Paper 1

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

ROOFR INC.,
Petitioner

v.

PICTOMETRY INTERNATIONAL CORP.,
Patent Owner

_____

IPR2023-00436
Patent 9,183,538

_____

PETITION FOR *INTER PARTES* REVIEW

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Exhibit	Description
Ex. 1001	U.S. Patent No. 9,183,538 ("'538 patent")
Ex. 1002	File History of the '538 patent
Ex. 1003	Expert Declaration of Anthony Cummings
Ex. 1004	U.S. Pat. Pub. No. 2008/0262789 A1 ("Pershing-789")
Ex. 1005	U.S. Pat. Pub. No. 2007/0220174 A1 ("Abhyanker")
Ex. 1006	**INTENTIONALLY OMITTED**
Ex. 1007	**INTENTIONALLY OMITTED**
Ex. 1008	*Pictometry: aerial photography on steroids*, LET Staff, Law Enforcement Technology (July 2002) ("Pictometry")
Ex. 1009	U.S. Pat. Pub. No. 2009/0304227 A1 ("Kennedy")
Ex. 1010	*Roofer: Steep Roofing Inventory Procedures And Inspection And Distress Manual For Asphalt Shingle Roofs*, David M. Bailey, U.S. Army Corps of Engineers, CERL Tech. Rept. (December 1999) ("Bailey")
Ex. 1011	Excerpted Drawings From File History of Pershing-789
Ex. 1012	Declaration of Sylvia Hall-Ellis
Ex. 1013	*RSMeans Illustrated Construction Dictionary*, RSMeans 4th Ed. (2010) ("RSMeans")

GROUNDS OF CHALLENGE (37 C.F.R. § 42.204(b)(2))

No.	Ground for Challenge
1	Pershing-789 And Bailey Render Obvious Claims 1-5 And 8-13 Of The ’538 Patent
2	Pershing-789, Bailey And Abhyanker Render Obvious Claims 6-7 And 14-18 Of The ’538 Patent
3	Kennedy And Bailey Render Obvious Claims 1-5 And 8-13 Of The ’538 Patent
4	Kennedy, Bailey And Abhyanker Render Obvious Claims 6-7 And 14-18 Of The ’538 Patent

LIST OF CHALLENGED CLAIMS

Claims
Claim 1a: One or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems that when executed cause the one or more computer systems to:
Claim 1b: identify a geographic location of a roof;
Claim 1c: determine a footprint and predominant pitch of the roof by analyzing one or more image showing the roof;
Claim 1d: determine an estimated roofing area of the roof based on the predominant pitch and the footprint of the roof;
Claim 1e: and generate a roof report for determination of an amount of materials needed for a construction project, wherein the roof report includes at least one image showing the roof and the estimated roofing area of the roof.
Claim 2: The one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems of claim 1, that when executed further cause the one or more computer systems to determine contact information of one or more contractors within a region of interest of the geographic location of the roof, and to provide a roof report, wherein the roof report includes one or more ortho images of the roof one or more oblique images of the roof, the estimated roofing area and the contact information of one or more contractor within the region of interest of the geographic location of the roof.
Claim 3: The one or more non-transitory computer readable medium of claim 2, wherein the roof report includes contact information of the customer.
Claim 4: The one or more non-transitory computer readable medium of claim 1, wherein the one or more non-transitory computer readable medium comprises a first non-transitory computer readable medium of a first host system and a second non-transitory computer readable medium of a second host system.

Claims
Claim 5: The one or more non-transitory computer readable medium of claim 1, wherein identifying the geographic location of the roof further comprises obtaining contact information of a customer.
Claim 6: The one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems of claim 1, that when executed further cause the one or more computer systems to receive customer input to validate geographic location of the roof.
Claim 7: The one or more non-transitory computer readable medium of claim 6, wherein the geographic location includes coordinates and validation of the geographic location includes instructions for receiving customer input to alter one or more coordinates of the geographic location.
Claim 8: The one or more non-transitory computer readable medium of claim 1, wherein identifying a geographic location of the roof includes identifying one or more edges of the roof in an image.
Claim 9: The one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems of claim 1, that when executed further cause the one or more computer systems to identify edges of the roof; determine three-dimensional information of the edges including position, orientation and length using multiple oblique images from multiple cardinal directions; and, determine, automatically, one or more line segments forming a portion of a footprint of the roof utilizing position and orientation of the edges.
Claim 10: The one or more non-transitory computer readable medium of claim 1, wherein determining the predominant pitch includes determining a plurality of pitch values with each pitch value associated with a portion of the roof, the predominant pitch based on the plurality of pitch values.
Claim 11: The one or more non-transitory computer readable medium of claim 10, wherein each pitch value is associated with an estimated percentage of roof area to provide an average pitch value.
Claim 12: The one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems of claim 1, that when executed further cause the one or more computer systems to provide the roof report to one or more

Claims
contractors, the contractor located within the region of interest of the geographic location of the roof.
Claim 13a: A system, comprising: two or more host systems, each host system having one or more non-transitory computer readable medium;
Claim 13b: the non-transitory computer readable medium of the first host system storing a set of computer executable instructions that when executed by one or more processors causes the one or more processors to:
Claim 13c: identify a geographic location of a roof;
Claim 13d: determine contact information of at least one contractor within a region of interest about the geographic location of the roof
Claim 13e: the non-transitory computer readable medium of the second host system storing a set of computer executable instructions that when executed by one or more processors causes the one or more processors to:
Claim 13f: determine a footprint and predominant pitch of the roof by analyzing one or more image showing the roof
Claim 13g: determine an estimated roofing area based on the predominant pitch and the footprint of the roof; and,
Claim 13h: generate a roof report for determination of an amount of materials needed for a construction project, wherein the roof report includes one or more ortho images of the roof, one or more oblique images of the roof, the estimated roofing area and contact information of one or more contractors within the region of interest.
Claim 14a: A roofing estimate method, comprising: receiving, by at least one computer processor from a user via a user terminal, a geographic location of a roof
Claim 14b: providing to the user, with the computer processor, imagery of the roof based on the geographic location of the roof
Claim 14c: determining and providing, with the computer processor, an estimated roofing area based at least on a predominant pitch and a footprint of the roofby analyzing one or more image showing the roof, the footprint of the roof determined at least in part using at least one image of the roof, and
Claim 14d: generating, with the computer processor, a roof report for determination of an amount of materials needed for a construction project,

Claims
wherein the roof report includes at least one image showing the roof and the estimated roofing area of the roof.
Claim 15: The roofing estimate method of claim 14, wherein the roof report further includes contact information of one or more contractor within a region of interest of the geographic location of the roof.
Claim 16: The roofing estimate method of claim 14, wherein the footprint of the roof is determined at least in part with oblique images of the roof.
Claim 17: The roofing estimate method of claim 14, wherein the predominant pitch value of the roof based at least in part on the footprint of the roof as a boundary of the roof.
Claim 18: The roofing estimate method of claim 14, wherein the predominant pitch is based on a weighted average of individual pitch factors for two or more portions of the roof.

I. INTRODUCTION

For many decades, roofers used age-old measurement techniques to generate estimates for roof repair and replacement. These techniques include estimated dimensions such as length, roof area and roof pitch (sometimes called slope), which allow roofers to approximate the size of a roof and, consequently, the amount of materials needed for a given project. Prior art roof measurement techniques also included the claimed "predominant pitch" measurement—*i.e.*, a weighted average of roof pitch values, which the examiner here believed to be missing.

The '538 patent claims nothing more than applying these well-known measurement techniques to aerial images of roofs stored on a computer, rather than sending workers to make estimates by hand. But even the computer automation recited in the '538 patent claims is not new. The prior art disclosed such automation years before the '538 invention. For example, Pershing-789, published in 2008, expressly discloses generating roofing estimates using aerial imagery. As described below, the prior art expressly teaches each and every element recited in the challenged claims. Accordingly, claims 1-18 of the '538 patent should be found unpatentable.

II. LEVEL OF SKILL IN THE ART

A person of ordinary skill in the art at the time of the alleged invention would have bachelor's degree in architecture or an equivalent with at least five years of experience performing roof estimation. This level of skill is approximate, and more experience would compensate for less formal education, and vice versa. Ex. 1003 at ¶¶ 1-7.

III. CLAIM CONSTRUCTION

Petitioner submits that express interpretations of the challenged claims of the '538 patent are not necessary, as the challenged claims are rendered unpatentable by the cited art under any reasonable interpretation of the claims. Petitioner takes no position in this petition as to whether the claims are indefinite, and no statements herein should be interpreted to mean that the terms are definite. Ex. 1003 at ¶ 15.

IV. OVERVIEW OF THE '538 PATENT

The '538 patent is generally directed towards a "system and process for roof measurement" using an image of a roof. Ex. 1001 at Abstract. The challenged claims generally recite: (1) identifying a location of a roof; (2) determining the footprint of a roof; (3) identifying the ***predominant pitch*** of the roof by analyzing an image of the roof; (4) determining an estimate of the

roofing area; (5) generating a report estimating the amount of materials needed for a construction project. Ex. 1001 at claim 1.

The specification of the '538 patent includes exemplary flow charts describing the alleged invention. For example, Figure 6 shows a general flow diagram of the process recited in the claims:

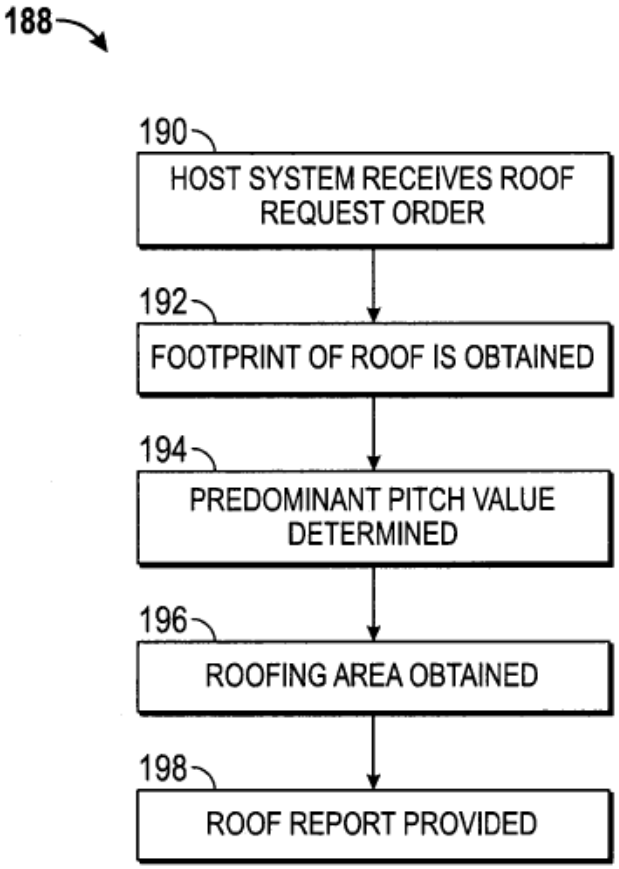


FIG. 6

Ex. 1001 at Fig. 6.

Figure 8 (split into two parts) shows a roof report:

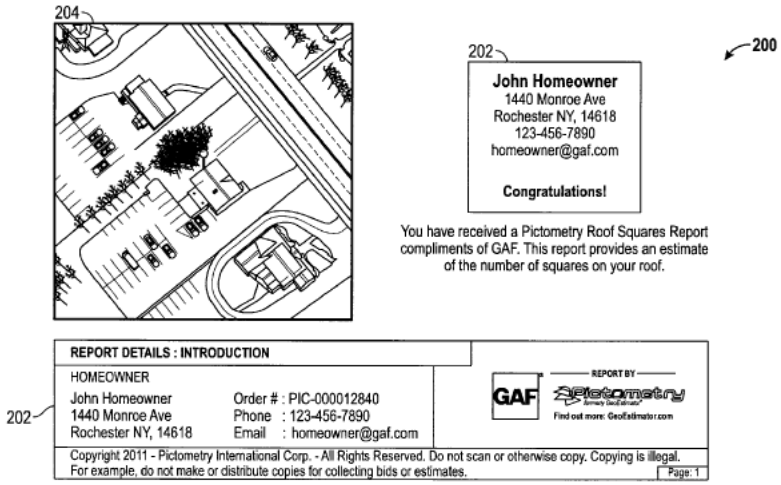


FIG. 8

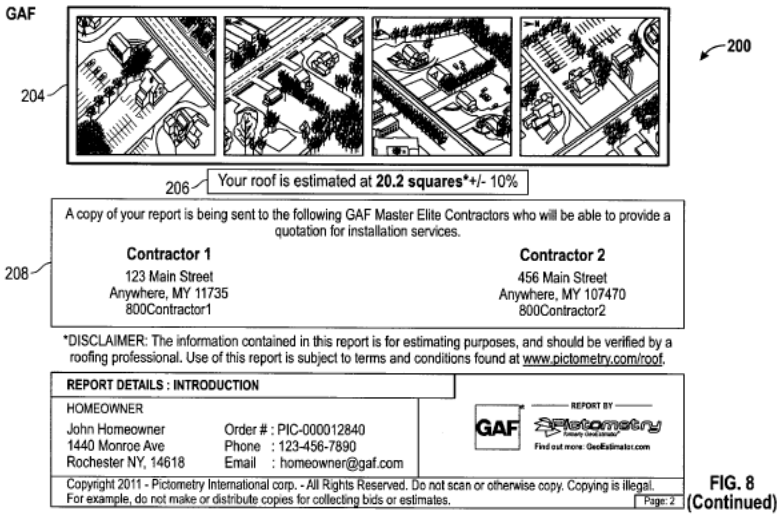


FIG. 8 (Continued)

Ex. 1001 at Fig. 8; Ex. 1003 at ¶¶ 16-17.

V. PROSECUTION OF THE '538 PATENT

The application that led to the '538 patent was filed on March 19, 2012. On April 16, 2014, the Examiner issued a Non-Final rejection finding that the recited claims were unpatentable under § 101, and anticipated by Como (US 2002/00897332), and rendered obvious by Como in view of Thornberry (US

20210/0296693). In response, applicant amended the claims to recite "one or more non-transitory computer readable storage medium" to address the § 101 rejection. Ex. 1002, August 15, 2014 Argument at 10-11. Applicant further argued that Como does not teach computer executable instructions for identifying a location of a roof, determining a footprint of a roof, determining a predominant pitch, and determining an estimated roofing area. *Id.* at 12. Applicant asserted that Thornberry does not disclose "predominant pitch," suggesting Thornberry was limited to "pitch direction" only. *Id.* at 13-14.

The examiner issued a Final Rejection finding the claims unpatentable under § 101. *Id.*, November 28, 2014 Final Rejection. The Examiner stated that the prior art does not disclose "predominant pitch," which "involves a weighted average of individual pitch factors for two or more portions or a roof." *Id.* at 4.

Applicant responded by arguing § 101 does not invalidate the claims and amended the claims to require "determining" a roofing area based on "predominant pitch." *Id.*, May 27, 2015 Argument at 21. The examiner issued a Notice of Allowance thereafter, finding that the prior art did not disclose "determing[ing] an estimated roofing area of the roof based on the

predominant pitch and the footprint of the roof." *Id.*, Notice of Allowance at 5.

Thus, the examiner ultimately issued the claims based on the perceived lack of a disclosure of determining the "predominant pitch" of a roof in the prior art. As discussed below, this limitation is expressly taught by Bailey. Ex. 1003 at ¶¶ 18-21.

VI. PRIORITY DATE OF THE '538 PATENT

The application that led to the '538 patent was filed on March 19, 2012. The '538 patent does not claim priority to any earlier applications. The references relied upon in the Grounds of this petition all qualify as prior art based on the '538 patent's March 19, 2012 filing date.

VII. PRIOR ART

A. Pershing-789

Pershing-789 is a U.S. Patent Publication published on October 23, 2008. Accordingly, Pershing-789 qualifies as prior art to the '538 patent under pre-AIA § 102(b). Pershing-789 discloses a "system that allows the remote measurement of the size, geometry, pitch and orientation of the roof…and then uses the information to provide an estimate to repair or replace the roof, or to install equipment thereon." Ex. 1004 at Abstract, [0003].

Pershing-789 discloses receiving first location data, such as an address (Ex. 1004 at [0011]), and displaying an aerial image of the address in question to enable roof measurement:

> The software program 50 is linked to ***an aerial image file database 52 that contains aerial images files 54*** of various building 92 in a region. The aerial image files 54 may be taken any available means, such as an aircraft, balloon, a satellite, etc. ***As shown in FIG. 3, the image files*** 54 typically include at least one a top plan view 65 and a perspective view 66 of the building 92.

Id. at [0022] (emphasis added). Pershing-789 discloses, after taking measurements of the roof in question, generating a report: "From these determinations, the overall shape, slopes and square footage of the roof sections are determined and a ***report*** is produced." Ex. 1004 at [0012] (emphasis added). An exemplary report is shown in Figure 5C:

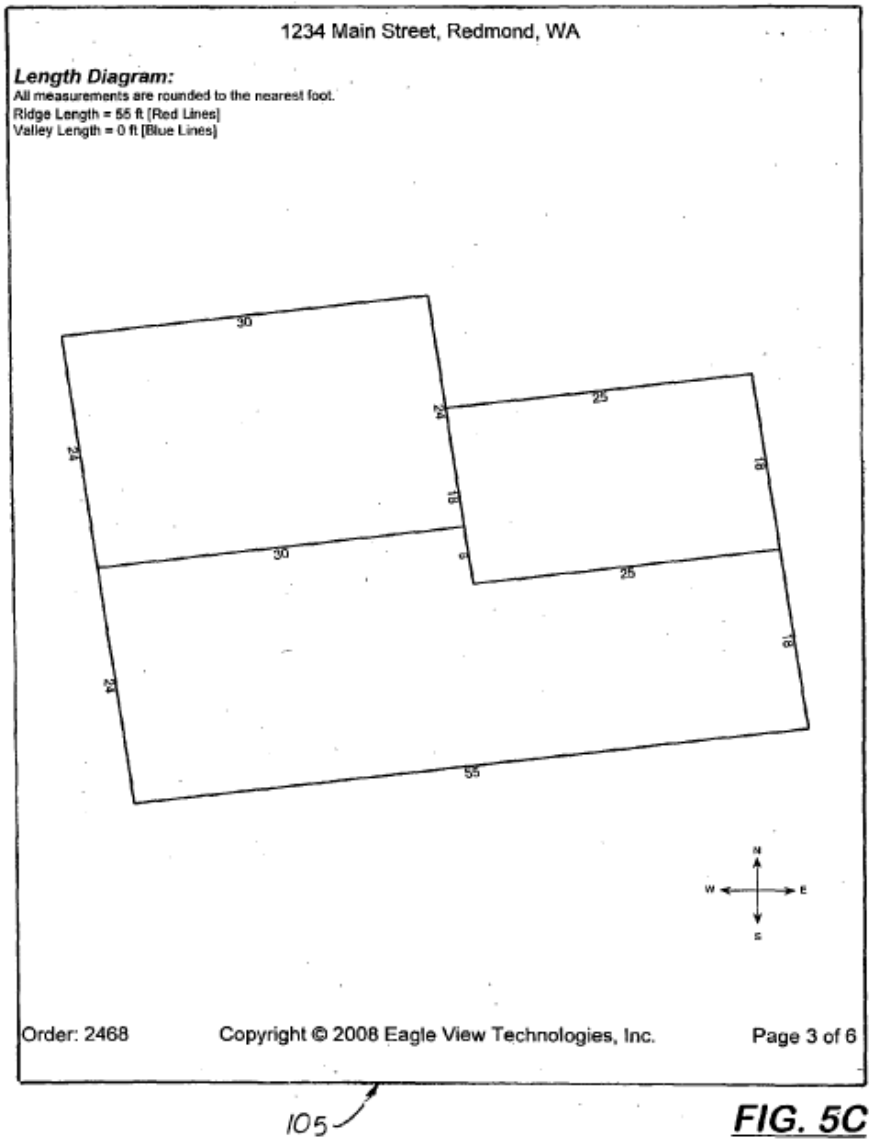


FIG. 5C

Ex. 1004 at Fig. 5C; *id.* at [0038]; Ex. 1003 at ¶¶ 23-25.

