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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte CHRISTOPHER P. BENSON, LEONARD J. QUADRACCI, and
DOUGLAS C. CAMERON

Appeal 2019-000983
Application 14/064,366
Technology Center 3600

Before JENIFER D. BAHR, STEFAN STAICOVICI, and
MICHAEL J. FITZPATRICK, *Administrative Patent Judges*.

FITZPATRICK, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant¹ appeals under 35 U.S.C. § 134(a) from the Examiner's final decision rejecting claims 2, 5, 6, 9–14, 17, and 20–23. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

¹ The Boeing Company (“Appellant”) is the Applicant, as provided for under 37 C.F.R. § 1.46, and is also identified as the sole real party in interest.
Appeal Br. 2.

STATEMENT OF THE CASE

The Specification

The Specification “relates to a method and apparatus for an aircraft electric motor system.” Spec. 1.

The Rejected Claims

Claims 2, 5, 6, 9–14, 17, and 20–23 are rejected. Final Act. 1. No other claims are pending. *Id.* Appellant argues the claims together. Appeal Br. 7–10. Accordingly, we select independent claim 21 as representative. *See* 37 C.F.R. § 41.37(c)(1)(iv); *see also* Appeal Br. 7 (“Independent claim 21 is representative of the claims on appeal.”). Claim 21 is reproduced below.

21. An apparatus comprising:
- a motor;
 - a power source;
 - a switch bridge connected to the motor;
 - a voltage controller connected to the switch bridge and the power source; and
 - a four-quadrant motor controller programmed to:
 - control the voltage controller to control a voltage provided from the power source to the switch bridge during an operating state,
 - control the switch bridge to control a current provided to the motor during the operating state,
 - control the switch bridge to control a current provided from the motor during a recharge state, and
 - control the voltage controller to control a voltage provided to the power source to charge the power source during the recharge state.

Appeal Br. 14–15.

The Examiner's Rejection

The following rejection is before us for review: claims 2, 5, 6, 9–14, 17, and 20–23, under 35 U.S.C. § 103, as being unpatentable over Criado,² Bailey,³ and Applicant Admitted Prior Art.⁴ Final Act. 3.

DISCUSSION

Criado discloses “an unmanned aerial vehicle (UAV) able to harvest energy from updrafts.” Criado ¶1. Figure 5 of Criado is reproduced below.

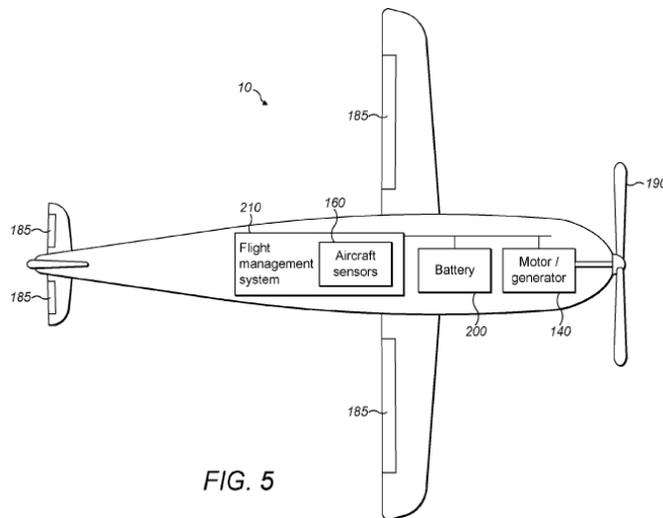


Figure 5, reproduced above, shows UAV 10 having, among other things, flight management system 210, motor/generator 140, and rotor/propeller 190. *Id.* ¶18. As illustrated, “the rotor 190 may act as a propeller, i.e. the rotor 190 and the generator/motor 140 may be both an energy harvesting means, and a propulsion means for providing thrust.” *Id.* ¶21. “Preferably,

² EP 2 629 166 A1, published Aug. 21, 2013 (“Criado”).

