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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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ALMENDRA PTE. LTD.
Petitioner,

v.

FIENILE ACGRONECÓCIOS LTDA.
Patent Owner.

Case No. PGR2025-00055
U.S. Patent No. 12,089,543 B2

Declaration of John Long, Ph.D., P.E.

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Patent Trial and Appeal Board
US Patent and Trademark Office
PO Box 1450
Alexandria, Virginia 22313-1450

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1005	U.S. Patent Pub. No. 2019/0098843 ("Rosen")
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GLOSSARY OF TERMS

Term	Description
The ’543 Patent	U.S. Patent No. 12,089,543
Board	Patent Trial and Appeal Board
Challenged Claims	Claims 1-7 of the ’543 Patent.
Patent Owner	Fienile Agronegocios LTDA
Petitioner	Almendra Pte. Ltd.
Richardville	U.S. Patent Pub. No. 2021/0185945
Rosen	U.S. Patent Pub. No. 2019/0098843
Singh	U.S. Patent Pub. No. 2016/0198640
USPTO	United States Patent and Trademark Office

LIST OF CHALLENGED CLAIMS

#	Claim
1.Pre	1. AGRICULTURAL MANAGEMENT SYSTEM (100) is characterized by comprising:
1.A	a modular agricultural irrigation pivot-like device (101) positioned on an agricultural field (200) in the cultivation of a crop (202 a) species, the modular agricultural irrigation pivot-like device (101) comprising:
1.A.i	a plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e) arranged along the modular agricultural irrigation pivot-like device (101) at a predetermined distance above the aerial parts of the crop (202 a), comprising a plurality of light-emitting diodes; and
1.A.ii	a plurality of energy sources that feed the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e),
1.B	the agricultural management system (100) further comprising:
1.B.i	a processor in communication with a dimerizer and/or a polarizer of the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e) and with the plurality of energy sources, wherein the processor is configured to:
1.B.ii	a) adjust (501), in the intervals of the electromagnetic spectrum, the balance between the spectral bands emitted by the plurality of light-emitting diodes; and
1.B.iii	b) determine and implement: an irrigation routine (502); and/or an artificial light(s) supplementation routine (503);
1.B.iv	wherein stages a) and b) are determined by the processor considering at least one among: a crop (202 a) species under cultivation; a phenological stage of the crop (202 a) under cultivation;

#	Claim
	a photoperiod, a season and current weather conditions under which the agricultural field (200) is subjected; and one or more objective(s) intended for the crop (202 a) development.
2	SYSTEM (100), according to claim 1, characterized in that stages a) and b) determined by the processor using an artificial intelligence model.
3.Pre	SYSTEM (100), according to claim 1, characterized in that the modular agricultural irrigation pivot-like device (101) comprises:
3.A	a drive device for the displacement of the modular agricultural irrigation device (101) over the agricultural field (200); and
3.B	sprinkler devices comprising a plurality of sprinklers,
3.C	wherein the processor is in communication with the drive device and with the sprinkler device for the execution of stage b).
4.Pre	4. AGRICULTURAL MANAGEMENT METHOD (500), for the cultivation of a crop (202 a) in an agricultural field (200), characterized by comprising the steps of:
4.A	a) adjusting (501), in intervals of the electromagnetic spectrum, the balance between the spectral bands emitted by a plurality of light-emitting diodes of a plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e); and
4.B	b) determining and implementing: an irrigation routine (502) of a modular agricultural irrigation device (101); and/or a routine of artificial light(s) supplementation (503) of the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e);
4.C	wherein stages a) and b) are determined considering at least one among:

#	Claim
	a crop (202 a) species under cultivation; a phenological stage of the crop (202 a) under cultivation; a season, a photoperiod, and current weather conditions under which the agricultural field (200) is subjected; and one or more objective(s) intended for the crop (202) development.
5	METHOD (500), according to claim 4, characterized in that stages a) and b) are determined by the processor using an artificial intelligence model.
6	METHOD (500), according to claim 4, is characterized by further comprising a stage c) of determining a routine of soil management in the agricultural field (200) based on soil analyses from the agricultural field (200).
7	METHOD (500), according to claim 6, characterized in that stage c) of determining through the artificial intelligence model considers at least one of the following: the irrigation routine (502); the routine of artificial light(s) supplementation (503); the crop (202 a) species under cultivation; the phenological stage of the crop (202 a) under cultivation; the photoperiod, the season and the current weather conditions under which the agricultural field (200) is subjected; and the one or more objective(s) intended for the crop (202 a) development.

I, John Long, Ph.D., P.E., do hereby declare under penalty of perjury that the following statements are made based on my personal knowledge and are true and correct:

I. SCOPE OF ENGAGEMENT

1. I have been retained by Perilla Knox & Hildebrandt LLP on behalf of Petitioner Almendra Pte. Ltd. ("Almendra") to provide analysis and opinion regarding Amendra's Petition for Post-Grant Review of U.S. Patent No. 12,089,543 (the "'543 Patent"). EX1001.

2. I have been asked to provide my opinions as to the validity of Claims 1-7 (the "Challenged Claims") of the '543 Patent.

3. This Declaration sets forth the opinions that I have formed related to the Challenged Claims based on my personal knowledge, education, research, personal and professional experience, and the information I have reviewed as of the date of this Declaration. In connection with my analysis, I have reviewed the '543 Patent, its file history, all exhibits listed in the above list of exhibits, and all documents referenced herein.

4. I am being compensated at the hourly rate of $250.00 for my work in this proceeding, including studying this matter, preparing this declaration, and providing deposition and trial testimony. This is my standard hourly rate for engagements of this nature. My compensation is not contingent upon the outcome

of this proceeding or the particular testimony or opinions that I express. I am also being reimbursed for expenses incurred as a result of activities performed as an expert in this matter.

5. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

6. If called as a witness in this proceeding, I expect to testify as an expert witness on all the issues set forth in this Declaration, including:

- the level of ordinary skill in the art relevant to the ’543 Patent, as well as the state of that art from the time the ’543 Patent claims priority;
- the subject matter disclosed by and claimed in the ’543 Patent;
- prior art to the ’543 Patent;
- the prosecution of the ’543 Patent; and
- Petitioner’s challenges regarding the ’543 Patent.

7. I may also testify in response to papers, expert testimony, or other evidence submitted on behalf of the Patent Owner.

8. Between now and such time that I may be asked to testify, I expect to continue my review, evaluation, and analysis of evidence presented during this proceeding. I expressly reserve the right to amend or supplement this Declaration, as appropriate. I have personal knowledge of the facts stated in the declaration, and I am willing to competently testify to them if and when called to do so. In the event

that additional relevant information becomes available to me, I also reserve the right to review and consider that information in further developing or refining my opinions.

II. EDUCATION AND WORK EXPERIENCE

9. I grew up on a family farming operation as part of the fifth generation to engage in the daily operation in North Carolina with parts of the farm dating to back to the mid 1700's before the American Revolution. My roots in agriculture run deep. Our family farm raised multiple cash crops such as tobacco, beef cattle, forages like hay and corn silage, and grain crops like corn, soybean, and small grains (wheat, oats, barley). We also marketed horticultural crops such as produce and poultry products at local farmer's markets.

10. I gained experience at an early age learning every aspect required of the operation such as tillage, planting, cultivation and harvest. By the time I was 16, I invested financially in the operation and was given full responsibly over all production decisions for a portion of the operation. During graduate school, I assumed full responsibility of my grandfather's farming operation where I raised beef cattle, corn and soybeans to cover my expenses while pursuing my Doctor of Philosophy in Biological Engineering at North Carolina State University.

11. A portion of our farm focused on horticultural crops and high value specialty crops such as tobacco. These crops required the use of irrigation during the

summer months of the growing season when rainfall was insufficient. I became familiar with different irrigation systems specifically pipe and riser sprinkler irrigation systems on our farming operation. I was also exposed to other types of irrigation systems through formal coursework such as my undergraduate Irrigation and Drainage course. The semester project required the design of a center pivot style irrigation system for a farm in eastern North Carolina.

12. I received a Bachelor of Science in Biological Engineering with concentrations in both Agricultural and Environmental Engineering at North Carolina State University in 2005, and a Master of Science in Biological Engineering with a minor in Mechanical Engineering at North Carolina State University in 2008.

13. I also received a Doctor of Philosophy in Biological Engineering at North Carolina State University in 2014.

14. I am a registered Professional Engineer (PE) in the state of Oklahoma in the area of Agricultural Engineering. As a Professional Engineer, I work closely with our Applications Engineer Services program that provides engineering services to over 3,000 small and mid-sized manufacturers across the state of Oklahoma in conjunction with the Oklahoma Manufacturing Alliance. I support these Applications Engineers with projects that align with my expertise.

15. I joined the faculty at Oklahoma State University in August 2014, and am currently employed as an Associate Professor tenured in the Department of Biosystems and Agricultural Engineering at Oklahoma State University.

16. This role accounts for 60% of my current appointment.

17. I am also employed as an Extension Agricultural Engineer and State Extension Specialist for Agricultural Machinery and Precision Agriculture for the Oklahoma Cooperative Extension Service.

18. This role accounts for 40% of my current appointment.

19. During my time as a graduate researcher and faculty member, I have been involved in a variety of different projects related to agricultural machinery and production systems involving intelligent technologies and precision agriculture methods.

20. As an instructor, I am currently responsible for six different courses in the Biosystems Engineering and Agricultural Systems Technology Programs. These courses cover topics across the breadth of agricultural technology from precision positioning systems (e.g., GNSS) and land surveying to mechanical vehicle design to senior capstone project experiences. Of these senior capstone experiences, I have advised over 40 different student project teams including projects related to novel wireless crop monitoring systems, unmanned systems and other precision agriculture technologies.

21. Additionally, I led the development of a new Agricultural Systems Technology Degree focused on the development of individuals with a broad skill set necessary to master new technologies as they develop in the agriculture sector. I currently serve as the head of curricula for both the Agricultural Systems Technology and Biosystems Engineering Degree Programs.

22. I have authored or co-authored at least 12 refereed journal articles and over 35 conference proceedings and presentations.

23. I have published nine cooperative extension factsheets and book chapters.

24. I co-authored the fourth edition of an engineering technology textbook used by programs domestically and internationally.

25. I have offered over 90 extension presentations, workshops and continuing education courses and over 35 invited talks related to my expertise in teaching, extension and research.

26. I serve as a state specialist for the Oklahoma Cooperative Extension Service where I provide expertise and training to county and area extension educators related to agricultural machinery, precision agriculture technologies and unmanned systems amongst others. I regularly interact with agricultural producers, industry professionals and other citizens in the state of Oklahoma through public presentations, workshops and continuing education courses.

27. My teaching, extension and research efforts have been recognized by various organizations. My research team won the Oklahoma State University President's Cup for Creative Interdisciplinarity in 2017 to recognize research excellence cutting across multiple disciplines at the University. My extension work was recognized in 2018 with the Award of Outstanding Faculty and Field Staff Program Contributions to the Oklahoma Cooperative Extension Service. I have been selected by students in 2017, 2018 and 2025 for the Alpha Epsilon Distinguished Service Faculty Award that recognizes faculty that significantly impacted their academic careers.

28. I am also actively involved with standards work in the American Society of Agricultural and Biological Engineers ("ASABE") and serve on four committees that are responsible for the development and maintenance of multiple standards for the agricultural machinery industry. I have chaired these committees in the past and currently serve as the chair of the executive steering committee for the Education, Outreach and Professional Development division of ASABE.

29. I previously worked for AMADAS Industries in Suffolk, Virginia as an engineering intern, where I supported the engineering efforts to collect data and helped modify one of their self-propelled peanut harvesters for edible bean harvest. I also designed and set up a production line in the engineering spaces of the plant

where I helped others assemble an initial prototype run of a new three-point peanut digger series.

III. UNDERSTANDING OF APPLICABLE LEGAL PRINCIPLES

30. I am not a lawyer. In expressing my opinions and considering the subject matter of the claims of the ’543 Patent, certain legal principles relevant to this Declaration have been explained to me.

31. **Claim Construction.** I understand that in a post-grant proceeding (or PGR), claim terms must be construed in accordance with their ordinary and customary meaning to a person of ordinary skill in the art at the relevant time and in light of the specification and the prosecution history.

32. **Enablement.** I understand that a patent claim is invalid if it is not enabled, meaning the specification does not teach a person of ordinary skill how to make and use the full scope of the claimed invention without undue experimentation. I understand that enablement is determined from the point of view of a person of ordinary skill at the time when the patent application was filed.

33. I further understand that the following factors (described to me as the *Wands* factors) may be considered to determine whether any experimentation would have been undue:

- the quantity of experimentation necessary;
- the amount of direction or guidance presented;

- the presence or absence of working examples;
- the nature of the claimed invention;
- the state of the prior art;
- the relative skill of those in the art;
- the predictability or unpredictability of the art; and
- the breadth of the claims.

34. **Definiteness.** I understand that a patent claim is invalid if it is indefinite. I understand that to satisfy the definiteness requirement, a claim must inform a person of ordinary skill in the art of the claimed invention's scope with reasonable certainty when read in view of the specification and prosecution history. I further understand that definiteness is measured from the view of a person of ordinary skill in the art at the time of the patent application was filed.

35. **Subject Matter Eligibility.** I understand that there are three categories of subject matter referred to as "judicial exceptions" or "exceptions" to patentable subject matter: abstract ideas, laws of nature, and natural phenomena. I understand that a patent claim directed to one of these categories is not eligible for patenting unless the claim as a whole includes additional limitations amounting to something significantly more than that precise exception. I am informed that the test for subject matter eligibility has two parts. The first step is to determine whether the claim is directed to one of the described judicial exceptions. If so, the second step is to

determine whether the claim recites additional elements that impart an inventive concept.

36. **Burden of Proof.** I understand that Almendra has the burden to prove that the claims of the ’543 Patent are invalid by a preponderance of the evidence. I am informed that a preponderance of the evidence is evidence that is sufficient to show that a fact is more likely true than it is not true.

37. **Obviousness.** I understand that a patent claim is invalid under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to persons having ordinary skill in the art to which the subject matter pertains. Obviousness, as I understand, is determined based on the scope and content of the prior art; the level of ordinary skill in the art at the time of the alleged invention; differences between the alleged invention and the prior art; and objective evidence of non-obviousness.

38. I further understand that a party seeking to invalidate a patent on obviousness grounds must demonstrate that a person of ordinary skill in the art would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the person of ordinary skill in the art would have had a reasonable expectation of success in doing so.

