Ex. 1003

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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ROOFR INC.,
Petitioner

v.

PICTOMETRY INTERNATIONAL CORP.,
Patent Owner

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IPR2023-00437
Patent 8,170,840

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**DECLARATION OF TONY CUMMINGS IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW**

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## LIST OF EXHIBITS

| Exhibit | Description |
|---|---|
| Ex. 1001 | U.S. Patent No. 8,170,840 ("'840 patent") |
| Ex. 1002 | File History of the '840 patent |
| Ex. 1003 | Expert Declaration of Anthony Cummings |
| Ex. 1004 | U.S. Pat. Pub. No. 2008/0262789 A1 ("Pershing-789") |
| Ex. 1005 | **INTENTIONALLY OMITTED** |
| 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 | **INTENTIONALLY OMITTED** |
| Ex. 1012 | Declaration of Sylvia Hall-Ellis |

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

| No. | Ground for Challenge |
|---|---|
| 1 | Kennedy And Bailey Render Obvious Claims 1-25 And 28 Of The '840 Patent |
| 2 | Kennedy, Bailey And Pictometry Render Obvious Claims 1-25 And 28 Of The '840 Patent |
| 3 | Pershing-789 And Kennedy Render Obvious Claims 1-25 And 28 Of The '840 Patent |
| 4 | Pershing-789, Kennedy And Pictometry Render Obvious Claims 1-25 And 28 Of The '840 Patent |

## LIST OF CHALLENGED CLAIMS

| Claim |
| --- |
| **Claim 1a:** A computer-implemented method for generating a roof estimate report, the method comprising: |
| **Claim 1b:** displaying an aerial image of a building having a roof comprising a plurality of planar roof sections that each have a corresponding pitch; |
| **Claim 1c:** displaying a pitch determination marker operable to indicate pitch of a planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having the roof; |
| **Claim 1d:** receiving, based on the displayed pitch determination marker, an indication of the pitch of one of the plurality of planar roof sections of the roof of the building; and |
| **Claim 1e:** modifying a model of the roof based on the received indication of the pitch of the one planar roof section. |
| **Claim 2:** The method of claim 1 wherein the pitch determination marker is adjustable to specify pitch of a planar roof section. |
| **Claim 3:** The method of claim 1 further comprising: transmitting roof measurement information based on the modified model of the roof, the roof measurement information including a measure of the pitch of the one planar roof section. |
| **Claim 4:** The method of claim 1 wherein modifying the model of the roof includes associating the indicated pitch with a portion of the model of the roof that corresponds to the one planar roof section of the roof of the building. |
| **Claim 5:** The method of claim 1 further comprising: displaying a wireframe rendering of the modified model superimposed on the aerial image of the building. |
| **Claim 6:** The method of claim 5 wherein displaying the wireframe rendering occurs in response to the receiving of the indicated pitch. |
| **Claim 7:** The method of claim 1 wherein the pitch determination marker includes an adjustable protractor tool having a member that is adjustable to indicate an angle. |

| Claim |
| --- |
| **Claim 8:** The method of claim 1 wherein the pitch determination marker includes an envelope tool having two surfaces that are adjustable to indicate an angle. |
| **Claim 9:** The method of claim 1 wherein modifying the model of the roof includes modifying a three-dimensional model of the roof. |
| **Claim 10a:** A computing system for generating a roof estimate report, the computing system comprising: a memory; |
| **Claim 10b:** a roof estimation module that is stored on the memory and that is configured, when executed, to: display an aerial image of a building having a roof comprising a plurality of planar roof sections that each have a corresponding pitch; |
| **Claim 10c:** display a pitch determination marker operable to indicate pitch of a planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having the roof; |
| **Claim 10d:** receive, based on the displayed pitch determination marker, an indication of the pitch of one of the plurality of planar roof sections of the roof of the building; |
| **Claim 10e:** modify a model of the roof based on the received indication of the pitch of the one planar roof section; and |
| **Claim 10f:** provide roof measurement information based on the model of the roof, the roof measurement information including a measure of the pitch of the one planar roof section. |
| **Claim 11:** The computing system of claim 10 wherein the roof estimation module is further configured to transmit a roof estimate report based on the provided roof measurement information. |
| **Claim 12:** The computing system of claim 10 wherein the pitch determination marker includes at least one of an adjustable protractor tool and an envelope tool. |
| **Claim 13:** The computing system of claim 10 wherein the roof estimation module includes an interactive roof modeling user interface. |
| **Claim 14:** The computing system of claim 10 wherein the roof estimation module is further configured to display the pitch determination marker as part of an interactive user interface. |
| **Claim 15:** The computing system of claim 10 wherein the model of the roof is a three-dimensional model of the roof. |

| Claim |
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| **Claim 16a:** A non-transitory computer-readable storage medium whose contents enable a computing system to generate a roof estimate report for a building having a roof, by performing a method comprising: |
| **Claim 16b:** displaying an aerial image of a building having a roof comprising a planar roof section that has a corresponding pitch; |
| **Claim 16c:** displaying a pitch determination marker operable to indicate pitch of the planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having the roof; |
| **Claim 16d:** receiving, based on the displayed pitch determination marker, an indication of the pitch of the planar roof section; and |
| **Claim 16e:** modifying a model of the roof based on the received indication of the pitch of the planar roof section. |
| **Claim 17:** The non-transitory computer-readable storage medium of claim 16 wherein the pitch determination marker is adjustable to specify pitch of a planar roof section. |
| **Claim 18:** The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: generating a roof estimate report based on the modified model of the roof; and transmitting the generated roof estimate report. |
| **Claim 19:** The non-transitory computer-readable storage medium of claim 18 wherein the transmitted roof estimate report includes a line drawing of the roof of the house labeled with a measure of the pitch of the planar roof section. |
| **Claim 20:** The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: determining roof measurement information based on the modified model of the roof, the roof measurement information including a measure of the pitch of the planar roof section; and transmitting the determined roof measurement information. |
| **Claim 21:** The non-transitory computer-readable storage medium of claim 16 wherein modifying the model of the roof includes modifying a model of the roof by associating the indicated pitch with a portion of the model of the roof that corresponds to planar roof section of the roof of the building. |
| **Claim 22:** The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: displaying a wireframe |

| Claim |
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| rendering of the modified model superimposed on the aerial image of the building. |
| **Claim 23:** The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: registering, based on operator indicated features, multiple aerial images to a reference grid corresponding to the model. |
| **Claim 24:** The non-transitory computer-readable storage medium of claim 23 wherein registering multiple images includes: displaying a marker operable to specify a point on the aerial image; receiving, via the marker, an indication of a point on the aerial image; and registering, based on the received indication of the point, the aerial image to the reference grid. |
| **Claim 25:** The non-transitory computer-readable storage medium of claim 24 wherein registering the aerial image to the reference grid includes determining a transformation between the aerial image and the reference grid. |
| **Claim 28:** The non-transitory computer-readable storage medium of claim 16 wherein modifying the model of the roof includes modifying a three-dimensional model of the roof. |

## I. BACKGROUND AND QUALIFICATIONS

1. I have been retained by Petitioner as a technical expert to analyze claims 1-25 and 28 of U.S. Patent No 8,170,840. I am being compensated for my time at a consulting rate of $490 per hour. My compensation does not depend on the outcome of this petition. In this section I have summarized my education, career history, publications, and other relevant information. My curriculum vitae, which includes my qualifications as well as my publications, is attached hereto.

2. I have a Bachelor of Architecture from Kansas State University graduating in 1977. I have been a licensed, practicing architect since 1983 hold architectural licenses in 18 states, 14 are currently active. I also have certification with OSHA 10-hour Construction Safety and Health Training and California Office of Emergency Services Safety Assessment Program Evaluator. I have previously held a Level 2 Certification as an Infrared Thermographer performing building wall and roof evaluations for moisture intrusion. I hold professional memberships at the American Institute of Architects (AIA), Construction Specifications Institute (CSI), International Code Council (ICC), National Fire Protection Association (NFPA), National Institute of Building Science (NIBS), Society of Value Engineering (SAFE), American Society of Professional Estimators (ASPE), and the International

Institute of Building Enclosure Consultants (IIBEC), formally known as The Roof Consultant's Institute (RCI).

3. My experience with evaluation and testimony on construction disputes started in 1984 during the period I had an architectural practice in Colorado. In 1989 and a portion of 1990, I worked for a claims consulting firm in their Clearwater Florida office where I evaluated defective construction claims primarily related to condominium projects.

4. Since 1990, I have owned and operated Construction Forensics, Incorporated (CFI) providing analysis of construction failures and disputes. In that time, I have performed forensic investigations in 16 states, for plaintiffs and defendants to include: code review and conformance, failure analysis of building systems and components, material and workmanship evaluations, Standard of Care for design professionals, CPM schedule analysis, suitability of plans and specifications, analysis of cost estimates and providing cost estimate for remediation, including roofing. Deposition and expert testimony, beginning in 1984, have been for cases in Circuit Courts, District Courts, Superior Court, Arbitration, Mediation, the Armed Services Board of Contract Appeals, and the United States Civilian Board of Contract Appeals.

5. My experience with estimating construction projects began during my architectural internship period assembling preliminary cost

estimates for clients on projects that the architectural firms were designing. The vast majority of these projects were new construction which required cost related to new roofing on both commercial and residential. Between 1980 and 1983 I began as an estimator and later became head of estimating for a firm in Colorado specializing in Department of Defense construction projects (primarily housing rehabilitation). In total, we bid and completed approximately 2000 housing units across the United States ranging from minor interior renovation to whole house/building repairs. Between 1987 to 1989, I was hired to become head of estimating and overhaul the existing estimating component of the firm which also specialized in Department of Defense construction projects. While at this firm, I became the quality control officer on a 135-unit housing development overseeing the total renovation of abandoned base housing in Newport, Rhode Island. Since 1990, I have provided forensic analysis of numerous roofs and performed estimates which have included estimating the cost to repair for litigation purposes on a variety of project types.

6. While I am not a computer programmer, I have extensive experience using software related to construction. Indeed, I have spent decades working with software related to construction modeling and estimation. For example, I have relied on Computer-aided Design Packages

(CAD), programs that have automated the building code review process, Critical Path Method scheduling packages (CPM), and construction estimating software. I have been using this software for decades. I also have experience collaborating with software developers to create new software in my field. For example, in approximately 2010 I partnered with a computer programmer to develop a photo-documentation and document control software to assist in my Owner's Representative assignments.

## II. LEVEL OF SKILL IN THE ART

7. In my opinion, 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.

## III. LEGAL STANDARDS

8. I understand that "prior art" includes patents and printed publications that existed before the earliest applicable filing date of the '840 Patent.

9. I understand that in order for a claim to be anticipated, each and every requirement of the claim must be found, expressly or inherently, in a single prior art reference as recited in the claim.

10. I understand that a claimed invention is not patentable if the claimed invention would have been obvious to a person of ordinary skill in the field of the invention at the time the invention was made.

11. I understand that in order to show obviousness based on a combination of references, a particular motivation to combine the teachings in the references must be shown.

12. I understand that claim terms are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art at the time of the invention. I further understand that a person of ordinary skill in the art must read the claim term not only in the context of the particular claim in which the term appears but in the context of the entire patent, including the specification.

13. I understand that the obviousness inquiry should not be done in hindsight, and depends on the scope and content of the prior art, the differences between the prior art and the claims at issue, the knowledge of a person of ordinary skill in the pertinent art at the time of invention, and any other objective factors indicating obviousness or non-obviousness.

14. I understand that in order to rely on a reference for obviousness, the reference must be analogous art. I also understand that to be analogous art, the reference must be either (1) from the same field of endeavor as the

claimed subject matter, regardless of the problem addressed, or (2) if not in the same field of endeavor, reasonably pertinent to the particular problem with which the inventor is involved. I am also familiar with the premise that for a reference to be reasonably pertinent, it must have logically commended itself to an inventor's attention at the time of invention.

## IV. CLAIM CONSTRUCTION

15. Based on my review of the '840 patent, it is my opinion that express interpretations of the Challenged Claims are not necessary. I reserve my right to respond to, and/or to offer alternative constructions to any proposed claim constructions offered by Patent Owner. I take 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.

## V. OVERVIEW OF THE '840 PATENT

16. The '840 patent is generally directed towards a user interface for roof estimation. Ex. 1001 at Abstract. The challenged claims generally recite: (1) displaying an aerial image of a building; (2) displaying a "pitch determination marker"; (3) receiving an indication of the pitch from the "pitch determination marker"; and (4) modifying a model of the roof based on the pitch. Ex. 1001 at claim 1.

17. The specification of the '840 patent includes exemplary flow charts describing the alleged invention. For example, Figure 10 shows a general flow diagram of the process recited in the claims:

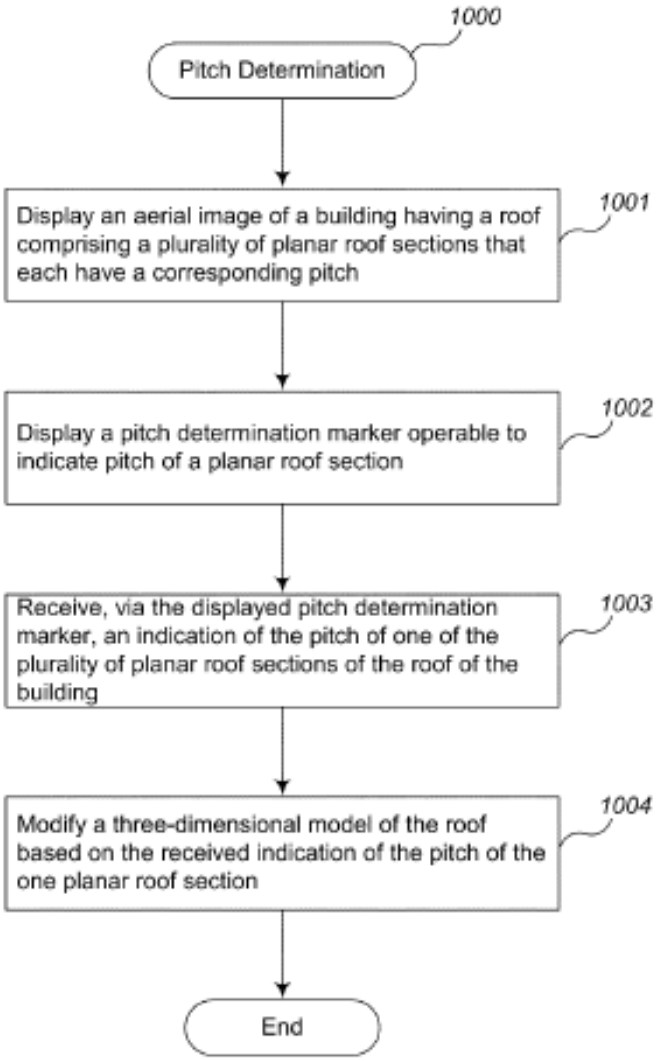



***Fig. 10***

18. Ex. 1001 at Fig. 10. Figure 5B, for example, shows the pitch being measured with a "pitch determination marker 510":

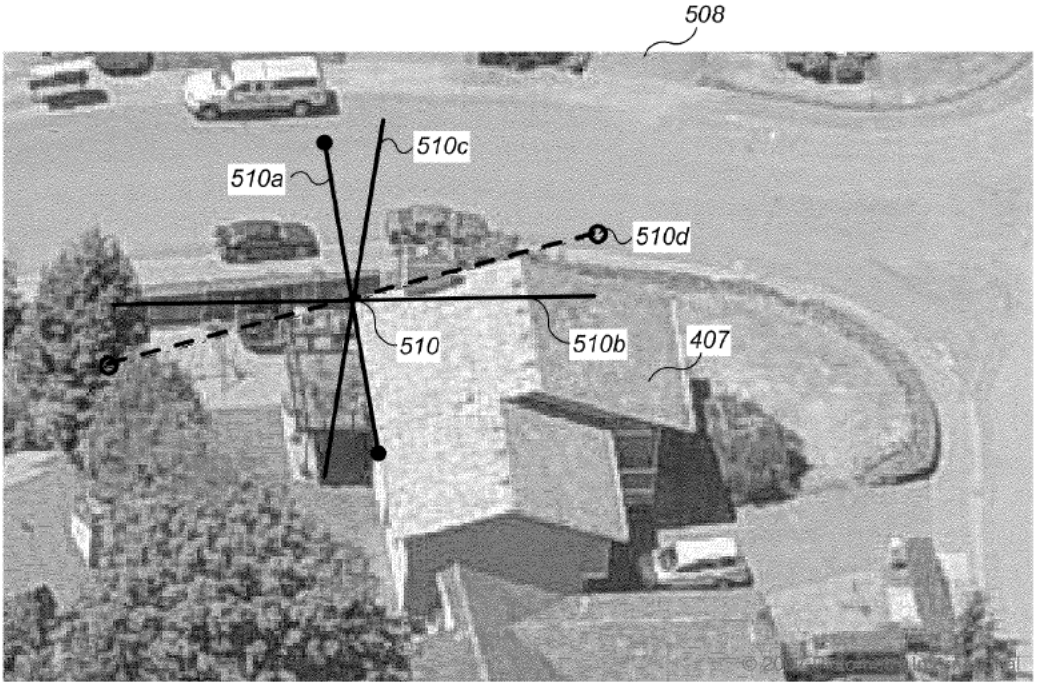



***Fig. 5B***

Ex. 1001 at Fig. 5B.