B. Abhyanker

Abhyanker is a U.S. Patent Publication published on September 20, 2007. Accordingly, Abhyanker qualifies as prior art to the '538 patent under pre-AIA § 102(b). Abhyanker discloses a system that allows "***marker placement in a mapping environment***." Ex. 1005 at Abstract (emphasis

added). Abhyanker discloses that its mapping environment may include, *e.g.*, "***aerial photography*** over neighborhoods and/or places in a terrestrial environment (e.g., the Earth)." Ex. 1004 at [0005] (emphasis added). Abhyanker teaches a "marker" (e.g., a pushpin, an indicator, a pointer, a pin, etc.) may be placed on a landmark in the aerial image by an algorithm. *Id.* at [0004].

Abhyanker notes that, in some cases, an algorithm may not correctly place the marker. Abhyanker explains that the algorithm may mistakenly "place [a] marker nearby, but not precisely on, a correct rooftop" or other landmark. *Id.* at [0005]. This glitch may cause problems because, for example, a misplaced marker may result in incorrect driving directions and would result in customer disappointment. *Id.*

Abhyanker teaches remedying marker misplacement by allowing a user to "drag and drop" a market to a corrected location:

> Furthermore, the method may include applying a ***drag and drop*** algorithm that enables the user to sequentially and/or concurrently relocate markers in the mapping environment, iteratively performing additional verifications when any particular marker has been previously moved[.]

Ex. 1005 at [0011] (emphasis added). Abhyanker further teaches that, once the marker has been placed by a user, the user may "lock" the location of a marker, confirming its placement:

> The locking module 220 may process a marker ***locking request*** when the particular user claims the wiki profile associated with the address data. In addition, the locking module 220 may enable the user(s) to control the future relocation of the marker in the mapping environment.

Id. at [0064] (emphasis added); Ex. 1003 at ¶¶ 26-29.

C. Bailey

Bailey is a printed publication published December 1999. Accordingly, Bailey qualifies as prior art to the '538 patent under pre-AIA § 102(b).

Bailey is a printed publication. As set forth in the accompanying declaration of Dr. Hall-Ellis, Bailey qualifies as a printed publication because it was published in December 1999 and publicly available on or shortly after July 24, 2000. Specifically, Petitioner's librarian expert, Dr. Hall-Ellis, verified that Bailey was available first by confirming its availability at the U.S. Army Corps of Engineers headquarters Library—her research confirmed Bailey was made part of the OCLC bibliographic database on July 24, 2000. Dr. Hall-Ellis also verified that Bailey was available by at least January 29, 2001 at the University of Wisconsin – Madison Libraries. Ex. 1012 at ¶ 67.

Dr. Hall-Ellis further confirmed Bailey's availability by downloading Bailey's corresponding MARC records. Ex. 1012 at ¶¶ 67-71. Moreover, a publication of the U.S. Army Corps of Engineers, Bailey is inherently reliable and trustworthy. *See, e.g., Ericsson Inc. v. Intellectual Ventures I LLC*, IPR 2014-00527, Paper 41 at 11-12 (PTAB May 18, 2015) ("[a]llowing IPR petitioners to rely on" publication dates from well-known sources "serves the interests of justice").

Bailey is also authentic. As noted above, Dr. Hall-Ellis obtained a copy from the University of Wisconsin—this is the ***same*** copy relied upon in this petition. Dr. Ellis confirmed the authenticity of this reference by comparing the attached copy to the version she obtained from the University of Wisconsin. Ex. 1012 at ¶ 66. Dr. Hall-Ellis found Ex. 1010 to be complete, with no pages missing, the text on each page flowing seamlessly and "no visible alternations" creating "no suspicion about its authenticity." Additionally, pursuant to FRE § 901(b)(8), Ex. 1010 qualifies as an "ancient document," and is, for this additional reason, authentic.

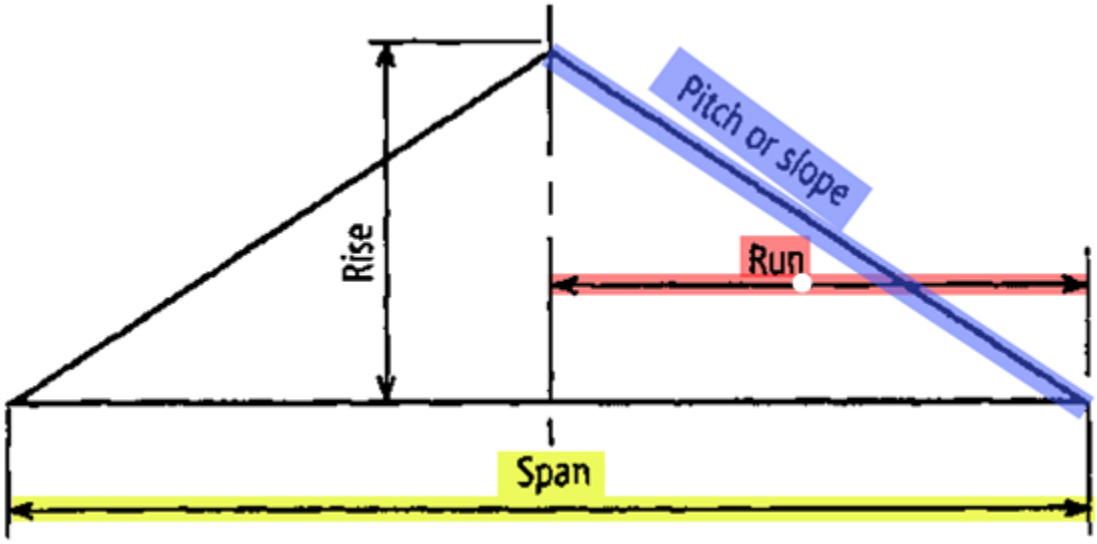
Bailey discloses steep roofing inventory procedures and inspection techniques. Baily generally teaches methods for collecting data about a roof, including the "***predominant slope***" of the roof:

> Section 33 - Slope. The ***predominant slope*** of the roof section. The roof plan will ***generally indicate the slope*** (e.g., 4 in. in 12). If the slope is not noted on the roof plan, the section drawings may indicate the slope. If such information is not available, field measurement will be required (use the method in Appendix B).

Ex. 1010 at 17 (emphasis added); *see also id.* at 15 (showing a "primary" slope at entry line 33).

Bailey explains that "slope" and "pitch" are equivalents, both describing the "degree of incline" of a roof. Ex. 1006 at 134 ("The degree of incline a roof possess is usually expressed as its ***'pitch' or 'slope.'***") (emphasis added).

Bailey explains that pitch uses the entire span of the roof (*i.e.*, the entire length of the base of the roof) to express this incline, and slope uses the run of the roof (*i.e.*, half the length of the base of the roof), but, as shown in Figure 14 of Bailey, both pitch and slope represent the ***same thing***—the degree of incline of the roof:



Id. at Fig. 14 (annotated), 134-35.

As Bailey further explains, pitch and slope are interchangeable for purposes of area calculations: "Whether a particular roof incline is expressed in pitch or slope, ***the results of area calculations will be the same***." *Id.* at 134 (emphasis added).

Bailey explains that finding the "predominant slope [*i.e.*, pitch]" for a "roof section"—a "roof section" means any roofing area of 10,000 square feet or less—for example, Bailey teaches that "all exposed roof areas on the building shown in Figure 2 would comprise ***one roof section***" (*id.*):

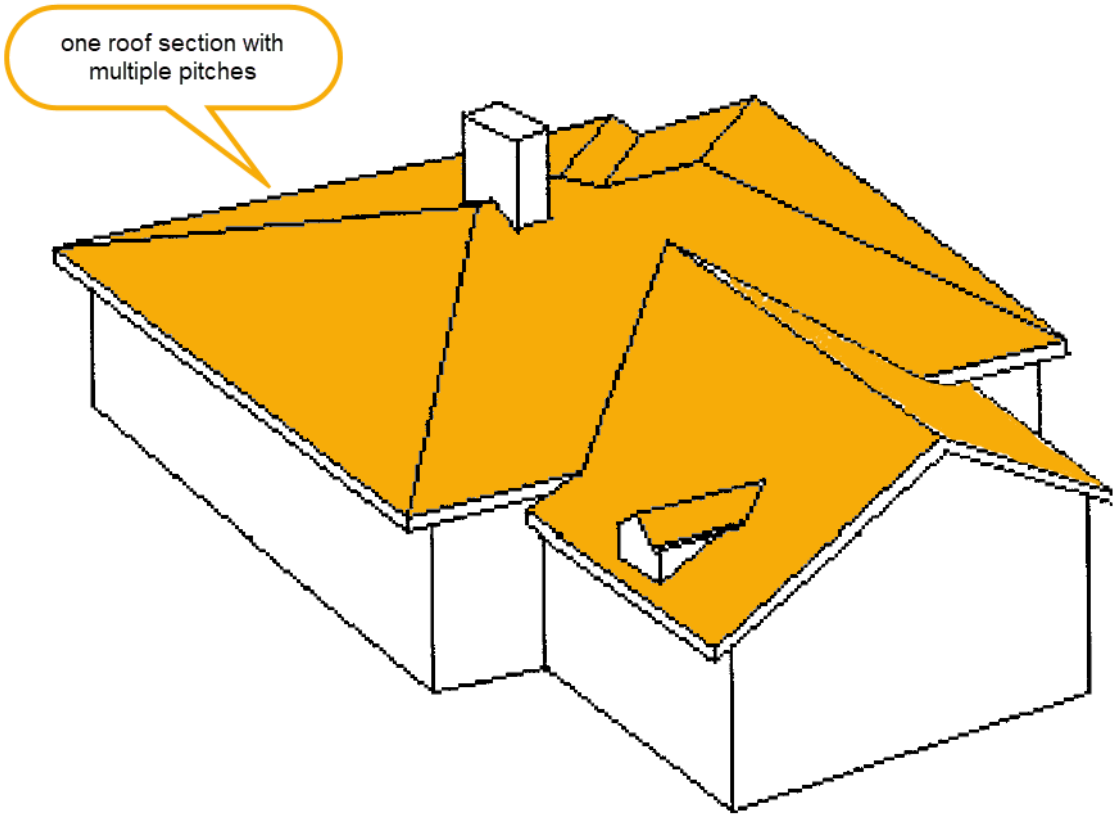


Figure 2. Example of a building roof comprising a roof section.

Id. at Fig. 2 (annotated). Thus, Bailey teaches finding the "predominant slope [pitch]" for, *e.g.*, an entire residential roof, like that shown in Figure 2. Ex. 1003 at ¶¶ 30-36.

D. Kennedy

Kennedy is a U.S. Patent Publication published on December 10, 2009 claiming priority to provisional applications filed February 1, 2008 and April 22, 2008. Accordingly, Kennedy qualifies as prior art to the '538 patent under pre-AIA § 102(b). Kennedy teaches a computer implemented method for

generating a roof estimate. Kennedy teaches a "roof estimating software program." Ex. 1009 at Abstract. Kennedy teaches displaying an aerial image of a building having a roof comprising a plurality of planar roof sections that each have a corresponding pitch. Kennedy teaches that some embodiments of the system "include a sizing tool for determining the size, geometry, and pitch of the roof sections of a building being displayed." Ex. 1009 at Abstract. This is shown, for example, in Figure 36:

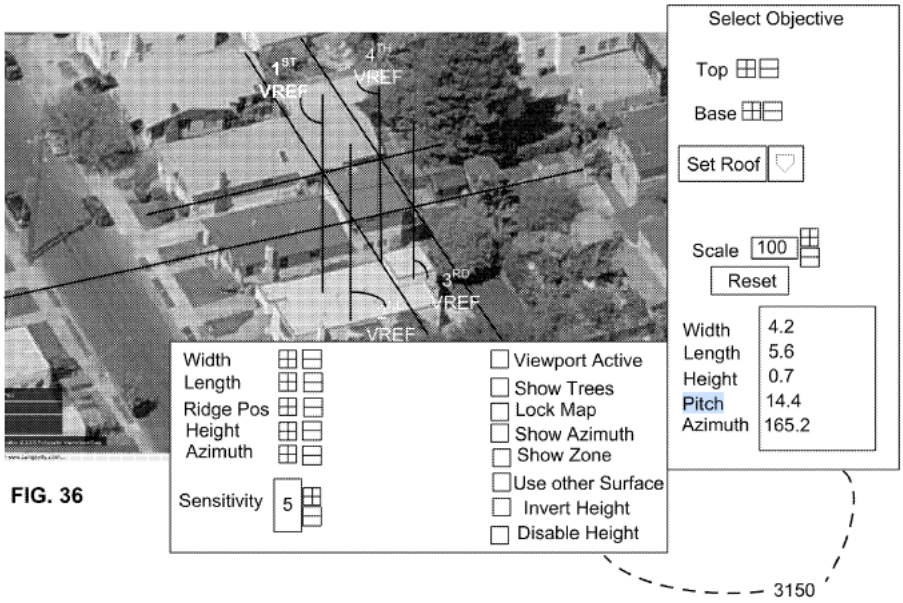


FIG. 36

Id. at Fig. 36. Kennedy discloses a sizing subsystem with a "sizing tool" that can be used to determine pitch:

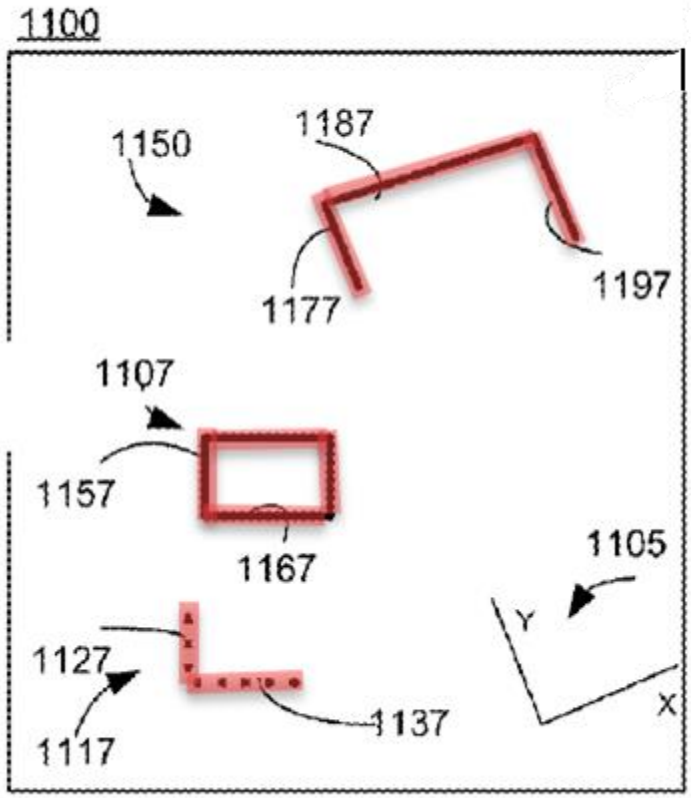
> In one embodiment of the invention, a graphical user interface (best illustrated in FIGS. 8-9) cooperates with sizing subsystem 500 of system 100 to implement a sizing tool enabling user 107 to ***determine surface dimensions and pitch of a surface, for***

> ***example a roof*** 191 of a house ***appearing in the retrieved image*** 153. Thus there is no need to physically visit the installation site to make measurements and perform sizing calculations.

Id. at [0058] (emphasis added).

In one embodiment, Kennedy's "sizing subsystem" includes an "***interactive measuring tool***…for use in sizing surfaces such as roof of house 600 in Fig. 6." *Id.* at [0105] (emphasis added). The sizing tool is shown, for example, in Figure 11:

FIG. 11



Id. at Fig. 11 (annotated). Kennedy explains that its measuring tool is "rotatable and scalable by a user 507 to align at least two sides of the tool an image [sic] of an object to be measured, for example a roof surface to be measured." *Id.* at [0105]. Kennedy further explains that "an orientation of measuring tool with respect to axes 670 [the x/y/z axis] is determined." *Id.* at [0108].

Kennedy makes clear that the sizing tool is "superimposed" over an aerial image. *Id.* at [0110] ("To size surface 1215 user 507 superimposes sizing tool, in this example tool 1117 (illustrated in Fig. 11) of at least a portion of image 1215…in some embodiments, information defining an orientation of shape 1215 with respect to a reference axis 1211 is generated by comparing orientation of adjusted tool 1107 to reference axis 1211.").

Kennedy discloses that the measuring tool can be used to determine the pitch of a roof. *Id.* at [0116] ("…measuring tool 1107 [can be] used to measure displacement of a ridge of roof 650 from base 635. The displacement information is used by modeling unit 591 (Fig. 5) to determine ***pitch of roof*** 600.") (emphasis added); Ex. 1003 at ¶¶ 37-41.

I. DISCRETIONARY FACTORS

The Board should not exercise its discretion to deny this IPR petition.

