

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD**

PRECISION PLANTING LLC,

Petitioner,

U.S. Patent No. 8,770,121

v.

IPR Case No.: IPR2024-00008

MASCHIO GASPARDO S.p.A.,

Patent Owner

DECLARATION OF HARRY DANKOWICZ, PH.D.

I, Harry Dankowicz, declare as follows:

I. INTRODUCTION

1. I have been retained as an independent expert consultant on behalf of Patent Owner MASCHIO GASPARDO S.p.A. (“Maschio”) in this *Inter Partes* Review proceeding (“IPR”) before the Patent Trial and Appeal Board (“Board” or “PTAB”) of the United States Patent and Trademark Office (“PTO”) regarding U.S. Patent No. 8,770,121 (“the ‘121 patent”) (Exhibit 1001 to the Petition which is Paper No. 2).¹ I am being compensated for the time I spend on this matter, in addition to

¹ In this Declaration, I reference documents by the exhibit or paper numbers that I understand have been attached to them in this IPR.

expenses. My compensation in this case is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no interest in this proceeding.

2. In particular, I have been asked to consider, and provide my opinion regarding, whether the alleged prior art references cited in this proceeding disclose or suggest the features recited in claims 1-5, 7-14, and 16 of the '121 patent, which I understand PRECISION PLANTING LLC ("Petitioner" or "Precision") has challenged in this IPR. In my view, the alleged prior art references do neither. This Declaration is based on the information currently available to me. To the extent that additional information becomes available, I reserve the right to continue my investigation and study, which may include review of documents and information that may be produced, as well as testimony from depositions that have not yet taken place. My opinions are set forth below.

II. BACKGROUND AND QUALIFICATIONS

3. I have summarized in this section my educational background, career history, publications, and other relevant qualifications. My full *curriculum vitae* is attached as Appendix A to this Declaration and includes further details on my background, education, and experience in mechanical engineering, and is incorporated in its entirety into this paragraph.

4. I am currently Professor (with tenure) and Chair of the Department of Mechanical Engineering at the University of Maryland, College Park. I am the chief academic officer of the Department and am “authorized and expected to provide leadership toward the achievement of excellence in the teaching, research, and service activities of the Department.” (<https://faculty.umd.edu/media/67/download>) The Department is the administrative home for the undergraduate program in mechanical engineering and the graduate programs in mechanical engineering and reliability engineering. The undergraduate program in mechanical engineering is accredited by the Accreditation Board for Engineering and Technology (ABET) to meet nationally adopted educational standards by developing students who demonstrate “an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.” (<https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2022-2023/>) I have held the titles of Professor and Chair since starting my work at the University of Maryland on December 31, 2023.

5. Between August 2005 and December 2023, I was (first Associate and then Full) Professor in the Department of Mechanical Science and Engineering (prior to 2006, this was named the Department of Mechanical and Industrial Engineering) at the University of Illinois at Urbana-Champaign. This Department is the administrative home for undergraduate degree programs in mechanical

engineering and engineering mechanics (both of which are ABET accredited), as well as graduate degree programs in mechanical engineering and theoretical and applied mechanics. My work responsibilities included teaching undergraduate and graduate courses in system dynamics and vibrations, nonlinear dynamics, dynamics of multibody mechanisms, and computational methods. I also regularly served as advisor of capstone design projects for teams of senior undergraduate mechanical engineering students who explored engineering design challenges, including for agricultural applications such as harvest combines. I further served as research supervisor and thesis and dissertation advisor to a large number of students in the Master of Science in Mechanical Engineering and Doctor of Philosophy in Mechanical Engineering degree programs, including several who worked on engineering design problems involving agricultural equipment.

6. Between August 1999 and August 2005, I was (first Assistant and then Associate) Professor in the Department of Engineering Science and Mechanics (now subsumed under the Department of Biomedical Engineering and Mechanics) at Virginia Polytechnic Institute and State University in Blacksburg, Virginia. The Department was home to undergraduate and graduate degree programs in engineering mechanics. My work responsibilities included teaching undergraduate and graduate courses in introductory mechanics, linear and nonlinear vibrations, and multibody dynamics. I also regularly served as advisor of capstone design projects

for teams of senior undergraduate students who explored engineering design challenges, including in orthopedic medicine. I further served as research supervisor and thesis and dissertation advisor to students in the Master of Science in Engineering Mechanics, Mechanical Engineering, and Biomedical Engineering Sciences and Doctor of Philosophy in Engineering Mechanics degree programs, including work on computer-enabled design and manufacturing of surgical implants.

