office World article from 1998. Ex. 1014, Office World, (“With USB, a person could hook up as many as 127 devices to the computer through a series of USB hubs.”).

209. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 46 would have been obvious to a person of ordinary skill as of July 26, 2000.

(xii) Independent Claim 51

210. Claim 51 recites a device for imaging the body comprising the same limitations as claim 1 recited in means plus function form. For the same reasons that claim 1 would have been obvious to a person of ordinary skill in the art, the device of claim 51 would have been obvious to a person of ordinary skill in the art and was disclosed in the prior art. Each claim limitation is addressed below.

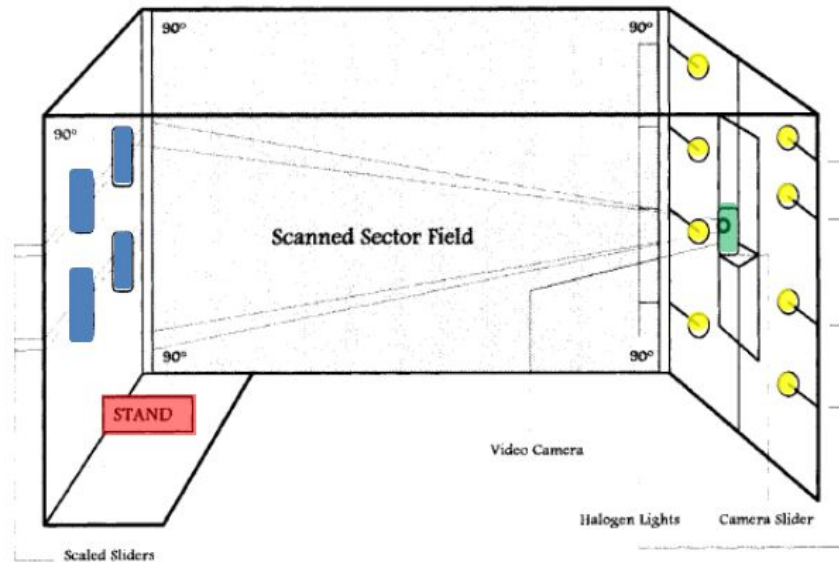
(a) PREAMBLE: A device for the identification of maladies that effect human tissue comprising:

211. To the extent this is deemed a limitation, Voigt discloses a device “to identify and evaluate changes of cutaneous lesions in melanoma screenings.” Ex. 1003 at p. 981. Use of the device allows for “digitized measurements of skin-

surface image parameters” and quantitative image analysis of skin-lesion changes over time. *Id.* This constitutes a device for the identification of maladies that effect human tissue. Thus, it would have been obvious to one of ordinary skill in the art to use such a device to identify maladies that effect human tissue.

(b) First means for receiving and enclosing a person or portion thereof to image the person or portion thereof,

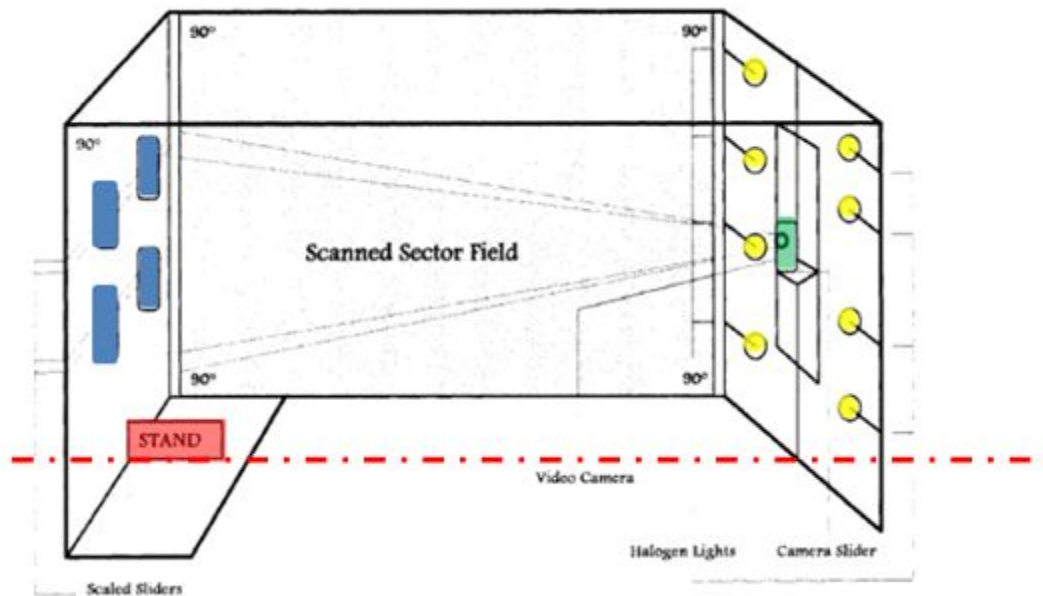
212. As I have defined above, the “first means for receiving and enclosing a person” is “a structure that fully surrounds (*i.e.* encloses) a person made of plywood, particle board, or any other structural material capable of supporting the structure and equivalents thereof known at the time of the filing of the application.” Voigt discloses a schematic of a “position framework” shown in Figure 1 of Ex. 1003. Although Voigt does not disclose the material used to construct the position framework, it is formed of a structural material capable of supporting the structure of the system. Further, the position framework fully surrounds the person to be imaged. Accordingly, Voigt discloses the first means limitation.



(c) Second means located within the first means for placing the person or portion thereof within the first means, wherein the second means defines a centerline

213. As defined above, the second means is a “shield positioned in such proximity to the person being imaged that the person is physically confined to the specified imaging position, or equivalent structures known at the time of the filing of the application that would similarly physically confine the person.”. While Voigt does not disclose shields, it discloses that, using its position framework, the “patient’s standing position was fixed at the thoracic and iliac level by symmetrically fitting the lateral extent of the trunk shape into horizontally adjustable scaled sliders of the position framework.” Ex. 1003 at p. 982. The positions of the adjustable sliders were recorded and identically readjusted for future measurements of the patient to ensure that the position was in the same specified imaging position. The stand where the person is located for imaging is

highlighted in red below and the adjustable sliders are highlighted in blue. Here, both the stand and the sliders constitute portions of the first means that physically confine the person. The lateral sliders are placed symmetrically about the person being imaged, defining a centerline passing through the subject from front to back. Thus, one of ordinary skill in the art would understand that Voigt discloses an equivalent of the second means.



- (d) **A plurality of imaging means, wherein a plurality of the imaging means are vertically spaced relative to each other, a plurality of the imaging means are laterally spaced relative to each other, a plurality of the imaging means are located on opposite sides of the centerline of the specified imaging position relative to each other and each imaging means is located a predetermined distance relative to the specified imaging position.**

214. One of ordinary skill in the art would understand the imaging means of claim 51 to constitute the imaging devices of claim 1. Voigt discloses an imaging device located a predetermined distance relative to the specified imaging position. Ex. 1003 at p. 982. Voigt, however, does not disclose the use of multiple cameras, or cameras located on opposite sides of the subject. The camera in Voigt captures one side of a person's torso. *Id.* at 983.

215. However, Voigt itself acknowledges the usefulness of total body photography for melanoma screenings. *Id.* at 981 (noting that total body photography is a known method for extending both the quantity and quality of skin-surface information.)

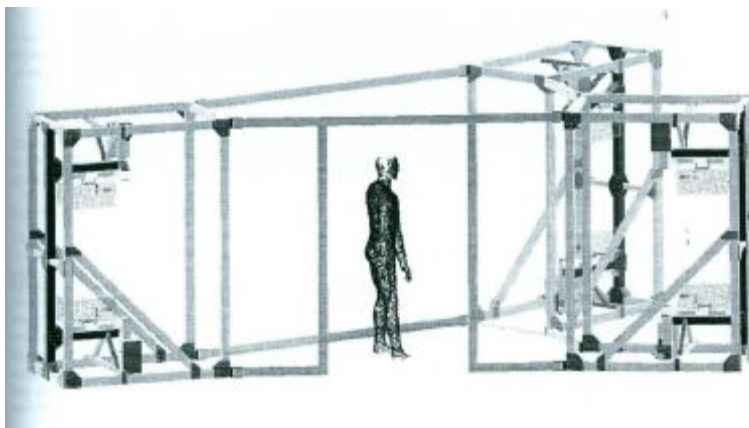
216. To increase the quantity and quality of skin-surface information, while avoiding the time and inconvenience of having to reposition the person being imaged, the camera, or both, one of ordinary skill in the art would have been motivated to make an obvious modification to Voigt to employ the multiple cameras explicitly disclosed in Hurley (Ex. 1004) to cover more body surface area

without having to reposition the subject. Hurley was published on July 7, 1997. Ex. 1004.

217. There are a number of reasons a person of ordinary skill in the art would have been motivated to consider the disclosures of Hurley in connection with improvements and modifications to the system described in Voigt. The device depicted in Hurley was specifically discussed in a 1998 article titled “Whole Body Scanners,” which surveyed eight commercially available total body imaging devices including that described in Hurley. See Daanen, Hein and van de Water, Jeroen, “Whole Body Scanners,” *Displays* 19 (1998) at p. 115 (Ex. 1005). That article acknowledged that whole body scanners had applicability in the medical field, among others, describing their use in medicine as “typical.” *Id.* at p. 111.

218. In addition, Hurley shares a number of other similarities with Voigt that would have prompted a person of ordinary skill in the art to look to Hurley for improvement upon Voigt. For example, like Voigt, Hurley discloses an enclosure (shown in Fig. 2.1 of Ex. 1004 below) to receive a person being imaged. Ex. 1004 at p. 213. In a manner similar to the “framework” shown in Voigt, the Hurley enclosure is designed “with an ‘erector set’ approach” built with a black anodized aluminum extrusion.” *Id.* at p. 213. The extrusion is covered with black theater cloth for light tightness and to reduce spurious reflection inside the system. *Id.* This

enclosure is defined by “three towers; each tower consisting of an upper and lower sensor” with two towers located in front of the person’s body and one tower located behind the person being captured. Ex. 1004 at p. 212. The location of the person being imaged defines a centerline of the device along at least two planes, one along the frontal plane of the person’s body dividing the person from side to side and one along the sagittal plane dividing the person from front to back.



219. Hurley also discloses that the location of the person being imaged is specified. Specifically, Hurley describes that the device is calibrated by placing a calibration object “approximately where the subject will be standing.” Ex. 1004 at p. 221.

220. In addition, the applicant for the ‘748 Patent himself acknowledged the relevance to his invention of systems, such as Hurley ostensibly directed to total body imaging for purposes of precisely measuring a person and their features for purposes of custom fitting clothing:

Below are some examples, but not limited to, in regards to the invention's scope and intended applications of TIP [Total Immersion Photography]: . . .

Body Morphology Analysis—Shape Evaluation

. . . This invention allows for total body evaluation on several dimensions. Measurements and comparisons of body contours, fat deposit analysis, asymmetry, etc. with volume measurements will be valuable for the cosmetic surgeon, the physician, the physical trainer, **the clothier,** **etc.**

'748 Patent, 5:61-61, 6:54-66 (emphasis added.)

221. A person of skill in the art would have been motivated to combine elements of Hurley with the system described in Voigt because of the obvious advantages of doing so. The authors of the 1998 article noted that because systems like Hurley used multiple stationary cameras (*e.g.* “in order to cover the entire body, multiple scan heads [containing at least one light and camera] have to be used”), they allowed for substantially increased resolution of the imaged subject—a capability of particular importance to those seeking to identify and measure skin defects, such as melanoma.

222. As one of skill in this art at the time of the application would have appreciated, a larger number of cameras in a simultaneous acquisition system permits each camera to focus on a smaller area, increasing the number of pixels capable of capturing a particular surface feature (see discussion of the relation of focal length, distance and pixel resolution above).

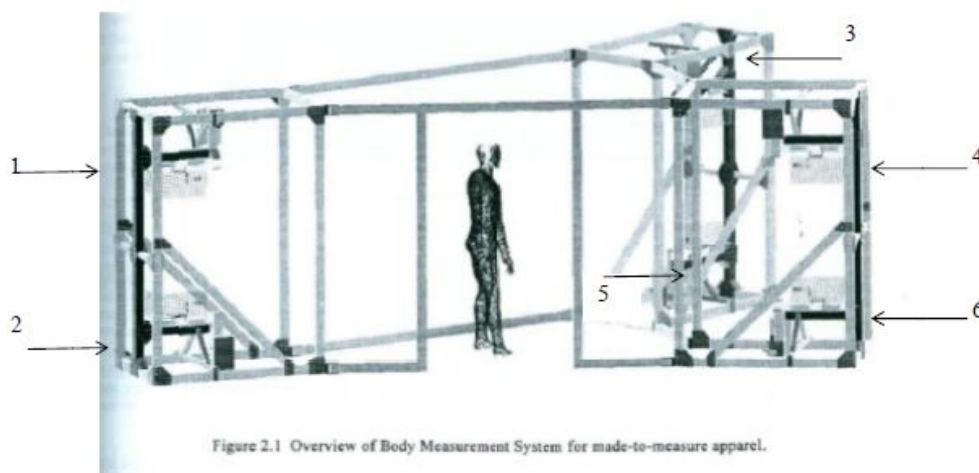
223. So too, one of ordinary skill in this art would have appreciated, as was recognized in Daanen, that use of multiple cameras reduces the shading effects encountered when attempting to scan the body surface using fewer cameras. *Id.* at 114 (“The use of multiple cameras reduces the shading effects, because of the captured surface area of the body increases.”)

224. In addition, a person of ordinary skill in this art would have appreciated prior to the filing of the application for the ‘748 Patent that the time involved in obtaining full body information would be greatly reduced through use of Hurley’s multiple imaging device. Hurley explains that its device uses six stationary sensors, each containing a camera and a light source to shorten the acquisition time of the full body information, among other reasons. Ex. 1004 at p. 213. Hurley’s use of multiple cameras positioned on either side of the subject also avoids the need to reposition the subject and/or the cameras (*i.e.* what Hurley refers to as “dynamic issues”). *Id.*

225. Additionally, as Daanen also notes, the use of steady mounted cameras in Hurley provide additional advantages over systems having moveable cameras, such as Voigt, because configurations such as Hurley have no moving components which “increases the life cycle of the scanning system and also increases the safety of the scanned subjects.” *Id.* This again is an advantage of the Hurley configuration that one of ordinary skill in this art would have—and as

shown by Daanen, did—appreciate prior to the time of the application. It is my opinion that each of these advantages would provide a rationale for one of ordinary skill in the art to modify the Voigt to a device containing multiple cameras that capture the entire body, as in Hurley.

226. Hurley discloses a device using six imaging devices, including at least a plurality that are spaced vertically, laterally, or opposite the centerline of the specified imaging position from one another. Specifically, Hurley describes six sensor heads, with an upper and lower sensor heads located on each tower. Ex. 1004 at p. 212. These sensor heads are numbers one through six in the annotated reproduction of Figure 2.1 of Ex. 1004 below. Ex. 1004 at p. 212-213.



227. Each sensor head consists of “a structured light projector and an area sensing CCD camera” which form “a vertical triangulation with the object or body.” Ex. 1004 at p. 213. Cameras 1 and 2 constitute a plurality of imaging

devices that are vertically spaced relative to each other. Cameras 3 and 4 constitute a plurality of imaging devices that are laterally spaced relative to each other.

Cameras 2 and 6 constitute a plurality of imaging devices that are located on opposite sides of the centerline of the specified imaging position (defining the centerline as the frontal plane of the body dividing the person from side to side).

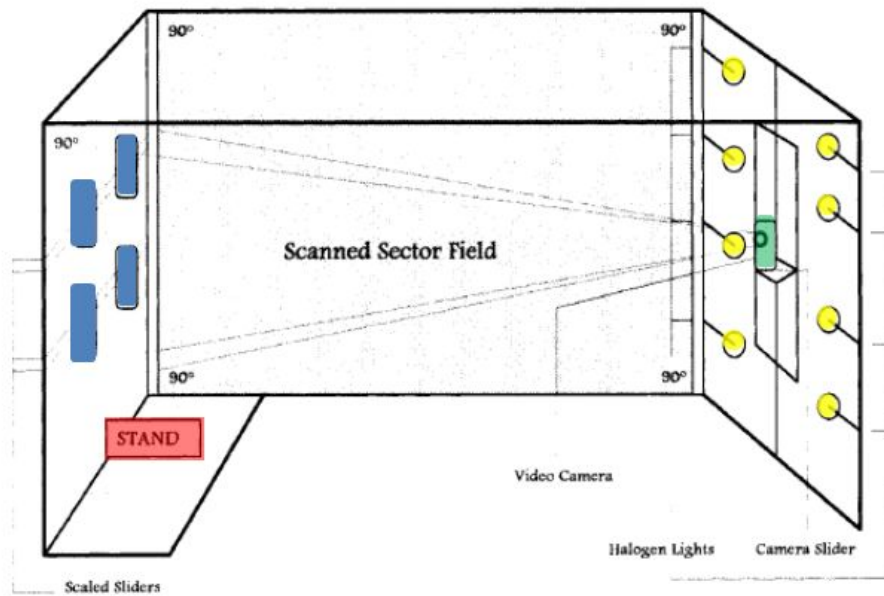
Hurley also discloses a plurality of imaging devices, cameras 3 and 4, located on opposite sides of the centerline of the specified imaging position (defining the centerline as the sagittal plane of the body dividing the person from front to back).

