

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SZ DJI TECHNOLOGY CO., LTD.,

Petitioner,

v.

AUTEL ROBOTICS USA LLC,

Patent Owner.

IPR2019-00846

U.S. Patent No. 9,260,184

**DECLARATION OF DR. ALFRED DUCHARME
IN SUPPORT OF PETITIONER'S OPPOSITION TO
PATENT OWNER'S MOTION TO AMEND**

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I. Introduction

I, Alfred Ducharme, declare as follows:

1. I submit this declaration in support of SZ DJI Technology Co., Ltd.'s ("Petitioner's") Opposition to Autel's ("Patent Owner's") Motion to Amend U.S. Patent No. 9,260,184 ("the '184 patent").

2. I understand that the Patent Trial and Appeal Board instituted a trial against claims 3 and 4 of the '184 patent based on the combination of Sasaki and Sokn. I further understand that Patent Owner has filed a Motion to Amend that is not contingent on the patentability of claims 3 and 4. Consequently, I understand that the patentability of claims 3 and 4 is no longer in dispute. Patent Owner's Motion to Amend proposes substitute claims 12 and 13 to replace claims 3 and 4, respectively.

3. This declaration supplements my March 19, 2019, declaration submitted as DJI-1003 in the above-referenced proceeding and is in response to Patent Owner's Motion to Amend ("Motion") dated January 10, 2020, and the Declaration of Charles F. Reinholtz, submitted as Exhibit 2001 and dated January 10, 2020. I understand that my curriculum vitae has been submitted into the record of this proceeding as DJI-1004.

4. In preparing this declaration, in addition to my knowledge and experience, I have reviewed and am familiar with the following references:

- The '184 patent (DJI-1001)
- File History of the '184 patent (DJI-1002)
- Declaration of Alfred Ducharme in support of Petition for Inter Partes Review of claims 3 and 4 of the '184 patent (DJI-1003)
- English translation of Japanese Unexamined Utility Model Application Publication H06-17511 to Sasaki ("Sasaki") (DJI-1006)
- U.S. Patent 5,133,617 to Sokn ("Sokn") (DJI-1007)
- U.S. Patent 2,470,517 to Obrist ("Obrist") (DJI-1017)
- European Patent Application EP 0921067 ("EP067") (DJI-1018)
- U.S. Patent 6,929,226 to Philistine ("Philistine") (DJI-1026)
- Board's Decision to Institute Trial (Paper 6)
- Patent Owner's Non-contingent Motion to Amend (Paper 10)
- Declaration of Dr. Reinholtz (Exhibit 2001)
- Deposition Transcript of Dr. Reinholtz (Exhibit 1027)

I have also considered all other materials cited herein.

II. Qualifications

5. My qualifications and professional experience are described in my *Curriculum Vitae*, which I understand has been provided as DJI-1004. My first declaration, which I understand has been provided as DJI-1003, provides a brief summary of my relevant qualifications and professional experience.

III. Relevant legal standards

6. I have been asked to provide my opinions regarding the patentability of substitute claims 12 and 13 of the '184 patent based on the references discussed herein.

7. I am not an attorney. In preparing and expressing my opinions and considering the subject matter of the '184 patent, I am relying on certain legal principles that counsel has explained to me.

A. Anticipation

8. I have been instructed as to the definition of “anticipation” in the context of the patent laws. I understand that for a claim to be invalid as anticipated, all of the requirements of that claim must be present in a single previous device or method that was known of, used, or described in a single previous printed publication or patent. To anticipate the invention, the prior art does not have to use the same words as the claim, but all of the requirements of the claim must have been disclosed, either stated expressly or implied to a person having ordinary skill in the art in the technology of the invention, so that looking at that one reference, that person could make and use the claimed invention.

B. Obviousness

9. I have been instructed as to the definition of “obviousness” in the context of the patent laws.

10. It is my understanding that even though an invention may not have been identically disclosed or described before it was made by an inventor, in order to be patentable, the invention must also not have been obvious to a person having ordinary skill in the art (“POSITA”) before the effective filing date of the patent (which in these proceedings I am assuming to be May 15, 2013).

11. I understand that obviousness is a question of law based on underlying factual issues including the level of ordinary skill in the art at the time of the patent’s effective filing date, the scope and content of the prior art, and any differences between the prior art and the claimed invention.

12. I understand that the scope and content of prior art for deciding whether the invention was obvious includes at least prior art in the same field as the claimed invention. It also includes prior art from different fields that a POSITA would have considered when trying to solve the problem that is addressed by the invention.

13. I understand that the existence of each and every element of the claimed invention in the prior art does not necessarily prove obviousness. Most, if not all, inventions rely on building blocks of prior art. But, in considering whether a claimed invention is obvious, I understand that one may find obviousness if, at the time of the patent’s effective filing date, there was a reason that would have prompted a POSITA to combine the known elements in a way the claimed

invention does, taking into account such factors as (1) whether the claimed invention was merely the predictable result of using prior art elements according to their known function(s); (2) whether the claimed invention provides an obvious solution to a known problem in the relevant field; (3) whether the prior art teaches or suggests the desirability of combining elements claimed in the invention; (4) whether the prior art teaches away from combining elements in the claimed invention; (5) whether it would have been obvious to try the combinations of elements, such as when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions; and (6) whether the change resulted more from design incentives or other market forces.