7. I received a Master of Science degree in engineering physics from KTH Royal Institute of Technology in Stockholm, Sweden, in 1991. As part of these studies, I took courses on rigid body mechanics, advanced dynamics of complex systems, control theory and practice, strength of materials and solid mechanics, computing science, measurement techniques, and history of technology. I received a Doctor of Philosophy degree in Theoretical and Applied Mechanics from Cornell University in 1995. As part of these studies, I took courses on dynamical systems, linear and nonlinear vibrations and waves, solid mechanics, and numerical methods. Between 1995 and 1999, I held postdoctoral and research associate positions in the Department of Mechanics at KTH Royal Institute of Technology, during which time I conducted research on robotic locomotion and mechanical friction.

8. As part of my academic responsibilities, I have developed new undergraduate and graduate courses that take advantage of advanced computational tools to facilitate student mastery of methods for the analysis and design of complex

multibody mechanisms, including construction equipment. I am the author of the introductory textbook Multibody Mechanics and Visualization that teaches a systematic approach to the mathematical description of the motion of mechanisms consisting of multiple rigid bodies, as well as of educational software tools for computer-aided modeling and design of such mechanisms. I am the author of the advanced textbook Recipes for Continuation that teaches computational methods used in analysis and design optimization of nonlinear dynamical systems. I have been recognized for these contributions to education and research by my home institutions, as well as by the American Society for Engineering Education, the American Society of Mechanical Engineers, and the Society for Industrial and Applied Mathematics.

9. My past research includes several projects funded by Deere & Co in the context of precision agriculture, i.e., methods and tools for collecting reliable and precise data during agricultural operations, specifically of planting or harvesting equipment, and relying on such data in making future operational decisions. I have published research papers together with Deere & Co engineers on tire-terrain contact modeling and modeling of dynamic grain flow through harvest combines. I am an inventor on a patented technology for self-calibration of mass flow yield sensors in harvest combines, owned by the University of Illinois. Separately, I am a past recipient of research funding from the U.S. Department of Agriculture National

Institute of Food and Agriculture on cooperative human-robot networks for agricultural applications. As part of this work, I have published papers on scheduling of large-scale seeding operations, as well as the development of advanced control algorithms for manipulators on moving platforms, including a proposed, autonomous, planter seed-refilling system. Separately, I have filed an invention disclosure with the University of Illinois for a novel brush design for seed-delivery systems.

10. I am a current member of the American Society of Mechanical Engineers with Fellow status since 2012, as well as of the American Society for Engineering Education and the Society for Industrial and Applied Mathematics.

11. I have not previously been retained as an expert consultant independently of my academic service.

12. I am not an attorney and offer no legal opinions. In the course of my work, I have had extensive experience studying and teaching the design and function of machine components, including by making innovative contributions to the design of agricultural equipment, such as harvest combines. In addition to the issued patent on a self-calibrating mass flow sensor system, I have applied for patent protection on inventions related to computer-aided shaping of spinal implants and systems and methods for characterization of spinal deformities, respectively.

III. MATERIALS REVIEWED

13. The opinions contained in this Declaration are based on the documents that I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding technologies related to the '121 patent.

14. In forming my opinions expressed in this Declaration, I reviewed:

- U.S. Patent No. 8,770,121 (Exhibit 1001)
- Prosecution History U.S. Patent No. 8,770,121 (Exhibit 1002)
- Declaration of Dr. Mark Fleming and CV (Exhibits 1003 and 1018)
- Transcript of Deposition of Mark Fleming taken June 27, 2024 (Exhibit 2014)
- EP 2,637,492,B1(Exhibit 1004)
- EP Opposition File History (Exhibit 1005)
- U.S. Patent No. 7,228,807 to VenHuizen (Exhibit 1006)
- E.P. Patent Publication No. 0536543 to Fiorido (Exhibit 1007)
- Amazone Manual – English (Exhibit 1011)
- U.S. Patent No. 9,127,708 (Exhibit 2017)
- Dictionary Excerpts (Exhibit 2016)
- Complaint (Exhibit 2011)
- Precision's Answer to Interrogatory No. 2 (Exhibit 2019)
- Precision's Petition for IPR (Paper No. 2)

- Board’s Decision Granting Institution of IPR (Paper No. 12)
- Precision’s vSet Advertisement (Appendix B to this document)
- Kinze Manufacturing Article (Appendix C to this document)
- Various legal background materials including a PTO Memorandum dated March 18, 2024 on the subject of “Resources for Examining Means-Plus-Function and Step-Plus-Function Claim Limitations (35 U.S.C. 112(f))” (Exhibit 2015); “Inter Partes Review: Expert Considerations, Practical Law Practice Note w-039-1870” (2024); and a book titled “Patent Law in a Nutshell.”