A. The Prior Art Was Not Considered During Prosecution

Denial is not warranted under § 325(d). None of the prior art in this petition was substantively addressed by either the examiner or applicant during prosecution of the '538 patent.

Likewise, this is the first post-grant proceeding brought against the '538 patent. Accordingly, this is not a "follow-on" petition and the *General Plastic* factors do not apply or counsel against institution.

B. Institution Should Not Be Denied Under *Fintiv*

1. *Sotera* Stipulation

Petitioner stipulates that, if this IPR proceeding is instituted, Petitioner will not pursue in the district court litigation any grounds it brought ***or could have brought*** here.[1] *See* 35 U.S.C. § 315(e)(2). This waiver ***eliminates*** any overlap in invalidity grounds between the district court litigation and an IPR instituted based on this Petition, and thus mitigates any concerns of duplicative efforts or prejudice to Patent Owner. *See Sotera Wireless, Inc.* v.

[1] This stipulation is not intended, and should not be construed, to limit Petitioner's ability to assert invalidity of the asserted claim of the '538 patent in the district court litigation on any other ground (*i.e.*, invalidity under §§ 101, 112), regardless of whether *inter partes* review is instituted.

Masimo Corp., IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020) (precedential). As noted by the Director, "the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petition presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds that could have reasonably been raised before the PTAB." *USPTO Interim Procedure for Discretionary Denials in AIA Post-Grant Proceeding with Parallel District Court Litigation*, at 3 (June 21, 2022).

2. A Final Written Decision Will Issue Before Any Trial

A schedule has not yet been issued in the corresponding district court litigation. No trial date has been set. This petition is being filed on January 3, 2022. Thus, the approximate date of the PTAB hearing would be June 2024, whereas the trial date for the district court case (which has not be set) will likely not be until 2025. Accordingly, the PTAB trial will pre-date the district court trial, perhaps by many months.

3. The Merits of the Petition Support Institution

As discussed in more detail below, the prior art teaches every element of the challenged claims—this also weighs in favor of institution. *USPTO Interim Procedure for Discretionary Denials*, at 2.

VIII. GROUND 1: PERSHING-789 AND BAILEY RENDER OBVIOUS CLAIMS 1-5 AND 8-13 OF THE '538 PATENT

Ground 1 relies on the teachings of Pershing-789's computer-implemented roof estimation system which covers nearly every element of claims 1-5 and 8-13. Ground 1 further relies on the teachings of Bailey which discloses the "predominant pitch" limitation (through its teaching of "predominant slope") that the examiner stated was missing from the prior art during prosecution. *See* Section V, *supra*; Ex. 1003 at ¶ 42.

A. Motivation To Combine Pershing-789 and Bailey

A POSITA would have been motivated to combine the teachings of Pershing-789 and Bailey. Ex. 1003 at ¶¶ 43-48. As discussed in more detail below, Pershing-789's teachings broadly disclose calculating the pitch of a roof: "It should be understood that the system and method described herein may be used to any individual or company that would find the calculation of the size, geometry, ***pitch*** and orientation of the roof of a building from aerial images of the building useful." Ex. 1004 at [0016] (emphasis added). A POSITA would understand that this broad reference to a pitch calculation would include pitch weighted averages typically used in estimation. As Mr. Cummings confirms, using an average pitch value for a roof is useful because it simplifies area calculations. A POSITA would understand that using a

weighted average that gives greater weight to roof facets with larger surface area is desirable because it enhances accuracy in the area estimation process. Accordingly, a POSITA considering Pershing-789 would be motivated to use a weighted average to compute pitch.

As discussed with respect to claim 1, below, Bailey expressly teaches finding the "predominant slope [*i.e.*, pitch]"—which Mr. Cummings explains is a weighted average of roof pitches. Bailey teaches calculating the predominant slope of a "roof section," *i.e.*, any roof area 10,000 square feet or less, which may include an entire residential roof. A POSITA would have been motivated to incorporate Bailey's predominant pitch estimation into Pershing-789 for a variety of reasons. For example, Bailey is a guide from the U.S. Army Corps of Engineers that teaches calculating the predominant pitch of a roof for, *e.g.*, repair assessment. Ex. 1010 at 1, 15, 17. As discussed below, Bailey's roof report collects the same types of attributes as Pershing-789's report (area, pitch, length). Ex. 1010 at 11-22. A POSITA considering Pershing-789's system for collecting roof data and generating a corresponding report would have been motivated by Bailey's teaching to include predominant pitch as part of its estimation techniques. Including Bailey's

predominant pitch would allow Pershing-789's system to estimate roof area accurately with simplified calculations, as discussed above.

Further, similar to Pershing-789, Bailey expressly teaches its methods can be used to assess "needed level of repair" of a roof. *Id.* at 1, 10. This is ***exactly*** the same assessment considered by Pershing-789. Ex. 1004 at Abstract. Accordingly, a POSITA would have been motivated to incorporate Bailey's predominant pitch measurement into Pershing-789's system which is also designed to estimate materials needed for, *e.g.*, repair. This would enhance Pershing-789, because it would allow for a more streamlined, yet accurate, estimation of materials using a "predominant pitch" instead of different pitch values for each facet.

In addition, as confirmed by Petitioner's expert, Mr. Cummings, calculating a predominant pitch, which is merely the computation of a weighted average of pitch values of a roof, has been used in the art ***for decades***. Ex. 1003 at ¶ 46. Indeed, there are only a finite number of ways to measure roof pitch, including calculating precise pitch values for every roof facet or creating a single pitch estimate for an entire roof (or roof section). A POSITA would be motivated to use Bailey's single pitch value (the "predominant slope") for a roof section of 10,000 square feet to simplify the

calculations used by Pershing-789 related to roof repair or replacement. *Id.* Indeed, Pershing-789 discloses a roof ***estimation*** system. Ex. 1004 at Title, Abstract. Accordingly, a POSITA considering Pershing-789 would be motivated to use Bailey's pitch estimation technique which generates a single pitch value instead of using every single pitch value for a given roof.

At a minimum, including "predominant pitch" in Pershing-789's estimation process would have been nothing more than a mere design choice. *See, e.g.,Uber Techs., Inc. v. X One, Inc.*, 957 F.3d 1334, 1340 (Fed. Cir. 2020) (in choosing between "terminal-side plotting" or "server-side plotting," "[a] person of ordinary skill would therefore have two predictable choices for when to perform plotting, providing them with a simple design choice… Because a [POSITA] has 'good reasons to pursue the known options within his or her technical grasp,' § 103 bars the patentability of such an obviousness combination."); *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1238 (Fed. Cir. 2010) (holding that a motivation to combine and a reasonable expectation of success exist when "it is simply a matter of common sense" to combine known elements of the prior art to solve a known problem). Indeed, there are only a finite number of ways to calculate pitch for a roof, including using pitch values for every facet or a single "predominant pitch" value, and, thus, it would have

been a simple design choice that a POSITA "ha[d] good reason to pursue" given "a finite number of identified, predictable solutions" to a design need. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007).

Bailey would have also motivated a POSITA to use its teachings in Pershing-789's system at least because it is a technical report from the US Army Corps of Engineers which provides instructions for evaluating roofs. Ex. 1010 at 1. A POSITA would have been highly motivated to consider the teachings of such a well-respected guide. Ex. 1003 at ¶ 47.

In addition, a POSITA would have been motivated to use the teachings of Pershing-789 and Bailey because they are in the ***same field of endeavor*** as the '538 patent. Both Pershing-789 and the '538 patent are directed towards systems that locate and measure roof dimensions to estimate costs for repair or replacement. Ex. 1001 at Abstract; Ex. 1004 at Abstract. Similarly, Bailey is broadly directed towards collection of roof data, such as pitch, to estimate roof area to assess, *e.g.*, level of roof repair needed. Ex. 1010 at 1, 134-35. Pershing-789, Bailey and the '538 patent all user ***similar techniques to solve the same problems***. As discussed below, Pershing-789 uses the same techniques to locate roofs and measure their dimensions as the '538 patent, and Bailey uses the exact same pitch estimation technique as the '538 patent:

predominant pitch estimation. A POSITA would also have a ***reasonable expectation of success*** in including the teachings of Bailey in Pershing-789. Bailey's teachings confirm that predominant pitch estimation was well known, and Bailey specifically teaches that its system can be used the same context as Pershing-789—measuring roof attributes. Ex. 1010 at 15, 17, 134-35. Accordingly, Bailey itself would motivate a POSITA to apply its teachings of user confirmation steps to improve Pershing-789's efficiency.

B. Claim 1

1. Claim 1a One or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems that when executed cause the one or more computer systems to:

Pershing-789 discloses "one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems." Ex. 1003 at ¶¶ 49-50. In particular, Pershing-789 discloses a "system that allows the remote measurement of the size, geometry, pitch and orientation of the roof…and then uses the information to provide an estimate to repair or replace the roof, or to install equipment thereon." Ex. 1004 at Abstract; *see also id.* at [0003] (describing "systems and methods for estimating construction projects") (emphasis added).

Pershing-789 discloses that its system "includes the use of a roof estimating software program and an location-linked, image file database." *Id.* at [0011]. A POSITA would understand that this software comprises "instructions for running on one or more computer systems." Further, Pershing-789 discloses that the "software program [is] loaded into its working memory[.]" *Id.* at [0012], [0024], [0025], [0027], [0039]. This description of "working memory" is not limited to any specific type of memory, and, thus, can include non-transitory memory (*i.e.*, the claimed "non-transitory computer readable medium"). Thus, Pershing-789 discloses "one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems."

2. Claim 1b identify a geographic location of a roof;

Pershing-789 discloses "identifying a geographic location of a roof":

> During use, the ***physical address or location information*** of the building ***is inputted into the program*** which then presents aerial images of roof sections on the building at the specific address location.

Ex. 1004 at [0011] (emphasis added), Abstract, [0012]-[0014], [0019], [022]-[0023], [0026]-[0029]. As discussed below, this identified roof location is used as part of Pershing-789's estimation process. Ex. 1003 at ¶ 51.

3. Claim 1c determine a footprint and predominant pitch of the roof by analyzing one or more image showing the roof;

Pershing-789 teaches analyzing an "image" of the roof in question (Ex. 1003 at ¶¶ 52-64):

> During use, the physical address or location information of the building is inputted into the program which then ***presents aerial images of roof sections on the building at the specific address location***.

Ex. 1004 at [0011] (emphasis added), [0012]-[0016].

For example, a first image showing the roof in question is shown in Figure 3:

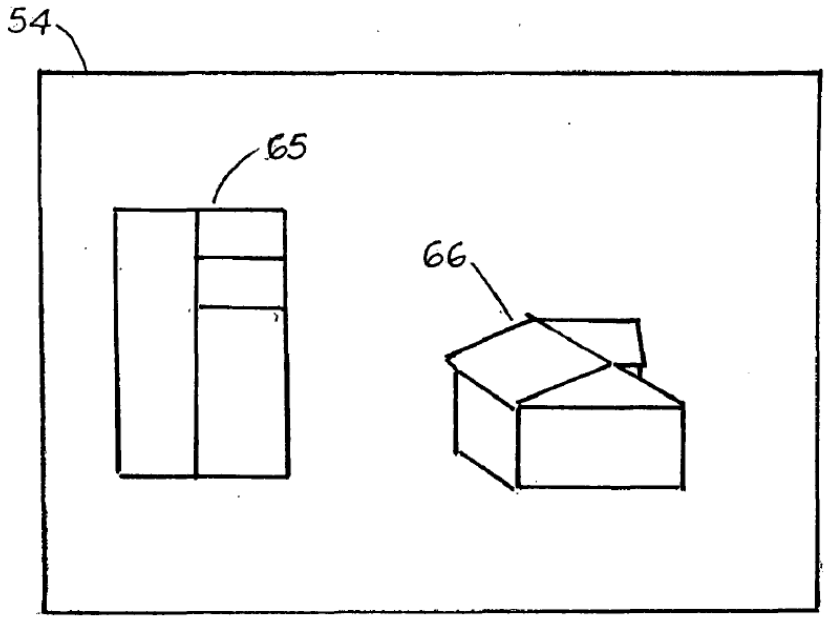


FIG. 3

Ex. 1004 at Fig. 3, *see also* 4, 5A-F. Pershing-789 explains that this hand-sketched drawing is meant to represent actual aerial images of a building stored in its system's database:

> The software program 50 is linked to ***an aerial image file database 52 that contains aerial images files 54*** of various building 92 in a region. The aerial image files 54 may be taken any available means, such as an aircraft, balloon, a satellite, etc. ***As shown in FIG. 3, the image files*** 54 typically include at least one a top plan view 65 and a perspective view 66 of the building 92.

Id. at [0022].

Pershing-789 teaches "determine[ing] a footprint" of the roof. The '538 patent teaches that the "footprint may provide a two-dimensional boundary and/or outline of the roof." Ex. 1001 at 12:8-9. Thus, the "footprint" of the roof includes at least its area. Pershing-789 teaches determining the claimed "***footprint***" of the roof by drawing two-dimensional boundaries/outlines of roof sections, *e.g.*, to compute area. This is shown, for example, in Figure 5E:

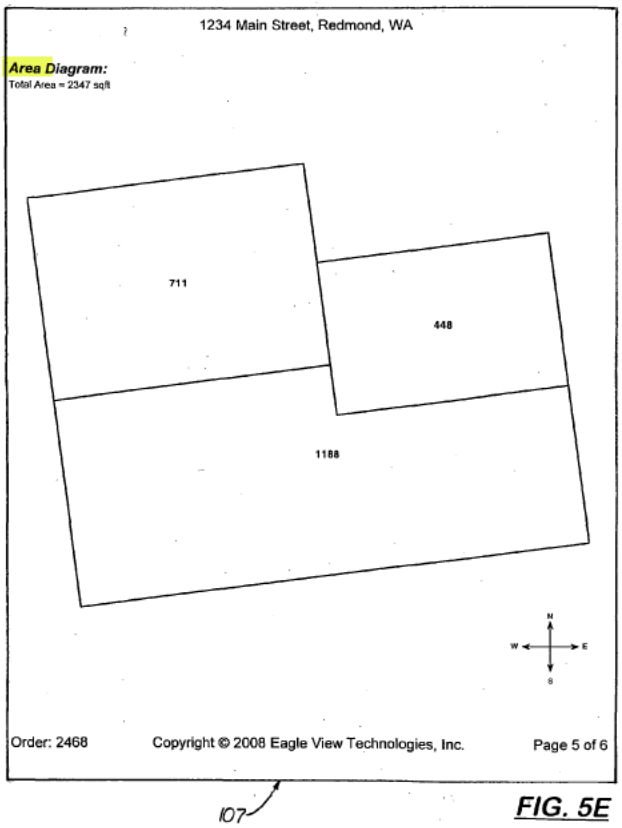
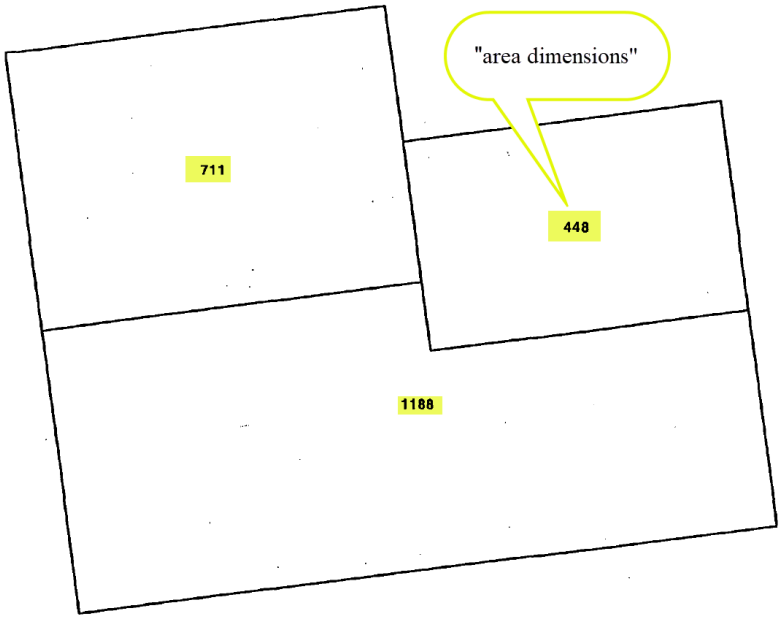
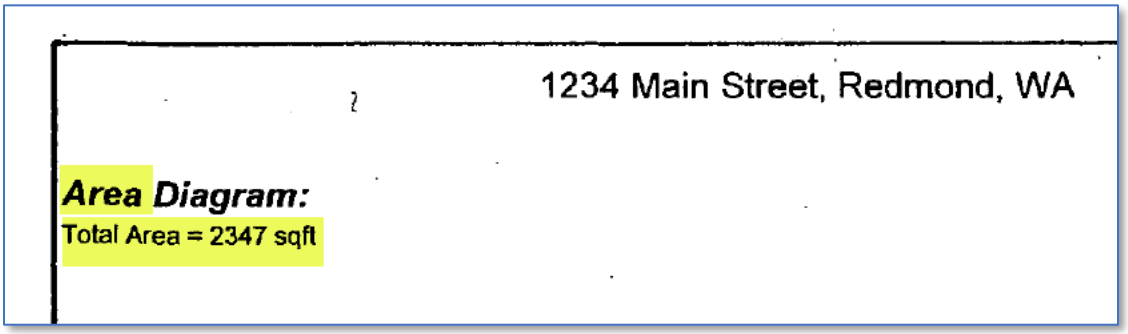


FIG. 5E

Ex. 1004 at Fig. 5E (annotated). Pershing-789 explains that, "FIG. 5E is an illustration of the fifth page 107 of the report showing the ***square footage of each roof section*** along with the total square foot ***area*** value." *Id.* at [0028] (emphasis added). A closeup of Fig. 5E shows the area of different roof facets:



Id. at Fig. 5E (annotated). Likewise, another closeup of the figure shows the total ***area*** calculation:



Id. (annotated).

Pershing-789 broadly discloses a calculation of pitch: "It should be understood, that the system and method described herein may be used to any individual or company that would find the calculation of the size, geometry,

pitch and orientation of the roof of a building from aerial images of the building useful." Ex. 1004 at [0016] (emphasis added).