39. I understand that information satisfying one of the categories of prior art set forth in 35 U.S.C. § 102 (either pre- or post-AIA) may be used in an obviousness analysis.

IV. PETITIONER'S INVALIDITY CHALLENGES

40. I understand that Petitioner challenges Claims 1-7 of the '543 Patent based on the following five grounds:

- Claims 1-7 are unpatentable under 35 U.S.C. § 112(b) as indefinite (Ground 1);
- Claims 1-7 are unpatentable under 35 U.S.C. § 112(a) because they are not enabled (Ground 2);
- Claims 1-7 are unpatentable under 35 U.S.C. § 101 because they claim unpatentable subject matter (Ground 3);
- Claims 1-7 are obvious under 35 U.S.C. § 103 over Rosen (Ground 4); and
- Claims 1-7 are obvious under 35 U.S.C. § 103 over Richardville, in view of Rosen (Ground 5).

41. Throughout my declaration, I rely on the designation of claim elements as set forth in the List of Challenged Claims, above.

V. SUMMARY OF OPINIONS

42. For the reasons set forth below, it is my opinion that:

- Claims 1-7 of the '543 Patent are invalid because they are indefinite;

- Claims 1-7 of the ’543 Patent are invalid because they are not enabled;
- Claims 1-7 of the ’543 Patent are invalid because they are directed to ineligible subject matter;
- Claims 1-7 of the ’543 Patent are invalid because they are obvious over Rosen; and
- Claims 1-7 of the ’543 Patent are invalid because they are obvious over Richardville, in view of Rosen.

VI. BACKGROUND

43. “Large-scale agricultural production has always been closely linked to and dependent on multiple variables,” including: (1) “the nutritional and microbiological factors of the soil,” (2) intrinsic regional characteristics such as “climate, photoperiod, and rainfall distribution,” and (3) “a plurality of stresses that affect crops” including pathogens, insect infestations, competitive weeds, and extreme deficiencies or excesses in light, water, and nutritional factors. EX1001, 1:26-34. A wide variety of agricultural management systems (both formal and informal) have been used throughout history in order to optimize plant growth.

44. For example, humans have long used both synthetic and organic fertilizer in order to enhance the nutritional and microbiological factors of the soil. Similarly, irrigation has been a mainstay of agriculture for thousands of years, and artificial lighting has long been used to supplement agricultural development.

45. The ’543 Patent recognizes that, in order to increase agricultural production, “advances have been made in studies on artificial light(s) supplementation for crop production outdoor (large scales), defined as the process of applying artificial light(s) to plants grown in the open field, emphasizing the beneficial effects of the use of light-emitting diodes (LEDs) on plant’s metabolism, on the efficiency of light absorption by the leaves, as well as the mitigation of abiotic (e.g., extreme temperatures and drought) and biotic (e.g., insect pests, plant diseases, weeds) stresses, while applying a sustainable management of the available resources.” EX1001, 2:11-21.

A. Modular agricultural irrigation pivot-like devices were well-known in the art.

46. Center-pivot irrigation systems are well established in the agriculture industry. These “systems typically comprise an extremely long water conduit ‘arm,’ which is pivotally connected at one end to a source of water under pressure. The conduit arm is carried in an elevated position, usually by a plurality of radially spaced wheeled towers which are powered by hydraulic, pneumatic or electrical motors to rotatably sweep the conduit arm through and over a circular field.” EX1008, 1:16-27.

47. Since as early as the 1950s, these “systems have strongly and successfully established themselves in the farming community. Although initially expensive, they presently represent one of the most efficient manners of irrigation,

[e]nsuring that most of the crop receives an adequate supply of water and thus increasing crop yield." EX1008, 1:28-33; EX1012.

48. "Of the various types of sprinkler apparatus, it has been found that the self-propelled, center pivot irrigation apparatus is the most effective type for irrigating large sections of land economically and in a uniform manner. Self-propelled irrigation apparatus of the center pivot type comprises an elongated main arm assembly, usually including several sections connected at their ends, supported at intervals by self-propelling wheeled support towers. The main arm assembly supports, or may itself constitute, a fluid carrying conduit and includes a large number of sprinklers or nozzles spaced along its length." EX1009, 1:6-22.

49. Examples of early irrigation pivots are depicted below:

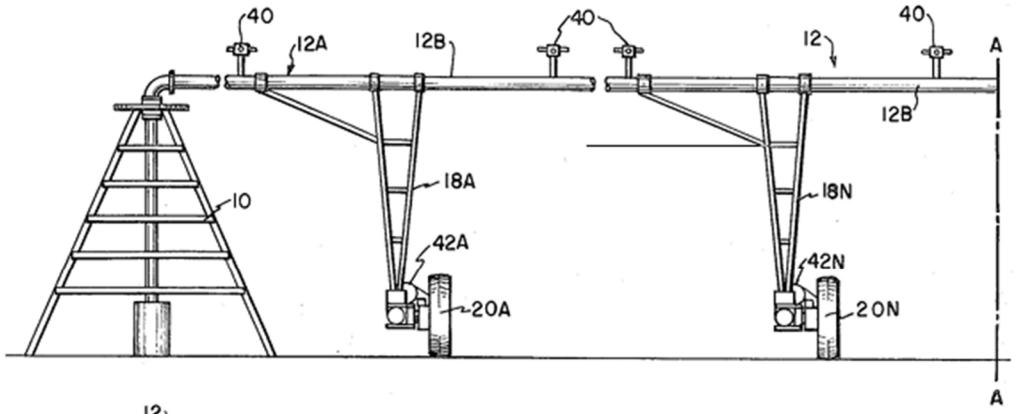


FIG. 4A

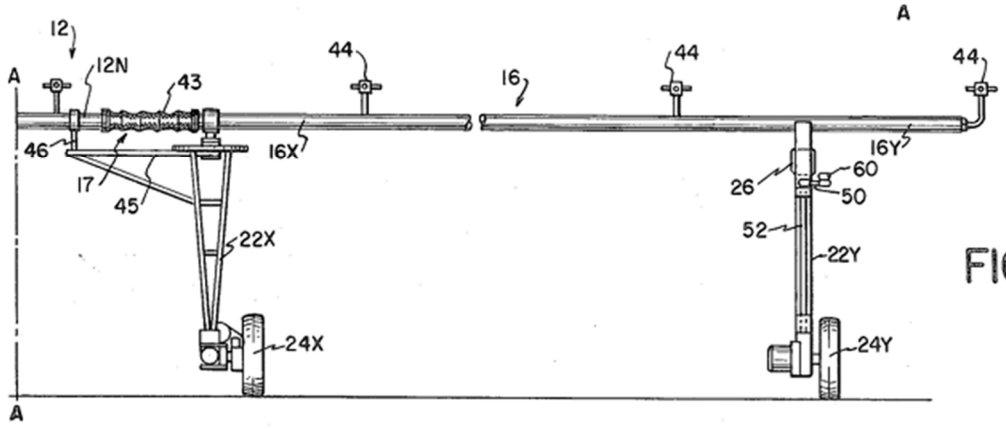


FIG. 4B

EX1009, Figs. 4A, 4B.

50. A person of ordinary skill in the art would have understood that irrigation pivots were typically implemented as modular devices to account for different agricultural environments. For example, Richardville discloses a "center pivot type irrigation system" and a "lateral move type irrigation system," both of which include "one or more spans." EX1007, ¶¶[0014], [0019]. The one or more spans could be assembled to one another to account for differences in field size, terrain, or any other differences in the horticulture environment.

51. Richardville's center pivot type irrigation system additionally includes "one or more drive units," and "one or more pivot legs," and is depicted below in Figure 1. EX1007, ¶[0014]; *see also id.*, Figs. 1-3.

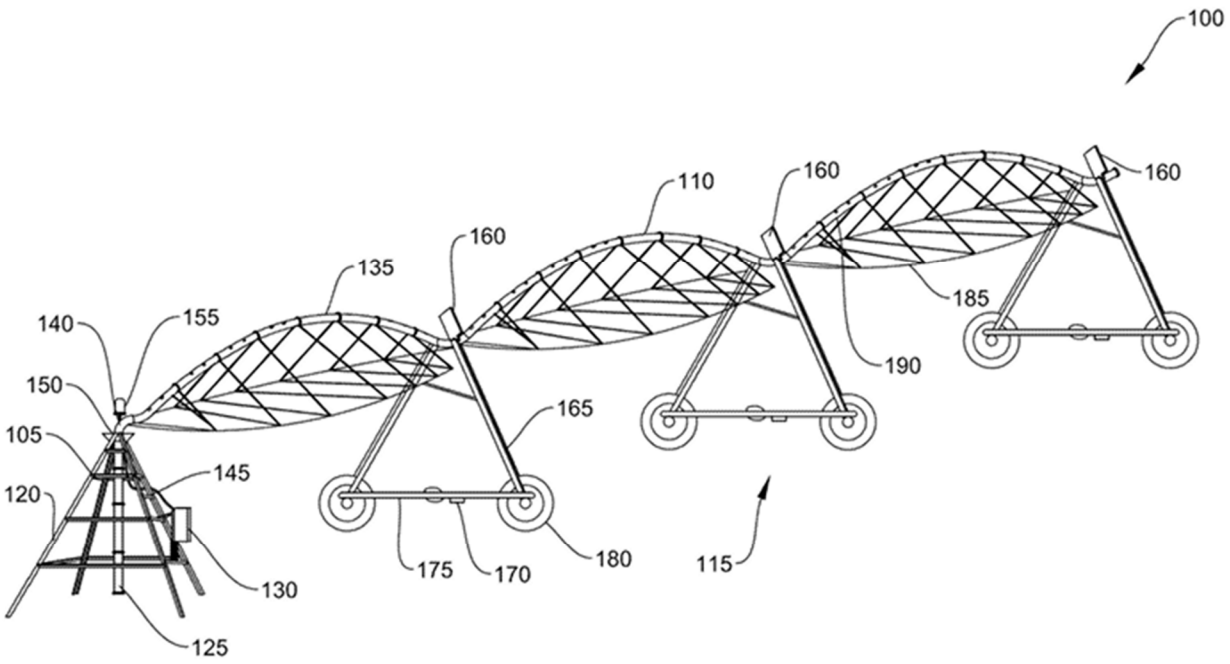


FIG. 1

B. <u>Use of artificial lighting to aid in cultivation of a crop species in a field is well known.</u>

52. "Light(s) supplementation applied to crops can alter plant responses significantly. However, these responses are affected by several factors, such as plant species, crop management, soil fertility, water availability, and the prevailing climate." EX1001, 2:33-37.

53. As early as the 1970's, it was recognized that "[t]he use of artificial light sources as a substitute for, or a supplement to, the sun is becoming widely used by research scientists, commercial growers and hobbyists in the growing of plant life." EX1010, 1:12-29. At that time, benefits of adjusting the spectral balance among and between a plurality of light sources was already known. EX1010, 1:45-58 (disclosing methods and apparatuses for "utilizing an artificial lighting system for growing plants wherein predetermined bursts of radiant energy are supplied to the plant life of a duration, intensity and periodicity such that the photosynthesis process of the plant life is maintained"); EX1010, 6:8-33 ("where the growing beds to be irradiated are fields or large enclosures a large number of lamps would be used, the lamps being typically strung overhead every few inches").

54. The '543 Patent recognizes one exemplary system, stating that:

> Document US 2016/0198640 A1 reveals a mobile irrigation pivot equipped with sprinklers and a plurality of light-emitting diodes configured to emit different frequencies of polarized light in spectral bands from violet to far red spectrum over plants of short, long, or neutral photoperiod response in an agricultural field. The light-emitting diodes are fixed on the irrigation pivot structure, illustrated in FIG. 1 of the referred document.

EX1001, 2:22-29.

55. Similarly, Richardville also discloses an "illuminated irrigation system 300 shown in FIG. 3 [that] includes the center pivot type irrigation system 100 and a light assembly 305. EX1007, ¶[0023], Fig. 3.

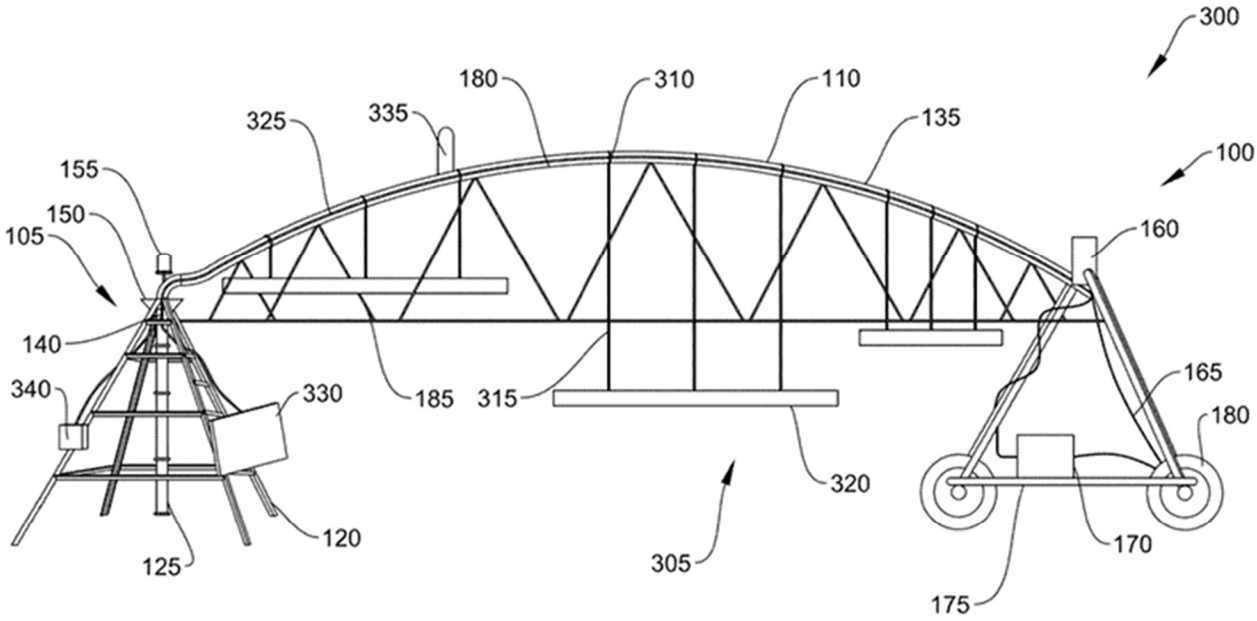


FIG. 3

C. <u>Agricultural management methods were well known in the art.</u>

56. Computer systems have long been used to automate agricultural management. As early as the 1970s, "automatic irrigation systems have sensed the moisture level in the soil of the agricultural area and irrigated whenever necessary to maintain a predetermined moisture level in the soil." EX1011, 1:18-35.

