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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex Parte ANINDYA GHOSHAL, ROXANA ZANGOR, ZAFFIR A. CHAUDHRY, JIMMY LIH-MIN YEH, JEFFERY R. SCHAFF, and MARK W. DAVIS

Appeal 2018-000217
Application 12/337,848
Technology Center 2800

Before JAMES A. WORTH, AVELYN M. ROSS, and MICHAEL G. McMANUS, *Administrative Patent Judges*.

ROSS, *Administrative Patent Judge*.

DECISION ON APPEAL[1]

Appellant[2] appeals under 35 U.S.C. § 134(a) from a non-final rejection of claims 1–4 and 6–24. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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[1] In our Decision we refer to the Specification filed December 18, 2008 ("Spec."), the Non-Final Office Action appealed from dated October 6, 2016 ("Non-Final"), the Appeal Brief filed March 31, 2017 ("Appeal Br."), the Examiner's Answer dated August 10, 2017 ("Ans."), and the Reply Brief filed October 10, 2017 ("Reply").

[2] We use the word "Appellant" to refer to "applicant" as defined by 37 C.F.R. § 1.42. Appellant identifies Sikorsky Aircraft Corporation as the real party in interest. Appeal Br. 1.

STATEMENT OF THE CASE

The subject matter on appeal relates to "structural health management, and more particularly to a method for monitoring [the] health of a structure" such as an aircraft. Spec. ¶¶ 1–3. Independent claim 1, reproduced below, is illustrative of the claimed subject matter:

> l. A method comprising:
>
> performing a first damage prediction with a computational model using at least data from a multitude of damage sensors mounted to a structure, the multitude of damage sensors including a multitude of local damage sensors applied to the structure and a multitude of global damage sensors applied to the structure, wherein the multitude of damage sensors provide data indicative of the configuration of the structure;
>
> performing a second damage prediction with the computational model using at least data from a multitude of load sensors associated with the structure;
>
> selectively performing on a Health and Usage Monitoring System ("HUMS") one of a plurality of predefined damage monitoring actions in response to the outcome of the first damage prediction and the second damage prediction to determine a structural health;
>
> identifying areas on the structure where damage is likely to occur under operational conditions;
>
> mounting a first quantity of the multitude of local damage sensors to the areas where damage is likely to occur; and
>
> mounting a second quantity of the multitude of global damage sensors to a plurality of locations on the structure, the second quantity greater than the first quantity.

Appeal Br. 10 (Claims App'x). Claim 19, the remaining independent claim, is similar to claim 1 but claims a system for monitoring the health of a structure. *Id.* at 13.

REJECTIONS

The Examiner maintains the following rejections:

A. Claims 1–4, 6–8, 19, 21, and 23 stand rejected under 35 U.S.C. § 103 over the combination of Trego,[3] Materer),[4] and Monroe.[5] Non-Final 3.

B. Claims 9–10, 14, and 20 stand rejected under 35 U.S.C. § 103 over the combination of Trego, Materer, Monroe, and further in view of Petrisco.[6] *Id.* at 8.

C. Claims 11–13 and 15–18 stand rejected under 35 U.S.C. § 103 over the combination of Trego, Materer, Monroe, and further in view of Swaminathan.[7] *Id.* at 13.

D. Claims 22 and 24 stand rejected under 35 U.S.C. § 103 over the combination of Trego, Materer, Monroe, and further in view of Malkin.[8] *Id.* at 22.

Appellant seeks our review of Rejections A–D. *See generally* Appeal Br. Appellant presents argument for Rejection A, claims 1 and 19 (together), and claim 23, and Rejection D, claims 22 and 24 (together). *See id*. Therefore, consistent with the provisions of 37 C.F.R. § 41.37(c)(1)(iv) (2013), we limit our discussion to Rejections A and D (claims 1, 19, and 22–

[3] Trego et al., US 2006/0004499 A1, published January 5, 2006 ("Trego").

[4] Materer et al., US 2009/0058427 A1, published March 5, 2009 ("Materer").