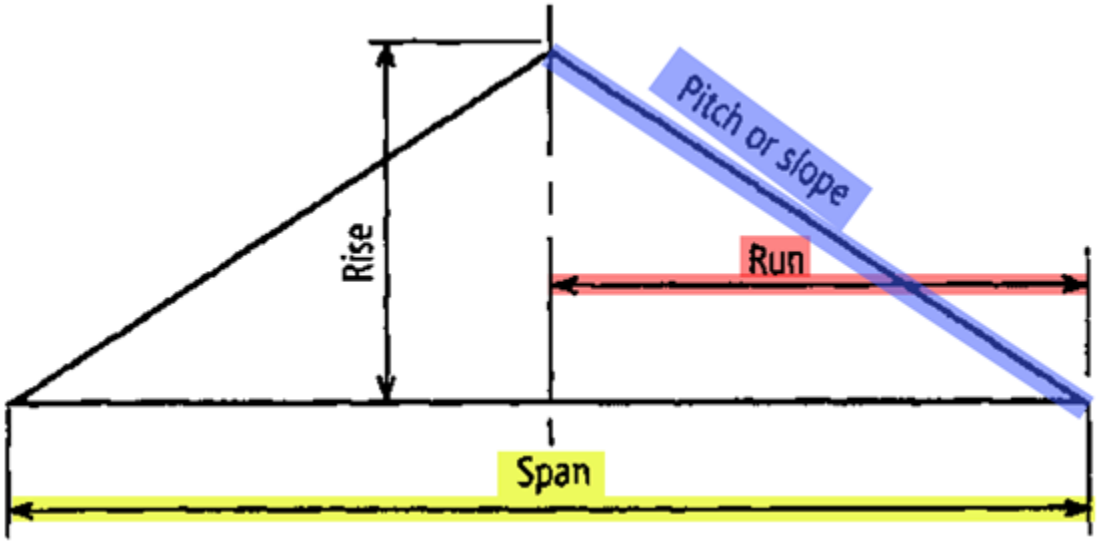
Bailey expressly teaches calculating the "***predominant slope***" of the roof:

> Section 33 - Slope. The ***predominant slope*** of the roof section. The roof plan will ***generally indicate the slope*** (e.g., 4 in. in 12). If the slope is not noted on the roof plan, the section drawings may indicate the slope. If such information is not available, field measurement will be required (use the method in Appendix B).

Ex. 1006 at 17 (emphasis added).

Bailey explains, as was well-known in the art, that ***"slope" and "pitch" are equivalents***, both describing the "degree of incline" of a roof. Ex. 1010 at 134 ("The degree of incline a roof possess is usually expressed as its ***'pitch' or 'slope.'***") (emphasis added). Accordingly, Bailey's disclosure of "predominant slope" is an express disclosure of "predominant pitch." Ex. 1003 at ¶ 59.

Bailey explains that pitch uses the entire span of the roof (*i.e.*, the entire length of the base of the roof) and slope uses the run of the roof (*i.e.*, half the length of the base of the roof), but, as shown in Figure 14 of Bailey, both pitch and slope are the ***same thing***—the degree of incline of the roof (Ex. 1003 at ¶ 60):



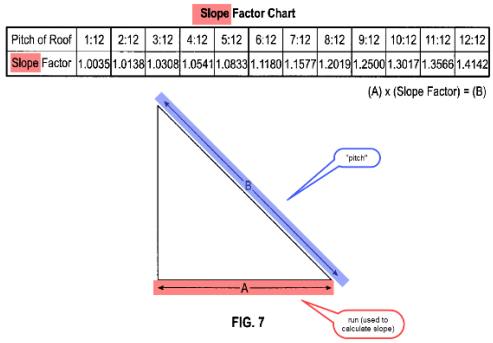
Id. at Fig. 14 (annotated).

As Bailey further explains, pitch and slope are equivalent for purposes of area calculations (like those claimed in the '538 patent): "Whether a particular roof incline is expressed in pitch or slope, ***the results of area calculations will be the same***." *Id.* at 134-35 (emphasis added).

Indeed, as Mr. Cummings explains, "slope" and "pitch" are often used interchangeably in the industry because they refer to the same incline. Ex. 1003 at ¶ 62, citing Ex. 1013 at 462 (defining "roof pitch" as "the ***slope*** of a roof…more roofing material is required to cover the increased roof area when the ***slope or pitch*** is great," and cross-referencing "roof pitch" in the definition of "roof slope") (emphasis added). In fact, the '538 patent itself uses "slope" and "pitch" interchangeably. For example, the '538 patent discloses relying

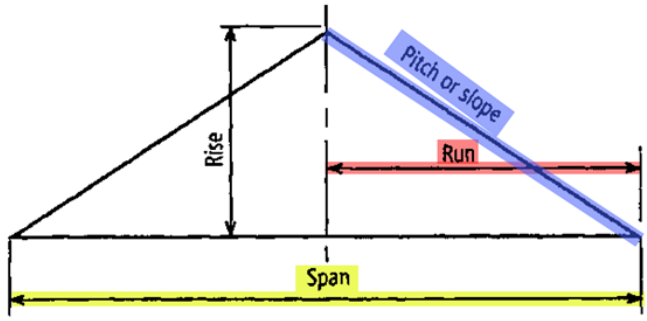
on a "1.1180…***pitch*** factor" from Figure 7 (Ex. 1001 at 12:17), but this number is labeled a "***slope*** factor" in Figure 7 (*id.* at Fig. 7). The '538 patent uses the terms interchangeably a second time, referring to a "***pitch*** factor of 1.0833 in the table in Figure 7" (*id.* at 12:36), whereas Figure 7 labels 1.0833 as a "***slope*** factor" (*id.*at Fig. 7). The '538 patent uses slope and pitch interchangeably twice more in Equations 1 and 2. Both Equations refer to the "***slope*** factors" in Figure 7 as a "***pitch*** factors." *Compare id.* at EQs. 1 and 2 *with* Fig. 7. Thus, Bailey's "predominant pitch" is the claimed "predominant slope."

Moreover, Bailey's "slope" is the same as the '538 patent's "pitch" at least because the claimed "pitch" (labeled "B" (blue)) in the '538 patent at Figure 7 is the ***same*** incline being calculated in Bailey (labeled "pitch or slope" (blue)):

<table>
<tr><th>’538 Patent</th><th>Bailey</th></tr>
<tr><td>

Slope Factor Chart

Pitch of Roof	1:12	2:12	3:12	4:12	5:12	6:12	7:12	8:12	9:12	10:12	11:12	12:12
Slope Factor	1.0035	1.0138	1.0308	1.0541	1.0833	1.1180	1.1577	1.2019	1.2500	1.3017	1.3566	1.4142

(A) x (Slope Factor) = (B)

FIG. 7
</td><td>


</td></tr>
</table>

Compare Ex. 1001 at Fig. 7 *with* Ex. 1010 at Fig. 14; Ex. 1003 at ¶ 63. Accordingly, the “predominant slope” disclosed in Baily is an express disclosure of the claimed “predominant pitch.”

4. Claim 1d determine an estimated roofing area of the roof based on the predominant pitch and the footprint of the roof;

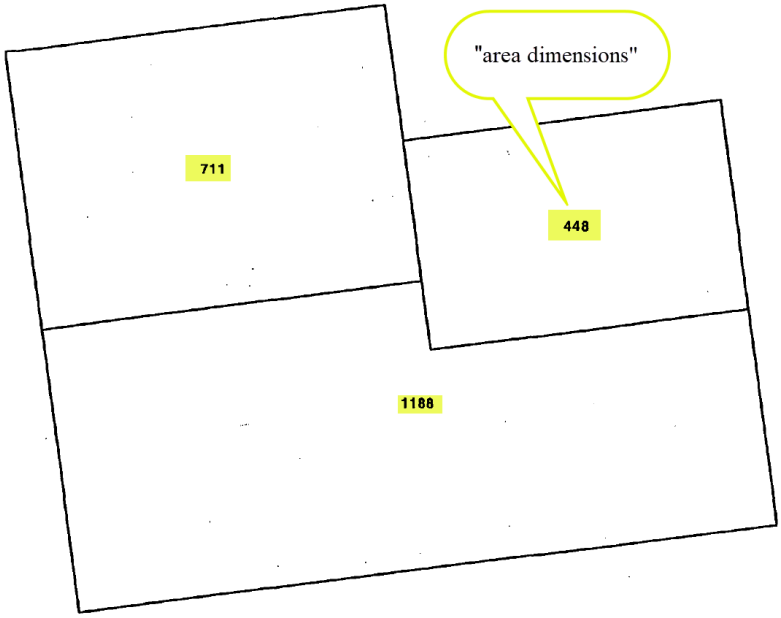
As discussed above, Pershing-789 uses a “footprint” of the roof and its pitch to calculate an estimate of its area. Ex. 1004 at [0013]-[0015], [0028]. As taught by Bailey, a roof’s area is calculated based on the footprint of a roof and its pitch. Ex. 1010 at 134-36. Further, Bailey teaches the a “predominant slope [*i.e.*, pitch]” may be used for an entire roof. Accordingly, Pershing-789 and bailey render obvious determining an “estimated roofing area” based on the “predominant pitch and the footprint” of the roof. Ex. 1003 at ¶ 65.

5. Claim 1e and generate a roof report for determination of an amount of materials needed for a construction project, wherein the roof report includes at least one

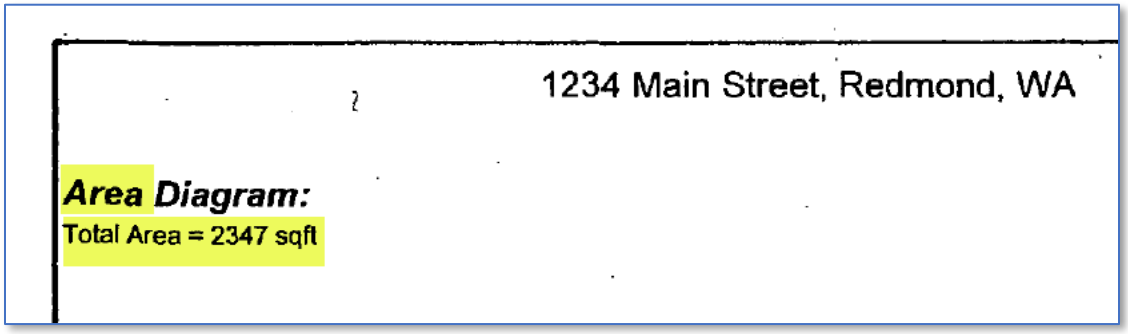
image showing the roof and the estimated roofing area of the roof.

Pershing-789 teaches that its system generates "a roof report for determination of an amount of materials needed for a construction project" (Ex. 1003 at ¶¶ 66-67): "The information can then be used to prepare a cost estimate for the repair or replacement of the roof or installation of roof equipment." Ex. 1004 at Abstract; [0012] (describing a "report").

Pershing-789's roof report includes "at least one image showing the roof and the estimated roofing area of the roof":



Id. at Fig. 5E (annotated). Likewise, another closeup of the figure shows the total area calculation:



Id. (annotated).

C. Claim 2

As discussed with respect to claim 1, Pershing-789 discloses the "one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems" of claim 1. *See* claim 1, *supra*; Ex. 1003 at ¶ 68.

Pershing-789 discloses "the one or more computer systems to determine contact information of one or more contractors within a region of interest of the geographic location of the roof." Ex. 1003 at ¶¶ 69-73. Pershing-789 teaches that the "roof estimating entity 130 prepare a preliminary report 101 which is then transmitted to various roof companies…associated with the entity…Accompanying the preliminary report 101 may be the name and contact telephone number(s) or email address of the customer 90." Ex. 1004 at [0027].

First, a POSITA would understand that in order for the estimating entity to "transmit" a preliminary report to roof companies, it would ***have to*** determine their contact information (*e.g.*, email) first. Thus, Pershing-789 teaches determining contact information of one or more contractors. Second, in any case, it would have been obvious to use Pershing-789 to determine contact information of one or more contractors at least because it already determines contact information for potential customers which it lists on its report. Ex. 1004 at [0014], [0027]. It would be equally important to determine contractor contact information so that customers could be put in communication with a contractor.

Pershing-789 also teaches that these contractors are within a "region of interest." In particular, the '538 patent discloses that the region of interest "may be determined by the customer via user terminal and/***or the region of interest may be a pre-programmed determination***." Ex. 1001 at 10:21-23.

Pershing-789 teaches that its aerial images are limited to roofs within a "the roof companies [sic] service area." Ex. 1004 at [0012]. Pershing-789 also teaches contacting roof companies "associated with the estimation service. *Id.* at [0014]. Pershing-789 also teaches that its contractors may be

"associated with the [estimation] entity." *Id.* at [0027]. Thus, Pershing-789 discloses a pre-programmed list of contractors within a "region of interest."

Indeed, it would make no sense to use Pershing-789's system with contractors located outside of a geographic area of interest. This is because, as Mr. Cummings confirms, estimates of remote contractors would be inaccurate based on variability of materials and labor costs across geographic regions. Ex. 1003 at ¶ 73. For example, the cost of materials and labor will differ greatly between Nebraska vs. New York City. And, as Mr. Cummings further explains, roofers typically only offer their services within a given service area. *Id.* Pershing-789's estimates would not have any value to a customer if they pertained to remote contractors, because they would not reflect estimates by a contractor in close enough proximity to actually perform the work the customer needs and a price commensurate with the customer's location.

Pershing-789 further discloses "providing a roof report," as discussed with respect to claim 1. *See* claim 1, *supra*; Ex. 1003 at ¶ 74.

Pershing-789 also discloses that the roof report includes "one or more ortho images of the roof." The plain meaning of an "ortho" image is an "orthogonal" image—*i.e.*, an image taken straight down. Ex. 1008 at 114

(Pictometry…uses aerial photography to capture, process and analyze ***orthogonal (straight down)*** and oblique (taken from angles) images[.]") (emphasis added); Ex. 1003 at ¶ 75.[2] As discussed with respect to claim 1, Pershing-789 discloses such images of a roof:

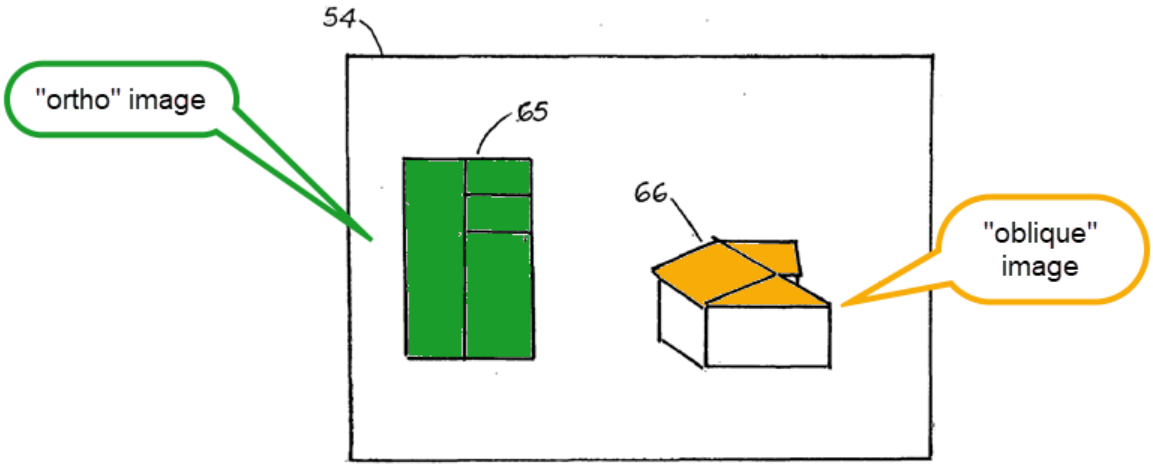


FIG. 3

Ex. 1004 at Fig. 3, Abstract (describing "oblique" and "top plan" views). As noted in claim 1, Pershing-789 explains that this hand-sketched drawing is meant to represent actual aerial images of a building stored in its system's database. *Id.* at [0022].

[2] Petitioner does not rely on Pictometry (Ex. 1008) as part of the proposed combination. Instead, Petitioner relies on Pictometry to show a POSITA's understanding of the '538 patent's reference to an "ortho" image.

Pershing-789 teaches that its report "includes one or more oblique images of the roof." A POSITA would understand the plain meaning of an "oblique image" is one captured at an angle. Ex. 1007 at 114 (Pictometry…uses aerial photography to capture, process and analyze orthogonal (straight down) and ***oblique (taken from angles)*** images[.]") (emphasis added). Pershing-789 teaches including such an oblique image of a roof in its report, for example, in Figure 3:

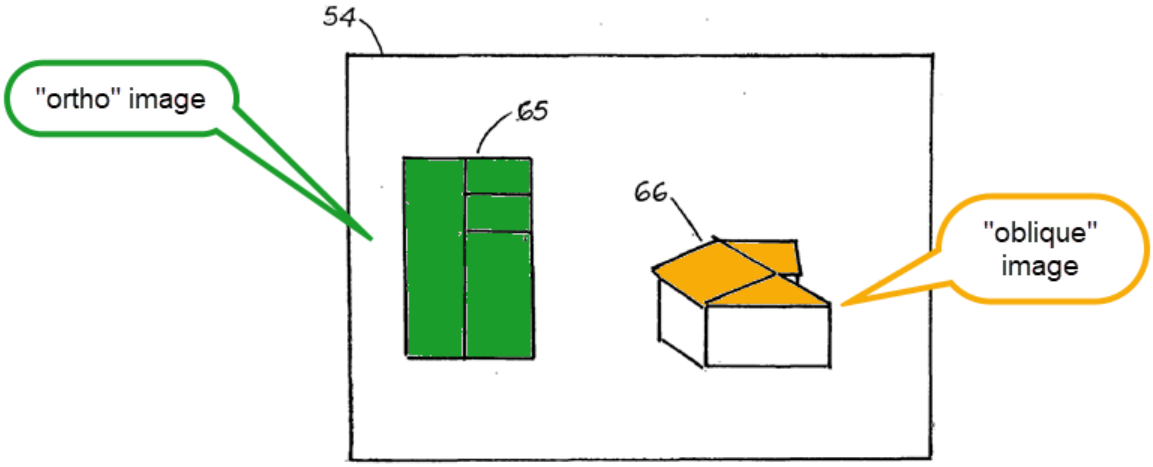


FIG. 3

Ex. 1004 at Fig. 3, Abstract (describing "oblique" and "top plan" views).