## VI. PROSECUTION OF THE '840 PATENT

19. The application that led to the '840 patent was filed on May 15, 2009. On August 26, 2011, the Examiner issued a Non-Final rejection based on double-patenting, and finding that the recited claims were unpatentable under § 101. Ex. 1002 at 387-393. The Examiner further found that the claims were anticipated by Pershing (2008/0262789 A1) (referred to in the Grounds below as "Pershing-789"). *Id.*

20. In response, applicant amended the claims to recite a "non-transitory computer readable medium" to overcome the § 101 rejection. Ex.

1002 at 85-89. Applicant further amended the claims to recite a "pitch determination marker" that is "overlaid on the aerial image" of the roof to overcome Pershing. *Id.*

21. On February 16, 2012, the Examiner allowed the claims, stating that the prior art failed to show the claimed "pitch determination maker" "overlaid" on the aerial image as recited in the claims. *Id.* at 46-47.

## VII. PRIORITY DATE OF THE '840 PATENT

22. The '840 patent claims priority to a provisional application filed on October 31, 2008. It is my understanding that all of the references relied upon in the petition Grounds qualify as prior art if October 31, 2008 is considered the priority date for the '840 patent and are, thus, appropriate to rely on as part of my patentability analysis. The disclosures in these references are consistent with my experience, which confirms that the disclosures in the prior art were well-known before October 31, 2008.

## VIII. PRIOR ART

### A. Kennedy

23. U.S. Pat. Pub. No. 2009/0304227 A1 ("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 '840 patent under pre-AIA § 102(e). 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:

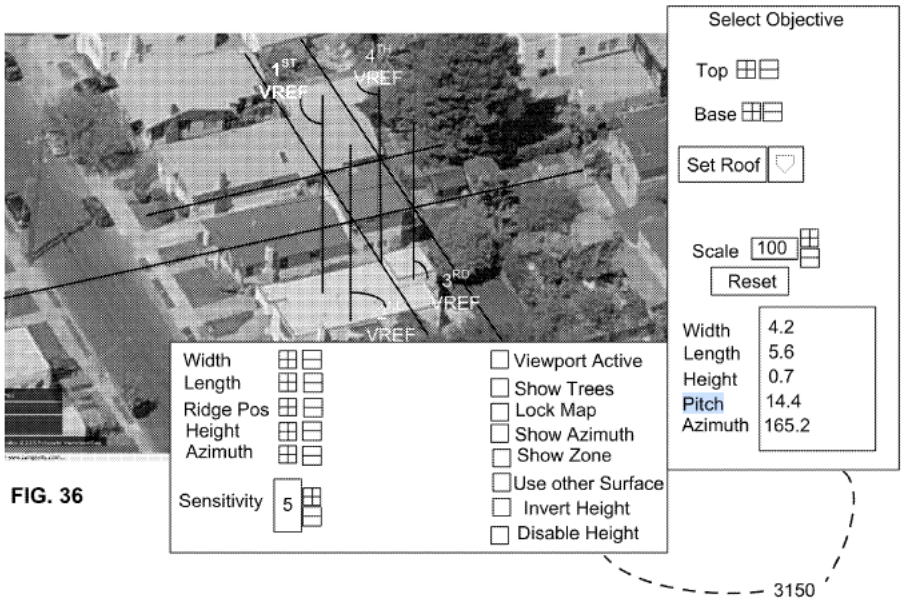



FIG. 36

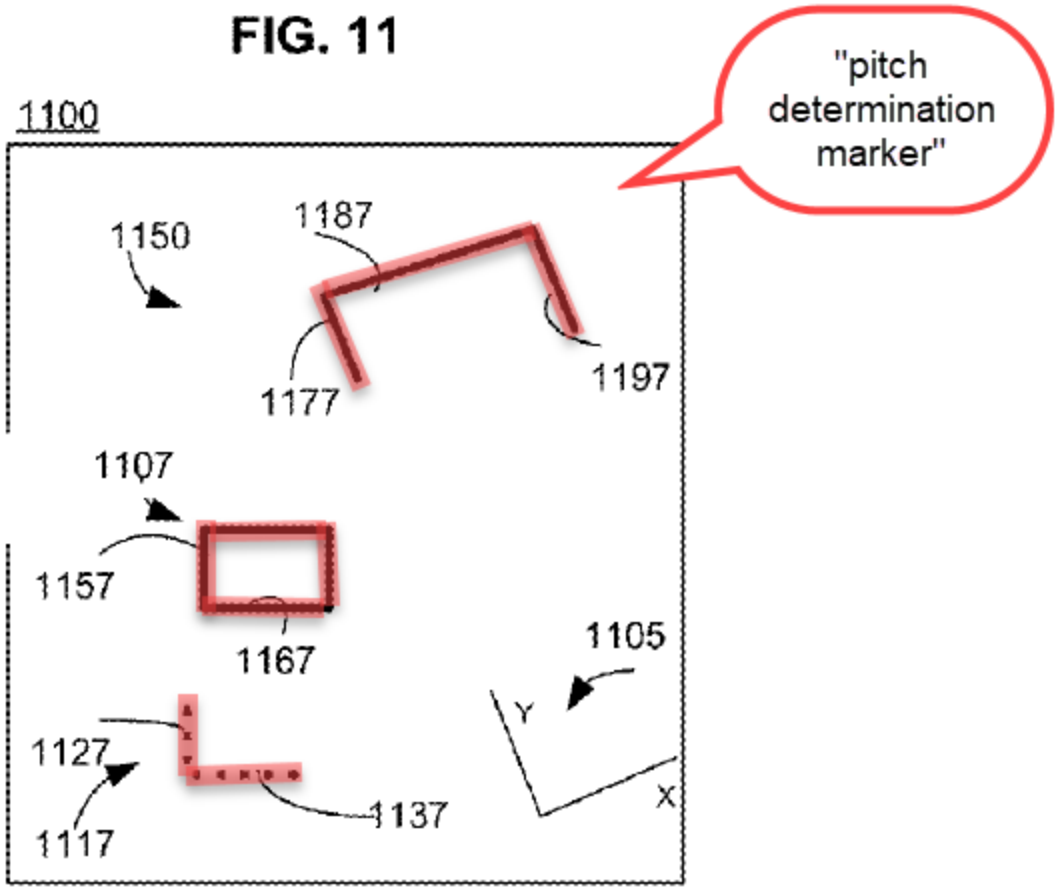
*Id.* at Fig. 36. Kennedy discloses a sizing subsystem with a "sizing tool" that can be used to determine pitch:

> 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).

24. 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:




*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].

25. 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.").

26. 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).

**B. Pershing-789**

27. U.S. Pat. Pub. No. 2008/0262789 A1 ("Pershing-789") is a U.S. Patent Publication published on October 23, 2008. Accordingly, Pershing-789 qualifies as prior art to the '840 patent under pre-AIA § 102(a). 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].

28. 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.

29. *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:

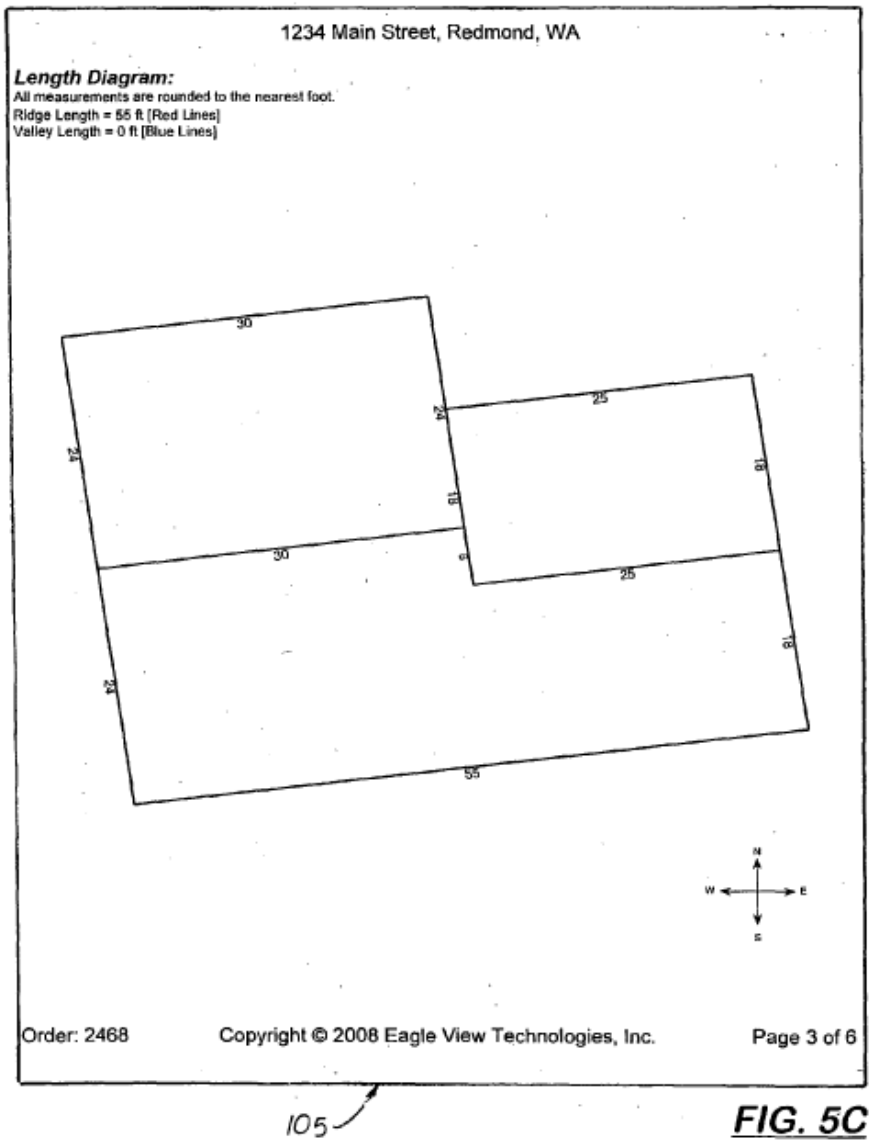



FIG. 5C

Ex. 1004 at Fig. 5C; *id.* at [0038].

**C. Bailey**

30. *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") is a printed publication published December 1999. Accordingly, Bailey qualifies as prior art to the '840 patent under pre-AIA § 102(b). Bailey discloses steep

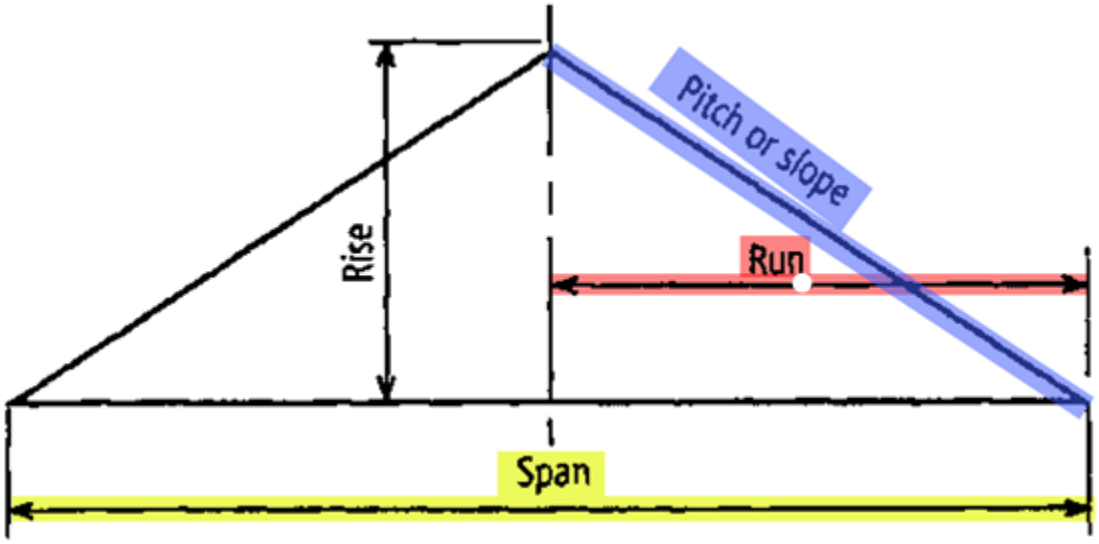
roofing inventory procedures and inspection techniques. Baily generally teaches methods for collecting data about a roof, including the "***predominant slope***" of the roof:

> 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).

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

32. 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).

33. 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.

34. 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).

35. Bailey explains that finding the "predominant slope [*i.e.*, pitch]" for 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.*):

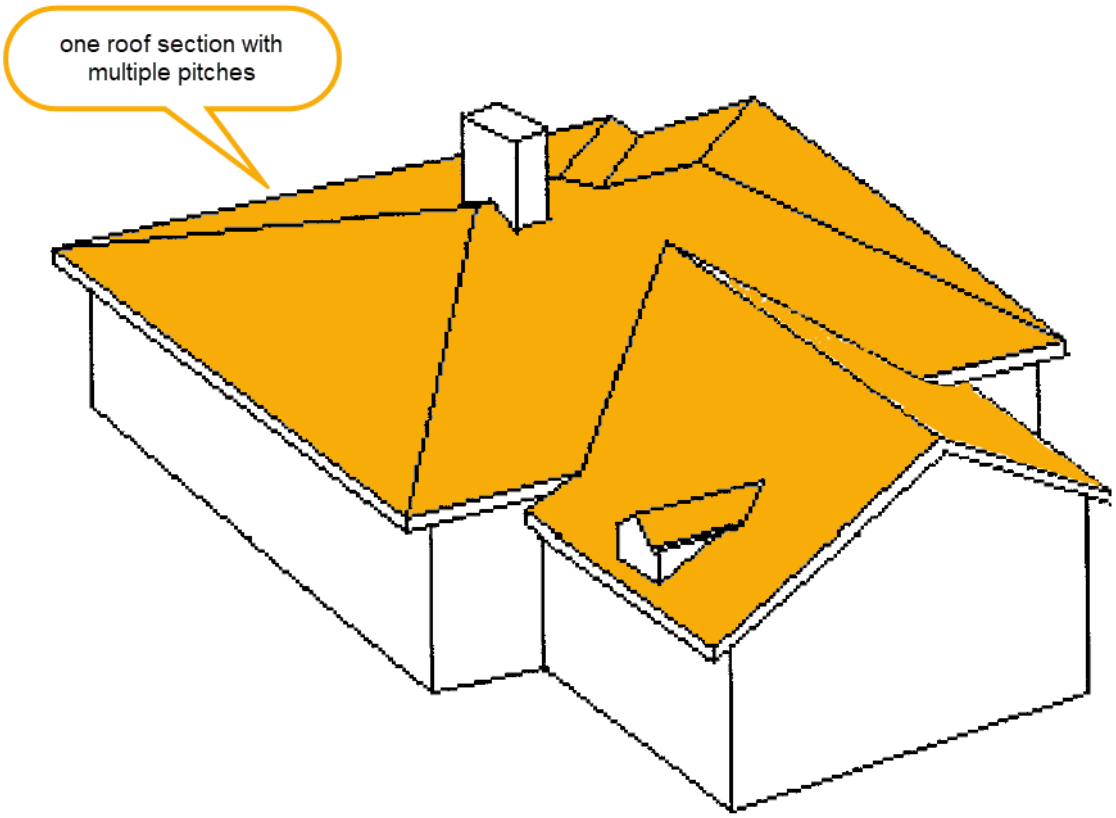



**Figure 2. Example of a building roof comprising a roof section.**

36. *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.