228. Even if Hurley did not disclose the specific locations of the imaging devices claimed in the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate imaging devices in any position that would allow capture of the surface area of the body sought to be imaged.

229. As discussed above, one of ordinary skill in the art would have had a reason to combine Voigt and Daanen to capture the entire body without repositioning the person to be imaged. Thus it would have been obvious to one of skill in the art to use a plurality of imaging devices located in positions around a person to be imaged, including those specific positions claimed in claim 51 of the '748 patent.

- (e) **A plurality of illuminating means spaced relative to each other and peripheral to the plurality of imaging means that illuminate the person or portion thereof located at the specified imaging position and generate refraction and reflectance light therefrom.**

230. One of ordinary skill in the art would understand the illuminating means of claim 51 to be the light sources of claim 1. Voigt discloses the use of a plurality of halogen light sources spaced relative to each other and peripheral to an imaging device that illuminate the person or portion thereof located at the specified imaging positions. This plurality of light sources is identified in the annotated figure below in yellow. Figure 1 of Ex. 1003. Ex. 1003 at p. 982. These light sources illuminate the person located at the specified imaging position as disclosed in Voigt's explanation that "total object illumination was given special attention to prevent any artificial shadowing." Ex. 1003 at p. 983. One of ordinary skill in the art would recognize that the halogen lights used in Voigt generate refraction and reflectance light from the person or portion thereof located at the specified imaging position. "Reflectance" light refers to light that reflects off a surface. "Refraction" occurs when light strikes a substance, such as human skin, penetrates and is then reflected with a changed direction. Halogen light or white light striking skin naturally results in both reflectance and refraction. These lights were located peripherally to the single camera and were spaced relative to each other.



231. Similarly, Hurley discloses the use of a plurality of light sources spaced relative to each other and peripheral to the plurality of imaging devices that illuminate the person or portion thereof located at the specified imaging position and that generate refraction and reflectance light therefrom. Specifically, Hurley discloses that each of the six sensor heads consists of “a structured light projector and an area sensing CCD camera.” Ex. 1004 at pp. 212-213. One of ordinary skill in the art that has chosen to incorporate the Hurley multi-camera format into the Hurley imaging device would understand that each of the additional cameras would also require lighting. Thus, to one of ordinary skill in the art it would be obvious to include light sources similar to those disclosed for use in connection with the single Voigt camera with each additional camera added.

232. A person of ordinary skill in the art would understand that, when using a plurality of cameras, light sources would need to be located peripheral to each of the cameras to avoid the artificial shadowing that Voigt sought to prevent.

233. Even if Hurley and Voigt did not disclose the specific locations of the light sources claimed in the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate light sources in any position that would prevent artificial shadowing when imaging a person or portion thereof.

234. Thus, it would have been obvious to one of ordinary skill in the art to locate multiple light sources around the enclosure, including light sources spaced relative to one another and peripheral to the imaging device or devices as claimed in claim 51 of the '748 patent.

- (f) **Wherein each of said imaging means generates an image of the illuminated person or portion thereof located at the specified imaging position, and defines respective coordinates and said respective predetermined distance relative to the specified imaging position, and defines a respective focal length and resolution information, allowing precise measurement of imaged features of the person or portion thereof located at the specified imaging position.**

235. Voigt discloses that its device and methodology are used to “capture and process detailed surface information for instant metric determinations of shape changes in multiple skin lesions in defined time periods.” Ex. 1003 at p. 987. The Voigt camera captured images of the front and back trunk areas. *Id.* at 983. This

was accomplished by using a “specifically defined position framework for the patient’s positioning” and recording the locations of the camera and the position framework, thus defining the coordinates of the camera and the predetermined distance from the camera to the specified imaging position. *Id.* at 983; 987. Then, using the resolution of the camera and its focal length, the spatial image resolution was calculated to be 1 mm per pixel. *Id.* at 983. Based upon this information, the area and dimension of the skin lesions was measured. *Id.*

236. Even if Voigt did not disclose the specific method for precise measurement claimed in claim 51 of the ‘748 patent, it would have been obvious to one of ordinary skill in the art that Voigt employed those parameters to measure objects shown in the captured image. The calculations reflected in Voigt constitute an example of photogrammetry, the science and engineering of making measurements using images. Photogrammetry has long used the well-known relationship between distance of the camera from the subject, and the focal length and resolution of the camera, to measure features depicted in the image. There are a number of forms of photogrammetry. The most familiar is what is sometimes referred to as Topographic Photogrammetry, which involves the measurement of topographic structures (*i.e.* the shape of areas on the surface of the earth) from the air or space. *See generally* Manual of Photogrammetry (4th Ed. 1980), published by the American Society of Photogrammetry. The same principles apply to what is

called “Close-Range Photogrammetry. *See id.* at 801 (“With little or no modifications, many of the computational methods which were developed over the years for aerial mapping and areotriangulation can be applied in close-range photogrammetric projects.”) It is well known that in photogrammetry the scale of the image relative to the object images is determined by the ratios of the focal length of the camera to the distance to the object imaged. *See* Comer, R.P. *et al.*, Talking Digital, *Photogrammetric Engineering & Remote Sensing*, 1139 (December 1998) (“The lens of an airborne digital camera forms an image of the ground on its focal plane at a certain scale. That *camera scale* is the ratio of focal length of the lens and the collection height above ground level (AGL), $\text{camera scale} = (\text{focal length})/(\text{height AGL})$. Where the image on the focal plane is captured using a charged couple device (CCD) array—such as was disclosed in the Voigt reference—then the scale is calculated with the addition of the image array size (*i.e.* resolution) by means of the following formula: $\text{scale} = (\text{array element size}) (\text{height AGL})/(\text{focal length})$. As Comer explains, “In general, GSD (Ground Sample Distance) [*i.e.* scale] is simply the linear dimension of a single pixel’s footprint on the ground.” *Id.*

237. Thus, it would have been obvious to one of ordinary skill in the art to use the coordinates of the cameras, the distance between the cameras and the

specified imaging position, the resolution, and the focal length to measure features found in the captured images.

238. In view of the disclosures of Voigt, Hurley, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 51 would have been obvious to a person of ordinary skill as of July 26, 2000.

B. Obviousness of Claims 1-8, 11, 30, 33-34, and 46 over Hurley

239. In a 1998 article titled “Whole Body Scanners,” the authors surveyed eight commercially available total body imaging devices including that described in Hurley. Ex. 1004. The authors noted that the use of a large number of cameras allows for substantially increased resolution of the imaged subject. See Ex. 1005 at pp. 115.

240. As discussed above, Hurley (Ex. 1004) discloses a body measurement system for use in making made-to-measure apparel. Ex. 1004 at 212. The system uses six sensors located on three separate towers, each tower containing an upper and lower sensor. *Id.* Each sensor contains an area sensing CCD camera and a structured light projector. *Id.* at 213. These six sensors are located in stationary positions within a structure built with a black anodized aluminum extrusion that is then covered with non-reflective black theater cloth. *Id.* at 213-214.

241. The applicant for the ‘748 Patent himself acknowledged that his allegedly inventive system was applicable for the same uses as the Hurley system:

“Below are some examples, but not limited to, in regards to the invention’s scope and intended applications of TIP [Total Immersion Photography]: . . . will be valuable for the cosmetic surgeon, the physician, the physical trainer, the clothier, etc.” Ex. 1001, ‘748 Patent at 5:61-61, 6:54-66 (emphasis added).

242. It is my opinion that the invention claimed in the following claims of the ‘748 Patent would have been obvious to one of ordinary skill in the art before the filing of the application for the ‘748 Patent based upon Hurley.

(i) Independent Claim 1

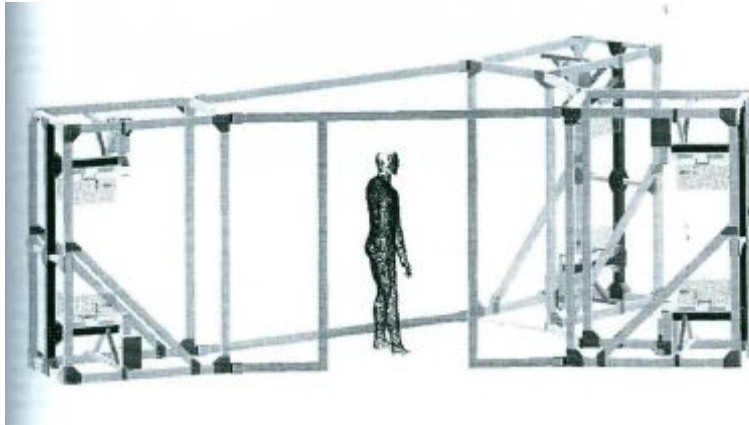
(a) PREAMBLE: A device for the identification of maladies that effect human tissue comprising:

243. The preamble is not a claim limitation.

(b) An enclosure configured to receive a person or portion thereof for imaging the person or portion thereof, wherein the enclosure defines a specified imaging position for placing the person or a portion thereof within the enclosure for imaging, and the specified imaging position defines a centerline.

244. The 1997 article, Hurley et al., “Body Measurement System Using White Light Projected Patterns for Made-to-Measure Apparel,” SPIE Vol. 3131, July 7, 1997, 212-223 (“Hurley,” Ex. 1004), describes an enclosure having multiple cameras for imaging a person. The structure is built “with an ‘erector set’ approach” from black anodized aluminum extrusion covered with non-reflective

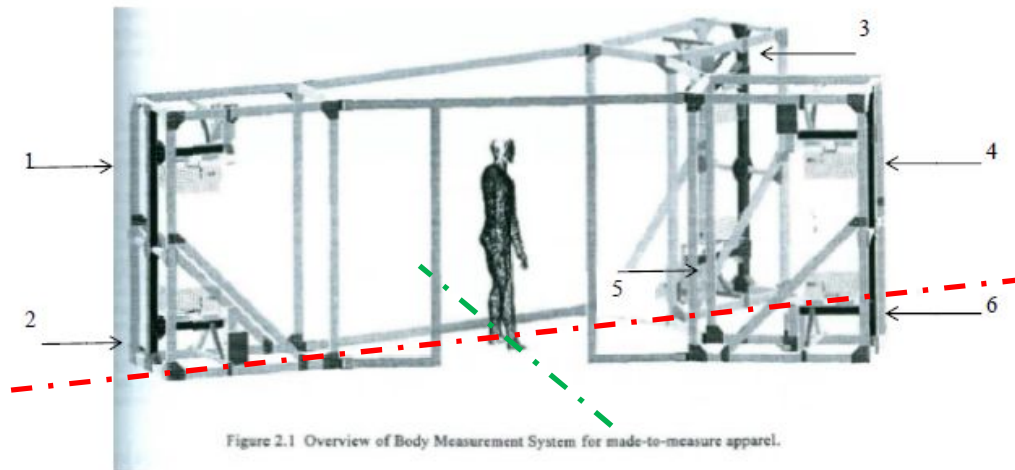
black theater cloth. *Id.* at 213-214. The system (omitting the cloth) is shown in the figure below from Hurley (Ex. 1004 at 213).



245. Hurley also discloses that the location of the person being imaged is pre-specified. Specifically, Hurley describes that the device is first calibrated by placing a calibration object “approximately where the subject will be standing.” *Id.* at. 221. Using this calibration object, the distance between each camera and the position that will be occupied by the subject is confirmed. *Id.* at 221 (“By scanning a calibration object of known size and orientation, we are able to calculate the orientation of each sensor head with respect to the object. . . . [not only to ensure] correct coverage but to make sure the subject is within the depth of focus of each of the sensor heads.”)

246. As shown in the annotated reproduction of Figure 2.1 of Ex. 1004 below, the location of the person being imaged may be used to define a centerline of the device along at least two planes, one along the frontal plane of the person’s

body dividing the person from side to side (green) and one along the sagittal plane dividing the person from front to back (red). *Id.* at 212-213.



- (c) **A plurality of imaging devices, wherein a plurality of the imaging devices are vertically spaced relative to each other, a plurality of the imaging devices are laterally spaced relative to each other, a plurality of the imaging devices are located on opposite sides of the centerline of the specified imaging position relative to each other and each imaging device is located a predetermined distance relative to the specified imaging position.**

247. The system has six imaging sensors (indicated by numerals 1-6 in the annotated figure above) located in stationary positions within the enclosure. *Id.* at 213-214. A plurality of these sensors are spaced both laterally and vertically to one another. The six sensors are arranged in three sets of two sensors to a set, one spaced vertically above the other (see sensors 1 and 2, 3 and 5 and 4 and 6, in the above diagram). As shown in the above diagram, sensors 5 and 6, for example, are

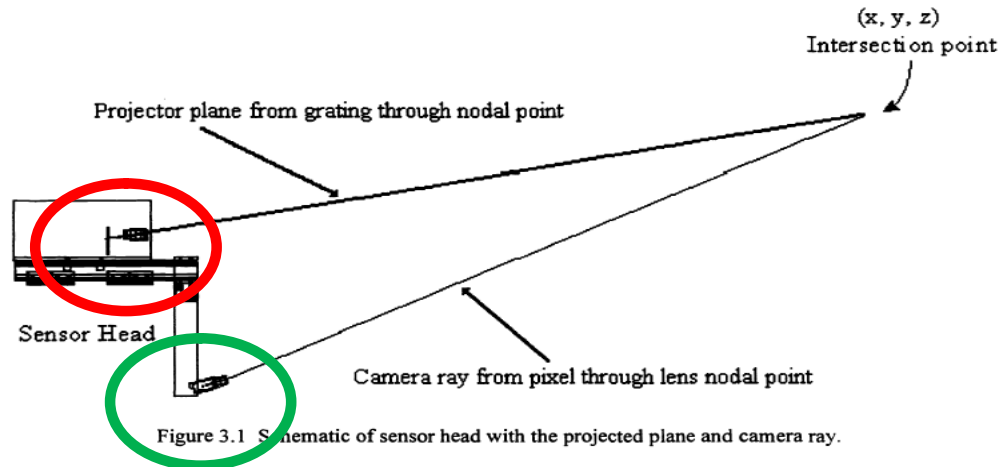
spaced laterally from one another and are located on opposite sides of the depicted centerline.

248. The distance between each of the cameras and imaging position specified for the subject is determined in advance of imaging by a calibration process. A calibration object is positioned “approximately where the subject will be standing.” *Id.* at 221. Using this calibration object, the proper distance between each camera and position that will be occupied by the subject is confirmed. *Id.* (“By scanning a calibration object of known size and orientation, we are able to calculate the orientation of each sensor head with respect to the object. . . . [not only to ensure] correct coverage but to make sure the subject is within the depth of focus of each of the sensor heads.”)

- (d) A plurality of light sources spaced relative to each other and peripheral to the plurality of imaging devices that illuminate the person or portion thereof located at the specified imaging position and generate refraction and reflectance light therefrom.**

249. Hurley discloses the use of a plurality of light sources spaced relative to each other and peripheral to the plurality of imaging devices. These light sources project light that illuminates the person or portion thereof located at the specified imaging position. This illumination generates refraction and reflectance light from the subject. Specifically, Hurley discloses that each of the six sensor heads consists of “a structured light projector and an area sensing CCD camera.”

Id. at 212-213. The light projector (red) is located peripheral to the imaging device (green), as depicted in the annotated diagram below from Hurley.



- (e) **Wherein each of said imaging devices generated an image of the illuminated person or portion thereof located at the specified imaging position, and defines respective coordinates and said respective predetermined distance relative to the specified imaging position, and defines a respective focal length and resolution information, allowing precise measurement of imaged features of the person or portion thereof located at the specified imaging position.**

250. In Hurley, the imaging devices generate an image of the illuminated person or portion thereof. The results of the image data obtained by each of the six imaging devices are shown in the following figure from Hurley.

