

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.

Case No. IPR2019-00343

Patent No. 9,260,184

DECLARATION OF DR. ALFRED DUCHARME

U.S. PATENT NO. 9,260,184 (CLAIMS 1-2, 5-9, AND 11)

DJI 1003-0001
SZ DJI Tech. Co. LTD. v. Autel Robotics USA LLC
IPR Pet. - U.S. Patent No. 9,260,184

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3.	“a plurality of arms extending laterally from the body;”	53
4.	“a rotor assembly attached to an outside end of each arm;”	53
5.	“each rotor assembly comprising a rotor blade releasably attached to a driveshaft by a lock mechanism, and a drive rotating the driveshaft;”	54
6.	“wherein a first driveshaft rotates in a clockwise direction and a second driveshaft rotates in a counterclockwise direction;”	60
7.	“wherein a clockwise rotor blade is releasably attached to the first driveshaft by engagement in a clockwise lock mechanism and generates a vertical lift force when rotated in the clockwise direction, and a counterclockwise rotor blade is releasably attached to the second driveshaft by engagement in a counterclockwise lock mechanism and generates a vertical lift force when rotated in the counterclockwise direction;”	62
8.	“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;”	67
9.	“wherein the clockwise lock mechanism comprises a shaft lock portion attached to the first driveshaft and a blade lock portion attached to the clockwise rotor blade, the shaft lock portion defining notches configured to engage corresponding lugs on the blade lock portion.”	70
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PETITIONER’S EXHIBIT LIST

<u>Exhibit</u>	<u>Description</u>
Ex. 1001	U.S. Patent No. 9,260,184 to Olm <i>et al.</i> (“the ’184 patent”)
Ex. 1002	Patent Prosecution History of the ’184 patent
Ex. 1003	Declaration of Dr. Ducharme Regarding U.S. Patent No. 9,260,184
Ex. 1004	Microdrones User Manual for md4-200 (Version 2.2) (“Microdrones”)
Ex. 1005	RESERVED
Ex. 1006	U.S. Patent Publication No. 2014/0263823 to Wang (“Wang”)
Ex. 1007	Certified English Translation of Chinese Application No. 201310008317.5 to Wang
Ex. 1008	Alibaba.com webpage featuring “LOTUSRC RC UFO T1000 with GPS RC Quadcopter” (“LotusRC”), archived by the Internet Archive Wayback Machine
Ex. 1009	Affidavit of Christopher Butler, Office Manager at the Internet Archive, dated September 11, 2018
Ex. 1010	U.S. Patent App. Pub. No. 2015/0203192 to Slanker (“Slanker”)
Ex. 1011	U.S. Patent No. 8,052,081 to Olm <i>et al.</i>
Ex. 1012	Webster’s Ninth New Collegiate Dictionary (9th ed. 1988) (“Webster’s Dictionary”) (excerpts)
Ex. 1013	The American Heritage College Dictionary (3rd ed. 1997) (“American Heritage Dictionary”) (excerpts)
Ex. 1014	McGraw-Hill Dictionary of Scientific and Technical Terms (5th ed. 1994) (“McGraw-Hill Dictionary of Scientific and Technical Terms”) (excerpts)
Ex. 1015	RESERVED
Ex. 1016	Declaration of Alan Stevens

Ex. 1017	Microdrones Webpage as captured on February 27, 2009 and retrieved from Wayback Machine
Ex. 1018	RESERVED
Ex. 1019	RESERVED
Ex. 1020	The New Oxford American Dictionary (2nd ed. 2005) (excerpts)
Ex. 1021	MW Power Systems Ltd. Homepage as captured on April 30, 2009 and retrieved from Wayback Machine
Ex. 1022	Microdrones Manual Available Through Online Forums
Ex. 1023	Cooperative Patent Classifications for Class B64C, downloaded from https://www.uspto.gov/web/patents/classification/cpc/pdf/cpc-scheme-B64C.pdf
Ex. 1024	<i>Hillary Brady</i> , “A Closer Look at Landing Gear,” Jan. 27, 2018, downloaded from https://airandspace.si.edu/stories/editorial/closer-look-landing-gear
Ex. 1025	WO 2014/108026 A1 (publication of PCT/CN2013/090470) to Wang et al.

I. ENGAGEMENT

1. I reside at Oviedo, Florida.

2. I have been asked by Petitioner to offer opinions regarding the '184 patent, including the unpatentability of claims 1-2, 5-9, and 11 (which I may refer to subsequently as the “Challenged Claims”) in view of certain prior art. This declaration sets forth the opinions I have reached to date regarding these claims.

3. I am being compensated by Petitioner at my standard hourly consulting rate for my time spent on this matter. My compensation is not contingent on the outcome of the IPR or on the substance of my opinions.

4. I have no financial interest in Petitioner or Patent Owner.

II. BACKGROUND

A. Educational Background

5. I earned a B.S. degree in Electrical Engineering in 1990 from the University of Massachusetts. I then earned my M.S. degree in 1992 from the University of Central Florida. I also earned my Ph.D. degree in Electrical Engineering from the University of Central Florida in 1994.

B. Career History & Relevant Industry Participation

6. From 2002 to 2013, I served as an Associate Professor of Engineering at the University of Central Florida, as Assistant Dean for the College of Engineering and Computer Science, and as Chairman for the Department of Engineering Technology for the College of Engineering and Computer Science. I

completed my doctoral degree in Electrical Engineering with a specialization in Photonics, which is the study of the generation, manipulation and detection of light. I created the University of Central Florida's undergraduate degree program in Photonics, and I have taught a variety of university level courses in photonics, electronics, mechanics, and robotics.

7. Before joining the University of Central Florida, I was an engineer in the optical industry for eight years and worked for three high technology companies. I am an inventor listed in the following twenty-three United States patents: 8,142,051, 7,959,320, 7,659,674, 7,572,028, 7,520,634, 7,387,405, 7,350,936, 7,255,457, 7,242,152, 7,186,003, 7,161,556, 7,135,824, 7,132,785, 7,088,040, 7,064,498, 7,014,336, 6,975,079, 6,956,500, 6,897,624, 6,608,453, 6,100,540, 6,049,297, 5,997,155. A listing of the year, patent number, and patent title is included in my curriculum vitae, included in Appendix A, below. I am also a listed inventor on several international patents.

8. In addition to my electrical engineering experience, I have been deeply involved in the design of mechanical and aesthetic features of a variety of products, specifically of Unmanned Aerial Vehicles ("UAV") and drones. In 2010, I and other co-founders, Daniel Burroughs and Stacey Ducharme, founded Hoverfly Technologies, Inc. ("Hoverfly"), a self-funded startup. Hoverfly currently develops and manufactures aerial drone systems for commercial and

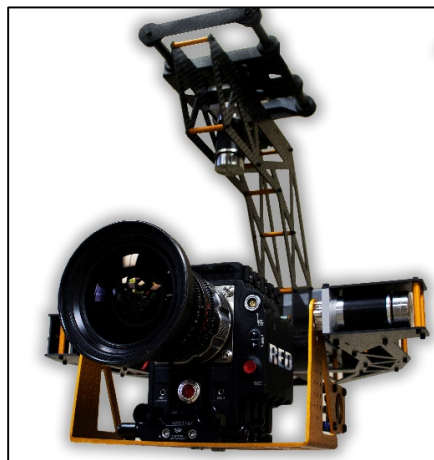
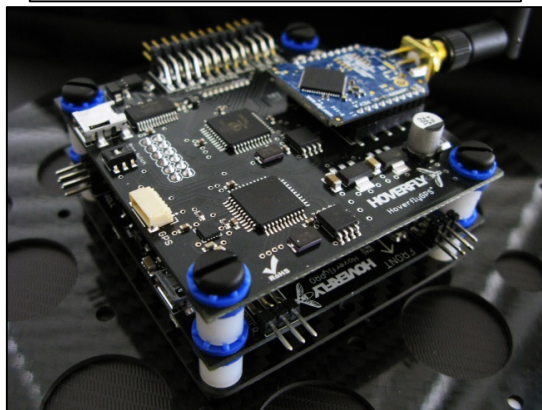
industrial use. These systems include multi-rotor aerial vehicles, flight controllers, and camera gimbal stabilizers for recording in-flight video. Around September 2011, Hoverfly launched a commercial multi-rotor flight controller, a first of its kind at the time.

9. As part of my past and ongoing experience at Hoverfly, I have experience with the design and fabrication of UAVs, including the design and fabrication of UAV control systems. The UAV products designed, fabricated, and sold by Hoverfly are mechanical in nature and have many mechanical components. As part of my work for Hoverfly, I developed a deep understanding of which mechanical components and component designs were suitable for UAVs, the mechanical design and engineering principles that control the design and build of UAV components, and how to design and produce components that would withstand environmental conditions and operational stresses and result in optimal flying performance.

10. At Hoverfly, I have managed a team of engineers in designing at least twenty (20) products. The development of these products has included mechanical, electrical, and aesthetic considerations. To provide just a few examples, our team's—and my—work includes the design and production of the: shape of landing gear and arms, main body, canopy, and power systems. In addition, I am

experienced with Computer Aided Design (CAD) software and have designed hundreds of mechanical parts used in our products.

11. A few photographs of Hoverfly products of which I have been involved in the design and manufacturing of are reproduced below:



Example UAV products designed by Dr. Alfred D. Ducharme.

12. It is for at least these reasons that I am an expert in Unmanned Aerial Vehicles, including the design of mechanical, electrical, and power related components and of software used for flight control, navigation, and obstacle detection and avoidance.

13. Additional information regarding my background, qualifications, and presentations is included as part of my *curriculum vitae* (“CV”), which is attached as Appendix A to this Declaration.

III. MATERIALS REVIEWED

14. In forming my opinions, I have reviewed the ’184 patent and considered each of the documents listed in the Exhibit List above and the other references cited in my declaration. In reaching my opinions, I have relied upon my experience in the field and also considered the viewpoint of a person of ordinary skill in the art at the time of the earliest relevant date of the ’184 patent, *i.e.*, early to mid-2013 (“PHOSITA” or “skilled artisan”). As explained below, I am familiar with the level of skill of a person of ordinary skill in the art regarding the relevant technology at issue as of that time.

IV. DESCRIPTION OF THE RELEVANT TIMEFRAME, THE RELEVANT FIELD, AND A PERSON OF ORDINARY SKILL IN THE ART

15. I have been informed that the ’184 patent has a date of May 15, 2013 that is relevant to the analysis in my declaration and I have been informed that this date is sometimes referred to as the “Alleged Priority Date.” For the purposes of my analysis, I have used the May 15, 2013 date as the relevant date.

16. I considered several factors to determine the skill level of a person of ordinary skill in the art of the ’184 patent in May 2013, including the types of

problems encountered in the art, the solutions to those problems, the pace of innovation in the field, the sophistication of the technology, and the education level of active workers in the field.

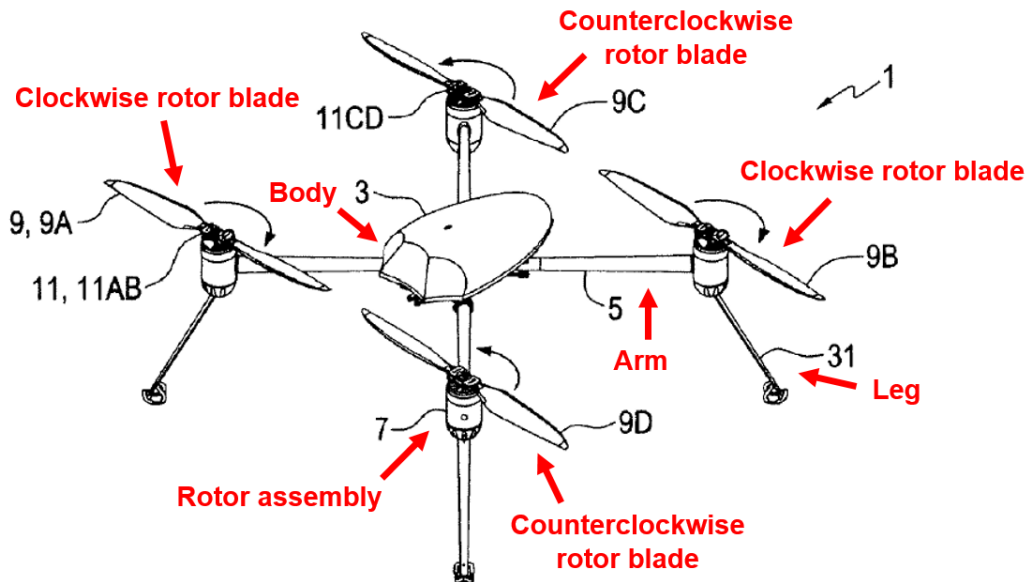
17. Based on my knowledge, expertise, and the prior art cited in the '184 patent, it is my opinion that a person of ordinary skill in the field of the '184 patent would have had at least an undergraduate degree in mechanical engineering, or equivalent education, training, or experience, with at least two years of experience with UAVs.

18. 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 person having ordinary skill in the art (“PHOSITA”), I am referring to a person with this level of education and experience in or around May 2013.

V. OVERVIEW OF THE '184 PATENT

19. A PHOSITA would have understood that the claims of the '184 patent are directed to the basic features of an unmanned aerial vehicle (“UAV”), a mechanism to releasably attach the rotors to the UAV, and a UAV’s landing gear. *See* Ex. 1001 at Abstract and 2:16-51. As acknowledged by the '184 patent, a PHOSITA would have known that UAVs having many of the claimed components were known before the Alleged Priority Date.

20. A PHOSITA would have recognized that the '184 patent discloses a rotary wing aircraft with arms extending from a body and a rotor assembly attached to an end of each arm:



Ex. 1001 at Abstract, Fig. 1.¹ As shown in Figure 1, above, the aircraft has a body (3), four arms (5), corresponding rotor assemblies (7) on each arm, four rotor blades (9A, 9B, 9C, 9D)—two of which rotate clockwise (9A, 9B) and two of which rotate counterclockwise (9C, 9D)—and four support legs (31).

21. A PHOSITA would have appreciated that the above referenced features were not new with respect to rotary aircraft or unmanned aerial vehicles (“UAV”). Indeed, my review of the '184 patent confirms that the '184 patent does

¹ All coloring and annotations added unless otherwise noted.

not assert there is anything novel about the general structure of a rotary aircraft, and even admits that many of the claimed features were well known in the art. *See generally* Ex. 1001 at 1:15-50.

22. A PHOSITA would have recognized that the '184 patent's alleged novel feature is a lock mechanism that keys the correct rotor blades to the correct driveshafts, so as to prevent the clockwise rotor blades from being attached to counterclockwise driveshafts, and vice versa.

23. Below I will review a few of the elements and characteristics of the claimed rotary aircraft that were well known in the art and admitted to be well known by the '184 patent.

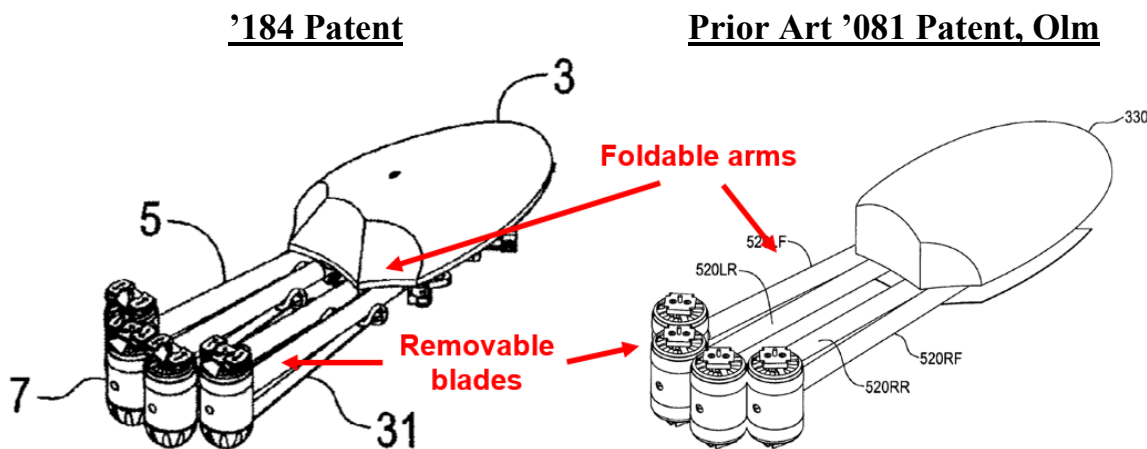
1. The '184 Patent Admits Numerous Rotary Aircraft Structures and Features Were Well Known

24. A PHOSITA would have recognized that the '184 patent admits that “[o]ne popular configuration [of rotary aircraft] includes a number of arms extending laterally from the aircraft body, with a rotor assembly on the end of each arm.” Ex. 1001 at 1:18-20. The '184 patent also admits that “a leg assembly is typically attached to the bottom of the aircraft body, and to support the aircraft on the ground in the necessary orientation for landing and takeoff.” *Id.* at 1:46-49.

25. As the '184 patent admits, I also can confirm that it was indeed “known in the art” to have two of the four rotor blades rotate clockwise and the

other two rotate counterclockwise to generate lift, equally divide the torque force, and maintain stability. *Id.* at 3:32-37, 1:24-31

26. Similarly, as the '184 patent further admits, a PHOSITA would have known that releasable rotor blades and foldable arms were well known. *Id.* at 1:43-46. One such example of this admittedly known structure is disclosed in U.S. Patent No. 8,052,081 (Ex. 1011) (“Olm”). I understand that this patent (Olm) has the same named inventors as the '184 patent, but that it is prior art to the '184 patent. As can be seen below, a PHOSITA would have recognized that Olm discloses the same releasable rotor blades and foldable arms structure as the '184 patent. Olm’s disclosures are also detailed later in this declaration.



Ex. 1001 at Fig. 3; Ex. 1011 at Fig. 14; *see* Ex. 1001 at Fig. 1 and Ex. 1011 at Fig. 1 (showing rotor blades attached).

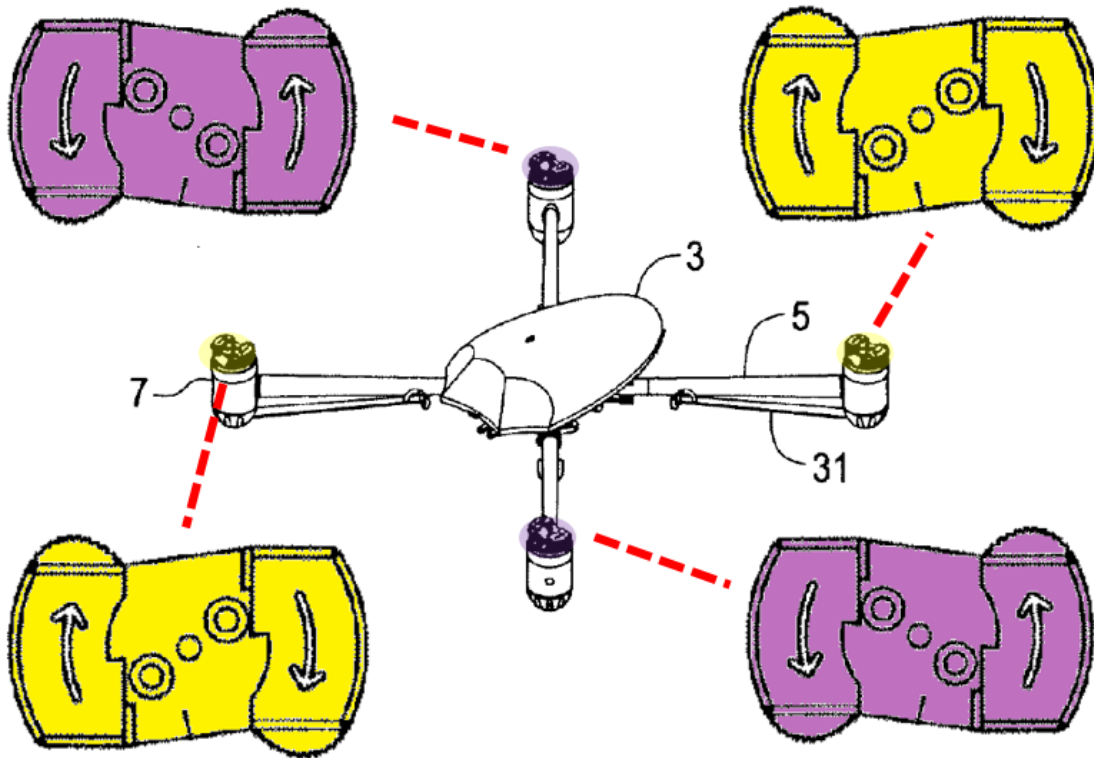
27. In addition to the '184 patent’s explicit admissions, a PHOSITA would have appreciated that many of the claimed features of the '184 patent were

well known on or before the Alleged Priority Date, including that a rotary aircraft could have a body with foldable arms, rotor assemblies, clockwise / counterclockwise rotor blades, releasable rotor blades, and support legs. *See generally* Ex. 1001 at 1:15-49, 3:31-37, 4:41-42.

2. '184 Patent Alleges A Lock Mechanism That Prevents Incorrect Attachment Of Rotor Blades Constitutes An Invention

28. I will now discuss the allegedly novel “lock mechanism” for attaching rotor blades that prevents the clockwise rotor blade from being attached to the counterclockwise driveshaft, and vice versa. *See* Ex. 1001 at 1:55-2:7. A PHOSITA would have recognized that the lock mechanism disclosed by the '184 patent has at least two parts: a “shaft lock portion” attached to the driveshaft, and a “blade lock portion” attached to the rotor blade.