57. The '543 Patent recognizes that at the time of the invention, the use of known "technologies and strategies for soil management and water resources, …

integration of the Internet of Things (IoT) into agriculture, and climate monitoring practices [were] *essential* for high crop performance and yield." EX1001, 1:48-56 (emphasis added). For example, while discussing prior art systems, the '543 Patent explained that "[t]he described irrigation pivot [of US2016/0198640 A1] can also comprise a control circuit configured to control the operation of light-emitting diodes, irrigation parameters, and pivot moving." EX1001, 2:30-32.

VII. OVERVIEW OF THE '543 PATENT

58. The '543 Patent explains that the prior art "fails to reveal artificial light(s) supplementation combined with crop management factors. Instead, when artificial light(s) supplementation is used alone, as indicated in document US 2016/0198640 A1, this may not have the desired effect or may even impair plant development." EX1001, 2:33-48.

59. According to the '543 Patent, "the state of the art lacks technological improvements regarding integrated crop management strategies. Actions in crop fields are still evaluated independently and not integrally. The sustainable use of energy, fertilizers, water, and adequate artificial light(s) supplementation are essential for sustainable large-scale improved cropping activities. These large-scale cropping activities have a great responsibility in human impact on Earth's environments. Improving the sustainability of large-scale cropping activities is possible with the present invention." EX1001, 2:29-58.

60. In response to these alleged concerns, Patent Owner filed U.S. Patent No. 12,089,543, titled "System and method of agricultural management." EX1001. The '543 Patent names Gustavo Alexandre Grossi as the sole inventor and is assigned to Fienile Agronegocios LTDA. EX1001. It was originally filed as PCT/BR2022/050461 on November 24, 2022 and claims priority to BR 1020220072728, filed April 14, 2022. EX1001. For the purposes of this proceeding only, I understand that Petitioner has assumed that the earliest effective filing date of the '543 Patent is April 14, 2022.

A. Person of Ordinary Skill in the Art ("POSA")

61. I understand that validity of a patent must be analyzed from the perspective of a hypothetical person of ordinary skill in the art at the time of the '543 Patent's effective filing date. I understand that there are several factors to consider in determining the level of skill of a person of ordinary skill in the art, including (i) the educational level of workers in the field, (ii) the types of problems encountered in the art, (iii) prior-art solutions to these problems, (iv) the rapidity with which innovations are made, and (v) the complexity of the technology.

62. The '351 Patent relates generally to the field of agricultural management systems. A person of ordinary skill in the art in the field of the '543 Patent on November 24, 2022 (the earliest priority date of the '543 Patent) would have held at least a Bachelor's degree in agricultural, biological or mechanical

engineering, or a closely related field, and at least one year of work or research experience in the design or development of agricultural management systems and/or irrigation pivot systems. Additional experience may compensate for less education, and additional education may compensate for less experience.

63. I had (as of April 14, 2022), and presently have, the capabilities set forth in Petitioner's definitions of a person of ordinary skill in the art at the time of the alleged invention as I both (1) met the educational requirements, and (2) have significant experience in the design and implementation of both irrigation and agricultural management systems. *See* Section II ("Education and Work Experience"), above.

B. <u>The '543 Patent's Prosecution History</u>

64. The '543 Patent is a national stage application of International Patent Application No. PCT/BR2022/050461, filed under the Patent Cooperation Treaty (PCT). The national phase entry was submitted to the United States Patent and Trademark Office (USPTO) on January 26, 2024, accompanied by a preliminary amendment conforming the claims to those now issued. EX1002, p. 256.

65. The international application was examined by the USPTO in its capacity as the International Searching Authority (ISA), and both a positive International Search Report (ISR) and a Written Opinion (WO/ISA) were issued. EX1002, pp. 113, 240.

66. Concurrently with the U.S. national phase filing, the applicant submitted a request under the Patent Prosecution Highway (PPH), relying on the favorable opinion issued during the international phase. The PPH request was granted, and the application was advanced out of turn for examination. EX1002, p. 302.

67. The ’543 Patent was allowed in a first Office Action without any substantive rejections. No claim amendments were made during prosecution beyond those set forth in the preliminary amendment submitted at national phase entry. The patent proceeded directly to issuance without any refusals or further substantive prosecution. EX1002, p. 351.

C. The ’543 Patent’s Claims

68. The ’543 Patent has two independent claims (Claims 1 and 4) and five dependent claims. Independent Claim 4 recites an agricultural management method. Independent Claim 1 implements the method of Claim 4 using generic irrigation and lighting components.

1. Agricultural Management Method

69. Independent Claim 4 recites a method for determining and implementing an artificial light supplementation routine for cultivation of a crop in a field, while considering one or more undefined objectives for the development of

the crop. The claimed method includes adjusting the balance of spectral bands emitted by a plurality of LEDs.

70. Claim 4 is reproduced below in its entirety:

> 4. AGRICULTURAL MANAGEMENT METHOD (500),[1] for the cultivation of a crop (202 a) in an agricultural field (200), characterized by comprising the steps of:
>
> a) adjusting (501), in intervals of the electromagnetic spectrum, the balance between the spectral bands emitted by a plurality of light-emitting diodes of a plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e); and
>
> b) determining and implementing:
>
> an irrigation routine (502) of a modular agricultural irrigation device (101); and/or
>
> a routine of artificial light(s) supplementation (503) of the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e);
>
> wherein stages a) and b) are determined considering at least one among:
>
> a crop (202 a) species under cultivation;
>
> a phenological stage of the crop (202 a) under cultivation;

[1] I have been informed by counsel that the presence of reference characters does not affect the scope of a claim.

> a season, a photoperiod, and current weather conditions under which the agricultural field (200) is subjected; and one or more objective(s) intended for the crop (202) development.

71. With respect to the "routine of artificial light(s) supplementation," the '543 Patent explains that the routine "occurs, preferably, between the phenological stages V3-V4 to R5-R6 of the crop 202 a under cultivation, and ***the balance between the spectral bands is adjusted***." EX1001, 12:64-13:7.[2] Thus, adjusting the balance between the spectral bands (the functional language in step "a") itself constitutes "implementing . . . a routine of artificial light(s) supplementation" (the second action of step "b").

72. The '543 Patent also teaches that "an objective of the present invention is to provide an agricultural management system ***combined with*** artificial light(s) supplementation." EX1001, 2:62-3:2. "The routine of light(s) supplementation is usually independent of the irrigation routine." EX1001, 3:3-9. "In other words, according to the established routine, a processor can command the action of the drive device, water sprinkle device, and the light dimerizer or polarizer. A processor determines this routine, preferably using an artificial intelligence model." EX1001, 7:60-8:3.

[2] All emphasis is added unless otherwise noted.

73. Despite emphasizing in the specification that the invention comprises the combination of an agricultural management routine (such as an irrigation routine) and an artificial light(s) supplementation routine, the '543 Patent does not actually claim said combination. Rather, Claim 4 recites several *optional* limitations, which I understand do not impact the scope of the claims.

74. Here, Claim 4 recites determining and implementing "an irrigation routine (502) of a modular agricultural irrigation device (101); **and/or** a routine of artificial light(s) supplementation (503) of the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e)." Because Claim 4 uses the disjunctive "and/or," I understand that invalidity can be shown through prior art that discloses (1) an irrigation routine of a modular agricultural irrigation device, (2) a routine of artificial light supplementation of a plurality of artificial lighting sources, or (3) both.

75. Similarly, Claim 4 recites determining and implementing the claimed routines based on at least one among (1) the specific crop species in question, (2) the phenological stage of the crop species, (3) the season, photoperiod, and weather conditions of the field, or (4) one or more objectives intended for the crop development. EX1001, Cls. 1, 4. I understand that in order to render Claim 4 obvious, the prior art only has to disclose one of these four considerations.

76. The specification teaches that a person of ordinary skill in the art would have understood "'objective(s) intended for the crop' as the main purpose of the

cropping of such plant specie[s].” EX1001, 4:41-47. Furthermore, “the objective(s) with crop 202 a development is to stimulate or inhibit the production of leaves, branches, roots, grains, fibers, fruits, and essences and, also, to stimulate or inhibit vegetative and reproductive growth and photosynthesis.” EX1001, 12:59-63.

2. Agricultural Management System

77. Independent Claim 1 merely implements the method of Claim 4 using generic structural components. Specifically, Claim 1 requires that the agricultural irrigation device is (1) modular and (2) pivot-like, and contains (3) a plurality of LEDs, (4) a plurality of power sources, (5) a processor, and (6) either a dimerizer or a polarizer. EX1001, Cl. 1. Claim 1 further require that the plurality of LEDs are located “at a predetermined distance above the aerial parts of the crop.” The specification explains that “[t]he light-emitting diodes can be implemented in any new or preexisting irrigation pivot in an agricultural cropping area.” EX1001, 3:3-9.

VIII. THE PRIOR ART

A. Rosen

78. U.S. Patent Pub. No. 2019/0098843 (“Rosen”) was published on April 4, 2019, and is prior art to the ’543 Patent under 35 U.S.C. § 102(a)(1). EX1005. Rosen is titled “Intelligent horticulture light” and names Steven Rosen, Ronald Cozean, Eric Allen, David Edward Mordetzky, Megan Horvath, Anthony John

Pyros, John Elwood, Michael Chang, and Elie Attarian as inventors. EX1005, (54), (72). Rosen is assigned to Resilience Magnum IP, LLC. EX1005, (71).

79. Rosen discloses "A horticulture light [that] can . . . determine at least one action for the horticulture light bulb to perform based on a state of the at least one characteristic and at least one objective of the installation of the horticulture light bulb in the horticulture environment, and execute the at least one action." EX1005, Abstract. Rosen teaches that its horticulture lights can be employed in a "field," "outdoor environment," "or any other suitable horticulture environment." EX1005, [0024].

80. Rosen likewise teaches that its "horticulture light can employ sensors to monitor plants in the horticulture environment, and customize light output and/or control other systems . . . to enhance growth of the plants based on their plant characteristics . . . and/or environmental characteristics" EX1005, [0026]. Specifically, Rosen identifies watering and fertilizing as examples of systems which can be controlled by the disclosed horticulture light. *Id*.

B. Richardville

81. U.S. Patent Pub. No. 2021/0185945 ("Richardville") was published on June 24, 2021, and is prior art to the '543 Patent under 35 U.S.C. § 102(a)(1). EX1007. Rosen is titled "Illuminated irrigation system" and names Matthew Richardville as the sole inventor. EX1007, (54), (72).

82. Richardville discloses "[a] light assembly mounted to a span of an irrigation system. The light assembly includes at least one bracket, at least one extension, and a light bar." EX1007, Abstract. Specifically, Richardville discloses a "center pivot type irrigation system" which includes "one or more spans," "one or more drive units," and "one or more pivot legs." EX1007, ¶¶[0014], [0019].

IX. THE CHALLENGED CLAIMS OF THE '543 PATENT ARE INVALID

A. Ground 1: Claims 1-7 of the '543 Patent are indefinite.

1. The '543 Patent does not inform a person of ordinary skill in the art about the scope of certain structural elements with reasonable certainty.

a. Claims 1-3: a plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e) arranged along the modular agricultural irrigation pivot-like device (101) at a predetermined distance above the aerial parts of the crop (202 a)

83. The '543 Patent claims artificial (LED) lights arranged along an irrigation device at a "predetermined distance" above the "aerial parts of the crop." However, neither the claims nor the specification inform a person of ordinary skill in the art of the scope of the term "predetermined distance." Moreover, neither the claims nor the specification provide a person of ordinary skill in the art with any guidance regarding which configurations of artificial lighting sources fall within—or are excluded from—the scope of the claims.

84. I understand that courts have previously construed similar terms to encompass *any* predetermined distance. However, the Challenged Claims lack a

reference point for measuring the "predetermined distance." Instead, the specification's guidance regarding the "aerial parts of the crop" only introduces additional ambiguity. Specifically, the specification states:

> The agricultural management system 100, combined with artificial light(s) supplementation, incorporates ***a plurality of artificial lighting sources*** 10 a, 10 b, 10 c, 10 d, 10 e arranged, for example, along the irrigation spans 102 a; 102 b of the agricultural irrigation modular device 101 and ***may be located*** at specific points and ***at a predetermined distance above the aerial part (canopy, plant shoot) of the crops*** 202 a[.]

EX1001, 7:25-36.

85. A person of ordinary skill in the art would have understood the claim's reference to the "aerial parts of the crop," read in light of the specification, to refer to the canopy or plant shoot, which collectively encompass any of the above-ground portions of the crop in question.

86. Because the '543 Patent does not identify an objective reference point for measuring the claimed "predetermined distance," a person of ordinary skill in the art would have understood that the claim language might mean several different things. For example, Claim 1 encompasses a plurality of artificial lighting sources arranged along the modular agricultural irrigation pivot-like device at *any* distance above the crop, (so long as that location was "predetermined").

87. However, any configuration of artificial lighting sources affixed to a pivot-like irrigation rig is necessarily affixed at a "predetermined" distance above the crops, at least insofar as the distance is necessarily "determined" when the lights are affixed. As such, the clause "a predetermined distance above the aerial parts of the crop" is meaningless.

b. Claims 1-3: a processor in communication with a dimerizer and/or a polarizer of the plurality of artificial lighting sources

88. The specification does not define "dimerizer," nor does it have any meaning in the context of the Challenged Claims.

89. The term "dimer" or "dimerize" appears to have meaning in other fields, most notably chemical fields, but does not have any relevance to the claimed subject matter.

90. Dimerizer appears to be a term that was coined—but not explained—by Patent Owner.

91. The specification does not provide any guidance, merely stating that "[a] light dimerizer or polarizer adjusts the luminous flux and the balance between the spectral bands emitted by a plurality of light-emitting diodes." EX1001, 8:25-48. But, the specification does not explain how a "dimerizer" is similar to or different from a polarizer, nor how the dimerizer "adjusts the luminous flux and the balance between the spectral bands emitted by a plurality of light-emitting diodes."

2. Claims 1-7 of the ’543 Patent are indefinite due to use of subjective catchall limitations.

92. Claims 1 and 4 of the ’543 Patent state that the claimed artificial light supplementation routine must be determined or implemented while considering “one or more objective(s) intended for the crop (2) development.” EX1001, Cls. 1, 4. Claim 7, meanwhile, recites that the claimed soil management routine must be determined while considering “one or more objective(s) intended for the crop (202 a) development.” EX1001, Cl. 7.