**D. Pictometry**

37. *Pictometry: aerial photography on steroids*, LET Staff, Law Enforcement Technology (July 2002) ("Pictometry") is a printed publication published on July 2002. Accordingly, Pictometry qualifies as prior art to the '840 patent under pre-AIA § 102(b). Pictometry discloses a program that allows users to annotate aerial photographs. *See, generally* Ex. 1008.

Pictometry teaches that a variety of aerial photographs can be taken, and that users can "zoom, measur[e]…and annotate[e]" these images. *Id.* at 115. Pictometry teaches a "distance tool" which allows a user to measure things contained within the image. *Id.* at 116. Pictometry specifically teaches drawing lines around a "parcel" to learn the square footage and area of a region. *Id.* Pictometry's tool can also be used for "measuring angles." *Id.* at 116.

## IX. GROUND 1: KENNEDY AND BAILEY RENDER OBVIOUS CLAIMS 1-25 AND 28 OF THE '840 PATENT

### A. Motivation To Combine

38. A POSITA would have been motivated to incorporate Bailey's teachings of generating a report into the system of Kennedy. A POSITA would have been motivated to generate a report based on the teachings of Bailey, which teaches using a report to record the same type of roof data Kennedy's system collects for, *e.g.*, repair assessment. Generating a digitized report would be beneficial because it would allow Kennedy to securely store customer records, and prevent them from getting lost, deleted or damaged. Generating a report would further allow Kennedy to transmit a digital report to customers via email. Likewise, a POSITA looking at Bailey's reports which also include roof images would readily understand the benefits of

including Kennedy's aerial images and annotations in a digital report, which would result in a helpful visual to both customers and roofers.

39. 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 '840 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 '840 patent—indeed, Kennedy discloses nearly all of the limitations of the '840 claims, and Bailey discloses generating a report as required by the claims. A POSITA would have had a ***reasonable expectation of success*** applying Bailey's teaching of generating a report into Kennedy's system at least because Kennedy already teaches collecting and storing roofing data.

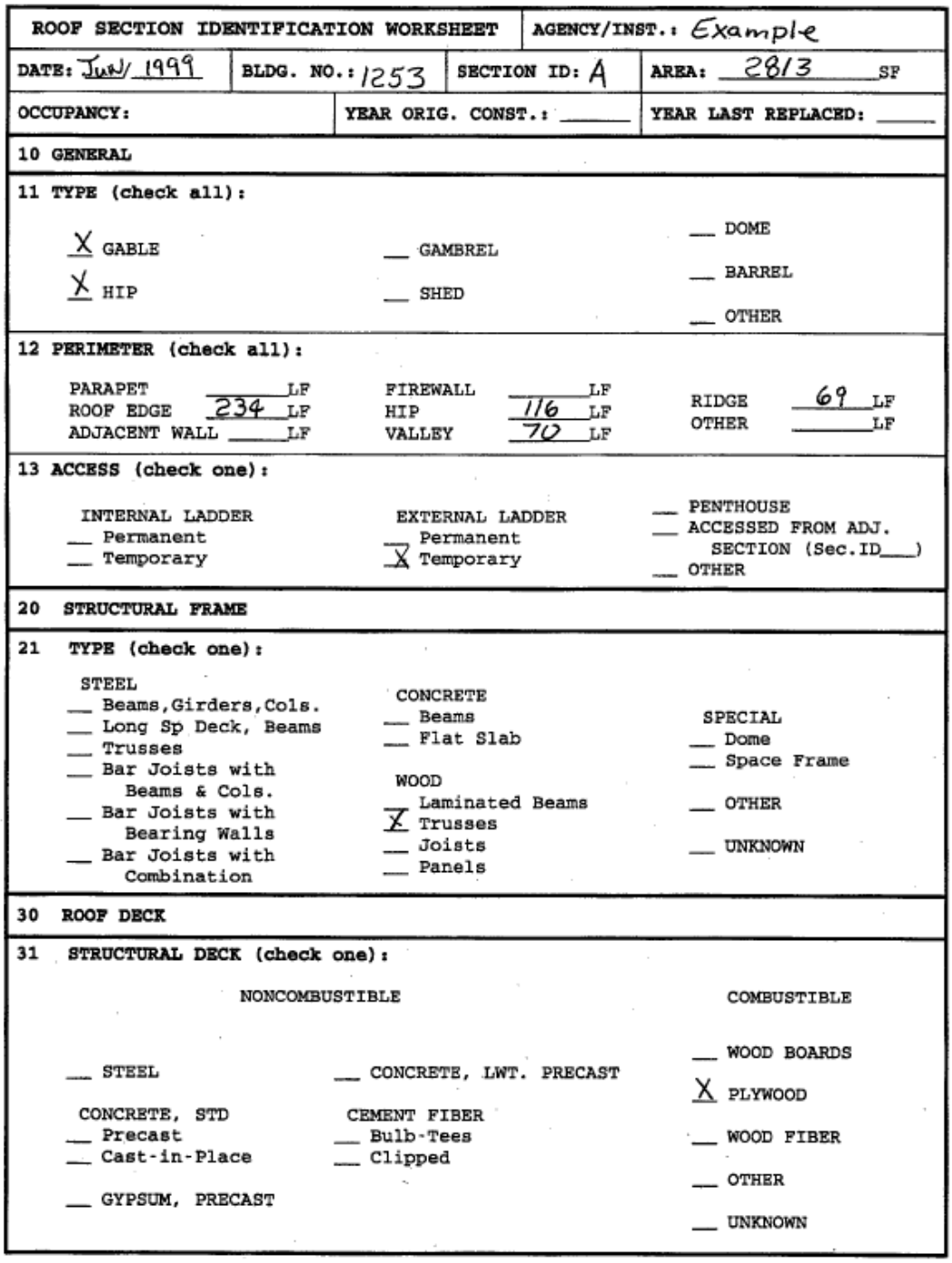
### B. Claim 1

#### 1. Claim 1a: A computer-implemented method for generating a roof estimate report, the method comprising:

40. Kennedy teaches a computer-implemented method for generating a roof estimate report. Kennedy teaches a "roof estimating software program." Ex. 1009 at Abstract. Kennedy expressly teaches preparing a "quote" for customers. Ex. 1009 at ¶¶ 164, 169, 179-80, Figs. 24, 36. 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***.

41. 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. 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
- [X] Laminated Beams
- [ ] 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

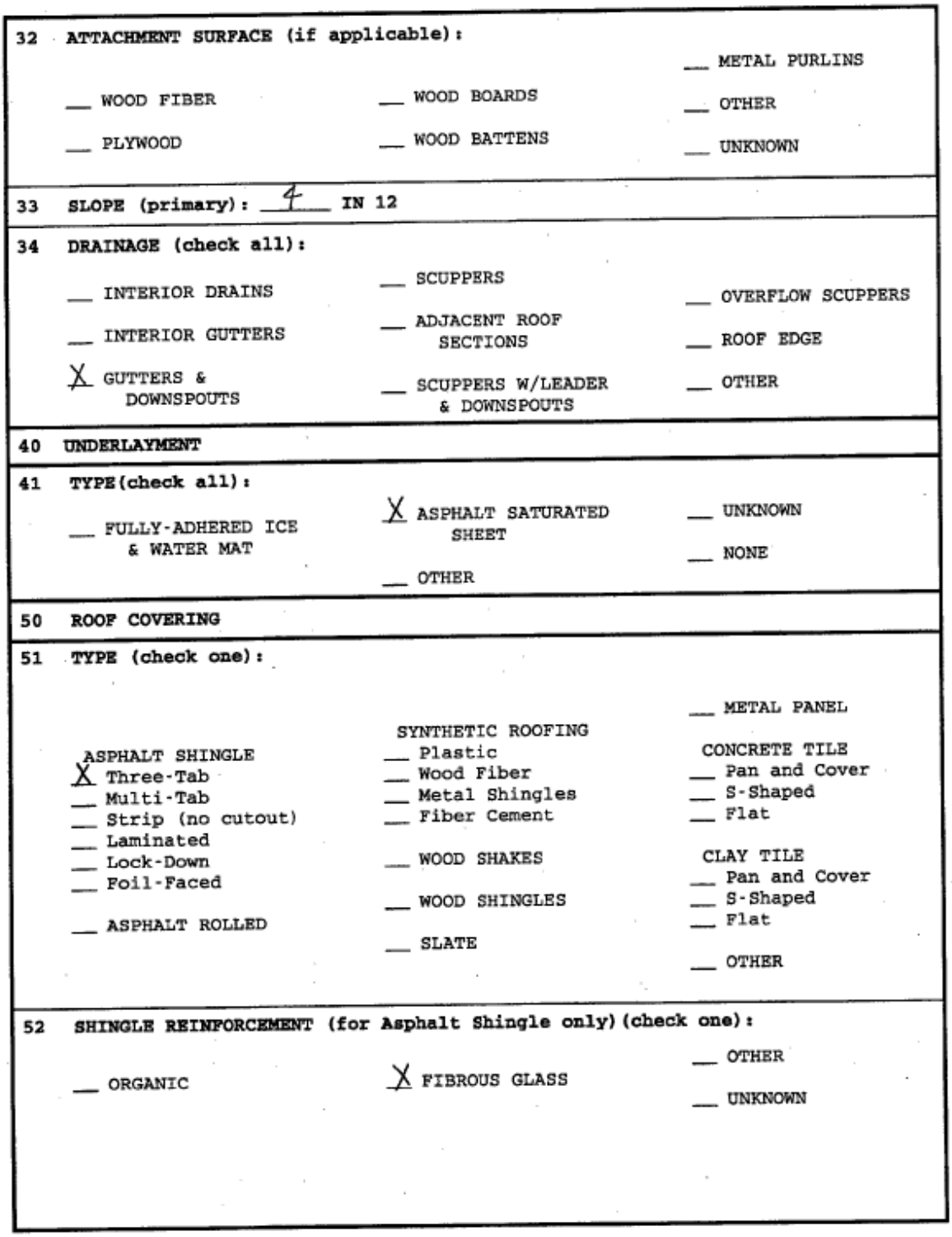
CEMENT FIBER
- [ ] Bulb-Tees
- [ ] Clipped

- [ ] 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).

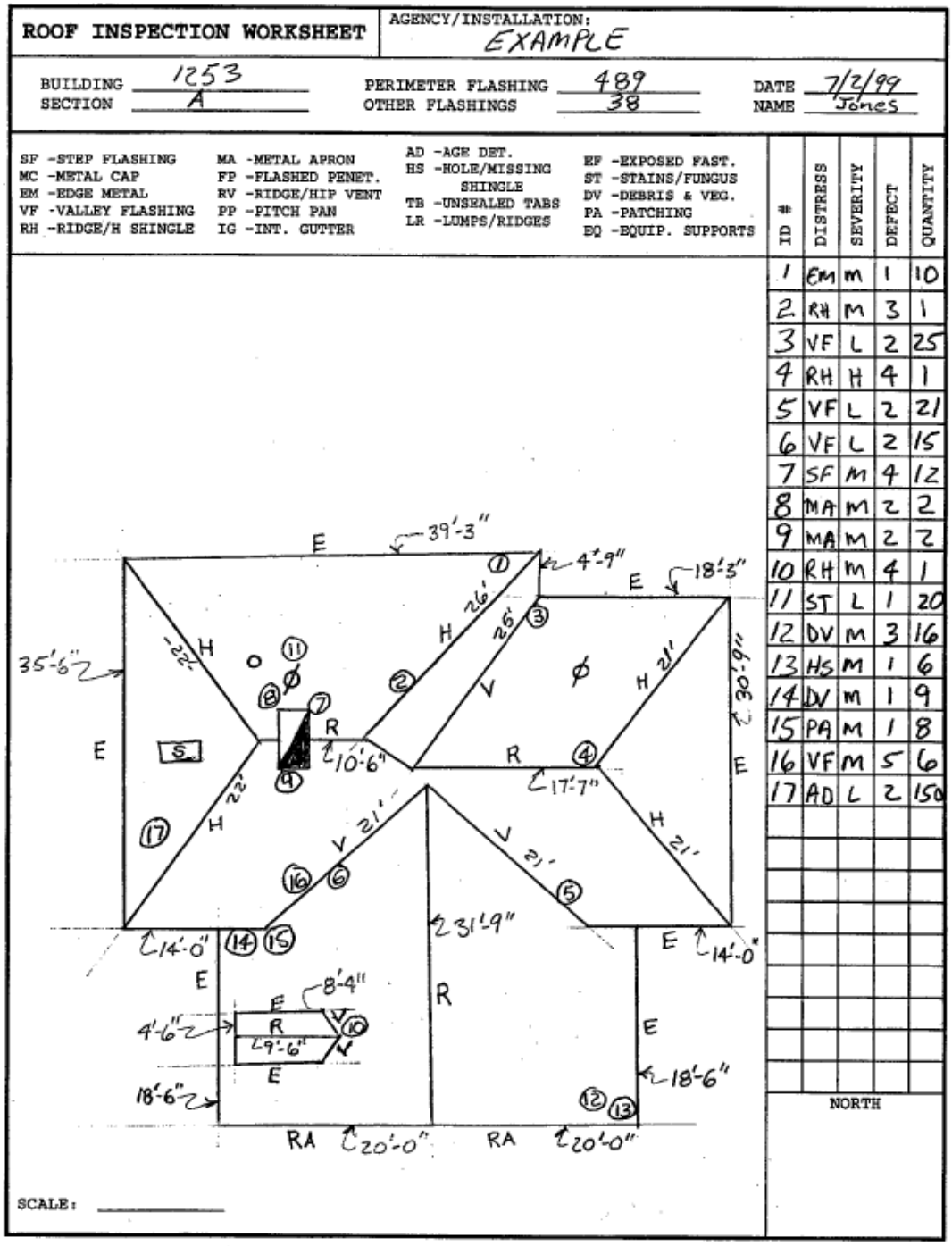



**Figure 10. Completed Roof Inspection Worksheet.**

Ex. 1010 at Fig. 10.

### 2. Claim 1b: displaying an aerial image of a building having a roof comprising a plurality of planar roof sections that each have a corresponding pitch;

42. 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:

> 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.

Ex. 1009 at Abstract (emphasis added); *see also id.* at ¶¶ 59-67.

43. Kennedy further 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:

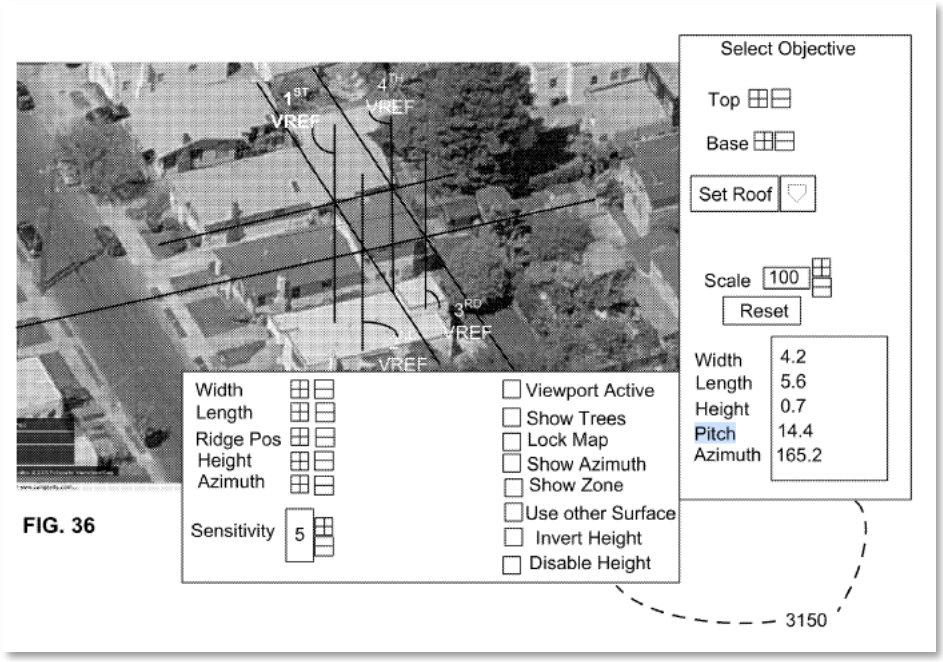



FIG. 36

*Id.* at Fig. 36. Kennedy discloses:

> 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].