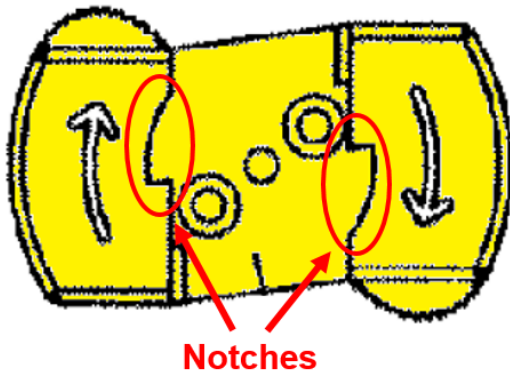
29. I will first discuss the shaft lock portion. A PHOSITA would have recognized that in the disclosed rotary aircraft, as shown below, each clockwise-rotating driveshaft has a shaft lock portion (yellow), and each counterclockwise-rotating driveshaft has an oppositely configured shaft lock portion (purple):



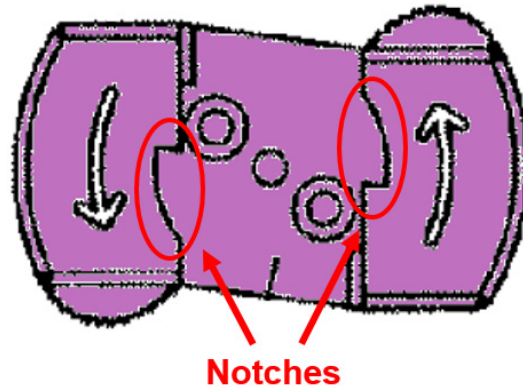
See id. at Figs. 2 and 6 (images cropped and combined; image of clockwise shaft lock portion (yellow) generated by mirroring counterclockwise shaft lock portion shown in Figure 6 (purple)). I note here that each shaft lock portion has “notches” and each blade lock portion has “lugs.” A PHOSITA would have appreciated that the “notches” on the shaft lock portions are designed to receive the projections or “lugs” on the blade lock portions of the rotor blades, as shown here:

Clockwise Shaft Lock Portion

Counterclockwise Shaft Lock Portion



See Id. at Fig. 6 (mirror image of counterclockwise shaft lock portion actually depicted).

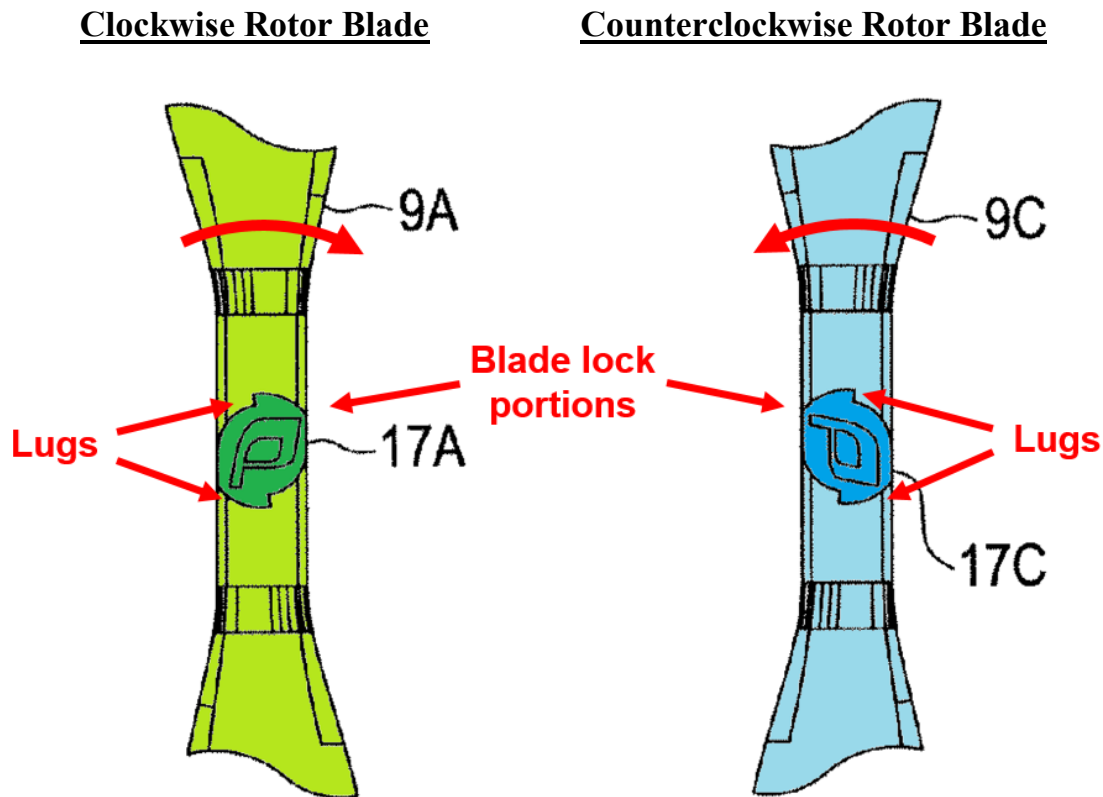


Id. at Fig. 6.

30. As can be seen above, each shaft lock portion has a center recess—in the middle, between the notches—into which the blade lock portion of the rotor blade may be inserted or “dropped” for attachment. *See id.* at Fig. 6 (showing recess 21 in counterclockwise shaft lock portion). A PHOSITA would have appreciated that since the clockwise shaft lock portion has notches that are configured differently from the notches on the counterclockwise shaft lock portion, the notches of the clockwise shaft lock portion will not “engage” the lugs on a rotor blade that is configured to engage the notches on the counterclockwise shaft lock portion, and vice versa.

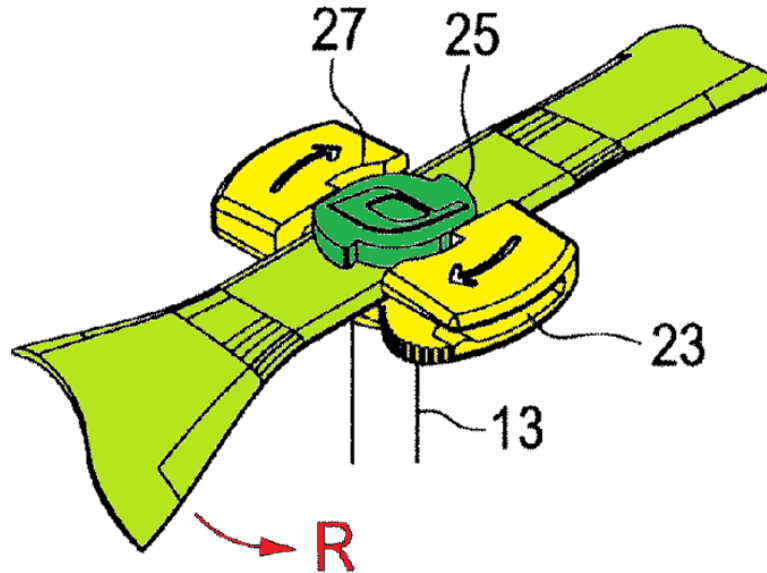
31. The lugs of the clockwise and counterclockwise rotor blades of the ’184 patent are shown below. A PHOSITA would have recognized that the clockwise rotor blade (9A, light green, below) includes lugs on a blade lock

portion (17A, dark green, below) that are specifically configured to engage the clockwise shaft lock portions (yellow, above), and that the counterclockwise rotor blade (9C, light blue, below) includes lugs on a blade lock portion (17C, dark blue, below) specifically configured to engage the counterclockwise shaft lock portions (purple, above).

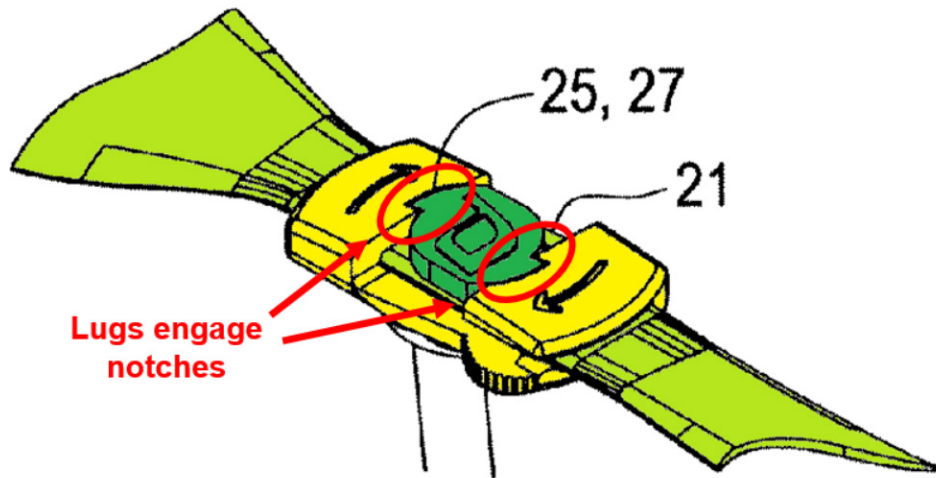


Ex. 1001 at Fig. 6 (portions of image cropped and rearranged), 4:19-23.

32. To attach the clockwise rotor blade, a PHOSITA would have recognized that the blade lock portion (dark green) of the clockwise rotor blade (light green) is inserted into and positioned in the recess of the shaft lock portion (yellow) of the clockwise lock mechanism. This is confirmed by the figure, below:



Id. at Fig. 4 (colored), 4:1-4. A PHOSITA would further recognize that, to complete the installation, the clockwise rotor blade (light green) is rotated as indicated by red-highlighted “R” and arrow in Figure 4, above. *Id.* As shown in the highlighted figures below, the rotor blade rotation causes the lugs (25) of the blade lock portion to engage the notches (27) of the shaft lock portion, and the rotor blade to slide into slots (23) on each side of the shaft lock portion. *Id.* at 4:7-8.



Id. at Fig. 5; *see id.* at 4:3-6, Figs. 6, 10.

33. While the description and figures above show how the '184 patent's disclosed embodiment function, a PHOSITA would have recognized that independent claim 1 does not require a rotation step to achieve a releasable attachment. In fact, only dependent claims 3 and 4 require the step of rotating the blade lock portion with respect to the shaft lock portion to releasably attach the rotor blades.

34. I further note here that the claims of the '184 patent do not require the lugs and notches to be the only components that lock the rotor blade to the driveshaft. Instead, a PHOSITA would have understood that the claims of the '184 patent merely require that the lugs on the blade lock portion (dark green) engage the notches of the shaft lock portion (yellow). As I understand that the term "comprise," when used in patent drafting, means "includes at least," and because

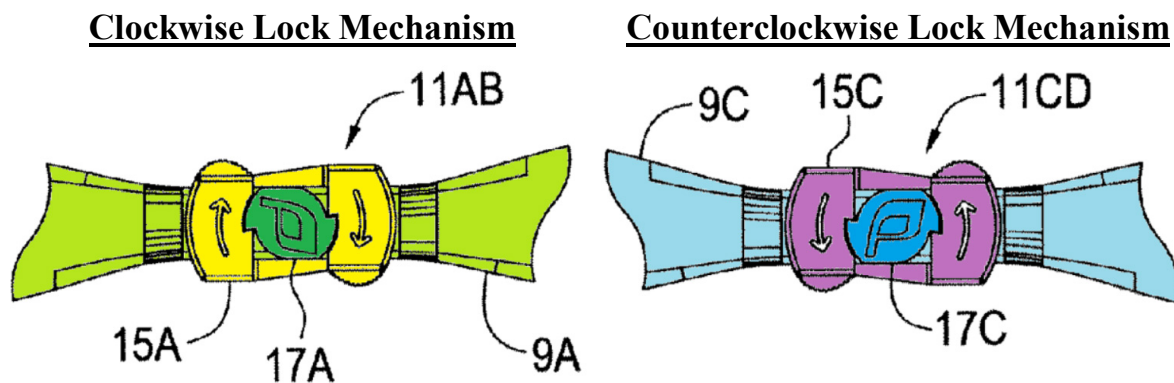
the claims recite that the clockwise and counterclockwise lock mechanisms

“**comprise**[]” a blade lock portion and a shaft lock portion, *see* Claims 1 and 2, I

recognize that the lock mechanisms may include other elements that are

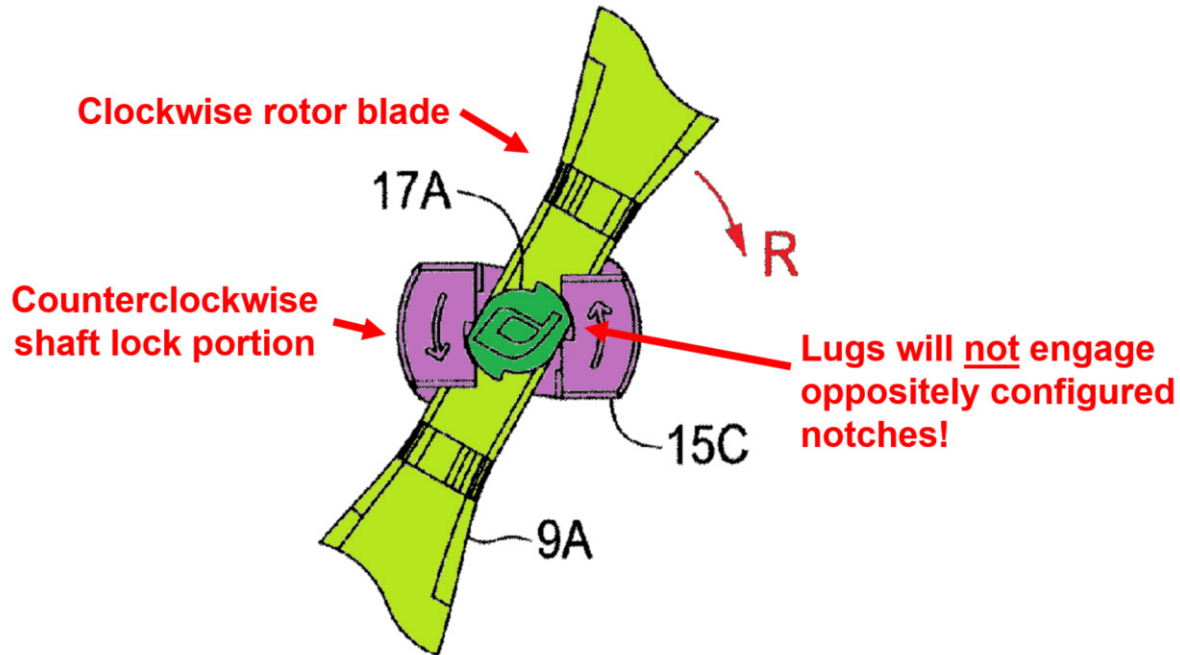
responsible for releasably attaching the rotor blade to the driveshaft.

35. The figures below show the clockwise and counterclockwise rotor blades “successfully installed” in their corresponding shaft lock portions using the disclosed lock mechanisms:



Ex. 1001 at Figs. 7 (right) and 10 (left); *id.* at 4:23-26, 4:38-40.

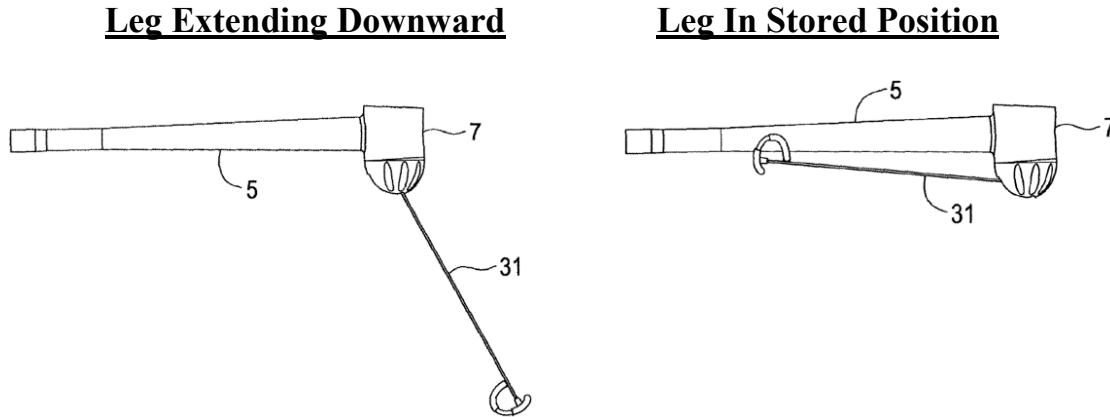
36. As shown below, and explained by the '184 patent, it is my understanding that the disclosed lock mechanism prevents the clockwise rotor blade from being improperly attached to the counterclockwise driveshaft because the lugs on the blade lock portion of the clockwise rotor blade do not align with, and thus cannot engage, the oppositely configured notches of the shaft lock portion of the counterclockwise driveshaft:



Id. at Fig. 8; *id.* at 4:27-30, 2:2-7. As the '184 patent states: “the clockwise rotor blades 9A, 9B cannot be installed on the shaft lock portion 15C of a counterclockwise lock mechanism, and similarly the counterclockwise rotor blades 9C, 9D cannot be installed on the shaft lock portion 15A of a clockwise lock mechanism.” *Id.* at 4:30-35.

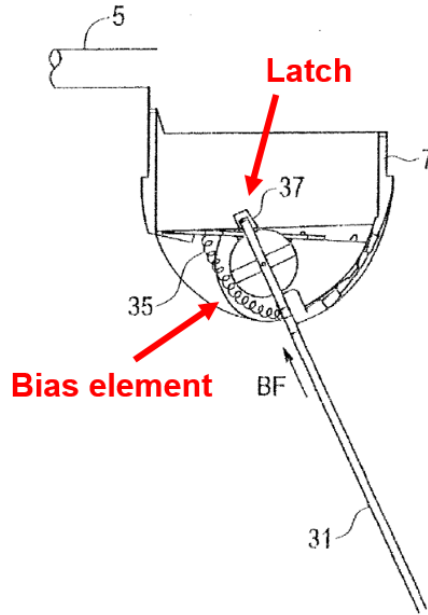
37. Furthermore, the '184 patent also claims that its configurations of the legs are novel. Although, it was well known to a PHOSITA that legs could extend down from a UAV's rotor assembly, the '184 patent recites “a leg extending downward from a bottom portion of the rotor assembly to support the apparatus on a ground surface.” Ex. 1001 at 2:13-15. The figures of the '184 patent show legs

that extend downward from the rotor assembly and away from the body, and which may also fold into a stored position:



Id. at Figs. 12 (left), 14 (right).

38. The '184 patent also teaches that a “bias element,” such as a spring 35, may “urge[] leg 31 toward the stored position” and that “the end of the leg 31 in the recess 37 acts then as a latch to lock the leg 31 in the operating position,” as shown here:



Ex. 1001 at Fig. 17. Similar to many of the '184 patent's claimed features, a PHOSITA would have known that this kind of latch and bias system has been utilized on many different kinds of leg configurations in aircrafts for a long time.

VI. OVERVIEW OF THE PRIOR ART

A. Cited Reference – Microdrones (Ex. 1004).

39. It is my understanding that Version 2.2 of the User Manual for the Microdrones md4-200 ("Microdrones") is prior art to the '184 patent as it was publicly available before the Alleged Priority Date of the '184 patent.

40. Microdrones discloses a rotary wing aircraft with many of the essential features a PHOSITA would have recognized are present on a UAV and that the '184 patent admits were well known. A PHOSITA would also recognize

that Microdrones discloses the feature that the '184 patent claims is a new invention—*i.e.*, lugs and notches.

41. From my review of Microdrones I recognized that the UAV/drone/rotary aircraft being described in the User Manual is called the “md4-200.” *See* Ex. 1004 at Cover, 1. As shown below, Microdrones discloses at least an aircraft body, plurality of arms, rotor assemblies, clockwise rotor blades, counterclockwise rotor blades, and legs:

Microdrones, Figure 18
2.1.2 The md4-200

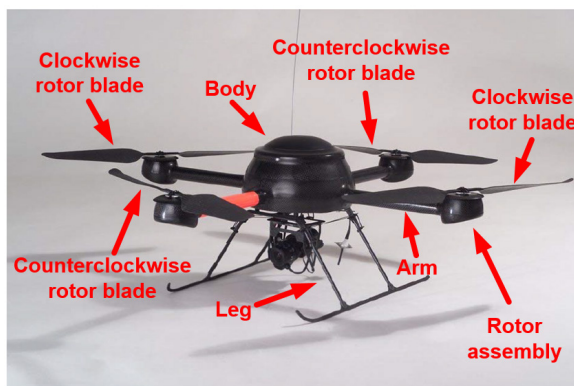
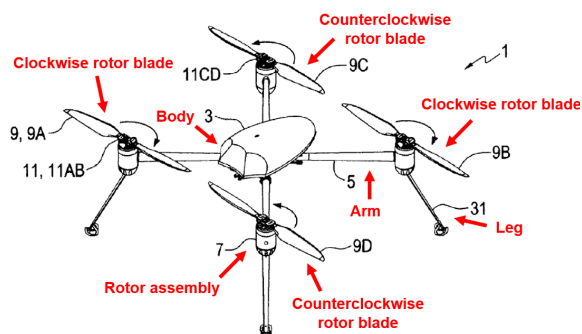


figure 18: md4-200, ready for take off

'184 Patent, Figure 2



42. A PHOSITA would have recognized that Microdrones discloses two clockwise rotor blades and two the counterclockwise rotor blades, just like the '184 patent. A PHOSITA would further recognize that each of the four rotor blades includes a respective lock mechanism.