93. The specification teaches that the claimed “‘objective(s) intended for the crop” are “the *main purpose* of the cropping of such plant specie[s].” EX1001, 4:41-47.

94. A person of ordinary skill in the art would have understood that the “objective(s) intended for the crop (2) development” relates to the end-user experience, but fails to provide any way to determine whether the unidentified “objectives” have been considered while developing or implementing an artificial light supplementation routine.

3. Claim 7’s references to “the artificial intelligence model” lack antecedent basis and are therefore indefinite.

95. Claims 4, 6, and 7 are reproduced in part, below:

Claim 4	Claim 6	Claim 7
4. AGRICULTURAL MANAGEMENT METHOD (500), for the cultivation of a crop (202 a) in an agricultural field (200), characterized by comprising the steps of: a) adjusting . . . b) determining and implementing . . . wherein stages a) and b) are determined considering . . .	METHOD (500), according to claim 4, is characterized by further comprising a stage c) of determining a routine of soil management in the agricultural field (200) based on soil analyses from the agricultural field (200).	METHOD (500), according to claim 6, characterized in that stage c) of determining through the artificial intelligence model considers at least one of the following. . . .

96. Claim 6 recites a "stage c" of "determining a routine of soil management" but does not reference the use of "artificial intelligence.

97. Claim 4 (which Claim 6 depends from) does not reference artificial intelligence.

98. Claim 7 characterizes "stage c" as "determining *through the artificial intelligence model.*"

99. Claim 7's reference to "*the* artificial intelligence model" creates ambiguity regarding which specific artificial intelligence model is referenced.

Moreover, it is unclear whether the "determining" step of Claim 6 also requires use of "an artificial intelligence model."

100. The specification does not provide any guidance regarding any specific artificial intelligence models, nor does it inform a person of ordinary skill in the art which model is appropriate to use for "determining a routine of soil management."

101. As such, a person of ordinary skill in the art would not have had reasonable certainty regarding which artificial intelligence model is implicated by Claim 7.

4. Claims 1-7 of the '543 Patent are indefinite due to their use of unintelligible process limitations.

102. Claim 1.B.iv and Claim 4.C both recite "stages a) and b) are determined. . ." EX1001, Cls. 1, 4.

103. However, "stage a" does not include a "determining" step, but merely claims "adjusting" the artificial lights.

104. The specification provides no additional guidance.

105. As such, a person of ordinary skill in the art would have had no way to know whether the factors recited in Claim 1.B.iv and Claim 4.C must also be considered while "adjusting" the artificial lights, nor would they have known what form said "considering" takes in the context of "adjusting" the artificial lights.

106. This argument applies with equal force to Claims 2 and 5.

B. Ground 2: Claims 1-7 of the ’543 Patent are not enabled.

107. A person of ordinary skill in the art would not have been able to practice several aspects of the claimed invention without undue experimentation.

108. The ’543 Patent broadly claims “determining and implementing” (1) irrigation routines, (2) artificial light supplementation routines, and (3) soil management routines, but does not provide any guidance as to how a person of ordinary skill in the art would have done so. EX1001, Cls. 1, 4, 6;

109. In effect, Patent Owner has claimed the very concept of undue experimentation—*i.e.*, the process of “determining” the irrigation routine.

110. Dependent claims further add that said “determining” occurs “using an artificial intelligence model,” but the ’543 Patent does not explain how a person of ordinary skill in the art would have used an artificial intelligence model to determine an irrigation routine. EX1001, Cls. 2, 5.

111. Because the claimed irrigation, artificial light supplementation, and soil management routines would have been understood by a person of ordinary skill in the art to broadly refer to *all* irrigation, supplementation, and soil management routines, the specification must likewise enable a person of ordinary skill in the art to both determine, and implement *all* irrigation, supplementation, and soil management routines.

112. Given that the specification provides (1) no guidance regarding how a person of ordinary skill in the art would "determine" an irrigation or soil management routine, and (2) only a single example of "determining" an artificial light supplementation routine, that burden is not met. EX1001, 8:25-48.

113. A narrower construction of at least the claimed irrigation and soil management routines is not supported by the specification, which fails to provide any guidance regarding the scope of those terms.

114. The *Wands* factors show that Claims 1-7 of the '543 Patent are not enabled. Any factors not discussed herein are, at most, neutral.

1. Nature of Invention and Quantity of Experimentation (Factors 1, 4)

115. Factor 1 (the quantity of experimentation necessary) and factor 4 (the nature of the invention) weigh strongly against a finding of enablement.

116. The challenged claims broadly cover all methods for "determining" irrigation, artificial light supplementation, and soil management routines (as well as all processors configured to "determine" irrigation, artificial light supplementation, and soil management routines).

117. Given the lack of guidance provided by the specification, a person of ordinary skill in the art would face a near-impassible challenge of attempting to comprehend the near-limitless methods available for "determining" an irrigation or soil management routine.

2. No Guidance or Examples Provided (Factors 2, 3)

118. The specification does not provide any guidance regarding how a person of ordinary skill in the art would go about "determining" the claimed irrigation and soil management routines, and only a single example of "determining" an artificial light supplementation routine. EX1001, 8:25-48.

119. Instead, a person of ordinary skill in the art would have been left to blindly attempt various actions to see if they resulted in "determining" any of the claimed "routines." This lack of guidance or examples of irrigation, artificial light supplementation, and soil management routines causes factors 2 (the amount of direction or guidance presented) and 3 (the presence or absence of working examples) to weigh heavily in favor of a finding of undue experimentation.

3. The Breadth of the Claims (Factor 8)

120. Here, the breadth of the claims—encompassing all methods to "determine" an irrigation, artificial light supplementation, or soil management routine—causes factor 8 to weigh against a finding of enablement.

4. Conclusion

121. Because undue experimentation would be required to practice each of Claims 1-7, they are not enabled and therefore invalid.

C. Ground 3: Claims 1-7 of the ’543 Patent are directed to ineligible subject matter.

122. Claims 1-7 the ’543 Patent cover unpatentable abstract ideas and are thus unpatentable under 35 U.S.C. § 101.

1. The Challenged Claims are directed to the abstract idea of providing plants with light, water, and soil to encourage growth.

123. Claim 4 of the ’543 Patent recites nothing more than the abstract idea of providing plants with the optimal light, water, and soil to facilitate growth.

124. The preamble to Claim 4 recites a method for cultivation of a crop in a field, which has been performed by mankind for thousands of years.

125. The claimed method includes two steps: (a) adjusting a plurality of artificial lights, and (b) determining and implementing an irrigation or light supplementation routine.

126. Claim 4 further recites adjusting “the balance between the spectral bands emitted by a plurality of light-emitting diodes.” Although the specification references the benefits of applying different colored light in different circumstances, the claims are not so limited. Adjusting “the balance between the spectral bands emitted by a plurality of light-emitting diodes” can also be accomplished by, for example, adjusting which of the plurality of light-emitting diodes are on vs off.

127. Claim 4 of the ’543 Patent claims (1) determining how to provide light or water to a crop in order to facilitate or inhibit growth, (2) adjusting artificial lights,

and (3) providing light or water to the crop. *See* Section VII.C, *supra*. This is nothing more than the abstract idea of providing plants with the optimal light and water to facilitate growth.

128. Claims 6 and 7 similarly refer to determining how to provide appropriate soil conditions to a crop in order to facilitate or inhibit growth. Again, this is nothing more than the abstract idea of providing plants with the optimal soil conditions to facilitate growth.

2. The Challenged Claims lack an inventive concept.

129. Claim 1 of the ’543 Patent implements the method of Claim 4 on generic processing equipment. This is nothing more than an instruction to implement or apply the abstract idea on a computer.

130. Similarly, Claims 1 and 3 recite generic irrigation components (e.g., an irrigation pivot with a plurality of LEDs, power sources, sprinklers, and a drive device.

3. The ’543 Patent’s reference to “artificial intelligence” does not render it patent-eligible.

131. Claims 2 and 5 of the ’543 Patent claim nothing more than the application of “artificial intelligence” to determine irrigation routines, artificial light(s) supplementation routines, and (potentially) soil management routines.

132. But, neither the claims nor the specification (1) disclose any improvements to either (1) the "artificial intelligence" or (2) the irrigation, artificial light(s) supplementation, or soil management routines.

133. Instead, they improperly claim "determining" routines using generic "artificial intelligence."

134. These claims are directed to the abstract idea of using a generic machine learning technique in a particular environment, with no inventive concept.

D. Ground 4: Claims 1-7 of the '543 Patent are obvious over Rosen.

135. As explained in additional detail, below, Claims 1-7 are obvious over Rosen.

136. Rosen was not considered during prosecution of the '543 patent and is more material than the prior art considered. EX1002.

1. Claim 1:

a. 1.Pre: AGRICULTURAL MANAGEMENT SYSTEM (100) is characterized by comprising:

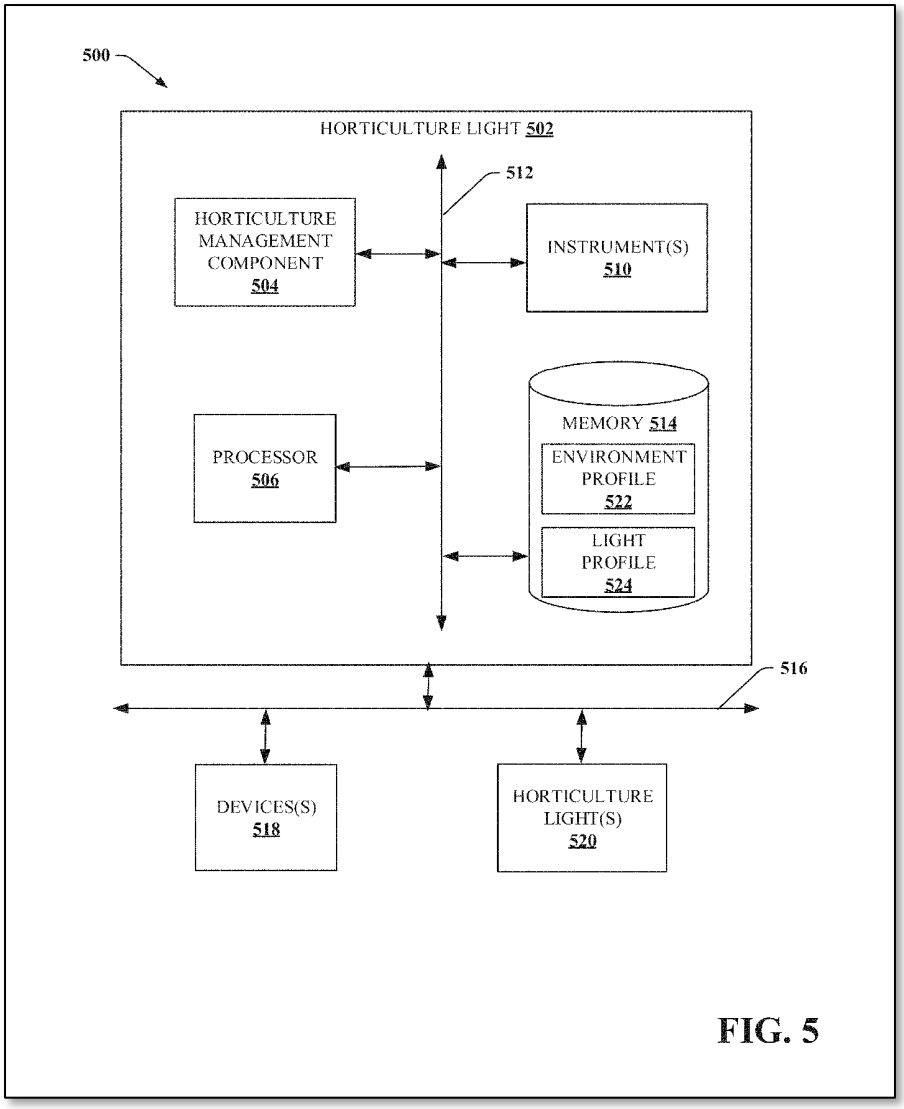
137. Rosen discloses an agricultural management system.

138. Specifically, Rosen discloses "a horticulture light that comprises instruments, and is able to communicate with other horticulture lights and other devices is presented that efficiently utilizes resources to enhance growth of plants." EX1005, ¶[0026]. Rosen's "horticulture light can understand its horticulture environment and device ecosystem using the instruments, and perform a self-

configuration to optimize its functionality to enhance growth of plants in the horticulture environment and device ecosystem." EX1005, ¶[0026].

139. The agricultural management system disclosed by Rosen is adapted for automation with a computer system. EX1005, ¶[0032] ("The subject disclosure is directed to computer processing systems, computer-implemented methods, apparatus and/or computer program products that facilitate efficiently and automatically . . . employing horticulture lights 100, 200 that utilize resources . . . to enhance growth of plants.").

140. Figure 5 (reproduced below) depicts an exemplary block diagram of Rosen's agricultural management system:



EX1005, Fig. 5.

141. Rosen teaches that "[d]evice 518 can be any electronic device that can electronically interact (e.g. unidirectional interaction or bidirectional interaction) with horticulture light 502, non-limiting examples of which can include a wearable electronic device or a non-wearable electronic device. It is to be appreciated that interaction can include in a non-limiting example, communication, control, physical interaction, or any other suitable interaction between devices." EX1005, ¶[0048].

"Non-wearable devices can include, for example, a system (e.g. temperature, humidity, watering, fertilizing, feeding, pollination, insect repellent, sound, air flow, air quality, windows, robots, or any other suitable systems associated with horticulture)." EX1005, ¶[0048].

b. 1.A: a modular agricultural irrigation pivot-like device (101) positioned on an agricultural field (200) in the cultivation of a crop (202 a) species, the modular agricultural irrigation pivot-like device (101) comprising:

142. Rosen discloses or otherwise renders obvious a modular agricultural irrigation pivot-like device positioned on an agricultural field in the cultivation of a crop species.

143. Rosen discloses an agricultural device positioned on an agricultural field in the cultivation of a crop species. Specifically, Rosen discloses a "horticulture light [that] can understand its horticulture environment and device ecosystem . . . and perform a self-configuration to optimize its functionality to enhance growth of plants in the horticulture environment and device ecosystem." EX1005, ¶[0026]. Rosen provides examples of an applicable "horticulture environment," including a "grow room, greenhouse, ***field***, indoor environment, ***outdoor environment***, liquid environment, or any other suitable horticulture environment." EX1005, ¶¶[0024], [0059], [0062].