[5] David A. Monroe, US 5,798,458, issued August 25, 1998 ("Monroe").

[6] Petrisko et al., US 3,777,555, issued Dec. 11, 1973 ("Petrisko").

[7] Swaminathan et al., US 5,140,528, issued August 18, 1992 ("Swaminathan")

[8] Malkin et al., US 7,302,866; issued December 4, 2007 ("Malkin").

24) and all other remaining claims stand or fall together with the claim from which they depend.

OPINION

We review the appealed rejections for error based upon the issues identified by Appellant and in light of the arguments and evidence produced thereon. *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (*cited with approval* in *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) ("[I]t has long been the Board's practice to require an applicant to identify the alleged error in the examiner's rejections . . . ."). After considering the evidence presented in this Appeal and each of Appellant's arguments, we are not persuaded that Appellant identifies reversible error. Thus, where we affirm the Examiner's rejection, we do so for the reasons expressed in the Final Office Action and the Answer. We add the following.

Rejection A – Obviousness
(claims 1–4, 6–8, 19, 21, and 23)

The Examiner rejects claims 1–4, 6–8, 19, 21, and 23 over the combination of Trego, Materer, and Monroe. Non-Final 3.

Claims 1 and 19:

The Examiner finds that Trego teaches nearly all aspects of claims 1 and 19, including "a multitude of local damage sensors applied to the structure (*Paragraph [0029], lines 7-8, corrosion sensors, Fig. 3* ***222***) and a multitude of global damage sensors applied to the structure (*Paragraph [0029], lines 1-7, acoustic sensors for detecting cracks; Fig. 3* ***220****; strain sensors detecting impact; Fig. 3,* ***214****, Paragraph [0031]*)." *Id.* at 4. The Examiner acknowledges that Trego does not disclose "a first quantity of the

multitude of local damage sensors . . . and a second quantity of the multitude of global damage sensors [where] the second quantity greater than the first quantity," as claimed. Non-Final 5; Appeal Br. 10 (Claims App'x). But, the Examiner finds that "Materer discloses placing four local damage sensors (Fig. 6, corrosion sensors **100**) at various locations on the aircraft to monitor corrosion (Paragraph [0041])" and "Monroe discloses placing a greater quantity of low cost, global damage sensors throughout the aircraft to monitor structural damages (Fig. 1, acoustic sensors **19a-19m** or 14 sensors; Col. 2, lines 11-15, lines 32-39, lines 57-65; Fig. 2)." *Id.* at 5. The Examiner reasons that because Trego describes identifying areas on the structure where damage is likely to occur—which is necessarily smaller than the remaining areas of the aircraft—it would have been obvious to mount local damage sensors to the smaller areas (i.e., damage-prone locations) and then mount global damage sensors in "a greater quantity throughout the larger areas . . . of the aircraft," in order to provide for comprehensive damage monitoring of the entire aircraft. *Id.* at 6.

Appellant presents four arguments in opposition to the Examiner's rejection of claims 1 and 19. Appeal Br. 4–7. First, Appellant argues that Monroe does not teach damage sensors because the claims require damage sensors to "perform[] a first damage *prediction*" where the sensors of Monroe are acoustic sensors that record sounds and are used to reconstruct an event. *Id*. at 5. According to Appellant, "[o]ne skilled in the art would not consider a sound recording device to be a 'damage sensor.'" *Id.*

We are not persuaded by Appellant's argument. As the Examiner explains, Appellant is narrowly interpreting "damage sensor." Ans. 3. The Specification, however, broadly defines "damage sensor" as "*any device* that

can either sense a deviation in a structure from its original configuration or that can produce a signal that can be used to sense the deviation in the structure from its original configuration." Spec. ¶ 16 (emphasis added). Furthermore, the Examiner finds that Trego "teaches that information gathered from the passive acoustic sensor and active acoustic sensors are used to develop information regarding likely, incipient, and actual damage and degradation of the structure." Ans. 4 (citing Trego ¶ 29). In particular, Trego states that data from these sensors can be used by the usage monitor to "include a probabilistic corrosion model *to predict* the initiation of corrosion and assess the subsequent progress thereof." Trego ¶ 29 (emphasis added). The Examiner also finds that Monroe "uses acoustic sensors to detect structural mechanical failures or other acoustical events where sensed information is sent to the flight crew and ground tracking system for analysis during flights." *Id.*