14. To find that the prior art renders the invention obvious, I understand that one must find that the prior art provided a reasonable expectation of success. I also understand that it is impermissible to find obviousness based on hindsight reasoning, and obviousness must be found only by considering what was known at the time of the patent's effective filing date.

C. Claim construction

15. I understand that the Patent Office applies the claim construction standard used in district courts which seeks to give claim terms their plain and ordinary meaning to a POSITA at the time of the claimed invention. I also understand that if the patent applicant gave a term a special meaning in the

specification or during prosecution, then that special meaning should be used. My analysis uses the plain and ordinary meaning of the claim terms. The plain and ordinary meaning is consistent with the specification of the '184 patent. I further understand that intrinsic evidence includes the prosecution history of a patent, prior art cited patents, and related patents for guidance in claim construction.

16. It is also my understanding that the Board may also look to extrinsic evidence for a variety of purposes, including for providing background on the technology at issue, explaining how an invention works, ensuring that the court's understanding of the technical aspects of the patent is consistent with that of a person of skill in the art, or establishing that a particular term in the patent or the prior art has a particular meaning in the pertinent/technical field. I understand that some examples of extrinsic evidence are things such as inventor testimony, dictionaries, treatises, and expert testimony.

17. I have followed these principles in my analysis throughout this declaration.

D. Indefiniteness

18. I have been informed that a patent claim is invalid if it fails to inform a person of ordinary skill in the art with reasonable certainty about the scope of the invention—that is, if the claim is indefinite. I understand that the Patent Office applies a different standard for indefiniteness than federal courts. I have been

informed that a patent claim is indefinite under the Patent Office's standard when the language in the claim is ambiguous, vague, incoherent, opaque, or otherwise unclear in describing and defining the claimed invention. I have been informed that this standard is known as the *Packard* standard.

19. I have been informed that a patent claim is indefinite under the standard used in federal district courts when it fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. I have been informed that this standard is known as the *Nautilus* standard.

IV. The '184 Patent & Technological Background

20. In my first declaration in this case (DJI-1003), I discussed the '184 patent and relevant technological background. For efficiency I will not repeat that background but will cite to it when relevant.

V. Level of ordinary skill in the art

21. For this declaration I have applied the same standard for a POSITA that I applied in my first declaration. Specifically, a person of ordinary skill in the field of the '184 patent would have had at least an undergraduate degree in mechanical engineering, or equivalent education, training, or experience, with at least two years of experience with UAVs. (DJI-1003, ¶72.) Unless noted otherwise, when I state that something would be known or understood by one skilled in the art,

or a skilled artisan, or a POSITA, I am referring to a person with this level of education and experience in or around May 2013.

22. I have reviewed the definition of a POSITA used by the International Trade Commission (ITC). (Ex. 2004, p. 6.) Specifically, the ITC found that a POSITA “would have at least (1) a Bachelor’s degree in mechanical engineering, or equivalent education, training, or experience, and (2) at least two years of experience with rotary apparatuses, including rotary aircraft apparatus and UAVs, or equivalent experience.” (*Id.*) My opinions would be unchanged under the ITC’s definition of a POSITA.

23. I have reviewed Dr. Reinholtz’s definition of a POSITA. (Ex. 2001, ¶28.) Specifically, Dr. Reinholtz states that a POSITA “would have had a bachelor’s degree in mechanical engineering and at least two years of experience designing mechanisms and mechanical structures of the type used in releasable couplings and locking devices.” (*Id.*) My opinions would be unchanged under Dr. Reinholtz’s definition of a POSITA.

VI. Claim construction

A. Engagement limitation (Claim 1)

24. Claim 1 recites “wherein the clockwise rotor blade is engageable only with the clockwise lock mechanism and cannot be engaged in the counterclockwise lock mechanism, and the counterclockwise rotor blade is engageable only with the

counterclockwise lock mechanism and cannot be engaged in the clockwise lock mechanism.”

25. Dr. Reinholtz refers to this portion of claim 1 as “the engagement limitation” and states that it “means that a clockwise rotor blade cannot be attached to a counterclockwise driveshaft and vice versa.” (Ex. 2001, ¶¶42-43.) I disagree.

26. I first note that Dr. Reinholtz uses the word “attached” in this definition, and that he stated in deposition in a related case that something can be attached without being locked. (DJI-1024, 101:4-15 (“I think a blade could be considered to be attached and not fully locked on, yes.”).)

27. The claims use both “attach” and “engage” and therefore intentionally distinguish “attachment” from “engagement.” The meaning of the engagement limitation is clear on its face: blades cannot be “engaged” in the wrong lock mechanism.

28. There are many ways to attach one thing to another. For example, two things could be glued together, taped together, or held together by a rubber band. Nothing in the claims or specification prevents this type of attachment, and therefore Dr. Reinholtz’s interpretation that the claim prevents attachment is incorrect.