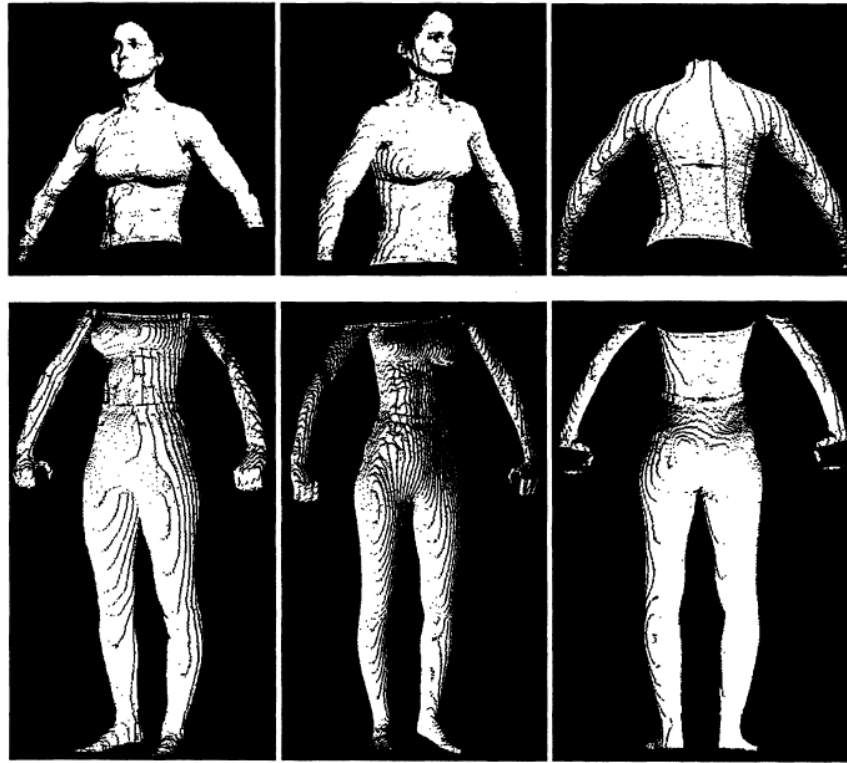


Figure 5.1 Six Individual Views of 3D Data Points

251. Hurley discloses that the respective coordinates of each imaging device are determined, as is the location of each relative to the position of the subject. *Id.* at 221 (“each sensor head location and orientation has already been determined in a calibration process[.]”).

252. Hurley discloses use of a commercial CCD camera having a lens. *Id.* at 214-215 (“a pixel location on the CCD array, q_{cc} , combined with the nodal point of the camera lens, q_{lc} , defines a unique ray in space[.]”). Such a camera consists of a charge coupled device consisting of a sensor array of a set number of pixel elements (*i.e.* resolution). Each camera would have a particular focal length that defined the depth of field or the portions of the subject that would be “in focus.”

Id. at 221 (noting that the calibration process ensures that the subject’s location will be “within the depth of focus of each of the sensor heads.”)

253. While Hurley does not explicitly describe the use of distance from the imaging position, focal length and resolution to calculate precise measurements of imaged features, the applicant for the ‘748 Patent acknowledged that the claimed calculations were “standard” techniques for the “measurement and analysis of optically depicted images of a patient’s surfaces[.]” See Ex 1001, ‘748 Patent at 1:7-12. In fact, the applicant apparently considered these techniques so obvious to those of skill in the art, that he provides no further articulation of these principles in his patent outside of the discussion in the claims.

254. Photogrammetry has long used the well-known relationship between distance of the camera from the subject, and the focal length and resolution of a pixel from the camera, to measure the size and distance between features depicted in the image. It is well known that in photogrammetry the scale of the image relative to the object images is determined by the ratios of the focal length of the camera to the distance from the front of the camera lens to the object being imaged. See Comer, R.P. et al., Talking Digital, Photogrammetric Engineering & Remote Sensing, 1139 (December 1998) (“The lens of an airborne digital camera forms an image of the ground on its focal plane at a certain scale. That camera scale is the ratio of focal length of the lens and the collection height above ground

level (AGL), camera scale = (focal length)/(height AGL). Where the image on the focal plane is captured using a charged couple device (CCD) array—such as disclosed in Hurley—then the scale is calculated with the addition of the image pixel size (i.e. resolution of the camera system) by means of the following formula: scale = (array element size) (height AGL)/(focal length). As Comer explains, “In general, GSD (Ground Sample Distance) [i.e. scale] is simply the linear dimension of a single pixel’s footprint on the ground.” *Id.*

255. Hurley describes a “non-contact measurement system (BMS)” for use in making “made-to-measure apparel.” Ex. 1004, Hurley at 212 (emphasis added). Hurley notes that mass producing such custom apparel requires a method of “accurately obtaining human body measurements[.]” *Id.*

256. Hurley seeks accurate surface measurements of three-dimensional, curved surfaces. The calculations required for such measurements are complex. Hurley notes at the conclusion of his article that work was still then progressing to extract measurements from the three dimensional data sets acquired using his multiple camera system.

257. However, not all body dimensions require such complex geometries. The lengths of a subject’s arm (i.e. sleeve) or leg (i.e. inseam) are generally linear dimensions for which the algorithm described in Claim 1 would suffice.

258. In light of Hurley’s invitation for further work to extract measurements from the body data sets, a person of ordinary skill in the art would be motivated to use the simpler algorithm described in claim 1 for at least those dimensions suitable to that method—particularly in light of the applicant’s accurate acknowledgement that such calculations were “standard” techniques for the “measurement and analysis of optically depicted images of a patient’s surfaces[.]” *See* ‘748 Patent, 1:7-12. The applicant had specifically acknowledged that such “standard” techniques used in his invention were useful for the types of measurements made in Hurley’s system. ‘748 Patent, 6:54-66 (emphasis added) (applicant noted that his invention “for total body evaluation on several dimensions” produced measurements “valuable for the cosmetic surgeon, the physician, the physical trainer, the clothier, etc.”)

259. In view of the disclosure of Hurley and the knowledge of a person of ordinary skill in the art, the device claimed in claim 1 would have been obvious to a person of ordinary skill as of July 26, 2000.

(ii) Dependent claim 2

- (a) A device according to claim 1 wherein the plurality of light sources is located amongst the plurality of imaging devices.**

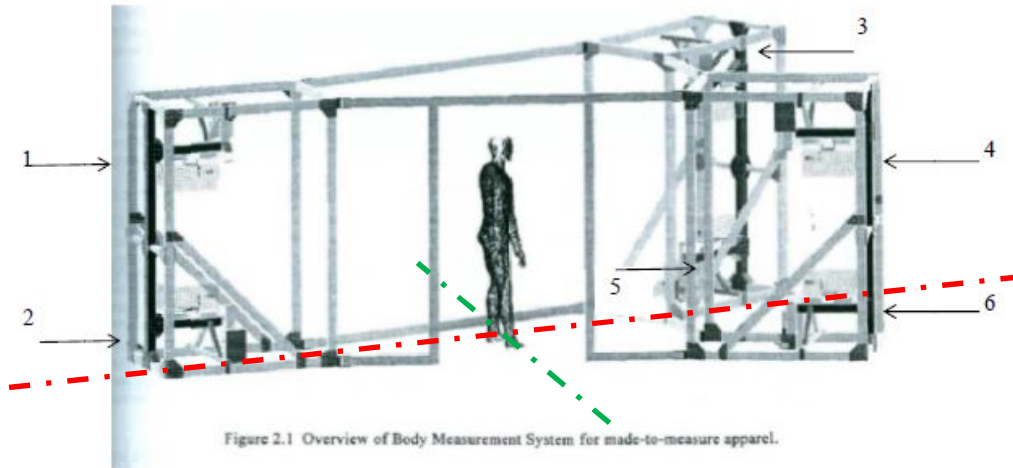
260. As discussed above, Hurley couples its imaging devices with structured white light sources positioned so as to illuminate the area of the subject

imaged by the imaging device. Specifically, Hurley discloses that, within the enclosure, there are six sensor heads that consist of “a structured light projector and an area sensing CCD camera.” Ex. 1004, Hurley at 213. The sensor heads are distributed about the enclosure at six different locations. Thus, because the cameras and light projectors are located on each respective sensor head, Hurley discloses a plurality of light sources located amongst the plurality of imaging devices and Hurley renders claim 2 obvious.

(iii) Dependent claim 3

(a) Claim 3 – A device according to claim 2 wherein at least two light sources are located lateral to at least two imaging devices.

261. Hurley discloses a device wherein at least two light sources are located lateral to at least two imaging devices. As shown in the annotated reproduction of Figure 2.1 of Ex. 1004 below, at least the light source located on sensor head 3 is lateral to the camera located on sensor head 4 and the light source located on sensor head 5 is lateral to the camera located on sensor head six 6. Ex *Id.* At 212-213. Thus, Hurley renders claim 3 obvious.



(iv) Dependent Claim 4

262. Claim 4 incorporates the limitations of claims 1, 2, and 3. Claim 4 is directed to the specific locations of the light sources. Hurley either discloses each of these claimed limitations, or one of ordinary skill would have understood such locations of light sources to constitute an obvious design choice. Each of the additional limitations of claim 4 is addressed below.

(a) A device according to claim 3 wherein at least two light sources are positioned symmetrically relative to the center line of the specified imaging position.

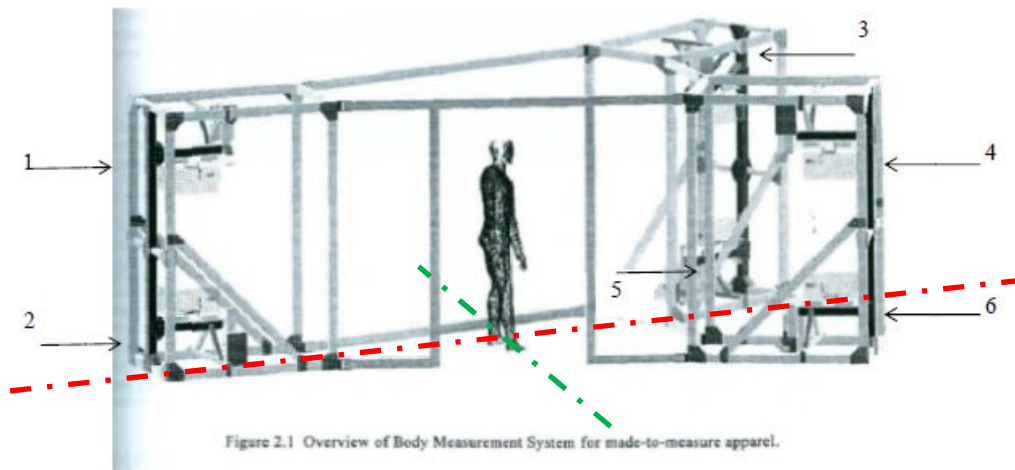
263. As shown in the annotated Figure above, at least the light source located on sensor heads 3 and 4 are positioned symmetrically relative to the center line (red) of the specified imaging position. *Id.* at 212-213.

(v) Dependent claim 5

264. Claim 5 incorporates the limitations of claim 1 and identifies additional limitations regarding the locations of the imaging devices

- (a) A device according to claim 1 wherein the plurality of imaging devices includes: a first imaging array spaced a predetermined distance relative to the specified imaging position to a side of the enclosure, wherein the first imaging array includes a plurality of first imaging devices vertically spaced relative to each other;**

265. Hurley discloses six sensor heads, with an upper and lower sensor heads located on each tower. Ex. 1004, Hurley at 212. These sensor heads are numbered one through six in the annotated reproduction of Figure 2.1 of Ex. 1004 below. Ex. 1004 at p. 212-213. Each sensor head contains a CCD camera. *Id.*



266. The sensor heads identified by numbers 3 and 5, for example, each containing a CCD camera, constitute a first imaging array spaced a predetermined

distance relative to the specified imaging position to a side of the enclosure. The imaging array consisting of sensor heads 3 and 5 includes a plurality of first imaging devices vertically spaced relative to each other.

(b) A second imaging array spaced a predetermined distance relative to the specified imaging position, and laterally spaced adjacent to the first imaging array, wherein the second imaging array includes a plurality of second imaging devices vertically spaced relative to each other.

267. The sensor heads identified by numbers 4 and 6 portrayed above, each containing a CCD camera, constitute a second imaging array spaced a predetermined distance relative to the specified imaging position, and laterally spaced adjacent to the first imaging array, wherein the second imaging array includes a plurality of second imaging devices vertically spaced relative to each other.

268. Alternatively, sensor heads 1 and 2 constitute a second imaging array spaced a predetermined distance relative to the specified imaging position, and laterally spaced adjacent to the first imaging array, wherein the second imaging array includes a plurality of second imaging devices vertically spaced relative to each other.

269. In view of the disclosure of Hurley and the knowledge of one of ordinary skill in the art, claim 5 would have been obvious to one of ordinary skill in the art in July, 2000.

(vi) Dependent Claim 6

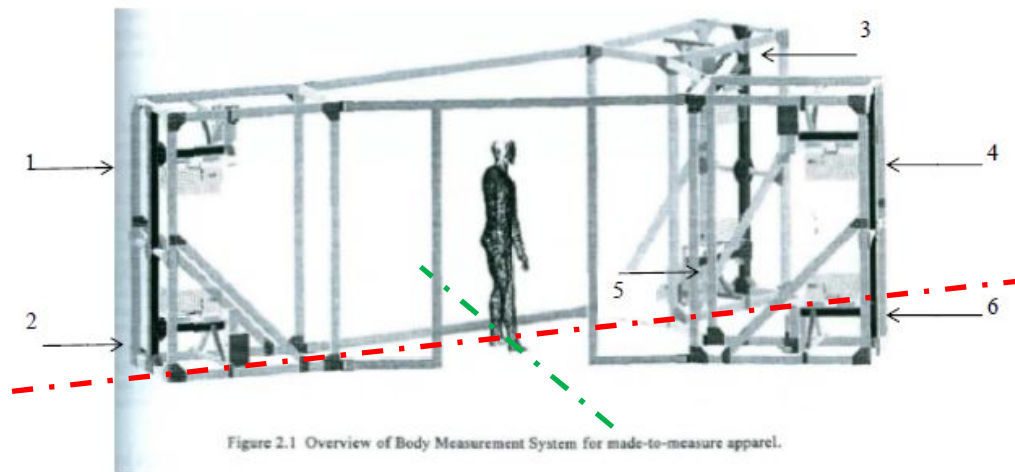
270. Claim 6 adds a third and fourth imaging array to Claim 5.¹

- (a) A third imaging array spaced a predetermined distance relative to the specified imaging position, and laterally spaced relative to the first imaging array on an opposite side of the first imaging array relative to the second imaging array wherein the third imaging array includes a plurality of third imaging devices vertically spaced relative to each other**

271. As shown in the annotated figure from Hurley, sensor heads 1 and 2 constitute an imaging array spaced a predetermined distance relative to the specified imaging position. This sensor array is laterally relative to the first imaging array (sensors 3 and 5), and is so spaced on the opposite side of the first imaging array relative to the imaging array consisting of sensors 4 and 6 (*i.e.* the

¹ For purposes of the IPR, I have assumed that Claim 6, due to its references to a third and fourth imaging array, is intended to depend from claim 5, despite its introductory statement “A device according to claim 1.”

second imaging array).



- (b) **A fourth imaging array spaced a predetermined distance relative to the specified imaging position, and laterally spaced relative to the second imaging array on an opposite side of the second imaging array relative to the first imaging array, wherein the fourth imaging array includes a plurality of fourth imaging devices vertically spaced relative to each other.**

272. Hurley does not describe a fourth sensor array. However, it would have been obvious based upon the disclosures of Hurley for a person of ordinary skill in the art to add a fourth array to Hurley, in an arrangement similar to the arrays for imaging the front of the subject, to obtain more detailed coverage of the back portion of the person.

273. Hurley noted that its design economized on the number of sensor arrays, based upon a determination that it was possible to accomplish the measurements using less detailed images of the subject's back than his or her front.

Id. at 212-213. Hurley notes that greater detailed imaging may be acquired using a plurality of image sensor arrays spaced laterally at a particular angle to the subject.

Id. (“The two front towers with a 60 degree included separation angle . . . are shown in Figure 2.1. With this separation angle, there is overlap between the viewing areas of the towers where detail is needed[.]”) Such a modification is illustrated (somewhat crudely) in the following modified figure:

274. One of ordinary skill in the art would have been motivated by the teachings in Hurley to add laterally spaced sensor arrays where greater detail was desired in the image.

275. In view of the disclosure of Hurley and the knowledge of one of ordinary skill in the art, claim 6 would have been obvious to one of ordinary skill in the art in July, 2000.

(vii) Dependent Claim 7

276. Claim 7 incorporates the limitations of claims 1, 5, and 6 and identifies additional limitations regarding the locations of the light sources.

(a) wherein the plurality of light sources is symmetrical about the center line

277. Hurley discloses that each sensor head includes a light source. As discussed above, it would have been obvious to modify Hurley to replicate the two-tower, 60 degree angled arrangement of sensors 3 and 5 and 4 and 6 are on the opposite side of the subject through the addition of a fourth tower adjacent the

tower housing sensors 1 and 2. In such an arrangement, the light sources of the four towers would be symmetrical about a centerline representing either the sagittal or the frontal planes. *See* above modified configuration.

- (b) and includes a first light source located lateral to the first imaging array, a second light source located between the first and second imaging array, a third light source located between the third and fourth imaging arrays and symmetrical about the centerline to the second light source, and a fourth light source located opposite the first light source and lateral to the fourth imaging array.**

278. In such a configuration, the lights sources peripheral to each image sensor would necessarily be lateral to that respective imaging array and thereby located in the area between adjacent imaging arrays. Lights sources peripheral to a third imaging array behind the subject, and located in an area between the third and fourth imaging arrays, would be symmetrical about at least the sagittal centerline discussed above (*i.e.* a centerline that passes side-to-side through the subject) to the opposite light source located between the first and second imaging arrays from by sensors 3 and 5 and 4 and 6.

