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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MARK MARVIN, MARC FEIFEL,
NICHOLAS ALBION, and JOHN E. MERCER

Appeal 2019-003461
Application 13/763,582
Technology Center 3600

Before JENNIFER D. BAHR, MICHELLE R. OSINSKI, and
SEAN P. O'HANLON, *Administrative Patent Judges*.

BAHR, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant[1] appeals under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 7–31. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM IN PART.

[1] We use the term "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Merlin Technology, Inc. Appeal Br. 3.

THE CLAIMED SUBJECT MATTER

Claims 7 and 21, reproduced below, are illustrative of the claimed subject matter.

> 7. An autopilot system for controlling the flight of a helicopter, said autopilot system comprising:
>
> a sensor arrangement that produces a set of sensor inputs for the autopilot system to characterize the flight of the helicopter for generating autopilot actuator control signals;
>
> a processing arrangement that is configured to generate the autopilot actuator control signals based on no more than the set of sensor inputs to control the flight of the helicopter in a pilot selected one of a plurality of flight modes and to further generate a slaved gyro output signal based on no more than the set of sensor inputs;
>
> an actuator arrangement to manipulate a cyclic control of the helicopter based on the actuator control signals to fly the helicopter; and
>
> an autopilot display that is configured to display autopilot flight mode information to the pilot while displaying a slaved gyroscopic heading to the pilot based on the slaved gyro output signal.

> 21. An autopilot system for controlling the flight of a helicopter, said autopilot system comprising:
>
> a plurality of sensors for generating a plurality of sensor outputs that characterize the flight of the helicopter;
>
> a processing arrangement that is configured to determine a current flight status of the helicopter based on the plurality of sensor outputs for operating the helicopter in a selected one of a plurality of autopilot flight modes and to generate a customized menu that includes a subset of one or more but less than all of the plurality of autopilot flight modes which subset is customized for pilot selection based on the current flight status of the helicopter; and
>
> a display for presenting the customized menu to the pilot for selection of one autopilot flight mode of the subset of autopilot flight modes.

EVIDENCE

The prior art relied upon by the Examiner is:

Name	Reference	Date
Skutecki	US 4,628,455	Dec. 9, 1986
Calise	US 6,092,919	July 25, 2000
Adams	US 6,314,343 B1	Nov. 6, 2001
McCall	US 6,697,758 B2	Feb. 24, 2004
Beard	US 2006/0058928 A1	Mar. 16, 2006
Bachelder	US 2007/0164167 A1	July 19, 2007
Younkin	US 2007/0182590 A1	Aug. 9, 2007
Cerchie	US 2007/0221782 A1	Sept. 27, 2007
Hamburg	US 2011/0022250 A1	Jan. 27, 2011
Duerksen	US 8,195,346 B1	June 5, 2012
Shue	US 2013/0261853 A1	Oct. 3, 2013

REJECTIONS[2]

I. Claim 21 stands rejected under 35 U.S.C. § 102(b) as anticipated by Adams.

II. Claims 27, 28, 30, and 31 stand rejected under 35 U.S.C. § 102(b) as anticipated by Bachelder.

III. Claims 7–9 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Hamburg and Younkin.

[2] The Final Action contained rejections of claims 1–6 under 35 U.S.C. § 103(a). Final Act. 5–8. Appellant cancelled claims 1–6 in the amendment filed October 3, 2018, subsequent to the Final Action. In the Advisory Action dated October 30, 2018, the Examiner indicated that the amendment would be entered for purposes of appeal. As such, cancelled claims 1–6 are not involved in this appeal, and the rejection of these claims presented in the Final Action is rendered moot. *See* 37 C.F.R. § 41.31(c) ("An appeal, when taken, is presumed to be taken from the rejection of all claims under rejection unless cancelled by an amendment filed by the applicant and entered by the Office.").