> The recorded signals are invaluable in locating the source of an onboard acoustic event such as . . . a structural failure . . . or the like. Additional sensors could also be utilized, the sensors 19*a*-19*m* are shown just to provide an example of placement in order to illustrate the teachings of the subject invention. . . . The time and intensity of the detected signal at each of the sensors 19*a*-19*m* will permit reconstruction of the event, pinpointing where the failure or event occurred. By tying the acoustic signal to a chronology, barometric pressure and navigational tracking signals, as will be explained herein, the acoustic data can be used to reconstruct the precise location, time and intensity of an event. This will greatly enhance the ability to reconstruct an event and will also permit corrective action to be taken while in flight, where possible.

Monroe, 5:8–32. Therefore, consistent with the Examiner's findings, both Trego and Monroe suggest the use of the damage sensors to predict where damage is likely to occur.

Second, Appellant asserts that "neither Materer nor Monroe teaches one to provide *more* global damage sensors than local damage sensors." Appeal Br. 5. Appellant contends that when Materer and Monroe teach four corrosion sensors or sensors 19a–19m, respectively, these are merely exemplary. *Id.* Appellants further argue that, relative quantities of local to global sensors are not suggested, but rather, "the teachings of Materer and Monroe could *still* result in an equal quantity of global and local sensors, or could result in more local sensors that global sensors." *Id.* at 6.

On this record, we are not persuaded by Appellant's argument. As the Examiner states (Ans. 5), the difference between local and global sensors are "merely labels" and do not differentiate between the two *types* of sensors, which "can actually be the same type of sensors." *Id.* at 6; *see also* Reply Br. 2 (admitting "that the local and global sensors could be the same type of sensor"). Because the difference between local and global sensors are quantitative, we agree with the Examiner that "any sensor arrangement showing simply the 'differences in the quantity' of two types of any damage sensors mounted onto the given structure, will read on the claims." Ans. 7. The Examiner's findings that Trego and Materer teach placing corrosion sensors in discrete areas where corrosion is likely to occur (*id.* at 7) and Monroe describes placing low cost acoustic sensors throughout the aircraft (*id.* at 8) are supported by the record. Therefore, like the Examiner, we determine that the combination of Trego, Materer, and Monroe suggests

placement of a greater number of global damage sensors as compared to local damage sensors.

Furthermore, our reviewing court guides that where "the problem is known, the possible approaches to solving the problem are known and finite, and the solution is predictable through use of a known option," a solution that is obvious to try may indeed be obvious. *Abbott Labs. v. Sandoz*, Inc., 544 F.3d 1341, 1351 (Fed. Cir. 2008), citing *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 420 (2007); see also *Merck & Co., Inc. v. Biocraft Labs., Inc.*, 874 F.2d 804, 807 (Fed. Cir. 1989) (The fact that a reference "discloses a multitude of effective combinations does not render any particular formulation less obvious."). Here, because there are only a finite set of options having predictable results—that is, a greater number, an equal number, or a lesser number of global sensors compared to local sensors—and the Examiner has identified each of the claimed elements in the cited references supported by an adequate rationale for combining those teachings, the claimed proportions, if any modification were required, would have been "obvious to try" at the time of Appellant's invention. Moreover, Appellant has provided no evidence that modifying the teachings in the cited references would have been "outside the technical grasp" of the ordinary artisan, nor has Appellant presented evidence that the result would not have been predictable. *KSR*, 550 U.S. at 420. As a result, we are not persuaded the Examiner reversibly erred in concluding that having a greater number of global damage sensors in comparison to the quantity of local damage sensors would have been obvious to an artisan possessing an ordinary skill at the time of invention.