IV. LEGAL STANDARDS

A. Overview

15. I am not an attorney or a legal expert. The legal standards I applied in reaching the conclusions expressed throughout this Declaration were provided to me by counsel. In preparing this Declaration, I have endeavored to faithfully apply these legal standards. I do not intend to offer opinions on the law. Below, I describe the law I applied in considering whether the claims of the ‘121 patent are patentable.

16. I have been informed that an issued patent is presumed valid and that the challenger of the patent’s validity bears the burden of proving invalidity of the patent.

B. Patent Claims

17. Patent claims describe the invention made by the inventor and describe

what the patent owner owns and what the owner may prevent others from doing.

18. Claims may describe products, such as machines, or processes for making or methods of using a product. Claims are usually divided into parts or steps called limitations.

19. There are two types of claims: independent claims and dependent claims. An independent claim sets forth all the requirements that must be met in order to be covered by that claim. Thus, it is not necessary to look at any other claim to determine what an independent claim covers. A dependent claim does not itself recite all of the requirements of the claim, but refers to another claim for some of its requirements. In this way, the claim depends on another claim. The law considers a dependent claim to incorporate all of the requirements of the claims to which it refers.

20. The dependent claim then adds its own additional requirements. To determine what a dependent claim covers, it is necessary to look at both the dependent claim and any other claims to which it refers.

21. In that case, the dependent claims incorporate the limitations of the independent claim upon which they depend and, if a reference fails to disclose any of the limitations of an independent claim, the claims which depend on that claim cannot be made invalid by that reference. As a result, any of the references at issue in this proceeding that fail to disclose all of the limitations of an independent claim

necessarily also fail to disclose all of the limitations of claims which depend on that claim.

C. Burden of Proof for Invalidity

22. I understand that the party challenging the validity of an issued U.S. patent in an IPR bears the burden of proving invalidity through facts supported by a preponderance of the evidence. I understand that a “preponderance of the evidence” means evidence sufficient to prove that a fact is more likely true than it is not.

D. Claim Construction

23. I understand that the first step in determining validity is to properly construe the claims. I further understand that, in this proceeding, the Board must determine the scope of the claims by using the same claim construction standard that United States District Courts use. Under this standard, words of a claim are given their “ordinary” and “customary” meaning as understood by a person of skill in the art at the time of the invention. I understand that such a person looks primarily to the claims, specification, and file history (collectively, the intrinsic evidence) in understanding the meaning of the claim terms. I further understand that evidence external to the patent (e.g., expert testimony, prior art, and dictionary definitions) may be relevant to claim construction. I have applied this understanding in this Declaration.

E. Person of Ordinary Skill in the Art

24. I understand that a person having ordinary skill in the art may be defined by factors such as: (a) the levels of education and experience of the inventor and other persons actively involved in the field; (b) the types of problems encountered in the field; (c) prior art solutions to those problems; (d) rapidity with which innovations are made; and (e) the sophistication of the technology.

F. Prior Art

25. I understand that a patent cannot be invalidated based on one person's testimony alone without corroborating evidence, particularly documentary evidence. Moreover, I understand that corroboration is required of any witness whose testimony alone is asserted to invalidate a patent, regardless of his or her level of interest in relation to that patent. Accordingly, even if the testifying individual has no interest in the litigation, I understand that corroboration is still required.

26. In this Declaration, I may use the phrase "prior art" when describing specific references. My use of this phrase should not be interpreted, however, as agreement that the reference or references described qualifies or qualify as prior art under the patent laws. I merely use this phrase to address the references labeled as "prior art" by Precision and its expert, Dr. Mark Fleming.

G. Anticipation

27. I understand that a patent claim can be found invalid as anticipated if

each and every limitation of the claim, as properly construed, is found either explicitly or inherently in a single prior art reference. If the single prior art reference does not disclose any one claim limitation, then that claim is not anticipated. I further understand that the single prior art reference cannot merely disclose each limitation; rather, it must disclose all of the limitations as arranged in the claim. I have been informed that for a prior art reference to “inherently” disclose something, the reference must necessarily function in accordance with, or include the claimed limitations, to anticipate. The missing descriptive matter cannot merely probably or possibly include the claimed limitations. I further understand that, with respect to an anticipation analysis, it is improper to combine separate, distinct embodiments of a single prior art reference.

28. I understand that for a claim to be anticipated, each claim limitation must be disclosed in a single prior art reference, and the claimed arrangement or combination of those limitations must also be disclosed in that same prior art reference. I understand that for a reference to be anticipatory, the reference must contain an enabling disclosure. I understand that merely naming or describing the subject matter is insufficient if it cannot be produced without undue experimentation.