IV. Claims 10–14 and 17–19 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, and Beard.

V. Claim 15 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, Beard, and Calise.

VI. Claim 16 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, Beard, Calise, and McCall.

VII. Claim 20 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, and Cerchie.

VIII. Claim 22 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Adams and Duerksen.

IX. Claim 23 and 25 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Adams, Duerksen, and Hamburg.

X. Claims 24 and 26 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Adams, Duerksen, Hamburg, and Shue.

XI. Claim 29 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Bachelder and Skutecki.

OPINION

Rejection I—Anticipation by Adams

In rejecting independent claim 21, the Examiner finds that Adams discloses, in relevant part,

> a processing arrangement (12) that is configured to . . . generate a customized menu that includes a subset of one or more but less than all of the plurality of autopilot flight modes which subset is customized for pilot selection based on the current flight status of the helicopter (e.g. menu C generated in fig. 3 does not provide the same flight modes available in menus D and E, given that the modes are viable).

Final Act. 2–3. Appellant argues that "[t]he sub-menus in Adams are not customized based on which flight modes are viable, non-viable or otherwise. Adams tests whether a flight mode is viable only after that flight mode has been selected." Appeal Br. 8 (underlining omitted). In particular, Appellant asserts that "the screens of figure 3 show responses to actuations of hardwired or soft switches merely in response to switch actuations made by the pilot." *Id.* at 9 (underlining omitted). We agree with Appellant that the Examiner's rejection is in error.

Adams discloses, with reference to Figure 3, that "there is shown a sequence of display screen menus which can occur when a particular combination of the hard wired switches and the soft bezel switches are actuated." Adams, col. 5, ll. 25–28 (boldface omitted). Adams also discloses "that the ability to switch from one sub-menu to another sub-menu requires the approval of the flight control computer 32 that the sub-menus are viable options in ongoing flight conditions." *Id.*, col. 6, ll. 15–18 (boldface omitted). In this regard, the Examiner takes the position that "Adams teaches limiting of sub-menu modes after the main-menu modes have been selected." Ans. 5. The Examiner explains that,

> [a]s shown in the example of fig. 3, the pilot has selected the Approach (APP) mode at main-menu switch (72). The display screen (4) displays the sub-menus ILS (86), BC (90), and VAP (94) available in the Approach (APP) mode (60) as shown in part B (upper left section of figure 3). If the pilot selects ILS switch (76), display screen 4 changes to sub-menu part C (lower left section of figure 3). If the pilot selects BC switch (78), display screen 4 changes to sub-menu part D, and so on.

Id. However, to the extent that Adams discloses customizing sub-menus to include a subset of less than all of a plurality of flight modes, such customizing is based on *the mode selected by the pilot* at the main menu and

not based on *the flight status of the helicopter*. In other words, Adams displays sub-menus C, D, and E, each including a subset of modes, based on the main menu selection made by the pilot, but Adams does not disclose that the sub-menus are customized based on the current flight status of the helicopter. Thus, the Examiner's finding that Adams discloses "generat[ing] a customized menu that includes a subset of one or more but less than all of the plurality of autopilot flight modes which subset is customized for pilot selection based on the current flight status of the helicopter" (*see* Final Act. 2–3) lacks adequate evidentiary support.

For at least the above reasons, the Examiner fails to establish by a preponderance of the evidence that Adams anticipates the subject matter of claim 21. Accordingly, we do not sustain the rejection of claim 21 under 35 U.S.C. § 102(b) as anticipated by Adams.

Rejection II— Anticipation by Bachelder

Claims 27, 28, and 30

In rejecting independent claim 27, the Examiner finds that Bachelder discloses, in relevant part,

> automatically activating an emergency descent mode (autorotation) to generate said autopilot actuator control signals responsive to the sensor outputs to first pitch the helicopter in a way that initially establishes a forward speed of the helicopter (push-over to gain airspeed (para [0078])) that is within a predetermined range of speed (i.e. desired speed for landing (para [0076]–[0078])) irrespective of a given forward speed at a time when the activation signal occurred (landing speed understood to be irrespective of speed at which failure occurred).

Final Act. 3–4. Appellant argues that "[t]he heavyweight condition described in paragraph 78 of Bachelder starts from a hover, which is generally an airspeed of zero. There is nothing in paragraph 78 to suggest

that the response would be the same irrespective of airspeed in the manner recited by claim 27." Appeal Br. 9 (boldface and underlining omitted). We agree with Appellant that the Examiner's rejection is in error.