Third, Appellant contends that the Examiner's reasoning is flawed, lacks rational underpinnings, and is supported by improper hindsight reconstruction. Appeal Br. 6. Appellant asserts that there is no basis for the Examiner's position that the areas where corrosion would occur (i.e., the location of local sensors) would *obviously* be smaller than the remaining area of the aircraft. *Id.*

Appellant argues that "the Examiner has no basis for *this* statement" and that "even if there were smaller number of areas where corrosion may occur, it does not necessarily follow that one would provide a small number of sensors in those areas—especially considering that Monroe and Materer do not teach one to provide *fewer* local sensors than global sensors." *Id.* According to Appellant, the Examiner's basis for combining the references—i.e., to provide "comprehensive damage monitoring—lacks any basis absent reference to Appellant's disclosure. *Id.* at 6–7.

On this record, we agree with the Examiner who finds "Trego teaches that corrosion sensors may be located in limited areas such as doors" and that Materer "discloses placing four local damage sensors in locations where corrosion is a concern." Ans. 7; *see also* Trego ¶ 29 (identifying "areas exposed to impact [which] include the following doors and surrounding structures: passenger doors, service doors, and cargo doors"). The Examiner further finds that "Monroe, on the other hand, discloses placing a greater quantity of low cost, global damage sensors throughout the aircraft to monitor structural damage." *Id.* at 8. Thus, Appellant's argument that the Examiner's account of the prior art is inaccurate and that "the notion that 'corrosion sensors do not need to be placed throughout the aircraft' comes entirely from the Examiner," and not the prior art (Reply Br. 2) is

unpersuasive. Based on the combined teachings of Trego, Monroe and Materer, the Examiner reasons that "one of ordinary skill in the art would have still obviously combined the above references to arrive at the claimed invention, since the particular combination of 'differences in quantity' of local and damage sensors . . . would have nonetheless, provided a comprehensive damage monitoring of the entire aircraft." Ans. 8. We find no error in the Examiner's reasoning or evidence of hindsight.

Lastly, Appellant urges that the Examiner's changing positions over four separate office actions is evidence "that there *truly is no rational reason*" for modifying Trego. Appeal Br. 7. Appellant's fourth argument does not identify, much less allege, a basis for reversible error on the part of the Examiner and is therefore unpersuasive.

Therefore, on this record, we sustain the Examiner's rejection of claims 1 and 19.

Claim 23:

Claim 23 depends from claim 1 and further requires "the local damage sensors are selected from the group consisting of ultrasonic sensors, phase data sensors, and crack gauges." Appeal Br. 14 (Claims App'x). The Examiner finds that "Trego discloses the local damage sensors are selected from the group consisting of ultrasonic sensors, phase data sensors, and crack gauges." Non-Final 8 (citing Trego, Fig. 3, 220 and ¶ 29).

Appellant argues that "when addressing claim 1, the Examiner reads the claimed *global sensors* on Trego's sensors 220 . . . [but] [c]laim 23 relates to *local sensors*, however." Appeal Br. 8. Therefore, sensors 220 cannot be the local sensors as claimed. *Id.*

We are not persuaded by Appellant's argument that the Examiner erred in incorrectly identifying the ultrasonic sensors and crack gauges, corresponding global sensor 220, as local sensors in claim 23. "Appellant agrees that the local and global sensors could be the same type of sensor." Reply Br. 2. The Examiner further explains that "Trego, in general terms, describes corrosion sensor, it is well known that ultrasonic sensors and crack monitors are also corrosion sensors, since they are widely accepted non-destructive testing technique for corrosion detection, including in pipes, tubes, and other structures." Ans. 10. Therefore, the fact that the Examiner identified ultrasonic sensors (acoustic sensors 220), i.e., a *type* of sensor, in rejecting claim 23 is irrelevant because the local and global sensors may be the same *type* of sensor.