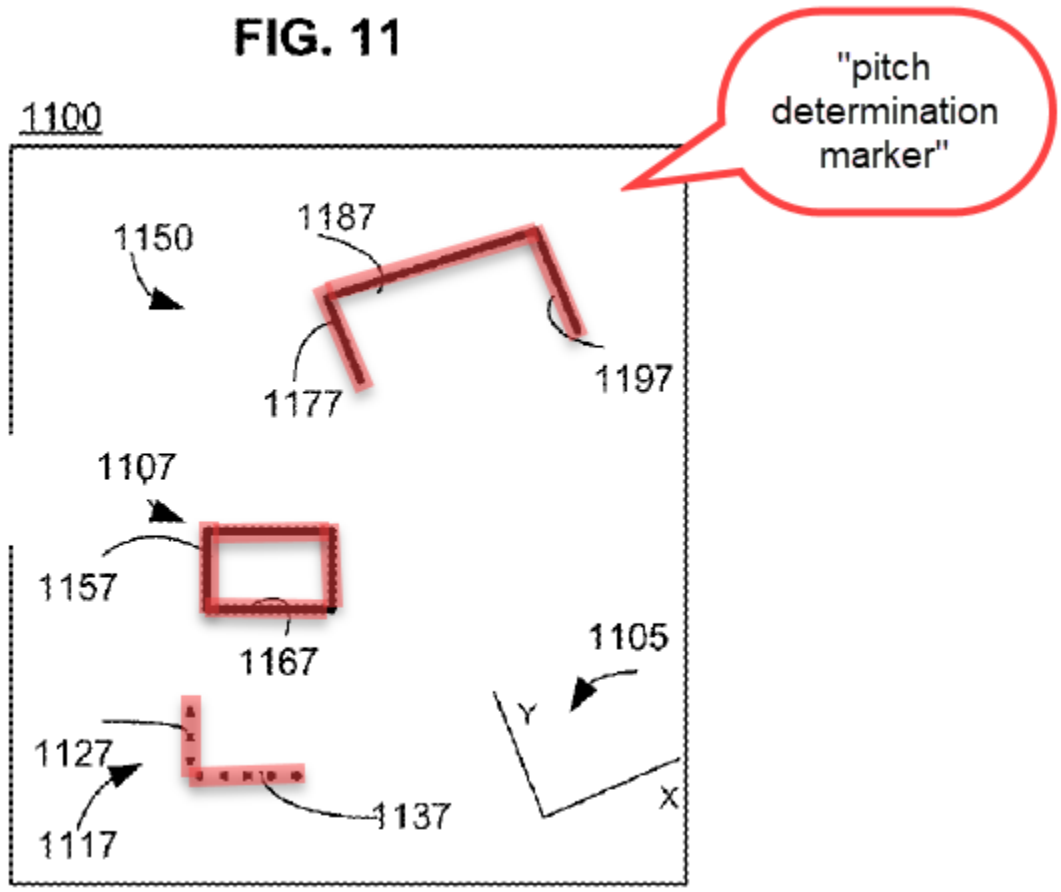
**3. Claim 1c: displaying a pitch determination marker operable to indicate pitch of a planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having the roof;**

44. Kennedy discloses "displaying a pitch determination marker operable to indicate pitch of a planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having

the roof." In particular, 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.

45. *Id.* at [0058], [0065]-[0067]. 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]; *see also id.* at [0082]-[0122] (describing embodiments of the sizing subsystem). The sizing tool is shown, for example, in Figure 11—this sizing tool (also called a "measuring tool") is the claimed "pitch determination marker":




46. *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." *Id.*

47. 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."). Kennedy's sizing/measuring tool is the claimed "pitch determination marker."

#### 4. Claim 1d: receiving, based on the displayed pitch determination marker, an indication of the pitch of one of the plurality of planar roof sections of the roof of the building; and

48. As discussed with respect to claim 1c, Kennedy teaches receiving an indication of the pitch of one of a plurality of planar roof sections of the roof of a building based on the displayed pitch determination marker ("measuring tool"). *See* claim 1c; Ex. 1009 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.").

#### 5. Claim 1e: modifying a model of the roof based on the received indication of the pitch of the one planar roof section.

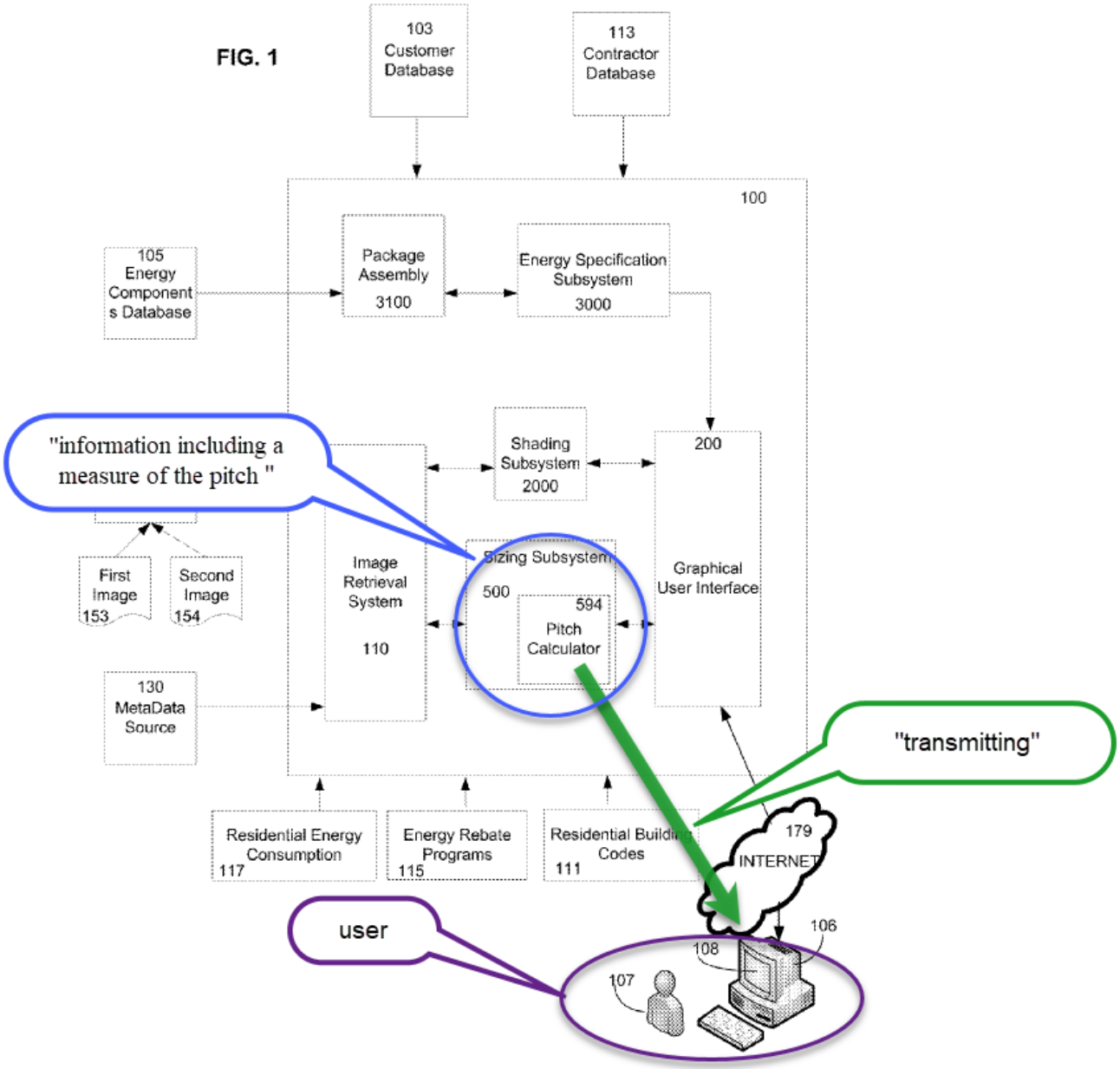
49. Kennedy teaches that its system models a roof based on, inter *alia*, the indication of pitch of the one planar roof section. Ex. 1009 at [0118] ("Returning now to FIG. 5, 3D transformer/translation module 596 uses the ***displacement information to generate a 3D model of roof*** 600.") (emphasis added). Kennedy further teaches that the system "tracks changes in the geometry of measuring tool 1107 in relation to the real world dimensions." *Id.* at [0119]. Kennedy's teachings of generating a model using the measuring tool, including tracking "changes" of the measuring tool discloses the claimed "modifying" of the model.

### C. Claim 2: The method of claim 1 wherein the pitch determination marker is adjustable to specify pitch of a planar roof section.

50. As discussed with respect to claim 1, Kennedy's pitch determination marker is adjustable to specify pitch of a planar roof section. *See also id.* at [0105] ("The measuring tool is ***rotatable and scalable*** by user 507[.]") (emphasis added); *see also* claim 1e.

**D. Claim 3: The method of claim 1 further comprising: transmitting roof measurement information based on the modified model of the roof, the roof measurement information including a measure of the pitch of the one planar roof section.**

51. Kennedy teaches transmitting roof measurement information based on the modified model of the roof, the roof measurement information including a measure of the pitch of the one planar roof section. For example, Kennedy teaches that its system transmits information to a user, including pitch information:




52. Ex. 1009 at Fig. 1. (annotated). As shown in Fig. 36, the information transmitted to the user's display include "pitch" information:

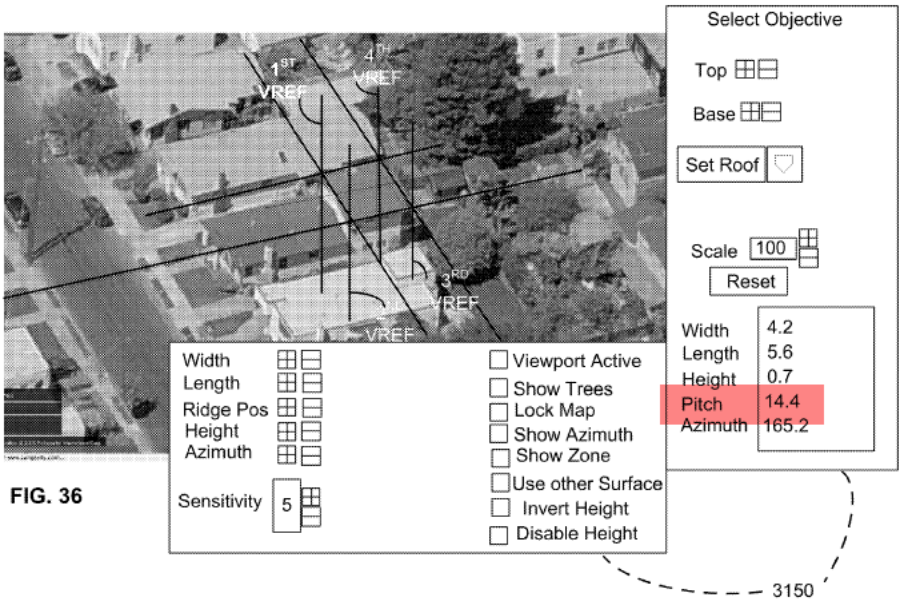



FIG. 36

53. *Id.* at Fig. 36 (annotated), [0186] ("The model 31100 is rotatable and translatable by the user operating model interface controls (example illustrated in Fig. 36)."), [0189] ("Fig. 36 is an image providing perspective view of the roof image of Fig. 35[.]"), [0188] ("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."); *see also* claims 1e, 2.

**E. Claim 4: The method of claim 1 wherein modifying the model of the roof includes associating the indicated pitch with a portion of the model of the roof that corresponds to the one planar roof section of the roof of the building.**

54. As discussed above with respect to claims 1 and 2, Kennedy's sizing tool teaches modifying a model of the roof, including associating the

indicated pitch with a portion of the model of the roof that corresponds to the one planar roof section of the roof of the building that a user is measuring.

### F. Claim 5: The method of claim 1 further comprising: displaying a wireframe rendering of the modified model superimposed on the aerial image of the building.

55. Kennedy discloses the claimed "wireframe rendering." In particular, the '840 patent discloses that a "wireframe" rendering superimposed on an aerial image may be generated when an "operator uses the drawing tool 610 to trace or outline planar sections of the roof 407, leading to the generation of wire frame 611." Ex. 1001 at 14:13-15. The '840 patent shows this wireframe image in Figure 6B:

**’840 Patent:**

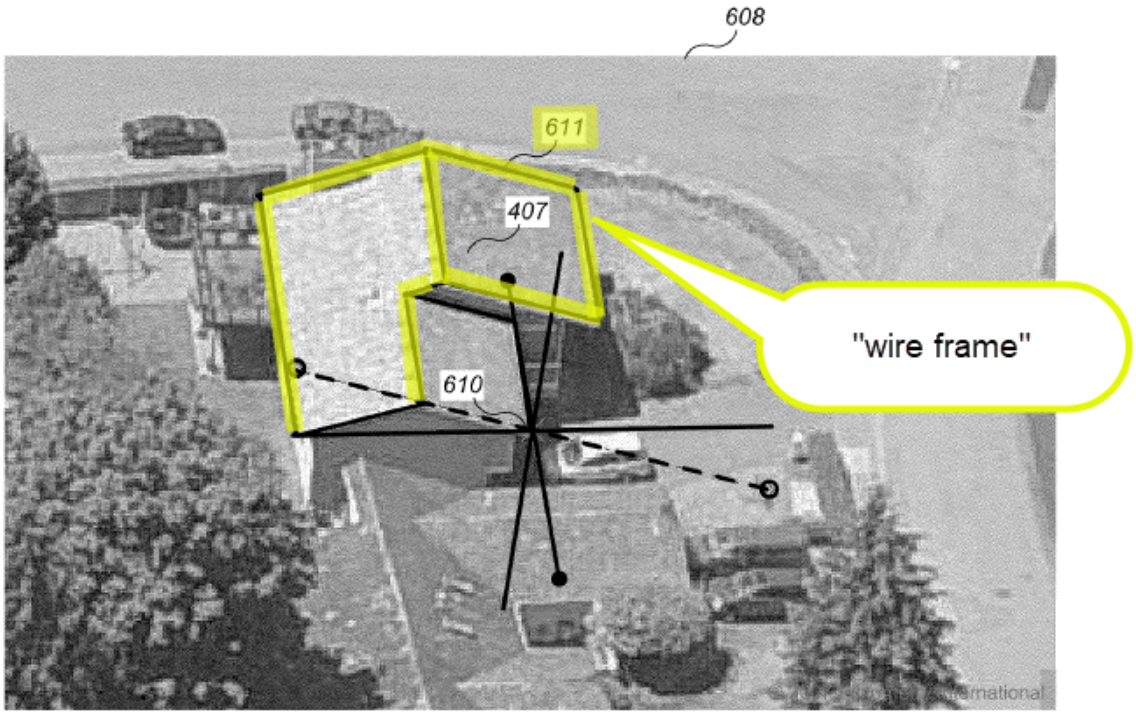



***Fig. 6B***

56. Ex. 1001 at Fig. 6B (annotated). Thus, the claimed “wireframe” image can be an outline of roof sections superimposed on an aerial image, for example, using a drawing tool.

57. As discussed above, 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.

58. *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."); *see* claim 1.