Bachelder discloses that "[t]he capability of the automatic guidance algorithm of the present invention to safely autorotate for the heavyweight condition is demonstrated in FIG. 12. The engine is failed when the helicopter is at a hover at an altitude of 400 ft above ground." Bachelder ¶ 78 (boldface omitted). Bachelder discloses that "[t]he optimal guidance commands an almost immediate push-over to gain airspeed (contrast with almost no pitch input for several seconds in FIG. 9) and maintain rotor-speed with a very rapid pull-up to about 35 degrees to arrest sink rate at low altitude." *Id.* (boldface omitted). In other words, Bachelder's guidance system commands the helicopter to pitch to increase airspeed in response to an engine failure for a heavyweight condition at a hover. However, the Examiner does not point to, nor do we find, any disclosure in Bachelder that the command to pitch the helicopter described in paragraph 78 would take place *irrespective* of the helicopter's forward airspeed at the time of the engine failure. Given that Bachelder only discloses pitching the helicopter forward in the context of a helicopter at a *hover* (i.e., stationary condition) at the time of engine failure, the Examiner's finding that Bachelder discloses first pitching the helicopter in a way that initially establishes a forward speed of the helicopter that is within a predetermined range of speed irrespective of a given forward speed at a time when the activation signal occurred (*see* Final Act. 3–4) lacks adequate evidentiary support.

For at least the above reasons, the Examiner fails to establish by a preponderance of the evidence that Bachelder anticipates the subject matter of claim 27. Accordingly, we do not sustain the rejection of claim 27, or its

dependent claims 28 and 30, under 35 U.S.C. § 102(b) as anticipated by Bachelder.

Claim 31

> The Examiner finds that Bachelder discloses, in relevant part,
>
> generate said autopilot actuator control signals responsive to the sensor outputs to manage the cyclic control without control inputs from a pilot (as understood by activation via autopilot) at least during an initial portion of the descent to hold a constant airspeed (20 kts. para [0076]) for descent so that there is sufficient flow through the rotor to maintain the RPM of the main rotor at an acceptable rate (above 75% (para [0076])).

Final Act. 4–5. Appellant argues that Bachelder's "[p]aragraph 76 is devoid of any mention of a constant airspeed or pitch angle." Appeal Br. 10. Appellant asserts that "[c]laim 31 involves an initial portion of the descent, immediately upon receiving the activation signal, not a run-on landing speed which is a final airspeed." *Id.* (underlining omitted). We are not persuaded by this argument.

Bachelder discloses that "[t]he collective is lowered immediately but there is no command to push the nose over or pitch down and gain airspeed until the rotor-speed approaches its lower constraint of 75%." Bachelder ¶ 76. Referring to Figure 9 of Bachelder, the Examiner takes the position that

> the airspeed (V) is held constant at 0 kts. (1st graph) after engine failure (0 to 5 seconds) while the helicopter descends 400 ft. to 300 ft. (5th graph) to maintain the rotor speed (Ω) above 75% (3rd graph) as recited in the paragraph, which meets the limitation of the claim to "an initial portion of the descent (400 ft. to 300 ft.) to hold a constant airspeed (0 kts.)."

Ans. 8. In this regard, Appellant does not specifically address the Examiner's position or explain why it is deficient. Given that Bachelder discloses an initial period of time (time = 0–5 sec) in which the helicopter

remains at a constant airspeed (V = 0) while descending from 400 feet to 300 to maintain rotor speed (Ω) (*see* Bachelder, Fig. 9, ¶ 76), a preponderance of the evidence supports the Examiner's finding that Bachelder meets the disputed limitation.

For the above reasons, Appellant fails to apprise us of error in the Examiner's finding that Bachelder anticipates the subject matter of claim 31. Accordingly, we sustain the rejection of claim 31 under 35 U.S.C. § 102(b) as anticipated by Bachelder.