³ US 4,494,051, issued Jan. 15, 1985 (“Bailey”).

⁴ The Examiner considers the subject matter of which the Examiner took Official Notice in the Non-Final Action issued March 6, 2017, to be Admitted Prior Art as a consequence of Appellant’s failure to challenge the Official Notice. *See* Final Act. 2.

the motor/generator 140 will be a brushless motor.” *Id.* The flight management control system controls the motor/generator and battery. *Id.* ¶23. For example, the flight control management system includes speed controller 120 that “controls the speed of revolution of the motor/generator.” *Id.* ¶¶24, 28.

The Examiner found that Criado discloses all of the subject matter of claim 21, including a controller, except that:

Criado does not expressly disclose that the controller is a [four-quadrant motor controller; that the voltage controller (120) is connected to a switch bridge, or that the motor controller is programmed to control the voltage controller to control voltage provided to the motor from the power source in an operating state, to control the switch bridge to control current to the motor during an operating state, to control the switch bridge to control current generated from the motor during a recharge state, and to control the voltage controller to control voltage provided back to the batter during a recharge state.

Final Act. 3–4.

The Examiner thus turned to Bailey, finding that it “teaches a control circuit for brushless DC motors which provides positive control in all four quadrants of operational space.” *Id.* at 4 (citing Bailey, [57]). The Examiner noted that Bailey explicitly teaches the use of such four quadrant motor controllers in aircraft. *Id.* (citing Bailey 1:58–2:25). The Examiner further found that the Bailey “controller is programmed to monitor the current and control the duty cycle of a motor in response to a feedback loop using the monitored current.” *Id.* (citing Bailey 3:5–4:15).

The Examiner determined that it would have been obvious to a person of ordinary skill in the art “to employ the four quadrant motor controller of Bailey in place of the generic controller of Criado to achieve the advantages

outlined in col. [1], lines 25–28, namely improvements in reliability, simplification of hardware, and reduction of weight.” *Id.* at 5.

The Examiner originally found that the asserted combination of Criado and Bailey “does not explicitly recite the details of a switch bridge and the connection to the motor and the voltage controller.” Final Act. 5. Thus, in the Final Action, the Examiner relied on Applicant Admitted Prior Art (“AAPA”). *Id.* The AAPA is “that the use of H-bridges [a ‘switch bridge’ per claim 21] to control the direction of electric motors in four quadrant motor control systems is well-known in the electric aircraft art,” and that “it is also well known to utilize PWM in order to [change] the speed of an electric motor in combination with an H-bridge in the electric aircraft art.” *Id.* The Examiner explained that PWM (i.e., Pulse Width Modulation) “requires the manipulation of power input duty cycle thereby affecting the voltage level output by the circuit which appears to inherently require the usage of the voltage controller.” *Id.*

However, in the Answer, the Examiner indicated that reliance on AAPA is not necessary because, “upon further review,” Bailey “explicitly teaches the H-bridge and PWM usage in a four-quadrant motor control system for use in an aircraft.” Ans. 4 (citing Bailey 3:34–43 (disclosing PWM) and Fig. 2 (illustrating H-bridge)).

Appellant generally argues that “[i]ndividual elements of the claimed circuit structure, the claimed circuit structure as a whole, and the control functions performed by the four-quadrant controller as claimed are not described or suggested in any of the cited references or in any possible combination thereof.” Appeal Br. 8; *see also id.* at 10 (similar generalized

argument). This generalized argument does not apprise us of error because it does not address the rejection with any particularity.

Appellant also argues the following:

Criado . . . teaches that the speed controller may indirectly control the power provided by a motor acting as a generator. However, Criado does not teach that the speed controller may be used in any way to control voltage. It is respectfully noted that power is the product of voltage and current. *Power may be controlled without controlling voltage, for example, by controlling only current.* The teaching that the speed controller in Criado may be used to control generated power thus does not necessarily mean that the speed controller may be used to control voltage. Therefore, the speed controller in Criado does not teach a ‘voltage controller’ as featured in the claims.