29. Instead, the claims prevent **engagement** of mismatched blade and shaft. Claim 1 recites that the “*clockwise rotor blade is releasably **attached** to the*

*first driveshaft by **engagement** in a clockwise lock mechanism.”* By making each blade **engageable** only with the correct lock mechanism, the claims do not prevent **attachment** by some other means—e.g., duct tape or other forceable attachment that does not require **engagement**.

30. Furthermore, Figure 8 of the '184 patent shows a blade that is attached to the wrong motor.

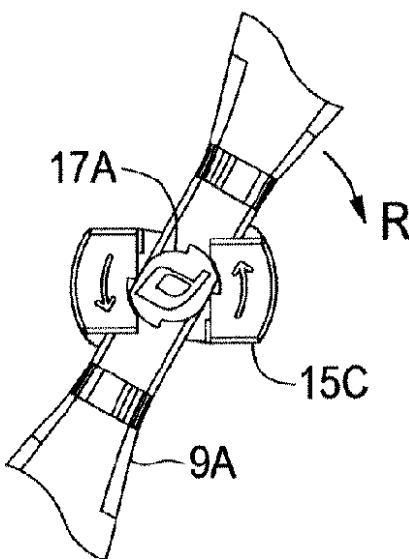


FIG. 8

The blade is partially inserted into the slots and the lugs are in contact with the notches but are not fully received. (See DJI-1024, 119:25-122:5; 122:19-24; 123:7-10.) If the motor were turned on and began rotating counterclockwise it is possible the blade would remain attached to the motor and begin to rotate with the motor. (DJI-1024, 124:4-16.) In other words, the blade is “blocked from engagement” but could still be considered to be “attached” to the rotor. (DJI-1001, 2:55-57.) Thus,

not being “engaged” is not the same as not being “attached” in the context of claim 1 of the ’184 patent.

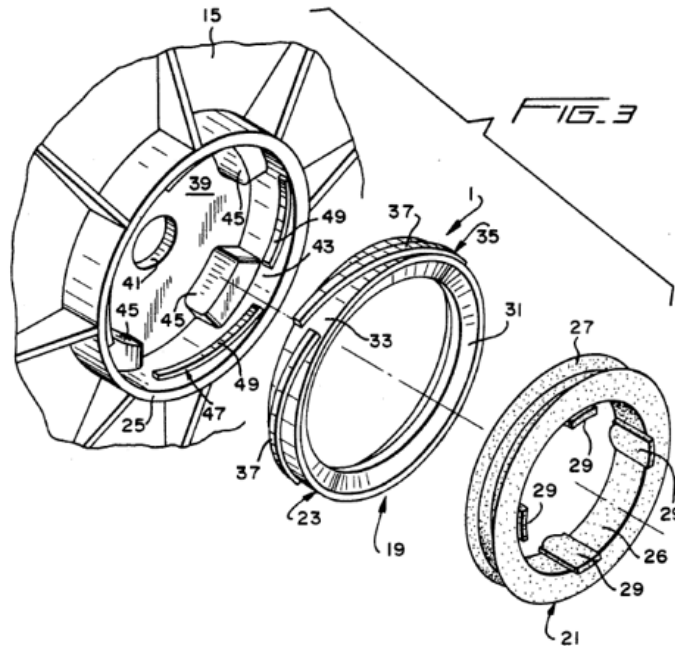
31. Therefore, the engagement limitation does not need to be construed beyond its plain language.

VII. Substitute claims 12 and 13 in view of the combination of Sasaki and Sokn

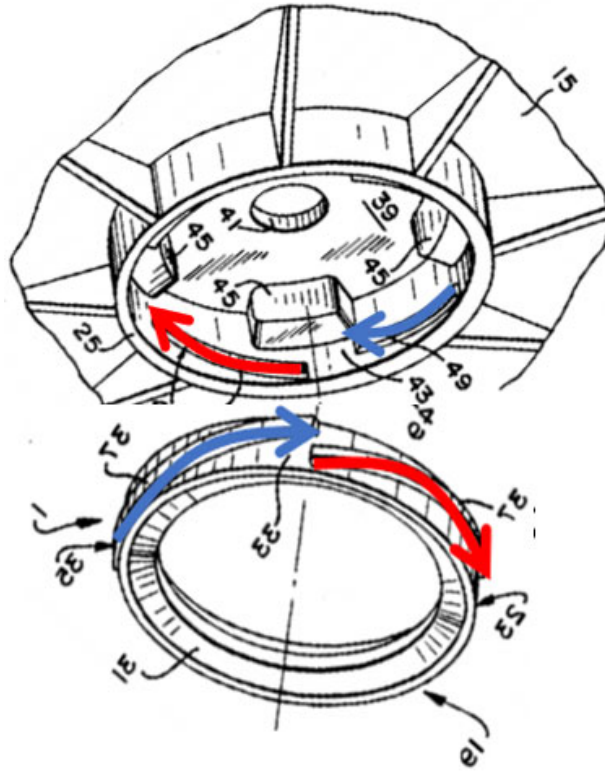
32. I previously discussed how the combination of Sasaki and Sokn discloses the limitations of claim 1, from which substitute claims 12 and 13 depend. (DJI-1003, ¶¶115-131.) I also discussed how the combination of Sasaki and Sokn discloses the limitations of claims 3 and 4. (DJI-1003, ¶¶132-133.) I note that in the discussions in my first declaration, I described that the combined system discloses “partial rotation” of the coupling mechanism. I do not repeat these discussions here. Below, I address the new limitations added to claims 12 and 13 and explain that the same combination also discloses the limitations of claims 12 and 13.