Microdrones, Figure 18

2.1.2 The md4-200

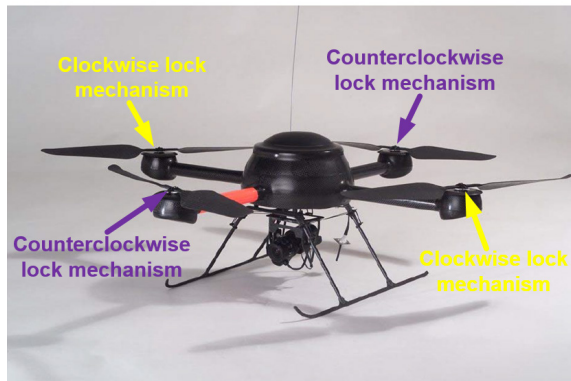
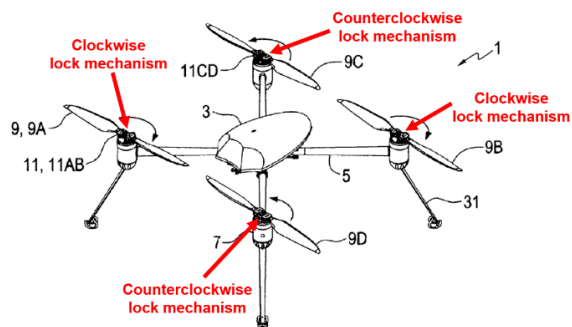


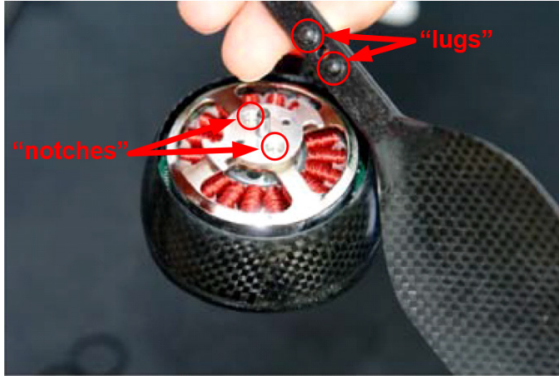
figure 18: md4-200, ready for take off

'184 Patent, Figure 1

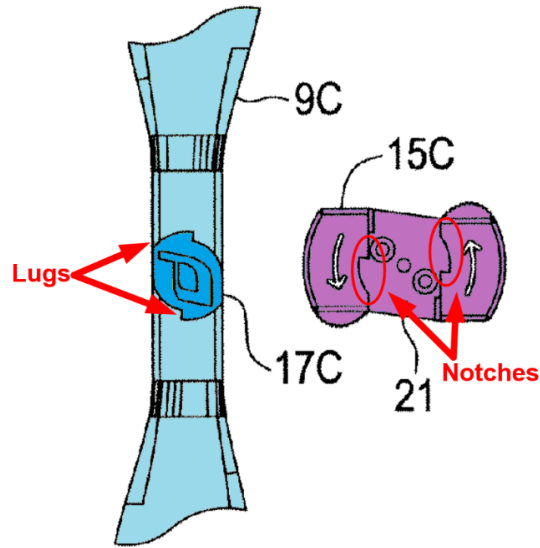


43. A PHOSITA would have appreciated that, just like the lock mechanisms claimed in the '184 patent, Microdrones' lock mechanisms feature lugs on a blade lock portion of the rotor blade (*i.e.*, center bar having protruding notches) and notches on a shaft lock portion (*i.e.*, silver rotor mounting plate with notches):

Microdrones, Figure 25 (partial)



'184 Patent, Figure 6 (partial)



44. As I will explain below, I understand a “lug” to be equivalent to a “projection” and a “notch” to be equivalent to an “indentation.”

45. In addition to the “lugs” and “notches,” a PHOSITA would have recognized that Microdrones discloses that the lock mechanisms are **keyed** to either the clockwise rotor blade or the counterclockwise rotor blade. This *keying* prevents the clockwise rotor blade from being attached to the counterclockwise driveshaft, and vice versa. Specifically, a PHOSITA would have recognized that Microdrones’ clockwise lock mechanism differs from its counterclockwise lock mechanism (discussed and shown above) in that the distances between the lugs on the center bar of the rotor blade and the matching notches on the rotor mounting plate are “**individual**” (*i.e.*, unique) and thus different. *See id.* at 27 (“To avoid

accidental misplacement, **both directions of turning use individual distances between these knobs.”).**

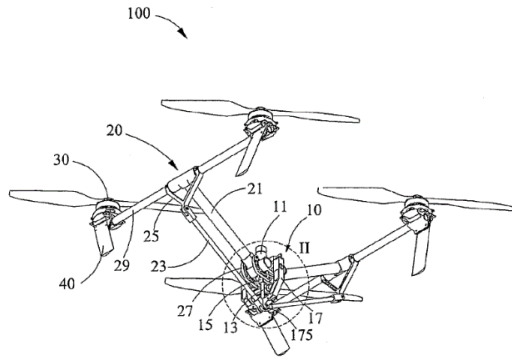
46. To be clear, a PHOSITA would have understood that the use of “individual” and different spacing between the lugs and notches in Microdrones’ clockwise and counterclockwise lock mechanisms is what keys the correct rotor blade to the correct driveshaft, so as to prevent Microdrones’ clockwise rotor blades from being attached to the counterclockwise driveshafts, and vice versa.

B. Cited Reference - Wang (Ex. 1006)

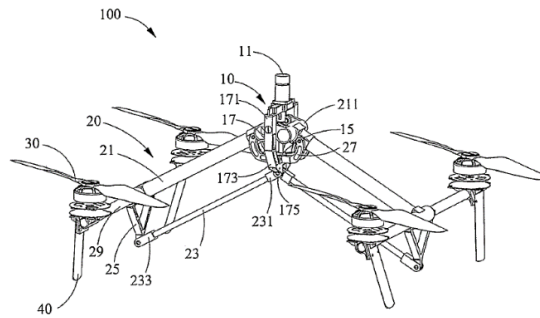
47. It is my understanding that U.S. Patent Publication No. 2014/0263823 to Wang (“Wang”) is prior art to the ’184 patent at least because it claims priority to a Chinese Application No. 201310008317.5 (Ex. 1007) (“Chinese Application”), which was filed before the Alleged Priority Date.

48. A PHOSITA would have appreciated that Wang is directed to a UAV with legs that slope downward and away from a bottom portion of a rotor assembly:

Wang, Figure 1



Wang, Figure 3



49. I have been informed that a comparison of the published claims of Wang and what is disclosed in the Chinese Application publication is advantageous for the purposes of establishing prior art. I further understand that I should look at this analysis as whether a PHOSITA would have been enabled to come to the invention claimed in Wang by the disclosures in the Chinese Application. As seen below, I believe that the claims of Wang are fully supported by the Chinese Application. As many of the claims are similar, the table below has the similar claims of the U.S. Publication (Wang) first 3 rows, and in the far-right column is at least one disclosure from the Chinese Application that supports and discloses the corresponding claim(s).

Wang Publication Independent Claims & Corresponding Dependent Claims			Wang Translation Disclosure
1. [p] A transformable aerial vehicle, the vehicle comprising:	12. [p] A transformable aerial vehicle, the vehicle comprising:	20. [p] A transformable aerial vehicle, the vehicle comprising:	Title; Abstract: “Transformation structure of aerial vehicle”

			See Figure 1, 3-5, 7-11, 13-14.
[a] a central body;	[a] a central body ;	[a] a central body coupled to a payload ;	<p>¶0025 In the present embodiment, the mini aerial vehicle 100 includes a central body 10.</p> <p>¶0024 The first embodiment of the present invention provides a mini aerial vehicle 100 for carrying certain payloads (e.g., imaging capturing devices, robotic arms, etc.).</p> <p>See Figure 1, 3-5, 7-11, 13-14.</p>
[b] at least two transformable frame assemblies respectively disposed on the central body, each of the at least two transformable frame assemblies having a proximal portion pivotally coupled to the central body	[b] at least two transformable frame assemblies respectively disposed on the central body, each of the at least two transformable frame assemblies having a proximal portion coupled to the central body and a distal portion;	[b] at least two transformable frame assemblies respectively disposed on the central body, each of the at least two transformable frame assemblies having a proximal portion coupled to the central body and a distal portion;	<p>¶0025 In the present embodiment, the mini aerial vehicle 100 includes a central body 10, two transformable frames 20, four propulsion units 30, and four landing gears 40. The central body 10 is coupled to the transformable frame assembly 20 and transforms the transformable frame assembly 20.</p> <p>¶006 each primary shaft includes a first proximal end and an opposite first distal end</p>

and a distal portion;			See Figure 2, 6, 12; Figs. 1, 3-5, 7-11, 13-14.
[c] an actuation assembly mounted on the central body and configured to pivot the at least two transformable frame assemblies to a plurality of different vertical angles relative to the central body;	[c] an actuation assembly configured to transform the at least two transformable frame assemblies between a first configuration and a second configuration;	[c] an actuation assembly mounted on the central body and configured to transform the at least two transformable frame assemblies between a first configuration and a second configuration,	<p>¶0008 Said transmission part includes: a screw rod that is connected to said drive unit in a fixed manner and rotates under the driving of said drive unit; a nut that is sleeved on the screw rod, and said nut moves up and down along said screw rod when the screw rod rotates.</p> <p>¶0025 In the present embodiment, the mini aerial vehicle 100 includes a central body 10, two transformable frames 20, four propulsion units 30, and four landing gears 40. The central body 10 is coupled to the transformable frame assembly 20 and transforms the transformable frame assembly 20 by user command or automatic drive.</p> <p>¶0020 In summary, the mini aerial vehicle of the present invention forms a simple transformation structure through the frame connecting members (such as the primary shaft, the secondary shaft and the</p>

			<p>connector rod), so that the frame produces an up-and-down motion relative to the central body to realize the transformation of the frame.</p> <p><i>See Figures 1, 3-5, 7-11, 13-14.</i></p>
[d] and a plurality of propulsion units mounted on the at least two transformable frame assemblies and operable to move the transformable aerial vehicle.	[d] and a plurality of propulsion units mounted on the at least two transformable frame assemblies and operable to move the transformable aerial vehicle,	[e] and a plurality of propulsion units mounted on the at least two transformable frame assemblies and operable to move the transformable aerial vehicle.	<p>¶0025 The propulsion unit 30 is disposed on the frame assembly 20 to drive the mini aerial vehicle 100 to ascent or descent.</p> <p><i>See Figure 1, 3-5, 7-11, 13-14.</i></p>
	[e] wherein the first configuration includes the propulsion units being positioned above the central body and the second configuration includes the propulsion units being positioned below the central body.	[d] wherein the first configuration permits the at least two transformable frame assemblies to support the transformable aerial vehicle resting on a surface, and wherein the second configuration increases a	<p>¶0037 – First Configuration There are also four said landing gears 40, which are respectively disposed below the propulsion units 30 to ensure said central body 10 and said frame assembly 20 are not touching the ground when the mini aerial vehicle 100 is landing on the ground.</p> <p><i>See Figures 1-7.</i></p> <p>¶0040 – Second Configuration</p>

		functional space of the payload;	<p>Thus, according to the transformation principle of the parallelogram, when the angle of the primary shaft 21 and the screw rod 13 is changed, the primary shaft 21 will change the angle between the secondary shaft 23 and the pull rod 25, thereby making the frame assembly 20 produce an upward transformation. At this time, the transformation action has been completed, the parallelogram is in the upward posture, and the propulsion unit 30 has moved to the upper position with the upward parallelogram structure, and the space below the central body 10 is released, which can provide more activity space and perspective for other apparatus</p> <p><i>See Figures 8-10.</i></p>
2. The vehicle of claim 1, wherein the transformable aerial vehicle is an unmanned aerial vehicle.	13. The vehicle of claim 12 , wherein the transformable aerial vehicle is an unmanned aerial vehicle.	21. The vehicle of claim 20, wherein the transformable aerial vehicle is an unmanned aerial vehicle.	<p>¶0024 In this embodiment, the mini aerial vehicle 100 is a remotely controlled mini aerial vehicle.</p>

<p>3. The vehicle of claim 1, wherein the at least two transformable frame assemblies comprise a primary shaft and at least one secondary shaft extending parallel to the primary shaft,</p> <p>the primary shaft and the at least one secondary shaft respectively pivotally coupled to the central body,</p> <p>wherein the primary shaft and the at least one secondary</p>	<p>14. The vehicle of claim 12, wherein the at least two transformable frame assemblies comprise a primary shaft and at least one secondary shaft extending parallel to the primary shaft,</p> <p>the primary shaft and the at least one secondary shaft respectively pivotally coupled to the central body,</p> <p>wherein the primary shaft and the at least one secondary shaft are coupled to each other such that actuation of the</p>	<p>22. The vehicle of claim 20, wherein the at least two transformable frame assemblies comprise a primary shaft and at least one secondary shaft extending parallel to the primary shaft,</p> <p>the primary shaft and the at least one secondary shaft respectively pivotally coupled to the central body,</p> <p>wherein the primary shaft and the at least one</p>	<p>¶0006 [A]t least two primary shafts that are respectively disposed on both sides of the transmission part, ... [and] at least two secondary shafts. ¶0016 In one embodiment, at least two said secondary shafts are respectively parallel to at least two said primary shafts. ¶0012 [T]he first proximal end of each of said primary shafts forms a hinge joint, the two primary shafts are hinged by said hinge joint ¶0053 The two proximal ends 233b of said secondary shafts 23b are hinged to the hinge holes on said pull rod 25b respectively so that said pull rod 25b and said secondary shaft 23b can rotate to each other. ¶0031 a pull rod 25 connecting said primary shaft 21 and said secondary shaft 23, ¶0040 Thus, according to the transformation principle of the parallelogram, when the angle of the primary</p>
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shaft are coupled to each other such that actuation of the primary shaft by the actuation assembly produces a corresponding actuation of the at least one secondary shaft.	primary shaft by the actuation assembly produces a corresponding actuation of the at least one secondary shaft.	secondary shaft are coupled to each other such that actuation of the primary shaft by the actuation assembly produces a corresponding actuation of the at least one secondary shaft.	shaft 21 and the screw rod 13 is changed, the primary shaft 21 will change the angle between the secondary shaft 23 and the pull rod 25 , thereby making the frame assembly 20 produce an upward transformation.
4. The vehicle of claim 1, wherein the actuation assembly comprises a linear actuator, and a portion of each of the at least two transformable frame assemblies is coupled to the linear actuator.			¶0020 In summary, the mini aerial vehicle of the present invention forms a simple transformation structure through the frame connecting members (such as the primary shaft, the secondary shaft and the connector rod), so that the frame produces an up-and-down motion relative to the central body to realize the transformation of the frame. ¶0006 [A] transmission part that is connected to the drive unit in a fixed manner and linearly reciprocates relative to the drive unit

			<p>under the driving of the drive unit;</p> <p><i>See Figures 1-14.</i></p>
<p>5. The vehicle of claim 4, wherein the linear actuator comprises a screw and nut mechanism, and the portion of each of the at least two transformable frame assemblies is coupled to the nut.</p>			<p>¶0008</p> <p>Said transmission part includes: a screw rod that is connected to said drive unit in a fixed manner and rotates under the driving of said drive unit; a nut that is sleeved on the screw rod, and said nut moves up and down along said screw rod when the screw rod rotates.</p> <p><i>See Figures 2, 6, 12.</i></p>
<p>6. The vehicle of claim 1, wherein each of the plurality of propulsion units comprises a rotor.</p>	<p>15. The vehicle of claim 12, wherein each of the plurality of propulsion units comprises a rotor.</p>	<p>23. The vehicle of claim 20, wherein each of the plurality of propulsion units comprises a rotor.</p>	<p>¶0002</p> <p>A mini quadrotor is particularly suitable for conducting surveillance and reconnaissance tasks in near-surface environments.</p> <p><i>See Figures 1, 3-5, 7-11, 13-14</i></p>
	<p>16. The vehicle of claim 15, wherein each rotor is oriented horizontally relative to the transformable aerial vehicle.</p>		<p><i>See Figure 14</i></p> <p>¶0052</p> <p>Said fixed assembly 17b is parallel to said cross bar 29, and its longitudinal cross-sectional view is in a substantially rectangular shape.</p>

<p>7. The vehicle of claim 1, wherein the actuation assembly is configured to pivot the at least two transformable frame assemblies between a first vertical angle and a second vertical angle.</p>			<p>¶0040 Since the nut 15 is connected to the connector rod 27 in a fixed manner, the upward force can be transmitted to the connector rod 27 and further to the hinge joint 211 of the primary shaft 21, which simultaneously causes the connector rod 27 to move upward along the screw rod 13 and causing the hinge joint 211 to drive the primary shaft 21 to rotate with each other, so that the angle of the primary shaft 21 and the screw rod 13 will be changed. Thus, according to the transformation principle of the parallelogram, when the angle of the primary shaft 21 and the screw rod 13 is changed, the primary shaft 21 will change the angle between the secondary shaft 23 and the pull rod 25, thereby making the frame assembly 20 produce an upward transformation</p> <p>¶0020 [T]he mini aerial vehicle of the present invention forms a simple transformation structure through the frame connecting members (such</p>
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			<p>as the primary shaft, the secondary shaft and the connector rod), so that the frame produces an up-and-down motion relative to the central body to realize the transformation of the frame.</p> <p><i>See Figures 1-10</i></p>
<p>8. The vehicle of claim 7, wherein at the first vertical angle, the at least two transformable frame assemblies are angled downwards relative to the central body, and wherein at the second vertical angle, the at least two transformable frame assemblies are angled upwards relative to the central body.</p>		<p>28. The vehicle of claim 20, wherein in the first configuration, the at least two transformable frame assemblies are angled downwards relative to the central body, and wherein in the second configuration angle, the at least two transformable frame assemblies are angled upwards relative to the central body.</p>	<p><u>¶10037 – First Config. (Downwards)</u> There are also four said landing gears 40, which are respectively disposed below the propulsion units 30 to ensure said central body 10 and said frame assembly 20 are not touching the ground when the mini aerial vehicle 100 is landing on the ground.</p> <p><i>See Figures 1-7.</i></p> <p><u>¶10040 – Second Config. (Above)</u> Thus, according to the transformation principle of the parallelogram, when the angle of the primary shaft 21 and the screw rod 13 is changed, the primary shaft 21 will change the angle between the secondary shaft 23 and the pull rod 25, thereby making the frame assembly 20 produce an</p>

			<p>upward transformation. At this time, the transformation action has been completed, the parallelogram is in the upward posture, and the propulsion unit 30 has moved to the upper position with the upward parallelogram structure, and the space below the central body 10 is released, which can provide more activity space and perspective for other apparatus</p> <p><i>See Figures 8-10.</i></p>
	<p>17. The vehicle of claim 12, wherein the at least two transformable frame assemblies are transformed into the first configuration during a first phase of operation of the transformable aerial vehicle and transformed into the second configuration during a second phase of operation of the</p>	<p>24. The vehicle of claim 20, wherein the at least two transformable frame assemblies are transformed into the first configuration during a first phase of operation of the transformable aerial vehicle and transformed into the second</p>	<p>¶0022 Figure 1 is a schematic structural view of the mini aerial vehicle in the landing configuration in the first embodiment of the present invention;</p> <p><i>See Figures 1-7.</i></p> <p>¶0022 Figure 7 is a side view of the mini aerial vehicle shown in Figure 5 in the flight configuration.</p> <p><i>See Figures 8-10.</i></p>

Declaration of Dr. Alfred Ducharme – Case No. IPR2019-00343
U.S. Patent No. 9,260,184; Challenging Claims 1-2, 5-9, 11

	transformable aerial vehicle.	configuration during a second phase of operation of the transformable aerial vehicle.	
	18. The vehicle of claim 17, wherein the first phase of operation comprises the transformable aerial vehicle flying in air, and the second phase of operation comprises the transformable aerial vehicle taking off from a surface and/or landing on the surface.	25. The vehicle of claim 24, wherein the first phase of operation comprises the transformable aerial vehicle flying in air, and the second phase of operation comprises the transformable aerial vehicle taking off from a surface and/or landing on the surface. 27. The vehicle of claim 20, wherein the at least two transformable frame assemblies each comprise a support	¶0022 Figure 1 is a schematic structural view of the mini aerial vehicle in the landing configuration in the first embodiment of the present invention; ¶0037 There are also four said landing gears 40, which are respectively disposed below the propulsion units 30 to ensure said central body 10 and said frame assembly 20 are not touching the ground when the mini aerial vehicle 100 is landing on the ground. <i>See Figures 1-7.</i> ¶0022 Figure 7 is a side view of the mini aerial vehicle shown in Figure 5 in the flight configuration. <i>See Figures 8-10.</i>

		member configured to support the transformable aerial vehicle resting on a surface.	
9. The vehicle of claim 1, wherein the transformable aerial vehicle further comprises a receiver configured to receive user commands for controlling one or more of the actuation assembly and the plurality of propulsion units.		29. The vehicle of claim 20, wherein the transformable aerial vehicle further comprises a receiver configured to receive user commands for controlling one or more of the actuation assembly and the plurality of propulsion units.	¶0028 The drive unit 11 is electrically connected to a control signal receiver (not shown in the figures). When the drive unit 11 receives the control signal from the user through the receiver , the corresponding turning on, turning off or reverse driving action is performed.
10. The vehicle of claim 9, wherein the user commands are transmitted from a remote terminal.		30. The vehicle of claim 29, wherein the user commands are transmitted from a remote terminal.	¶0028 The drive unit 11 is electrically connected to a control signal receiver (not shown in the figures). When the drive unit 11 receives the control signal from the user through the receiver , the corresponding turning on, turning off or reverse

			driving action is performed. ¶0024 In this embodiment, the mini aerial vehicle 100 is a remotely controlled mini aerial vehicle.
11. The vehicle of claim 1, wherein the transformable aerial vehicle further comprises a payload coupled to the central body.	19. The vehicle of claim 12, wherein the transformable aerial vehicle further comprises a payload coupled to the central body.	26. The vehicle of claim 20, wherein the payload comprises an image capturing device, and the functional space comprises an unobstructed field of view of the image capturing device.	¶0024 The first embodiment of the present invention provides a mini aerial vehicle 100 for carrying certain payloads (e.g., imaging capturing devices, robotic arms, etc.). ¶0020 This provides a large enough spatial view during its flight to conduct surveillance, reconnaissance, and other tasks, enabling the mini aerial vehicle to be optimized in weight and visual space. <i>See Figures 1-7</i>

C. Cited Reference – LotusRC (Ex. 1009).

50. It is my understanding that the webpage featuring “LotusRC RC UFO T1000 with GPS RC Quadcopter” (“LotusRC Quadcopter”) was publicly accessible on Alibaba.com at least as of February 27, 2013 and is prior art to the

'184 patent. From here on I will refer to the webpage as "LotusRC." I accessed

LotusRC via the Internet Archive's "Wayback Machine" at the following link:

[http://web.archive.org/web/20130227053449/http://9imod.en.alibaba.com/pr](http://web.archive.org/web/20130227053449/http://9imod.en.alibaba.com/product/626931837-)
[oduct/626931837-](http://web.archive.org/web/20130227053449/http://9imod.en.alibaba.com/product/626931837-)

[212516682/Newest_LOTUSRC_RC_UFO_T1000_with_GPS_RC_Quadcop](http://web.archive.org/web/20130227053449/http://9imod.en.alibaba.com/product/626931837-212516682/Newest_LOTUSRC_RC_UFO_T1000_with_GPS_RC_Quadcopter.html)
[ter.html](http://web.archive.org/web/20130227053449/http://9imod.en.alibaba.com/product/626931837-212516682/Newest_LOTUSRC_RC_UFO_T1000_with_GPS_RC_Quadcopter.html).