279. To the extent that these disclosures are not at least inherent in Hurley, positioning light sources in this manner to illuminate the subject from opposite sides and to do so symmetrically would have been an obvious design choice for one of ordinary skill in this art because this design ensures consistent illumination.

280. In view of the disclosure of Hurley and the knowledge of one of ordinary skill in the art, claim 7 would have been obvious to one of ordinary skill in the art in July, 2000.

(viii) Dependent Claim 8

- (a) A device according to claim 1 wherein said enclosure is further comprised of panels that enclose said person or portion thereof in a radius selected from at least one of: 360 degrees on the vertical axis and 360 degrees on the horizontal axis.**

281. Hurley discloses an enclosure shown in Fig. 2.1 of Ex. 1004 below to receive a person being imaged. Ex. 1004, Hurley at 213. The enclosure is designed “with an ‘erector set’ approach” built with a black anodized aluminum extrusion that is covered with black theater cloth for light tightness and to reduce spurious reflection inside the system. *Id.* at 213.

282. The fabric covered panels thus formed in Hurley enclosed a person on all sides (*i.e.* 360 degrees about a vertical axis).

283. In view of the disclosure of Hurley and the knowledge of one of ordinary skill in the art, claim 8 would have been obvious to one of ordinary skill in the art in July, 2000.

(ix) Dependent Claim 11

284. Claim 11 incorporates the limitations of claims 1 and 8 and identifies additional limitations regarding the panels of the enclosure. Hurley discloses each

of these claims. Each of these additional claim limitations of claim 11 is addressed individually below.

(a) A device according to claim 8 wherein said panels are further comprised of at least one imaging means.

285. Hurley discloses an enclosure according to claim 11 wherein the panels are further comprised of at least one imaging means. Hurley describes an enclosure that includes “three towers; each tower consisting of an upper and lower sensor” with two towers located in front of the person’s body and one tower located behind the person being captured. *Id.* at 212. The panels described above that encompass one of the towers include two imaging means or cameras.

286. In view of the disclosure of Hurley and the knowledge of one of ordinary skill in the art, claim 11 would have been obvious to one of ordinary skill in the art in July, 2000.

(x) Dependent Claim 30

(a) Claim 30 – A device according to claim 1 further comprising a display device for displaying one or more images generated by the plurality of imaging devices.

287. Hurley discloses individual views of the body generated by each of the six sensor heads in its Figure 5.1 reproduced below. *Id.* at 221.

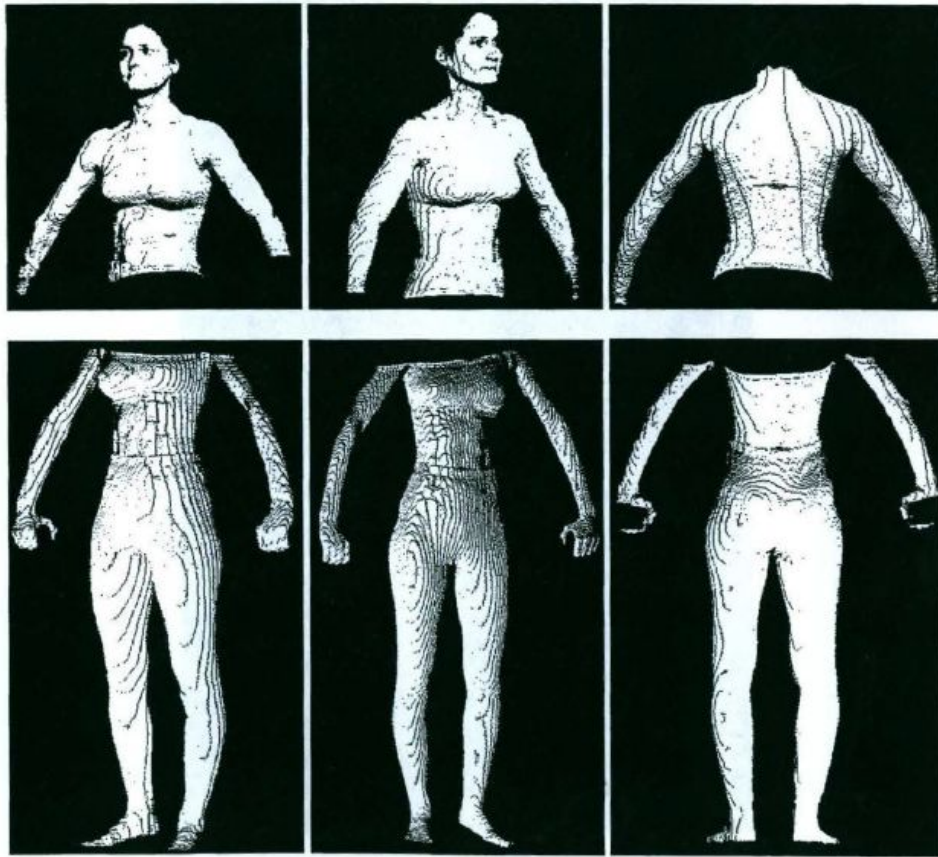


Figure 5.1 Six Individual Views of 3D Data Points

288. Hurley also discloses that its system is controlled by a Pentium 133 personal computer. *Id.* at 214. Hurley refers to the use of graphic *display* tools (*id.*) created using the OpenGL graphics library, and describes software that, among other things, performs the function of “displaying graphical output.” *Id.* One of ordinary skill in the art would understand that this personal computer would comprise a display device for displaying the images such as those shown in Fig. 5.1.

289. In view of the disclosure of Hurley and the knowledge of one of ordinary skill in the art, claim 30 would have been obvious to one of ordinary skill in the art in July, 2000.

(xi) Dependent Claim 33

290. Claim 33 depends from claim 30, which depends from claim 1. Claim 33 is directed to a display device capable of displaying said person or portion thereof in a visually perceivable form. This limitation is disclosed in Hurley. For that reason, claim 33 would have been obvious to one of ordinary skill in the art as of July 2000. Each limitation of claim 33 is address individually below.

(a) A device according to claim 30 wherein said display device further comprises a device capable of displaying said person or portion thereof in visually perceivable form.

291. As discussed above, Hurley discloses a device capable of displaying a portion of a person in visually perceptible form.

292. In view of the disclosure of Hurley and the knowledge of one of ordinary skill in the art, claim 33 would have been obvious to one of ordinary skill in the art in July, 2000.

(xii) Dependent claim 34

293. Claim 34 depends from claim 1 and includes the additional limitation that the device allows for viewing of said person or portion thereof in 360 degrees.

As shown above, Hurley discloses a system having six imaging devices or camera that that allows for views of the entire body (*i.e.* 360 degrees).

294. In view of the disclosure of Hurley and the knowledge of one of ordinary skill in the art, claim 34 would have been obvious to one of ordinary skill in the art in July, 2000.

(xiii) Dependent Claim 46

295. Dependent claim 46 depends from claim 1 but further comprises “a viewing device that includes at least one of a USB hub, an interfacing cable, a computer processor or like processor, a monitor, and a control device.”

296. Hurley discloses that its system contains sensor heads including “a custom designed projector, a commercial CCD camera, and **the necessary controls for both.**” *Id.* at 214 (emphasis added.) “The whole [Hurley] system is controlled by a Pentium 133 personal computer.” *Id.* as discussed above, Hurley discloses use of a monitor (*i.e.* display). *Id.* (describing software that, among other things, performs the function of “displaying graphical output.”)

297. Hurley discloses that “[a]dditional hardware and wiring necessary to interface the computer to the six sensor heads is contained in an enclosure attached to the sensor head.” *Id.* One of ordinary skill in the art would understand that it would be an obvious design choice for the hardware and wiring necessary to interface the computer to the six sensors to use interfacing cables and USB ports or

Hubs. Thus, Hurley discloses each limitation of claim 46 and renders claim 46 obvious.

C. Obviousness of Claims 6 and 7 over Voigt in combination with Hurley and Daanen

298. As set forth in detail above, the combination of Voigt and Hurley discloses each limitation of claim 5. Claims 6 and 7 depend from claim 5 and are directed to additional locations for imaging devices and light sources. Daanen, Ex. 1005, discloses the remaining limitations of claims 6 and 7.

299. Daanen Ex. 1005 is a summary of eight whole body scanners, each comprising a plurality of imaging devices, that were commercially available at the time of Daanen's publication in 1998. The body scanner system described in Hurley above was also briefly discussed in Daanen as a system available from a company called TC². Ex. 1005 at Fig. 5, pp. 115, 119.

300. One of ordinary skill in the art would understand that the variety of camera and light source locations of each of the systems disclosed in Daanen could be applied to the Voigt system. In comparing the commercial body scanners, Daanen explained that the use of multiple stationary cameras in systems like Hurley offer advantages over systems with a single camera and/or moving sensors. Ex. 1005 at p. 119. Daanen explains that "in order to cover the entire body, multiple scan heads [containing at least one light and camera] have to be used." (Ex. 1005 at p. 119). Daanen also notes that the use of a large number of cameras

allows for relatively high resolution. *Id.* at p. 115. Daanen further explains that the use of steady mounted cameras in Hurley and other products allows for systems that have no moving components which “increases the life cycle of the scanning system and also increases the safety of the scanned subjects.” *Id.*

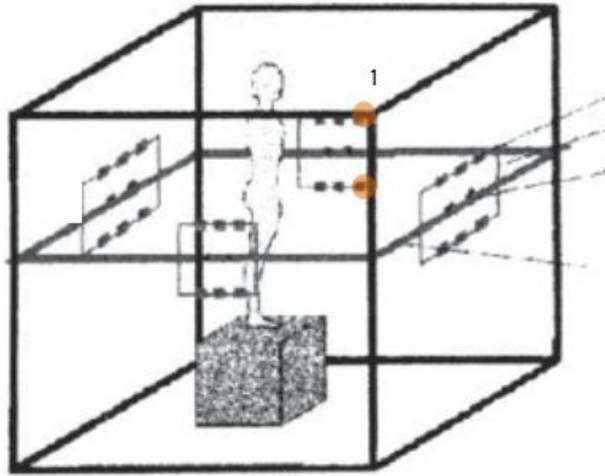
301. It is my opinion that each of these advantages would provide a rationale for one of ordinary skill in the art to modify the single, moving camera of Voigt to a device containing multiple cameras that capture the entire body in the locations identified in claims 6 and 7 in accordance with Daanen.

(i) Dependent Claim 6

302. Claim 6 incorporates the limitations of claims 1 and 5 and identifies additional limitations regarding the locations of the imaging devices. Daanen discloses each of these claimed limitations and one of ordinary skill in the art would have understood the locations of the imaging devices and cameras to constitute an obvious design choice. Each of these additional claim limitations of claims 5 and 6 are addressed individually below.

- (a) **Claim 5 - A device according to claim 1 wherein the plurality of imaging devices includes: a first imaging array spaced a predetermined distance relative to the specified imaging position to a side of the enclosure, wherein the first imaging array includes a plurality of first imaging devices vertically spaced relative to each other;**

303. Daanen discloses at least one body imaging device that include a first imaging array spaced a predetermined distance relative to the specified imaging position to a side of the enclosure wherein the first imaging array includes a plurality of first imaging devices vertically spaced relative to each other. As discussed above, imaging array should be defined to mean at least two imaging devices. The Vitronic system described in Daanen includes a first imaging array located to a side of the enclosure that includes a plurality of first imaging devices vertically spaced relative to each other identified in orange and marked with the number 1 below. Ex. 1005 at p. 113. For purposes of this analysis, the centerline is assumed to divide the person being imaged from side to side. However, due to the symmetry of the disclosed system, one of ordinary skill in the art would understand that the camera and light locations of claims 5, 6, and 7 would also be present if the centerline divided the person being imaged from front to back.

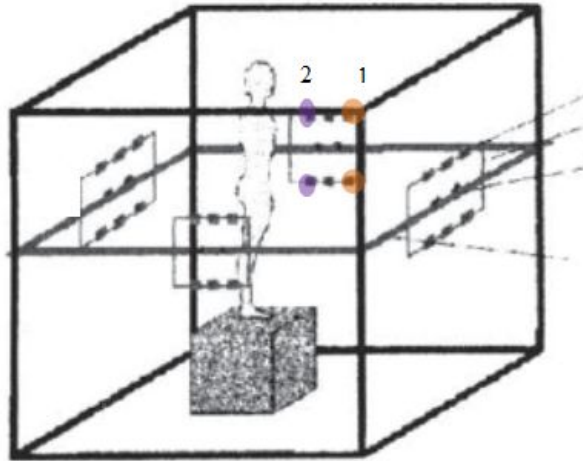


304. Even if Daanen did not disclose the specific locations of the imaging arrays claimed in claim 5 of the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate imaging devices in any position that would allow capture of the surface area of the body sought to be imaged, including locations on the sides of the body.

- (b) a second imaging array spaced a predetermined distance relative to the specified imaging position and laterally adjacent to the first imaging array on the opposite side of the centerline of the specified imaging position relative to the first imaging array, wherein the second imaging array includes a plurality of second imaging devices vertically spaced relative to each other.**

305. Daanen discloses a second imaging array located opposite the centerline (defined by the frontal plane of the imaged person's body from side to side) relative to the first imaging array, including a plurality of second imaging

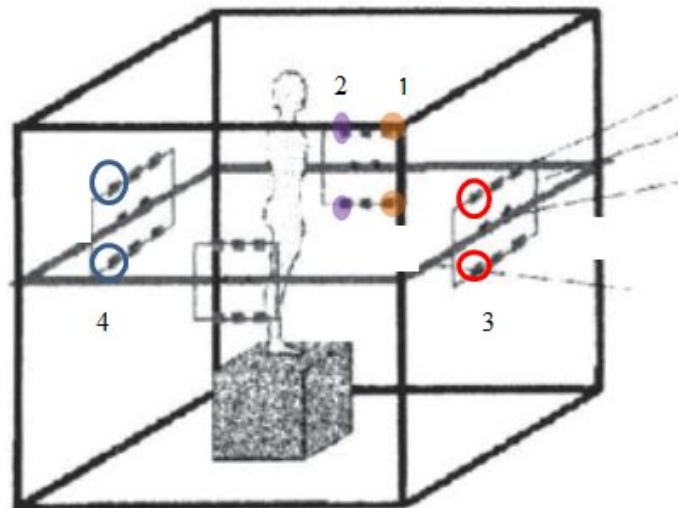
devices vertically spaced relative to each other. These second imaging devices are highlighted in purple below and marked with the number 2.



306. Even if Daanen did not disclose the specific locations of the imaging arrays claimed in claim 5 of the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate imaging devices in any position that would allow capture of the surface area of the body sought to be imaged, including locations on opposite sides of the body.

- (c) **Claim 6 – A device according to claim 1 wherein the plurality of imaging devices further includes: a third imaging array spaced a predetermined distance relative to the specified imaging position, and laterally spaced relative to the first imaging array on an opposite side of the first imaging array relative to the second imaging array wherein the third imaging array includes a plurality of third imaging devices vertically spaced relative to each other**

307. Daanen discloses a third imaging array located laterally to the first imaging array in the opposite direction from the second imaging array, wherein the third imaging array includes a plurality of third imaging devices vertically spaced relative to each other. Ex. 1005 at p. 113. As defined above, lateral means located at the side. The third imaging devices are circled in red and marked with the number 3 below.

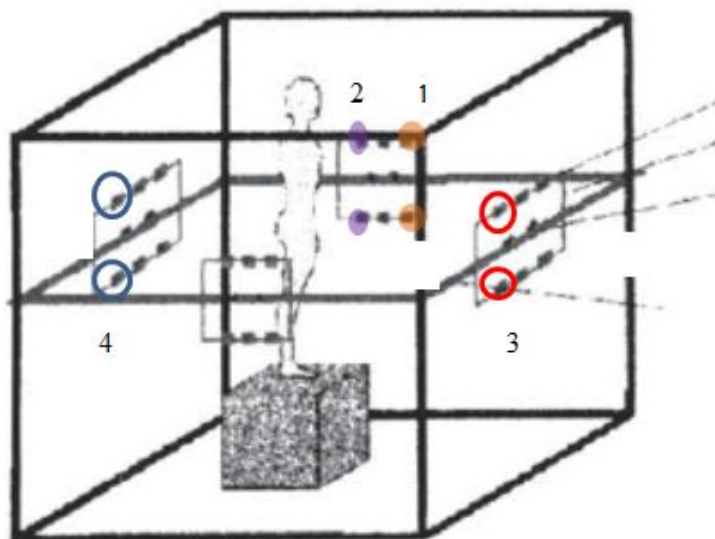


308. Even if Daanen did not disclose the specific locations of the imaging arrays claimed in claim 6 of the '748 patent, it would have been an obvious design

choice for one of ordinary skill in the art to locate imaging devices in any position that would allow capture of the surface area of the body sought to be imaged.