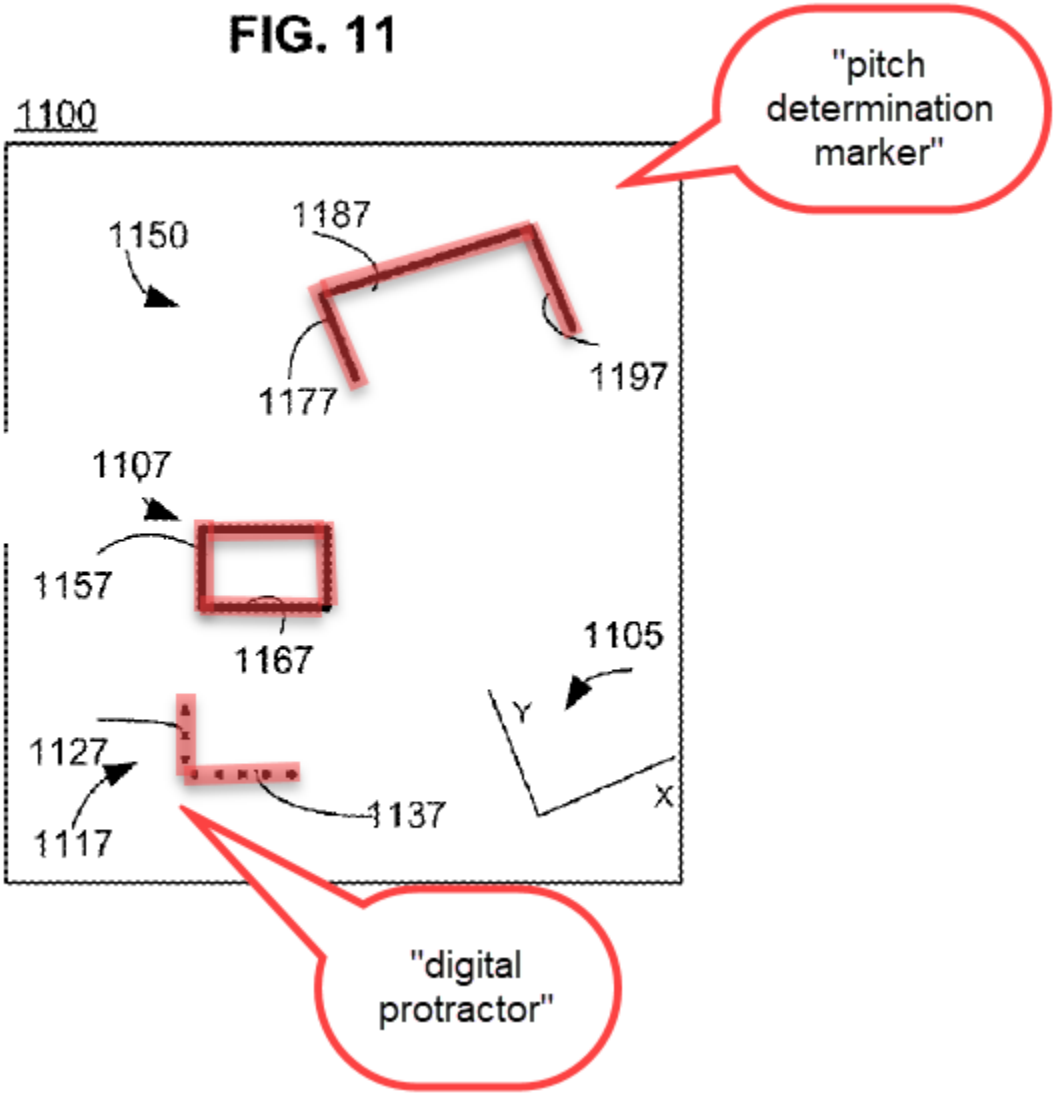
59. Kennedy's disclosure of using a sizing/measuring tool to draw a perimeter around the perimeter of roofing sections shown in an aerial image is the claimed "wireframe rendering."

### G. Claim 6: The method of claim 5 wherein displaying the wireframe rendering occurs in response to the receiving of the indicated pitch.

60. As discussed with respect to claim 5, Kennedy teaches displaying a wireframe image based on a user using its "sizing tool" to "determine surface dimensions ***and pitch***" of a roof. *Id.* at [0058] (emphasis added). For the same reasons, Kennedy renders obvious "wherein displaying the wireframe rendering occurs in response to the receiving of the indicated pitch." Indeed, the wireframe drawing is made as part of the pitch measurement and, thus, occurs in response to receiving the indicated pitch.

**H. Claim 7: The method of claim 1 wherein the pitch determination marker includes an adjustable protractor tool having a member that is adjustable to indicate an angle.**

61. Kennedy's pitch determination marker may act as a digital "adjustable protractor tool" because it can be rotated and scaled indicate an angle. *See* claim 1. This is shown, for example, by measuring tool 1117:




62. *Id.* at Fig. 11 (annotated). Kennedy explains that "user 507 superimposes sizing tool, in this example tool 1117 (illustrated in Fig. 11)

over at least a portion of image 1215…[u]ser 507 adjusts the dimensions of at least one of the tools sides…***manipulation of tool 1117 [is possible] in three dimensions***, x, z, and z [sic], with respect to axis 1311." *Id.* at [0111]-[0113] (emphasis added). The displacement information of the tool is used by transformer/translation module 596 to generate the three-dimensional model of the roof being measured. *Id.* at [0117]-[0118]. Kennedy teaches that this transformer/translation module 596 is coupled with a "pitch calculator" that may determine pitch. *Id.* at [0097]-[0098]. Accordingly, Kennedy's tool 1117 acts as an adjustable protractor tool having a member that is adjustable to indicate an angle.

### I. Claim 8: The method of claim 1 wherein the pitch determination marker includes an envelope tool having two surfaces that are adjustable to indicate an angle.

63. The '840 patent discloses an "envelope tool" as including a measuring tool with two surfaces, like that shown in Figure 5C:

840 Patent

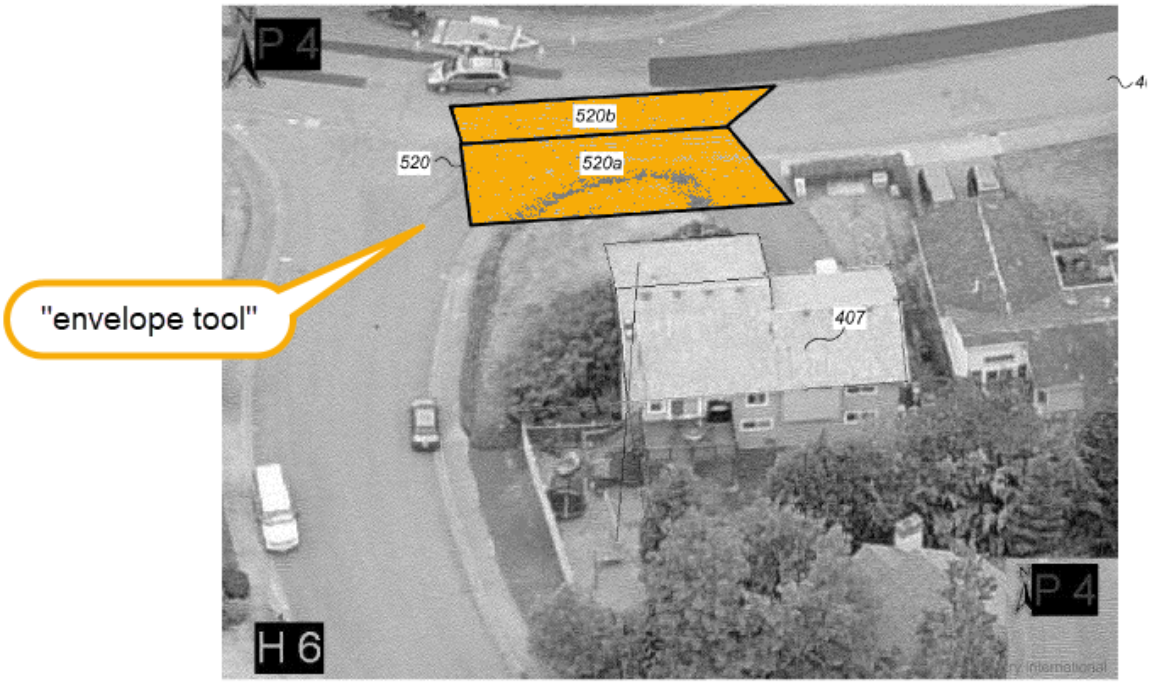
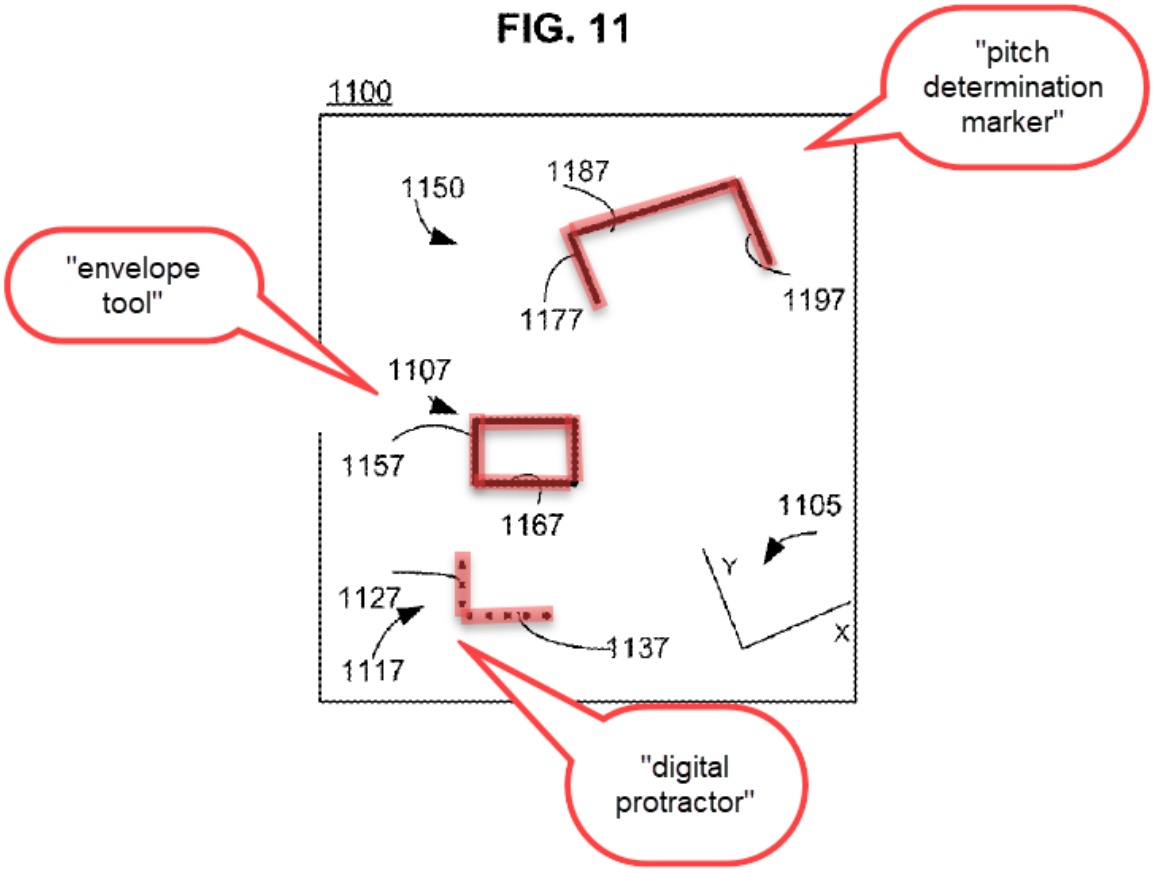



*Fig. 5C*

Ex. 1001 at Fig. 5C (annotated).

64. Kennedy includes at least two examples of the claimed "envelope tool." First, as discussed with respect to claim 7, Kennedy teaches a "digital protractor tool." This is also a disclosure of the digital "envelope" tool because it also uses two adjustable planes to make a measurement. The planes used by tool 1117 in Kennedy are depicted as thin, but the claims do not require a minimum size of the envelope tool. Likewise, Kennedy's disclosures do not restrict the size of the planes used in tool 1117.

65. Kennedy's sizing tool 1107 is a second example of a digital "envelope" tool. In particular, sizing tool 1107 is shown as a flat plane in Figure 11 of Kennedy:




*Id.* at Fig. 11 (annotated).

66. But Kennedy explains that its sizing tool 1107 can be manipulated in ***three dimensions for alignment*** with a roof:

> FIG. 15 illustrates an embodiment of ***measuring tool 1107 of FIG. 11 in 3 dimensions for alignment*** with roof image 600 in viewport 1300 illustrated in FIG. 13. A ridge line is indicated in FIG. 15 at 641.

67. *Id.* at [0114]. This disclosure would encompass ***folding*** sizing tool 1107 over the peak of a roof to conform it with the roof's shape, resulting in the "envelope tool" recited in the challenged claims. For example, the tool could be folded over the roof shown in Figure 15:

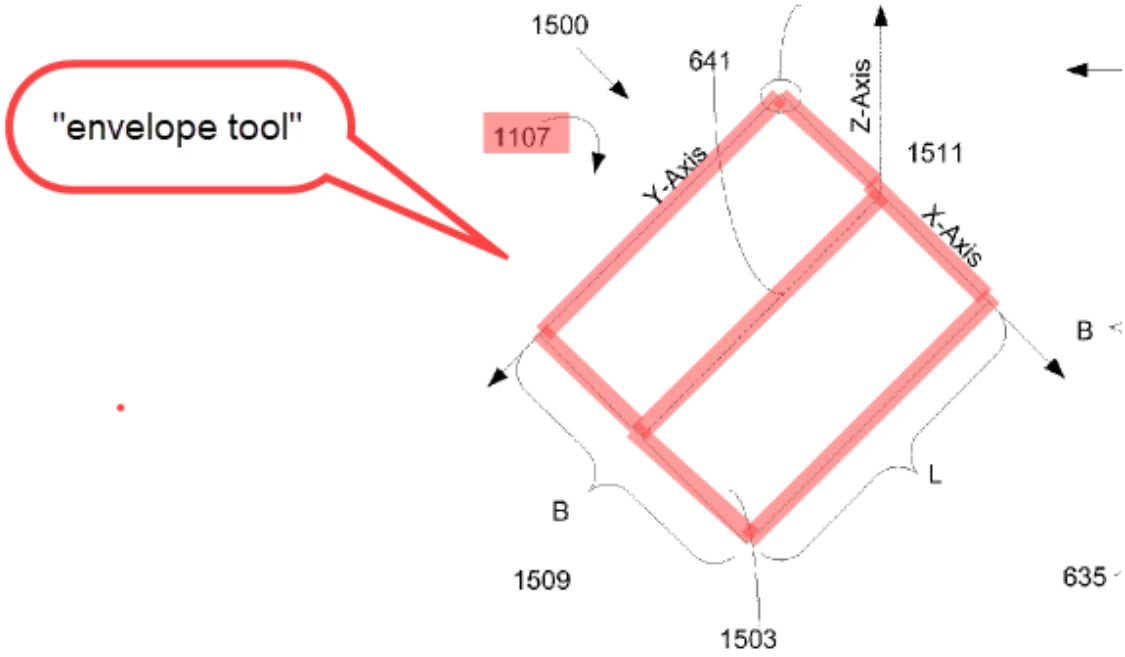



FIG. 15

*Id.* at Fig. 15 (annotated). Thus, tool 1107 is another example of an "envelope" tool disclosed by Kennedy.

**J. Claim 9: The method of claim 1 wherein modifying the model of the roof includes modifying a three-dimensional model of the roof.**

68. As discussed with respect to claims 1 and 2, modifying the model of the roof includes modifying a three-dimensional model of the roof. *Id.* at [0091] ("Modeling unit 591 develops a description of the ***three dimensional***

***roof shape*** based on two dimensional descriptions received from user system 506.") (emphasis added), [0104] ("In one embodiment of the invention described above, a translator unit 596 comprises a commercially available ***3D modeling software package such as AutoCad***™.") (emphasis added).

**K. Claim 10**

**1. Claim 10a: computing system for generating a roof estimate report, the computing system comprising: a memory;**

69. As discussed with respect to claim 1, Kennedy and Bailey render obvious a system for generating a roof estimate report. *See* claim 1. Kennedy expressly discloses a memory. Ex. 1009 at Abstract, [0051] ("For example, one of ordinary skill in the art will recognize upon reading this specification, that commercially available processors, ***memory modules***, input/output reports and other commercially available hardware components are suitable for use in constructing embodiments of system 100.").

**2. Claim 10b: a roof estimation module that is stored on the memory and that is configured, when executed, to: display an aerial image of a building having a roof comprising a plurality of planar roof sections that each have a corresponding pitch;**

70. *See* claim 1b.