Rejection III—Obviousness Based on Hamburg and Younkin

In rejecting independent claim 7, the Examiner finds that Hamburg teaches, in relevant part, "a processing arrangement (onboard computer) that is configured to . . . generate a heading output signal based on no more than the set of sensor inputs (high-lighted magnetic course flown based on previously recorded GPS coordinates)." Final Act. 8. The Examiner finds that "Hamburg fails to disclose generation of a slaved gyro output signal, and displaying a slaved gyroscopic heading to the pilot based on the slaved gyro output signal." *Id.* at 9. However, the Examiner finds that "Younkin discloses generating a slaved gyro output signal (heading source may be slaved (para [0067])); while displaying a slaved gyroscopic heading to the pilot based on the slaved gyro output signal (heading source may be displayed with GPS course by elliptical scale (113) (para [0067]))." *Id.* The Examiner determines that it would have been obvious to modify Hamburg

> to generate a slaved gyro output signal based on no more than the set of sensor inputs, and display a slaved gyroscopic heading to the pilot based on the slaved gyro output signal, since Hamburg states that the display screen may show the GPS coordinates and the magnetic course (para [0005]) and Younkin states that heading sources may be slaved to a magnetic heading source, and since doing so allows the pilot to know the

> difference between the displayed heading and the magnetic heading, increasing the pilot's understanding of the surrounding environment.

Id.

Appellant argues that Younkin fails to make up for the acknowledged deficiency in Hamburg. Appeal Br. 11. In particular, Appellant asserts that "there remains nothing in either reference to reasonably suggest the combined requirements of claim 7 wherein no more than the sensors used by the processing arrangement to generate the actuator control signals are used by that same processing arrangement to generate a slaved gyro." *Id.* (underlining omitted). According to Appellant, "[t]here is no mention of the sensors being shared between an autopilot and a slaved gyro in either reference, nor is there any mention of the processor that is shared between these two instruments." *Id.* We are not persuaded by these arguments because they attack the references individually rather than as combined by the Examiner in the rejection. "Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references." *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (citing *In re Keller*, 642 F.2d 413, 425 (CCPA 1981).

As discussed above, the Examiner relies on Hamburg for teaching a processing arrangement that generates control signals and a *heading* output signal based on no more than the set of sensor inputs. Final Act. 8 (citing Hamburg ¶¶ 5, 7); *see also* Ans. 8–9 (explaining that, "[a]s shown in fig. 2 of Hamburg, the sensors (1–4) provide inputs to the autopilot (or CPU) for actuation of the control signals (10), and for generating a course (or heading) signal via the high-lighted magnetic course (para [0004]) on the GPS display (7, 9)"). The Examiner relies on Younkin only for teaching a *slaved gyro*

output signal. Final Act. 9 (citing Younkin ¶ 67); *see also* Ans. 9 (explaining that "Younkin provides an azimuth, or aircraft course (para [0027]) output signal by using a slaved gyro (para [0067])"). In other words, the Examiner does not rely on either reference individually for teaching generating a slaved gyro output signal based on no more than the set of sensor inputs, but, rather, determines that this feature would have been obvious to one of ordinary skill in the art in view of the combined teachings of the cited references. *See* Final Act. 9 (reasoning that the proposed modification of Hamburg would "allow[] the pilot to know the difference between the displayed heading and the magnetic heading, increasing the pilot's understanding of the surrounding environment"). In this regard, Appellant does not specifically address the Examiner's articulated reasoning for the conclusion of obviousness. The Examiner articulates adequate reasoning based on rational underpinnings for the proposed modification of Hamburg, and Appellant does not offer any factual evidence or persuasive technical rationale to refute the Examiner's reasoning or explain why it would be deficient.

Appellant also argues that Younkin teaches away from using the same processing arrangement to generate actuator control signals and a slaved gyro output. Appeal Br. 11–12. In particular, Appellant asserts that Younkin "appears to utilize an autopilot control system that is isolated from the remainder of his system including his azimuth source 518." *Id.* at 11 (citing ¶ 73). According to Appellant,

> [a]side from adding weight in Younkin as a result of using separate autopilot and azimuth source units, the duplication of sensors in association with these units requires still more additional weight, not just arising from the weight of the

> additional sensors, but also the weight of their associated electrical connections.

Id. at 11–12. This line of argument is unconvincing.