A. Directional threading of Sokn

33. Figure 3 of Sokn, reproduced below, illustrates an embodiment using segmented threading to attach a motor to a fan assembly. I cited to this embodiment in my first declaration. (*See, e.g.*, DJI-1003, ¶¶102-105.)



34. This figure contains an error that would have been apparent to a POSITA: the threads on the ring assembly 19 do not match with the threads on the socket 25. Specifically, the threads on the ring assembly appear to require counterclockwise rotation for assembly, whereas the threads on the socket 25 appear to require clockwise rotation for assembly. I noticed this error while preparing this declaration; Dr. Reinholtz independently noticed it during his deposition when asked about which direction the ring would be rotated for assembly. (DJI-1027, 166:22-167:16.) A POSITA would immediately understand how to correct the error in Figure 3: reverse the threading of either the ring assembly or the socket. Reversing the threading of the ring assembly would result in a clockwise (right-hand) coupling. The figure below shows this reversal by mirroring the ring assembly.



35. Similarly, reversing the threading of the socket would result in a counterclockwise (left-hand) coupling.

B. Substitute claim 12

36. Substitute claim 12 recites:¹

12. The apparatus of claim 1 wherein the blade lock portion of the clockwise lock mechanism is configured to engage by partial ~~is rotated~~ counterclockwise rotation

¹ Relative to original claim 3, added language is shown as underlined, and removed language is shown as crossed out.

with respect to the shaft lock portion thereof to releasably attach the clockwise rotor blade to the first driveshaft.

37. In my first declaration I explained that the blade lock portion of the combined coupling mechanism is configured to engage and disengage by 90° rotation because of its multi-thread and stop member design. (DJI-1003, ¶¶105, 110, 132-133.) Sokn's ring assembly design preferably has "four segments 37 . . . equally spaced at 90° from each other around surface 33." (DJI-1007, 3:32-34.) The socket has "four corresponding thread segments 49 . . . [that] are equally and circumferentially spaced 90° around surface 43." (DJI-1007, 3:49-52.) When the socket and ring assembly are aligned, "rotation of ring assembly 19 90° with respect to socket 25 results in a secure and aligned interlock connection therebetween." (DJI-1007, 3:57-60.) Rotation of the ring assembly relative with respect to the socket is equivalent to rotation of the socket with respect to the ring assembly, albeit in the opposite direction. For example, a user can attach a screw to a nut by turning the screw or by turning the nut. Therefore, the blade lock portion (socket) of the combined coupling mechanism is configured to engage by 90° or one quarter of a full rotation to releasably attach the blade. (DJI-1007, 3:57-60; DJI-1003, ¶105.) As shown in annotated Figure 3 above, the 90° rotation results in each of the multiple threads on the blade lock portion engaging their respective slots on the shaft lock portion. This allows for faster installation and deinstallation than a

conventionally-threaded mechanism because a user can make a quarter-turn with a single motion of the user's hand, whereas making multiple turns for a conventionally-threaded mechanism requires multiple repetitive motions by a user's hand. The 90° rotation of coupling mechanism of the combined system constitutes "partial rotation," based on Patent Owner's and Dr. Reinholtz's definition of the term, because it is less than a full 360° rotation. (DJI-1027, 126:18-127:3.) Notably, the lock mechanism disclosed in the specification of the '184 patent also uses an approximately 90° rotation. (DJI-1027, 74:10-13.) The combination of Sasaki and Sokn therefore renders claim 12 obvious.

C. Substitute claim 13

38. Substitute claim 13 recites:²

13. The apparatus of claim 12 wherein the counterclockwise lock mechanism comprises a shaft lock portion attached to the second driveshaft and a blade lock portion attached to the counterclockwise rotor blade, and wherein the blade lock portion of the counterclockwise lock mechanism is configured to engage by partial ~~is rotated~~ clockwise rotation with respect to the shaft lock

² Relative to original claim 4, added language is shown as underlined, and removed language is shown as crossed out.

portion thereof to releasably attach the counterclockwise rotor blade to the second driveshaft.

39. I previously discussed how the combination of Sasaki and Sokn discloses a blade lock portion and shaft lock portion of the counterclockwise lock mechanism. (DJI-1003, ¶¶109-110, 129-133.)

40. Substitute claim 13 further amends original claim 4 to recite that “blade lock portion of the counterclockwise lock mechanism is configured to engage by partial clockwise rotation.” This limitation is identical to the amendment proposed in claim 12 except that it applies to the counterclockwise lock mechanism and therefore recites partial clockwise rotation (instead of counterclockwise rotation).