- (d) A fourth imaging array spaced a predetermined distance relative to the specified imaging position, and laterally spaced relative to the second imaging array on an opposite side of the second imaging array relative to the first imaging array, wherein the fourth imaging array includes a plurality of fourth imaging devices vertically spaced relative to each other.**

309. Daanen discloses a fourth imaging array located laterally to the second imaging array in the opposite direction from the first imaging array, wherein the fourth imaging array includes a plurality of fourth imaging devices vertically spaced relative to each other. Ex. 1005 at p. 113. The fourth imaging devices are circled in blue and marked with the number 4 below.



310. Even if Daanen did not disclose the specific locations of the imaging arrays claimed in claim 6 of the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate imaging devices in any position that would allow capture of the surface area of the body sought to be imaged.

311. As set forth above, one of ordinary skill in the art seeking to image the entire body in a single pose without repositioning would have a reason to combine the multi-camera system of Daanen with the single-camera device disclosed in Voigt for measuring skin lesions to diagnose Melanoma.

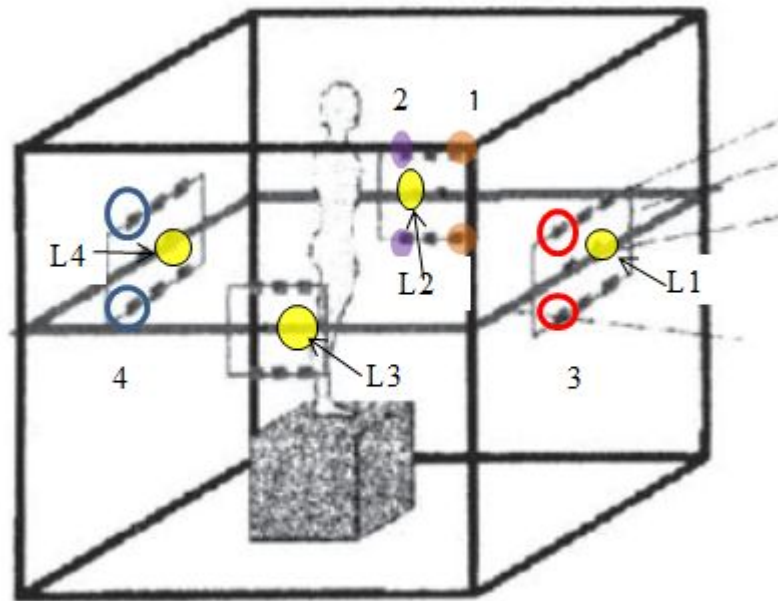
312. In view of the disclosures of Voigt, Hurley, Daanen, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 6 would have been obvious to a person of ordinary skill as of July 26, 2000.

(ii) Dependent Claim 7

313. Claim 7 incorporates the limitations of claims 1, 5, and 6 and identifies additional limitations regarding the locations of the light sources. Daanen discloses each of these claimed limitations and one of ordinary skill in the art would have understood the locations of the imaging devices and cameras to constitute an obvious design choice. Each of these additional claim limitations of claim 7 are addressed individually below.

- (a) **7. A device according to claim 6 wherein the plurality of light sources is symmetrical about the center line and includes a first light source located lateral to the first imaging array, a second light source located between the first and second imaging array, a third light source located between the third and fourth imaging arrays and symmetrical about the centerline to the second light source, and a fourth light source located opposite the first light source and lateral to the fourth imaging array.**

314. Daanen discloses a first light source located lateral to the first imaging array (marked L1 in yellow below), a second light source located between the first and second imaging array marked L2 in yellow), a third light source located between the third and fourth imaging arrays and symmetrical about the centerline to the second light source (marked L3 in yellow) and a fourth light source located opposite the first light source and lateral to the fourth imaging array (marked L4 in yellow). Ex. 1005 at p. 113



315. Even if Daanen did not disclose the specific locations of the light sources claimed in claim 7 of the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate light sources in any position that would illuminate the body sufficiently uniformly to avoid shadowing as noted in Voigt. Ex. 1003 at p. 983 (“Total in-depth object illumination was given special attention to prevent any artificial shadowing...”).

316. As set forth above, one of ordinary skill in the art seeking to image the entire body in a single pose without repositioning would have a reason to combine the multi-camera system of Daanen with the single-camera device disclosed in Voigt for measuring skin lesions to diagnose Melanoma.

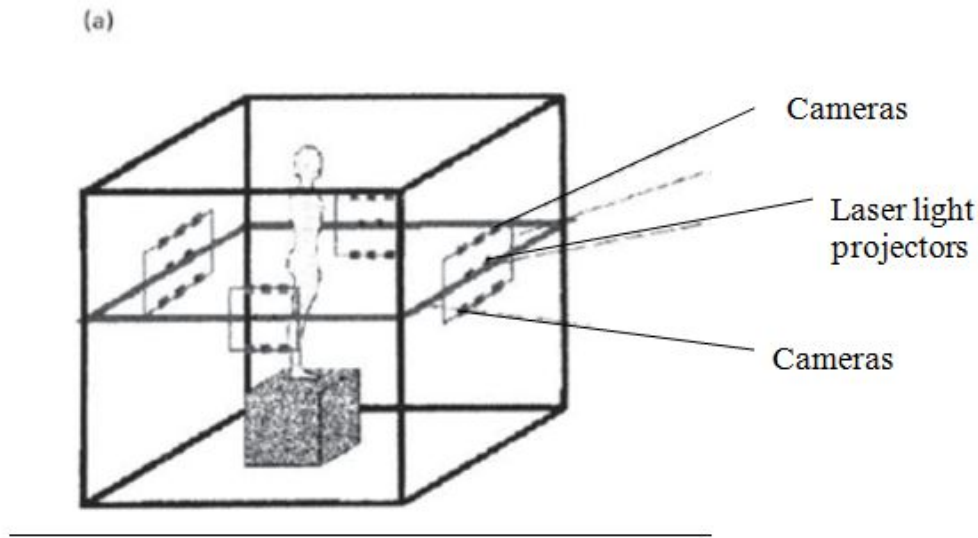
317. In view of the disclosures of Voigt, Hurley, Daanen, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 7 would have been obvious to a person of ordinary skill as of July 26, 2000.

318. Each of the eight whole body scanners disclosed in Daanen includes at least a plurality of imaging devices. Daanen describes a whole body scanner as consisting of:

- One or more light sources
- Cameras that capture the image of the projected light on the body;
- Software to extract the depth structure of the body surface from the images
- And a computer and screen to visualize the 3D surfaces.

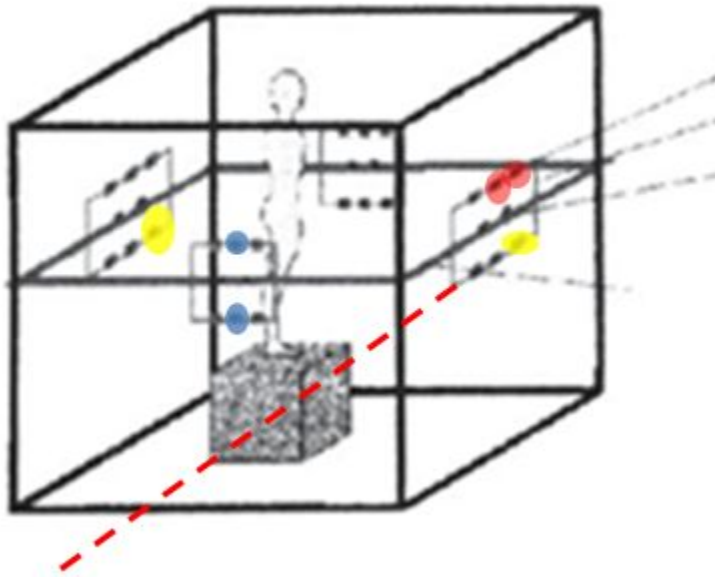
(Ex 1005 at 112).

319. Turning to a specific example, the Vitronic Viro 3D device discloses the use of 24 CCD cameras. Ex. 1005 at 115. These cameras are located on four scanning heads, with one scanner head placed on each wall of the enclosure as shown in the annotated Fig. 4a of Ex. 1005 shown below. Ex. 1005 at p. 113; 115.



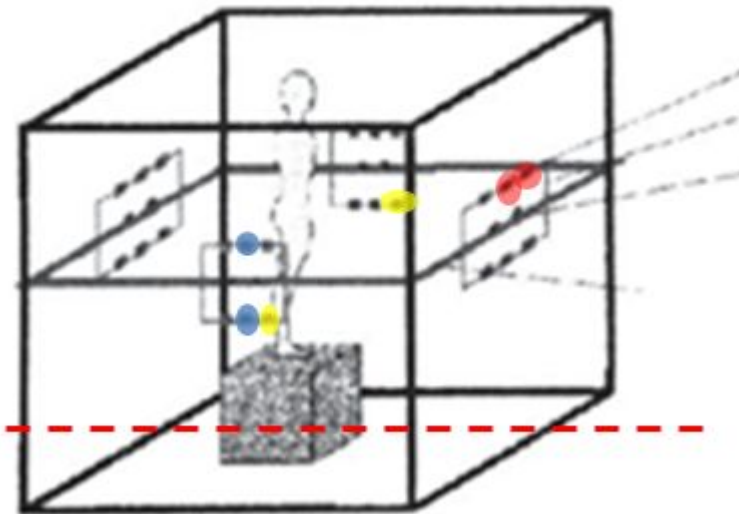
320. Daanen discloses that in the Vitronic system has an array of six cameras located on each side of an enclosure, arranged with a line of three cameras vertically spaced above three cameras. *Id* Using just one of the four sets of imaging arrays as an illustration, a plurality of imaging devices identified in blue in the annotated copy of Fig. 4a of Ex. 1005 below are vertically spaced relative to one another, a plurality of imaging devices identified in red are laterally spaced (or located to the side) relative to one another, and a plurality of imaging devices identified in yellow are located on opposite sides of the centerline (shown as a dashed line) of the specified imaging position relative to each other. Ex. 1005 at p. 113. The locations of these imaging devices are static and their distance relative to the specified imaging position (the box upon which the subject stands) is predetermined. In this analysis, the centerline divides the person being imaged from side to side.

(a)



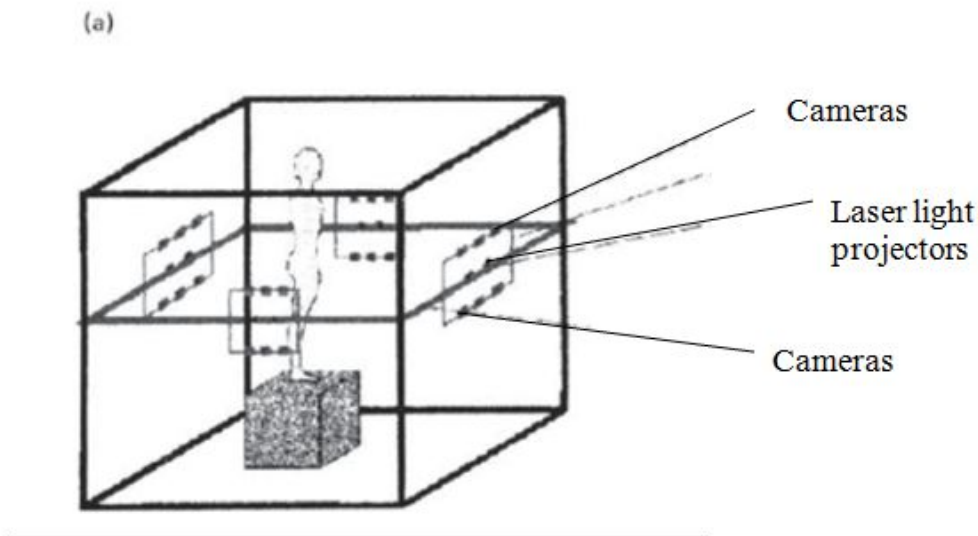
321. Similarly, if the centerline were to divide the person being imaged from front to back, the camera locations set forth in claim 1 would still be present as shown in the figure below.

(a)

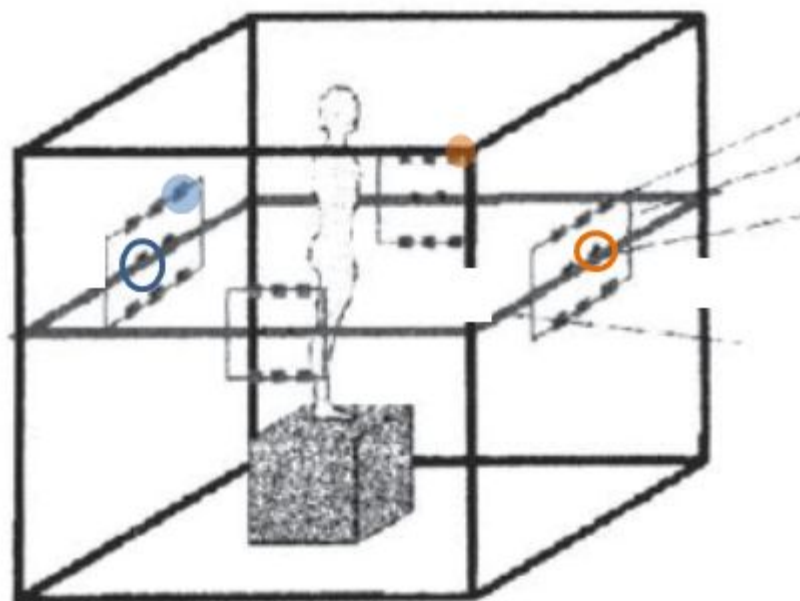


322. As set forth above, one of ordinary skill in the art seeking to image the entire body in a single pose without repositioning would have a reason to combine the multiple cameras of Daanen with the single-camera device disclosed in Voigt for measuring skin lesions to diagnose Melanoma.

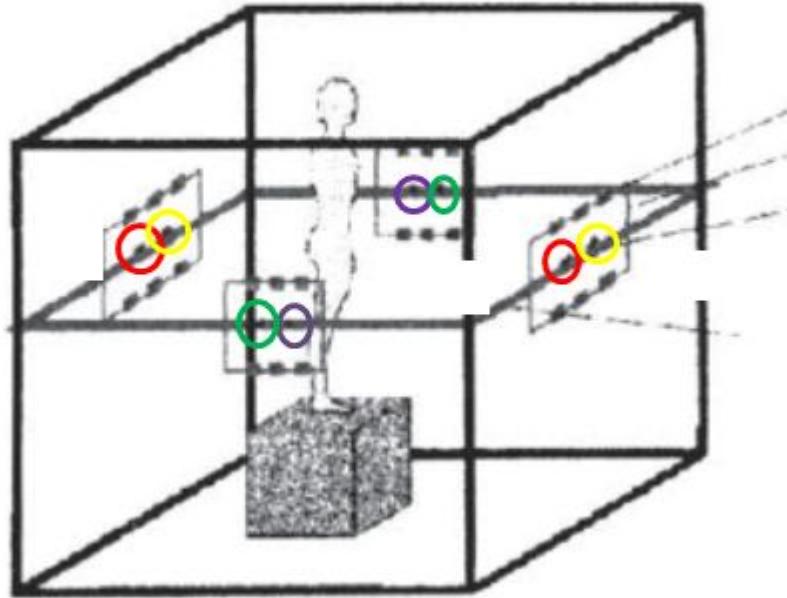
323. Daanen discloses a variety of locations for light sources in a variety of body scanner arrangements. In one example, describing the Vitronic Viro 3D scanner, Daanen discloses a plurality of light sources located amongst the plurality of imaging devices. Daanen describes that the cameras and laser lights of the Vitronic system are located on four scanning heads. Ex. 1005 at p. 115. Eight laser light sources are located along the scanning line, with 12 cameras located in a horizontal plane above the scanning line and 12 cameras located in a horizontal plane below the scanning line. *Id.* The image below demonstrates the locations of the cameras relative to the laser light sources. Accordingly, Daanen discloses a plurality of light sources located amongst the plurality of imaging devices.



324. Daanen discloses that, on each side of the enclosure, there are two rows of three cameras with two laser light sources located between the two rows of cameras. Ex. 1005 at p. 115. As shown in Figure 4a from Ex. 1005 reproduced below, both the laser light sources located on the same side of the enclosure as the respective cameras are centered to the side next to the cameras and are, thus, lateral to those cameras (one example highlighted in blue with a solid fill circle identifying the camera and an open circle identifying the laterally located laser light source). Similarly, the laser light sources located on the enclosure panels to the left and right of the individual cameras are also located lateral to those imaging devices (one example highlighted in orange with a solid fill circle identifying the camera and an open circle identifying the laterally located laser light source). Thus, Daanen discloses a device wherein at least two light sources are located lateral to at least two imaging devices.