144. Rosen also teaches that its "horticulture light can employ sensors to monitor plants in the horticulture environment, and customize light output and/or

control other systems (e.g. temperature, humidity, *watering*, fertilizing, feeding, pollination, insect repellent, sound, air flow, air quality, windows, robots, or *any other suitable systems associated with horticulture*)." EX1005, ¶¶[0026], [0048]. A person of ordinary skill in the art would have understood that a modular irrigation pivot was a known example of a "watering" system that functioned as a "suitable system[] associated with horticulture" for use in a horticulture environment such as a field. Therefore, a person of ordinary skill in the art would have understood that a modular irrigation pivot was an appropriate system to use in connection with the horticulture light disclosed by Rosen.

145. As additional evidence, the "Background of the Invention" section of the '543 Patent identifies examples of known suitable systems associated with horticulture at the time of filing. Specifically, the '543 Patent explains that "Document US 2016/0198640 A1 [("Singh"); EX1006] reveals a *mobile irrigation pivot* equipped with sprinklers and a plurality of light-emitting diodes configured to emit different frequencies of polarized light in spectral bands from violet to far red spectrum over plants of short, long, or neutral photoperiod response in an agricultural field." EX1001, 2:22-29.

146. A person of ordinary skill in the art would have understood that the mobile irrigation pivot disclosed in Singh would have been a "suitable system[]

associated with horticulture" for use in a horticulture environment such as a field, as contemplated by Rosen. EX1005, ¶¶[0024], [0026].

147. The mobile irrigation pivot disclosed by Singh is depicted below:

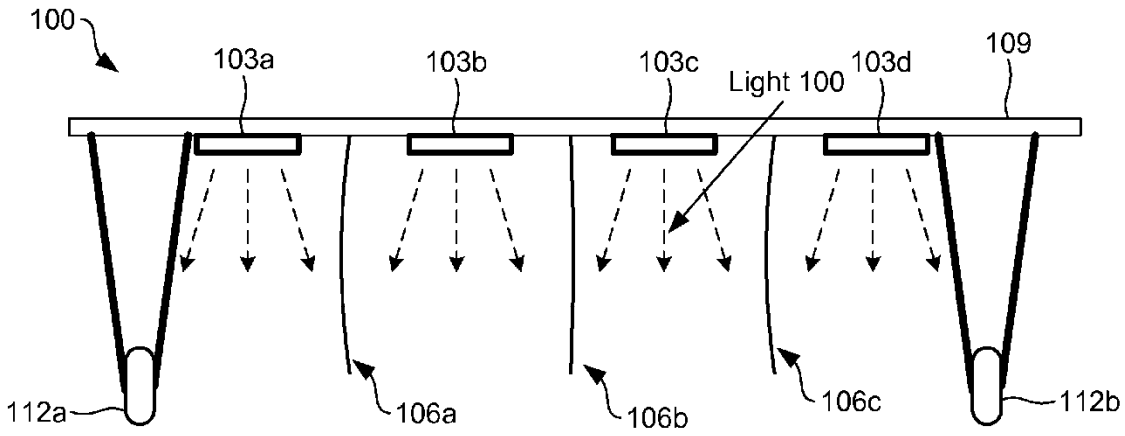


FIG. 1

EX1006, Fig. 1.

148. The '543 Patent teaches that its agricultural management system "can be adapted to an irrigation new pivot or already existing in an agricultural field 200, such as a central irrigation pivot, whether towed or non-towable, or even a linear irrigation pivot." EX1001, 6:62-7:3.

149. A person of ordinary skill in the art would have understood that the mobile irrigation pivot disclosed in Singh would have been implemented as either a central irrigation pivot or a linear irrigation pivot, both of which are "pivot-like"

devices. A person of ordinary skill in the art would have further understood that mobile irrigation pivots such as the one disclosed in Singh are well-known in the art and are conventionally implemented as modular devices to account for differences in field size, terrain, or any other differences in the horticulture environment. *See* §VI.A, above.

150. Rosen also explicitly discloses that its system is modular. *See, e.g.,* EX1005, ¶¶[0034]-[0035] (explaining that Rosen's horticulture system "can include any suitable number of light emitting devices" and "can include other components" such as additional LEDs, reflectors, shades, positioning motors, "or any other suitable components needed according to functionality described herein"), ¶¶[0039]-[0040] ("horticulture light 100, 200 can have a modular configuration that allows for one or more power sources [and instruments] to be added or removed by a manufacturer or operator"), Figs. 1-2, 8-10.

(1) 1.A.i: a plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e) arranged along the modular agricultural irrigation pivot-like device (101) at a predetermined distance above the aerial parts of the crop (202 a), comprising a plurality of light-emitting diodes; and

151. Rosen discloses a plurality of artificial lighting sources arranged along the modular agricultural irrigation pivot-like device at a predetermined distance above the aerial parts of the crop, comprising a plurality of light-emitting diodes.

152. Rosen discloses a plurality of artificial lighting sources comprising a plurality of light emitting diodes. Rosen explicitly teaches that "[t]he subject disclosure relates generally to horticulture lights for growing plants" and "[a]ccording to an embodiment, a horticulture light bulb is provided." EX1005, ¶¶[0002], [0004].

153. Specifically, Rosen explains that:

> Horticulture light 100 comprises a horticulture light bulb 102 which can be installed as a retrofit into a socket 116 of conventional light fixture 114. Horticulture light bulb 102 comprises *one or more light emitting devices* 104 a, 104 b, 104 c, 104 d, and 104 e (e.g. *light emitting diode (LED)*, organic light emitting diode (OLED), filament, quantum dot, incandescent, high-intensity discharge (HID), neon, fluorescent, compact fluorescent (CFL), electroluminescent (EL), laser, or any other suitable light emitting device) a housing 106, a base 108, a lens 110, and one or more instruments 112. *It is to be appreciated that while five light emitting devices 104 a, 104 b, 104 c, 104 d, and 104 e are depicted for illustrative purposes only, horticulture light bulb 102 can include any suitable number of light emitting devices*.

EX1005, ¶¶[0034]-[0035], Fig. 1; *see also* ¶¶[0036]-[0038].

154. As discussed with respect to Ground 1, a person of ordinary skill in the art would have understood that the term "predetermined distance" refers to any distance. Moreover, a person of ordinary skill in the art would have understood the claim's reference to the "aerial parts of the crop," read in light of the specification,

to refer to the canopy or plant shoots, which collectively encompass any of the above-ground portions of the crop in question. EX1001, 7:25-36. As such, a person of ordinary skill in the art would have found the limitation "predetermined distance above the aerial parts of the crops" indefinite because it fails to inform a person of ordinary skill in the art about the scope of the invention with reasonable certainty. *See,* §IX.A.1.a, above.

155. If the Board determines this limitation is not indefinite, a person of ordinary skill in the art would have understood it to encompass any predetermined arrangement of artificial lighting sources along the modular agricultural irrigation pivot-like device, so long as the artificial lighting sources are located "above" the aerial parts of the crop. With this understanding, Rosen discloses that the plurality of artificial lighting sources are arranged along the modular agricultural irrigation pivot-like device at a predetermined distance above the aerial parts of the crop.

156. Specifically, Rosen teaches that "[a] horticulture light can learn about its context and customize its configuration and/or operation in accordance with the context (e.g. using artificial intelligence). This can eliminate or minimize the need for an operator (e.g. user, administrator, or any other suitable entity) to perform manual configuration. Furthermore, a set of horticulture lights can automatically perform coordinated self-configuration and operation." EX1005, ¶[0031]. Rosen also teaches "that a user interface (not shown) can be provided that allows an

operator to manually adjust the configuration generated by the horticulture light 100, 200." EX1005, ¶[0032].

157. A person of ordinary skill in the art would have understood that at least manual configurations of the horticulture lights constitute "predetermining" the placement of the artificial lighting sources.

158. Consistent with this disclosure, Rosen depicts numerous examples of artificial lighting sources arranged above the aerial parts of plants. *See, e.g.*, Figs. 8-12E.

(2) 1.A.ii: a plurality of energy sources that feed the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e),

159. Rosen discloses a plurality of energy sources that feed the plurality of artificial lighting sources.

160. According to Rosen, "[a] horticulture light 100, 200 can include a power source." EX1005, ¶[0039]. Rosen teaches that "a horticulture light 100, 200 can have a constantly available power source, such as that provided by an electrical power grid" or "a temporary power source, such as a battery (e.g. disposable battery or rechargeable battery)." EX1005, ¶[0039].

161. Rosen's "horticulture light 100, 200 can have a plurality of different power sources, with one or more power sources acting as a backup for another power source." EX1005, ¶[0039]

162. . A person of ordinary skill in the art would have understood that the disclosed "plurality of different power sources" feed the plurality of artificial lighting sources. §IX.D.1.b(1) .

c. 1.B: the agricultural management system (100) further comprising:

163. Rosen discloses an agricultural management system. *See* 1.Pre, above.

(1) 1.B.i: a processor in communication with a dimerizer and/or a polarizer of the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e) and with the plurality of energy sources, wherein the processor is configured to:

164. Rosen discloses a processor in communication with a dimerizer and/or a polarizer of the plurality of artificial lighting sources and with the plurality of energy sources.

165. Rosen teaches that its "horticulture light bulb comprises one or more instruments, a memory that stores computer executable components, and a processor that executes the computer executable components stored in the memory." EX1005, ¶[0004]; *see also* EX1005, ¶¶[0005]-[0006]. A person of ordinary skill in the art would have understood that Rosen's processor would have been in electrical communication with the disclosed plurality of energy sources, in order to provide power to the processor. §IX.D.1.b(2).

166. Rosen's processor includes "an operation component that: determines at least one action for the horticulture light bulb to perform based on a state of the at

least one characteristic and at least one objective of the installation of the horticulture light bulb in the horticulture environment, and executes the at least one action." EX1005, ¶[0004].

167. Specifically Rosen discloses that its "computer processing systems" (including its processor), "facilitate efficiently and automatically (e.g., with little or no direct involvement from an operator) employing horticulture lights 100, 200 that utilize resources (e.g. light output characteristics . . . or any other suitable resource employed in horticulture) to enhance growth of plants." EX1005, ¶[0032]. Similarly, Rosen's horticulture lights are "associated with at least one processor 506 that executes the computer executable components stored in the memory 514. Horticulture light 502 can further include a system bus 512 that can couple the various components including, but not limited to, horticulture management component 504, instruments 510, memory 514, processor 506, and/or other components." EX1005, ¶[0047]. "Device 518 can be any electronic device that can electronically interact (e.g. unidirectional interaction or bidirectional interaction) with horticulture light 502, non-limiting examples of which can include . . . for example, a [watering] system." EX1005, ¶[0048] ("interaction can include in a non-limiting example, communication, control, physical interaction, or any other suitable interaction between devices").

168. A person of ordinary skill in the art would have understood that Rosen's processor is in communication with systems capable of altering "light output characteristics . . . to enhance the growth of plants." EX1005, ¶[0027] ("the horticulture light can adjust light output (e.g. spectrum, wavelength, frequency, intensity, pattern, direction, etc.) to optimize plant growth"); EX1005, ¶[0080] ("customization of light output from horticulture light 502 can relate to lighting output patterns, hues, light output movements, intensities, spectrum, saturation, light direction, reflection, refraction, dispersion, ***polarization***, on or off interval durations of light output, or any other suitable lighting attribute from one or more horticulture lights 502").

169. A person of ordinary skill in the art would have additionally understood that customization of the "polarization" of light output from horticulture light 502 is accomplished through use of a polarizer.

(2) 1.B.ii: a) adjust (501), in the intervals of the electromagnetic spectrum, the balance between the spectral bands emitted by the plurality of light-emitting diodes; and

170. Rosen discloses a processor configured to adjust, in the intervals of the electromagnetic spectrum, the balance between the spectral bands emitted by the plurality of light-emitting diodes.

171. A person of ordinary skill in the art would have understood that Rosen's horticulture lights are controlled by the disclosed processor. §IX.D.1.c(1) .

172. Specifically, Rosen's horticulture lights (including Rosen's processor), are configured to:

> [E]mploy pattern recognition to determine characteristics, such as a type of plant, stage of growth, development of the plant over time, . . . lighting conditions, plant watering conditions, soil condition, . . . or any other suitable condition associated with the plant(s) growing in the horticulture room. Based on the characteristics, ***the horticulture light can adjust light output*** *(e.g.* ***spectrum***, ***wavelength***, frequency, ***intensity***, pattern, direction, etc.) to optimize plant growth and cost (e.g. cost-benefit analysis). A set of horticulture lights can operate in a coordinated manner to optimize plant growth and cost for one or more plants.

EX1005, ¶[0027].

173. A person of ordinary skill in the art would have understood that the referenced "horticulture room" likewise includes any appropriate horticulture environment, such as a field. §IX.D.1.b.

174. Moreover, "[c]ustomization of light output ... can relate to lighting output patterns, hues, light output movements, intensities, spectrum, saturation, light direction, reflection, refraction, dispersion, polarization, on or off interval durations of light output, or any other suitable lighting attribute from one or more horticulture lights 502." *Id*., ¶[0080].

175. Rosen also teaches that "although the term 'horticulture light' is used herein, in various embodiments, the examples provided can include *one or more*

horticulture lights operating independently or in a distributed fashion." EX1005, ¶[0031]; *see also id.*, ¶[0082] ("Operation component 704 of horticulture light 802 a can customize light output according to the monitored characteristics and one or more objectives. Likewise, horticulture lights 802 b, 802 c, 802 d, 802 e, 802 f, 802 g, 802 h, 802 i, 802 j, 802 k, and 802 l can have their respective defined areas that they monitor and customize light output. It is to be appreciated that 802 a, 802 b, 802 c, 802 d, 802 e, 802 f, 802 g, 802 h, 802 i, 802 j, 802 k, and 802 l can coordinate their customized light outputs. For example, since light output from a horticulture light may enter a defined area of another horticulture light, the horticulture lights can coordinate one or more parameters of their respective light outputs.").

176. A person of ordinary skill in the art would have understood that independently adjusting the spectrum of a plurality of horticulture lights constitutes adjusting "the balance between the spectral bands emitted by the plurality of light-emitting diodes."

177. As a specific example, Rosen teaches that "operation component 704 can customize light output of horticulture light 1202 in a red light spectrum to stimulate flowering and/or fruit production." EX1005, ¶[0090]. A person of ordinary skill in the art would have understood customizing the "red light spectrum" to encompass "adjust[ing], in the intervals of the electromagnetic spectrum, the balance

between the spectral bands emitted by the plurality of light-emitting diodes." *See also* ¶¶[0032]-[0033], [0047], [0050]-[0058], [0070], [0072]-[0080], [0087]-[0092].