41. I previously discussed how the combination of Sasaki and Sokn discloses a counterclockwise lock mechanism where the blade lock portion is rotated clockwise to releasably attach the counterclockwise blade to the second driveshaft. (DJI-1003, ¶¶132-133.) Sasaki teaches a directional threading where blades designed to rotate in different directions are installed with opposite directions of rotation. (DJI-1003, ¶¶96-97.) Using opposite-threaded blades achieves the well-known design goal of “mistake-proofing” the lock mechanism so that the wrong blade is not installed on the wrong propeller. (DJI-1014, p. 3; DJI-1003, ¶¶45, 54-57, 64, 96, 100, 106, 111.) As shown in the previous section, this

combination results in a blade lock portion that is configured to engage by partial rotation. The partial rotation would be in the clockwise direction as taught by Sasaki. (DJI-1006, 2:5-8.) The combination of Sasaki and Sokn therefore renders claim 13 obvious.

D. Motivation to combine

42. I previously discussed why a POSITA would have combined Sasaki and Sokn, resulting in a system that renders claims 3 and 4 obvious. (DJI-1003, ¶¶106-114.) For example, I explained that the combination maintains the “mistake-proof” design of the prior art (i.e., by having directionally-threaded screw fasteners) without suffering from the overtightening problem of the continuously threaded coupling mechanism disclosed in Sasaki. (DJI-1003, ¶111.) I also explained that Sokn’s connection mechanism provides increased design flexibility by allowing for use with a wider range of aircraft (including larger UAVs) than Sasaki’s continuously threaded connection, improves usability because “a user can assembl[e] and disassemble the propellers with only ½ turn as compared with 3-4 turns,” and has “improved mechanical alignment.” (DJI-1003, ¶113.)

43. Dr. Reinholtz argues that there is no explicit motivation in Sasaki for a lock mechanism that depends on rotational direction or engages with partial rotation. (Ex. 2001, ¶62.) However, this motivation was well-known in the art as I

previously discussed and would have been recognized by a POSITA. (DJI-1003, ¶¶45, 49-66, 100, 111.)

44. Dr. Reinholtz also argues that Sasaki teaches away from directionally-specific lock mechanisms because it addressed issues with the prior art (including the overtightening problem) with a design not dependent on the direction of rotation. (Ex. 2001, ¶59.) But Sasaki never categorically disparages all directionally-specific lock mechanisms. Instead, Sasaki's design addresses several perceived issues specifically related to the conventional directionally-threaded design. A POSITA would not have understood Sasaki's nondirectional solution to teach away from all directional solutions. In fact, a POSITA would have understood the benefits of directional solutions for mistake-proofing. (DJI-1027, 37:1-14 (Dr. Reinholtz acknowledging that a POSITA would have known about the possibility and problems of mis-installing a blade on the wrong driveshaft); DJI-1003, ¶¶54-66.) Sasaki therefore does not teach away from the combination.

45. Dr. Reinholtz also argues that a POSITA would not look to Sokn when designing an attachment mechanism for UAV blades because Sasaki and Sokn "are from two substantially different fields" and "[a] POSA would not look to clothes dryer art when designing a flying vehicle." (Ex. 2001, ¶63.) However, as I previously discussed, Sokn's coupling mechanism is reasonably pertinent to the problem faced by the inventors because it provides a secure coupling mechanism

with precise mechanical alignment. (DJI-1003, ¶114.) Notably, Dr. Reinholtz’s definition of a POSITA requires experience with “mechanisms and mechanical structures of the type used in releasable couplings and locking devices”—which clearly encompasses the locking device of Sokn—and does not require the field of a POSITA’s knowledge to be limited to UAVs. (Ex. 2001, ¶28.) A POSITA would have sought out couplings and locking devices from a variety of fields and would not have limited its search to UAV prior art.

46. Dr. Reinholtz also argues that a POSITA would not look to Sokn when designing a “twist-lock mechanism” because Sokn does not discuss disassembly and its electric motor does not require easy disassembly. (Ex. 2001, ¶63.) I previously noted that Sokn’s coupling mechanism detaches with a 90° turn. (DJI-1003, ¶105.) Dr. Reinholtz does not rebut my previous opinion on this issue and does not appear to argue that Sokn’s coupling mechanism is not easy to detach. Rather, he speculates that a user would likely not need to detach the blade fan mount. (Ex. 2001, ¶63.) But the mechanism is a simple twist-lock mechanism which is easily detached with rotation in the direction opposite that of installation, in a similar manner as the only embodiment in the ’184 patent. Notably, Dr. Reinholtz acknowledged that disassembling a directionally-threaded mechanism simply requires rotation in the opposite direction of installation. (DJI-1027, 153:21-154:6.)

47. Dr. Reinholtz also argues that a POSITA would not look to Sokn because Sokn does not discuss having different directional configurations. (Ex. 2001, ¶63.) But my opinion relied primarily on Sasaki's explicit teaching of directionally specific lock mechanisms, and I previously discussed how this teaching motivates the combination. (DJI-1003, ¶¶106, 109 ("Based on this explicit teaching of Sokn and *the teachings of Sasaki regarding directionality* of threading in the clockwise and counterclockwise coupling mechanisms, a POSITA would have been motivated to orient the thread segments and corresponding notches for the clockwise coupling mechanism of the clockwise propeller in a left helical direction (similar to a left screw) as taught by Sasaki.") (citing Sasaki, 2:5-8) (emphasis added).) I also provided detail on the background knowledge of a POSITA which Dr. Reinholtz does not challenge. (DJI-1003, ¶¶45, 49-66.) I also previously explained that Sokn's engagement portions and stop members can be configured to provide a predetermined orientation for engagement and interlock. (DJI-1003, ¶109.) This teaching would have motivated a POSITA to orient the threads in the combined system for directional engagement. (DJI-1003, ¶¶109-110.)