A reference teaches away from a claimed invention or a proposed modification if "a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." *In re Kubin*, 561 F.3d 1351, 1357 (Fed. Cir. 2009) (quoting *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994)). Prior art does not teach away from claimed subject matter merely by disclosing a different solution to a similar problem unless the prior art also criticizes, discredits, or otherwise discourages the solution claimed. *See In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). Here, Appellant does not point to, nor do we find, any disclosure in Younkin criticizing, discrediting, or otherwise discouraging the combination of teachings proposed by the Examiner in the rejection. Even assuming *arguendo* that Younkin uses separate processing arrangements for autopilot and azimuth source (*see* Appeal Br. 11), this does not constitute a teaching away from the Examiner's proposal to use Hamburg's processing arrangement to generate a slaved gyro output signal based on no more than the set of sensor inputs (*see* Final Act. 9). Moreover, Appellant's argument appears to improperly presume a bodily incorporation of Younkin's separate processing arrangements and associated structures into the system of Hamburg. S*ee* Appeal Br. 11–12. "It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements." *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012); *see also Keller*, 642 F.2d at 425 (stating, "[t]he test for obviousness is not whether the features of a

secondary reference may be bodily incorporated into the structure of the primary reference").

For the above reasons, Appellant does not apprise us of error in the Examiner's determination that the subject matter of claim 7 would have been obvious. Accordingly, we sustain the rejection of claim 7, and its dependent claims 8 and 9, for which Appellant relies on the same arguments (*see* Appeal Br. 12), under 35 U.S.C. § 103(a) as unpatentable over Hamburg and Younkin.

Rejection IV—Obviousness Based on Hamburg, Younkin, and Beard

Claims 10, 11, 14, and 17

In contesting the rejection of claims 10, 11, 14, and 17, Appellant relies on the arguments asserted against the rejection of independent claim 7, and contends that Beard does not make up for the argued deficiencies in the combination of Hamburg and Younkin. Appeal Br. 12. For the reasons discussed above, Appellant's arguments do not apprise us of error in the rejection of claim 7, and, likewise, do not apprise us of error in the rejection of claims 10, 11, 14, and 17. Accordingly, we sustain the rejection of claims 10, 11, 14, and 17 under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, and Beard.

Claims 12 and 18

Claim 12 depends from claim 10, via claim 11, and recites that "said sensor arrangement includes a GPS that produces a GPS heading and the processing arrangement periodically updates the yaw heading based on the GPS heading." Appeal Br. 22 (Claims App.). Appellant argues that the Examiner's rejection is in error because it "[f]ails to identify any reason that one of ordinary skill in the art would reasonably be led to update a yaw

heading in Hamburg based on a GPS heading." *Id.* at 13. We agree with Appellant that a sustainable case of obviousness has not been established.

In rejecting claim 12, the Examiner finds that

> Hamburg discloses said sensor arrangement includes a GPS that produces a GPS heading and the processing arrangement periodically updates the yaw heading based on the GPS heading (GPS coordinates recorded every 4 to 30 seconds of flight (para [0005]) and automatic flight control adjustments are made to match the real-time GPS coordinates (para [0006]) and the autopilot makes automatic flight control adjustments of yaw, pitch, roll, and airspeed (para [0015])).

Final Act. 11.

Appellant correctly points out that Hamburg's "paragraphs 5, 6 and 15 appear to be devoid of any mention of a yaw heading." Appeal Br. 12. The Examiner responds to Appellant's assertion by stating that "the limitations are not solely disclosed in the teachings of Hamburg." Ans. 10. The Examiner maintains that "the limitations are understood to be taught by Hamburg as modified by Younkin and Beard, as is clear from the section heading." *Id.* However, the rejection does not set forth any reasoning to explain how or why one of ordinary skill would have been led—based on the teachings of Hamburg, Younkin, and Beard—to periodically update the yaw heading based on the GPS heading, as claimed. In other words, the Examiner errs by failing to articulate a sufficient rational evidentiary underpinning to support the conclusion that the claimed feature would have been obviousness to one to ordinary skill in the art. *See In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness") (cited with approval in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007)).

Accordingly, based on the record before us, the Examiner has not met the burden of establishing a proper case that claim 12 is unpatentable based on the cited references. On this basis, we do not sustain the rejection of claim 12 under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, and Beard.