51. The Wayback Machine, which archived this webpage on the date reflected in the URL, confirms my understanding that the public had access to LotusRC at least by February 27, 2013.

52. A PHOSITA would have recognized that LotusRC discloses a multi rotor aerial vehicle that has many of the same features recited by the '184 patent. For example, as shown below in one of the figures from LotusRC, a PHOSITA would have appreciated that LotusRC discloses, among other things, an aerial vehicle (which appears to be named the T1000) with a body, arms, rotor assemblies with motors and rotor blades, and retractable legs extending downward from the bottom of those rotor assemblies.



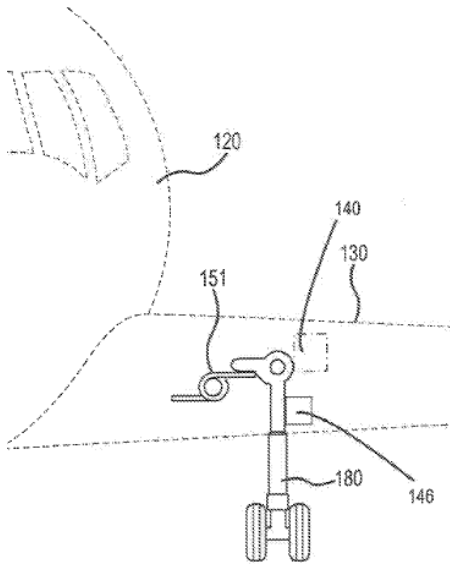
D. Cited Reference – Slanker

53. It is my understanding that U.S. Patent Publication No. US 2015/0203192 to Slanker (“Slanker”) is prior art to the ’184 patent as it was filed May 2, 2013.

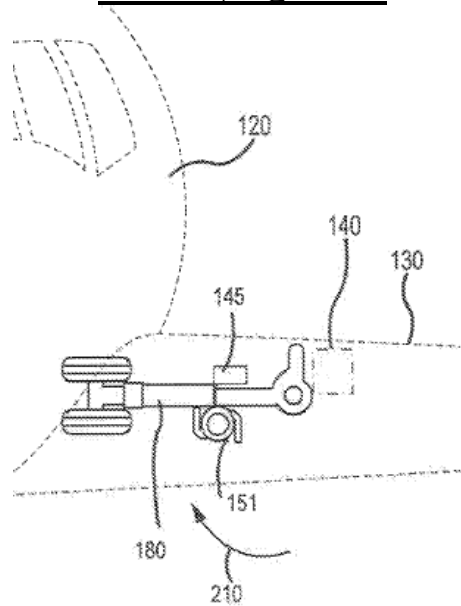
54. A PHOSITA would have recognized that Slanker’s disclosure is directed to a spring assisted landing gear mechanism for a flying apparatus. The main figures of Slanker show it in connection with a more traditional airplane, but a PHOSITA would have appreciated that this disclosure is directed to a mechanism to raise and lower landing gear on many different types of vehicles and aerial vehicles. Partial Figures 2A and 2B from Slanker are shown below to demonstrate the operating position—Figure 2A (below-left) showing the landing gear in a

landing position—and the retracted position—Figure 2B (below-right) showing the landing gear in a stored position.

Slanker, Figure 2A



Slanker, Figure 2B

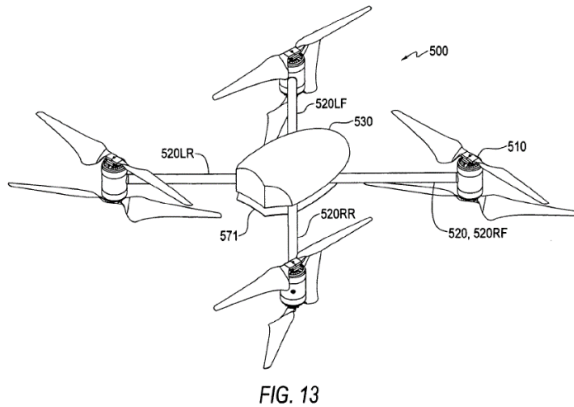


E. Cited Reference – Olm (Ex. 1011)

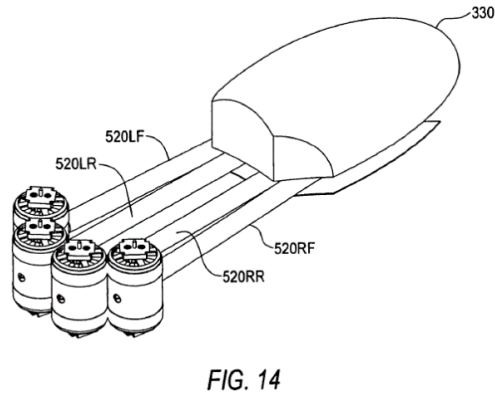
55. U.S. Patent No. 8,052,081 to Olm et al. (“Olm”) has the same listed inventors and assignee as the ’184 patent. It is my understanding that Olm is prior art to the ’184 patent because it was filed and issued well before the Alleged Priority Date of the ’184 patent.

56. Upon review, a PHOSITA would immediately recognize that Olm is directed to the same or similar overall apparatus as the ’184 patent. Olm is directed to a “rotary wing aircraft apparatus [that] includes a body and a rotor pair connected to the body by an arm.” Ex. 1011 at Abstract. Two figures showing part of Olm’s disclosures are shown below.

Olm, Figure 13



Olm, Figure 14



VII. SUMMARY OF MY OPINIONS

57. Having reviewed the '184 patent and the prior art cited above, I have formed the following opinions:

- Independent claim 1 and dependent claim 2 are anticipated by Microdrones (Ground #1)
- Independent claim 1 and dependent claim 2 are rendered obvious by Microdrones (Ground #2)
- Dependent claims 5-6 are rendered obvious by Microdrones in view of Wang (Ground #3)
- Dependent claims 5 and 7 are rendered obvious by Microdrones in view of LotusRC (Ground #4)
- Dependent claim 8 is rendered obvious by Microdrones in view of LotusRC and Slanker (Ground #5)

- Dependent claim 9 is rendered obvious by Microdrones in view of LotusRC and Wang (Ground #6)
- Dependent claim 11 is rendered obvious by Microdrones in view of Olm (Ground #7)

The reasons for my opinions are discussed in further detail below.

VIII. CLAIM CONSTRUCTION

58. I have been informed that claim construction begins with a focus on the words of the claim themselves, as they would have been understood by a person of ordinary skill in the art. It is my understanding that, at the same time, absent some reason to the contrary, claim terms are typically given their ordinary and accustomed meaning as would be understood by a person of ordinary skill in the art. 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.

59. 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.

60. I have followed these principles in my analysis throughout this declaration. I discuss below the meaning of certain claim terms that I have applied in forming my opinions.

A. “lock mechanism” / “clockwise lock mechanism” / “counterclockwise lock mechanism” (Claims 1-4)

61. Independent claim 1 recites that “each rotor assembly compris[es] a rotor blade releasably attached to a driveshaft by a **lock mechanism**,” that “a clockwise rotor blade is releasably attached to the first driveshaft by engagement in a **clockwise lock mechanism**,” and that a “counterclockwise rotor blade is releasably attached to the second driveshaft by engagement in a **counterclockwise lock mechanism**.” Claim 1 also recites that “the **clockwise lock mechanism comprises** a shaft lock portion...and a blade lock portion,” and claim 2 recites that “the **clockwise lock mechanism comprises** a shaft lock portion...and a blade lock portion.”

62. As I briefly discussed above, I believe that construing these terms helps clarify that the recited “lock mechanisms” may include more than one component (and components other than those specifically recited in the claims) to releasably attach the rotor blades. In my opinion nothing in the claims or specification restricts the recited lock mechanisms to consist of only the recited

“shaft lock portion” and “blade lock portion.” Rather, the claims recite that the “[clockwise / counterclockwise] lock mechanism **comprises** a shaft lock portion...and a blade lock portion,” leaving open the possibility that the lock mechanism may include other components that enable releasable attachment of the rotor blades. This belief would be further confirmed by the ’184 patent’s own lock mechanism that also includes at least slot 23 on the shaft lock portion, which help to releasably attach the rotor blades. *See* Ex. 1001 at Fig. 9, 4:1-8.

63. I have been informed that “comprises” is synonymous with includes, contains, or characterized by and is inclusive or open-ended and **does not exclude additional, unrecited elements** or method steps. This information aligns with my opinion that the specification also uses the open-ended term “comprises” when describing components that make-up the clockwise and counterclockwise lock mechanisms. *See* Ex. 1001 at 3:55-62. Thus, a PHOSITA would have understood that the recited “lock mechanism” could potentially include additional components used to releasably attach the blade.

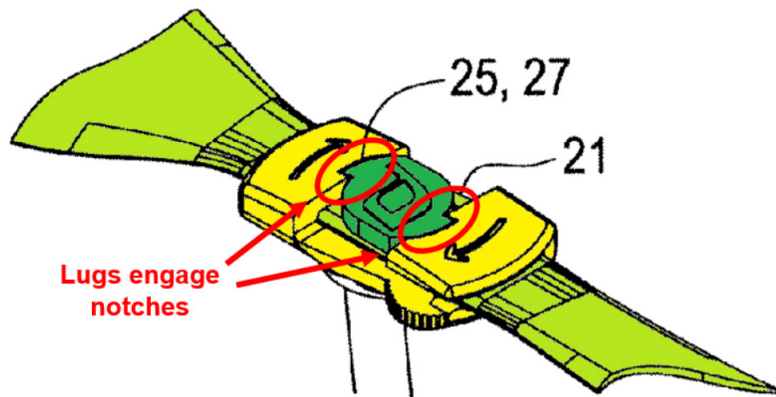
64. This understanding would have been confirmed by the various dictionary definitions of a “mechanism.” *See* Ex. 1013 at 843 (defining “mechanism” as “[t]he arrangement of connected parts in a machine” and a “system of parts that operate or interact like those of a machine”).

65. Therefore, my opinion is that the meaning of “lock mechanism” / “clockwise lock mechanism” and “counterclockwise lock mechanism” is “one or more components that enable a [rotor blade / clockwise rotor blade / counterclockwise rotor blade] to be releasably attach.”

B. “lugs” & “notches” (Claim 1)

66. Claim 1 recites “the shaft lock portion defining **notches** configured to engage corresponding **lugs** on the blade lock portion.”

67. I believe that the construction of these terms is again necessary to clarify their meanings in the mechanical context. The ’184 patent teaches that the blade lock portion (dark green) has “lugs” (25), which are simply projections that engage “notches” (27) on the shaft lock portion (yellow), as shown below:



Ex. 1001 at Fig. 5; *id.* at 4:3-6 (“[L]ugs 25A on the blade lock portion 17A engage notches 27A defined by the shaft lock portion as seen in FIG. 5.”).

68. A PHOSITA would have understood that “lugs” are projections and that these projections could, together with the notches, provide support or a fitting connection. This understanding would be confirmed by the contemporaneous dictionary definitions of the noun “lug.” *See* Ex. 1014 at 1177 (defining “lug” as a “projection or head on a metal part to serve as a cap, handle, support, or fitting connection”); Ex. 1013 at 803 (defining “lug” as “a handle or projection used as a hold or support” and a “projection that helps provide traction”).

69. A PHOSITA would further have understood that “notches” are simply indentations, which, in view of claim 1, would be designed to “engage” the “lugs.” This understanding would also be confirmed by the contemporaneous dictionary definitions of “notch.” *See e.g., e.g.,* Ex. 1020 at 1163 (defining “notch” as “an indentation or incision on an edge or surface”).

70. Therefore, in my opinion, “lugs” are “projections” and “notches” are “indentations.” These constructions comport with the usage of these terms in the ’184 patent, where the “the shaft lock portion defin[es] **notches [(i.e., indentations)]** to engage corresponding **lugs [(i.e., projections)]** on the blade lock portion.”

C. “drive” (Claim 1)

71. Claim 1 recites “a **drive** rotating the driveshaft.” A construction to clarify the meaning of “drive” is advantageous here. Upon my review as to what a

“drive” may be in the ’184 patent, I found that it is “typically **an electric motor**, rotating the driveshaft.” Ex. 1001 at 3:20-21. As claim 1 recites “a drive,” not just “an electric motor,” a PHOSITA would have understood the term “drive” to include, but not be limited to, an electric motor. Instead, a PHOSITA would have understood “a drive” to be any component that can impart a force to cause motion.

72. This understanding would be confirmed by the contemporaneous dictionary definitions of the term “drive.” *See* Ex. 1012 at 384 (defining “drive” as “to impart a forward motion to by physical force”); Ex. 1014 at 616 (defining “drive” as “[t]he means by which a machine is given motion or power..., or by which power is transferred from one part of a machine to another (as in gear drive, belt drive”).

73. Therefore, in my opinion, a “drive” is a “component that imparts motion.”

IX. ANTICIPATION

74. 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.

X. OBVIOUSNESS

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

76. 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 PHOSITA before the effective filing date of the patent (which in these proceedings I am assuming to be May 15, 2013).

77. 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.

78. 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 PHOSITA would have considered when trying to solve the problem that is addressed by the invention.

79. 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 PHOSITA 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.

80. 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 and that "obvious to try" is not sufficient in unpredictable technologies. I also understand that it is impermissible to find obviousness based on hindsight

reasoning, and must be found only by considering what was known at the time of the patent’s effective filing date.

XI. GROUND #1: MICRODRONES ANTICIPATES CLAIMS 1-2

81. As I will show below, in my opinion claims 1 and 2 are fully disclosed and anticipated by Microdrones.

A. Claim 1

1. “A rotary wing aircraft apparatus comprising:”

82. I have been informed that a preamble of a claim is generally not limiting. However, to the extent the preamble is limiting, I believe Microdrones discloses a rotary wing aircraft. A PHOSITA would readily recognize that the UAV disclosed by Microdrones—the md4-200—is a rotary wing aircraft.

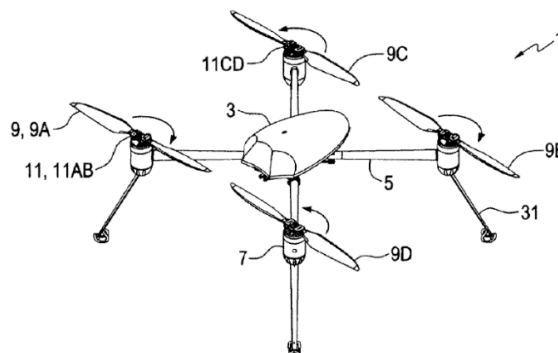
Microdrones, Figure 18

’184 patent, Figure 1

2.1.2 The md4-200



figure 18: md4-200, ready for take off



Ex. 1004, Figure 18. This understanding is further confirmed by some of the language in Microdrones, such as: “[t]he md4-200 operates four rotors” and that

“[w]hile hovering, the rotors, all have the [rotational] same speed level.” *Id.* at 7,

27. These quotes confirm that Microdrones discloses a rotary wing structure and a UAV aircraft that can generate lift.

83. Therefore, in my opinion, Microdrones discloses a “rotary wing aircraft” as recited in the preamble.

2. “a body;”

84. A PHOSITA would have understood that Microdrones’ disclosed rotary wing aircraft has “a body.” This understanding would be confirmed by Microdrones, which specifically refers to the md4-200 “drone’s body.” *See* Ex. 1004 at 48 (“The GPS antenna is an integral part of the upper dome of the **drone’s body**.”). In fact, as shown by the side-by-side figures, below, a PHOSITA would have appreciated that Microdrones’ body is highly similar to the body (3) of the aircraft described and claimed in the ’184 patent:

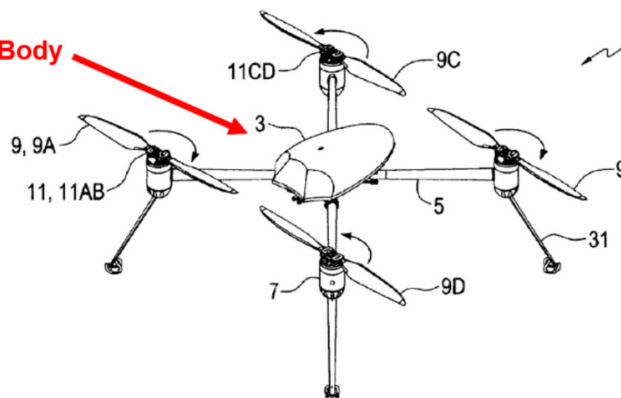
Microdrones, Figure 18

2.1.2 The md4-200



figure 18: md4-200, ready for take off

'184 patent, Figure 1



85. Therefore, in my opinion, Microdrones discloses “a body.”

3. “a plurality of arms extending laterally from the body;”

86. A PHOSITA would have appreciated that, as shown by the side-by-side figures, below, and just like the '184 patent, Microdrones discloses an aircraft having a plurality of arms that extend laterally from the body:

Microdrones, Figure 18

'184 patent, Figure 1

2.1.2 The md4-200

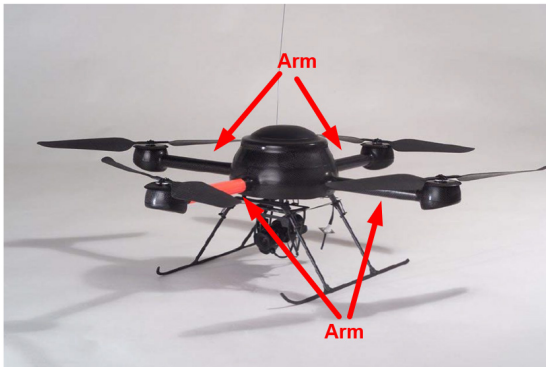
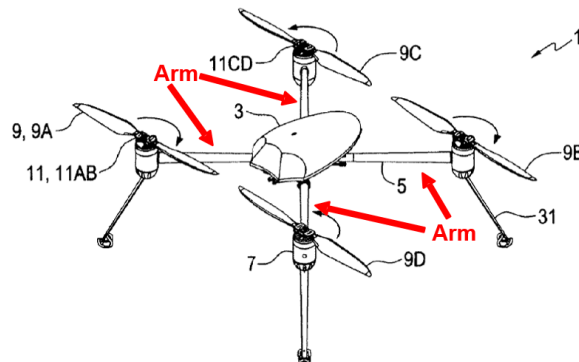


figure 18: md4-200, ready for take off



87. Therefore, in my opinion, Microdrones discloses “a plurality of arms extending laterally from the body.”

4. “a rotor assembly attached to an outside end of each arm;”

88. A PHOSITA would have recognized that Microdrones discloses this limitation. In addition to coming to this understanding by reviewing the figures of Microdrones, a PHOSITA would also come to this understanding as Microdrones discloses that “the md4-200 operates **four rotors**...” Ex. 1004 at 27. As seen in

the side-by-side figures, below, like the '184 patent, Microdrones' “four rotors” are part of a rotor assembly that is attached to the outside end of each arm:

Microdrones, Figure 18

'184 patent, Figure 1

2.1.2 The md4-200

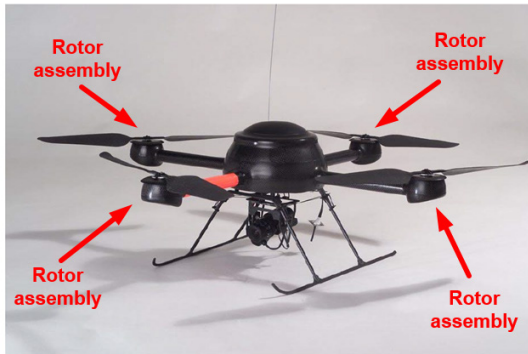
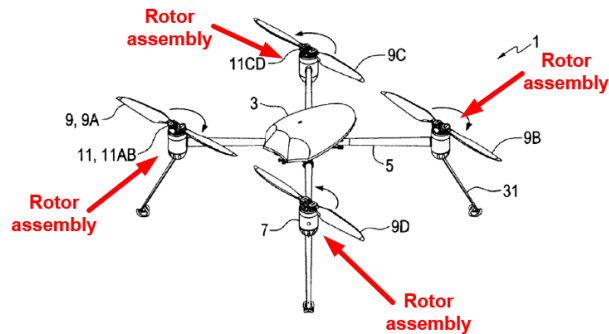


figure 18: md4-200, ready for take off



89. Therefore, in my opinion, Microdrones discloses “a rotor assembly attached to an outside end of each arm.”

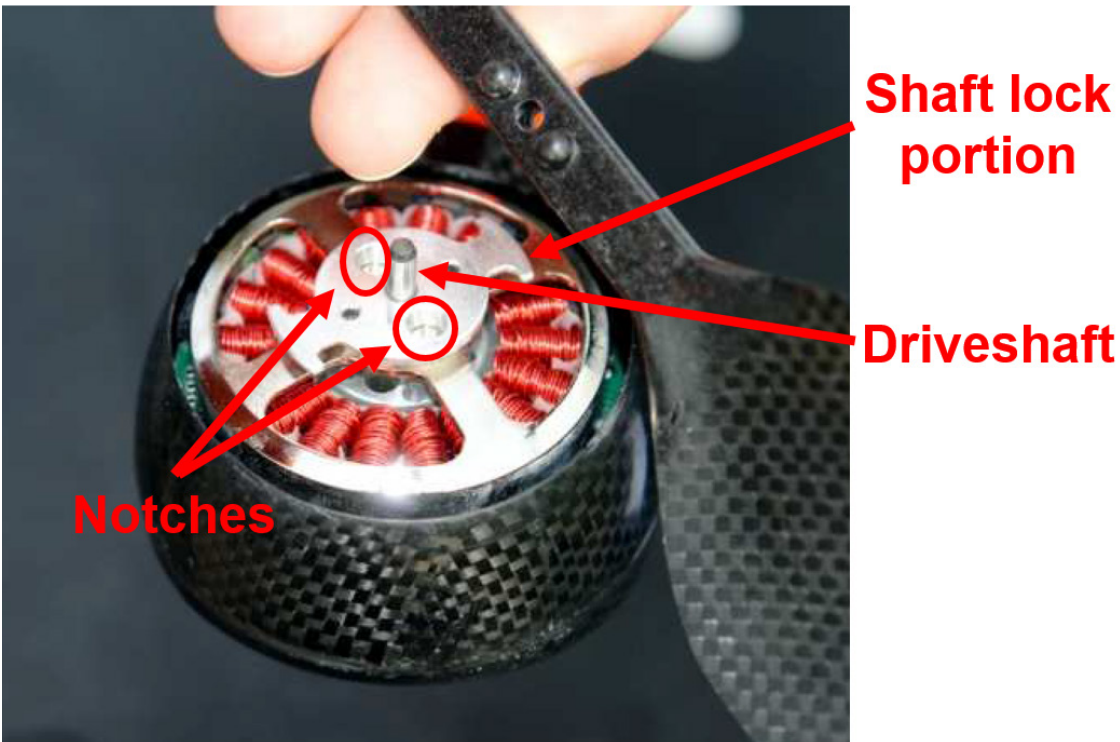
5. “each rotor assembly comprising a rotor blade releasably attached to a driveshaft by a lock mechanism, and a drive rotating the driveshaft;”

90. A PHOSITA would have recognized that Microdrones discloses this limitation. As I discussed above, the term “lock mechanism” means “one or more components that enable a rotor blade to be releasably attached,” and a “drive” means a “component that imparts motion.”