(3) 1.B.iii: b) determine and implement: an irrigation routine (502); and/or an artificial light(s) supplementation routine (503);

178. Rosen discloses a processor configured to determine and implement: an irrigation routine; and/or an artificial light(s) supplementation routine.

179. Specifically, Rosen teaches that its horticulture light "determines at least one action for the horticulture light bulb to perform." EX1005, ¶[0004]. Simply put, Rosen teaches that:

> Horticulture light 502 can include horticulture management component 504 that can enable horticulture light 502 to understand the environment in which the horticulture light 502 is installed, ***determine an objective of the installation***, perform a self-configuration according to the determined objective, and ***operate to achieve the determined objective*** related to efficiently enhancing plant growth.

EX1005, ¶[0046].

180. Rosen provides additional detail regarding the claimed "determining" and "implementing" steps:

> The horticulture light can understand its horticulture environment and device ecosystem using the instruments, and perform a self-configuration to optimize its functionality to enhance growth of plants in the horticulture environment and device ecosystem. For example, the horticulture light can employ sensors to monitor plants in the

> horticulture environment, and customize light output and/or control other systems (e.g. . . . watering . . .) to enhance growth of the plants based on their plant characteristics . . . and/or environmental characteristics. . . .

EX1005, ¶[0026]; *see also id.,* ¶¶[0027]-[0028] ("the horticulture light can learn over time lighting, watering, soil, air, plant spacing, and other conditions that enhance plant growth for respective plant types and adjust operations accordingly. The horticulture light can adjust its lights, employ tools, or instruct other devices/systems on operations to enhance plant growth. . . . For example, the horticulture light can instruct a water system to increase water flow to one or more plants").

181. As such, a person of ordinary skill in the art would have understood that Rosen discloses both (1) determining, and (2) implementing both irrigation and artificial light supplementation routines.[3] EX1005, ¶¶[0005]-[0006], [0029]-[0033],

[3] As explained with respect to Ground 2, above, the '543 Patent does not enable certain limitations of the Challenged Claims related to "determining" various routines. §IX.B, above. If the Board determines that the "determining" limitations are enabled, Rosen discloses determining routines in at least as much detail as the '543 Patent.

[0042]-[0044], [0047], [0050]-[0058], [0061], [0063], [0065]-[0066], [0070], [0072]-[0080], [0087]-[0092].

(4) 1.B.iv: wherein stages a) and b) are determined by the processor considering at least one among: a crop (202 a) species under cultivation; a phenological stage of the crop (202 a) under cultivation; a photoperiod, a season and current weather conditions under which the agricultural field (200) is subjected; and one or more objective(s) intended for the crop (202 a) development.

182. Rosen discloses wherein stages a) and b) are determined by the processor considering at least one among: a crop species under cultivation; a phenological stage of the crop under cultivation; a photoperiod, a season and current weather conditions under which the agricultural field is subjected; and one or more objective(s) intended for the crop development.

183. Although I understand that only one category is required to render the challenged claims obvious—in light of the fact that the claim language refers to "at least one among"—Rosen discloses "stages a) and b) are determined by the

processor considering"[4] each of (1) a crop species under cultivation; (2) a phenological stage of the crop under cultivation; (3) a photoperiod, a season and current weather conditions under which the agricultural field is subjected; and (4) one or more objective(s) intended for the crop development.

184. **A crop species under cultivation.** Rosen discloses that its "horticulture light can employ sensors to monitor plants in the horticulture environment, and customize light output and/or control other systems . . . to enhance growth of the plants based on their plant characteristics (e.g. ***type of plant***, stage of growth . . . or any other suitable characteristics associated with the plants)." EX1005, ¶¶[0026]-[0028]; *see also id.*, ¶¶[0061]-[0069]. A person of ordinary skill in the art would have understood "type of plant" to be synonymous with "crop species."

185. **A phenological stage of the crop under cultivation.** Rosen discloses that its "horticulture light can employ sensors to monitor plants in the horticulture

[4] As explained in Section IX.A.4, above, stage a) does not recite a step of "determining." To the extent that the Board determines the Challenged Claims are not indefinite, a person of ordinary skill in the art would have understood that stages a) and b) are implemented by Rosen's processor—including the "determining" step of stage b)—while considering each of the factors recited in limitation 1.B.iv for the reasons explained herein.

environment, and customize light output and/or control other systems . . . to enhance growth of the plants based on their plant characteristics (e.g. type of plant, ***stage of growth***. . . or any other suitable characteristics associated with the plants)." EX1005, ¶¶[0026]-[0028]; *see also id.*, ¶¶[0061]-[0069]. A person of ordinary skill in the art would have understood "stage of growth" to be synonymous with "phenological stage."

186. **A photoperiod, a season and current weather conditions under which the agricultural field is subjected.** Rosen discloses its "computer executable components can comprise: a monitoring component that employs at least one instrument of the one or more instruments to monitor at least one characteristic of a defined region in which at least one plant is planted in a horticulture environment in which horticulture light bulb is installed; and an operation component that: determines at least one action for the horticulture light bulb to perform based on a state of the at least one characteristic." EX1005, ¶¶[0004]-[0006]; *see also id.*, ¶¶[0026]-[0028] ("horticulture light can employ sensors to monitor plants in the horticulture environment, and customize light output and/or control other systems . . . to enhance growth of the plants based on . . . environmental characteristics (e.g. temperature, humidity, ambient lighting, air quality, water quality, soil quality, soil moisture, pests, location, location relative to other plants, ambient sounds, or any

other suitable characteristic associated with a horticulture environment)"); ¶¶[0061]-[0069].

187. A person of ordinary skill in the art would have understood the "environmental characteristics" disclosed by Rosen to include "photoperiod", "season" and "current weather conditions" for the field. Specifically, a person of ordinary skill in the art would have understood that ambient lighting refers to the total light available in the plant's environment, from both natural and artificial sources, and therefore encompasses a "photoperiod."

188. **One or more objective(s) intended for the crop development.**[5] Rosen discloses that its "computer executable components can comprise . . . and an operation component that: determines at least one action for the horticulture light bulb to perform based on . . . at least one objective of the installation of the horticulture light bulb in the horticulture environment." EX1005, ¶¶[0004]-[0006];

[5] As explained in Section IX.A.2, above, Claim limitation 1.B.iv is purely subjective and depends on the unpredictable vagaries of any one person's opinion. If the Board determines this element is not indefinite, a person of ordinary skill in the art would have understood that stages a) and b) are implemented by Rosen's processor while considering "at least one objective of the installation of the horticulture light" as explained herein. EX1005, ¶¶[0004]-[0006].

see also id., ¶[0025] ("efficiency can be based on an objective . . . of the horticulture environment defined by a user and/or the system"); ¶[0031] ("All examples below can involve coordination amongst a set of horticulture lights to achieve a horticulture objective, whether explicitly stated or not."); ¶¶[0043]-[0044], [0061]-[0069]; Fig. 5.

2. Claim 2: SYSTEM (100), according to claim 1, characterized in that stages a) and b) determined by the processor using an artificial intelligence model.

189. Rosen discloses the system, according to claim 1, characterized in that stages a) and b) [are] determined by the processor using an artificial intelligence model.[6]

190. Rosen discloses the system, according to Claim 1. *See* Claim 1, above.

191. Specifically, Rosen teaches that "[t]he horticulture light has artificial intelligence capabilities and can employ sensors to monitor environmental condition

[6] As explained in Section IX.A.4, above, Claim 2 alleges that "stages a) and b) [are] *determined* by the processor" but stage a) does not recite a step of "determining." If the Board determines the Challenged Claims are not indefinite, a person of ordinary skill in the art would have understood that stages a) and b) are implemented by Rosen's processor—including the "determining" step of stage b)— using an artificial intelligence model.

in a horticulture environment and growth conditions of plants in the horticulture room, and optimize its function to manage costs of operation of the horticulture room and maximize plant growth." EX1005, ¶[0027]; *see also id.*, ¶¶[0029]-[0032] ("A horticulture light can learn about its context and customize its configuration and/or operation in accordance with the context (e.g. using artificial intelligence)."); ¶[0077] ("operation component 704 can employ artificial intelligence to monitor the horticulture environment for conditions of the characteristics according to the determined one or more objectives using instruments 510, determine one or more suitable actions for horticulture light 502 to perform to achieve the determined one or more objectives based on the conditions of the characteristics and the determined capabilities, and execute the one or more suitable actions"); ¶¶[0093]-[0094], [0100]-[0102].

192. A person of ordinary skill in the art would have understood the "artificial intelligence capabilities" disclosed by Rosen to describe at least the ability of the processor to utilize an "artificial intelligence model."

3. Claim 3:

a. 3.Pre: SYSTEM (100), according to claim 1, characterized in that the modular agricultural irrigation pivot-like device (101) comprises:

193. Rosen discloses the system according to claim 1. *See* Claim 1, above.

b. 3.A: a drive device for the displacement of the modular agricultural irrigation device (101) over the agricultural field (200); and

194. Rosen discloses a drive device for the displacement of the modular agricultural irrigation device over the agricultural field.

195. Specifically, Rosen discloses that "Device 518 can be any electronic device that can electronically interact (e.g. unidirectional interaction or bidirectional interaction) with horticulture light 502, non-limiting examples of which can include . . . for example, a system (e.g. temperature, humidity, ***watering***, fertilizing, feeding, pollination, insect repellent, sound, air flow, air quality, windows, ***robots***, ***or any other suitable systems associated with horticulture***)." EX1005, ¶[0048] ("interaction can include in a non-limiting example, communication, control, physical interaction, or any other suitable interaction between devices").

196. Rosen discloses or otherwise renders obvious a modular agricultural irrigation device positioned on an agricultural field. *See* Claim 1.A,, above.

197. A person of ordinary skill in the art would have understood that "watering" systems refer to irrigation systems such as irrigation pivot systems, and the implementation of and "robots, or any other suitable systems associated with horticulture" constitute "a drive device for the displacement of the modular agricultural irrigation device over the agricultural field." Moreover, a person of

ordinary skill in the art would have understood that irrigation pivots are typically mobile and require a drive device to effectively provide irrigation to an entire field.

198. As further evidence, Singh (which is discussed in the "Background of the Invention" section of the '543 Patent) discloses that "the irrigation rig 100 may comprise a plurality of wheels 112 a . . . 112 b (collectively wheels 112) so that the irrigation system can be a mobile system. Further, the irrigation rig 100 may comprise, or may be communicatively coupled, to a control circuit configured to control an operation of the light sources 103, the sprinklers 106, and/or an operation of the wheels 112." EX1006, ¶[0033].

c. 3.B: sprinkler devices comprising a plurality of sprinklers,

199. Rosen discloses sprinkler devices comprising a plurality of sprinklers.

200. Specifically, Rosen teaches that "Device 518 can be any electronic device that can electronically interact (e.g. unidirectional interaction or bidirectional interaction) with horticulture light 502, non-limiting examples of which can include . . . for example, a [watering] system." EX1005, ¶[0048] ("interaction can include in a non-limiting example, communication, control, physical interaction, or any other suitable interaction between devices"). A person of ordinary skill in the art would have understood that a watering system would comprise sprinkler devices comprising a plurality of sprinklers. EX1005, ¶¶[0063]-[0066], Figs. 9-10.

201. For example, Singh (which is discussed in the "Background of the Invention" section of the '543 Patent) discloses "an irrigation rig 100, which can be part of a water irrigation system for a field" and "includes . . . a plurality of sprinklers." EX1006, ¶[0033]. Indeed, Rosen explicitly discloses a plurality of "combination feeder/water spray heads," which a person of ordinary skill in the art would have understood to comprise "sprinkler devices comprising a plurality of sprinklers." EX1005, ¶¶[0065]-[0066].

d. 3.C: wherein the processor is in communication with the drive device and with the sprinkler device for the execution of stage b).

202. Rosen discloses wherein the processor is in communication with the drive device and with the sprinkler device for the execution of stage b).

203. Rosen teaches that its "horticulture light bulb comprises one or more instruments, a memory that stores computer executable components, and a processor that executes the computer executable components stored in the memory." EX1005, ¶[0004]; *see also* EX1005, ¶¶[0005]-[0006]. Additionally, Rosen's "horticulture light that comprises instruments, and is able to communicate with other horticulture lights and other devices." EX1005, ¶[0026]. Specifically, "[a] horticulture light 100, 200 can communicate via any suitable form of wireless or wired communication using a communication device. Non-limiting examples of wireless communication can include radio communication, optical communication, sonic communication,

electromagnetic induction communication, or any other suitable wireless communication." EX1005, ¶[0040].

204. A person of ordinary skill in the art would have understood that the claimed "drive device" and "sprinkler device" are "other devices" which are in communication with Rosen's horticulture light. §§IX.D.3.b-c.

205. Rosen's drive device and sprinkler device "can electronically interact . . . with horticulture light 502. . . . It is to be appreciated that interaction can include, in a non-limiting example, communication." EX1005, ¶[0048].

206. Given that Rosen's horticulture light bulb (1) contains a processor (Claim 1.B.i), (2) is responsible for the execution of stage b) (Claim 1.B.iii), and (3) is in communication with both the drive device and the sprinkler device (Claims 3.A, 3.B), a person of ordinary skill in the art would have understood that Rosen's processor is in communication with the drive device and with the sprinkler device for the execution of stage b). A person of ordinary skill in the art would have understood that adjusting the location of the irrigation device and/or activating (or deactivating) the sprinklers is a part of implementing the irrigation and/or light supplementation routines described with respect to limitation 1.B.iii.

207. In light of the foregoing disclosures of Rosen a person of ordinary skill in the art would have understood that Rosen's horticulture light bulb (and the

processor associated with the horticulture bulb) are in communication with drive device and sprinkler device disclosed therein. EX1005, ¶¶[0072]-[0080].

4. Claim 4:

a. 4.Pre: AGRICULTURAL MANAGEMENT METHOD (500), for the cultivation of a crop (202 a) in an agricultural field (200), characterized by comprising the steps of:

208. Rosen discloses an agricultural management method, for the cultivation of a crop in an agricultural field. Claim 1.Pre, 1.A, above.