48. Dr. Reinholtz also argues that Sokn's lock mechanism would not solve the overtightening problem described in Sasaki because it is similar to the nut component of the prior art and similar to a jar lid. (Ex. 2001, ¶¶68-69.) However, unlike Sasaki's nut or a jar lid, Sokn has four separate stop members and four

separate thread segments. The use of the term “stop members” informs a POSITA that they stop rotation. (DJI-1007, 3:40-42; DJI-1003, ¶109.)

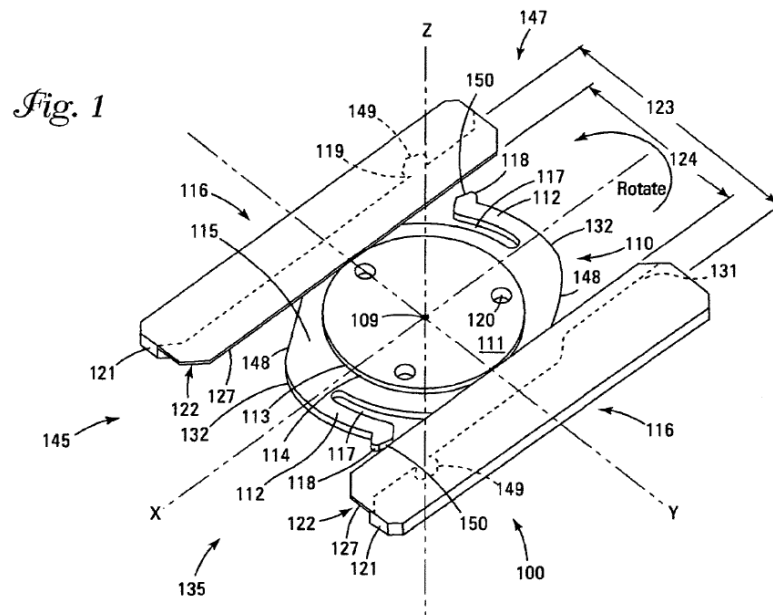
E. Engagement limitation

49. Dr. Reinholtz states that Sasaki “does not prevent a rotor blade from being attached to the wrong driveshaft” and therefore does not disclose the engagement limitation of claim 1. (Ex. 2001, ¶52.) Specifically, Dr. Reinholtz provides a video of himself forcing a blade from a UAV apparently utilizing a conventional screw-on attachment mechanism onto the wrong driveshaft. (Ex. 2001, ¶54 (citing Ex. 2006).) This argument is irrelevant because it does not address my previous opinion about the combination of Sasaki and Sokn, which does not rely on Sasaki’s attachment mechanism. (DJI-1003, ¶¶127-128.) Further, Dr. Reinholtz stated that the mismatched threads of Sokn’s Figure 3 “probably wouldn’t work,” which appears to imply that a thread under Sokn’s design could not be forced into a mismatched socket. (DJI-1027, 167:1-16.) Nevertheless, Dr. Reinholtz relies on an improper construction for the engagement limitation, as I discussed above in Section VI. When a blade is forced onto the driveshaft and the threads are “stripped,” the blade is not, and cannot be, “engaged” with the lock mechanism. Rather, the metal threads on the shaft lock portion are likely carving out new notches in the blade lock portion. Further, this ability to force a propeller on the wrong driveshaft is not an intrinsic feature of all threaded couplings, but relates to

the specific materials and thread pitch used in the UAV in Dr. Reinholtz's video.
(See DJI-1027, 161:12-163:11.)

VIII. Lock mechanisms using partial rotation are prevalent in the prior art.

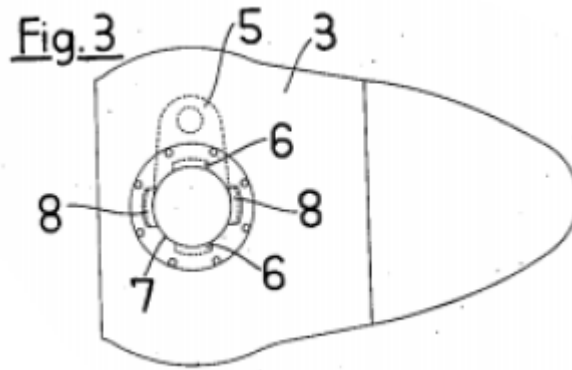
50. Mechanisms that use partial rotation to install one component onto another component have been known for more than a century. (DJI-1003, ¶¶50-53; DJI-1027, 96:6-15.) Sokn is just one example. Another example is U.S. Patent 6,929,226 to Philistine (DJI-1026), which discloses a “twist lock mount for quick mounting and positioning a device to a support.” (DJI-1026, Abstract.) Figure 1 of Philistine is reproduced below.