**3. Claim 10c: display a pitch determination marker operable to indicate pitch of a planar roof section,**

**wherein the pitch determination marker is overlaid on the aerial image of the building having the roof;**

71. *See* claim 1c.

**4. Claim 10d: receive, based on the displayed pitch determination marker, an indication of the pitch of one of the plurality of planar roof sections of the roof of the building;**

72. *See* claim 1d.

**5. Claim 10e: modify a model of the roof based on the received indication of the pitch of the one planar roof section; and**

73. *See* claim 1e.

**6. Claim 10f: provide roof measurement information based on the model of the roof, the roof measurement information including a measure of the pitch of the one planar roof section.**

74. *See* claims 1, 3.

**L. Claim 11: The computing system of claim 10 wherein the roof estimation module is further configured to transmit a roof estimate report based on the provided roof measurement information.**

75. *See* claim 3.

**M. Claim 12: The computing system of claim 10 wherein the pitch determination marker includes at least one of an adjustable protractor tool and an envelope tool.**

76. *See* claims 7, 8.

**N. Claim 13: The computing system of claim 10 wherein the roof estimation module includes an interactive roof modeling user interface.**

77. *See* claims 1, 9.

**O. Claim 14: The computing system of claim 10 wherein the roof estimation module is further configured to display the pitch determination marker as part of an interactive user interface.**

78. *See* claims 1, 2.

**P. Claim 15: The computing system of claim 10 wherein the model of the roof is a three-dimensional model of the roof.**

79. *See* claim 1, 9.

**Q. Claim 16**

**1. Claim 16a: A non-transitory computer-readable storage medium whose contents enable a computing system to generate a roof estimate report for a building having a roof, by performing a method comprising:**

80. *See* claims 1, 4, 10.

**2. Claim 16b: displaying an aerial image of a building having a roof comprising a planar roof section that has a corresponding pitch;**

81. *See* claims 1, 4.

**3. Claim 16c: displaying a pitch determination marker operable to indicate pitch of the planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having the roof;**

82. *See* claim 1.

**4. Claim 16d: receiving, based on the displayed pitch determination marker, an indication of the pitch of the planar roof section; and**

83. *See* claims 1, 2.

**5. Claim 16e: modifying a model of the roof based on the received indication of the pitch of the planar roof section.**

84. *See* claim 1, 4.

**R. Claim 17: The non-transitory computer-readable storage medium of claim 16 wherein the pitch determination marker is adjustable to specify pitch of a planar roof section.**

85. *See* claim 2.

**S. Claim 18: The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: generating a roof estimate report based on the modified model of the roof; and transmitting the generated roof estimate report.**

86. *See* claims 1, 3.

**T. Claim 19: The non-transitory computer-readable storage medium of claim 18 wherein the transmitted roof estimate report includes a line drawing of the roof of the house labeled with a measure of the pitch of the planar roof section.**

87. *See* claim 1, 3.

**U. Claim 20: The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: determining roof measurement information based on the modified model of the roof, the roof measurement information including a measure of the pitch of the planar roof section; and transmitting the determined roof measurement information.**

88. *See* claim 1, 3.

**V. Claim 21: The non-transitory computer-readable storage medium of claim 16 wherein modifying the model of the roof includes modifying a model of the roof by associating the indicated pitch with a portion of the model of the roof that corresponds to planar roof section of the roof of the building.**

89. *See* claim 1.

**W. Claim 22: The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: displaying a wireframe rendering of the modified model superimposed on the aerial image of the building.**

90. *See* claim 5.

**X. Claim 23: The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: registering, based on operator indicated features, multiple aerial images to a reference grid corresponding to the model.**

91. The '840 patent teaches that a "reference grid" is the "coordinate system for a 3D model of the roof" and that by "registering multiple images to the reference grid, an operator may indicate a roof feature on an image…which may be translated from the coordinate system of the image to the coordinate system of the reference grid, for purposes of including the indicate feature in the 3D model." Ex. 1001 at 9:63010:4.

92. As discussed with respect to claim 1, Kennedy discloses such a "reference grid" coordinate system. *See* claim 1. Indeed, Kennedy teaches using multiple images to generate 3D models: "One embodiment of the invention employs as GIS service (for example Google Earth) to obtain images to locate and view properties. In some embodiments of the invention, only one image is retrieved from a source of images. In other embodiments relying on ***3-dimensional models, more than one image is retrieved*** from a source of images." Ex. 1009 at [0080] (emphasis added).

93. Kennedy also discloses that its modeling unit maps measurements taken by Kennedy's sizing tool onto 3D space: "Modeling unit 591 develops a description of the three dimensional roof shape based on two dimensional descriptions received from user system 506. In some embodiments of the invention, modeling unit 591 also receives image metadata for the image in viewport 1000.". *Id.* at [0091].

94. Kennedy teaches that it uses a "reference axis" to map points defining a measured shape:

> Image transform module 596 generates ***a transform, or map***, for points on a user measured surface. The transform maps points defining the surface shape in one orientation with respect to a ***reference axis*** to corresponding points defining the surface shape in any other orientation with respect to the reference axis. Once a transform is generated, points defining a surface shape in, e.g., a perspective view are translatable to corresponding points comprising a side elevation model description of the shape.

95. *Id.* at [0093]. This is the claimed "registering, based on operator indicated features, multiple aerial images to a reference grid corresponding to the model."

**Y. Claim 24: The non-transitory computer-readable storage medium of claim 23 wherein registering multiple images includes: displaying a marker operable to specify a point on the aerial image; receiving, via the marker, an indication of a point on the aerial image; and registering, based on the received indication of the point, the aerial image to the reference grid.**

96. *See* claims 1, 23.

**Z. Claim 25: The non-transitory computer-readable storage medium of claim 24 wherein registering the aerial image to the reference grid includes determining a transformation between the aerial image and the reference grid.**

97. *See* claims 1, 23. Kennedy expressly teaches that its modeling subsystem uses a "transform, or map, for points on a user measured surface" and generates the model using a "reference axis." *Id.* at [0093].

**AA. Claim 28: The non-transitory computer-readable storage medium of claim 16 wherein modifying the model of the roof includes modifying a three-dimensional model of the roof.**

98. *See* claims 1-3.

## X. GROUND 2: KENNEDY, BAILEY AND PICTOMETRY RENDER OBVIOUS CLAIMS 1-25 AND 28 OF THE '840 PATENT

99. As discussed in Ground 1, Kennedy expressly teaches the claimed "pitch determination marker" recited in the claims. But to the extent

Patent Owner argues Kennedy is missing this limitation, or that Kennedy was substantively considered by the Examiner already during prosecution (it was not), the claimed "pitch determination marker" is also taught by Pictometry.

### A. Motivation To Combine

100. A POSITA would have been motivated to incorporate Pictometry's teachings of a pitch determination marker into Kennedy. Indeed, Kennedy already teaches using a "sizing tool" that can measure pitch that is overlayed on an aerial image. Pictometry broadly teaches annotating an image to measure "angles"—this teaching would motivate a POSITA to use Pictometry's annotation tool (another example of a "pitch determination marker") to determine the pitch of a roof being analyzed by Kennedy.

101. Further, Pictometry teaches that the annotation feature is an "***indispensable*** tool." Ex. 1008 at 115 (emphasis added). A POSITA would, thus, have been motivated to utilize Pictometry's indispensable annotation feature in similar systems, like Kennedy.

102. Likewise, Pictometry expressly discloses that its annotation tool can be used to "analyze any house [or] building." *Id.* at 114. A POSITA reading Pictometry would have been motivated to use Pictometry's annotation tool in Kennedy's system to analyze the roof of a house or building.

103. A POSITA would have also been motivated to use Pictometry's annotation tool in Kennedy's system because doing so would allow roofers and customers to see the house being analyzed. This would ***promote accuracy***, since users could confirm that the correct house was being measured.

104. Likewise, a POSITA would be motivated to use Pictometry's annotation tool because it would provide roofers and customers ***greater flexibility*** related to which aspects of the home to measure. Showing annotations on an aerial image, as taught by Pictometry, would also improve ***precision*** because users could ensure that the measurements were properly aligned with the building.

105. Petitioner has already explained why a POSITA would have been motivated to combine the teachings of Kennedy and Bailey. A POSITA would be further motivated to incorporate Pictometry's annotation feature for similar reasons. Like Kennedy and Bailey, Pictometry is in the ***same field of endeavor*** as the '840 patent, roof estimation. Pictometry is broadly directed towards accurate measurements of structure, including buildings, in aerial images. Ex. 1008 at 114. Further, Kennedy, Bailey, Pictometry and the '840 patent all user ***similar techniques to solve the same problems***. As discussed above, Kennedy teaches nearly all of the claimed elements, and Pictometry also teaches the "pitch determination marker" of the '840 patent. A POSITA

would also have a ***reasonable expectation of success*** in including the teachings of Pictometry in Kennedy's system. Pictometry's itself discloses that its annotation feature can be used in a system for measuring attributes of buildings. Ex. 1008 at 114. For the foregoing reasons, a POSITA would be motivated to use Pictometry's teachings of annotations to improve Kennedy's system.

### B. Pictometry Renders Obvious "wherein the pitch determination marker is *overlaid* on the aerial image of the building having the roof" (Claims 1, 10, 16)

106. The examiner issued the claims because he found that none of the prior art showed that the "pitch determination marker" was "overlaid on the aerial image." *See*, Section V, *supra.* As discussed in Ground 1, Kennedy discloses this limitation.

107. Pictometry also expressly discloses overlaying pitch determination markers on aerial images. For example, Pictometry discloses a program that allows users to annotate aerial photographs. *See, generally* Ex. 1008. Pictometry teaches that a variety of aerial photographs can be taken, and that users can "zoom, measur[e]…and annotate[e]" these images. *Id.* at 115. Pictometry teaches a "distance tool" which allows a user to measure things contained within the image. *Id.* at 116. Pictometry's tool can also be used for "measuring ***angles***." *Id.* at 116 (emphasis added). Thus,

Pictometry's measuring tool can be used as a "pitch determination" marker that is overlaid on an aerial image.

108. Accordingly, Pictometry provides a second example of overlaying a pitch determination marker on a roof—the sole limitation the Examiner believed was missing from the prior art.

## XI. GROUND 3: PERSHING-789 AND KENNEDY RENDER OBVIOUS CLAIMS 1-25 AND 28 OF THE '840 PATENT

109. As discussed above, Patent Owner did not contest that Pershing-789 teaches every claim limitation of the '840 patent except for the "pitch determination marker." The "pitch determination marker" limitation is taught by Kennedy and Pictometry. *See* Grounds 1 and 2. For the reasons discussed in the Grounds below, a POSITA would have been motivated to include Kennedy's pitch determination marker in Pershing-789's system.

### A. Motivation to Combine

110. A POSITA would have been motivated to use Kennedy's pitch determination marker in Pershing-789 for a variety of reasons. As discussed below, Pershing-789 is directed towards generating roof estimates and employs a user interface that allows various roof attributes, including pitch, to be measured. A POSITA considering Pershing-789 would be motivated to use Kennedy's "pitch determination marker" in Pershing-789's system because it would further Pershing-789's goal of allowing users to employ

interactive tools to measure roof attributes. Kennedy's pitch determination marker would promote accuracy by allowing a user to precisely align the tool when taking pitch measurements. Using Kennedy's pitch determination marker would also give real time feedback to users seeking to determine pitch values, which would provide an added convenience. Kennedy's pitch determination marker would also enhance user experience by offering a user more control in the measuring process. Kennedy's pitch determination marker would also allow a user to confirm that Pershing-789's system was accurately associating measured pitch values with appropriate roof sections by providing a visual confirmation of segments being measured.

111. Further, a POSITA would have been motivated to combine Kennedy and Pershing-789 because they are in the ***same field of endeavor*** as the '840 patent, roof estimation. Ex. 1001 at Abstract; Ex. 1009 at Abstract; Ex. 1004 at Abstract. Likewise, as discussed throughout this petition, both Kennedy and Pershing-789 use ***similar techniques to solve the same problems*** as the '840 patent—indeed, both Kennedy and Pershing-789 disclose the majority of the challenged claim limitations. *See* Grounds 1 and 3. Finally, a POSITA would have a ***reasonable expectation of success*** in making the proposed combination—as described below, Pershing-789 already permits user to measure roof attributes using an interface, and Kennedy

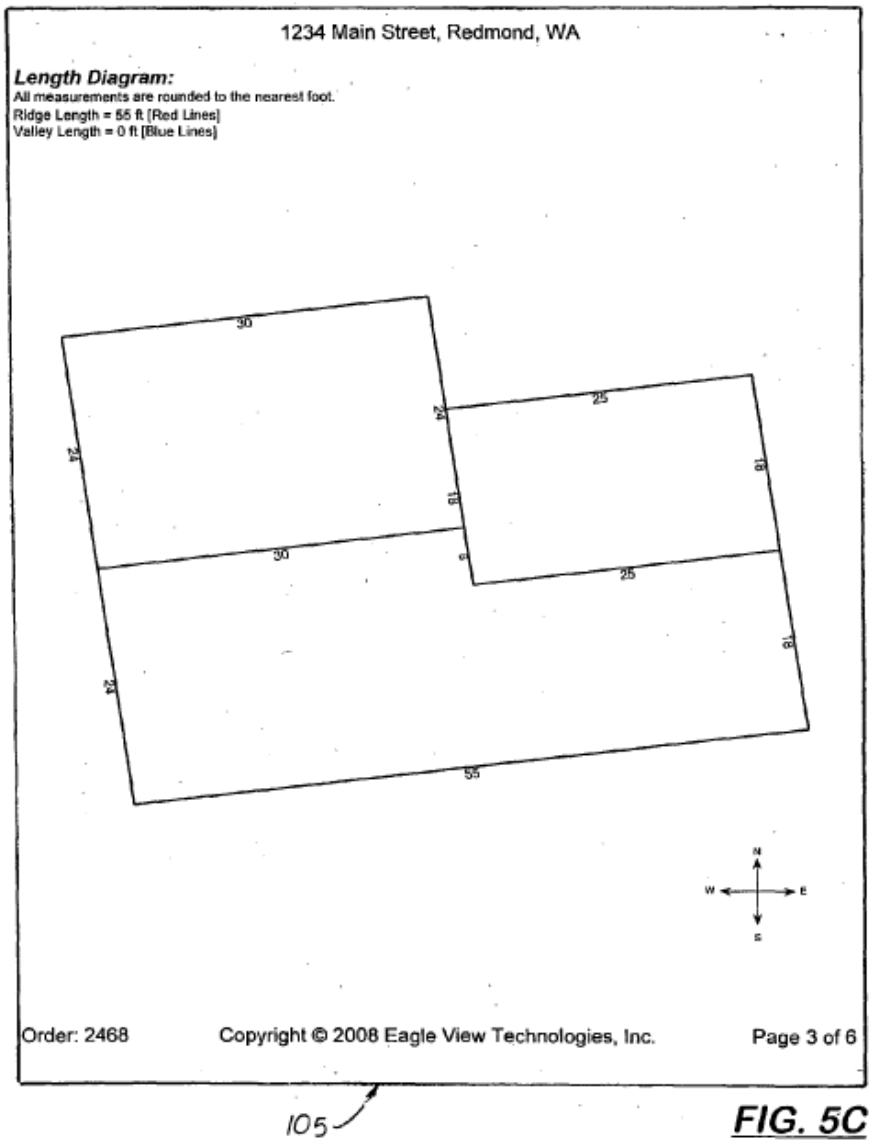
teaches its pitch determination marker can be deployed in this same environment. *See* claim 1d, *infra*. Accordingly, a POSITA would be motivated to use Kennedy's pitch determination marker in Pershing-789's system.

### B. Claim 1

#### 1. Claim 1a: A computer-implemented method for generating a roof estimate report, the method comprising:

112. Pershing-789 discloses a process. 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).

113. 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:




Ex. 1004 at Fig. 5C; *id.* at [0038]

**2. Claim 1b: displaying an aerial image of a building having a roof comprising a plurality of planar roof sections that each have a corresponding pitch;**

114. Pershing-789 displaying an aerial image of a building having a roof comprising a plurality of planar roof sections that each have a corresponding pitch by displaying an image of the input location:

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).