209. Specifically, a person of ordinary skill in the art would have understood that operation of the system described in Claim 1 constitutes practicing an agricultural management method. For example, Rosen explicitly teaches that "[t]he subject disclosure is directed to computer processing systems, ***computer-implemented methods***, apparatus and/or computer program products that facilitate efficiently and automatically (e.g., with little or no direct involvement from an operator) employing horticulture lights 100, 200 that utilize resources (e.g. light output characteristics, sunlight, energy, water, fertilizer, feed, insecticide, pest repellant, chemicals, devices, bees, or any other suitable resource employed in horticulture) to enhance growth of plants." EX1005, ¶[0032].

b. 4.A: a) adjusting (501), in intervals of the electromagnetic spectrum, the balance between the spectral bands emitted by a plurality of light-emitting diodes of a

plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e); and

210. Rosen discloses adjusting, in intervals of the electromagnetic spectrum, the balance between the spectral bands emitted by a plurality of light-emitting diodes of a plurality of artificial lighting sources. Claim 4.Pre, 1.A.i, 1.B.ii, above.

c. 4.B: b) determining and implementing: an irrigation routine (502) of a modular agricultural irrigation device (101); and/or a routine of artificial light(s) supplementation (503) of the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e);

211. Rosen discloses determining and implementing: an irrigation routine of a modular agricultural irrigation device; and/or a routine of artificial light(s) supplementation of the plurality of artificial lighting sources. Claim 4.Pre, 1.A, 1.B.iii, above.

d. 4.C: wherein stages a) and b) are determined considering at least one among: a crop (202 a) species under cultivation; a phenological stage of the crop (202 a) under cultivation; a season, a photoperiod, and current weather conditions under which the agricultural field (200) is subjected; and one or more objective(s) intended for the crop (202) development.

212. Rosen discloses wherein stages a) and b) are determined considering at least one among: a crop species under cultivation; a phenological stage of the crop under cultivation; a season, a photoperiod, and current weather conditions under which the agricultural field is subjected; and one or more objective(s) intended for the crop development. Claim 4.Pre, 1.B.iv, above.

5. Claim 5: METHOD (500), according to claim 4, characterized in that stages a) and b) are determined by the processor using an artificial intelligence model.

213. Rosen discloses the method according to claim 4. *See* Claim 4, above.

214. Rosen discloses the method, according to claim 4, characterized in that stages a) and b) are determined by the processor using an artificial intelligence model. *See* Claim 2, above.

6. Claim 6: METHOD (500), according to claim 4, is characterized by further comprising a stage c) of determining a routine of soil management in the agricultural field (200) based on soil analyses from the agricultural field (200).

215. Rosen discloses the method, according to claim 4, is characterized by further comprising a stage c) of determining a routine of soil management in the agricultural field based on soil analyses from the agricultural field. *See* Claim 4, above.

216. Rosen's "horticulture light can understand its horticulture environment and device ecosystem using the instruments, and perform a self-configuration to optimize its functionality to enhance growth of plants in the horticulture environment and device ecosystem." EX1005, ¶[0026]. "For example, the horticulture light can employ sensors to monitor plants in the horticulture environment, and . . . control other systems (e.g. . . . fertilizing, feeding . . . or any other suitable systems associated with horticulture) to enhance growth of the plants based on their plant characteristics . . . and/or environmental characteristics (e.g. . . .

soil quality, soil moisture . . . or any other suitable characteristic associated with a horticulture environment). EX1005, ¶[0026].

217. Rosen also teaches that:

> Horticulture light 502 can include horticulture management component 504 that can enable horticulture light 502 to understand the environment in which the horticulture light 502 is installed, *determine an objective of the installation*, perform a self-configuration according to the determined objective, and operate to achieve the determined objective related to efficiently enhancing plant growth.

EX1005, ¶[0046].

218. Based on at least the disclosure of Rosen referenced herein, a person of ordinary skill in the art would have understood that Rosen discloses determining an objective of the installation, where the objective is control of horticulture systems to enhance the growth of plants based on soil quality and moisture. If the Board determines the "determining" step is enabled, a person of ordinary skill in the art would have understood Rosen's disclosure constitute determining a soil

management routine based on soil analyses from the agricultural field.[7] EX1005, ¶¶[0027]-[0028], [0032], [0040], [0048], [0050]-[0058], [0061], [0063], [0065]-[0066], [0072]-[0080], [0087]-[0092].

> **7. Claim 7: METHOD (500), according to claim 6, characterized in that stage c) of determining through the artificial intelligence model considers at least one of the following: the irrigation routine (502); the routine of artificial light(s) supplementation (503); the crop (202 a) species under cultivation; the phenological stage of the crop (202 a) under cultivation; the photoperiod, the season and the current weather conditions under**

[7] As explained with respect to Ground 2, above, the '543 Patent does not enable certain limitations of the Challenged Claims related to "determining" various routines. §IX.B, above. If the Board finds that the "determining" limitations are enabled, Rosen discloses determining routines in at least as much detail as the '543 Patent.

which the agricultural field (200) is subjected; and the one or more objective(s) intended for the crop (202 a) development.

219. Rosen discloses the method, according to claim 6, characterized in that stage c) of determining through the artificial intelligence model[8] considers at least one of the following: the irrigation routine; the routine of artificial light(s) supplementation; the crop species under cultivation; the phenological stage of the crop under cultivation; the photoperiod, the season and the current weather conditions under which the agricultural field is subjected; and the one or more objective(s) intended for the crop development. *See* Claims 4, 6, above.

220. Although I understand that only one category is required to render the Challenged Claims obvious—in light of the fact that the claim language refers to "at least one of the following"—Rosen discloses stage c) of determining considers at least each of (1) the irrigation routine; (2) the routine of artificial light(s) supplementation; (3) a crop species under cultivation; (4) the phenological stage of

[8] As explained with respect to Ground 1, above, Claim 6 the '543 Patent does not recite an "artificial intelligence model." §IX.A.3. Regardless, to the extent that the Board determines Claim 7 is not indefinite, a person of ordinary skill in the art would have understood Rosen's artificial intelligence model would have been implemented for the "determining" step of Claims 6 and 7. *See* Claim 5.

the crop under cultivation; (5) the photoperiod, a season and current weather conditions under which the agricultural field is subjected; and (6) one or more objective(s) intended for the crop development.

221. **The irrigation routine.** Rosen discloses that "best practices component 606 can aggregate, from horticulture lights 502 installed in various environments, information, such as objectives, images, audio recordings, sensor readings (e.g. humidity, temperature, ambient lighting, ***soil moisture, soil chemistry***, air quality, water quality, or any other suitable sensor reading), and actions performed (e.g. ***watering operations***, fertilizing operations, lighting output operations, HVAC operations, audio output operations, or any other suitable actions performed. Best practices component 606 can analyze this information using artificial intelligence to learn ***actions*** (e.g. light output, control of ***other devices*** 518, etc.) ***to perform by horticulture light 502 to affect characteristics of a particular plant type at a particular stage of plant growth in a particular environment to meet a defined objective***." EX1005, ¶¶[0094].

222. A person of ordinary skill in the art would have understood the soil management routine of Claim 6 constitutes "actions" regarding control of "other devices" referenced by Rosen. A person of ordinary skill in the art would have understood that Rosen teaches the use of an irrigation routine as at least one

consideration by an "artificial intelligence model" to determine the soil management routine of Claim 6.

223. **The routine of artificial light(s) supplementation.** Rosen discloses that "best practices component 606 can aggregate, from horticulture lights 502 installed in various environments, information, such as objectives, images, audio recordings, sensor readings (e.g. humidity, temperature, ambient lighting, ***soil moisture***, ***soil chemistry***, air quality, water quality, or any other suitable sensor reading), and actions performed (e.g. watering operations, fertilizing operations, ***lighting output operations***, HVAC operations, audio output operations, or any other suitable actions performed. Best practices component 606 can analyze this information using artificial intelligence to learn ***actions*** (e.g. light output, control of ***other devices*** 518, etc.) ***to perform by horticulture light 502 to affect characteristics of a particular plant type at a particular stage of plant growth in a particular environment to meet a defined objective***." EX1005, ¶¶[0094].

224. A person of ordinary skill in the art would have understood the soil management routine of Claim 6 constitutes "actions" regarding the control of "other devices" referenced by Rosen. A person of ordinary skill in the art would have understood that Rosen teaches the use of artificial light(s) supplementation routine as at least one consideration by an "artificial intelligence model" to determine the soil management routine of Claim 6.

225. **The crop species under cultivation.** Rosen discloses that its "horticulture light can employ sensors to monitor plants in the horticulture environment, and . . . control ***other systems*** . . . to enhance growth of the plants based on their plant characteristics (e.g. ***type of plant***, stage of growth . . . or any other suitable characteristics associated with the plants)." EX1005, ¶¶[0026]-[0028]; *see also id.*, ¶¶[0061]-[0069]. A person of ordinary skill in the art would have understood the soil management systems of Claim 6 are the "other systems" referenced by Rosen.

226. **The phenological stage of the crop under cultivation.** Rosen discloses that its "horticulture light can employ sensors to monitor plants in the horticulture environment, and . . . control ***other systems*** . . . to enhance growth of the plants based on their plant characteristics (e.g. type of plant, ***stage of growth***. . . or any other suitable characteristics associated with the plants)." EX1005, ¶¶[0026]-[0028]; *see also id.*, ¶¶[0061]-[0069]. A person of ordinary skill in the art would have understood the soil management systems of Claim 6 are the "other systems" referenced by Rosen.

227. **The photoperiod, the season and the current weather conditions under which the agricultural field is subjected.** Rosen discloses its "computer executable components can comprise: a monitoring component that employs at least one instrument of the one or more instruments to monitor at least one characteristic

of a defined region in which at least one plant is planted in a horticulture environment in which horticulture light bulb is installed; and an operation component that: determines at least one action for the horticulture light bulb to perform based on a state of the at least one characteristic." EX1005, ¶¶[0004]-[0006]; *see also id.*, ¶¶[0026]-[0028] ("horticulture light can employ sensors to monitor plants in the horticulture environment, and customize light output and/or control other systems . . . to enhance growth of the plants based on . . . environmental characteristics (e.g. temperature, humidity, ambient lighting, air quality, water quality, soil quality, soil moisture, pests, location, location relative to other plants, ambient sounds, or any other suitable characteristic associated with a horticulture environment)"); ¶¶[0061]-[0069].

228. A person of ordinary skill in the art would have understood the "environmental characteristics" disclosed by Rosen to include "photoperiod", "season" and "current weather conditions" for the field. Specifically, a person of ordinary skill in the art would have understood that ambient lighting refers to the total light available in the plant's environment, from both natural and artificial sources, and therefore encompasses a "photoperiod."

229. **One or more objective(s) intended for the crop development.**[9] Rosen discloses that its "computer executable components can comprise . . . and an operation component that: determines at least one action for the horticulture light bulb to perform based on . . . at least one objective of the installation of the horticulture light bulb in the horticulture environment." EX1005, ¶¶[0004]-[0006]; *see also id.*, ¶[0025] ("efficiency can be based on an objective . . . of the horticulture environment defined by a user and/or the system"); ¶[0031] ("All examples below can involve coordination amongst a set of horticulture lights to achieve a horticulture objective, whether explicitly stated or not."); ¶¶[0043]-[0044], [0061]-[0069]; Fig. 5.

E. Ground 5: Claims 1-7 of the '543 Patent are obvious over Richardville in view of Rosen.

230. Claims 1-7 are obvious over Richardville in view of Rosen.

[9] As explained in Section IX.A.2, above, Claim 7 is purely subjective and depends on the unpredictable vagaries of any one person's opinion. If the Board determines this element is not indefinite, a person of ordinary skill in the art would have understood that stage c) is implemented by Rosen's processor while considering "at least one objective of the installation of the horticulture light" as explained herein. EX1005, ¶¶[0004]-[0006].

231. Richardville (EX1007) was not considered during prosecution of the '543 patent and is more material than the prior art considered. EX1002.

1. Motivation to Combine

232. Rosen discloses an agricultural device positioned on an agricultural field in the cultivation of a crop species. Specifically, Rosen discloses a "horticulture light [that] can understand its horticulture environment and device ecosystem . . . and perform a self-configuration to optimize its functionality to enhance growth of plants in the horticulture environment and device ecosystem." EX1005, ¶[0026]. Rosen provides examples of an applicable "horticulture environment," including a "grow room, greenhouse, ***field***, indoor environment, ***outdoor environment***, liquid environment, or any other suitable horticulture environment." EX1005, ¶¶[0024], [0059], [0062].

233. Rosen also teaches that its "horticulture light can employ sensors to monitor plants in the horticulture environment, and customize light output and/or control other systems (e.g. temperature, humidity, watering, fertilizing, feeding, pollination, insect repellent, sound, air flow, air quality, windows, robots, or ***any other suitable systems associated with horticulture***)." EX1005, ¶¶[0026], [0048]. A person of ordinary skill in the art would have understood that a modular irrigation pivot was a "suitable systems associated with horticulture" for use in a horticulture environment such as a field.

234. Rosen additionally teaches that its "[h]orticulture light 100 comprises a horticulture light bulb 102 which can be installed as a retrofit into a socket 116 of conventional light fixture 114." EX1005, ¶[0034].

235. Richardville discloses "[a] light assembly mounted to a span of an irrigation system. The light assembly includes at least one bracket, at least one extension, and a light bar." EX1007, Abstract. Specifically, Richardville discloses a "center pivot type irrigation system" which includes "one or more spans," "one or more drive units," and "one or more pivot legs." EX1007, ¶¶[0014], [0019].

236. Richardville also teaches its "[t]he light bar 320 includes one or more grow lights 410 to aid in crop growth when sun exposure is low. The grow lights 410 may be of the Light Emitting Diode (LED) type, the High Intensity Discharge (HID) type, the fluorescent type, and/or the plasma type." EX1007, ¶[0028].

237. Richardville also teaches that "logic may be implemented into the light assembly control panel 340 to monitor the environment for sunlight. When sunlight is not available the logic may command that power be applied to the light assembly 305. In this configuration the light timers 335 are unnecessary and the process becomes more autonomous." EX1007, ¶[0026]; *see also id.,* ¶[0033] ("An example of a logic flowchart 800 is shown in FIG. 8. The logic flowchart 800 gives an example of the operational logic behind the intended light assembly usage. The logic flowchart 800 has separate pathways for grow light applications and sprinkler

applications. The individual pathways allow the grow lights and the sprinkler system to run independently of each other.").

238. A person of ordinary skill in the art would have understood that Richardville's "light assembly mounted to a span of an irrigation system" is precisely the type of "suitable systems associated with horticulture" that was envisioned by Rosen. For at least these reasons, a person of ordinary skill in the art would have been motivated to implement Rosen's horticulture light bulb (including the processors and other software components associated with Rosen's horticulture light bulb) into the light assembly and pivot-like irrigation system disclosed by Richardville, in order to provide additional "logic" to increase the autonomy of Richardville's light assembly and pivot-like irrigation system.