325. Daanen discloses a device wherein at least two light sources are positioned symmetrically about the center line of the specified imaging position. Daanen discloses that, on each side of the enclosure, there are two rows of three cameras with two laser light sources located between the two rows of cameras. Ex. 1005 at p. 115. As shown in Figure 4a from Ex. 1005 reproduced below, because there are two light sources located on each of four sensor heads that are centered on each of the four panels of the enclosure, four light sources are located on each side of the centerline with a corresponding, mirror-image light sources. The corresponding light sources positioned symmetrically relative the center line (wherein the centerline is the frontal plane dividing the body from side to side) are color-coded in the figure below.



D. Obviousness of Claims 1, 4, 11, 33, 34, and 51 over Voigt in combination with Crampton

326. As set forth in section IX.A. above and in more detail below, Voigt discloses most of the claim limitations of claims 1 and 51 of the '748 patent. However, Voigt does not disclose the use of multiple cameras. While Voigt recognized that total body photography could be used for melanoma screenings, the device disclosed in Voigt allowed only for the capture of one side of a person's torso. *Id.* at 981-983. Thus, to perform the capture of both the front and back of the torso using the Voigt device, one would have to reposition the person being imaged.

327. Crampton Ex. 1006 was filed on December 22, 1997 claiming priority to an earlier application filed in Great Britain on December 24, 1996 and was published on July 2, 1998. This application discloses a free-standing booth or kiosk

used to capture a 3D image of the human body, specifically to create high-level surface avatars that represent the real person and describes several options for the location of cameras and lights.

328. Crampton notes that some prior art scanning machines are limited in scope to parts of a person such as the head or hand. Ex. 1006 at p. 1. Crampton explains that, in order to capture the entire body, it is necessary either to have multiple sensors or relative movement between the sensor and the person. *Id.* Crampton discloses several embodiments providing for different locations of cameras and lights, varying depending on the number of poses that one seeks to require to completely capture the body and the size of kiosk that one desires. Crampton explains that “to capture a person in one pose, cameras must be placed on at least 4 sides of the person.” Ex. 1006 at p. 9. Thus, one of ordinary skill in the art seeking to image the entire body in a single pose without repositioning would have a reason to combine the multi-camera system of Crampton with the single-camera device disclosed in Voigt for measuring skin lesions to diagnose Melanoma.

(i) Independent Claim 1

329. Claim 1 recites a device for imaging the body comprising an enclosure, a specified imaging position, multiple imaging devices in specified positions, and multiple light sources used to make precise measurement of objects

that have been imaged. Such a device would have been obvious to a person of ordinary skill in the art and was disclosed in the prior art. Each claim limitation is addressed below.

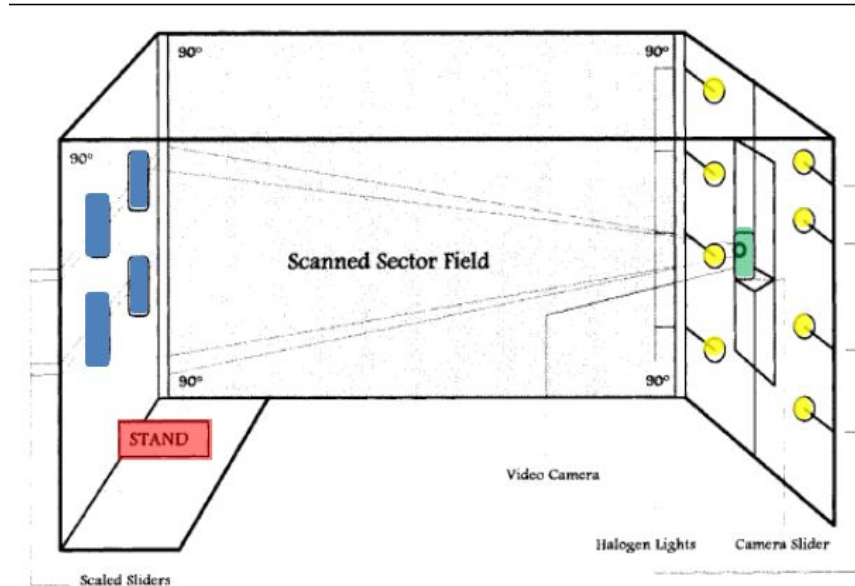
(a) A device for the identification of maladies that effect human tissue comprising:

330. Voigt discloses a device “to identify and evaluate changes of cutaneous lesions in melanoma screenings.” Ex. 1003 at p. 981. Use of the device allows for “digitized measurements of skin-surface image parameters” and quantitative image analysis of skin-lesion changes over time. *Id.* This constitutes a device for the identification of maladies that effect human tissue. Thus, it would have been obvious to one of ordinary skill in the art to use a device to identify maladies that effect human tissue.

(b) An enclosure configured to receive a person or portion thereof for imaging the person or portion thereof, wherein the enclosure defines a specified imaging position for placing the person or a portion thereof within the enclosure for imaging, and the specified imaging position defines a centerline.

331. Voigt discloses a schematic of a “position framework” shown in Figure 1 of Ex. 1003. This Figure shows an enclosure in which the person being imaged is located. Using this position framework, the “patient’s standing position was fixed at the thoracic and iliac level by symmetrically fitting the lateral extent of the trunk shape into horizontally adjustable scaled sliders of the position

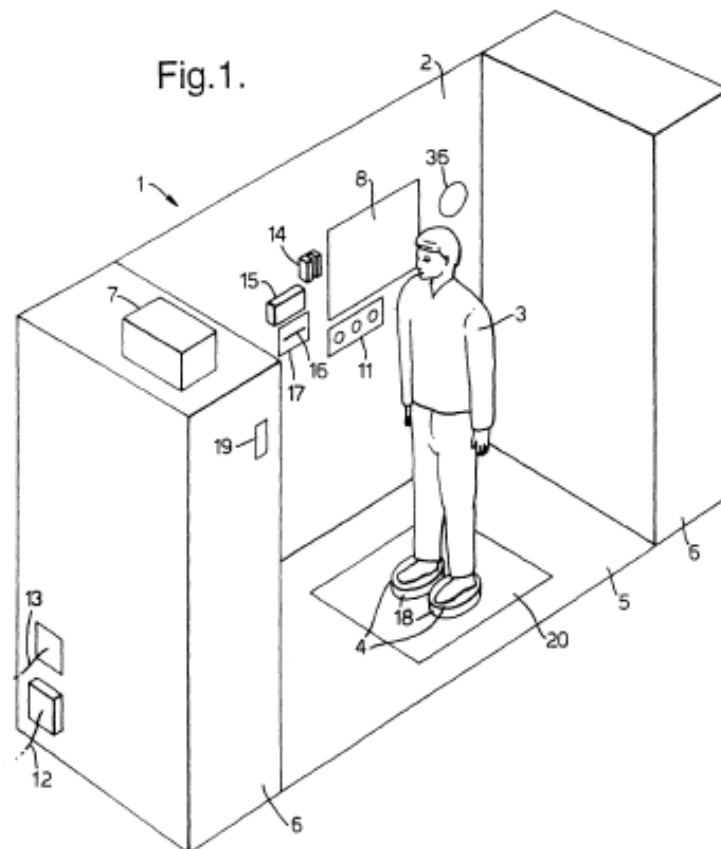
framework.” Ex. 1003 at p. 982. The positions of the adjustable sliders were recorded and identically readjusted for future measurements of the patient to ensure that the position was in the same specified imaging position. The stand where the person is located for imaging is highlighted in red below and the adjustable sliders are highlighted in blue. These elements constitute the specified imaging position. The lateral sliders are placed symmetrically about the person being imaged, defining a centerline.



332. Similarly, Crampton Ex. 1006 discloses a variety of different enclosures that constitute a specified imaging position that defines a centerline. For example, Crampton discloses a variety of different sizes of kiosks to generate a 3D avatar of a person. Ex. 1006 at p. 4; The kiosk “has a central area [2] for a person [3] to stand in.” *Id.* at p. 4. The kiosk includes “foot positioning guidance means [4]” “provided on the floor of the central area.” *Id.* The person stands in a specified

position with his feet positioned using the foot positioning guidance means. *Id.*

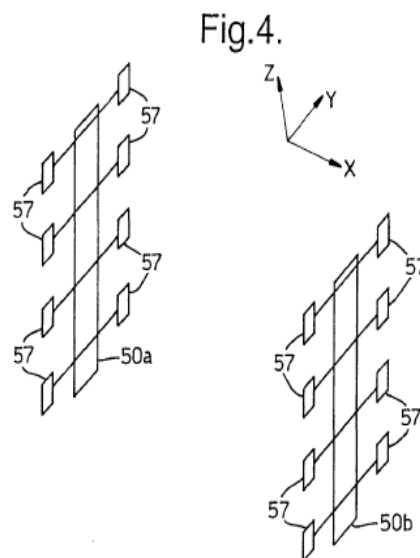
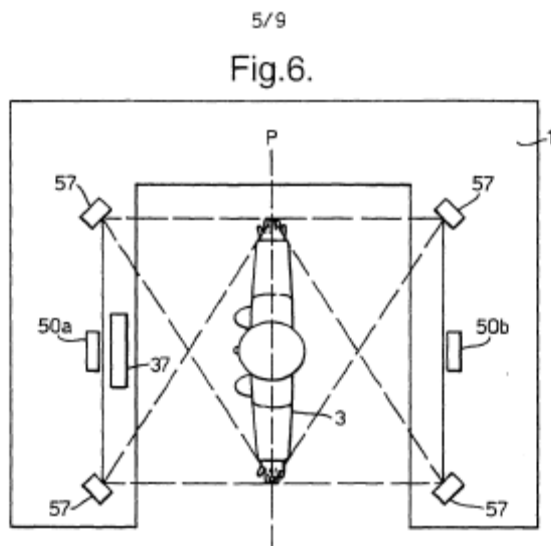
Two footprint graphics on the floor of the kiosk are disclosed as one example of foot positioning guidance means. *Id.* at p. 5. An example of the kiosk containing foot positioning guidance means [4] is shown in Figure 1 reproduced below. The foot positioning guidance means divide the kiosk along a centerline defined by the frontal plane of the body of the person being imaged.



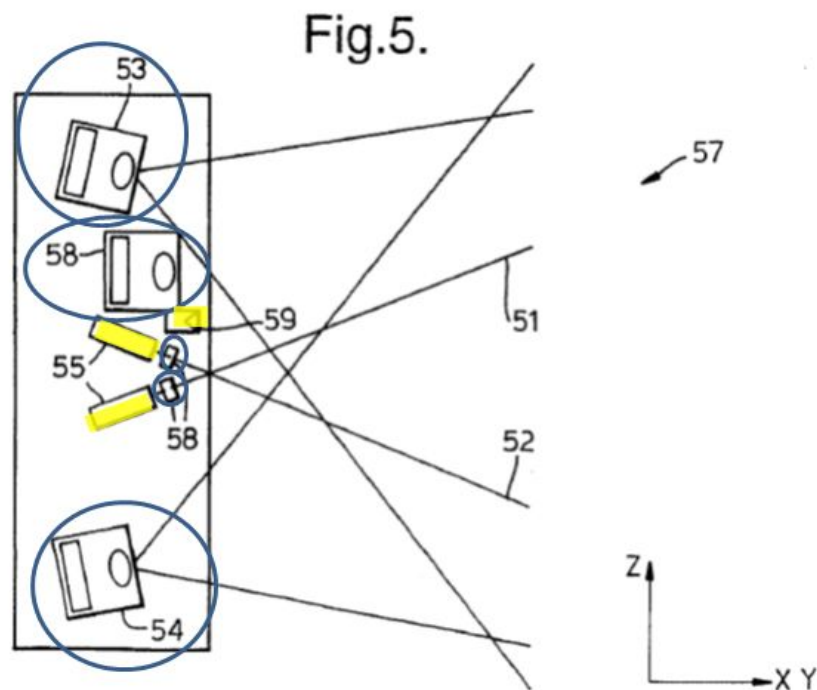
333. Thus, it would have been obvious to one of ordinary skill in the art to place a person to be imaged within an enclosure that comprises a specified imaging position that defines a centerline.

- (c) **A plurality of imaging devices, wherein a plurality of the imaging devices are vertically spaced relative to each other, a plurality of the imaging devices are laterally spaced relative to each other, a plurality of the imaging devices are located on opposite sides of the centerline of the specified imaging position relative to each other and each imaging device is located a predetermined distance relative to the specified imaging position.**

334. Crampton disclose a variety of kiosk arrangements that contain a plurality of imaging devices, many spaced vertically, laterally, or opposite the centerline of the specified imaging position from one another. For example, Crampton discloses one embodiment that includes two linear axes (50a and 50b) of sensors (57) shown in figure 4 below located on either side of the person in figure 6 reproduced below). Thus, Figure 6 shows a design in which four sensors are located in each corner of the kiosk.

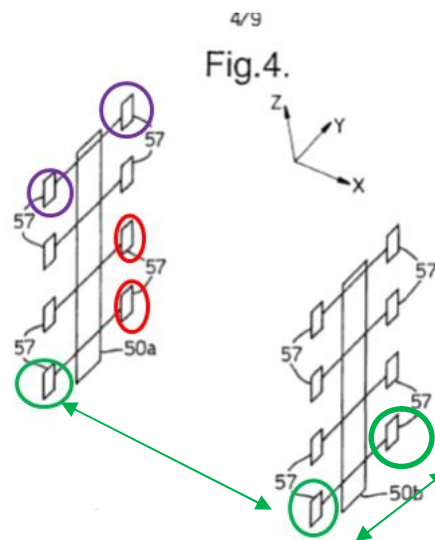


335. Each sensor may contain a variety of cameras, laser generators, colour cameras, and flash lights mounted. Ex. 1006 at pp. 7-8. Thus, Crampton discloses at least eight cameras and flash lights on each axis. One example of the location of cameras and flashes on a sensor is shown in Figure 5 reproduced below. Cameras are identified as 53, 54, and 58 circled in blue. *Id.* at p. 8. Laser stripe generators are identified as 55 and are highlighted in yellow. *Id.* Flash lights are identified as 59 and are also highlighted in yellow. *Id.*



336. Assuming just a single camera and flash located on each sensor in the sensor layout disclosed in Figures 4 and 6, Crampton discloses at least two imaging devices vertically spaced relative to each other (mounted on the sensors circled in red below), at least two imaging devices laterally spaced relative to

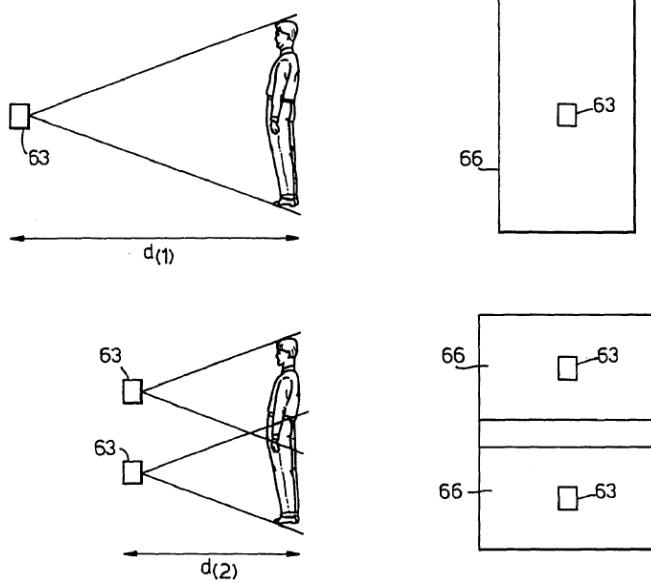
each other (mounted on the sensors circled in purple below), and at least two imaging devices located on opposite sides of the centerline of the specified imaging position (various alternatives shown by the green arrow using both frontal and from side) (those imaging devices mounted on the sensors circled in green below).



337. However, Crampton also notes that the positions of the sensors can be optimized to recover the maximum amount of the surface area of the person and that the invention is not limited to the specific arrangement of cameras described, but is applicable to any arrangement of cameras. *Id.* at 10, 14.

338. Crampton observes that the addition of cameras (63), and particularly in a vertical arrangement, permits imaging at greater resolutions. Ex. 1006, Crampton, pp. 10, Fig. 9. Crampton illustrates this greater resolution in Figure 9. *Id.*

Fig.9.



339. For the same reasons set forth in connection with Hurley, it would have been obvious to a person of ordinary skill in the art to modify the enclosure of Voigt to include additional cameras, as suggested by Crampton, having the vertical and lateral spacing of claim 1, in order to achieve the advantages of such total body, multi-camera systems.

340. Even if Crampton did not disclose the specific locations of the imaging devices claimed in the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate imaging devices in any position that would allow capture of the surface area of the body sought to be imaged.