91. A PHOSITA would have appreciated that Microdrones discloses rotor assemblies each having a rotor blade releasably attached to the driveshaft by a lock mechanism (*i.e.*, one or more components that enable a rotor blade to be releasably

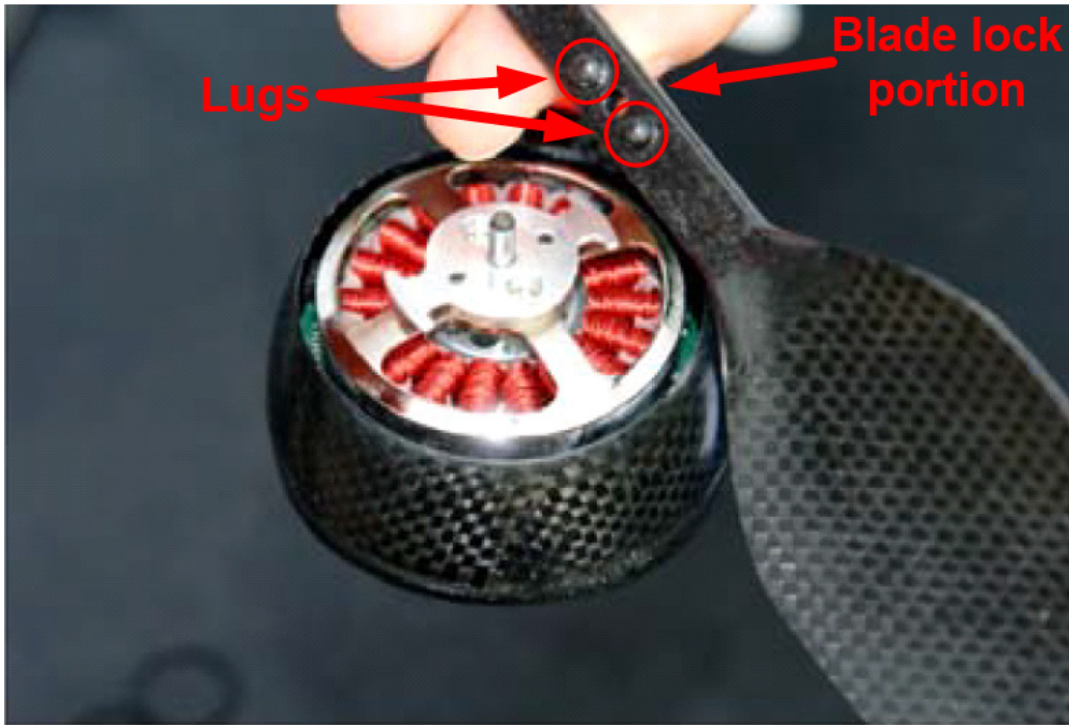
attached). *See* Ex. 1004 at 27 (“Assembling the Rotors”). A PHOSITA would further appreciate that Microdrones’ lock mechanism includes three (3) main elements, *i.e.*, (1) a shaft lock portion with notches for receiving the lugs (which, in my opinion, is just like the one in the ’184 patent), (2) a blade lock portion with projecting lugs (which, in my opinion, is also just like the one in the ’184 patent), and (3) two rubber O-rings that loop over the center bar of the rotor blade.

92. *First*, as shown below, a PHOSITA would have recognized that Microdrones discloses a lock mechanism comprising a “**rotor mounting plate**” (which corresponds to the **shaft lock portion** recited in the claims of the ’184 patent) attached to the **driveshaft** and having “**holds**” (*i.e.*, indentations) (which correspond to the **notches** recited in the claims of the ’184 patent) that are designed to receive the knobs (*i.e.*, the claimed lugs) of the rotor blade. *See id.* at 27.



93. *Second*, as shown below, a PHOSITA would have understood that Microdrones' lock mechanism further comprises a **blade lock portion** attached to the **rotor blade** and having **knobs/projections**. As I described above, the “lugs” recited in the claims of the '184 patent are equivalent to “projections.” The knobs on the blade lock portion of Microdrones' rotor blade² are clearly projections that extend outward from the rotor blade. Therefore, in my opinion, these knobs correspond to the claimed lugs.

² A PHOSITA would understand that Microdrones “rotors” refer and correspond to rotor blades.

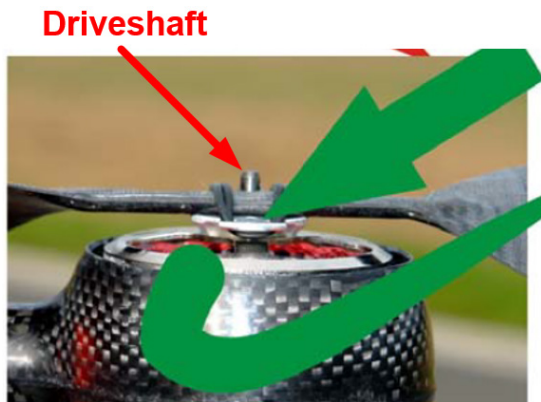


94. A PHOSITA would have understood that Microdrones also explains that the knobs/projections (*i.e.*, claimed lugs) on the rotor blades engage the notches in the rotor mounting plate (*i.e.*, shaft lock portion). *See* Ex. 1004 at 27. A PHOSITA would have recognized that the '184 patent does not teach or require the lugs and notches to actually releasably attach the rotor blades to the driveshafts (rather, slots 23 shown in Figs. 4-10 of the '184 patent prevent the blades from detaching from the driveshafts in the vertical direction). A PHOSITA would have appreciated, however, that Microdrones nevertheless discloses that there is a tight fit between Microdrones' lugs and notches, which enables a secure fit between the blade and rotor mounting plate attached to the driveshaft. *See id.* at 27 ("Each

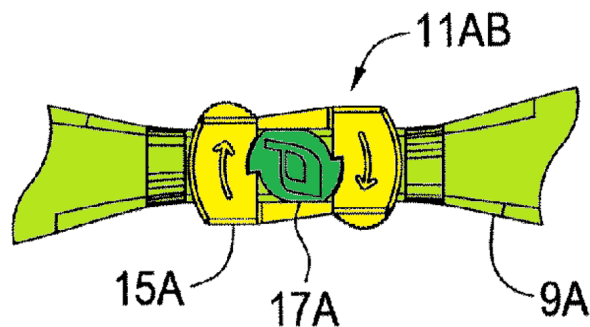
rotor has two knobs on its bottom of the centre bar which are matched by two holds in the rotor mounting plate.”), 27 (explaining knobs may need to be filed for “correct fitting” in the notches and “to make the rotors fit nicely”). This further confirms my belief that the knobs correspond to the claimed lugs, as they serve the same or similar purpose (*i.e.*, among other things, to engage the notches) as the lugs in the ’184 patent.

95. *Lastly*, as shown below, a PHOSITA would have appreciated that Microdrones’ lock mechanism further comprises two rubber O-rings and, in my opinion similar to the ’184 patent. This lock mechanism enables the rotor blade to be releasably attached to the driveshaft:

Microdrones, Fig. 25³



’184 Patent, Fig. 10



96. Figure 25 of Microdrones includes multiple depictions relevant to the attachment of the rotor blade to the rotor mounting plate. It is clear that the rotor

³ Green arrow and checkmark in original; red annotations added.

blade (as shown at least in the final figure of Figure 25 (above-left)) is the counterclockwise rotor blade, and therefore that the lock mechanism depicted is the counterclockwise lock mechanism. I can tell that the depicted rotor blade is the counterclockwise rotor blade because of the twist of the propeller (*i.e.*, the propeller pitch). *See* Ex. 1004 at 27, Fig. 25. The leading edge of the propeller in this system is the edge that is vertically higher than the other corresponding edge. The leading edge of the depicted propeller is oriented such that, to generate lift, the propeller is rotated in the counterclockwise direction.

97. A PHOSITA would have recognized that Microdrones' rotor blades are attached to the driveshafts. As can be seen in the figure above, a PHOSITA would know that the small rod that projects through the center of the mounting plate and through the rotor blade is a driveshaft that protrudes from the motor. Microdrones' attachment system securely fits the rotor blade to the drive shaft at least through the "two knobs on [each rotor's] bottom of the centre bar which are matched by two holds in the rotor mounting plate" and using the two rubber O-rings. *Id.* at 27. A PHOSITA would have appreciated that the combination of the knobs (*i.e.*, lugs), holds (*i.e.*, notches), and O-rings together lock each blade to its corresponding driveshaft. A PHOSITA would further appreciate that Microdrones' rotor blades may then be released by removing the rubber O-rings and disengaging the projecting lugs from the notches on the rotor mounting plate.

98. I further note that, as shown in each of the above images of

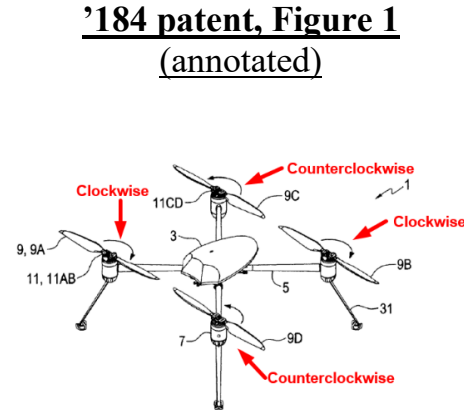
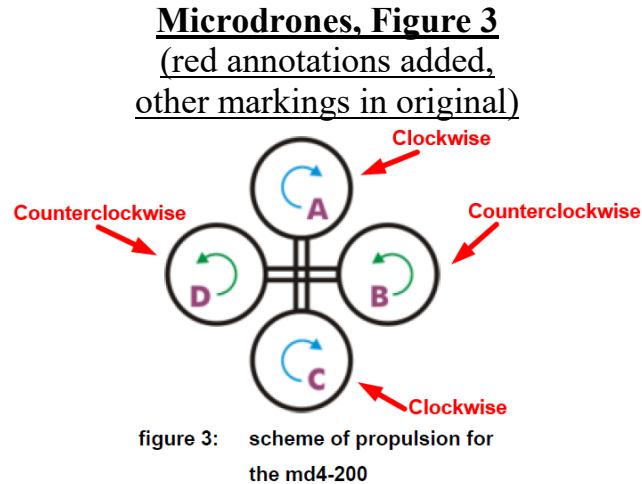
Microdrones, the driveshaft is part of or at least attached to the motor unit, which is a “component that imparts motion” by rotating the driveshafts and thus constitutes a “drive.” *See id.* at 7, Fig. 3 (showing “scheme of propulsion” for rotating rotors), 9, Fig. 5 (showing motor unit with driveshaft), 27 (“The md4–200 operates four rotors, two of which turn clockwise and the other two counter clockwise.”).

99. As such, in my opinion, Microdrones discloses “each rotor assembly comprising a rotor blade [*e.g.*, Microdrones’ rotor blades] releasably attached to a driveshaft [*e.g.*, Microdrones’ driveshaft] by a lock mechanism [*e.g.*, Microdrones’ mounting plate having notches, a blade lock portion having lugs, and two rubber O-rings], and a drive [*e.g.*, motor unit] rotating the driveshaft.”

6. “wherein a first driveshaft rotates in a clockwise direction and a second driveshaft rotates in a counterclockwise direction;”

100. In my opinion, Microdrones discloses this limitation. As I discussed with respect to the previous element, Microdrones discloses four rotor assemblies, each of which has a motor driving a driveshaft. *See* Ex. 1004 at 27-28 and Fig. 25 (showing driveshaft attached to motor of rotor assembly). As shown in the side-by-side figures below, and in my opinion just like the ’184 patent, a PHOSITA would have appreciated that Microdrones discloses two clockwise driveshafts,

which rotate two blades clockwise, and two counterclockwise driveshafts, which rotate the other two blades counterclockwise:



101. In the '184 patent Figure 1 (above-right), rotors 9A and 9B are rotated by clockwise-rotating driveshafts, and rotors 9C and 9D are rotated by counterclockwise-rotating driveshafts. *See* Ex. 1001 at 1:18-19, 3:32-36. This is clearly denoted by the small rotation arrows near each of the four rotor assemblies. A PHOSITA would have recognized that, just like the '184 patent, Figure 3 of Microdrones (above-left) shows that rotors A and C are rotated by clockwise-rotating driveshafts, and rotors B and D are rotated by counterclockwise-rotating driveshafts. This understanding would be confirmed by Microdrones, which states: “The md4–200 operates four rotors, two of which turn clockwise and the other two counter clockwise.” Ex. 1004 at 7-8, 27.

102. Therefore, in my opinion, Microdrones discloses “a first driveshaft rotates in a clockwise direction and a second driveshaft rotates in a counterclockwise direction.”

7. **“wherein a clockwise rotor blade is releasably attached to the first driveshaft by engagement in a clockwise lock mechanism and generates a vertical lift force when rotated in the clockwise direction, and a counterclockwise rotor blade is releasably attached to the second driveshaft by engagement in a counterclockwise lock mechanism and generates a vertical lift force when rotated in the counterclockwise direction;”**

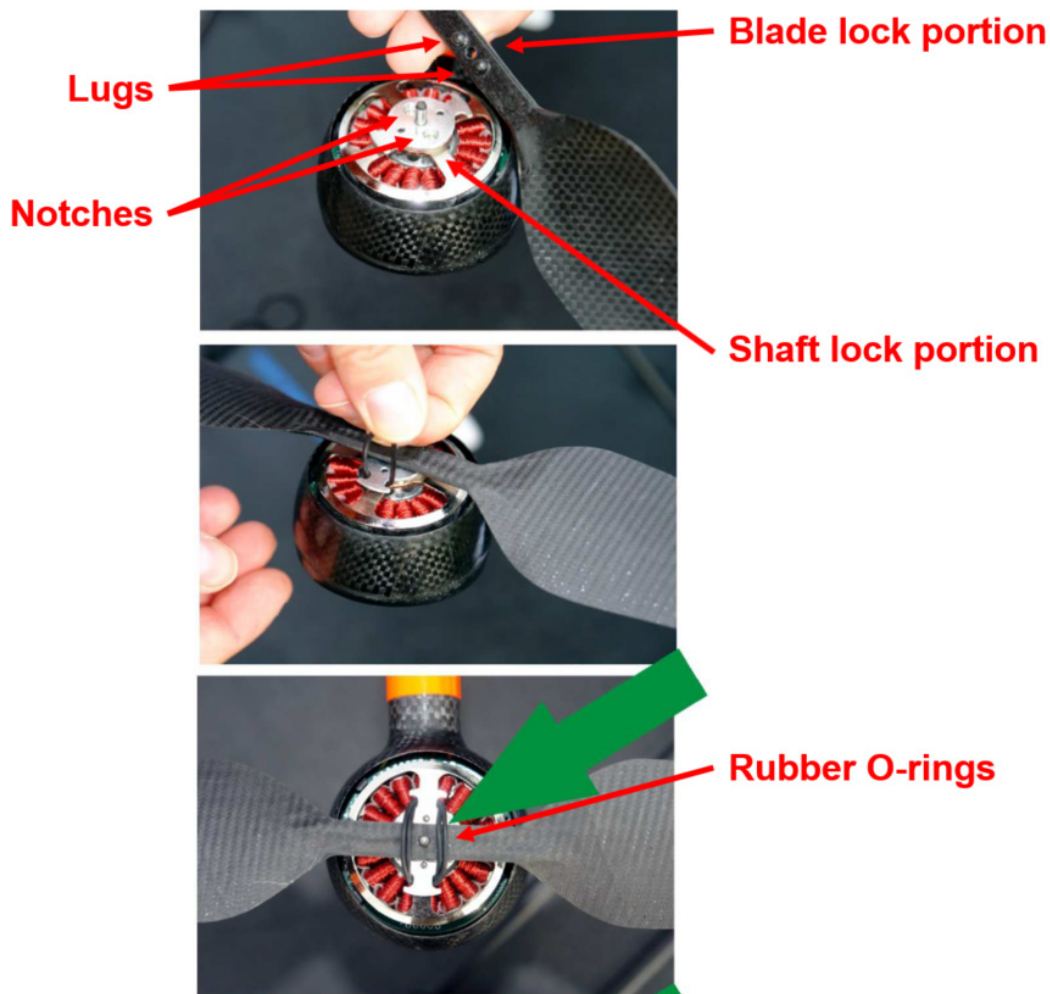
103. In my opinion, Microdrones discloses this limitation. As I discussed above, the term “[clockwise / counterclockwise] lock mechanism” means “one or more components that enable a [clockwise rotor blade / counterclockwise] rotor blade to be releasably attached.”

104. As I also discussed above, each rotor assembly disclosed in Microdrones includes a “lock mechanism” that enables the rotor blade to be releasably attached to the driveshaft. *See* Ex. 1004 at 7-8, 27. Moreover, as I will explain below, a PHOSITA would have recognized that Microdrones discloses lock mechanisms that are keyed to either the clockwise blade or the counterclockwise blade, so as to prevent the clockwise blade from being attached to the counterclockwise driveshaft, and vice versa. As such, in my opinion, Microdrones discloses a “clockwise lock mechanism” for releasably attaching the

clockwise blades, and also discloses a “counterclockwise lock mechanism” for releasably attaching the counterclockwise blades.

105. Microdrones contains close-up photographs of the disclosed counterclockwise lock mechanism, which a PHOSITA would have recognized includes the lock mechanism components identified below used to releasably attach the counterclockwise blade:

Microdrones, Figure 25



Ex. 1004 at Fig. 25 (green arrow in original). As I stated above, the leading edge of the depicted propeller is oriented such that, to generate lift, the propeller should be rotated in the counterclockwise direction. Therefore, a PHOSITA would have recognized that the above figures depict the counterclockwise rotor blade and counterclockwise rotor mounting plate.

106. As shown above, a PHOSITA would have appreciated that the components that enable the counterclockwise blade to be releasably attached to the driveshaft include, at least, the portion of the blade's center bar having two projecting knobs or lugs (which corresponds to a "blade lock portion," discussed below), the rotor mounting plate having two matching holds or notches (which corresponds to the "shaft lock portion," discussed below), and the two rubber O-rings. The language of Microdrones confirms this understanding. *See id.* at 27 (explaining "[e]ach rotor has two knobs [*e.g.*, lugs] on its bottom of the centre bar [*e.g.*, blade lock portion] which are matched by two holds [*e.g.*, notches] in the rotor mounting plate [*e.g.*, shaft lock portion]" and that "[t]he rotors are secured by two O-rings of rubber").

107. Microdrones does not include the close up pictures shown above for both the clockwise and counterclockwise rotor blades. But Microdrones sufficiently explains how the clockwise rotor blades would be configured to enable a PHOSITA to make and use them. For example, it contains up-close photographs

of the counterclockwise rotor blades and lock mechanism, and explains that the clockwise rotor blades and lock mechanism are different in terms of the distance between the lugs and the notches. A PHOSITA would have understood that the same set of components that make up the counterclockwise lock mechanism (shown above), would be the same for the clockwise lock mechanism, which releasably attaches the clockwise blades to the clockwise-rotating driveshafts. *See id.* at 27 (explaining “[e]ach rotor” has lugs which engage notches on the rotor mounting plate and “[t]he rotors are secured by two O-rings of rubber”), 22 and Fig. 18 (showing md4-200 with clockwise and counterclockwise rotors releasably attached). A PHOSITA would have appreciated that the clockwise lock mechanism differs, however, in that the distance between the lugs on the center bar of the blade and the matching notches on the rotor mounting plate is unique and different from the distance between these components of the counterclockwise lock mechanism. This understanding is confirmed by the Microdrones’ clear disclosure that “[t]o avoid accidental misplacement, **both directions of turning use individual distances between these knobs.**” *See id.* at 27. As I will discuss more below, a PHOSITA would have appreciated that this difference between the clockwise and counterclockwise lock mechanisms is what *keys* the correct blade to the correct driveshaft, so as to prevent the clockwise blade from being attached to the counterclockwise driveshaft, and vice versa. Therefore, in my opinion

Microdrones expressly describes, or at the very least inherently discloses, a clockwise lock mechanism for the clockwise rotor blades that meets the requirements of claim 1.