239. Additionally, because Rosen discloses that its horticulture light bulb can be installed as a retrofit into the socket of a conventional light fixture, a person of ordinary skill in the art would have had a reasonable expectation that the proposed combination would have been successful.

2. Claim 1:

a. 1.Pre: AGRICULTURAL MANAGEMENT SYSTEM (100) is characterized by comprising:

240. Rosen discloses an agricultural management system. *See* Ground 4, Claim 1.Pre, above.

241. Richardville also discloses an agricultural management system. EX1007, ¶¶[0033]-[0040], Fig. 8.

242. A person of ordinary skill in the art would have understood that the combination of Rosen's horticulture light bulb (including the processors and other software components associated with Rosen's horticulture light bulb) and the light assembly and pivot-like irrigation system disclosed by Richardville constitutes an agricultural management system.

b. 1.A: a modular agricultural irrigation pivot-like device (101) positioned on an agricultural field (200) in the cultivation of a crop (202 a) species, the modular agricultural irrigation pivot-like device (101) comprising:

243. Rosen discloses a modular agricultural irrigation pivot-like device positioned on an agricultural field in the cultivation of a crop species. *See* Ground 4, Claim 1.A, above.

244. If Rosen does not disclose or otherwise render obvious Claim 1.A, Richardville discloses a modular agricultural irrigation pivot-like device positioned on an agricultural field in the cultivation of a crop. EX1007, ¶[0014] ("FIG. 1 shows *an example of a center pivot type irrigation system 100*, the center pivot type irrigation system 100 has a pivot point 105, *one or more spans 110*, and one or more drive units 115."); *see also id.*, Figs. 1-3.

245. Based on Richardville's disclosure of a pivot-type irrigation system with "one or more spans" and "one or more drive units," a person of ordinary skill in the art would have understood that Richardville discloses a modular system.

(1) 1.A.i: a plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e) arranged along the modular agricultural irrigation pivot-like device (101) at a predetermined distance above the aerial parts of the crop (202 a), comprising a plurality of light-emitting diodes; and

246. Rosen discloses a plurality of artificial lighting sources arranged along the modular agricultural irrigation pivot-like device at a predetermined distance above the aerial parts of the crop, comprising a plurality of light-emitting diodes. *See* Ground 4, above.

247. Richardville also discloses a plurality of artificial lighting sources arranged along the modular agricultural irrigation pivot-like device at a predetermined distance above the aerial parts of the crop, comprising a plurality of light-emitting diodes. Specifically, Richardville teaches its "light bar 320 includes one or more grow lights 410 to aid in crop growth when sun exposure is low. The grow lights 410 may be of the Light Emitting Diode (LED) type, the High Intensity Discharge (HID) type, the fluorescent type, and/or the plasma type." EX1007, ¶[0028].

248. Richardville also discloses that its "light assembly 305 includes one or more brackets 310, one or more extensions 315, and a light bar 320. The bracket 310

is configured to surround the span 110 and attaches via clamping force. Descending from the bracket is the extension 315. The extension 315 is variable along its length. For example, the extension may be set to allow for the light bar 320 to hang anywhere from 1-10 meters above the ground. In an example embodiment, the light bar 320 is hung approximately 3.5 meters above the ground. In another embodiment, the light bar 320 is hung approximately 3.5 meters above the top of the crop." EX1007, ¶[0024].

249. As explained above, a person of ordinary skill in the art would have been motivated to implement Rosen's horticulture light bulb (including the processors and other software components associated with Rosen's horticulture light bulb) into the light assembly and pivot-like irrigation system disclosed by Richardville. §IX.E.1.

(2) 1.A.ii: a plurality of energy sources that feed the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e),

250. Rosen discloses a plurality of energy sources that feed the plurality of artificial lighting sources. *See* Ground 4, above.

251. Specifically, Rosen teaches that its "horticulture light 100, 200 can have a plurality of different power sources, with one or more power sources acting as a backup for another power source." EX1005, ¶[0039].

252. Richardville teaches that its "light assembly 305 may be powered independent of the irrigation system." EX1007, ¶[0026].

253. A person of ordinary skill in the art would have been motivated to implement the plurality of different power sources, with one or more power sources acting as a backup—as disclosed by Rosen—into the light assembly and irrigation system disclosed by Richardville. Richardville discloses multiple energy sources for both its light assembly and irrigation system. A person of ordinary skill in the art would have understood that implementing backup power sources helps to prevent potential damage or loss to crops caused by power disruptions from a primary power source.

c. 1.B: the agricultural management system (100) further comprising:

(1) 1.B.i: a processor in communication with a dimerizer and/or a polarizer of the plurality of artificial lighting sources (10 a, 10 b, 10 c, 10 d, 10 e) and with the plurality of energy sources, wherein the processor is configured to:

(2) 1.B.ii: a) adjust (501), in the intervals of the electromagnetic spectrum, the balance between the spectral bands emitted by the plurality of light-emitting diodes; and

(3) 1.B.iii: b) determine and implement: an irrigation routine (502); and/or an artificial light(s) supplementation routine (503);

(4) 1.B.iv: wherein stages a) and b) are determined by the processor considering at least one among: a crop (202 a) species under cultivation; a phenological stage

of the crop (202 a) under cultivation; a photoperiod, a season and current weather conditions under which the agricultural field (200) is subjected; and one or more objective(s) intended for the crop (202 a) development.

254. Richardville in view of Rosen discloses limitations 1.B, 1.B.i, 1.B.ii, 1.B.iii, and 1.B.iv. *See,* Ground 4, above.

255. Specifically, Rosen discloses that its "horticulture light bulb comprises one or more instruments, a memory that stores computer executable components, and a processor that executes the computer executable components stored in the memory." EX1005, ¶[0004]; *see also* EX1005, ¶¶[0005]-[0006].

256. A person of ordinary skill in the art would have understood that Rosen's processor would have been in electrical communication with the disclosed plurality of energy sources, in order to provide power to the processor. §IX.E.2.b(2).

257. Because Rosen's processor is associated with its horticulture light bulb, and because the proposed combination of Richardville in view of Rosen implements Rosen's horticulture light bulb, a person of ordinary skill in the art would have understood that the combination of Richardville's light assembly and pivot-like irrigation system with Rosen's horticulture light bulb (including the processors and other software components associated with Rosen's horticulture light bulb) would have disclosed or otherwise rendered obvious limitations 1.B, 1.B.i, 1.B.ii, 1.B.iii, and 1.B.iv. *See,* Ground 4; §IX.E.1.

3. Claim 2: SYSTEM (100), according to claim 1, characterized in that stages a) and b) determined by the processor using an artificial intelligence model.

258. Richardville in view of Rosen discloses the system, according to claim 1, characterized in that stages a) and b) [are] determined by the processor using an artificial intelligence model. *See* Claim 1, above; *see also* Ground 4, Claim 2, above.

259. As explained with respect to claim elements 1.B-1.B.iv, above, because Rosen's processor is associated with its horticulture light bulb, and because the proposed combination of Richardville in view of Rosen implements Rosen's horticulture light bulb, a person of ordinary skill in the art would have understood that the combination of Richardville's light assembly and pivot-like irrigation system with Rosen's horticulture light bulb (including the processors and other software components associated with Rosen's horticulture light bulb) would have disclosed or otherwise rendered obvious that stages a) and b) determined by the processor using an artificial intelligence model. *See,* Ground 4, Claim 2, above; §IX.E.1.

4. Claim 3:

a. 3.Pre: SYSTEM (100), according to claim 1, characterized in that the modular agricultural irrigation pivot-like device (101) comprises:

260. Richardville in view of Rosen discloses the system according to claim 1. *See* Claim 1.A, above; *see also* Ground 4, Claim 1, above.

b. 3.A: a drive device for the displacement of the modular agricultural irrigation device (101) over the agricultural field (200); and

261. Richardville in view of Rosen discloses a drive device for the displacement of the modular agricultural irrigation device over the agricultural field. *See* Ground 4, Claim 3.A, above.

262. To the extent that Rosen does not disclose or otherwise render obvious Claim 1.A, Richardville discloses a drive device for the displacement of the modular agricultural irrigation device over the agricultural field. EX1007, ¶[0014] ("FIG. 1 shows an example of a center pivot type irrigation system 100, the center pivot type irrigation system 100 has a pivot point 105, one or more spans 110, and *one or more drive units 115*."); *see also id.*, Figs. 1-3.

c. 3.B: sprinkler devices comprising a plurality of sprinklers,

263. Richardville in view of Rosen discloses sprinkler devices comprising a plurality of sprinklers. *See* Ground 4, Claim 3.B, above.

264. To the extent that Rosen does not disclose or otherwise render obvious Claim 1.A, Richardville discloses sprinkler devices comprising a plurality of sprinklers. EX1007, ¶[0014] ("The one or more spans 110, including the first span 135, further include *at least one sprinkler 190*."); *see also id.*, Figs. 1-3, ¶[0020] ("Located on the spans 205 are one or more sprinklers 220. The one or more

sprinklers 220 serve to distribute the water from inside the spans to the surrounding crops.").

265. A person of ordinary skill in the art would have understood that each "span" contains a "sprinkler device" comprising multiple "sprinklers" 190.

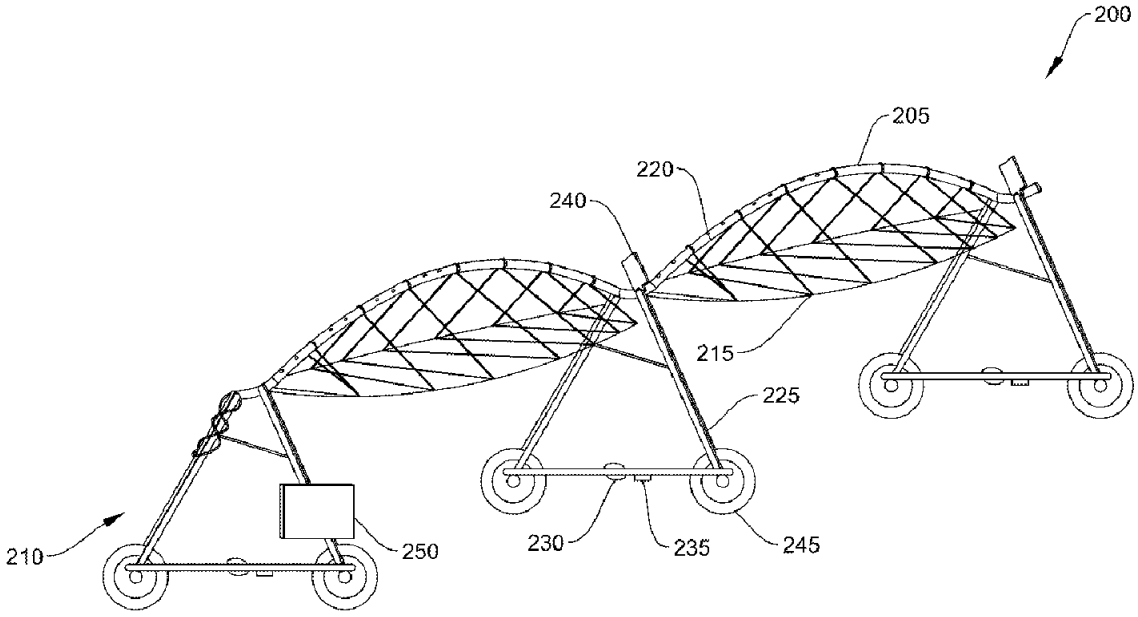


FIG. 2

d. 3.C: wherein the processor is in communication with the drive device and with the sprinkler device for the execution of stage b).

266. Richardville in view of Rosen discloses wherein the processor is in communication with the drive device and with the sprinkler device for the execution of stage b).

267. Specifically, Rosen discloses that its "horticulture light bulb comprises one or more instruments, a memory that stores computer executable components,

and a processor that executes the computer executable components stored in the memory." EX1005, ¶[0004]; *see also* EX1005, ¶¶[0005]-[0006].

268. Because Rosen's processor is associated with its horticulture light bulb, and because the proposed combination of Richardville in view of Rosen implements Rosen's horticulture light bulb, a person of ordinary skill in the art would have understood that the combination of Richardville's light assembly and pivot-like irrigation system with Rosen's horticulture light bulb (including the processors and other software components associated with Rosen's horticulture light bulb) would have implemented Rosen's processor. §IX.E.1.

269. Rosen discloses that its processor is in communication with the drive device and with the sprinkler device for the execution of stage b). *See,* Ground 4, Claim 3.C, above. A person of ordinary skill in the art would have understood that when Rosen's processor and horticulture light bulb are implemented with Richardville's light assembly and pivot-like irrigation system—which includes a drive device and a sprinkler device—that Rosen's processor would have been in communication with said drive device and sprinkler device while determining and implementing irrigation and/or artificial light supplementation routines. §IX.E.1.

5. Claims 4-7

270. Claims 4-7 relate to various agricultural management methods, and are disclosed or otherwise rendered obvious by Rosen. *See,* Ground 4, Claims 4-7.

271. A person of ordinary skill in the art would have understood that when Rosen's processor and horticulture light bulb are implemented with Richardville's light assembly and pivot-like irrigation system—which includes a drive device and a sprinkler device—that Rosen's processor would have been in communication with said drive device and sprinkler device while determining and implementing irrigation and/or artificial light supplementation routines. §IX.E.1.

X. CONCLUSION AND SUPPLEMENTATION

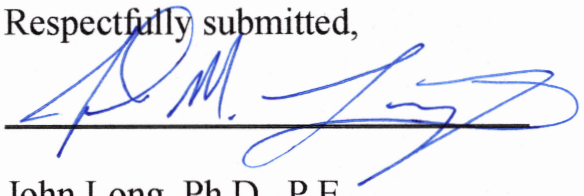
272. Petitioner has met their burden to show that the Challenged Claims are invalid. As such, and for the additional reasons set forth above, in my opinion each of the Challenged Claims are invalid.

273. In this Declaration, I have presented my opinions regarding the validity of the Challenged Claims of the '543 Patent based on the information available to me. My opinions are subject to change in view of opinions provided by the Patent Owner or its expert, or any additional information that I may receive. I reserve the right to supplement my opinions accordingly.

I hereby declare that all statements made herein of my own knowledge are true and that all opinions expressed herein are my own, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: June 16, 2025

Respectfully submitted,



John Long, Ph.D., P.E.