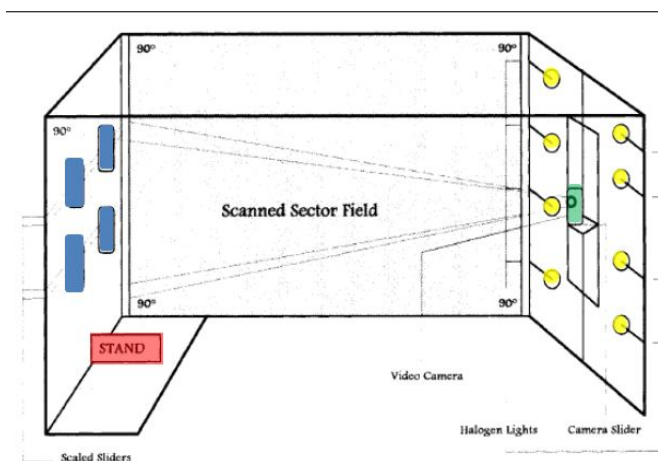
341. As discussed above, one of ordinary skill in the art would have had a reason to combine Voigt and Crampton to capture the entire body without

repositioning the person to be imaged. Thus, it would have been obvious to one of skill in the art to use a plurality of imaging devices located in positions around a person to be imaged, including those specific positions claimed in claim 1 of the '748 patent.

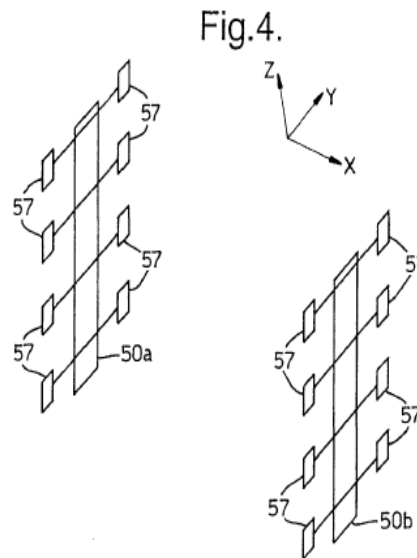
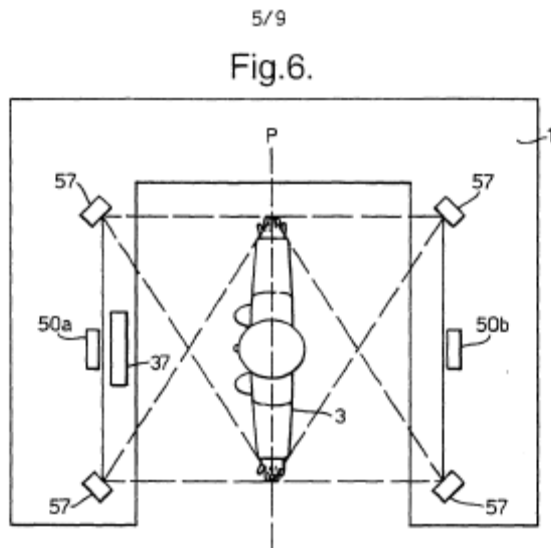
- (d) A plurality of light sources spaced relative to each other and peripheral to the plurality of imaging devices that illuminate the person or portion thereof located at the specified imaging position and generate refraction and reflectance light therefrom.**

342. Voigt discloses the use of a plurality of halogen light sources spaced relative to each other and peripheral to the plurality of imaging devices that illuminate the person or portion thereof located at the specified imaging positions. This plurality of light sources is identified in yellow below. Ex. 1003 at p. 982. Voigt notes that “total object illumination was given special attention to prevent any artificial shadowing.” Ex. 1003 at p. 983. One of ordinary skill in the art would recognize that the halogen lights used in Voigt generate refraction and reflectance light from the person or portion thereof located at the specified imaging position. These lights were located peripherally to the single camera and were spaced relative to each other. It would have been obvious to a person of skill in the art who added cameras to Voigt’s enclosure as suggested by Crampton to also replicate the illumination scheme for those cameras disclosed in Voigt. The result

would be a plurality of light sources having the spacing, locations and properties described in this claim.



343. Similarly, Crampton discloses a variety of whole body imaging devices that contain a plurality of light sources spaced relative to each other and peripheral to the plurality of imaging devices that illuminate the person or portion thereof located at the specified imaging position and that generate refraction and reflectance light therefrom. In the example shown in Figure 6, the light sources are flash lights, but Crampton also discloses the use of laser diodes. Ex. 1006 at p. 14. Because at least one camera and at least one light source are located on each sensor as configured in Figures 4, 5, and 6, the light sources are spaced relative to each other and located peripherally to the imaging devices. *Id.* One of ordinary skill in the art would understand that both the flash lights and the laser light sources of the Crampton design generate refraction and reflectance light from the person or portion thereof located at the specified imaging position.



344. Even if Crampton did not disclose the specific locations of the light sources claimed in the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate light sources in any position that would prevent artificial shadowing when imaging a person or portion thereof. Voigt Ex. 1003 at p. 983.

345. Thus, it would have been obvious to one of ordinary skill in the art to locate multiple light sources around the enclosure, including light sources spaced relative to one another and peripheral to the imaging device or devices as claimed in claim 1 of the '748 patent.

- (e) **Wherein each of said imaging devices generates an image of the illuminated person or portion thereof located at the second means, and defines respective coordinates and said respective predetermined distance relative to the second means, and defines a respective focal length and resolution information, allowing precise measurement of imaged features of the person or portion thereof located at the second means.**

346. Voigt discloses that its device and methodology are used to “capture and process detailed surface information for instant metric determinations of shape changes in multiple skin lesions in defined time periods.” Ex. 1003 at p. 987. The Voigt camera captured images of the front and back trunk areas. *Id.* at 983. This was accomplished by using a “specifically defined position framework for the patient’s positioning” and recording the locations of the camera and the position framework, thus defining the coordinates of the camera and the predetermined distance from the camera to the specified imaging position. *Id.* at 983; 987. Then, using the resolution of the camera and its focal length, the spatial image resolution was calculated to be 1 mm per pixel. *Id.* at 983. Based upon this information, the area and dimension of the skin lesions was measured. *Id.*

347. Similarly, Crampton discloses the use of the images captured by the cameras in the whole body imaging devices described to create a 3d model of the body. Ex. 1006 at p. 9. The locations of the cameras and the person being imaged

are known in each device and the x, y, and z coordinates of each point captured on the body are calculated. *Id.* at p. 7; 9.

348. Even if Voigt did not disclose the specific methodology for precise measurement claimed in claim 1 of the '748 patent, it would have been obvious for one of ordinary skill in the art to use known formulas to measure objects shown in the captured image.

349. Thus, it would have been obvious to one of ordinary skill in the art to use the coordinates of the cameras, the distance between the cameras and the specified imaging position, the resolution, and the focal length to measure features found in the captured images at least as precisely as the claimed invention.

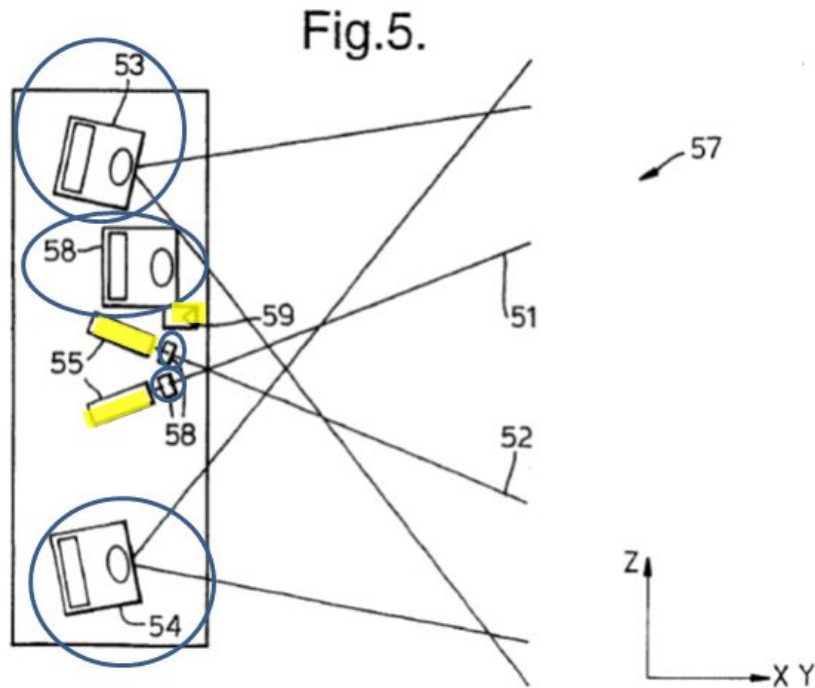
350. In view of the disclosures of Voigt, Daanen, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 1 would have been obvious to a person of ordinary skill as of July 26, 2000.

(ii) Dependent Claim 4

351. Claim 4 incorporates the limitations of claims 1, 2, and 3. Claim 4 is directed to the specific locations of light sources. Voigt in combination with Crampton discloses each of these claimed limitations and one of ordinary skill would have understood the locations of the light sources to constitute an obvious design choice. Each of the additional limitations of claims 2, 3, and 4 are addressed individually below.

(a) Claim 2 – A device according to claim 1 wherein the plurality of light sources is located amongst the plurality of imaging devices.

352. Crampton discloses a variety of locations for light sources in a variety of kiosk arrangements. Specifically, Crampton discloses in Figure 5, a plurality of light sources located amongst the plurality of imaging devices on just a single sensor, with 16 sensors being disclosed for use in the kiosk. Ex. 1006 at p. 8. In one sensor, at least three light sources (55 and 59 highlighted in yellow) are located amongst the plurality of cameras (53, 54, and 58 circled in blue).

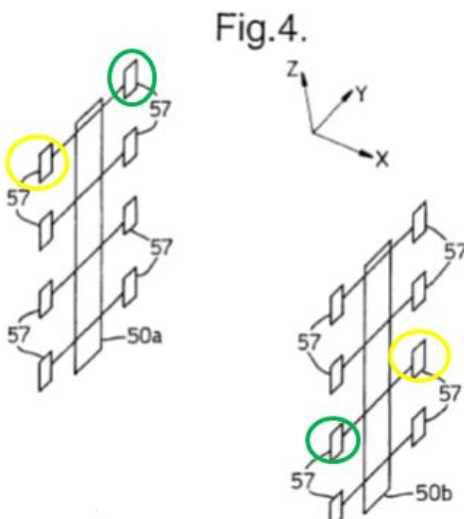


353. Accordingly, Crampton discloses a plurality of light sources located amongst the plurality of imaging devices.

354. Even if Crampton did not disclose the specific locations of the light sources claimed in claim 2 of the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate light sources in any location that would illuminate the person to be imaged to avoid shadowing as noted in Voigt. Ex. 1003 at p. 983 ("Total in-depth object illumination was given special attention to prevent any artificial shadowing...").

(b) Claim 3 – A device according to claim 2 wherein at least two light sources are located lateral to at least two imaging devices.

355. Crampton discloses a device wherein at least two light sources are located lateral to at least two imaging devices. As defined above, lateral means located at or issuing from the side. Crampton discloses two vertical axes of sensors, wherein each sensor contains at least one camera and at least one light source. Accordingly, at least the sensors located laterally to one another disclose at least two light sources located lateral to at least two imaging devices. In Figure 4 reproduced below, two examples showing a sensor containing at least one light source (circled in yellow) located laterally to a sensor containing at least one camera (circled in green). Thus Crampton discloses at least two light sources located lateral to at least two imaging devices.



356. Even if Crampton did not disclose the specific locations of the light sources claimed in claim 3 of the ‘748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate light sources in any location that would illuminate the person to be imaged to avoid shadowing as noted in Voigt. Ex. 1003 at p. 983 (“Total in-depth object illumination was given special attention to prevent any artificial shadowing...”).

(c) Claim 4 – A device according to claim 3 wherein at least two light sources are positioned symmetrically relative to the center line of the specified imaging position.

357. Crampton discloses a device wherein at least two light sources are positioned symmetrically about the center line of the specified imaging position. Crampton discloses two axes of sensor located on opposite sides of the centerline of the person being imaged. Ex. 1006 at p. 7; Figure 4. Each sensor contains at least one camera and at least one light. *Id.* at p. 8. Accordingly, Crampton discloses

at least eight light sources that are positioned symmetrically relative to the center line of the specified imaging position.

358. Even if Crampton did not disclose the specific locations of the light sources claimed in claim 4 of the '748 patent, it would have been an obvious design choice for one of ordinary skill in the art to locate light sources in any location that would illuminate the person to be imaged to avoid shadowing as noted in Voigt. Ex. 1003 at p. 983 ("Total in-depth object illumination was given special attention to prevent any artificial shadowing...").

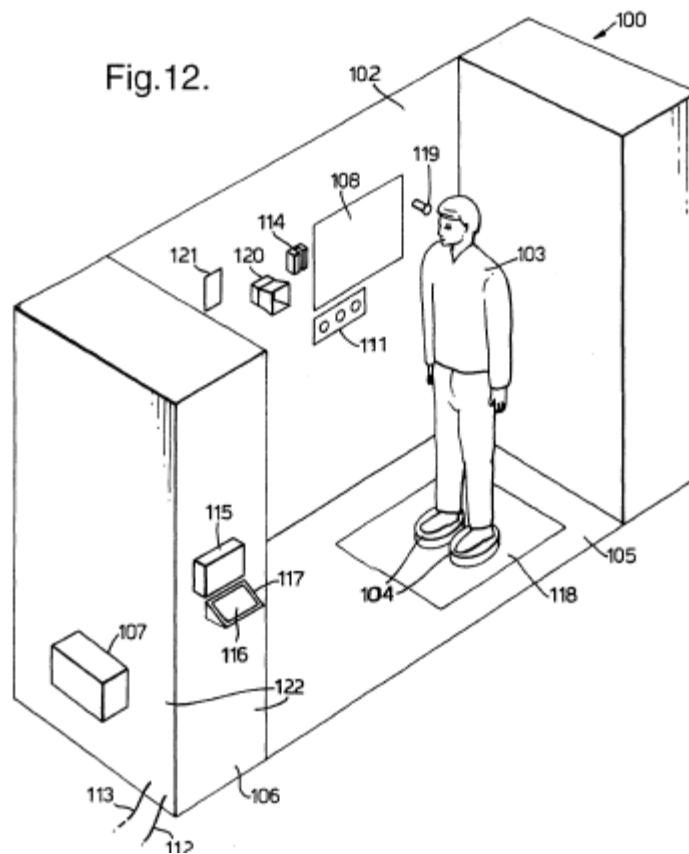
359. In view of the disclosures of Voigt, Crampton, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 4 would have been obvious to a person of ordinary skill as of July 26, 2000.

(iii) Dependent Claim 11

360. Claim 11 incorporates the limitations of claims 1 and 8 and identifies additional limitations regarding the panels of the enclosure. Crampton discloses each of these claimed limitations and one of ordinary skill in the art would have understood them to constitute an obvious design choice. Each of these additional claim limitations of claims 8 and 11 are addressed individually below.

- (a) **8. A device according to claim 1 wherein said enclosure is further comprised of panels that enclose said person or portion thereof in a radius selected from at least one of: 360 degrees on the vertical axis and 360 degrees on the horizontal axis.**

361. Crampton discloses multiple embodiments that constitute an enclosure comprised of panels that enclose said person in a radius of 360 degrees on the vertical axis. For example, Figure 12 shows an outline of the kiosk. The specification notes that Figure 12 shows one side removed, but the device encompasses the user in 360 degrees, with a gap enclosed by a curtain to allow entry. Ex. 1006 at p. 12. The enclosure with the front side removed is shown below.

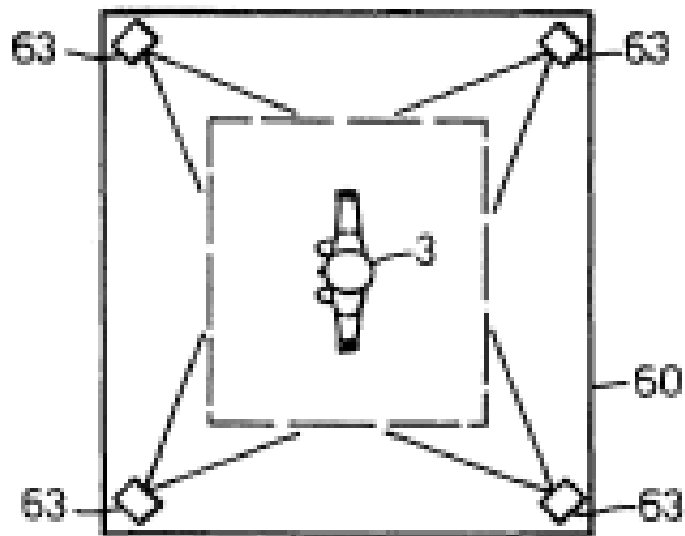


362. Even if Crampton did not disclose that the enclosure encompasses a person in a radius of 360 degrees on the vertical axis, it would have been an obvious design choice for one of ordinary skill in the art to do so.

(b) Claim 11 – A device according to claim 8 wherein said panels are further comprised of at least one imaging means.

363. Crampton discloses an enclosure according to claim 8 wherein the panels are further comprised of at least one imaging means. For example, in the Figure 7, Crampton discloses a kiosk in which a camera 63 is located in each wall. Ex. 1006 at p. 9; Fig. 7.

Fig.7.



364. In view of the disclosures of Voigt, Crampton, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 11 would have been obvious to a person of ordinary skill as of July 26, 2000.