H. Obviousness

29. I understand that a patent claim can be determined to be invalid as obvious if the differences between the claim and the prior art references would have

been obvious to a person of ordinary skill in the art at the time of the invention, taking into account (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any objective indicia of non-obviousness. I understand that, if present, objective indicia of non-obviousness concern real-world evidence of non-obviousness of the claimed invention (such as copying by another of the claimed invention; long-felt but unmet need in the art for the claimed invention; and failure of others in the art to achieve the results of the claimed invention), and that the evidence must be related to the novel features of the claimed invention. I further understand that a claim can be found to be obvious in light of either a single prior art reference or multiple prior art references. I understand that references qualify as prior art for an obviousness determination only when they are analogous to the claimed invention. Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed; and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

30. To be obvious in light of a single prior art reference or multiple prior art references, there must be a reason either to modify the single prior art reference or to combine the two or more prior art references to achieve the claimed invention. I understand that this reason may come from a teaching, suggestion, or motivation to

combine or may come from the reference or references themselves, the knowledge or “common sense” of one skilled in the art, or from the nature of the problem to be solved and may be explicit or implicit from the prior art as a whole.

31. I also understand that a hypothetical “person of ordinary skill in the art” or “POSA” must have reasonably expected that the combination of references would work, which is sometimes referred to as a “reasonable expectation of success.”

32. I further understand that a reference that “teaches away” from a given combination may negate a motivation to modify the prior art to meet the claimed invention. It is improper to combine references where the references teach away from their combination.

33. A reference may be said to teach away when a POSA, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the claimed invention, or if the reference suggests that the line of development flowing from the reference’s disclosure is unlikely to yield the result sought by the claimed invention. When the prior art teaches away from combining certain known elements, discovery of a successful way of combining them is more likely to be nonobvious.

34. I understand that if the teachings of a prior art reference would lead a POSA to make a modification that would render another prior art device inoperable, then such a modification would generally not be obvious. I understand that if a

proposed modification would render the prior art device unsatisfactory for its intended purpose, then the proposed modification would generally not be obvious.

35. I understand that it is improper to use hindsight in making the obviousness determination.

36. I understand that some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness must be made.

V. PERSON OF ORDINARY SKILL IN THE ART (POSA) RELATED TO THE ‘121 PATENT

37. In its Institution Decision on pages 7-8, Paper No. 12, the Board adopted Precision’s unopposed definition of a hypothetical POSA. I have no objection to that definition, which is relevant to the issues of claim construction, anticipation, and obviousness.

VI. THE ‘121 PATENT

38. With reference to its Fig. 3, the ‘121 patent generally relates to agricultural seed drills (reference number 3) which include as one component sowing elements (2) which, in turn, include as one component seed distribution elements (1). The focus of the claims of the ‘121 patent is on the seed distribution element illustrated in Fig. 1 which, via a pressure differential generated in the area of a sowing disc, separates and distributes seeds in a controlled manner. The operating principle is based on the fact that, as a result of a pressure differential between the opposed faces of the sowing disc (16), a seed (4) adheres to each of a

plurality of selector holes (23) in the sowing disc and is then transported by the rotation of the sowing disc from the seed selection zone to the point at which the pressure differential ceases and the seed is released to drop through a sowing pipe into the furrow or sowing track in the ground. In practice, a strong air suction is exerted on one of the faces of the sowing disc which retains the seeds on the opposite face in the region of the respective holes. For the correct functioning of such seed distribution elements, it is necessary to ensure an effective pneumatic seal between the face of the sowing disc that is subjected to suction and a seal (24) which delimits the pneumatic suction chamber (17). The suction effects a substantial compression of the sowing disc against the seal. Although this ensures adequate adherence of the seal to the sowing disc surface which is subjected to negative pressure, sliding of the disc against the seal also creates abrasion on and wear of the seal, which limit the effective service life of the seal. The '121 patent explains that prior art seed drills include a thrust-bearing element (TBE) mounted on the fixed portion of the housing to relieve the heavy load on the seal, but that this configuration creates its own problems:

In order to remedy this drawback, seed drills have been developed which are equipped with a thrust-bearing element which relieves the heavy load on the seal. In all cases, however, the thrust-bearing element, which must be rotated with the disc, is mounted on the fixed portion of the housing, that is to say, that portion which is fixed

to the framework of the sowing elements. This means that the disc must be attached to the thrust-bearing element; therefore an attachment system must be provided which in the stage of replacement of the disc must be removed, consequently lengthening the operation. This is inevitable in the known machines since it is obligatory to mount on the fixed portion the transmission which drives in rotation the motor-driven shaft which rotates the disc.