The rejection of claim 18 relies on the same findings and reasoning as those discussed above with respect to claim 12. *See* Final Act. 12; *see also* Appeal Br. 14 (relying on the arguments presented for claim 12). Accordingly, for the same reasons discussed above, we do not sustain the rejection of claim 18 under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, and Beard.

Claims 13 and 19

In rejecting claim 13, the Examiner finds that Hamburg teaches "a magnetometer arrangement that produces a magnetic heading signal (i.e. magnetic course) and the processing arrangement periodically updates the yaw heading based on the magnetic signal heading (directed to pass through the magnetic course (para [0004]) is understood to include changes in yaw heading)." Final Act. 11. The Examiner explains that "the 'magnetic heading signal', not the magnetic compass, is taught by the magnetic course referenced in para [0004] of Hamburg." Ans. 11.

Appellant argues that "Hamburg merely records the compass heading for each GPS recorded point and does not disclose or suggest utilizing the magnetic heading signal to update any yaw heading in the manner required by claim 13." Appeal Br. 13 (underlining omitted). We agree with Appellant that a sustainable case of obviousness has not been established.

Here, the rejection suffers from the same deficiency as the rejection of claim 12, discussed above. Namely, the rejection does not set forth any

reasoning to explain why one of ordinary skill would have been led—based on the teachings of the cited references—to periodically update the yaw heading based on the magnetic signal heading. In other words, the Examiner errs by not articulating a sufficient rational evidentiary underpinning to support the conclusion of obviousness. *See Kahn*, 441 F.3d at 988 (cited with approval in *KSR*, 550 U.S. at 418).

Accordingly, based on the record before us, the Examiner has not met the burden of establishing a proper case that claim 13 is unpatentable based on the cited references. On this basis, we do not sustain the rejection of claim 13 under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, and Beard.

The rejection of claim 19 relies on the same findings and reasoning as those discussed above with respect to claim 13. *See* Final Act. 12. Accordingly, for the same reasons discussed above, we do not sustain the rejection of claim 19 under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, and Beard.

Rejections V and VII—Obviousness Based on Hamburg, Younkin, and either Beard and Calise or Cerchie

Appellant does not present any separate argument for patentability of claims 15 and 20, apart from their dependence from claim 14 and from claim 7, respectively. *See* Appeal Br. 8–20. For the reasons discussed above, Appellant's arguments do not apprise us of error in the rejections of claims 7 and 14, and, likewise, do not apprise us of error in the rejections of claims 15 and 20. Accordingly, we sustain the rejections under 35 U.S.C. § 103(a) of claim 15 as unpatentable over Hamburg, Younkin, Beard, and Calise, and claim 20 as unpatentable over Hamburg, Younkin, and Cerchie.

Rejection VI—Obviousness Based on Hamburg, Younkin, Beard, Calise, and McCall

In rejecting claim 16, the Examiner finds that "neither Hamburg, Younkin, Beard, nor Calise disclose[s] said inner loop determines the helicopter attitude based on a direction cosine matrix." Final Act. 13. However, the Examiner finds that "McCall discloses the helicopter attitude is based on a direction cosine matrix (attitude and heading processor (80) includes direction cosine matrix (806) in figure 15)." *Id.* The Examiner determines that it would have been obvious to modify

> Hamburg in view of Calise to have the inner loop determine the helicopter attitude based on a direction cosine matrix, since Calise discloses the use of control loops to regulate aircraft dynamics, and providing a direction cosine matrix in the control loop aids in the computation of the attitude and heading angle in aircraft flight (col. 8 ln. 38–65), allowing the processor to make highly accurate attitude and heading measurements as stated in col. 1, ln. 15–23.

Id.

Appellant contests the Examiner's reasoning articulated in support of the conclusion of obviousness. *See* Appeal Br. 14–15. In particular, Appellant asserts that the Examiner

> fail[s] to cite to any evidence gleaned solely from the references to suggest why one of ordinary skill in the art would reasonably be led to utilize a direction cosine matrix in an inner loop. Moreover, it is respectfully submitted that there is nothing in the references [that] would teach one to overcome the sweeping technical challenges that would be introduced.

Id. at 14 (underlining omitted). According to Appellant, "the necessary modifications are well beyond the capabilities of one having ordinary skill in the art." *Id.* at 15. This line of argument is unpersuasive.