(iv) Dependent Claim 33

365. Claim 33 depends from claims 30, which depends from claim 1. Claim 33 is directed to a display device capable of displaying said person or portion thereof in a visually perceivable form. This limitation is disclosed in both Voigt and Crampton. For that reason, claim 33 would have been obvious to one of ordinary skill in the art as of July 2000. Each limitation of claim 33 is addressed individually below.

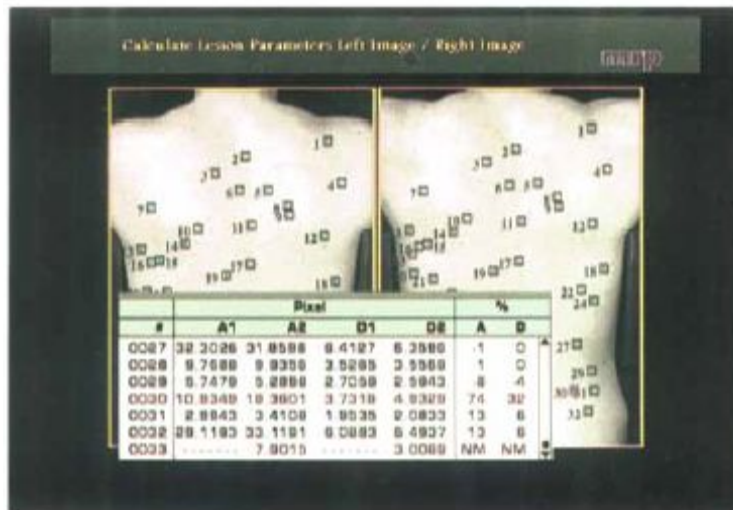
- (a) Claim 30 – A device according to claim 1 further comprising a display device for displaying one or more images generated by the plurality of imaging devices.**

366. Voigt discloses the use of a personal computer monitor to display the images generated by its single imaging device. Ex. 1003 at p. 982; Fig. 3.

367. Similarly, Crampton discloses a number of methods of viewing images generated by imaging devices. For example, Crampton discloses a display which can be a computer monitor, an LCD flatscreen, or any other type of pixel display technology connected to a computer for displaying the resulting avatar. Ex. 1006 at Abstract; p. 6.

- (b) Claim 33 – A device according to claim 30 wherein said display device further comprises a device capable of displaying said person or portion thereof in visually perceivable form.**

368. Voigt discloses the use of a computer monitor to display the imaged trunk of the body. Ex. 1003 at Fig. 3 (showing monitor display). Figure 3 is reproduced below.



369. Similarly, Crampton discloses a display which can be a computer monitor, an LCD flatscreen, or any other type of pixel display technology connected to a computer for displaying the resulting avatar. Ex. 1006 at Abstract; p. 6.

370. In view of the disclosures of Voigt, Crampton, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 33 would have been obvious to a person of ordinary skill as of July 26, 2000.

(v) Dependent claim 34

371. Claim 34 depends from claim 1 and includes the additional limitation that the device allows for viewing of said person or portion thereof in 360 degrees. Crampton discloses this limitation and one of ordinary skill in the art would have understood that it was obvious when imaging the whole human body to view the person or portion thereof that is being imaged in 360 degrees.

372. Crampton describes a variety of methodologies to fully capture and view the entire human body. Crampton is directed to the creation of lifelike Avatars for use in virtual environments. Ex. 1006 at p. 4. Crampton discloses a variety of kiosk designs that use a number of cameras to capture a person. *Id.* at p. 9. To capture the person in a single pose (*i.e.* without repositioning), Crampton discloses placing cameras on at least four sides of the person. *Id.*

373. With regard to viewing the captured image of the person, Crampton discloses a display means, including a computer monitor, large LCD flatscreen or any other form of pixel display technology that displays the resulting avatar. Ex. 1006 at p. 6. Thus, Crampton discloses a device that is capable of displaying said person or portion in 360 degrees.

374. As discussed above, one of ordinary skill in the art would have had a reason to combine Voigt and Crampton to capture and display the entire body in 360 degrees without repositioning the person to be imaged. Thus, it would have been obvious to one of skill in the art to provide the capability to view the person or person imaged in 360 degrees.

375. In view of the disclosures of Voigt, Crampton, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 34 would have been obvious to a person of ordinary skill as of July 26, 2000.

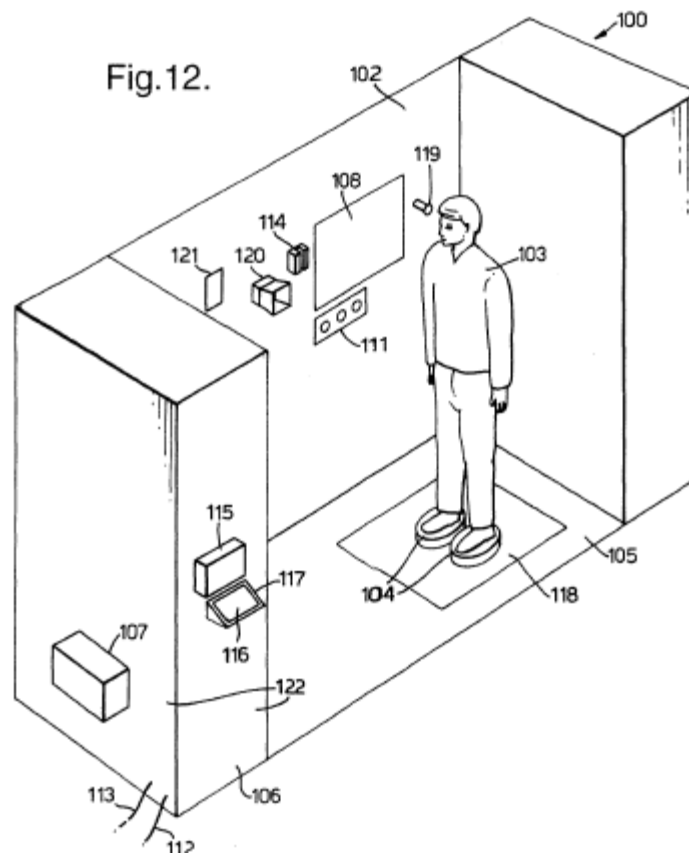
(vi) Independent Claim 51

376. As set forth above, Voigt discloses each limitation of claim 51 except for the use of a plurality of imaging means located as specified in claim 51.

377. As I have described in my discussion of claim 1 above, Crampton discloses a variety of embodiments containing a plurality of imaging means located as specified in claim 51.

378. Further, to the extent that the second means is deemed to include use of a visual indication where the person to be imaged is to stand, such a visual indication would have been obvious in light of the further combination of Crampton with Voigt. Crampton also discloses a whole body imaging system that positions the person to be imaged using floor markings (104). Ex. 1006 at p. 12 (“Markings [104] for foot positioning are provided on the floor [105] of the internal area.”) The use of these markings is shown in Figure 12 of Crampton shown below.

379. In view of the disclosures of Voigt, Crampton, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 51 would have been obvious to a person of ordinary skill as of July 26, 2000.



380. A person would have been motivated to use the floor markings in substitution of, or in combination with, the sliders disclosed in Voigt. Their use alone to designate the location on the stand at which the person would to be positioned would simplify the construction of the device by eliminating the need for the sliders. Their use in combination with the sliders would render more accurate the positioning of the person, and would speed the set up by indicating where the person was to stand before adjustment of the sliders was undertaken.

E. Obviousness of Claims 32 and 46 over Voigt in combination with Crampton and Dye

381. Each limitation of claims 32 and 46 would have been obvious to one of ordinary skill in the art as a substitution of known technology for their established functions as described in Dye, Exhibit 1007.

382. Dye, Exhibit 1007, is a PCT application WO 99/56249 published on November 4, 1999. Dye discloses an improved graphics controller for displaying 2d and 3d objects. Dye generally discusses the state of the art in 1999 regarding computer technology and accessories as used in graphics display. This state of the art includes the use of personal digital assistant devices as a display screen, the use of USB connections to connect one or more video devices to a computer, and the use of a keyboard as a control device. Each of these elements constitutes a known technology for viewing 2d and 3d objects.

383. The application of these known technologies to the full body imaging scanners of Crampton to make measurements of skin lesions in accordance with Voigt to diagnose melanoma would yield predictable results. Crampton discloses that the sensing equipment (cameras) are connected to computing means and that operator or user input means, such as a touch screen or keyboard, are connected to the computing means. Ex. 1006 at pp. 4-5. The substitution of the specific input means, display means, and connections between the sensing means and computer

for their established functions as disclosed in Dye constitute a simple substitution of known prior art elements for their established functions.

(i) Dependent claim 32

384. Dependent claim 32 incorporated limitations from claims 1 and 30. Dye discloses each of the additional limitations of claims 30 and 32. Thus, in combination with disclosure of claim 1 found in Voigt and Crampton as set forth in Section IV.B.2. above, claim 32 would be obvious to one of ordinary skill in the art. The individual limitations of claims 30 and 32 are addressed below.

(a) Claim 30 – A device according to claim 1 further comprising a display device for displaying one or more images generated by the plurality of imaging devices.

385. Voigt discloses the use of a personal computer monitor to display the images generated by its single imaging device. Ex. 1003 at p. 982; Fig. 3.

386. Similarly, Crampton discloses the use of a display to show the image resulting from the body scan. The display may be a computer monitor, a large LCD flatscreen, or any other form of pixel display technology to be used to display the resulting image from the data collection. Ex. 1006 at p. 6.

387. Dye discloses an invention directed to a graphics controller for video, 2d, and 3d graphics that includes video display monitors, which can include LCD screens or flat panel screens, a computer system, personal digital assistant devices (PDAs), consumer or Internet appliances, and other systems where video and/or

graphics images or information are displayed to a user. Ex. 1007 at p. 5, ll. 25-32; *see also* p. 6, ll. 15-24.

(b) Claim 32 – A device according to claim 30 wherein said display device further comprises a PDA (personal digital assistance).

388. As discussed in paragraph 142 above, Dye discloses that known display technology for displaying 2d and 3d graphics includes personal digital assistant devices (PDAs). Ex. 1007 at p. 5, l. 31. The use of such a device to display the images gathered by a body imaging device as disclosed in Crampton would merely constitute a simple substitution of one type of known display device (a PDA) for another type of known display device (a computer monitor). Such a substitution of a prior art technology for its established function would be obvious to one of ordinary skill in the art.

389. In view of the disclosures of Voigt, Daanen, Dye, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 32 would have been obvious to a person of ordinary skill as of July 26, 2000.

(ii) Dependent claim 46

390. Claim 46 depends from claim 1 and includes additional limitations directed to specific hardware and accessories used in the claimed device. Each additional limitation is disclosed in Dye as a known technology that could be

substituted in the body imaging systems disclosed in Crampton to obtain predictable results. The additional limitation of claim 46 is addressed below.

- (a) A device according to claim 1 further comprising a viewing device that includes at least one of a USB hub, an interfacing cable, a computer processor or like processor, a monitor, and a control device.**

391. Voigt discloses that its device performs digitized measurements using a plug-in set of a high-speed processor with an on-board coprocessor, and a high-resolution video camera source, a specifically designed image processing software, and position framework. Ex. 1003 at p. 982. The image processing software was installed on a personal computer. *Id.* Resulting images were viewed in a monitor display. *Id.* at Fig. 3, p. 983. When viewing, the user can select the setting for the binary threshold focus – which determines which lesions will be measured, and can select the elements to be displayed. *Id.* at p. 983-984; Figs. 2-3. Thus, Voigt discloses the use of a camera that is connected in some way to a computer containing a computer processor, a monitor, and some method for a user to control the device.

392. Similarly, Crampton discloses sensing equipment (static 3D cameras, laser stripe sensors, and colour cameras used with flashlights) connected to computing means. Ex. 1006 at Abstract; p. 4, 7. The computing means is connected to an operator input means (a touch screen surface, a keyboard, or a

panel with buttons). Ex. 1006 at Abstract; p. 4, 5. Crampton discloses that the computer performs a variety of image processing algorithms. *Id.* at p. 8-9. Thus, one of ordinary skill in the art would understand that Crampton discloses a device comprising a viewing device that includes at least one of a computer processor, some type of interfacing cable connecting the sensing means to the computing means, a monitor, and a control device.

393. Dye discloses a graphics system that includes a personal computer containing a processor, a display screen or monitor connected through an interface cable to the computer, and an input device such as a keyboard or a mouse. Ex. 1007 at pp. 8-9. Dye further discloses that USB (Universal Serial Bus ports) are a preferred method for connecting the computer to one or more video devices and to the display device for displaying 2d and 3d graphics. Ex. 1007 at p. 7, lines 19-24; 28-31; Fig. 2B. Dye merely discloses specific information regarding known technology able to perform the functions of connecting video devices and display devices to a computer. One of ordinary skill in the art would understand that this technology was either already used in Crampton and Voigt or could be substituted into those systems to perform its established function.

394. Even if Dye had not specifically disclosed the use of each of a computer processor, a monitor, a control device, an interfacing cable, and a USB hub for viewing images, it would have been obvious to one of ordinary skill in the

art to use such known technology to view images from a device for imaging a human body.

395. In view of the disclosures of Voigt, Daanen, Dye, and the knowledge of a person of ordinary skill in the art, the device claimed in Claim 46 would have been obvious to a person of ordinary skill as of July 26, 2000.

F. Obviousness of Claim 46 over Voigt in combination with Crampton, Dye, and Office World

396. As set forth in section VIII.E. above Voigt in combination with Crampton and Dye discloses each limitation of claim 46. Office World News reported on September 1, 1998 (Ex. 1014) regarding the growing use and acceptance of USB ports and hubs. USB provides a plug and play ability for users to connect peripherals. *Id.* “With USB, a person could hook up as many as 127 devices to the computer through a series of USB hubs.” *Id.* This is important when using multiple devices such as digital cameras. *Id.* Accordingly, in combination with Voigt, Crampton, and Dye, it would have been obvious to one of ordinary skill in the art to use the USB hubs discussed in Office World in the system created by the combination of Voigt, Crampton, and Dye to connect multiple digital cameras to the computer.

397. The use of USB hubs to connect peripheral devices such as digital cameras to a computer was a known substitute for prior connectors as of July 26, 2000. In view of the large number of digital cameras used by Daanen, USB hubs

would be an obvious choice for one of ordinary skill in the art to use in such a system.

X. CONCLUSIONS

398. For all of the foregoing reasons, it is my opinion that inventions claimed in claims 1-8, 11, 30, 32-34, 46, and 51 each would have been obvious to one of ordinary skill in the art.

399. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for cross examination within the United States during the time allotted for cross examination.

400. I reserve the right to supplement my opinions in the future to respond to any arguments raised by the owner of the '748 patent and to take into account new information as it becomes available to me.

All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on September __, 2017

A handwritten signature in dark ink, reading "Jan-Peter Muller". The signature is written in a cursive style with a long horizontal stroke extending from the end of the name.

Dr. Jan-Peter Muller

APPENDIX A

Materials Reviewed

Exhibit No.	Description
1001	U.S. Patent No. 7,359,748 (Drugge)
1002	File History for U.S. Patent No. 7,359,748
1003	Holger Voigt M.D. and Richarda Classen M.D., "Topodermatographic Image Analysis for Melanoma Screening and the Quantitative Assessment of Tumor Dimension Parameters of the Skin, " Cancer 1995 Fed; 75(4):981-988 ("Voigt")
1004	Jeffrey D. Hurly, Michelle H. Demers, Richard C. Wulpern, John R. Grindon, "Body Measurement System Using White Light Projected Patterns for Made-to-Measure Apparel," SPIE Vol. 3131, July 7, 1997, 212-223 ("Hurley")
1005	Heim A.M. Daanen and Jeroen van de Water, "Whole Body Scanners," Displays 19 (1998) 111-120. ("Daanen")
1006	PCT published application WO 98/28908 ("Crampton")
1007	PCT published application WO 99/56249 ("Dye")
1008	H.A.M. Daanen, <i>3-D Surface Anthropometry: accurate determination of body dimensions</i> , NATO Panel 8 RSG 24 Workshop on Emerging Technologies in Human Engineering and Testing & Evaluation, June 24-26, 1997
1009	Atkinson, Whittles Publishing, "Close Range Photogrammetry and Machine Vision" Ch. 11 "Medical photogrammetry," pp. 303-327 (1996)
1010	Curriculum Vitae of Dr. Jan-Peter Muller
1011	Deacon, Bhatia, and Jan-Peter Muller, "Evaluation of a CCD-based Facial Measurement System," Medical Informatics 16 pp. 213-228 (1991).
1012	Comer, R.P. <i>et al.</i> , Talking Digital, <i>Photogrammetric Engineering & Remote Sensing</i> , 1139 (December 1998)
1013	Manual of Photogrammetry (4 th Ed. 1980), published by the American Society of Photogrammetry at p. 801.
1014	"USB powers up for market thrust," Office World News, September 1, 1998.
1015	"What's the big deal about USB," Info-Tech Advisor Newsletter, January 12, 1999.