115. For example, a first image corresponding to the first location data is shown in Figure 3:

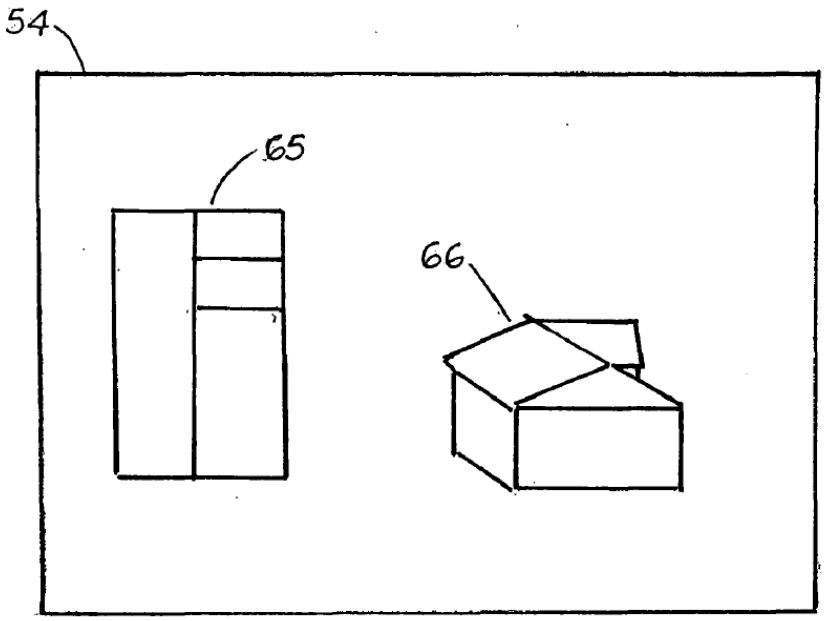



***FIG. 3***

116. Ex. 1004 at Fig. 3. Pershing-789 explains that this hand-sketched drawing in Figure 3 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.

117. *Id.* at [0022] (emphasis added). Accordingly, Pershing-789 discloses displaying an actual aerial photo of a building. Pershing-789's disclosure that actual aerial images are used in Figure 3A is consistent with its disclosure that the same aerial images of customer roofs are included in its report, such as the exemplary reports shown in Figures 5A-B:

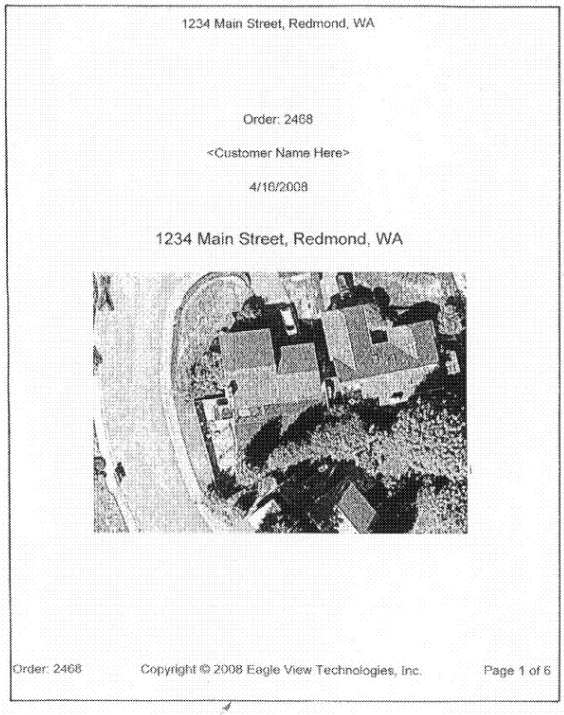



FIG. 5A

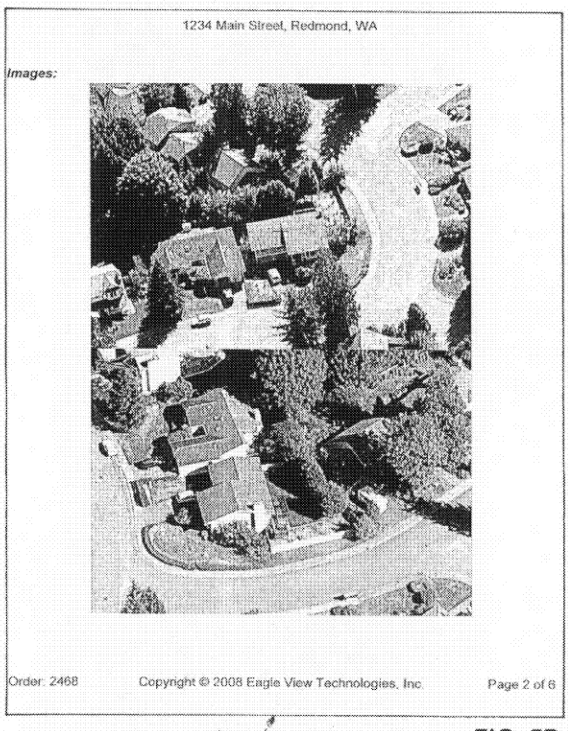



FIG. 5B

*Id.* at Figs. 5A-B.

118. Further, as shown in Figure 3 (and Figures 5A-B), Pershing-789's image includes a roof structure of a building as part of its "***top plan view***" of the building. *Id.*

119. Pershing-789 further teaches showing "pitch" dimensions in its outline drawing, for example, in Figure 5D:

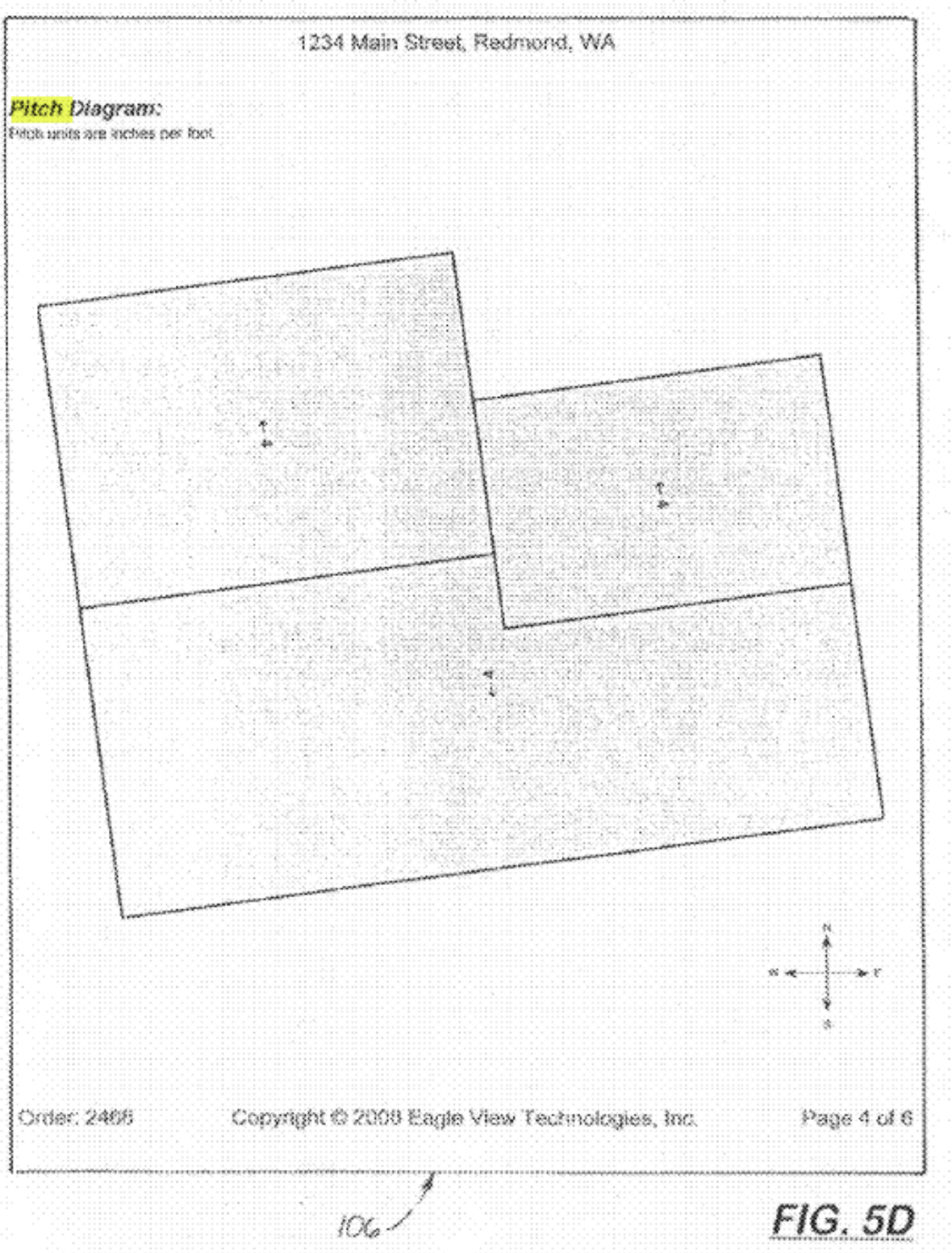
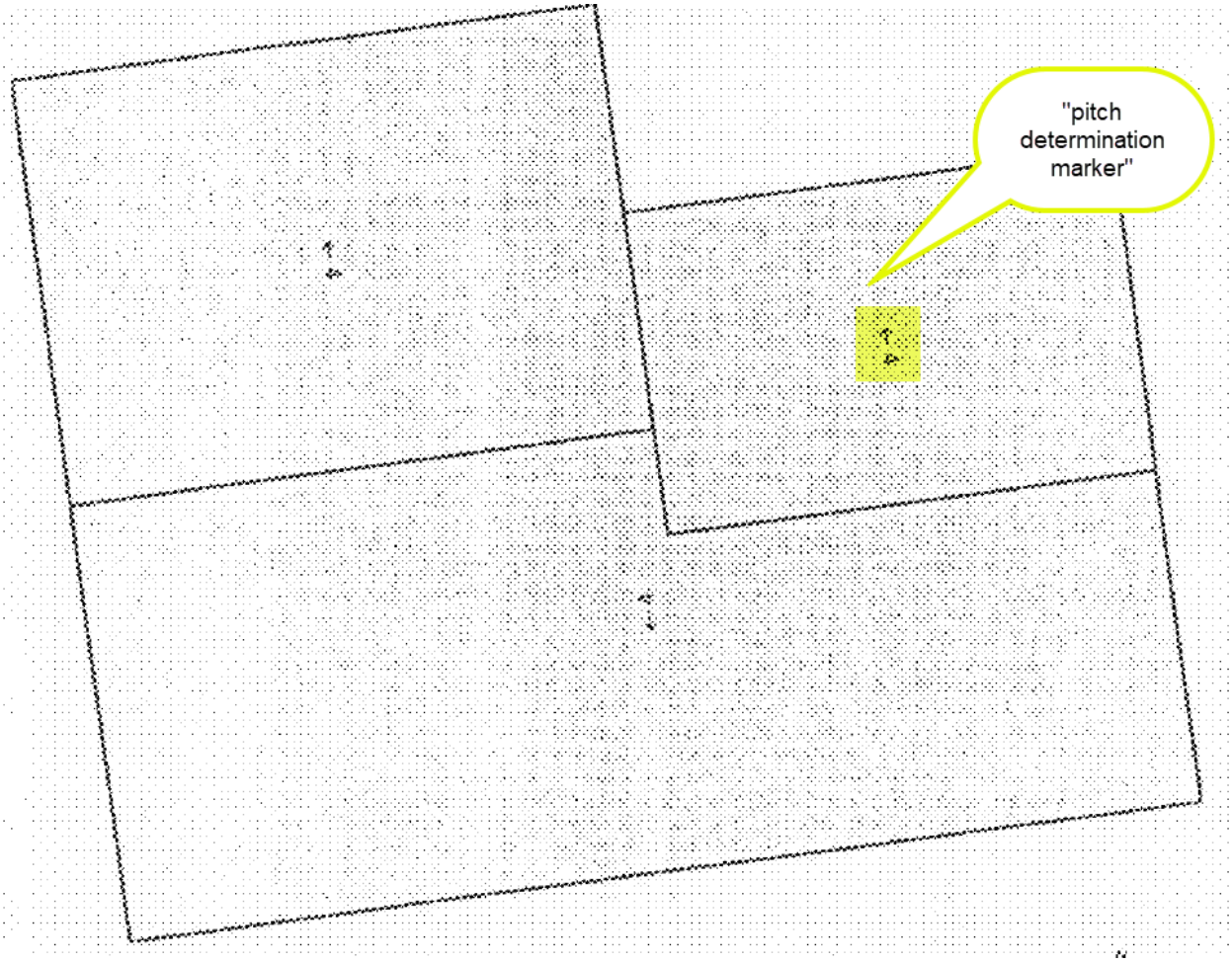



FIG. 5D

120. Ex. 1004 at Fig. 5D (annotated). Pershing-789 explains that, "FIG. 5D is an illustration of the fourth page 106 of the report showing the ***pitch angle*** of each roof section along with a compass indicator." *Id.* at [0028] (emphasis added).

**3. Claim 1c: displaying a pitch determination marker operable to indicate pitch of a planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having the roof;**

121. Pershing-789 and Kennedy render obvious displaying a pitch determination marker operable to indicate pitch of a planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having the roof. Pershing-789 discloses "***image analysis and calibration is then performed*** either manually or ***via a software*** program that ***determines*** the geometry, the slopes, the ***pitch angles***, and the outside dimensions of the roof sections." Ex. 1004 at [0011] (emphasis added). Pershing-789 further teaches overlaying pitch data on an aerial image of a roof:




122. Ex. 1004 at Fig. 5D (annotated). Pershing-789 explains that, "FIG. 5D is an illustration of the fourth page 106 of the report showing the ***pitch angle*** of each roof section along with a compass indicator." *Id.* at [0028] (emphasis added). Pershing-789 does not restrict how its pitch is calculated.

123. As discussed with respect to Ground 1, Kennedy teaches a "pitch determination marker" that is "overlaid" over the aerial image as required by the claims. *See* Ground 1 at claim 1, *supra*. It would have been obvious to use Kennedy's "pitch determination marker" in Kennedy's system for the reasons discussed above in Section A.

#### 4. Claim 1d: receiving, based on the displayed pitch determination marker, an indication of the pitch of one of the plurality of planar roof sections of the roof of the building; and

124. As discussed with respect to claim 1c, Pershing-789 and Kennedy disclose receiving, based on the displayed pitch determination marker, an indication of the pitch of one of the plurality of planar roof sections of the roof of the building.

#### 5. Claim 1e: modifying a model of the roof based on the received indication of the pitch of the one planar roof section.

125. As discussed above, Pershing-789 teaches collecting pitch data for planar roof sections. Further, Pershing-789 teaches that its system can "build a 3D model" based on the data collected. Ex. 1004 at [0029]-[0038].

### C. Claim 2: The method of claim 1 wherein the pitch determination marker is adjustable to specify pitch of a planar roof section.

126. As discussed with respect to claim 1, Pershing-789 broadly discloses calculating a pitch value and displaying it on an aerial image. *See* claim 1. Thus, the Kennedy-Pershing-789 pitch determination marker is "adjustable to specify pitch of a planar roof section."

**D. Claim 3: The method of claim 1 further comprising: transmitting roof measurement information based on the modified model of the roof, the roof measurement information including a measure of the pitch of the one planar roof section.**

127. As discussed with respect to claim 1, Pershing-789 teaches building a model based on collected roof measurement information. *See* claim 1. Pershing-789 expressly teaches that its 3D model may be modified: "Once the reconstruction of the building is complete, the results are viewed for completeness and correctness. If necessary, a user of the service's software will make corrections to the reconstructed model." *Id.* at [0036].

128. Pershing-789 teaches that the 3D model is used to generate a report. *Id.* at [0037]. The report can be transmitted, *e.g.*, to a roof company. *Id.* at [0026]-[0027], [0037].

**E. Claim 4: The method of claim 1 wherein modifying the model of the roof includes associating the indicated pitch with a portion of the model of the roof that corresponds to the one planar roof section of the roof of the building.**

129. As discussed with respect to claim 3, Pershing-789 permits users to make corrections to the model of the roof. *See* claim 3. This broad disclosure would include correcting pitch data (*see* claim 1) displayed on the model. Thus, Pershing-789 teaches modifying the model of the roof includes associating the indicated pitch with a portion of the model of the roof that corresponds to the one planar roof section of the roof of the building.