108. A PHOSITA would further appreciate that once each of Microdrones' disclosed rotor blades is releasably attached in place, each generates vertical lift when rotated (*i.e.*, the clockwise blade generates a vertical lift force when rotated in the clockwise direction, and the counterclockwise blade generates a vertical lift force when rotated in the counterclockwise direction). *See* Ex. 1004 at Fig. 3 (showing “scheme of propulsion” relying on clockwise and counterclockwise-rotating rotors), 7 (explaining “climbing” requires “adjust[ing] the speed level and thrust of all rotors simultaneously”), 8 (“To climb (>>Pitch<<) all motors are accelerated identically....”), 22 (figure 18 md4-200 with clockwise and counterclockwise rotors being “ready for takeoff”).

109. Therefore, in my opinion, Microdrones discloses “wherein a clockwise rotor blade [*e.g.*, Microdrones' blade] is releasably attached to the first driveshaft [*e.g.*, Microdrones' driveshaft] by engagement in a clockwise lock mechanism [*e.g.*, center bar with lugs on clockwise blade, matching notches on clockwise rotor mounting plate, and rubber O-rings] and generates a vertical lift force when rotated in the clockwise direction, and a counterclockwise rotor blade is releasably attached to the second driveshaft by engagement in a

counterclockwise lock mechanism [*e.g.*, center bar with lugs on counterclockwise blade, matching notches on counter clockwise rotor mounting plate, and rubber O-rings] and generates a vertical lift force when rotated in the counterclockwise direction.”

8. **“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;”**

110. In my opinion, Microdrones discloses this limitation. As I discussed above, Microdrones discloses clockwise rotor blades that have projecting knobs spaced apart by a certain “individual” (*i.e.*, unique) distance and matching equally-spaced apart notches on the clockwise rotor mounting plate, while the counterclockwise rotor blades have projecting knobs spaced apart by a *different* “**individual**” distance and matching equally-spaced apart notches on the counterclockwise rotor mounting plate. *See also* Ex. 1004 at 27 (“Each rotor has **two knobs** [*i.e.*, lugs] on its bottom of the centre bar which are **matched by two holds** [*i.e.*, notches] in the rotor mounting plate. To avoid accidental misplacement, both directions of turning use **individual distances** between these knobs.”).

111. In my opinion, Microdrones’ discussion of this feature explains that the clockwise lock mechanism cannot engage the counterclockwise lock

mechanism, and vice-versa. This is based at least in part on Microdrones' specific disclosure that the different distances of the knobs on the blade lock portions is designed to prevent "accidental misplacement" of the rotor blades. *Id.*

112. Indeed, because the knobs on the clockwise blades are spaced apart by a unique distance that matches the positions of the notches on the clockwise rotor mounting plate but **not** the notches on the counterclockwise rotor mounting plate, the clockwise blades are keyed to be engageable only with the clockwise lock mechanism and not with its counterclockwise lock mechanism. Likewise, because the knobs on the counterclockwise blades are spaced apart by a unique distance that matches the positions of the notches on the counterclockwise rotor mounting plate but **not** the notches on the clockwise rotor mounting plate, the counterclockwise blades are keyed to be engageable only with the counterclockwise lock mechanism and not with its clockwise lock mechanism.

113. A PHOSITA would have appreciated that Microdrones emphasizes that the rotor blade is not engaged unless the notches on the rotor mounting plate fully receive the knobs (*i.e.*, lugs) on the blade. In my opinion, for example, as shown in Figure 25, below, Microdrones teaches that the counterclockwise rotor blade is not engaged in the case where its lugs are not fully received by corresponding notches (*see* top image with red "X" through it), but that the

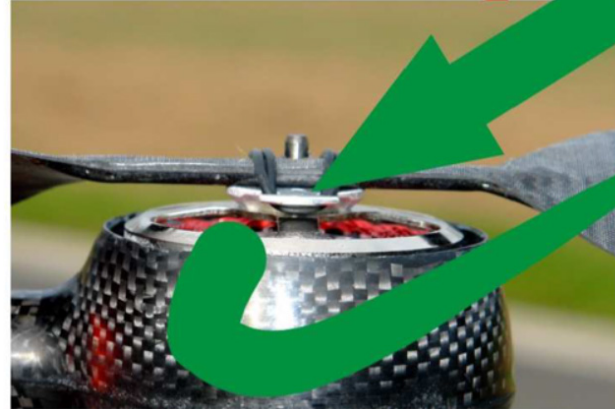
counterclockwise blade is engaged when its lugs are fully received by the corresponding notches (see bottom image with green checkmark):

Microdrones, Figure 25

**Not
Engaged**



Engaged



Ex. 1004 at Fig. 25 (large red “X,” green arrows, and green checkmark in original).

Therefore, a PHOSITA would have understood that Microdrones discloses that the lugs on the rotor blades can only be engaged by a lock mechanism that has corresponding notches the same distance apart as the lugs on the rotor blade, and, thus, can fully receive the blade’s lugs.

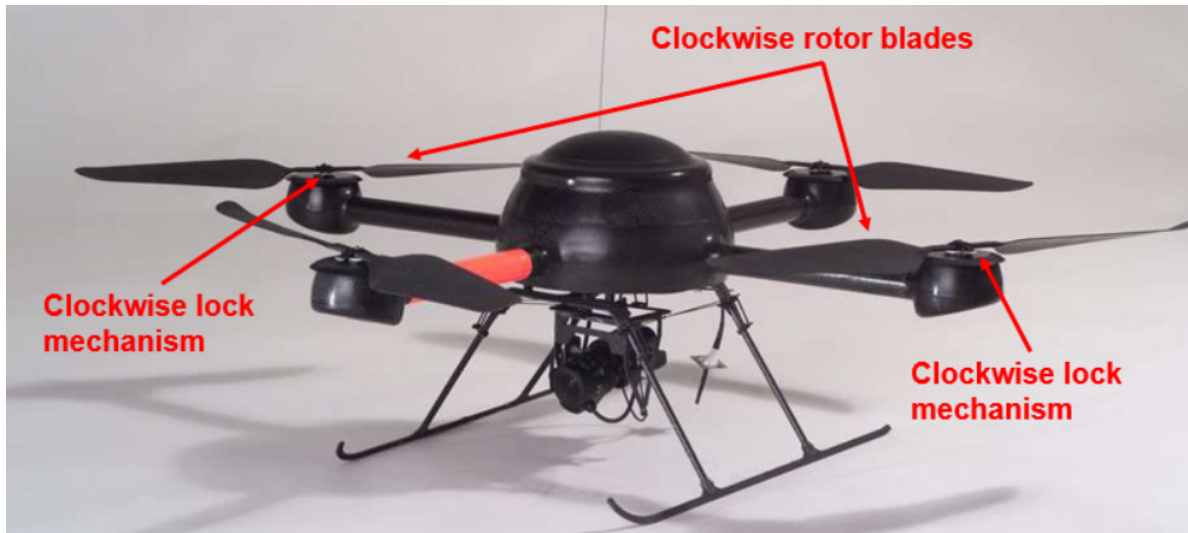
114. As such, in my opinion, Microdrones discloses “the clockwise rotor blade is engageable only with the clockwise lock mechanism and cannot be

engaged in the counterclockwise lock mechanism [e.g., because the clockwise blade has lugs specifically positioned to match the positions of the notches on the clockwise rotor mounting plate which constitutes part of the clockwise lock mechanism], and the counterclockwise rotor blade is engageable only with the counterclockwise lock mechanism and cannot be engaged in the clockwise lock mechanism [e.g., because the counterclockwise blade has lugs specifically positioned to match the positions of the notches on the counterclockwise rotor mounting plate which constitutes part of the counterclockwise lock mechanism].”

9. **“wherein the clockwise lock mechanism comprises a shaft lock portion attached to the first driveshaft and a blade lock portion attached to the clockwise rotor blade, the shaft lock portion defining notches configured to engage corresponding lugs on the blade lock portion.”**

115. In my opinion, Microdrones discloses this limitation. The claim construction of “[clockwise/counterclockwise] lock mechanism” as I discussed and applied above in connection with my earlier discussion of this element. As I also discussed above, “lugs” are “projections,” and “notches” are “indentations.”

116. As I discussed above, a PHOSITA would have appreciated that Microdrones discloses clockwise lock mechanisms configured to releasably attach the clockwise blades. The clockwise lock mechanisms for the clockwise blades are shown in the below image:



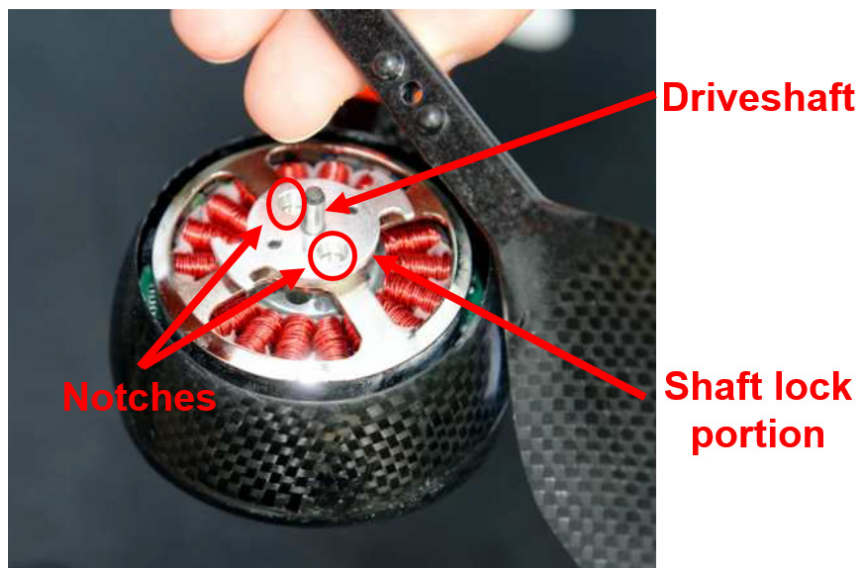
Ex. 1004 at Fig. 18.

117. A PHOSITA would have recognized that Microdrones' clockwise lock mechanisms each include a "rotor mounting plate," which corresponds to the claimed "shaft lock portion," and a portion of the clockwise rotor blade's center bar having projecting "knobs" (*i.e.*, lugs), which corresponds to the claimed "blade lock portion." The rotor mounting plates are the silver-colored, plate-shaped component (shown in part in the image below) attached to the driveshafts. Ex. 1004 at Fig. 25. A PHOSITA would have appreciated that each rotor mounting plate has two "holds" (*i.e.*, notches) for receiving matching "knobs" (*i.e.*, lugs) on the center bar of the rotors. *Id.* at 27 ("Each rotor has two knobs on its bottom of the centre bar which are matched by two holds in the rotor mounting plate."). In my opinion, it is clear that the engagement of these lugs and notches serves to

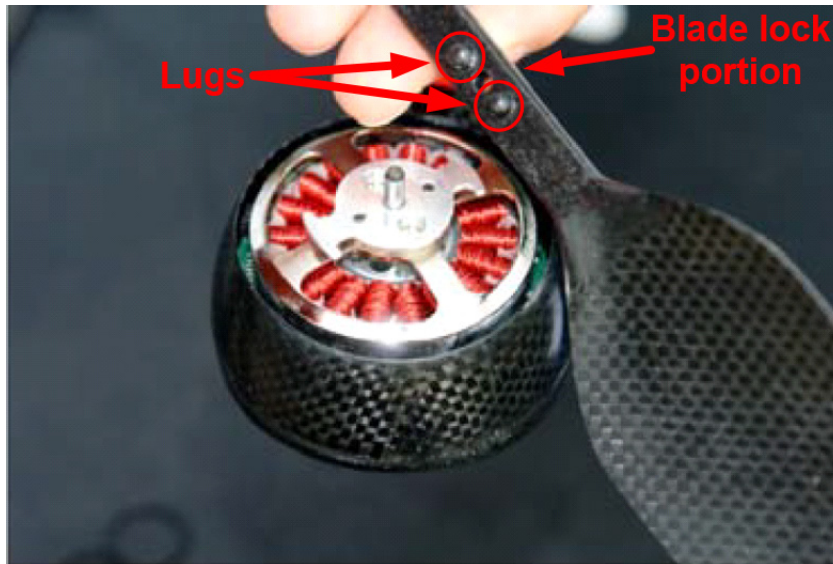
position and hold Microdrones' rotor blade in place on the rotor mounting plate.

Id.

118. As can be seen below, Microdrones discloses close-up images of a rotor mounting plate having notches (*i.e.*, shaft lock portion) and a portion of the blade's center part having projecting knobs (*i.e.*, blade lock portion) configured to attach counterclockwise rotors. *See id.* at 27, Fig. 25. A PHOSITA would have appreciated that the only difference between the portions shown in the images (for the **counterclockwise** rotor attachment) and the portions used to attach the **clockwise** rotors is the distance **between the notches** in the rotor mounting plate and the distance between the corresponding **distance between knobs on the blades**. *See id.* at 27. Again, this understanding would be confirmed by the Microdrones' disclosure that "[t]o avoid accidental misplacement, both directions of turning use individual distances between the knobs." *See id.*, *see also id.* at Figs. 18 and 25. As shown below, a PHOSITA would have understood that Microdrones' rotor mounting plate (*i.e.*, shaft lock portion) is attached to the driveshaft and has two holds (*i.e.*, notches or indentations):

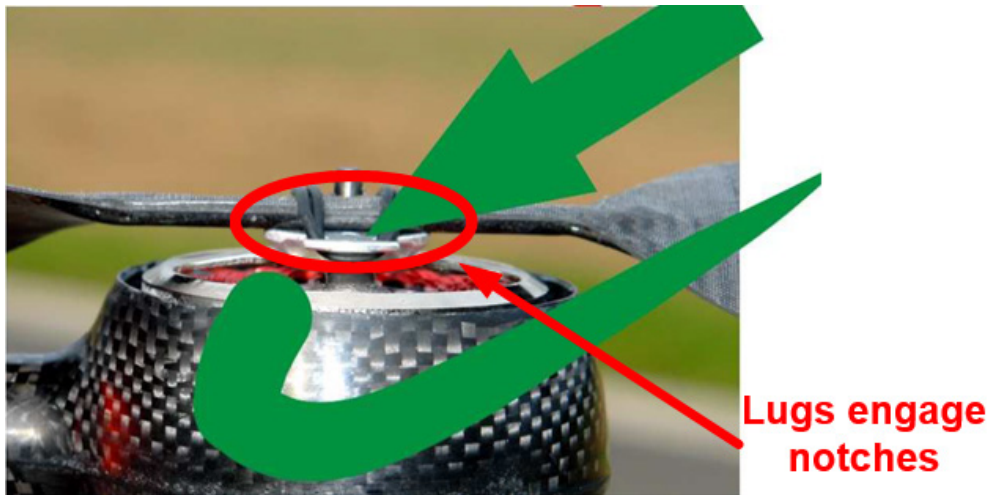


119. A PHOSITA would further recognize that the portion of the Microdrones blade's center bar having projecting knobs corresponds to the claimed blade lock portion and the lugs thereon, as shown below:



120. In my opinion, the portion of Microdrones' rotor blade's center bar having projecting knobs is part of and thus attached to the rotor blade, similar to how the blade lock portion and lugs thereon are shown to be part of and attached to the rotor blade disclosed in the '184 patent. *See* Ex. 1001 at Fig. 6.

121. I further note that, as shown below, the knobs (*i.e.*, lugs) projecting from the center bar portion of Microdrones' rotor blades engage with the matching notches in the rotor mounting plate to form a fitting connection:



122. A PHOSITA would have recognized that this is similar to how the lugs of the blade lock portion engage and fit with the notches of the shaft lock portion in the embodiment described in the '184 patent. *See* Ex. 1001 at Fig. 5.

123. Because the center bar portions of Microdrones' clockwise and counterclockwise blades have projecting knobs that engage with matching (*i.e.*, corresponding sized) notches in the rotor mounting plate, a PHOSITA would have appreciated that these portions help to attach, support, fit, and position (*i.e.*, lock) each rotor blade to the correct rotor mounting plate and thus to the driveshaft. Therefore, it is my opinion that at least Microdrones' clockwise rotor blade's **center bar portion having projecting knobs** corresponds to a **blade lock portion** of the clockwise lock mechanism, and the **rotor mounting plate**, which has

notches and is attached to the driveshaft, corresponds to the **shaft lock portion** of the clockwise lock mechanism.

124. It is further my opinion that the knobs that project from the Microdrones clockwise blade's center bar constitute "lugs" on the blade lock portion. These lugs help support and lock the rotor blade on the rotor mounting plate. In fact, a PHOSITA would have appreciated that because the knobs (*i.e.*, lugs) engage matching holds (*i.e.*, notches) in the rotor mounting plate, which is attached to the driveshaft and rotates when the motors are activated, the knobs on Microdrones' rotor blades not only help hold the blades in the correct position, but also help transfer rotational force from the rotating driveshaft to the blades during operation and flight.

125. Overall, a PHOSITA would have appreciated that the elements of Microdrones' lock mechanism are similar to the elements of the '184 patent's lock mechanism. *First*, for proper alignment, releasable attachment, and locking of the rotor blades with the driveshafts, a PHOSITA would have recognized both Microdrones and the '184 patent disclose lugs on a blade lock portion that fit with and engage with corresponding notches on a shaft lock portion (Microdrones' rotor mounting plate). *Second*, the PHOSITA would have recognized that Microdrones' and the '184 patent have clockwise lock mechanisms with lugs and notches that have different configurations from those on the counterclockwise lock mechanism

to ensure that the proper rotors are correctly keyed to their corresponding drive shaft. *Third*, the PHOSITA would have recognized that the lugs and notches of both the '184 patent and Microdrones do not, however, provide much vertical locking force to prevent the blades from detaching in the vertical direction during operation. *Therefore*, the PHOSITA would have understood and concluded that, to provide sufficient vertical locking force, the '184 patent uses slots 23 (into which the blades are slid and secured); and Microdrones uses O-rings (under which the blades are located and secured to the mounting plate).

126. As such, in my opinion, Microdrones discloses “the clockwise lock mechanism comprises a shaft lock portion [*e.g.*, rotor mounting plate] attached to the first driveshaft and a blade lock portion [*e.g.*, portion of blade’s center bar having projecting knobs] attached to the clockwise rotor blade, the shaft lock portion [*e.g.*, rotor mounting plate] defining notches [*e.g.*, holds] configured to engage corresponding lugs [*e.g.*, knobs] on the blade lock portion [*e.g.*, portion of blade’s center bar having projecting knobs].”

B. Claim 2

127. Claim 2 depends from claim 1. As I discussed above, all the limitations of claim 1 are disclosed by Microdrones. Claim 2 further recites “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, the blade lock portion comprising **lugs with a configuration that is different than a configuration of the lugs on the blade lock portion of the clockwise lock mechanism.**”

128. As I discussed above, a PHOSITA would have appreciated that Microdrones discloses that both the clockwise and counterclockwise blades have a center bar portion with projecting knobs (*i.e.*, lugs) that engage matching notches in the rotor mounting plate, and that this portion helps to attach and secure (*i.e.*, lock) each rotor blade to the rotor mounting plate, and thus to the driveshaft. Therefore, a PHOSITA would have understood that at least Microdrones’ counterclockwise blade’s center bar portion having projecting knobs corresponds to a blade lock portion of the counterclockwise lock mechanism, and the rotor mounting plate, which has notches and is attached to the driveshaft, corresponds to the shaft lock portion of the counterclockwise lock mechanism.

129. Claim 2 further requires that “the blade lock portion [attached to the counterclockwise lock mechanism] compris[es] lugs with a configuration that is **different than** a configuration of the lugs on the blade lock portion of the clockwise lock mechanism.” A PHOSITA would have recognized that Microdrones discloses this additional requirement because it teaches that the projecting knobs (*i.e.*, lugs) on the counterclockwise blade’s center bar portion are spaced apart by a certain “individual” distance that is **different than** the distance

between the knobs on the clockwise blade's center bar portion. The PHOSITA would have understood that this disclosure because it is stated in Microdrones: "[e]ach rotor has **two knobs** [*i.e.*, lugs] on its bottom of the centre bar which are **matched by two holds** [*i.e.*, notches] in the rotor mounting plate. To avoid accidental misplacement, both directions of turning use **individual distances** between these knobs." *See also* Ex. 1004 at 27. As such, it is my belief that the lugs on the blade lock portion of Microdrones' counterclockwise lock mechanism are configured differently (*i.e.*, spaced apart by a different distance) than the lugs on the blade lock portion of Microdrones' clockwise lock mechanism.

130. Therefore, in my opinion, Microdrones discloses "the counterclockwise lock mechanism comprises a shaft lock portion [*e.g.*, rotor mounting plate having notches] attached to the second driveshaft and a blade lock portion [*e.g.*, rotor center bar having projecting knobs] attached to the counterclockwise rotor blade, the blade lock portion [*e.g.*, rotor center bar having projecting knobs] comprising lugs with a configuration that is different than a configuration of the on the blade lock portion of the clockwise lock mechanism [*e.g.*, knobs spaced apart by a different "individual" distance]."

XII. GROUND #2: MICRODRONES RENDERS CLAIM 1-2 OBVIOUS

131. A PHOSITA would have understood that claims 1 and 2 do not require that the lock mechanisms, blade lock portions, or shaft lock portions are a

single piece and/or be integral with any other component recited in the claims.