Rejection D – Obviousness
(claims 22 and 24)

The Examiner rejects claims 22 and 24 over the combination of Trego, Materer, Monroe, and further in view of Malkin. Non-Final 22. Claims 22 and 24, depending from claim 1 and claim 19 respectively, additionally requires that "the multitude of global damage sensors are piezo sensors." Appeal Br. 14 (Claims App'x). The Examiner finds that the additional subject matter of claims 22 and 24 are taught by Malkin. *Id.* at 22. The Examiner explains that "[a]lthough Trego discloses the use of strain gauges, the strain gauges are not disclosed as piezo," but "Malkin discloses a piezo strain sensor for an aerospace vehicle." *Id.* The Examiner reasons that one skilled in the art would have reason to use the piezo strain gauge of Malkin "so as to allow the complete sensor assembly to be placed in the

airstream of the vehicle or within confined tight interior spaces in which no cable need[s] to be permanently attached to the sensing head." *Id.* at 22–23.

Appellant contends that claims 22 and 24 are not obvious over the combination proffered by the Examiner. Appeal Br. 8. Specifically, Appellant argues that "the Examiner appears to have forgotten the rejection of claims 1 and 19 modified Trego such that its 'global sensors' were replaced by Monroe's acoustic sensors 19a-19m. One would certainly not replace an acoustic sensor with a piezo sensor." *Id.*

The Examiner explains that he has designated both the "acoustic sensors as well as strain sensors as global damage sensors (see Section B1 above). It should be noted that strain sensors can also utilize surface acoustic waves for detection of strain. In this sense, strain sensors can also be viewed as an acoustic sensor." Ans. 9. The Examiner finds that Malkin's "piezosensor . . . is based on ultrasound (or acoustic as it is related to sound)." *Id.*

We are not persuaded by Appellant's arguments. The Examiner relies upon Trego to teach *nearly all aspects* of claims 1 and claim 19—including global sensors (acoustic sensors 220 and strain sensors 214)—except that Trego does not suggest "a first quantity of the multitude of local damage sensors . . . and a second quantity of the multitude of global damage sensors [where] the second quantity greater than the first quantity," as claimed. Non-Final 5; Appeal Br. 10, 13 (Claims App'x). The Examiner relies on the combined teachings of Trego, Materer, and Monroe to suggest a quantity of global damage sensors that is greater than the quantity of local damage sensors. The Examiner *does not* suggest replacing Trego's global sensors with Monroe's acoustic sensors 19a–19m. Furthermore, Appellant

acknowledges local damage sensors and global damage sensors could be the same type. Reply Br. 2. Therefore, Appellant's argument fails to identify any reversible error because Appellant does not address the rejection as presented by the Examiner.

CONCLUSION

Appellant fails to identify a reversible error in the Examiner's rejection of claims 1–4, 6–6, 19, 21, and 23 under 35 U.S.C. § 103 over the combination of Trego, Materer, and Monroe.

Appellant fails to identify a reversible error in the Examiner's rejection of claims 9–10, 14, and 20 under 35 U.S.C. § 103 over the combination of Trego, Materer, Monroe, and further in view of Petrisco.

Appellant fails to identify a reversible error in the Examiner's rejection of claims 11–13 and 15–18 under 35 U.S.C. § 103 over the combination of Trego, Materer, Monroe, and further in view of Swaminathan.

Appellant fails to identify a reversible error in the Examiner's rejection of claims 22 and 24 under 35 U.S.C. § 103 over the combination of Trego, Materer, Monroe, and further in view of Malkin.

DECISION

For the above reasons, the Examiner's rejection of claims 1–4 and 6–24 is affirmed as detailed below.

Claims Rejected	Basis	Affirmed	Reversed
1–4, 6–8, 19, 21, 23	§ 103 Trego, Materer, Monroe	1–4, 6–8, 19, 21, 23	
9–10, 14, 20	§ 103 Trego, Materer, Monroe, Petrisco	9–10, 14, 20	
11–13, 15–18	§ 103 Trego, Materer, Monroe, Swaminathan	11–13, 15–18	
22, 24	§ 103 Trego, Materer, Monroe, Malkin	22, 24	
Overall Outcome		1–4, 6–24	

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1).

AFFIRMED