However, positioning the thrust-bearing element on the fixed portion entails the pneumatic suction chamber being provided on the fixed portion, or on the same side at which the thrust-bearing element is placed, while the seed collection chamber must be provided in the movable portion. This is the source of numerous drawbacks, including the fact that the opening of the housing necessarily involves the removal of the portion containing the seed collection chamber from the hopper type store located above, which must necessarily be fixed to the framework of the sowing element.

Furthermore, for the replacement of the sowing disc it is necessary to remove some parts of the distributor, such as the adjustable seed selector, and the seed ejector, where provided.

See the '121 patent from column 1, line 53 to column 2, line 11 (emphasis added).

39. Important to the '121 patent is the distinction between two portions of the housing (10) as illustrated in Fig. 1: the fixed portion (11), which is fixed on the frame (6), and a movable portion (12) hinged to the fixed portion (11). *See the '121 patent at column 2, lines 44-47. "The [seed distribution] element 1 itself comprises a housing 10 with a fixed portion 11 fixed in a stable manner on the frame 6 [of the*

seed drill 3 illustrated in Fig. 3] and a movable portion 12 hinged in the region of a hinge 12a on the fixed portion 11 by means of a removable hinge pin 13.” The two portions of the housing permit “opening of the housing,” *id.* at column 2, line 5, and facilitate access to, removal of, and replacement of the sowing disk (16) and the seal (24). *See, e.g., id.* at column 1, lines 46-49 and lines 60-62. In fact, the housing portions are sufficiently separate and distinct that “[t]he whole of the movable portion 12 complete with thrust-bearing element 26 and seal 24 lends itself advantageously to the production of a kit for the retrofitting of existing seed drills. It is sufficient in this case to separate the old type of movable portion by removing the hinge pin 13 and replacing the old movable portion with the aforesaid kit.” *Id.* at column 3, lines 60-65.

40. The ‘121 patent not only recognizes but solves the problems associated with mounting a thrust-bearing element (26) on the fixed portion (11) of the housing. The ‘121 patent generally solves the problems by arranging the drive shaft (20) and the thrust-bearing element (26) in different housing sections, i.e., by mounting the drive shaft (20) in the fixed housing portion (11) and by mounting the thrust-bearing element (26) in the other, movable housing portion (12). Further, the ‘121 patent places the suction chamber (17) in the movable housing portion (12), i.e., the suction forces pull on the sowing disc in the direction of the movable housing portion.

41. More specifically, the specification of the '121 patent illustrates the seal in Fig. 1 and describes the seal at column 3, lines 6-10:

A seal 24 is fitted in the suction chamber 17 [of the movable portion 12 of the housing] and is placed in sliding contact with the facing surface [16a] of the disc 16, when the movable portion [12] is closed on the fixed portion [11], to delimit a circumferential segment in which the holes 23 are subjected to the aforesaid pressure differential.

42. The seal is recited in independent claim 1, column 4 at lines 29-32: “a seal which [i] is arranged on the movable portion and [ii] is capable of sliding contact with the facing surface of the disc when the fixed and movable portions are closed against one another” (emphasis on two limitations added). Independent claim 10 recites similar limitations at column 5, lines 21-23. Remember, among the problems solved by the claimed invention are abrasion on and wear of the seal, which limit the effective service life of the seal, resulting from sliding of the disc against the seal.

43. The thrust-bearing element (26) is important to solving those problems. The specification of the '121 patent illustrates the thrust-bearing element in Fig. 2 and describes the thrust-bearing element at column 3, lines 21-32:

In order to limit the wear on the seal 24 resulting from sliding against the surface of the disc 16, a thrust-bearing element indicated as a whole by 26 is mounted on the movable portion [12].

The thrust-bearing element 26 comprises a shaft 27 rotatably mounted by means of bearings 28 in a seat 29 of the movable portion 12. The shaft 27 has flanging 30 by means of which it is fixed to a

thrust-bearing plate 31 which can bear on that surface of the disc which faces the seal 24 in a zone radially inside the ring of holes 23 in order to withstand at least some of the axial load produced by the disc 16 on the seal 24.

44. The thrust-bearing element is recited in independent claim 1, column 4 at lines 37-40, and in independent claim 10, column 6 at lines 2-6 (“a thrust-bearing element [i] of the sowing disc, which thrust-bearing element [ii] is supported rotatably in the movable portion [iii] in order to withstand at least some of the axial load produced by the disc on the seal”) (emphasis on three limitations added). By withstanding at least some of the axial load produced by the disc on the seal, the thrust-bearing element addresses the problems highlighted in Paragraph 42. Specifically, the thrust-bearing element reduces substantially abrasion on and wear of the seal resulting from sliding of the disc against the seal, and the resulting limitation on the effective service life of the seal.