Pershing expressly discloses including these types of images in its reports, for example, in Figure 5B:

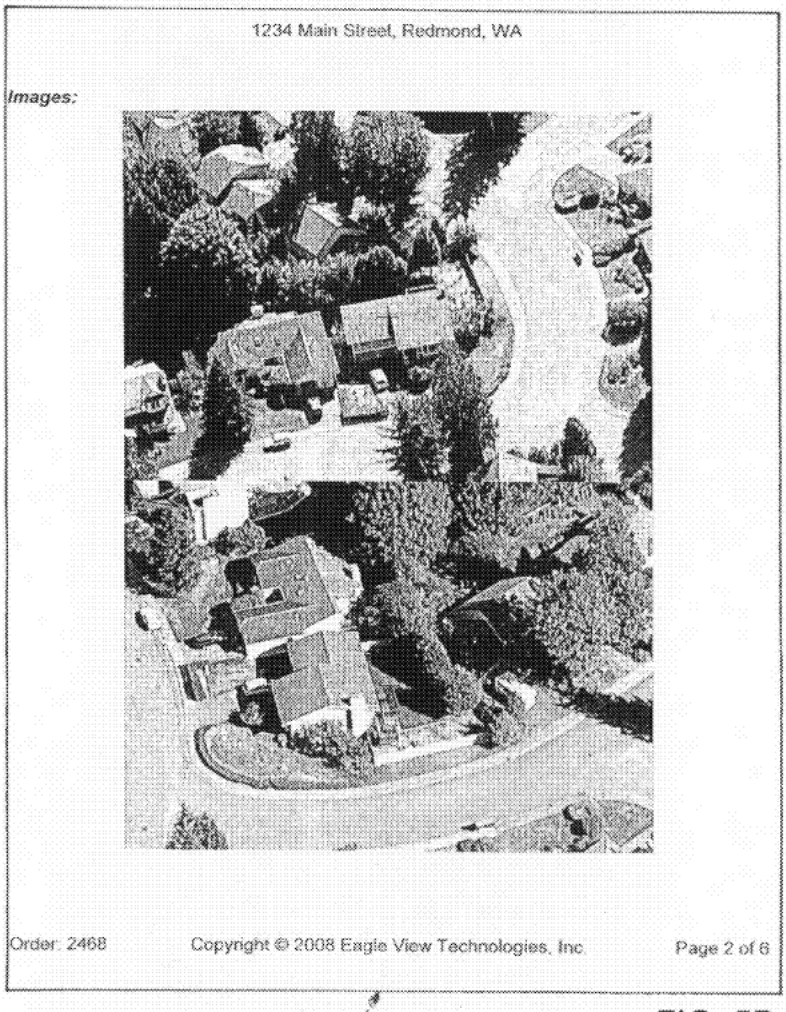


FIG. 5B

Ex. 1004 at Fig. 5B.

Pershing-789 teaches that its report includes the "estimated roofing area" as discussed with respect to claim 1. *See* claim 1, supra; Ex. 1003 at ¶ 79.

Pershing-789 renders obvious including "contact information of one or more contractor within the region of interest of the geographic location of the

roof." Ex. 1003 at ¶ 80. As discussed above, Pershing-789 already teaches including a customer's information on a preliminary report to be provided to a contractor and, thus, it would be obvious to also include a contractor's contact information on a report. Ex. 1004 at [0027]. Indeed, Pershing-789 teaches that a "final report" which includes estimates from a variety of contractors is transmitted to the customer, and that the customer may contact the roof company. *Id.* at [0026]-[0027]. It would be obvious to include the contractors' contact information so aid the customer.

D. Claim 3

As discussed with respect to claim 2, Pershing-789 expressly discloses including a customer's contact information in its report. *See* claim 2, supra; Ex. 1003 at ¶ 81.

E. Claim 4

Pershing-789 discloses this claim. Ex. 1003 at ¶¶ 82-85. The '538 patent broadly discloses that, "[g]enerally, the first host system 102 may include one or more processors 108 capable of executing a first set of processor executable code and the second host system 126 may include one or more processors 128 capable of executing a second set of processor

executable code." Ex. 1001 at 5:35-41. The '538 patent provides Figure 1 as an example of two "host systems":

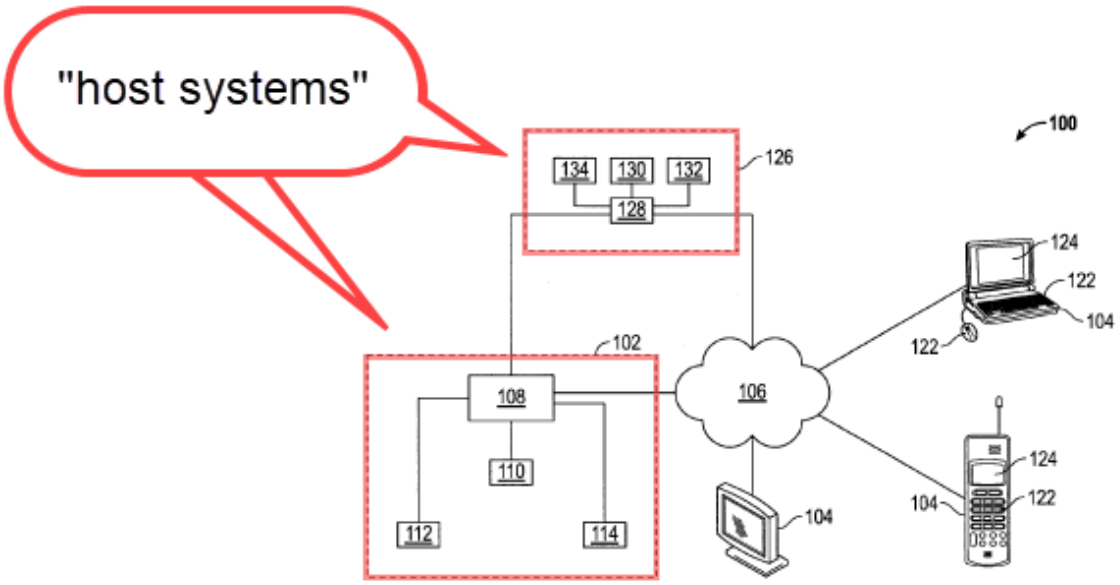


FIG. 1

Ex. 1001 at Fig. 1, 3:21-25.

The '538 patent explains that in some embodiments the two host systems may be controlled by different entities:

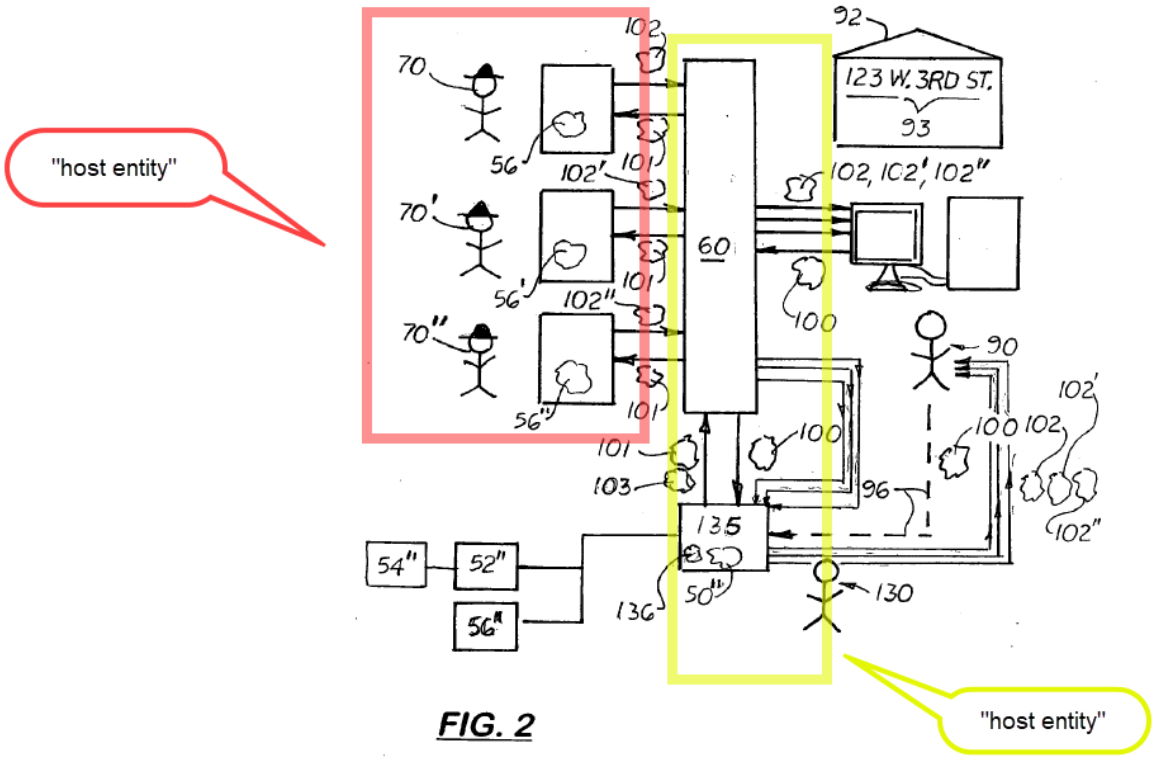
> [H]ost systems 102 and 126 may be independently controlled by separate entities. Host system 102 may be controlled by a first company and host system 126 may be controlled by a second company distinct from the first company. For example, host system 102 may be controlled by a roofing material supplier and host system 126 may be controlled by a roofing report company. The roofing material supplier may be a separate entity from the roofing report company.

Ex. 1001 at 4:13-21.

Pershing-789 discloses two such "host entities": one belonging to the "estimating entity 130" and the other belonging to "roof company 70":

> FIG. 2 shows a third embodiment of the system 10 where the customer 90 contacts a roof estimating entity 130 who receives a request 100 from the customer 90 via the wide area network 60 or telecommunication network 96. The roof ***estimating entity 130 prepares a preliminary report 101*** which is then transmitted to various roof companies 70, 70', 70" associated with the entity 130. Accompanying the preliminary report 101 may be the name and contact telephone number(s) or email address of the customer 90. Each ***roof company 70***, 70', 70" reviews the preliminary report 101 and any associated images sent therewith and ***then prepares a final estimate*** 102, 102', 102". The final estimate 102,102', 102" is then mailed, emailed or faxed to the customer 90 or back to the estimating entity 130.

Ex. 1004 at [0027] (emphasis added). For example, the two host system is shown in Figure 2:



Ex. 1004 at Fig. 2 (annotated). As discussed with respect to claim 1, Pershing-789 also discloses that its system may use "working memory," which would include the claimed "non-transitory computer readable medium" in these host entities. Accordingly, Pershing-789 teaches this limitation.

F. Claim 5

As discussed with respect to claim 1, Pershing-789 discloses obtaining contact information of a customer. *See* claim 1, *supra*; Ex. 1003 at ¶ 86.

G. Claim 8

As discussed with respect to claim 1, Pershing-789 teaches identifying one or more edges of the roof in an image, *e.g.*, to measure area. *See* claim 1, supra; Ex. 1003 at ¶ 87.

H. Claim 9

Pershing-789 teaches the "one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems" of claim 1. *See* claim 1; Ex. 1003 at ¶ 88.

Pershing-789 teaches that its "one or more computer systems to identify edges of the roof." *See* claim 1; Ex. 1003 at ¶ 89.

Pershing-789 teaches determining "three-dimensional information of the edges including position, orientation and length using multiple oblique images from multiple cardinal directions." Ex. 1003 at ¶ 90. First, as discussed with respect to claim 2, Pershing-789 teaches using "oblique images" as part of its image analysis. *See* claim 2. Pershing-789 teaches determining three-dimensional information about the edges of a roof: "An image analysis…determines the geometry, the slopes, the pitch angles, and the outside dimensions of the roof sections." Ex. 1004 at [0011]. Pershing-789 further teaches that "reference points" identified in each image is used to

reconstruct a "three dimensional geometry" of the roof. *Id.* at [0034]. Pershing-789 teaches that a variety of algorithms can be used, including algorithms that "triangulate points of interest." *Id.* Pershing-789 also teaches that its algorithm may rely on "a number of factors such as the ***spatial relationships between the photographs***, the number and locations of the reference points." *Id.* at [0035] (emphasis added). Pershing-789 also teaches using cardinal directions as a reference point in image analysis. *See, e.g.*, Fig. 5C-F. Thus, Pershing-789 renders obvious determining "three-dimensional information of the edges including position, orientation and length using multiple oblique images from multiple cardinal directions."

Pershing-789 also "determines, automatically, one or more line segments forming a portion of a footprint of the roof utilizing position and orientation of the edges." Ex. 1003 at ¶ 91. As discussed with respect to claim 1, Pershing-789 uses line segments to draw the footprint of the roof based on the position and orientation of its edges. *See* claim 1, supra.

I. Claim 10

Bailey renders obvious "wherein determining the predominant pitch includes determining a plurality of pitch values with each pitch value associated with a portion of the roof, the predominant pitch based on the

plurality of pitch values." Ex. 1003 at ¶ 92. As discussed with respect to claim 1, Bailey expressly discloses the claimed "predominant pitch."

Bailey further renders obvious basing its "predominant pitch" on a "***plurality of pitch values***" as required by the claims. Ex. 1003 at ¶ 93. In particular, Bailey teaches determining the "predominant slope [pitch] ***of the roof section***." Ex. 1010 at 17 (emphasis added). Bailey defines a "roof section" as an area of 10,000 square feet or less: "As a rule, a building having a steep roofing system of approximately 10,000 SF or less should be managed as ***one section***." *Id.* at 10 (emphasis added). This means that an entire roof is a single roof section as long as it is 10,000 square feet or less. For example, Bailey discloses that "all exposed roof areas on the building shown in Figure 2 would comprise ***one roof section***" (*id.*):

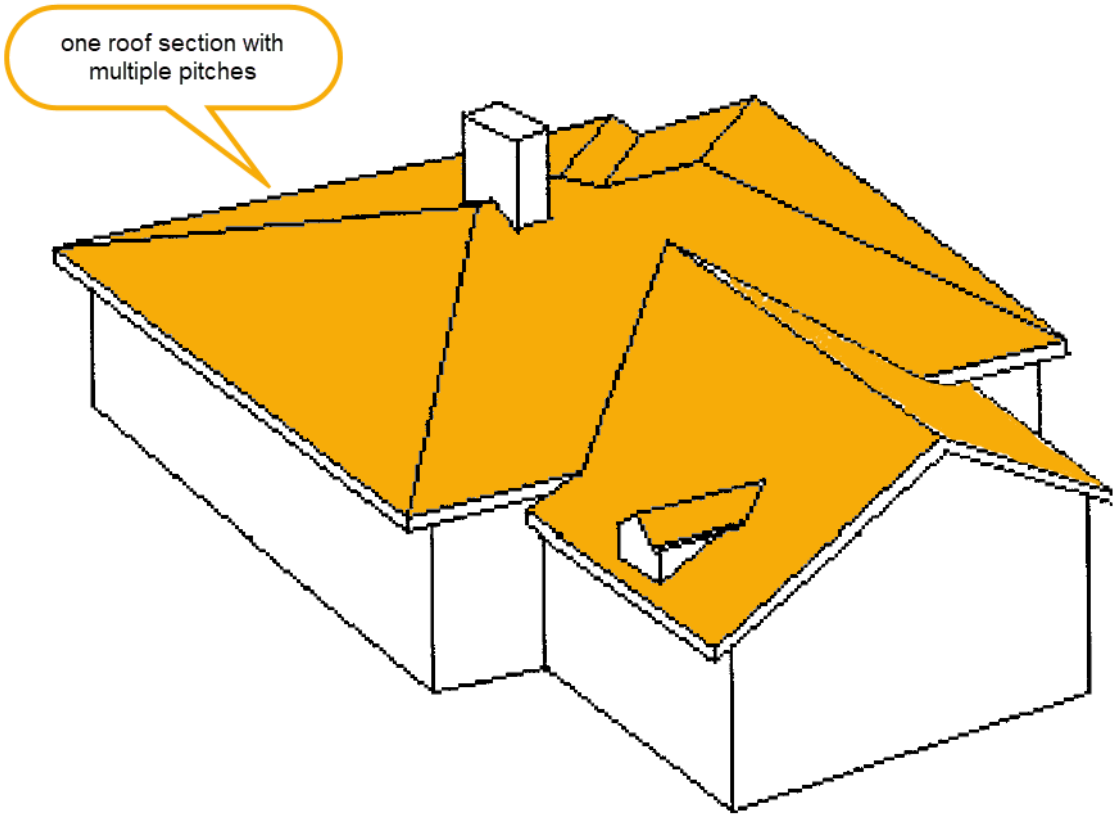


Figure 2. Example of a building roof comprising a roof section.

Id. at Fig. 2 (annotated). To determine the single "predominant slope [pitch]," for the entire roof shown in Figure 2, Bailey teaches relying on slopes indicated in, *e.g.*, a roof plan, drawings or through field measurement. *Id.* at 17. Thus, Bailey renders obvious using multiple pitch values for a multi-sloped roof to calculate a single "predominant slope [pitch]" as required by the claims. *See also id.* at Fig. 3 at line 33 (referring to the "predominant slope [pitch]" for a roof as its "slope (***primary***)") (emphasis added); Ex. 1003 at ¶ 94.

Indeed, a POSITA would have been motivated to rely on all a roof section's different pitch values when calculating a single "predominant slope" value to promote accuracy. Ex. 1003 at ¶ 95. As Bailey explains, the pitch of a roof is used in conjunction with its footprint to compute area. Ex. 1010 at 134-36. When estimating a single predominant slope value, it would be important to account for all of the pitches of a roof, giving greater weight to pitch values associated with greater surface area of the roof. For example, if 80% of a roof section had a pitch value of 4:12 and 20% of the same roof section had a pitch of 7:12, a POSITA would understand greater weight should be given to the 4:12 pitch value when computing a single "predominant" or "primary" pitch, as disclosed by Bailey. Otherwise, the single pitch value could not properly be referred to as the "predominant" or "primary" pitch, since it would represent a simple average. *See also* claims 11, 17, 18.

J. Claim 11

As discussed with respect to claim 1, Bailey teaches determining a "predominant pitch" based on slope values for a given roof. Bailey further renders obvious "wherein each pitch value is associated with an estimated percentage of roof area to provide an average pitch value." Ex. 1003 at ¶ 96.