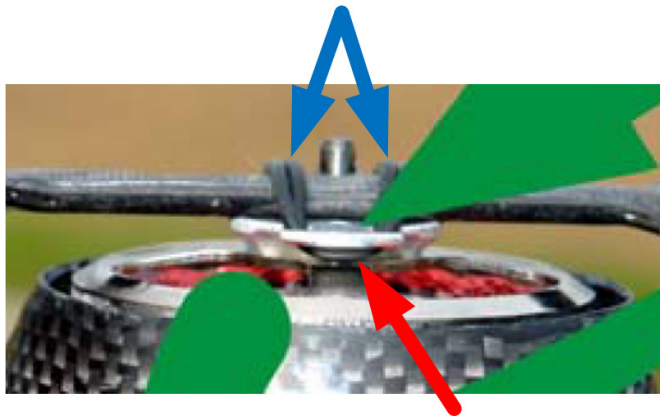
However, in the unlikely event that the Board determines that the claimed lock mechanisms each must consist of only (i) a lock shaft portion and (ii) a blade lock portion, it would have been obvious to a PHOSITA that the O-rings can be considered or made to be part of either the shaft lock portion or the blade lock portion.

132. As I discussed above, Microdrones discloses the remainder of the claim limitations of claims 1 and 2, as set forth above in Ground 1, incorporated here. As I also stated above, a PHOSITA would have understood that Microdrones uses O-rings to help secure the rotors to the rotor mounting pate, and are part of Microdrones’ “lock mechanisms.”

133. A PHOSITA would, however, recognize that the O-rings could be advantageously and integrally formed and attached to either the driveshaft mounting plates or the rotor blades. In particular, a PHOSITA would appreciate that the disclosed O-rings are small and potentially easy to drop or lose while a user is installing, removing, or replacing the rotors. Losing the O-rings and having no replacements immediately available would be problematic to a user. This is especially true because rotor replacement can happen when a user is outdoors or in a remote location, and not having the proper O-rings would potentially sacrifice the security of the rotor blade’s connection with the rotor mounting plate. A

PHOSITA would have recognized that a design that directly incorporates the O-ring into either the driveshaft or the rotor blade would reduce the likelihood of losing or dropping the O-rings.

134. A PHOSITA would have understood that the design could be implemented in many different ways. For example, one portion of the O-ring (blue arrows) could be force-fit into a groove that is formed on the underside of the rotor mounting plate, for example as indicated by the red arrow, or into a groove on the rotor blade. Alternatively, one portion of the O-ring could be glued to the underside of the rotor mounting plate using a temporary adhesive or glue with a low shear strength (i.e., permitting clean removal of the glue and O-ring end from the plate surface with shear force). Either such implementation would secure the O-ring during ordinary use and prevent loss, but would also allow for removal and replacement in the case of a worn or broken O-ring.



Ex. 1004 at 27 (partial, annotated)

135. As an alternative example, a PHOSITA might consider that the O-ring could be integrally formed at the time of manufacture with the blade or driveshaft mounting plate. A PHOSITA may also seek a more durable O-ring, or any similar structure (such as a clip), so as to reduce the need (or frequency) to replace the O-ring. This physical modification would be well within a PHOSITA's skill (and would have a more than reasonable expectation of success) as it would only require forming, fusing, or gluing one component to another.

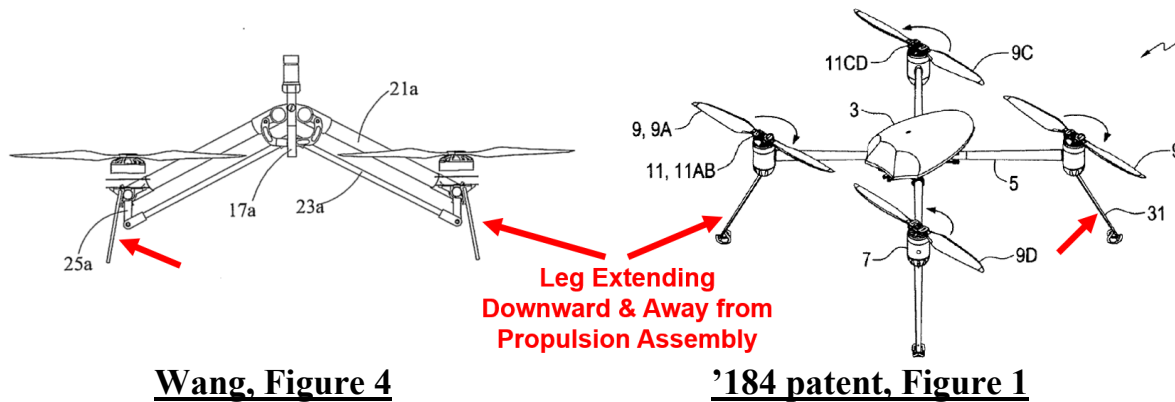
136. Therefore, for the reasons I have discussed above, claims 1 and 2 are also obvious in view of Microdrones.

XIII. GROUND #3: MICRODRONES AND WANG RENDER CLAIMS 5-6 OBVIOUS

137. Claim 6 depends from claim 5, which depends from independent claim 1. As I discussed above, all the limitations of claim 1 are disclosed by Microdrones. Claim 5 further recites “wherein each rotor assembly comprises a **leg extending downward** from a bottom portion of the rotor assembly to support the apparatus on a ground surface.” Claim 6 depends from claim 5 and further recites “wherein the **leg slopes downward and away** from the body.” In my opinion, Microdrones in view of Wang renders claims 5 and 6 obvious.

138. As shown below, a PHOSITA would have appreciated that Wang discloses a UAV with rotor assemblies—comprising a motor and a propeller—with (i) legs extending **downward** from the bottom of the rotor assembly (as required

by claim 5) and (ii) sloping downward and away from the body (as required by claim 6). I note here that a PHOSITA would clearly understand Wang’s “propulsion unit” corresponds to the “propulsion assembly” recited by the ’184 patent. In my opinion, Wang’s design and landing leg orientation (below-left) is remarkably similar to the ’184 patent (below-right):



139. A PHOSITA would have recognized that Wang also clarifies that its legs extend from the **bottom** of the rotor assemblies. *See* Ex. 1006 ¶ 0065 (“[T]he support member [*i.e.*, leg] 40 can be situated ... **under the propulsion unit** 30...[and] may be **coupled** to the propulsion unit 30.”); Ex. 1007 ¶ 0037.

140. A PHOSITA would also recognize that Wang further explains that its legs can support the apparatus on the ground. *See* Ex. 1006 ¶ 0046 (disclosing “a first configuration [where] [] the transformable aerial vehicle **rest[s] on a surface (e.g., the ground)**...with a plurality of **support members** [*i.e.*, legs] suitable for **supporting the transformable aerial vehicle** such that the central body does not contact the surface”); Ex. 1007 ¶ 0037.

141. Therefore, in my opinion Microdrones in view of Wang discloses claim 5’s recitation that “each rotor assembly comprises a leg [*e.g.*, Wang’s support member] extending downward from a bottom portion of the rotor assembly [*e.g.*, coupled under propulsion unit 30] to support the apparatus on a ground surface,” and claim 6’s recitation that “the leg [*e.g.*, Wang’s support member] slopes downward and away from the body [*e.g.*, as shown in Wang’s Figure 4 (above-left), the support members slope downward and away from a central body].”

142. A PHOSITA would have appreciated that Microdrones and Wang are within the same technical field of the ’184 patent. Indeed, Wang, entitled “Transformable Aerial Vehicle,” is squarely within the same technical field. *See* Ex. 1006, at Cover; *compare* Ex. 1001 at 1:53-54 (“The present disclosure provides a rotary aircraft apparatus....”), *with* Ex. 1006 ¶ 0041 (“The present invention provides systems, devices and methods for a transformable aerial vehicle.”); Ex. 1007 at Abstract, ¶0001, 6. A PHOSITA would have also found Wang’s teachings to be at least reasonably pertinent to the problems associated with leg assemblies for rotary aircraft because Wang discloses a particular type of leg assembly that is situated under the rotor assembly and extends downward and away from the body.

143. Furthermore, a PHOSITA would be motivated to combine

Microdrones and Wang. A PHOSITA would have appreciated that legs attached to the rotor assembly instead of the central main body and that extend downward and away from the rotor allows for a wider support base and ensures more stability for a UAV when landing on a variety of surfaces, particularly ones with differing evenness, compositions, and textures.

144. I note here that structures utilizing legs that extend downward and away have been well known and advantageously used in all sorts of fields. This ranges from fields that are related to very simple and non-technical devices to much more advanced technologies. On the less technical side, things such as a chairs, stools, or tables incorporate legs that slope downward and away from a center body (*e.g.*, seat, table top, etc.). The wider base helps support the structure and, especially when devices are top-heavy, helps prevent the structure from tipping over. As to more complicated systems, many different types of helicopters have legs that slope downward and away from the body. A wider base creates a better opportunity to land safely and helps prevent the helicopter from tipping if the ground is uneven or if heavy winds or forces push against one side of the helicopter so that the propeller and helicopter body does not contact the ground and cause serious damage. Although these are only a few of the many different

examples of these types of structures, this well-known principle would have been understood and appreciated by a PHOSITA.

145. I further note that replacing Microdrones' narrowly spaced legs, which create a narrow base, with the legs taught by Wang, which create a wider and more secure landing base, would be a simple substitution of one known element for another to obtain an improved and predictable result (namely, a UAV with landing legs that provide more stable support).

146. I also believe that the physical combination of Microdrones with Wang would also be well within a PHOSITA's skill and would provide a reasonable expectation of success. The combination would give the PHOSITA a reasonable expectation of success because the only modification required to Microdrones' would be to alter the design of the legs and, in the case where the optional camera is used and attached to the legs, to remove the camera or re-attach it directly to the underside of the UAV's body. The PHOSITA would have recognized that the legs disclosed by Microdrones could be easily replaced with the more advantageous leg design disclosed by Wang. If the Microdrones' optional camera is used and attached to the legs, the camera could simply be re-attached using a support directly attached to the underside of the UAV's body, such as by using one of the basic camera supports disclosed in Microdrones. *See, e.g.,* Ex. 1004 at 43-47. Alternatively, Wang's legs could simply be added (while

keeping Microdrones’ legs and optional camera installed) as a means to improve overall stability on the ground and during landing. A PHOSITA would have known that it was possible and desirable to simply attach the legs to the bottom of each of Microdrones’ rotor assemblies, as taught by Wang, and arrive at the modified apparatus.

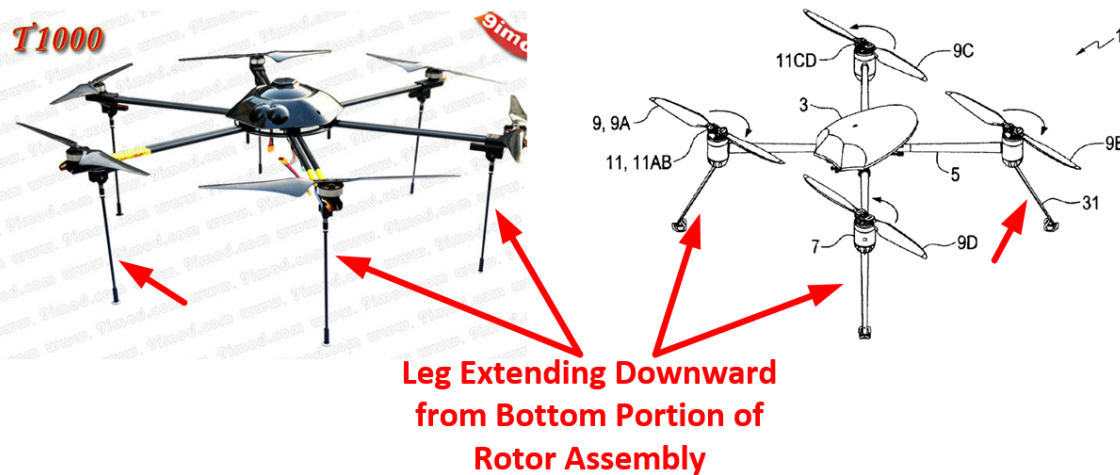
147. As such, in my opinion, a PHOSITA would have been motivated to combine Microdrones and Wang in a way that renders claims 5 and 6 invalid as obvious.

XIV. GROUND #4: MICRODRONES IN VIEW OF LOTUSRC RENDERS CLAIMS 5 AND 7 OBVIOUS

A. Claim 5

148. Claim 5 depends from independent claim 1. All the limitations of claim 1, discussed above and incorporated here, are disclosed by Microdrones. Claim 5 further recites “wherein each rotor assembly comprises a **leg extending downward** from a bottom portion of the rotor assembly to support the apparatus on a ground surface.” As I previously discussed, claim 1 describes the “rotor assembly” as “comprising a rotor blade releasably attached to a driveshaft by a lock mechanism, and a drive rotating the driveshaft” and being “attached to an outside of each arm.” In my opinion, Microdrones in view of LotusRC discloses claim 5.

149. A PHOSITA would have recognized that, similar to Microdrones and the '184 patent, LotusRC discloses a propeller assembly comprising a rotor blade and a drive (*e.g.*, an electric motor) rotating a driveshaft. As can be seen in the side-by-side figures, below, and in my opinion similar to the '184 patent, the legs disclosed by LotusRC extend **downward** from the rotor assemblies, which are “attached to an outside end of each arm.”



LotusRC

'184 Patent

150. As such, in my opinion, Microdrones in view of LotusRC discloses “[t]he apparatus of claim 1 wherein each rotor assembly comprises a leg extending downward from a bottom portion of the rotor assembly to support the apparatus on a ground surface.”

B. Claim 7

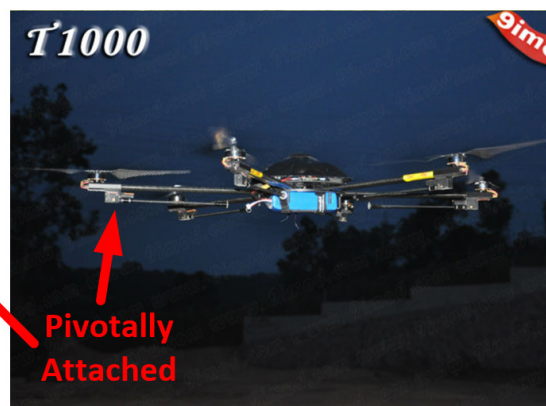
151. Claim 7 depends from claim 5, which depends from independent claim 1. As I discussed above, all the limitations of claims 1 and 5 are disclosed by Microdrones and LotusRC. Claim 7 further recites “wherein **each leg is**

pivotally attached to the bottom portion of the rotor assembly such that the leg is **movable from a stored position**, where the leg extends laterally from the rotor assembly along the arm supporting the rotor assembly, to an **operating position** where the leg extends downward from the rotor assembly.” After reading Claim 7, I recognized that it refers to two different positions: (1) a “stored position” and (2) an “operating position.” In my opinion both of these positions are disclosed by Microdrones in view of LotusRC.

152. *First*, a PHOSITA would have recognized that the LotusRC discloses legs that are “pivotally attached” to the bottom of the rotor assembly. The basis of this understanding can be seen at least from the side-by-side pictures, below, which show the legs disclosed by LotusRC pivot from extending downward (below-left) to a position where the arms swing up and extend laterally along the arm (below-right).



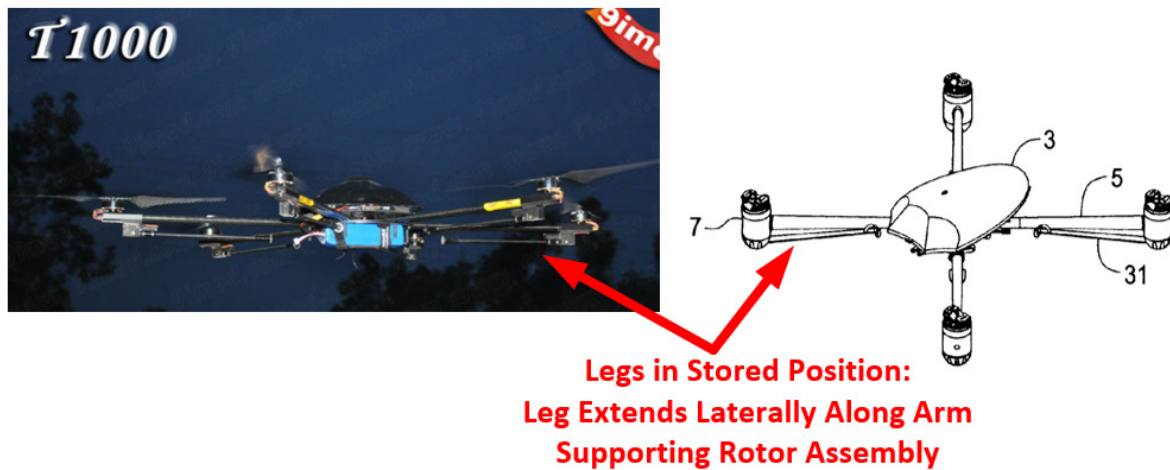
LotusRC



LotusRC

153. *Second*, a PHOSITA would have appreciated that the LotusRC

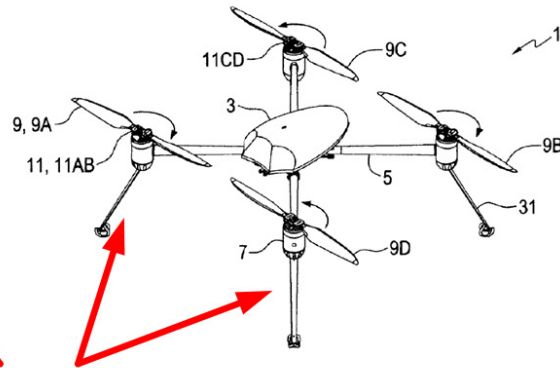
discloses that when its legs are in a “stored position,” they extend laterally along the arms of the apparatus. This is shown below. In the side-by-side figures, below, the LotusRC shows that the UAV’s legs pivot into a laterally stored position that in my opinion is similar to the ’184 patent’s legs being in the stored position. *See* Ex. 1001 at 3:22-24 (“FIG. 2 shows the apparatus 1 with rotor blades removed and support legs in the stored position.”).



LotusRC

'184 patent

154. *Third*, a PHOSITA would have appreciated that the LotusRC discloses legs in an “operating position” where the legs extend downward from the rotor assemblies, as I discussed with respect to claim 5 above. As can be seen in the figures below, a PHOSITA would have recognized that LotusRC discloses that the legs of the UAV are in an “operating position” as they extend downward from the rotor assemblies.



**Legs in Operating Position:
Legs Extend Downwardly**

LotusRC

'184 patent

155. As such, in my opinion, Microdrones in view of LotusRC discloses “wherein each leg is pivotally attached to the bottom portion of the rotor assembly such that the leg is movable from a stored position, where the leg extends laterally from the rotor assembly along the arm supporting the rotor assembly, to an operating position where the leg extends downward from the rotor assembly.”

C. Motivation to Combine Microdrones and LotusRC

156. As I discussed above, Microdrones is within the same technical field as the '184 patent. Similarly, I believe the LotusRC is within the same technical field as the '184 patent. LotusRC discloses a multi-rotor unmanned aerial vehicle with many of the same design features as depicted and recited by the '184 patent and thus is squarely within the same technical field. *See* Ex. 1010 (having disclosures that a PHOSITA would have recognized clarify the technical field to be

related to a “rc helicopter,” “Radio Control Toy,” and “Quadcopter”). A

PHOSITA would also appreciate that the LotusRC discloses a UAV that is also reasonably pertinent to the problem of providing foldable support legs for a rotary aircraft as it discloses a particular type of retractable landing legs.

157. A PHOSITA would have been motivated to combine these references because the compact design of the apparatus disclosed by LotusRC, both during flight and for storage, are advantageous to the manufacturing and sale of drones. I note here that, for example, reducing the size and burden on the consumer for transportation and use is beneficial. Indeed, a PHOSITA would have appreciated that both Microdrones and LotusRC disclose removable cameras, confirming it was desirable to employ methods to reduce the size of a UAV for storage and transport. *See* Ex. 1004 at 93 (“Post Flight Check” includes “[d]ismount[ing] the camera”); Ex. 1008 at 5 (camera gimbal allows for “quick removal”). A PHOSITA would also appreciate that LotusRC advantageously discloses legs that pivot and retract into a “stored” position and includes a disclosure of a general desire to reduce size for storage and transport of a UAV.

158. A PHOSITA would have understood that the folding legs disclosed by LotusRC can be in the stored position when the arms of the UAV are in the “flying position.” If the legs are in a stored position during flight it allows for greater visibility if a camera coupled to the underside of the UAV body. It also allows for

better placement in-line with the UAV's center of gravity. A PHOSITA would have been intimately aware of the fact that UAVs are useful for aerial filming and, for that task, it is highly desirable for a camera attached to the UAV to have the most unobstructed view possible.

159. The PHOSITA would have understood that when a camera is located below the landing gear, a camera can take photographs and videos without the field of view being obstructed by the landing gear.

160. A PHOSITA would thus appreciate that the legs disclosed by LotusRC allow for the camera to have both (i) an unobstructed view and (ii) additionally protect the camera from impact with the ground upon landing. For example, I note here that LotusRC's folding landing gear is capable of retracting during flight and allows a camera to hang below the UAV body and to take videos without any obstruction from the landing gear. This appreciation would be further confirmed by LotusRC's specific disclosure that its disclosed UAV "is targeted for professional aerial photo and video usage." Ex. 1008 at 9. Additionally, prior to landing, a PHOSITA would have understood that the landing gear extends below the camera so that the camera is protected upon landing.

161. Moreover, the PHOSITA would have understood that the retractable landing gear allows for more aerodynamic flight and can for example, increase

flight speed and decrease drag (which would also reduce wear and battery depletion).