45. The importance of the seal and thrust-bearing element to the solution provided by the claimed invention is also summarized in the Abstract of the ‘121 patent: “A seed distribution element (1) includes . . . -- a seal (24) on the movable portion (12) capable of sliding contact with the facing surface (16a) of the disc (16) when the portions are closed against one another,--a thrust-bearing element (26) of the sowing disc (16), supported rotatably in the movable portion (12), to withstand the axial load produced by the disc (16) on the seal (24).”

VII. CLAIM CONSTRUCTION

46. I understand that the terms of the '121 patent should be given their “ordinary and customary meaning” as understood by a POSA at the time of the invention. I have followed this principle in my analysis.

47. The Board preliminarily construed the claim term “transmission drive shaft” to mean “a shaft that is driven by a motor and is part of, or associated with, a transmission.” Institution Decision at 11. In my opinion, the Board’s interpretation is both reasonable and correct for the reasons recited on pages 11-13 of the Institution Decision.

48. The Board’s preliminary interpretation of the claim term “thrust-bearing element” (TBE) is “an [i.e., any] element that provides support against an axial force.” *Id.* at 10. In my opinion, the Board’s interpretation is unreasonably broad.

49. I understand that a part or limitation in a claim that describes a function without describing the physical structures for performing that function is a “means-plus-function” claim limitation. My understanding is informed by the PTO Memorandum dated March 18, 2024, which provides guidelines for examining patent claims with means-plus-function limitations under Section 112(f) of the Patent Act. Exhibit 2015.

50. The claimed TBE uses the term “element” as a generic placeholder. The claimed TBE is modified by functional language, namely, “to withstand at least some of the axial load produced by the disc on the seal.” The generic term “element” is linked to the functional language by the transition phrase “in order to.” The generic term “element” is not modified by sufficient structure for performing the claimed function. Therefore, in my opinion and based on the PTO’s Memorandum, the claim limitation “TBE” should be interpreted as a means-plus-function limitation.

51. The specification of the ‘121 patent expressly and unequivocally defines the structure of the TBE in the first, definitional sentence of a paragraph in column 3 of the ‘121 patent (Exhibit 1001): “The thrust-bearing element 26 comprises a shaft 27 rotatably mounted by means of bearings 28 in a seat 29 of the movable portion 12.”

52. The specification of the ‘121 patent associates additional components (beyond the three components of the shaft 27, bearings 28, and seat 29 recited in the definitional sentence) with the TBE: a flanging 30, a thrust-bearing plate 31, and a drive element 32. Some of these additional components are separately claimed in the ‘121 patent. *See* claim 3 (“The seed distribution element according to claim 1, wherein the thrust-bearing element comprises a thrust-bearing plate [31] . . .”) and claim 4 (“The seed distribution element according to claim 3, wherein the thrust-bearing element comprises a drive element [32]. . .”). Thus, these additional

components cannot be considered part of the structure of the TBE as recited more broadly in claims 1 and 10.

53. The definitional sentence in the specification of the '121 patent also defines the location of the three structural components that comprise the TBE. The shaft 27, the bearings 28, and the seat 29 are all “of” the movable portion 12. Claims 1 and 10 of the '121 patent further clarify “which thrust-bearing element is supported rotatably in the movable portion.” There is nothing redundant or inconsistent about defining the TBE to be both mounted rotatably by structure “of” the movable portion of the housing and supported rotatably “in” the movable portion.

54. In my opinion, the last limitation of claims 1 and 10 of the '121 patent should be interpreted to mean: “a shaft rotatably mounted in the movable portion and supported by means of bearings in a seat of the movable portion in order to withstand at least some of the axial load produced by the disc on the seal.”

55. The adjective and hyphenated term “thrust-bearing” that modifies the noun and generic word “element” in the TBE limitation supports this interpretation. The word “thrust” refers to the function of the TBE, which claims 1 and 10 later expand upon (viz, the TBE provides a thrust, driving force, or pressure that counters or withstands at least some of the axial load produced by the disc 16 on the seal 24 in the absence of the TBE). In addition to operating as a verb to indicate that the structure of the claimed “element” functions to “bear” thrust, the word “bearing”

also refers to the bearings 28 that form part of the structure of the TBE and that reduce the friction of motion between the shaft and the seat. Thus, the embodiment of the thrust-bearing element (hyphen) disclosed in the ‘121 patent resembles the structure and function of a well-known “thrust bearing” (no hyphen).