As confirmed by Mr. Cummings, a POSITA would understand that Bailey's disclosure of a single "predominant" or "primary" pitch value is a weighted average pitch value that accounts for the amount of surface area taken up by roof facets, as discussed with respect to claim 10. Ex. 1003 at ¶ 97. This is because Bailey teaches using its estimates for purposes of "selecting repair strategies, and establishing planning and budgeting needs for accomplishing necessary work." Ex. 1010 at 7. A POSITA would understand that, consistent with Bailey's express teachings, pitch values are used in conjunction with the footprint of a roof to calculate area. *Id.* at 134-36. Bailey's disclosures of a single pitch value, therefore, would be understood to account for the amount of surface area taken up by a roof facet of a given pitch, because doing so would provide the most accurate single pitch value to be used in area calculations. Indeed, this is ***why*** Bailey (and the '538 patent) refer to the single pitch value as the "predominant" (or "primary") pitch.

Moreover, such weighted average calculations are extremely common in construction, including roofing, and were in widespread use many years before the '538 patent. Ex. 1003 at ¶ 98. Indeed, the RSMeans Illustrated Construction Dictionary—frequently referred to by those of ordinary skill in the art as a "complete source of construction terms and concepts," including

Mr. Cummings—defines a weighted average in the construction context "[a]n average in which certain entries, usually at the extremes of the range of values, are manipulated so a number is obtained that is believed to be more representative of the true mean that that obtained by straight averaging." Ex. 1013 at 1, 605. Thus, a POSITA would understand that ***by definition*** a weighted average can be used to give a "more representative" number in the face of a range of values than a straight average. This is precisely the situation called for when estimating a predominant pitch, as taught by Bailey. For example, if 90% of Bailey's 10,000 square foot roof section has a pitch of 4:12 and 10% of the roof section has a pitch of 7:12, a POSITA would be motivated to weight the pitches according to their surface areas because doing so would most accurately result in the true "predominant" or "primary" pitch of the roof. If each section were weighted equally, it could not be understood as a "predominant" pitch—indeed, there would be nothing "predominant" about it.

Thus, a POSITA would be motivated to use the well-known weighted averaging technique prolific in construction to generate Bailey's "predominant slope [pitch]" because it would provide the most accurate estimate of pitch (and, thus, materials required for a job). Ex. 1003 at ¶ 99.

Moreover, there are only a finite number of ways to calculate a single pitch value (predominant pitch) from a plurality of pitch values, including a simple average (giving equal weight to all pitch values) and a weighted average. For the foregoing reasons, a POSITA would be motivated to use a weighted average to promote accuracy. Ex. 1003 at ¶ 100.

K. Claim 12

As discussed with respect to claim 1, Pershing-789 generates a preliminary report which is provided to a contractor within the region of interest of the geographic location of the roof. *See* claim 1; Ex. 1003 at ¶ 101.

L. Claim 13

1. Claim 13a

See claims 1, 4; Ex. 1003 at ¶ 102.

2. Claim 13b

See claims 1, 4; Ex. 1003 at ¶ 103.

3. Claim 13c

See claim 1; Ex. 1003 at ¶ 104.

4. Claim 13d

See claim 2; Ex. 1003 at ¶ 105.

5. Claim 13e

See claim 1, 4; Ex. 1003 at ¶ 106.

6. Claim 13f

See claim 1c; Ex. 1003 at ¶ 107.

7. Claim 13g

See claim 1d; Ex. 1003 at ¶ 108.

8. Claim 13h

See claims 1, 2; Ex. 1003 at ¶ 109.

IX. GROUND 2: PERSHING-789 AND BAILEY IN FURTHER VIEW OF ABHYANKER RENDER OBVIOUS CLAIMS 6-7 AND 14-18 OF THE '538 PATENT

Ground 2 relies on the same combination of Pershing-789 and Bailey discussed in Ground 1 but adds the additional disclosure of Abhyanker to address the additional limitations of claims 6-7 and 14-18 (requiring various user input). Ex. 1003 at ¶ 110.

A. Motivation To Combine Pershing-789, Bailey and Abhyanker

For the same reasons discussed above, a POSITA would have been motivated to combine the teachings of Pershing-789 and Bailey. Ex. 1003 at ¶¶ 111-15. A POSITA would have been further motivated by the teachings of Abhyanker to allow users of Pershing-789's roofing system the option to specifically designate the geographic position of a roof to be analyzed, and to include a subsequent user confirmation option to ensure that the correct roof

is being analyzed. There are a variety of reasons a POSITA would be motivated to use these teachings from Abhyanker in Pershing-789.

A POSITA would have been motivated by the teachings of Abhyanker to allow users of Pershing-789's roofing system the option to specifically designate the geographic position of a roof to be analyzed using a marker, and to include a subsequent user confirmation option to ensure the correct roof is being analyzed. There are a variety of reasons a POSITA would be motivated to apply these teachings from Abhyanker to Pershing-789.

For example, allowing a user to designate a geographic position of a roof and to subsequently confirm that the roof location is correct would promote the ***accuracy of the system***. Abhyanker's teachings expressly address this motivation. Abhyanker discloses that automated systems used to pinpoint geographic locations (like Pershing-789's) are not always 100% accurate, and mistakes will result in user disappointment. Ex. 1005 at [0004]-[0005]. That is especially true here: if Pershing-789's system inadvertently marked a neighboring roof (or a roof with the same address in a different state or town), the resulting materials estimate would be incorrect. This would cost both the user and the service provider time and money (and would potentially cost the software provider business). Thus, it would have been obvious to

include Abhyanker's teachings of allowing a user to place a "marker" on the roof in question and to affirmatively "confirm" the right selection was made. This accuracy check would ***save money***, ***save time*** and ***avoid customer losses***.

In addition, applying Abhyanker's teachings to Pershing-789's system would also ***add convenience*** to a user. For example, if a user inadvertently input a neighbor's address it would be convenient to allow the user to apply a drag-and-drop feature, like that taught by Abhyanker, to correct this error by simply sliding the marker to the correct location. This would also add to the convenience for users who may have difficulties typing or reading smaller print in the form fields in a screen—dragging a colored "marker" would assist such users in marking the right roof.

As explained above, Pershing-789 and Bailey are in the same field of endeavor as the '538 patent, use similar techniques to solve the same problems as the '538 patent and their combination would result in a reasonable expectation of success. Similarly, a POSITA would have been motivated to combine the teachings of Pershing-789 and Abhyanker because they are in the ***same field of endeavor*** as the '538 patent. Both Pershing-789 and the '538 patent are directed towards systems that locate and measure roof dimensions to estimate costs for repair or replacement. Ex. 1001 at Abstract; Ex. 1004 at

Abstract. Similarly, Abhyanker is broadly directed towards accurate placement of markers in a "mapping environment," like the ones used in the Pershing-789 and '538 patent systems. Ex. 1005 at Abstract, [0012]. Further, Pershing-789, Abhyanker and the '538 patent all user ***similar techniques to solve the same problems***. As discussed above, Pershing-789 uses the same techniques to locate roofs and measure their dimensions as the '538 patent, and Abhyanker uses the same techniques to ensure accurate roof placement. A POSITA would also have a ***reasonable expectation of success*** in including the teachings of Abhyanker in Pershing-789. Abhyanker's teachings confirm that user confirmation options in "mapping environments" such as Pershing-789's were well known, and Pershing-789 specifically teaches that its system can be used the same context—locating roofs. Ex. 1005 at Abstract, [0012]. Accordingly, Abhyanker itself would motivate a POSTIA to apply its teachings of user confirmation steps to improve Pershing-789's system.

B. Claim 6

For the reasons discussed in Ground 1, the combination of Pershing-789 and Bailey render obvious claim 1.

In addition, Abhyanker teaches that the "one or more computer systems to receive customer input to validate geographic location of the roof." Ex.

1003 at ¶¶ 116-19. Abhyanker teaches that a user may "drag and drop" a marker to choose a location:

> Furthermore, the method may include applying a ***drag and drop*** algorithm that enables the user to sequentially and/or concurrently relocate markers in the mapping environment, iteratively performing additional verifications when any particular marker has been previously moved[.]

Ex. 1005 at [0011] (emphasis added). Thus, a user has freedom to relocate a marker anywhere desired within the aerial image, including a location that is different from the original address entered by a user.

Thereafter, Abhyanker discloses that "additional verifications may be iteratively performed when any particular marker has been previously moved[.]" *Id.* at [0053]. For example, Abhyanker teaches a user may "lock" the location of a marker, preventing its future relocation:

> The locking module 220 may process a marker ***locking request*** when the particular user claims the wiki profile associated with the address data. In addition, the locking module 220 may enable the user(s) to control the future relocation of the marker in the mapping environment.

Id. at [0064] (emphasis added).

C. Claim 7

As discussed above with respect to claim 6, Abhyanker teaches that a customer may provide input to alter one or more coordinates of the geographic location, for example, by dragging-and-dropping or user verification. *See*

claim 6, supra. For the same reasons, Abhyanker teaches "the geographic location includes coordinates and validation of the geographic location includes instructions for receiving customer input to alter one or more coordinates of the geographic location." Ex. 1003 at ¶ 120.

D. Claim 14

1. Claim 14a

See claims 1, 6; Ex. 1003 at ¶ 121.

2. Claim 14b

See claim 1; Ex. 1003 at ¶ 122.

3. Claim 14c

See claim 1 Ex. 1003 at ¶ 123.

4. Claim 14d

See claim 1; Ex. 1003 at ¶ 124.

E. Claim 15

See claims 1, 2; Ex. 1003 at ¶ 125.

F. Claim 16

See claims 1, 2; Ex. 1003 at ¶ 126.

G. Claim 17

As discussed with respect to claim 1 in Ground 1, the footprint of the roof may be represented by the roof's boundary lines. *See* claim 1. Any

pitch value estimation must necessarily account for these boundary lines in order to estimate the pitch from peak to edge. Accordingly, the proposed combination renders obvious this limitation for the same reasons discussed with respect to claim 1 in Ground 1. Ex. 1003 at ¶ 127.

H. Claim 18

Bailey also expressly teaches using the same "pitch factors" shown in Figure 7 of the '538 patent to calculate area (as shown below). Ex. 1010 at 137. Thus, Bailey also renders obvious "wherein the predominant pitch is based on a weighted average of individual pitch factors for two or more portions of the roof." *See also* claims 10, 11; Ex. 1003 at ¶ 128.

'538 Patent (Fig. 7)

Slope Factor Chart

Pitch of Roof	1:12	2:12	3:12	4:12	5:12	6:12	7:12	8:12	9:12	10:12	11:12	12:12
Slope Factor	1.0035	1.0138	1.0308	1.0541	1.0833	1.1180	1.1577	1.2019	1.2500	1.3017	1.3566	1.4142

(A) x (Slope Factor) = (B)

<table>
<tr><td>Bailey</td><td>
<table>
<tr><th colspan="2">Table 3:
Area/Rake Conversion*</th></tr>
<tr><th>Slope
(inches per foot)</th><th>Area/Rake Factor</th></tr>
<tr><td>4</td><td>1.054</td></tr>
<tr><td>5</td><td>1.083</td></tr>
<tr><td>6</td><td>1.118</td></tr>
<tr><td>7</td><td>1.157</td></tr>
<tr><td>8</td><td>1.202</td></tr>
<tr><td>9</td><td>1.250</td></tr>
<tr><td>10</td><td>1.302</td></tr>
<tr><td>11</td><td>1.356</td></tr>
<tr><td>12</td><td>1.414</td></tr>
</table>
*To use the table, simply multiply the projected horizontal area by the conversion factor for the appropriate roof slope. The result is the actual area of the roof.
</td></tr>
</table>

X. GROUND 3: KENNEDY AND BAILEY RENDER OBVIOUS CLAIMS 1-5 AND 8-13 OF THE '538 PATENT

Ground 3 relies on the teachings of Kennedy, which disclose almost every claim element recited in the '538 patent, in combination with Bailey's teachings of generating a roof report and determining the "predominant pitch" of a roof. Ex. 1003 at ¶ 129.

A. Motivation To Combine Kennedy and Bailey

A POSITA would have been motivated to generate a report and to incorporate a "predominant pitch" estimation in Kennedy's system based on the teachings of Bailey. The motivations described in Ground 1 with respect to the predominant pitch limitation apply equally to the combination of Kennedy and Bailey. Ex. 1003 at ¶¶ 130-32.

In addition to those motivations, Bailey generates a report based on roof attributes, including predominant pitch. Ex. 1010 at 15. Bailey's roof report collects the same types of roof attributes as Kennedy's system (area, pitch, length). Ex. 1010 at 11-22, Ex, 1009 at [0072], [0081]-[0087]. Thus, a POSITA considering Kennedy's system for collecting roof data would be motivated by Bailey to generate a report reflecting that data, including predominant pitch.

A POSITA would likewise be motivated to combine the teachings of Bailey and Kennedy because they are both in the ***same field of endeavor*** as the '538 patent, roof estimation. Ex. 1001 at Abstract; Ex. 1009 at Abstract; Ex. 1010 at 1, 17, 134. As discussed below, both Kennedy and Bailey use ***similar techniques to solve the same problems*** as the '538 patent—indeed, Kennedy discloses nearly all of the limitations of the '538 claims, and Bailey discloses generating a report and determining the predominant pitch as required by the claims. A POSITA would have had a ***reasonable expectation of success*** applying Bailey's teaching of generating a report and computing the predominant pitch into Kennedy's system at least because Kennedy already teaches collecting and storing the same type of roofing data taught by Bailey.

B. Claim 1

1. Claim 1a

Kennedy teaches a "roof estimating software program." Ex. 1009 at Abstract; Ex. 1003 at ¶¶ 133-35. Kennedy teaches using its system's roof estimation to prepare a "quote" for customers. Ex. 1009 at ¶¶ 164, 169. For example, Kennedy teaches:

> A system according to one embodiment of the invention remotely determines the measurements of a roof. An exemplary system comprises a computer including an input means, a display means and a ***working memory***. An aerial image file database contains a plurality of aerial images of roofs of buildings in a selected region. A roof estimating ***software program*** receives location information of a building in the selected region and then presents the aerial image files showing roof sections of building located at the location information. Some embodiments of the system include a sizing tool for determining the size, geometry, and pitch of the roof sections of a building being displayed.

Id. at Abstract (emphasis added); *see also id.* at [0169] ("In one embodiment of the invention a quote for the displayed system is provided in association with the image of the system."). Kennedy further teaches:

> For example a commercially available processor or computer system adapted in accordance with the teachings herein implements system 100 including at least one of subsystems 110, 2000, 3000, 3100, 500 and/or 200. For example, one of ordinary skill in the art will recognize upon reading this specification, that commercially available ***processors, memory modules***, input/output ports and other commercially available hardware components are suitable for use in constructing embodiments of

> system 100. These may be assembled as taught in this specification to arrive at the various embodiments.

Id. at [0051] (emphasis added). These "memory modules" would include the claimed "non-transitory computer readable medium."

2. Claim 1b

Kennedy teaches that its user interface is configured to receive "user information, for example, ***site location information from a user***[.]" Ex. 1009 at [0053]-[0054] (emphasis added). Kennedy teaches providing visual access to a first image corresponding to the first location data, the first image including a roof structure of a building:

> [S]ystem 100 uses the location information received from user system 106 to ***retrieve an image*** 153 of the location (or site) from a geophysical database 109. In response to receiving the location information, system 100 provides an image corresponding to the location, for example ***an image of a roof of a house 391 for display on screen*** 380 of display device 108 of a user system 106.

Ex. 1009 at [0056] (emphasis added); Ex. 1003 at ¶ 136.

3. Claim 1c

Kennedy expressly discloses a "sizing tool" that is superimposed on an aerial image to determine "surface dimensions" of a roof:

> In one embodiment of the invention, a graphical user interface (best illustrated in FIGS. 8-9) cooperates with sizing subsystem 500 of system 100 to implement a sizing tool enabling user 107 to determine surface dimensions and pitch of a surface, for example a roof 191 of a house appearing in the retrieved image

> 153. Thus there is no need to physically visit the installation site to make measurements and perform sizing calculations.

Id. at [0058]; *see also id*. at [0110] ("***To size surface 1215 user 507 superimposes sizing tool***, in this example tool 1117 (illustrated in Fig. 11) of at least a portion of image 1215…in some embodiments, information defining an orientation of shape 1215 with respect to a reference axis 1211 is generated by comparing orientation of adjusted tool 1107 to reference axis 1211.") (emphasis added). Kennedy discloses "***generating length and width measurements*** for a generally rectangular planar installation surface such as a side of a roof." *Id*. at [0082] (emphasis added); *see also* [0109], Fig. 12.

Kennedy discloses that the measuring tool can be used to determine the pitch of a roof. *Id*. at [0116] ("…measuring tool 1107 [can be] used to measure displacement of a ridge of roof 650 from base 635. The displacement information is used by modeling unit 591 (Fig. 5) to determine ***pitch*** of roof 600.") (emphasis added). Kennedy expressly teaches including the "pitch" dimension on its outline drawing, *e.g.*, in Fig. 36:

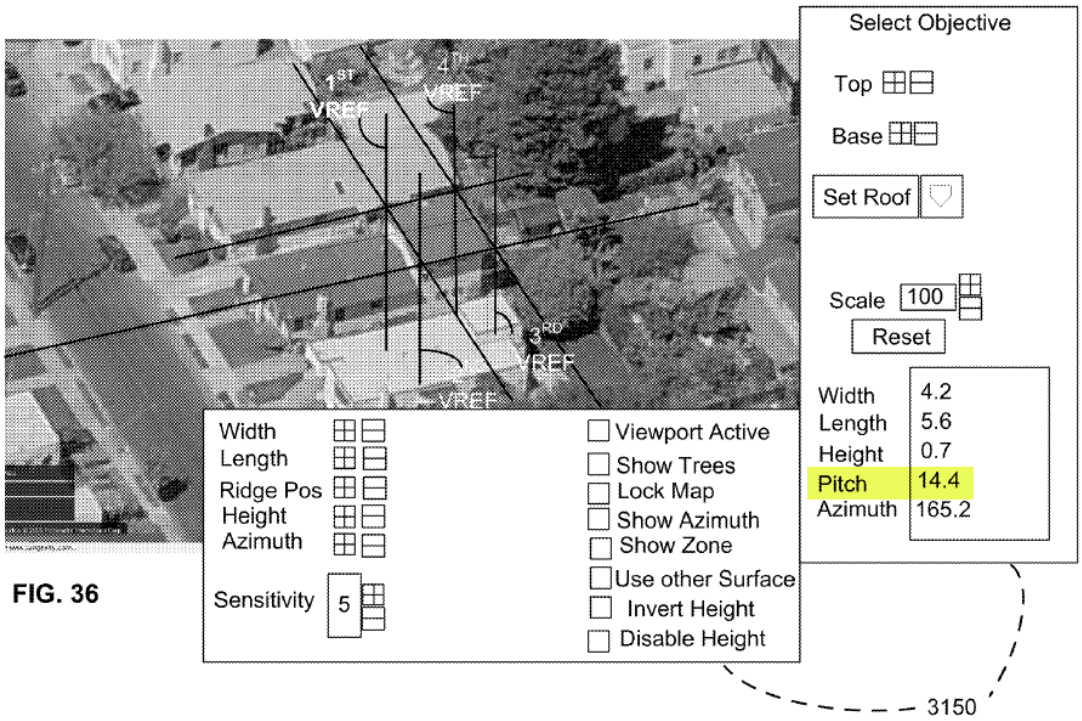


FIG. 36

Id. at Fig. 36 (annotated).