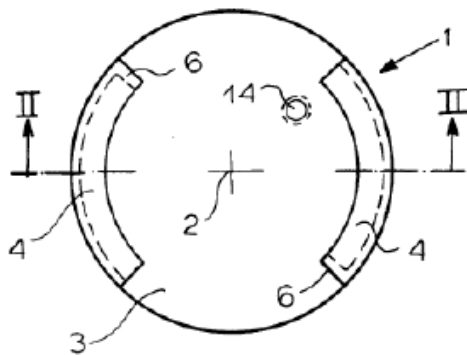
51. Philistine's lock mount is not application-specific, but rather allows “secure attachment and detachment of a variety of devices to various surfaces.” (DJI-1026, 1:10-14.) Philistine's lock mount includes a “mounting member 110 that is secured to or integrated with a device to be mounted, and a receiving member

116 that is secured to or integrated with a mounting surface or support.” (DJI-1026, 2:33-44.) The mounting member 110 slides into the channel 123 and securely locks in place with a 90° (“one-quarter turn” (DJI-1026, 4:24-27)) rotation of the mounting plate relative to the receiving member, engaging “lugs 150” on the mounting plate with notches (“recesses 119”) on the receiving member. (DJI-1026, Figure 2, 2:33-44; 3:10-22; *see also* Figure 1.) The mechanism is not susceptible to overtightening because “the mounting member 110 is locked into position and will resist further rotation in the counterclockwise direction.” (DJI-1026, 4:27-29.)

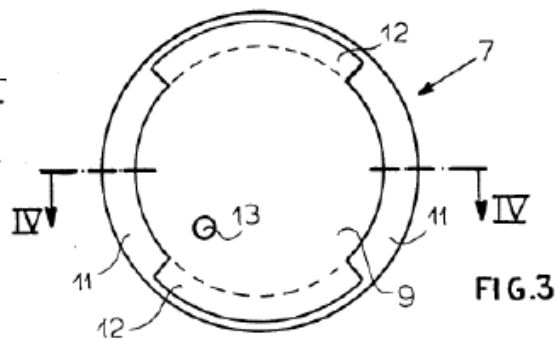
52. Similarly, U.S. Patent No. 2,470,517 to Obrist (“Obrist,” DJI-1017), filed in 1945, and EP 0921067 to Muller (“EP067,” DJI-1018) each describes a directional “twist-lock” mechanism for a propeller. (*See* DJI-1003, ¶¶59-63.) Specifically, Obrist describes a directional twist-lock coupling mechanism for a variable-pitch marine propeller. (DJI-1003, ¶59.) As shown in Figure 3, below, the root of the blade includes two projections 6 arranged opposite to one another. (DJI-1017, 2:28-32.) The propeller hub includes two recesses 8 that are slightly larger than the projections 6. (DJI-1017, 2:38-42.) The lugs are introduced through recesses 8, the blade root is turned about 90° so that “the lugs 6 are displaced from the recesses 8 through which they entered, and engage an arcuate seat formed therefor on the internal face of the hub” as shown in Figure 3 of Obrist below. (DJI-1017, 2:44-54.)



53. EP067 describes a directional coupling mechanism for use with propeller assemblies. (DJI-1003, ¶61.) Figure 1 of EP067, reproduced below at left, illustrates the blade support plate 1. The upper side of the blade support plate 1 includes “two diametrically-opposite claws 4 projecting radially inwardly and extending along the circumference of the respective plate.” (DJI-1018, ¶[0018].)



EP067, Figure 1



EP067, Figure 3

54. “Between the claws 4 there remain gaps in the circumferential direction and between each claw 4 and the planar upper side of the plate, there is left a gap 5.” (DJI-1018, ¶[0018].) “[E]ach of the claws 4 is provided at one end with an abutment or stop 6.” (DJI-1018, ¶[0018].)

55. Figure 3 of EP067, reproduced above at right, is a plan view of the underside of the base of a blade. (DJI-1018, ¶[0015].) In this figure, “each of the blades 8 has a blade foot or base 7 having a planar underside 9 and a circumferential groove extending over the entire periphery.” (DJI-1018, ¶[0019].) “The circumferential groove 10 has two radially-opposite cutouts 11 between which the radial projections 12 are disposed.” (DJI-1018, ¶[0019].)

56. Both Obrist and EP067 explain that the force in rotation of the propeller maintains the lugs in position. EP067 states that “the reaction force in rotation of the propeller, maintains the respective projection against the stop.” (DJI-1018, ¶[0011].) Although the forces are different with the UAV connection, a POSITA would understand how to apply the teachings of Obrist and EP067 to the rotational forces experienced by the blades in a UAV, such as Sasaki.

57. A POSITA would have been motivated to use Philistine or Obrist or EP067 to mount a UAV blade onto a driveshaft for several reasons. First, the mechanisms of Philistine, Obrist, and EP067 each solves the overtightening problem of Sasaki’s prior art threads while maintaining the well-known “mistake-proof” design. Second, the mechanism allows for easy installation and de-installation while being secure enough for “harsh environments where extreme vibration and shock loading is expected” as explained by Philistine. (DJI-1026, 1:25-28.) Philistine is reasonably pertinent to the problem faced by the inventors of

attaching a blade to a UAV driveshaft because it discloses a general-purpose twist-lock mechanism, whereas both Obrist and EP067 relate to coupling a blade to a rotating member as discussed above.