162. This modification of Microdrones to include LotusRC's landing gear would be well within a PHOSITA's skill and would not require any undue experimentation. A PHOSITA need only replace Microdrones' legs with LotusRC's retractable landing gear, and, if a camera is used, attach the camera to the underside of the UAV's body as I discussed above. In my opinion, the modification would simply involve locating the landing gear legs on the bottom portion of the rotor assembly and sizing the arms and legs so that the legs are long enough to extend below the camera for landing; but not too long so that when they are folded inward during flight or storage they contact the camera or the camera attachment mechanism. I also recognize that to make it so the legs can fold during flight, this modification would involve adding the electronics, electrical connections, and reprogramming Microdrones' software so that Microdrones' UAV could control Lotus RC's retractable landing gear. A PHOSITA would have understood that these modifications could be made without adding significant weight that would impede flying performance, as evidenced by LotusRC, which already has such electronics incorporated into a UAV. Additionally, these tasks would be well within the capabilities of a PHOSITA (as they had already been achieved by LotusRC), and thus a PHOSITA would have had a reasonable

expectation of success and it would not have required undue testing or

experimentation. As I discussed, such a routine combination would result in an

improved apparatus and a PHOSITA would have been motivated to modify

Microdrones in view of LotusRC, rendering at least claims 5 and 7 obvious.

**XV. GROUND #5: MICRODRONES IN VIEW OF LOTUSRC AND
SLANKER RENDERS CLAIM 8 OBVIOUS**

163. Claim 8 depends from claim 7, which depends from claim 5, which depends from independent claim 1. As I discussed above, all the limitations of claims 1, 5, and 7, are disclosed in Microdrones and on LotusRC. Claim 8 further recites “comprising a **bias element urging the leg toward the stored position**, and a **latch operative to lock the leg in the operating position.**” In my opinion, Microdrones in view of LotusRC and further in view of Slanker discloses this claim.

164. Upon review of the language of claim 8, I recognized that it recites nothing more than conventional retractable landing gear. A PHOSITA would have known that retractable landing gear for aircraft have existed since the early 1900s. As confirmed by some quick searching, retractable landing gear was implemented into various aerial vehicles in at least 1911 and has been well known since at least the 1930s. *See* Ex. 1024 (“The retractable landing gear that is now commonplace on commercial and military aircraft was first developed for Glen Curtiss’ Triad airplane in 1911. ... By the 1930s, landing gear was being developed for other

aircraft models, bringing with it an increase in speed and efficiency.”). As I discussed above, the ’184 patent admits that implementing this type of landing gear was well known in the art at the time of the purported invention. *See* Ex. 1001 at 1:46-49 (“[A] leg assembly is typically attached to the bottom of the aircraft body, and to support the aircraft on the ground in the necessary orientation for landing and takeoff.”). The ’184 patent’s admission aligns with what a PHOSITA would also know and confirm. As such, a PHOSITA would have been motivated to look to common aircraft landing gears when designing an aircraft such as the UAVs disclosed by Microdrones or LotusRC. In my opinion, Slanker further discloses such a retractable landing gear design.

165. A PHOSITA would have understood that Slanker discloses landing gear with a bias element urging the landing leg towards the stored position. *See* Ex. 1010 ¶ 0003 (disclosing a “a **spring system** configured to counterbalance the weight of the landing gear and/or assist the motive force system in **moving the landing gear** from a first position to a second position.”). This understanding would be confirmed and clarified by various disclosures in Slanker, such as that the “spring system 150 disclosed herein may be **biased towards** the retracted or deployed position...[and] may translate its [] energy to assist the landing gear 180 being moved **from the deployed position to the stowed position.**” Ex. 1010 ¶ 0028-29. A PHOSITA would further recognize that, just like the ’184 patent’s

“spring 35 urges the leg 31 toward the stored position,” Slanker’s disclosed spring system can be “**biased to retract landing gear 180**” to “move landing gear 180 from a deployed position to a stowed position.” Ex. 1010 ¶ 0031.

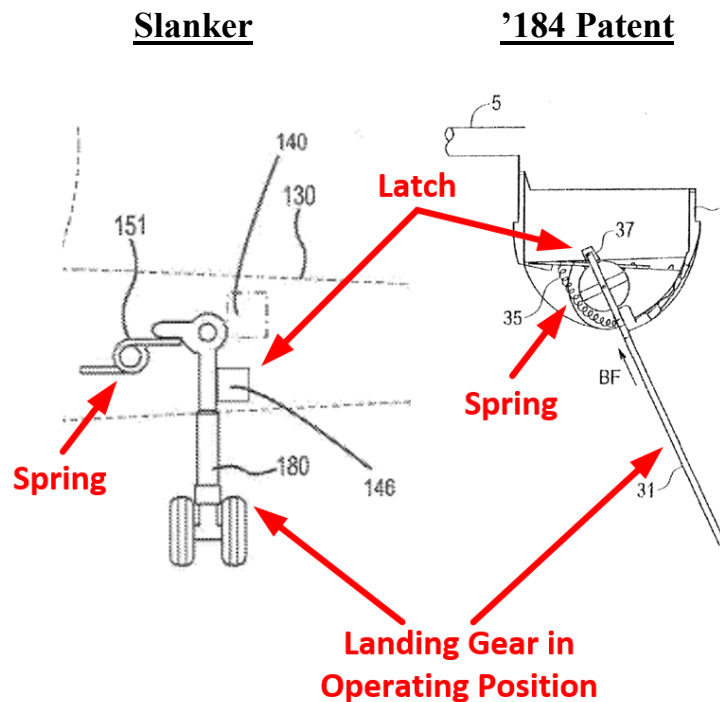
166. A PHOSITA would further recognize that Slanker also discloses a latch to lock the landing gear legs in an operating position. *See* Ex. 1010 ¶ 0032 (“[A] **locking mechanism 146** (e.g., a down piston gear lock) may automatically engage a landing gear 180 column, in response to landing gear 180 being in a desired location or traveling past a pre-selected location with a requisite amount of force.”).

167. I further note that, once Slanker’s landing gear has engaged the locking mechanism 146, Slanker’s “**locking mechanism 146 retain[s] landing gear 180 in its deployed position.**” Ex. 1010 ¶ 0064. In my opinion, and as seen in the side-by-side figures, below, this is similar to the ’184 patent.

168. I note here that a “latch” is a very broad term to refer to some sort of component that holds another element in place. For example, a latch may refer to a simple clasp-like component that fastens two (or more) things together. A “latch” could also be another component or crevice or hook or mechanical/electrical feature that holds another component in place. For example, in the ’184 patent a latch appears to be just a slot or depression or hole where the leg is fit into to hold the leg in place. Similarly, Slanker’s locking mechanism 146 engages the landing

gear leg 180 so that it is secured and held in place. As this claim uses the very broad term “latch” I believe that a latch as used in the claims of the ’184 patent refers to one of many different kinds of systems/structures that secure a component in place.

169. Moreover, my understanding and belief of the similarity of the **operating position** of the systems would be further confirmed by a review of at least the side-by-side figures, below.



Ex. 1010 at Figure 2A (left, partial); Ex. 1001 at Figure 17 (right).

170. As such, in my opinion, Microdrones in view of LotusRC and Slanker discloses “comprising a bias element [e.g., Slanker’s spring biasing system] urging the leg [e.g., Slanker’s landing gear] toward the stored position [e.g., Slanker’s

stowed position], and a latch [*e.g.*, Slanker’s locking mechanism 146 that locks the landing gear in its deployed position] operative to lock the leg in the operating position [*e.g.*, Slanker’s deployed position].”

171. I again note that retractable landing gear was first implanted in aircraft as early as 1911 and has been well known since at least the 1930s. Besides what would be simple modifications regarding the size and proportions, a PHOSITA would have understood that the main difference between landing gear designed for a full size aircraft (such as the one disclosed by Slanker) and a small vertical takeoff and landing aircraft (such as the UAV disclosed by LotusRC and Microdrones) is that a full size aircraft is designed to address larger forces in both the vertical and horizontal directions. A PHOSITA would have therefore recognized that the legs of the UAVs disclosed by LotusRC and Microdrones, on the other hand, only have to handle relatively small vertical forces when landing. These are well understood design criteria easily addressed by a PHOSITA.

172. A PHOSITA would have been motivated to modify the Microdrones-LotusRC UAV in view of Slanker so that that each arm and leg included, at or near the leg pivot point, a scaled version of Slanker’s spring system including a spring connected between the leg and the respective arm (or otherwise configured to urge the leg toward the arm), and a scaled version of Slanker’s locking mechanism

capable of locking the leg in the deployed position. A PHOSITA would have been motivated to make these modifications for at least the following reasons:

173. *First*, Microdrones, LotusRC, and Slanker are within the same technical field as they all relate to aircraft. The fact that Slanker describes a full size fixed wing aircraft and Microdrones and LotusRC describe smaller multi-rotor UAVs is immaterial, as Slanker does not disclose that its landing gear cannot be scaled for smaller aircraft that are often built in the image of larger aircraft, and Slanker is within the same technical field as it is reasonably pertinent to the problems faced by LotusRC and Microdrones of how to carry a camera without obstructing its view but protecting the camera from impact with the ground when landing. A PHOSITA would also have understood that retractable landing gear for a full size aircraft has many of the same problems encountered by smaller UAVs. For example, a PHOSITA would have appreciated that the need for increased camera visibility under the aircraft, the need to reduce drag, the need for efficient and compact storage of the landing gear, and the need for increased power efficiency by reducing energy consumption, etc. are all considerations relevant to UAVs and full size aircraft alike.

174. In my opinion, the similarity of U.S. Classification B64C (“Aeroplanes; Helicopters”) of both the ’184 patent and Slanker further confirm the similarity of the two disclosures. USPTO Classifications, Ex. 1023 at XX

(Cooperative Patent Classification

<https://www.uspto.gov/web/patents/classification/cpc/html/cpc-B64C.html>). This further confirms that Slanker is at least reasonably pertinent to the problem of how to design retractable landing gear for an aircraft.

175. *Second*, as I previously discussed, a PHOSITA would have understood that it is advantageous to have legs that can be retracted into a stored position. For storage, Slanker's disclosed bias element (i.e., spring system) helps urge the legs toward a stored position. During flight, Slanker's disclosed bias element ensures that the legs do not accidentally extend, which would adversely affect aerodynamics. Slanker's locking mechanism (i.e., latch) also prevents accidental collapse of the landing gear during landing. As such, a PHOSITA designing a combined Microdrones-LotusRC aircraft would look to landing gear references, such as Slanker, to provide details regarding landing gear design (i.e., details not provided in Microdrones or LotusRC), including a bias mechanism used to retract the landing gear into a stored position and a latch (i.e., locking mechanism) to securely lock the landing gear in an operational position—both of which are explicitly recited in Slanker. Therefore, a PHOSITA would have understood that, by implementing retractable landing gear of Slanker into the Microdrones-LotusRC UAV would not only include the benefits of Slanker's

retractable landing gear, but also be simpler to design and install because of the reduced forces encountered by the landing gear of these UAV aircrafts.

176. *Finally*, a PHOSITA would have understood that Slanker discloses that its disclosed system can be implemented in a range of different configurations and locations. *See* Ex. 1010 ¶ 0040 (“[S]pring system 150 is coupled **between an anchoring location and a portion of landing gear** 180. Th[e] anchoring location may be any **suitable anchoring location**.”); *id.* ¶ 0037 (“Spring system 150 may be configured to reduce the size, weight and/or energy requirements of a landing gear 180 extension retraction system[, and]...the spring of spring system 150, such as torsion spring 151 and/or leaf spring 152, may be made from **any material**.”). This modification of adding Slanker’s spring biasing system and locking mechanism (*i.e.*, the latch) to Microdrones in view of LotusRC would be well within a PHOSITA’s skill and a PHOSITA would have had a reasonable expectation of success because the modification would merely involve an installment of a known element in a way that would yield predictable results. For example, a PHOSITA would have recognized that all that would be required is to attach one end of the torsion spring to the arm of the disclosed Microdrones UAV (*i.e.*, an anchoring location) and attach the other end of the spring to any “portion of [the] landing gear” legs added in view of LotusRC.

177. As such, in my opinion the modification of Microdrones in view of

LotusRC and Slanker renders claim 8 obvious.

XVI. GROUND #6: MICRODRONES IN VIEW OF LOTUSRC AND WANG RENDERS CLAIM 9 OBVIOUS

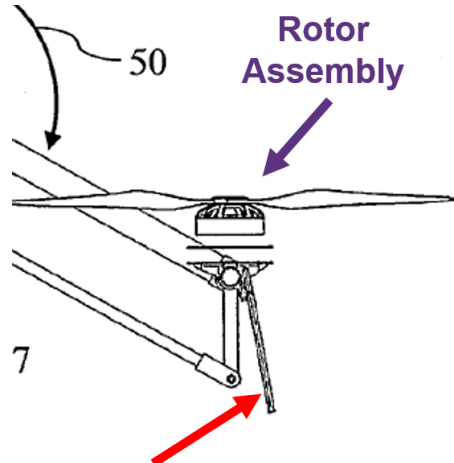
178. Claim 9 depends from dependent claim 7, which depends from claim 5, which depends from independent claim 1. As I discussed above, all the limitations of claims 1, 5, and 7 are disclosed by Microdrones and LotusRC. Claim 9 further recites “wherein the **leg slopes downward** and away from the body when in the operating position.” In my opinion, Microdrones in view of LotusRC and further in view of Wang discloses this claim.

179. As I discussed above, and as required by claims 5 and 7, a PHOSITA would have recognized that LotusRC discloses legs that pivot from an operating position where the legs extend downward to a stored position where the legs extend laterally along the arm. A PHOSITA would further understand that Wang also discloses legs extending **downward and away** from the body when in the operating position. *See* Ex. 1006 ¶ 0028 (“FIG. 4 is a side view of the transformable unmanned aerial vehicle of FIG. 1 in a landing configuration, in accordance with embodiments.”); Ex. 1007 ¶ 002.



Leg Extending Downward in
Operating Position

LotusRC



Legs Sloped Downward
and Away from Body

Wang, Figure 4 (partial)

180. As I discussed above, a PHOSITA would have appreciated that LotusRC and Wang are within the same technical field as the '184 patent. A PHOSITA would have been motivated to implement Wang's teaching of legs that extend downward and away from the rotor assemblies into the apparatus disclosed by Microdrones in view of LotusRC.

181. As I also discussed above, a PHOSITA would have been motivated to incorporate landing legs that slope downward and away from a rotor assembly. A PHOSITA would have understood that replacing the legs on the apparatus disclosed by Microdrones creates a narrow landing base with the landing legs disclosed by LotusRC—which, in view of Wang, would be designed to slope away from the rotor assembly—would be a simple substitution of one known element for

another to obtain an improved and/or predictable result (*e.g.*, a wider, sturdier base with a lower center of gravity for safe landing).

182. A PHOSITA would have had a reasonable expectation of success that this modification would yield predictable results and the modification would be well within a PHOSITA's skill and ability as it would simply require a slight modification to the legs to be sloped away from the rotor assemblies.

183. Such a modification, in my opinion, discloses “wherein the leg [*e.g.*, LotusRC landing leg] slopes downward and away [*e.g.*, Wang's legs sloping downward and away] from the body when in the operating position.”

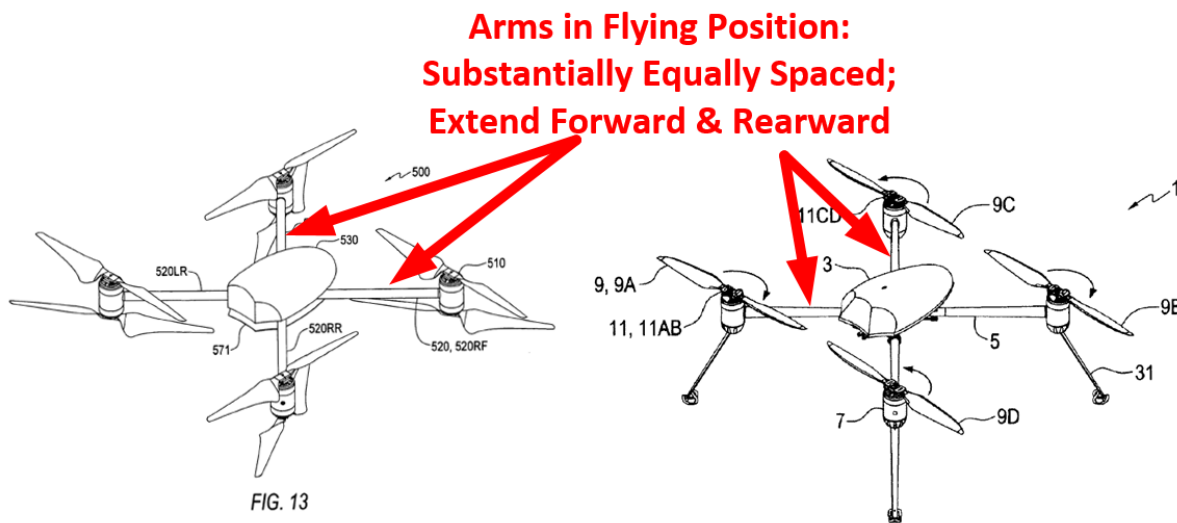
XVII. GROUND #7: MICRODRONES IN VIEW OF OLM RENDERS CLAIM 11 OBVIOUS

184. Claim 11 depends from claim 1. As I discussed above, claim 1 is disclosed by Microdrones. Claim 11 further recites “wherein the arms are movably attached to the body such that the **arms can be moved from a flying position**, where the **arms** extend forward and rearward laterally outward from the body such that the **arms** are substantially equally spaced, **to a folded stored position** where at least one **arm** is substantially aligned with and adjacent to another arm.” In my opinion, Microdrones in view of Olm discloses this claim.

185. As I previously discussed, Olm and the '184 patent have the same named inventors. As shown in the side-by-side figures, below, a PHOSITA would have recognized that Olm discloses an apparatus with **arms** positioned in the

claimed **“flying position.”** This becomes even more evident when the figures and corresponding language of Olm and the ’184 patent are compared. *Compare* Ex.

1001 at 3:26 (“[T]he **arms 5** can be moved from a **flying position** illustrated in FIG. 1.”), *with* Ex. 1011 at 6:26-34 (“Each **arm 520** is positioned approximately ninety degrees around a central axis...when the aircraft is in a **flying position** as illustrated in FIG[. 13.]”).



Olm, Figure 13

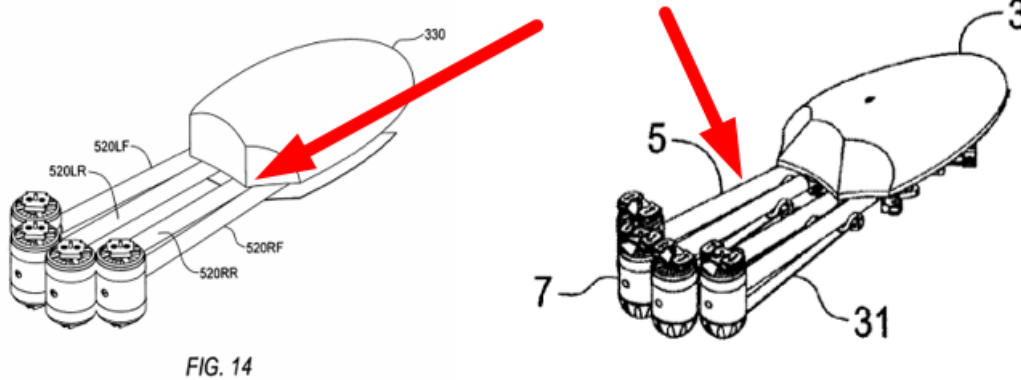
’184 patent, Figure 1

186. A PHOSITA would also appreciate that Olm discloses the claimed **“folded stored position”** where the **arms** are folded from the flying position shown above to be adjacent to and parallel, as shown below. *Compare* Ex. 1001 at 3:28-29 (“...FIG. 3 [shows] [] the arms [being] generally **aligned with and adjacent to each other.**”), *with* Ex. 1011 at 6:34-45 (“[A]ll arms 520 are pivotally

attached to the body 530 such that the...**front arms** 520RF, 520LF can be

pivoted...[to be] **substantially parallel to and adjacent to the rear arms.**”).

**Arms in Folded Stored Position:
Arms Substantially Aligned
and Adjacent to Each Other**



Olm, Figure 14

'184 patent, Figure 3

187. As such, in my opinion, Microdrones in view of Olm renders claim 11 obvious.

188. I believe that Olm is in the same technical field as the '184 patent. A PHOSITA would have appreciated that Olm shares the same inventors as the '184 patent, contains many of the same structural features as the '184 patent, was cited by the Examiner during prosecution of the '184 patent, discloses features of a “rotary wing aircraft apparatus” (Ex. 1011 at Abstract), and is even referenced in the '184 patent’s specification: “[s]uch multi-rotor unmanned remote control rotary aircraft are disclosed for example in U.S. Pat. No[.]. 8,052,081 [*i.e.*, Olm]” (Ex. 1001 at 1:41-42). Moreover, as shown at least in the LotusRC, these types of

pivotable arm designs to advantageously reduce the overall size of an apparatus were well known to a PHOSITA before the Alleged Priority Date.

189. A PHOSITA would have understood that since the Microdrones' arms cannot be pivoted and a PHOSITA would have been motivated to look to other references, such as Olm, that disclose adjustable and movable arms to advantageously reduce the storage and transportation size. Olm's space-efficient arm storage system would reduce the burden on a user who wishes to have a UAV that can be made more compact for transportation or storage. A PHOSITA would simply substitute the pivotable arm attachment system disclosed by Olm for the rigid Microdrones arms, a change that would be within a PHOSITA's skill and would give a PHOSITA a reasonable expectation of success. As such, in my opinion, this obvious combination renders at least claim 11 obvious.

XVIII. CONCLUSION

190. For the reasons set forth above, in my opinion, claims 1-2, 5-9, and 11 of the '184 patent are rendered obvious.

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


Declaration of Dr. Alfred Ducharme – Case No. IPR2019-00343

U.S. Patent No. 9,260,184; Challenging Claims 1-2, 5-9, 11

and that such willful false statements may jeopardize the results of these
proceedings.

Declaration of Dr. Alfred Ducharme – Case No. IPR2019-00343
U.S. Patent No. 9,260,184; Challenging Claims 1-2, 5-9, 11

Executed on November 16, 2018 in Oviedo, Florida.



Alfred Ducharme