Appellant appears to insist on an explicit teaching, suggestion, or motivation in the cited art to establish obviousness, but such a requirement has been foreclosed by the Supreme Court. *KSR*, 550 U.S. at 419 (stating that a rigid insistence on teaching, suggestion, or motivation is incompatible with its precedent concerning obviousness). The Court noted that an obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for [an examiner] can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *Id.* at 418. Instead, the relevant inquiry is whether the Examiner has set forth "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *Kahn*, 441 F.3d at 988 (cited with approval in *KSR*, 550 U.S. at 418).

Here, as discussed above, the Examiner articulates adequate reasoning based on rational underpinnings as to why it would have been obvious to modify the combination of Hamburg, Younkin, Beard, and Calise so that the inner loop taught by Calise determines helicopter attitude based on the direction cosine matrix taught by McCall. *See* Final Act. 13 (explaining that providing a direction cosine matrix in the control loop taught by Calise would allow the processor to make highly accurate attitude and heading measurements (citing McCall, col. 1, ll. 15–23)). In this regard, Appellant does not persuasively refute the Examiner's articulated reasoning or explain why it would lack rational underpinnings. In particular, Appellant does not set forth any factual evidence or persuasive technical reasoning as to what technical challenges would need to be overcome to use a direction cosine matrix in an inner loop (Appeal Br. 14), as proposed by the Examiner, or why such a modification would have been somehow beyond the capability of one of ordinary skill in the art (*id.* at 15).

For the above reasons, Appellant does not apprise us of error in the Examiner's determination that the subject matter of claim 16 would have been obvious. Accordingly, we sustain the rejection of claim 16 under 35 U.S.C. § 103(a) as unpatentable over Hamburg, Younkin, Beard, Calise, and McCall.

Rejections VIII–X—Obviousness Based on Adams and Duerksen, alone or further in combination with Hamburg or Hamburg and Shue

The rejections of claims 22–26, which depend directly or indirectly from independent claim 21, are deficient for the same reasons discussed above in connection with Rejection I. The Examiner relies on Duerksen, Hamburg, and Shue for teaching additional features, but does not articulate any findings or reasoning that would cure the aforementioned deficiency in Adams. *See* Final Act. 15–19. Accordingly, we do not sustain the rejections under 35 U.S.C. § 103(a) of: claim 22 as unpatentable over Adams and Duerksen; claims 23 and 25 as unpatentable over Adams, Duerksen, and Hamburg; and claims 24 and 26 as unpatentable over Adams, Duerksen, Hamburg, and Shue.

Rejection XI—Obviousness Based on Bachelder and Skutecki

The rejection of claim 29, which depends from independent claim 27, is deficient for the same reasons discussed above in connection with Rejection II. The Examiner relies on Skutecki for teaching additional features, but does not articulate any findings or reasoning that would cure the aforementioned deficiency in Bachelder. *See* Final Act. 19–20. Accordingly, we do not sustain the rejection of claim 29 under 35 U.S.C. § 103(a) as unpatentable over Bachelder and Skutecki.

CONCLUSION

In summary:

Claim(s) Rejected	35 U.S.C. §	Reference(s)	Affirmed	Reversed
21	102(b)	Adams		21
27, 28, 30, 31	102(b)	Bachelder	31	27, 28, 30
7–9	103(a)	Hamburg, Younkin	7–9	
10–14, 17–19	103(a)	Hamburg, Younkin, Beard	10, 11, 14, 17	12, 13, 18, 19
15	103(a)	Hamburg, Younkin, Beard, Calise	15	
16	103(a)	Hamburg, Younkin, Beard, Calise, McCall	16	
20	103(a)	Hamburg, Younkin, Cerchie	20	
22	103(a)	Adams, Duerksen		22
23, 25	103(a)	Adams, Duerksen, Hamburg		23, 25
24, 26	103(a)	Adams, Duerksen, Hamburg, Shue		24, 26
29	103(a)	Bachelder, Skutecki		29
Overall Outcome			7–11, 14–17, 20, 31	12, 13, 18, 19, 21–30

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

AFFIRMED IN PART