58. I previously showed that Sasaki discloses the preamble and the UAV structure components recited in limitations [1A]-[1D]. (DJI-1003, ¶¶116-123.)

59. The combined system of Sasaki and Philistine also teaches the lock mechanism limitations of claim 1 in a similar manner as the combination of Sasaki and Sokn. In the combination, Philistine's mounting plate is attached or integrated onto the blade, forming the "*blade lock portion*," and Philistine's receiving member is attached or integrated onto the shaft, forming the "*shaft lock portion*." As shown in Figure 1, Philistine's mounting plate is attached by rotating it counterclockwise relative to the receiving member. It can be detached by rotating it in the opposite direction. (DJI-1026, 2:44-49.) This embodiment would serve as the "*clockwise lock mechanism*" of claim 1. Based on the teachings of Sasaki and the well-known prior art design goal of directional or keyed attachment mechanisms for UAV blades, a POSITA would have been motivated to mirror the design (e.g., the lugs and notches) of Philistine's Figure 1 embodiment to form a "*counterclockwise lock mechanism*" for blades that spin in counterclockwise. Philistine's lock mechanism is uninstalled with a rotational force in the opposite direction of the force used for installation, so a mirrored design would be necessary to keep the mechanism

engaged when applying it to UAV blades rotating in different directions. Such a design would be a mirror image of Figures 1 and 2, with the lugs and notches being on opposite sides of their respective components. Because of its mirrored design, it would lock with clockwise rotation. When applied to blade attachments of a UAV such as Sasaki's, Obrist and EP067 would also form a "*clockwise*" and "*counterclockwise lock mechanism*" for similar reasons, each locking with rotation in the opposite direction.

60. The combined system results in the blade being "releasably attached" to the driveshaft because Philistine's teaching that its mechanism is detachable. (DJI-1026, Abstract ("A rotation in the opposite direction will unlock the device so that the mount can be slid out of the channel quickly and easily.")) It is releasably attached by engagement of the blade (i.e., the blade lock portion) with the lock mechanism, as recited in claim 1. Moreover, the blade lock portions are keyed such that they can engage only with their corresponding lock mechanism—i.e., the lugs of a counterclockwise blade will not engage with the notches of the clockwise lock mechanism. And, as clearly shown in Figures 1 and 2, the blade lock portion includes lugs that engage with notches on the corresponding shaft lock portion. Moreover, the blade lock portion is configured to engage by partial rotation—"one-quarter turn"—for clockwise and counterclockwise mechanisms. (DJI-1026, 4:24-27.)

61. The mechanisms of Obrist and EP067 would also releasably attach the blades to the driveshaft by engagement, with lugs engaging notches, formed by partial rotation of the blade lock portion. As I described above, Obrist's design includes lugs that are introduced through recesses 8, and the blade root is turned about 90° for engagement and installation. (DJI-1017, 2:44-54.) For example, Obrist states that "[i]n this position the projections 6 act as a lock with regard to the centrifugal forces exerted on the correlated blade 1 in that they rest directly against the inner surface of the hub 3." (DJI-1017, 2:55-3:4.) Thus, in Obrist the lug/notch connection is configured to twist so that the connection remains locked when system is exposed to centrifugal forces. (DJI-1003, ¶60.)

62. Similarly, a POSITA would have been motivated to modify Sasaki based on EP067 to include two radially-opposite cutouts between which radial projections are disposed and to locate stops 6 at different positions based on the rotation of the propeller. The portion of the blade foot integrated into the propeller in the combined UAV of Sasaki and EP067 that has cutouts 11 and projections is the "*blade lock portion.*" Projections 12 are "*lugs on the blade lock portion.*" Support plate 1 integrated into the driveshaft in the combined UAV of Sasaki and EP067 is the recited "*shaft lock portion*" and gaps 5 are the recited "*notches.*"

IX. Substitute claims 12 and 13 are indefinite.

63. Substitute claims 12 and 13 each requires that the “blade lock portion of the [] lock mechanism is **configured to engage** by partial counterclockwise rotation with respect to the shaft lock portion thereof” In the field of the ’184 patent, engaging requires **two components** that mate together. (DJI-1025, 435:11-14; DJI-1027, 86:19-20.) In other words, the blade lock portion must be configured to engage **something**. The phrase “configured to engage” is indefinite in the context of claims 12 and 13 because nothing in the claim or specification informs a POSITA about what the blade lock portion is configured to engage.

64. Additionally, a POSITA would not be reasonably certain about the scope of the partial rotation required for the blade lock portion to engage in substitute claims 12 and 13. For example, a 0.1 degree turn could be consider partial rotation, but Dr. Reinholtz states that the claim requires “reasonable rotation that creates the required engagement.” (DJI-1027, 127:8-18.) Neither the specification nor the claims provide guidance as to what level of rotation would be “reasonable” enough to meet the claim language.

I 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 that these statements were made with 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.

Dated: April 6, 2019



Alfred Ducharme