As discussed with respect to Ground 1, Bailey expressly discloses predominant pitch. A POSITA would have been motivated to include predominant pitch in Kennedy's system based on the teachings of Bailey as discussed above. *See* Section A; Ex. 1003 at ¶ 137-40.

4. Claim 1d

Kennedy teaches measuring the area dimension of a roof: "Referring now to FIG. 6, in order to ***measure an installation surface area***, such as a ***roof 640 area*** of house 600 in FIG. 6, user 507 ***positions measuring tool 1150***

over an image of roof 600 in alignment with a side of the image of roof 600." Ex. 1009 at [0106] (emphasis added). Kennedy further calculates the pitch of a roof as part of its estimation as discussed above.

As discussed above, a POSITA would have been motivated to use Bailey's teaching of calculating the predominant pitch for use as Kennedy's "pitch" value. As taught by Bailey, the pitch is used in conjunction with the footprint of a roof to compute area. Ex. 1010 at 134-36; Ex. 1003 at ¶¶ 141-42.

5. Claim 1e

Kennedy teaches preparing a "quote" for customers based on the data collected. Ex. 1009 at ¶¶ 164, 169. Kennedy broadly teaches that "In one embodiment of the invention ***a quote for the displayed system is provided in association with the image of the system***." *Id.* at ¶ 169 (emphasis added). A POSITA would readily understand that such a quote would be a roof estimate ***report***.

In any case, as discussed above, a POSITA would be motivated to use Kennedy's roof estimation software to generate a report for a customer based on the teachings of Bailey. Ex. 1003 at ¶¶ 143-45. Bailey is directed at providing instructions for collecting "roofing inventory" in connection with

maintenance and repairs. Ex. 1010 at 1. Bailey expressly teaches that, once roofing data (such as pitch and length) are calculated, that data should be included in a report—examples are shown in Figures 4 and 10 below:

ROOF SECTION IDENTIFICATION WORKSHEET			AGENCY/INST.: Example
DATE: Jun/ 1999	BLDG. NO.: 1253	SECTION ID: A	AREA: 2813 SF
OCCUPANCY:	YEAR ORIG. CONST.: _____		YEAR LAST REPLACED: _____

10 GENERAL

11 TYPE (check all):

X GABLE
X HIP
__ GAMBREL
__ SHED
__ DOME
__ BARREL
__ OTHER

12 PERIMETER (check all):

PARAPET	____ LF	FIREWALL	____ LF	RIDGE	69 LF
ROOF EDGE	234 LF	HIP	116 LF	OTHER	____ LF
ADJACENT WALL	____ LF	VALLEY	70 LF		

13 ACCESS (check one):

INTERNAL LADDER
__ Permanent
__ Temporary

EXTERNAL LADDER
__ Permanent
X Temporary

__ PENTHOUSE
__ ACCESSED FROM ADJ. SECTION (Sec.ID___)
__ OTHER

20 STRUCTURAL FRAME

21 TYPE (check one):

STEEL
__ Beams,Girders,Cols.
__ Long Sp Deck, Beams
__ Trusses
__ Bar Joists with Beams & Cols.
__ Bar Joists with Bearing Walls
__ Bar Joists with Combination

CONCRETE
__ Beams
__ Flat Slab

WOOD
__ Laminated Beams
X Trusses
__ Joists
__ Panels

SPECIAL
__ Dome
__ Space Frame
__ OTHER
__ UNKNOWN

30 ROOF DECK

31 STRUCTURAL DECK (check one):

NONCOMBUSTIBLE

__ STEEL
__ CONCRETE, LWT. PRECAST

CONCRETE, STD
__ Precast
__ Cast-in-Place

CEMENT FIBER
__ Bulb-Tees
__ Clipped

__ GYPSUM, PRECAST

COMBUSTIBLE

__ WOOD BOARDS
X PLYWOOD
__ WOOD FIBER
__ OTHER
__ UNKNOWN

Figure 4. Completed Roof Section Identification Worksheet.

Ex. 1010 at Fig. 4 (Part 1).

32 ATTACHMENT SURFACE (if applicable):

__ WOOD FIBER
__ PLYWOOD
__ WOOD BOARDS
__ WOOD BATTENS
__ METAL PURLINS
__ OTHER
__ UNKNOWN

33 SLOPE (primary): 4 **IN 12**

34 DRAINAGE (check all):

__ INTERIOR DRAINS
__ INTERIOR GUTTERS
X GUTTERS & DOWNSPOUTS
__ SCUPPERS
__ ADJACENT ROOF SECTIONS
__ SCUPPERS W/LEADER & DOWNSPOUTS
__ OVERFLOW SCUPPERS
__ ROOF EDGE
__ OTHER

40 UNDERLAYMENT

41 TYPE (check all):

__ FULLY-ADHERED ICE & WATER MAT
X ASPHALT SATURATED SHEET
__ OTHER
__ UNKNOWN
__ NONE

50 ROOF COVERING

51 TYPE (check one):

ASPHALT SHINGLE
X Three-Tab
__ Multi-Tab
__ Strip (no cutout)
__ Laminated
__ Lock-Down
__ Foil-Faced

__ ASPHALT ROLLED

SYNTHETIC ROOFING
__ Plastic
__ Wood Fiber
__ Metal Shingles
__ Fiber Cement

__ WOOD SHAKES

__ WOOD SHINGLES

__ SLATE

__ METAL PANEL

CONCRETE TILE
__ Pan and Cover
__ S-Shaped
__ Flat

CLAY TILE
__ Pan and Cover
__ S-Shaped
__ Flat

__ OTHER

52 SHINGLE REINFORCEMENT (for Asphalt Shingle only) (check one):

__ ORGANIC
X FIBROUS GLASS
__ OTHER
__ UNKNOWN

Figure 4 (continued). Completed Roof Section Identification Worksheet.

Ex. 1010 at Fig. 4 (Part 2).

ROOF INSPECTION WORKSHEET

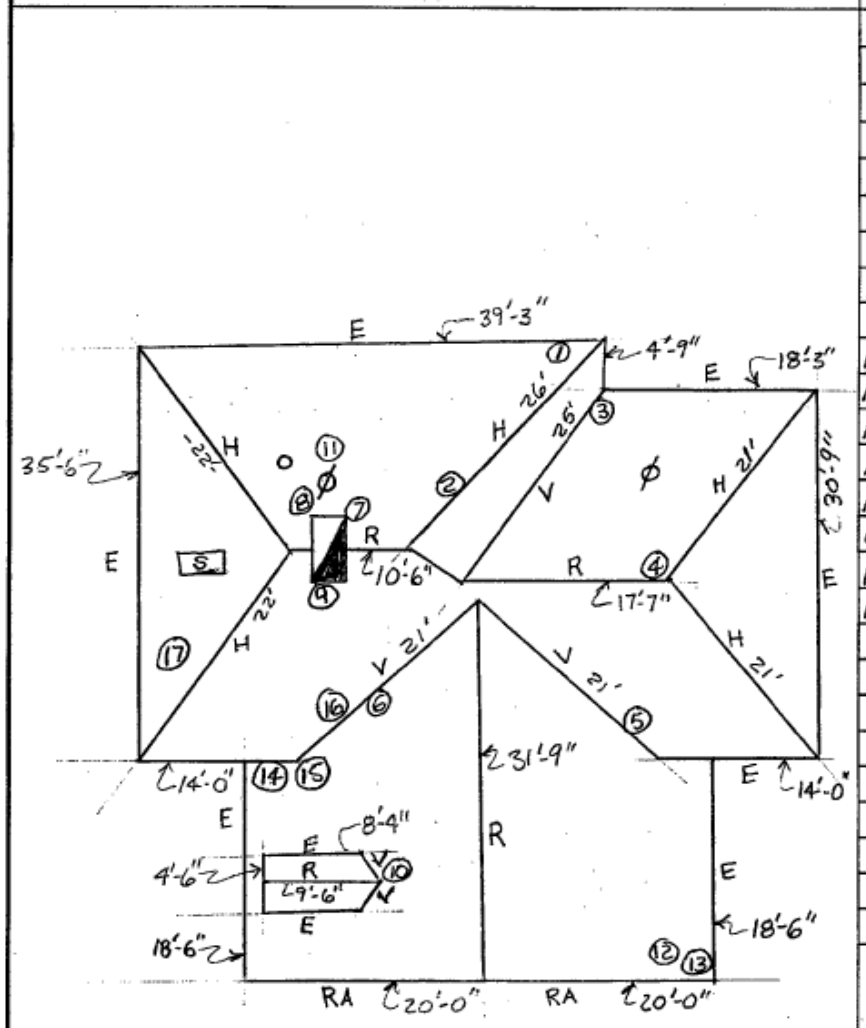
AGENCY/INSTALLATION: EXAMPLE

BUILDING 1253
SECTION A

PERIMETER FLASHING 489
OTHER FLASHINGS 38

DATE 7/2/99
NAME Jones

SF -STEP FLASHING
MC -METAL CAP
EM -EDGE METAL
VF -VALLEY FLASHING
RH -RIDGE/H SHINGLE
MA -METAL APRON
FP -FLASHED PENET.
RV -RIDGE/HIP VENT
PP -PITCH PAN
IG -INT. GUTTER
AD -AGE DET.
HS -HOLE/MISSING SHINGLE
TB -UNSEALED TABS
LR -LUMPS/RIDGES
EF -EXPOSED FAST.
ST -STAINS/FUNGUS
DV -DEBRIS & VEG.
PA -PATCHING
EQ -EQUIP. SUPPORTS



ID #	DISTRESS	SEVERITY	DEFECT	QUANTITY
1	EM	M	1	10
2	RH	M	3	1
3	VF	L	2	25
4	RH	H	4	1
5	VF	L	2	21
6	VF	L	2	15
7	SF	M	4	12
8	MA	M	2	2
9	MA	M	2	2
10	RH	M	4	1
11	ST	L	1	20
12	DV	M	3	16
13	HS	M	1	6
14	DV	M	1	9
15	PA	M	1	8
16	VF	M	5	6
17	AD	L	2	150

SCALE: _____

Figure 10. Completed Roof Inspection Worksheet.

Ex. 1010 at Fig. 10. A POSITA would be motivated based on Bailey to generate a report for its customers for the same reasons.

C. Claim 2

Kennedy discloses "the one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computer systems of claim 1." *See* claim 1, *supra*.

Kennedy discloses "one or more computer systems to determine contact information of one or more contractors within a region of interest of the geographic location of the roof." Ex. 1003 at ¶¶ 146-54. Kennedy teaches a "contractor database 113" which stores contractor information which can be accessed by a customer:

> Some embodiments of the invention include a ***contractor database 113***. In that case, ***contractor database 113 stores information, including for example, contractor location, qualifications, availability etc. related to contractors*** and installation support personnel. In that manner some embodiments of system 100 enable a ***user 107 to interact with GUI 200 to select a contractor*** to install an energy system procured using system 100.

Ex. 1009 at [0074] (emphasis added). Accordingly, Kennedy discloses this limitation.

As discussed with respect to claim 1, Bailey teaches providing a "roof report." *See* claim 1, *supra*.

Kennedy and Bailey render obvious "wherein the roof report includes one or more ortho images of the roof one or more oblique images of the roof, the estimated roofing area and the contact information of one or more contractor within the region of interest of the geographic location of the roof." Ex. 1003 at ¶ 150. In particular, as discussed above, it would have been obvious in view of Bailey to generate a roof report using the data collected by Kennedy. Kennedy teaches that its system collects and display the claimed "ortho" image of a roof (*i.e.*, an overhead view) as shown, for example, in Figure 35:

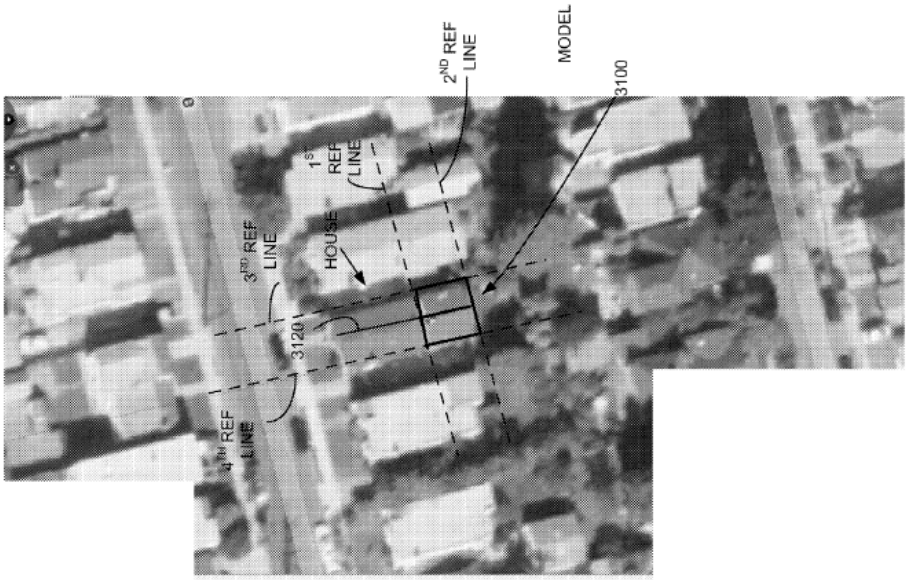


FIG. 35

Ex. 1009 at Fig. 35, [0041] ("***FIG. 35 illustrates a top plan view of a roof*** to be sized as the roof appears in an image obtained from a geographical

information service (GIS) and further illustrating reference lines for generating a model in accordance with an embodiment of the invention.") (emphasis added).

Likewise, Kennedy also teaches collecting the claimed "oblique image" of a roof for display, as shown, for example, in Figure 36:

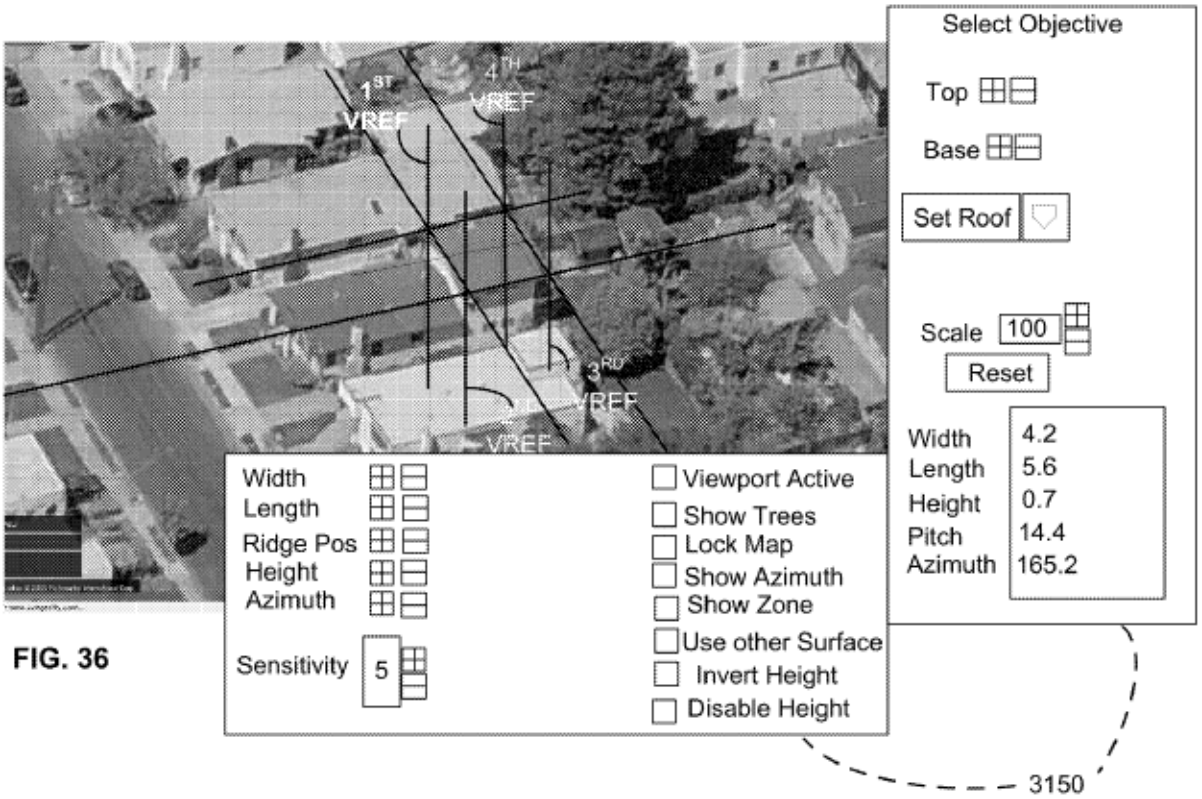


FIG. 36

Id. at [0042], [0189] (referring to Fig. 36 as a "perspective[3]" view).

As discussed with respect to claim 1, it would have been obvious to include area in Kennedy's report based on Bailey. *See* claim 1, *supra*.

Finally, as discussed above, Kennedy teaches collecting contact information for contractors in an area of interest. A POSITA would have been motivated to include all of Kennedy's collected data in a roof report based on Bailey for the reasons discussed above, and in Ground 1. Ex. 1003 at ¶ 154.