56. The PTO issued U.S. Patent No. 9,127,708 to US Synthetic Corporation in 2015 based on an application filed in 2013. Exhibit 2017. As used in the ‘708 patent, the terms “thrust-bearing apparatus” and “thrust-bearing assembly” connote structures that achieve support against an axial load while being supported in a way that reduces friction between stationary and rotating machine parts, consistent with the means-plus-function interpretation of “TBE.” The analogous use in the ‘708 patent of the terms “radial bearing apparatus” and “radial bearing assembly” describing structures that achieve support against radial loads while being supported in a way that reduces friction between stationary and rotating machine parts shows that this interpretation is independent of the use of hyphenation in constructions using “thrust.”

VIII. VENHUIZEN DOES NOT ANTICIPATE THE CLAIMS (GROUND 1).

57. Precision has not met its burden of establishing that claims 1-3, 7-12, and 16 of the ‘121 patent are anticipated by the VenHuizen patent (Exhibit 1006) because VenHuizen does not disclose a TBE under the correct interpretation of that limitation. Specifically, VenHuizen fails to disclose or suggest any one of the three

structural features of the claimed TBE: [iii] a shaft rotatably mounted in the movable portion [ii] and supported by means of bearings [i] in a seat of the movable portion.

58. On pages 45-47 of the Petition, Precision equates the winged hub handle 58 disclosed by VenHuizen with the claimed TBE. I disagree.

59. As shown in Fig. 6 of the VenHuizen patent, neither the hub handle 58 nor any structure associated with it equates to [i] the claimed seat of the movable portion. Although the handle 58 is located within the physical confines of the movable second housing member 90 when the two housing portions 50, 90 are closed together and not before, the handle 58 is rotatably supported by the retaining hub 56 in the fixed first housing member 50. *See also* Exhibit 1006, 7:48-51 (emphasis added): “As shown in FIGS. 3, 5, and 7, when the two housing members 50, 90 are latched in assembled relationship, with a seed disk 60 retained on the retaining hub 56 of the housing member 50, the interior of the metering unit 36 will be divided into two chambers.” Thus, VenHuizen does not disclose or suggest any seat, and certainly not a seat of the movable portion, as required by the TBE recited in the claims of the ‘121 patent.

60. Further, and as shown in Fig. 6 of the VenHuizen patent, neither the hub handle 58 nor any structure associated with it equates to [ii] bearings that support a shaft in the seat of the movable portion. VenHuizen does not disclose or suggest any bearings as required by the TBE recited in the claims of the ‘121 patent. The

absence of bearings in VenHuizen is not surprising because bearings are not needed in the movable portion of the housing in the device taught by VenHuizen. Bearings are not needed, in turn, because VenHuizen also does not disclose or suggest [iii] a shaft rotatably mounted in the movable portion.

61. The '121 patent teaches that “[t]he thrust-bearing element 26 is driven in rotation with the sowing disc 16” Exhibit 1001, 3:36-37. *See also* claims 2 (“the thrust-bearing element is rotated with the disc”) and 4 (“the thrust-bearing element comprises a drive element which . . . can be coupled with the drive shaft of the disc”). Clearly, the shaft of the TBE, as rotatably mounted in the movable portion and supported by means of the bearings in the seat of the movable portion, rotates along with the disc in an unrestricted, 360° manner. The shaft engages the seat through bearings that permit, indeed facilitate, such unrestricted rotation of the shaft (and disc) relative to the seat of the movable portion.

62. In contrast, the hub handle 58 taught by VenHuizen simply clamps or locks the sowing disc against the retaining hub. The handle does not rotate with respect to the hub when in the locked position, and no structure in the movable portion of VenHuizen permits unrestricted rotational movement between a shaft and either a (non-existent) seat or (more generally) the movable portion of the housing. The functions of the hub handle 58 disclosed by VenHuizen are to permit

replacement of a seed disk 60 and, after the seed disk is installed, to retain the seed disk on the hub 56.

63. More specifically, as shown in Fig. 4 (labeled “PRIOR ART”) of VenHuizen, the sowing disk 60 has ramps 63, 64 and corresponding lock notches 65, 66 (which are located opposite each other, i.e., 180° apart) arranged around a wing-shaped center opening 53. The wing-shaped opening receives the winged hub handle 58. *See* Exhibit 1006, 6:19-27. The retaining hub 56 is threaded on the drive shaft 55, both of which are located in the fixed portion 50 of the housing, and the handle 58 is located on the distal end of the retaining hub. The user can grasp the handle 58 and rotate it about the retaining hub relative to the seed disk a short distance so that the ramps facilitate engagement with the lock notches and the seed disk is locked to the hub. Once locked, the hub and handle do not rotate with respect to each other. Essentially, the handle 58 functions like a nut on the retaining hub to lock and unlock the sowing disk.