### F. Claim 5: The method of claim 1 further comprising: displaying a wireframe rendering of the modified model superimposed on the aerial image of the building.

130. As discussed above, Pershing-789 teaches including outline drawings ***on the aerial image itself*** using Pershing-789's calibration module:

> Like the software program **50** loaded into the roof contractor's computer **72** in the previous embodiment the software program **50'** is also able to ***retrieve aerial images of houses*** from a database **52'** containing aerial images files **54'** of houses located in the region served by the roof company **70.** An optional ***calibration module 56' may be provided which enables the entity 105 to determine the angles and linear dimensions of various roof sections on the house* 92.**

131. Ex. 1004 at [0025]. Pershing-789 teaches that, for example, the calibration module may calculate the physical length of features ***in an aerial photo*** using "distance in pixels between two points" that is "converted into physical length":

> Once the images of the roof section of the building are obtained, at least one of the images needs to be calibrated. During calibration, ***the distance in pixels between two points on the image is converted into a physical length***. This calibration information is ***typically presented as a scale marker on the image*** itself, or as additional information supplied by the image database provider along with the requested image.

132. *Id.* at [0032]. This "scale marker" depicting "physical length" between pixels renders obvious a wire frame rendering that is super-imposed on the aerial image. Indeed, a user of Pershing-789 would apply the same

scale marker to the perimeter of the roof as part of its area estimation process, which would result in the same wire frame image disclosed in the '840 patent.

**G. Claim 6: The method of claim 5 wherein displaying the wireframe rendering occurs in response to the receiving of the indicated pitch.**

133. As discussed with respect to claims 1 and 5, Pershing-789 discloses displaying a wireframe rendering, including the received indicated pitch.

**H. Claim 7: The method of claim 1 wherein the pitch determination marker includes an adjustable protractor tool having a member that is adjustable to indicate an angle.**

134. Kennedy discloses this limitation for the same reasons discussed with respect to Ground 1.

**I. Claim 8: The method of claim 1 wherein the pitch determination marker includes an envelope tool having two surfaces that are adjustable to indicate an angle.**

135. Kennedy discloses this limitation for the same reasons discussed with respect to Ground 1.

**J. Claim 9: The method of claim 1 wherein modifying the model of the roof includes modifying a three-dimensional model of the roof.**

136. As discussed with respect to claims 1- 3, Pershing-789 discloses modifying the model of the roof including modifying a three-dimensional model of the roof.

## K. Claim 10

### 1. Claim 10a: computing system for generating a roof estimate report, the computing system comprising: a memory;

137. *See* claim 1a. Pershing-789 expressly teaches using a "working memory." Ex. 1004 at [0012].

### 2. Claim 10b: a roof estimation module that is stored on the memory and that is configured, when executed, to: display an aerial image of a building having a roof comprising a plurality of planar roof sections that each have a corresponding pitch;

138. *See* claim 1b.

### 3. Claim 10c: display a pitch determination marker operable to indicate pitch of a planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having the roof;

139. *See* claim 1c.

### 4. Claim 10d: receive, based on the displayed pitch determination marker, an indication of the pitch of one of the plurality of planar roof sections of the roof of the building;

140. *See* claim 1d.

### 5. Claim 10e: modify a model of the roof based on the received indication of the pitch of the one planar roof section; and

141. *See* claim 1e.

### 6. Claim 10f: provide roof measurement information based on the model of the roof, the roof measurement

**information including a measure of the pitch of the one planar roof section.**

142. *See* claims 1, 3.

**L. Claim 11: The computing system of claim 10 wherein the roof estimation module is further configured to transmit a roof estimate report based on the provided roof measurement information.**

143. *See* claim 3.

**M. Claim 12: The computing system of claim 10 wherein the roof estimation module is further configured to transmit a roof estimate report based on the provided roof measurement information.**

144. *See* claims 7, 8.

**N. Claim 13: The computing system of claim 10 wherein the roof estimation module includes an interactive roof modeling user interface.**

145. *See* claims 1, 9.

**O. Claim 14: The computing system of claim 10 wherein the roof estimation module is further configured to display the pitch determination marker as part of an interactive user interface.**

146. *See* claims 1, 2.

**P. Claim 15: The computing system of claim 10 wherein the model of the roof is a three-dimensional model of the roof.**

147. *See* claim 1, 9.

**Q. Claim 16**

**1. Claim 16a: A non-transitory computer-readable storage medium whose contents enable a computing**

**system to generate a roof estimate report for a building having a roof, by performing a method comprising:**

148. *See* claims 1, 4, 10.

**2. Claim 16b: displaying an aerial image of a building having a roof comprising a planar roof section that has a corresponding pitch;**

149. *See* claims 1, 4.

**3. Claim 16c: displaying a pitch determination marker operable to indicate pitch of the planar roof section, wherein the pitch determination marker is overlaid on the aerial image of the building having the roof;**

150. *See* claim 1.

**4. Claim 16d: receiving, based on the displayed pitch determination marker, an indication of the pitch of the planar roof section; and**

151. *See* claim 2.

**5. Claim 16e: modifying a model of the roof based on the received indication of the pitch of the planar roof section.**

152. *See* claim 1, 4.

**R. Claim 17: The non-transitory computer-readable storage medium of claim 16 wherein the pitch determination marker is adjustable to specify pitch of a planar roof section.**

153. *See* claim 2.

**S. Claim 18: The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: generating a roof estimate report based on the modified model of the roof; and transmitting the generated roof estimate report.**

154. *See* claim 1, 3.

**T. Claim 19: The non-transitory computer-readable storage medium of claim 18 wherein the transmitted roof estimate report includes a line drawing of the roof of the house labeled with a measure of the pitch of the planar roof section.**

155. *See* claim 1, 3.

**U. Claim 20: The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: determining roof measurement information based on the modified model of the roof, the roof measurement information including a measure of the pitch of the planar roof section; and transmitting the determined roof measurement information.**

156. *See* claim 1, 3.

**V. Claim 21: The non-transitory computer-readable storage medium of claim 16 wherein modifying the model of the roof includes modifying a model of the roof by associating the indicated pitch with a portion of the model of the roof that corresponds to planar roof section of the roof of the building.**

157. *See* claim 1.

**W. Claim 22: The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: displaying a wireframe rendering of the modified model superimposed on the aerial image of the building.**

158. *See* claim 5.

**X. Claim 23: The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: registering, based on operator indicated features, multiple aerial images to a reference grid corresponding to the model.**

159. Pershing-789 teaches that a plurality of images can be used to create a 3D model by "triangulating" points of interest. Ex. 1004 at [0034]-[0037]. Thus, Pershing-789 teaches registering, based on operator indicated features, multiple aerial images to a reference grid corresponding to the model. Indeed, otherwise a 3-D model could not be built from the points of interest across multiple images.

**Y. Claim 24: The non-transitory computer-readable storage medium of claim 23 wherein registering multiple images includes: displaying a marker operable to specify a point on the aerial image; receiving, via the marker, an indication of a point on the aerial image; and registering, based on the received indication of the point, the aerial image to the reference grid.**

160. *See* claims 1, 23.

**Z. Claim 25: The non-transitory computer-readable storage medium of claim 24 wherein registering the aerial image to the reference grid includes determining a transformation between the aerial image and the reference grid.**

161. As discussed with respect to claim 23, Pershing-789 includes determining a transformation between the aerial image and the reference grid, namely, by "building" a 3D model based on "triangulating" points of interest across multiple images. Ex. 1004 at [0034]-[0037]. This is a disclosure of a

transformation between an aerial image and the reference grid—otherwise, a 3-D model could not be built from the points of interest across multiple images.

### AA. Claim 28: The non-transitory computer-readable storage medium of claim 16 wherein modifying the model of the roof includes modifying a three-dimensional model of the roof.

162. *See* claims 1, 3.

## XII. GROUND 4: PERSHING-789, KENNEDY AND PICTOMETRY RENDER OBVIOUS CLAIMS 1-25 AND 28 OF THE '840 PATENT

163. As discussed in Ground 3, Kennedy expressly teaches the claimed "pitch determination marker" recited in the claims. The claimed "pitch determination marker" is also taught by Pictometry.

### A. Motivation To Combine

164. A POSITA would have been motivated to incorporate Pictometry's teachings of a pitch determination marker into Pershing-789. As discussed above, Pershing-789 is directed towards generating roof estimates and employs a user interface that allows various roof attributes, including pitch, to be measured. A POSITA considering Pershing-789 would be motivated to use Pictometry's "pitch determination marker" in Pershing-789's system because it would further Pershing-789's goal of allowing users to employ interactive tools to measure roof attributes. Pictometry's pitch determination marker would promote accuracy by allowing a user to precisely align the tool when taking pitch measurements. Using Pictometry's pitch

determination marker would also give real time feedback to users seeking to determine pitch values, which would provide an added convenience. Pictometry's pitch determination marker would also enhance user experience by offering a user more control in the measuring process. Pictometry's pitch determination marker would also allow a user to confirm that Pershing-789's system was accurately associating measured pitch values with appropriate roof sections by providing a visual confirmation of segments being measured.

165. Further, Pictometry teaches that the annotation feature is an "***indispensable*** tool." Ex. 1008 at 115 (emphasis added). A POSITA would, thus, have been motivated to utilize Pictometry's indispensable annotation feature in similar systems, like Pershing-789.

166. Likewise, Pictometry expressly discloses that its annotation tool can be used to "analyze any house [or] building." *Id.* at 114. A POSITA reading Pictometry would have been motivated to use Pictometry's annotation tool in Pershing-789's system to analyze the roof of a house or building.

167. Likewise, a POSITA would be motivated to use Pictometry's annotation tool because it would provide roofers and customers ***greater flexibility*** related to which aspects of the home to measure. Showing annotations on an aerial image, as taught by Pictometry, would also improve

***precision*** because users could ensure that the measurements were properly aligned with the building.

168. Petitioner has already explained why a POSITA would have been motivated to combine the teachings of Pershing-789 and Kennedy. A POSITA would be further motivated to incorporate Pictometry's annotation feature for similar reasons. Like Pershing-789 and Kennedy, Pictometry is in the ***same field of endeavor*** as the '840 patent, roof estimation. Pictometry is broadly directed towards accurate measurements of structure, including buildings, in aerial images. Ex. 1008 at 114. Further, Pershing-789, Kennedy, Pictometry and the '840 patent all user ***similar techniques to solve the same problems***. As discussed above, Pershing-789 and Kennedy teach nearly all of the claimed elements, and Pictometry also teaches the "pitch determination marker" of the '840 patent. A POSITA would also have a ***reasonable expectation of success*** in including the teachings of Pictometry in Pershing-789's system. Pictometry's itself discloses that its annotation feature can be used in a system for measuring attributes of buildings. Ex. 1008 at 114. For the foregoing reasons, a POSITA would be motivated to use Pictometry's teachings of annotations to improve Pershing-789's system.

### B. Pictometry Renders Obvious "wherein the pitch determination marker is *overlaid* on the aerial image of the building having the roof" (Claims 1, 10, 16)

169. The examiner issued the claims because he found that none of the prior art showed that the "pitch determination marker" was "overlaid on the aerial image." *See,* Section V, *supra.* As discussed in Ground 1, Kennedy discloses this limitation. Pictometry also expressly discloses overlaying pitch determination markers on aerial images for the same reasons discussed with respect to Ground 2.

170. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on January 3, 2023, in Springfield, VA

*/s/ Tony Cummings*
Tony Cummings

# Tony L Cummings, AIA, CSI

Construction Forensics, Inc. - President


***Registrations & Certifications***

Vermont, New Hampshire, Massachusetts, Maine, Rhode Island, Connecticut, New York, Delaware, Pennsylvania, Maryland, Virginia, N Carolina, S Carolina, Tennessee, Missouri, Oklahoma, Florida, Texas, Colorado, Montana, Oregon.
*Contact CFI for license status
National Council of Architectural Registration Boards
OSHA 10-hour Construction Safety and Health Training
California Office of Emergency Services Safety Assessment Program Evaluator
Infraspection Institute – Level II Certified Infrared Thermographer

***Education***

Bachelor of Architecture – Kansas State University

***Professional Service Organizations***

Member – American Institute of Architects (AIA)
Member – Construction Specifications Institute (CSI)
Member – International Code Council (ICC)
Member – National Fire Protection Association (NFPA)
Member – International Institute of Building Enclosure Consultants (IIBEC)
Member – National Institute of Building Science (NIBS)
Member – Society of American Value Engineering (SAFE)
Member – American Society of Professional Estimators (ASPE)

***Lectures, Seminars & Publications***

*"Mitigating Moisture Intrusion":* Oregon Washington Community Association Managers
*"Construction Defects & Forensic Applications":* Build Virginia Mid-Atlantic Conference
*"Construction Defects & How to Avoid Them":* Commercial Builder/Architect Magazine
*"The Use of Experts":* Community Association Institute, National Law Review
*"Preserving & Protecting Your Investment":* Various Condominium Associations
*"Making the Complex Simple - How To Keep The Jury Awake":* Insurance Adjusters
*"Failure to Plan* – What Could Possibly Go Wrong": KSU College of Architecture
*"Failure to Plan* – What Could Possibly Go Wrong": Kansas Chapter AIA

***Professional History***

***Construction Forensics, Inc.***

Founded in 1990 in Virginia, Mr. Cummings is president of CFI, a consulting firm specializing in analyzing and investigating construction disputes. CFI has performed forensic investigations in 16 states, for plaintiffs and defendants to include: code review and conformance, failure analysis of building systems and components, claims analysis, material and workmanship evaluations, Standard of Care for design professionals and contractors, CPM schedule analysis, cost estimating, and the suitability of plans and specifications. Mr. Cummings has qualified as an expert and provided testimony numerous times in 9 states and the Federal Contractor Board of Appeals. Experience as an architect and contractor offers a unique perspective when assessing construction disputes and forensic evaluations. Previously named one of two forensic experts for the State of Tennessee Board of Architecture and Engineering to evaluate Standard of Care claims against architects brought before the Board.

***High Point Schaer, Senior Consultant***

Mr. Cummings served as Senior Consultant in the Forensic Analysis Department of High Point Schaer (HPS) Florida office. HPS was an international construction-consulting arm of the High Point/Rendel Group. Responsibilities included the analysis and forensic evaluation of numerous defective construction claims related to Florida's condominium market. In addition to forensic investigations, Mr. Cummings provided expert testimony on claims of faulty construction, improper maintenance, moisture intrusion, material failures, and A/E professional standard of care.

***Bill Strong Enterprises***

Mr. Cummings was hired to head the estimating department of six estimators for the general contracting firm specializing in DOD military base housing throughout the United States. Mr. Cummings was the lead estimator for a ten-million-dollar multi-family housing rehab project at the Naval War College in Newport, RI. Contract requirement resulted in Mr. Cummings becoming the on-site quality control representative responsible for reviewing shipments received, daily documentation of work performed, evaluation of workers, and workmanship.

***TL Cummings & Associates***

Mr. Cummings owned a full-service architectural firm in Colorado Springs, Colorado. Services included conceptual design development, land planning, the architectural design for residential, multi-family, commercial, industrial, hospitality, shopping plazas, offices, and financial institutions. Responsible for initial design and specifications, reviewing all documents issued by this office, and supervising drafting staff. Mr. Cummings provided a forensic evaluation and expert testimony for claims of faulty construction to an underground parking garage.

***DANAC, Inc.***

Mr. Cummings began as an estimator and one of the four individuals in the establishment of western division of this general contracting firm specializing in DOD military base housing. Located in Colorado Springs, Colorado, DANAC was an arm of Danish Arctic Contractors (DAC), a firm specializing in construction and services to military installations worldwide. Mr. Cummings was one of two estimators responsible for reviewing contract documents suitability for construction, evaluation errors and ambiguities in the drawings, and preparing cost estimates for competitive bidding. Mr. Cummings became head of estimating, overseeing six additional estimators, coordinating and reviewing all estimates before they were released. DANAC was responsible for renovating over 2,000 multi-family living units in numerous locations around the United States, Bachelor Enlisted Quarters, and a prototype day-care center at the Air Force Academy. During my employment at DANAC, we also performed a design/build joint venture of 100 multi-family housing units at Guantanamo Bay, Cuba.