Id. at 8 (underlining omitted; emphasis added).

The Examiner responds that Appellant’s arguments about Criado are not commensurate with the rejection. In that regard, the Examiner concedes that “Criado does not recite specific details relating to the type of control system (e.g. a ‘four quadrant controller’) employed and/or the detailed electrical circuitry used by the control system.” Ans. 3. “Criado is utilized to demonstrate that an aircraft having a motor and power source, wherein the motor is used to drive the aircraft, is capable of being electrically braked, and is capable of being utilized as a generator is known in the art.” *Id.* Thus, the rejection “relies on Bailey to show that four-quadrant motor control systems in aircraft which provide driving power to a motor, provide electrical motor braking, and allow for use of the motor as a generator are known and used in the art.” *Id.*; *see also id.* at 4 (noting that each of AAPA and Bailey teach both an H-bridge—a “switch bridge” within the meaning of claim 21—and PWM usage in a four-quadrant motor control system for use

in an aircraft) (referring to Final Act. 5–6 and citing Bailey 3:34–43 and Fig. 2). In sum, “[w]hile Criado may not explicitly teach the manipulation of voltage with the speed controller, Bailey and AAPA were utilized to show that manipulation of voltage (e.g. PWM) is utilized by four quadrant motor controllers to effect the same functions as recited in Criado.” *Id.* at 5; *see also id.* (“Bailey explicitly discloses manipulation of voltage using PWM and the switch bridge to operate in four quadrants.”); Bailey 3:34–40.

In addition, the Examiner responds to Appellant’s argument that, in Criado, voltage is not inherently controlled merely because power is controlled. In that regard, the Examiner points out that “in order for a motor to reverse its rotation direction, the direction of the current and polarity of the voltage (i.e. +V or -V) must be reversed.” *Id.* Thus, the Criado controller controls the voltage, at least in terms of polarity, even if not in magnitude. *Id.*

Appellant filed a Reply Brief but, in it, fails to rebut any of these responses by the Examiner. Appellant’s Reply Brief repeats the same generalized and unpersuasive argument as its Appeal Brief. *See* Reply Br. 2 (“[I]ndividual elements of the claimed circuit structure, the claimed circuit structure as a whole, and the control functions performed by the four-quadrant controller as claimed are not described or suggested in any of the cited references or in any possible combination thereof.”); *see also id.* at 4 (similar generalized argument).

Instead of rebutting the Examiner’s responses, Appellant contends it need not do so:

The Examiner asserts that a voltage controller is taught by Criado. The Examiner does not rely on any other references for teaching a voltage controller. Therefore, Applicant need not deal

with any other references in pointing out that the Examiner's assertion is incorrect.

Reply Br. 2. Appellant is mistaken in its premise and thus its conclusion. *See, e.g.,* Ans. 5 (“While Criado may not explicitly teach the manipulation of voltage with the speed controller, Bailey and AAPA were utilized to show that manipulation of voltage (e.g. PWM) is utilized by four quadrant motor controllers to effect the same functions as recited in Criado.”); *see also In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (“Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references. . . . [The reference] must be read, not in isolation, but for what it fairly teaches in combination with the prior art as a whole.”).

Because Appellant does not apprise us of error, we affirm the rejection of claim 21 as unpatentable over Criado, Bailey, and Applicant Admitted Prior Art,⁵ as well as that of claims 2, 5, 6, 9–14, 17, 20, 22, and 23, which fall therewith. *See* 37 C.F.R. § 41.37(c)(1)(iv).

SUMMARY

The Examiner's rejection of claims 2, 5, 6, 9–14, 17, and 20–23 is affirmed.

⁵ As discussed above, our affirmance of the rejection does not rely on AAPA.

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TIME PERIOD

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)(iv).

AFFIRMED