D. Claim 3

Kennedy and Bailey render obvious wherein the roof report includes contact information of the customer. Ex. 1003 at ¶ 155. Kennedy teaches that its system includes a "customer database 103" which includes "a customer's information." Ex. 1009 at [0075]. Kennedy further teaches that its method includes contacting a customer with an offer. *Id.* at [0180]. It would have been, thus, obvious to include the customer contact information stored by Kennedy in a roofing report based on the teachings of Bailey for the reasons

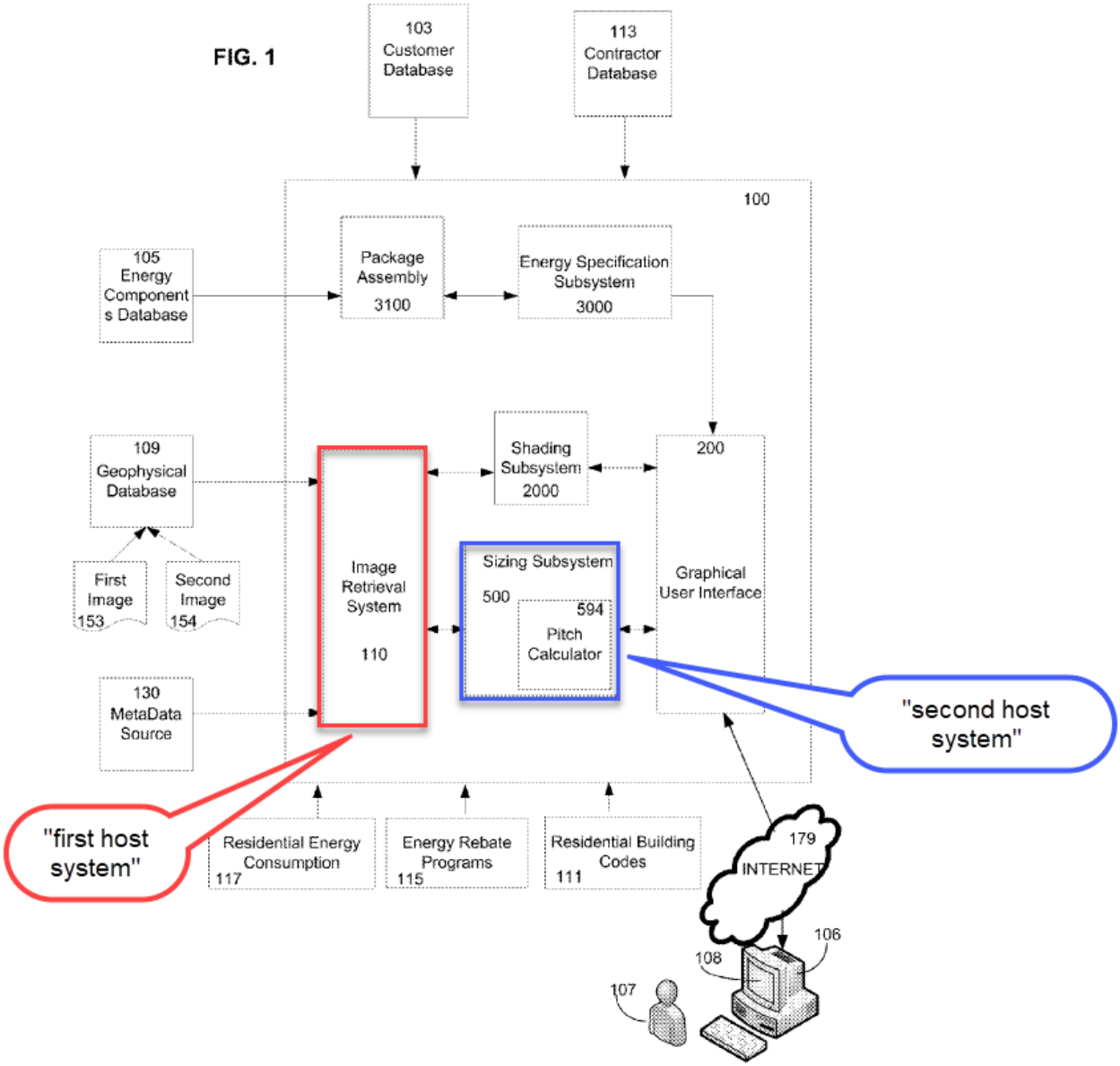
[3] Kennedy equates "oblique" view with "perspective" view. *Id.* at [0186] ("FIG. 34 illustrates ***a perspective view, i.e., an oblique view***, of a structure 5 including the roof illustrated in FIGS. 32-33 above.") (emphasis added).

discussed above. Indeed, this would facilitate easy communication between a contractor reaching out to provide an offer to a customer.

E. Claim 4

As discussed with respect to Ground 1, the '538 patent broadly discloses that "[g]enerally, the first host system 102 may include one or more processors 108 capable of executing a first set of processor executable code and the second host system 126 may include one or more processors 128 capable of executing a second set of processor executable code." Ex. 1001 at 5:35-41. Thus, at least one example of a host system includes a system with a processor capable of executing a set of processor executable code.

Kennedy discloses multiple host systems. Ex. 1003 at ¶¶ 156-58. In particular, Kennedy teaches a plurality of "subsystems" used to, *e.g.*, calculate the size of the roof, calculate the pitch of the roof and retrieve images of the roof from a database. Ex. 1009 at [0050] ("System 100 comprises a graphical user interface module 200 and at least one of an energy specification subsystem 3000, a ***sizing subsystem 500*** including a ***pitch calculator 594***, a shading subsystem 2000, an ***image retrieval subsystem 110*** and a package assembly subsystem 3100.") (emphasis added). These subsystems—each of which are a "host system" are shown, for example, in Figure 1:



Id. at Fig. 1 (annotated).

While exemplary Figure 1 depicts Kennedy's "subsystems" (*i.e.*, "host entities") as housed within system 100, Kennedy teaches that its subsystems may also stand alone and communicate with each other ***remotely***. *Id.* at [0052] ("Other embodiments of the invention are configured for ***wireless*** or wired

internet communication between subsystems of system 100."). For example, Kennedy's image retrieval subsystem 110 communicates with an image source to retrieve images. *Id*. at [0059]-[0060]. Separately, sizing subsystem 500 may be "coupled for communication, for example, via the Internet 179" with the image retrieval subsystem 110 and computes roof attributes (such as pitch). *Id.* at [0065]-[0067]. Kennedy teaches that its system may use "commercially available processors" and "memory modules." *Id.* at [0051]. Non-volatile memory is one type of "memory module," and, thus, Kennedy teaches two "host entities" with non-volatile memory.

F. Claim 5

Kennedy teaches that in "reverse geo coding" a customer's "textual location such as a street address" can be found "based on geographic coordinates." Ex. 1009 at [0063]. A customer's address is one type of contact information of a customer, which Kennedy identifies through its "geographic location of the roof." Accordingly, Kennedy teaches this claim. Ex. 1003 at ¶ 159.

G. Claim 8

Kennedy teaches that identifying a geographic location of the roof includes identifying one or more edges of the roof in an image:

> FIGS. 6 and 9 illustrate respectively a perspective view and a side elevation view of a "real world" surface to be measured wherein the surface comprises a roof 600. Roof 600 is defined by roof side surfaces 640 and 641 (641 not visible in FIG. 6). As seen in FIG. 6 ***roof surface 640 is defined by parallel side edges 631 and 731 and parallel side edges 630 and 730***. Roof side surfaces 640 and 641 meet to form a roof ridge 641. Roof ridge 641 is elevated with respect to a bottom side surface edge 630. The elevation of roof ridge 641 with respect to ***bottom edge 630*** is represented by dimension H. A roof span of 600 is indicated as B. Roof 600 is oriented in FIG. 6 as indicated by axes 670. In FIG. 9 orientation of roof 600 is indicated at 970.

Ex. 1009 at [0087] (emphasis added); Ex. 1003 at ¶ 160.

H. Claim 9

Kennedy discloses "one or more non-transitory computer readable medium storing a set of computer executable instructions for running on one or more computers systems of claim 1, as discussed with respect to claim 1." *See* claim 1, *supra*.

Kennedy further teaches that its system identifies "edges of the roof" as discussed with respect to claim 8. *See* claim 8, *supra*.

Kennedy further teaches that its system determines "three-dimensional information of the edges including position, orientation and length":

> FIGS. 6 and 9 illustrate respectively a perspective view and a side elevation view of a "real world" surface to be measured wherein the surface comprises a roof 600. Roof 600 is defined by roof side surfaces 640 and 641 (641 not visible in FIG. 6). As seen in FIG. 6 ***roof surface 640 is defined by parallel side edges***

> ***631 and 731 and parallel side edges 630 and 730***. Roof side surfaces 640 and 641 meet to form a roof ridge 641. Roof ridge 641 is elevated with respect to a bottom side surface edge 630. ***The elevation of roof ridge 641 with respect to bottom edge 630 is represented by dimension H.*** A roof span of 600 is indicated as B. Roof 600 is oriented in FIG. 6 as indicated by axes 670. In FIG. 9 ***orientation of roof 600 is indicated at 970***.

Ex. 1009 at [0087] (emphasis added).

Kennedy also teaches that the roof "edges" which "defin[e]" a roof are used to calculate roof size. *Id.* at [0182] ("The roof 3110 is defined by four lateral side edges…and a ridge."). Kennedy teaches that edges can be used as "reference lines" to measure the size of a roof. *Id.* at [0183]-[0184]. Kennedy makes clear that the term "sizing" refers to "obtaining or generating length and width measurements[.]" *Id.* at [0082]. Accordingly, Kennedy teaches determining edge position (*e.g.*, by identifying the location of parallel edges 630 and 730), orientation (*e.g.*, through identifying the orientation of roof 600) and length (*e.g.*, through roof sizing).

Kennedy teaches that this three-dimensional information is calculated based on multiple roof images, as required by claim 9. *Id.* at [0080]-[0082] ("In other embodiments of the invention, for example, for embodiments relying on 3-dimensional models, more than one image is retrieved from a

source of images…The site dimensions are determined by analyzing the images obtained[.]"

As discussed with respect to claim 2, Kennedy also teaches obtaining "oblique" images. *See* claim 2, *supra.* Accordingly, the multiple images used by Kennedy include oblique images.

Because these images are taken using real-world satellite imagery, they are "oblique images from multiple cardinal directions."

As discussed with respect to claim 1, Kennedy teaches that this information is also used to compute a "footprint" as required by claim 9. *See* Ex. 1003 at ¶ 161-68.

I. Claim 10

Bailey discloses this claim for the same reasons discussed with respect to Ground 1. *See* Ground 1 at claim 10, *supra*; Ex. 1003 at ¶ 169.

J. Claim 11

Bailey discloses this claim for the same reasons discussed with respect to Ground 1. *See* Ground 1 at claim 11, *supra*; Ex. 1003 at ¶ 170.

K. Claim 12

Kennedy and Bailey render this claim obvious. Bailey expressly teaches providing a report, *e.g.*, for use by contractors in repair. *See* claim 1. It would have been obvious to provide a report to contractors using Kennedy's

system based on the teachings of Bailey. Indeed, this is consistent with the Bailey's disclosure that the invention is meant to provide, *inter alia,* "contractors" with "tools and resources for gathering site specific information[.]" Ex. 1009 at [0008]; Ex. 1003 at ¶ 171.

L. Claim 13

1. Claim 13a

See claims 1, 4; Ex. 1003 at ¶ 172.

2. Claim 13b

See claims 1, 4; Ex. 1003 at ¶ 173.

3. Claim 13c

See claim 1; Ex. 1003 at ¶ 174.

4. Claim 13d

See claims 1, 2; Ex. 1003 at ¶ 175.

5. Claim 13e

See claim 1, 4; Ex. 1003 at ¶ 176.

6. Claim 13f

See claim 1c; Ex. 1003 at ¶ 177.

7. Claim 13g

See claim 1d; Ex. 1003 at ¶ 178.

8. Claim 13h

See claims 1, 2; Ex. 1003 at ¶ 179.

XI. GROUND 4: KENNEDY AND BAILEY IN FURTHER VIEW OF ABHYANKER RENDER OBVIOUS CLAIMS 6-7 AND 14-18 OF THE '538 PATENT

Ground 4 relies on the same combination of Kennedy and Bailey discussed in Ground 3 but adds the additional disclosure of Abhyanker to address the additional limitations of claims 6-7 and 14-18 (requiring various user input). Ex. 1003 at ¶ 180.

A. Motivation To Combine Kennedy, Bailey and Abhyanker

For the same reasons discussed above, a POSITA would have been motivated to combine the teachings of Kennedy and Bailey. A POSITA would have been motivated by the teachings of Abhyanker to allow users of Kennedy's roofing system the option to specifically designate the geographic position of a roof to be analyzed, and to include a subsequent user confirmation option to ensure that the correct roof is being analyzed. There are a variety of reasons a POSITA would be motivated to use these teachings from Abhyanker in Kennedy, including the same reasons discussed with respect to Ground 2 (Pershing-789 and Abhyanker). Ex. 1003 at ¶¶ 181-85.

A POSITA would have been motivated by the teachings of Abhyanker to allow users of Kennedy's roofing system the option to specifically

designate the geographic position of a roof to be analyzed using a marker, and to include a subsequent user confirmation option to ensure the correct roof is being analyzed. There are a variety of reasons a POSITA would be motivated to apply these teachings from Abhyanker to Kennedy.

For example, allowing a user to designate a geographic position of a roof and to subsequently confirm that the roof location is correct would promote the ***accuracy of the system***. Abhyanker's teachings expressly address this motivation. Abhyanker discloses that automated systems used to pinpoint geographic locations (like Kennedy's) are not always 100% accurate, and mistakes will result in user disappointment. Ex. 1005 at [0004]-[0005]. That is especially true here: if Kennedy's system inadvertently marked a neighboring roof (or a roof with the same address in a different state or town), the resulting materials estimate would be incorrect. This would cost both the user and the service provider time and money (and would potentially cost the software provider business). Thus, it would have been obvious to include Abhyanker's teachings of allowing a user to place a "marker" on the roof in question and to affirmatively "confirm" the right selection was made. This accuracy check would ***save money***, ***save time*** and ***avoid customer losses***.

In addition, applying Abhyanker's teachings to Kennedy's system would also ***add convenience*** to a user. For example, if a user inadvertently input a neighbor's address it would be convenient to allow the user to apply a drag-and-drop feature, like that taught by Abhyanker, to correct this error by simply sliding the marker to the correct location. This would also add to the convenience for users who may have difficulties typing or reading smaller print in the form fields in a screen—dragging a colored "marker" would assist such users in marking the right roof.

As explained above, Kennedy and Bailey are in the same field of endeavor as the '538 patent, use similar techniques to solve the same problems as the '538 patent and their combination would result in a reasonable expectation of success. Similarly, a POSITA would have been motivated to combine the teachings of Kennedy and Abhyanker because they are in the ***same field of endeavor*** as the '538 patent. Both Kennedy and the '538 patent are directed towards systems that locate and measure roof dimensions to estimate costs for repair or replacement. Ex. 1001 at Abstract; Ex. 1009 at Abstract. Similarly, Abhyanker is broadly directed towards accurate placement of markers in a "mapping environment," like the ones used in the Kennedy and '538 patent systems. Ex. 1005 at Abstract, [0012]. Further,

Kennedy, Abhyanker and the '538 patent all user ***similar techniques to solve the same problems***. As discussed below, Kennedy uses the same techniques to locate roofs and measure their dimensions as the '538 patent, and Abhyanker uses the same techniques to ensure accurate roof placement. A POSITA would also have a ***reasonable expectation of success*** in including the teachings of Abhyanker in Kennedy. Abhyanker's teachings confirm that user confirmation options in "mapping environments" such as Kennedy's were well known, and Kennedy specifically teaches that its system can be used the same context—locating roofs. Ex. 1005 at [0012]. Accordingly, Abhyanker itself would motivate a POSTIA to apply its teachings of user confirmation steps to improve Kennedy's system.

B. Claim 6

Abhyanker teaches this limitation for the same reasons discussed with respect to Ground 1. *See* Ground 1 at claim 6, *supra*; Ex. 1003 at ¶ 186.

C. Claim 7

Abhyanker teaches this limitation for the same reasons discussed with respect to Ground 1. *See* Ground 1 at claim 7, *supra*; Ex. 1003 at ¶ 187.

D. Claim 14

1. Claim 14a

See claim 1, 6; Ex. 1003 at ¶ 188.

2. Claim 14b

See claim 1; Ex. 1003 at ¶ 189.

3. Claim 14c

See claim 1; Ex. 1003 at ¶ 190.

4. Claim 14d

See claim 1; Ex. 1003 at ¶ 191.

E. Claim 15

See claim 2; Ex. 1003 at ¶ 92.

F. Claim 16

See claim 2; Ex. 1003 at ¶ 193.

G. Claim 17

As discussed with respect to claim 1 in Ground 3, the footprint of the roof may be represented by the roof's boundary lines. *See* Ground 3, claim 1. Any pitch value estimation must necessarily account for these boundary lines in order to estimate the pitch from peak to edge. Accordingly, the proposed combination renders obvious this limitation for the same reasons discussed with respect to claim 1 in Ground 1. Ex. 1003 at ¶ 194.

H. Claim 18

See claim 11, Ground 1 claim 18; Ex. 1003 at ¶ 195.

XII. MANDATORY DISCLOSURES

Pursuant 37 C.F.R. § 42.8(a)(1), the following mandatory notices are provided as part of this Petition.

A. Real Party in Interest

Pursuant to 37 C.F.R. § 42.8(b)(1), Petitioner certifies ROOFR INC. is the real party-in-interest.

B. Related Matters

Petitioner is not aware of any other related matters before the Patent Office with respect to the '538 patent.

The '538 patent has been asserted by Patent Owner in *Pictometry Int'l Corp. v. Roofr Inc.*, No. 1:21-cv-01852-RGA (D. Del.) against Petitioner.

C. Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3)) and Service Information (37 C.F.R. § 42.8(b)(3)-(4))

Petitioner provides the following counsel and service information. Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition. Petitioner agrees to accept electronic service at the email addresses below.

LEAD COUNSEL	BACK-UP COUNSEL
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D. Payment of Fees (37 C.F.R. § 42.15(a))

The undersigned authorizes the Office to charge the fee required for this Petition for *Inter Partes* Review to Deposit Account No. 50-5708. Any additional fees that might be due are also authorized.

Date: January 3, 2023

By: */s/ Jim Glass*

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CERTIFICATE OF LENGTH (37 C.F.R. §§ 42.24(D))

The undersigned hereby certifies that, according to the word-processing system used to prepare the foregoing document, this document has 13,868 words and thus complies with the applicable word limit.

Date: January 3, 2023

By: */s/ Sean Gloth*

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CERTIFICATE OF SERVICE (37 C.F.R. §§ 42.6(E), 42.105(A))

The undersigned hereby certifies that on January 3, 2023 a copy of this petition and supporting exhibits were served on counsel of record at the mailing address below via Priority Mail Express mail, and a courtesy copy was served via email on litigation counsel at the email addresses below:

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