64. Claims 1 and 10 of the ‘121 patent recite, separately from the TBE, a motor-driven transmission drive shaft 20 that rotates the sowing disc 16. The drive shaft 20 is supported in the fixed portion 11 of the housing and the sowing disc is removably mounted to the drive shaft. *See* Exhibit 1001, 2:60-63 and Fig. 1. If the drive shaft 55 taught by VenHuizen equates to any structure of the ‘121 patent, it

would be to the drive shaft 20. The drive shaft 55 has nothing to do with a TBE as recited in the claims of the '121 patent and correctly interpreted.

IX. FIORIDO DOES NOT ANTICIPATE THE CLAIMS (GROUND 2).

65. Precision has not met its burden of establishing that claims 1-5 and 10-14 of the '121 patent are anticipated by European Patent Application Publication No. 0536543 filed by Fiorido (Exhibit 1007) because Fiorido does not disclose a TBE under the correct interpretation of that limitation. Specifically, Fiorido fails to disclose or suggest any one of the three structural features of the claimed TBE: a shaft rotatably mounted in the movable portion and supported by means of bearings in a seat of the movable portion. Fiorido also does not disclose or suggest a TBE that functions to withstand at least some of the axial load produced by the disc on the seal. Finally, Fiorido fails to disclose or suggest a housing with a fixed portion and a portion which is movable relative to the fixed portion and can be closed against the fixed portion -- as recited in both claims 1 and 10 of the '121 patent.

66. Distinguish components that are movable relative to another component, such as the claimed movable housing portion that is “movable” relative to the fixed housing portion, from components that are “removable” because they can be separated, taken away, and conveyed to another place. The '121 patent makes this distinction clear. *See* Exhibit 1001, 1:60-62; 2:3-7; 2:9-10; and 4:1-9.

67. Fiorido teaches a single-seed distributor means 10 that is formed by two housing components: a seed container 11 and a box-like casing 12. Neither housing component is movable relative to the other (fixed) housing component. Instead, Fiorido bolts the housing components together into a fixed position. Both housing components are fixed relative to each other per Fiorido and are not moveable relative to one another once they are bolted together. The fact that the bolts of Fiorido can be removed to separate the seed container 11 from the casing 12 of Fiorido does not make either of those components movable relative to the other.

68. The components that the Petition equates with the claimed TBE, namely Fiorido's shaft [29], bearings [28], and driving disk [31], are located in the casing [12]. The '121 patent describes the "fixed portion" as "that portion which is fixed to the framework of the sowing elements." Exhibit 1001, 1:57-59. The patent also teaches that it is "obligatory to mount on the fixed portion the transmission which drives in rotation the motor-driven shaft which rotates the disc," *id.*, 1:63-65, because the drive shaft must be fixed in translation to the framework. And Fig. 1 of the '121 patent locates the transmission shaft [20] in the fixed portion [11] of the housing. Therefore, the casing [12] of Fiorido, in which the transmission drive shaft is located, would be the fixed portion of the housing -- and the TBE is not mounted in the other portion of the Fiorido housing (whether movable or not).

69. Fiorido does not disclose or suggest a TBE that functions “to withstand at least some of the axial load produced by the disc on the seal.” The function of the driving disk 31 (assisted by the related components of a perforated hub 27, bearings 28, a shaft 29, a cog-wheel 30, a centering dowel 32, and a driving pin 33) is expressly taught by Fiorido and is “to rotatably drive the disk 13.” *See* Exhibit 1007, 5:49-55.

70. The driving disk and sowing disk are not necessarily rigidly attached nor does the face of one necessarily touch or contact the face of the other. Specifically, Fig. 3 of Fiorido shows that the centering dowel 32 of the driving disk 31 engages a center hole of the sowing disk 13, centering the sowing disk 13 with respect to the driving disk 31, and that the driving pin 33 engages a smaller offset hole of the sowing disk 13 to rotatably drive the disk 13. *See also* claim 7 of Fiorido. Thus, the driving disk and sowing disk do not necessarily transfer any axial load whatsoever. The two components might slide axially, for example, with respect to each other.

71. This concept is further informed by Fiorido’s teaching that “a hollow sealing ring 39 or similar gasketing means of plastic material may be appropriately provided between the casing 12 and the disk 13 so as to ensure correct positioning of said two elements and an effective sealing effect between them (Figure 2).” Exhibit 1007, 7:53-58 (emphasis added). Because the sealing ring 39 “appropriately”

positions the disk 13 to create a seal between the casing and disk, the face of the driving disk 31 does not necessarily contact the face of the sowing disk 13. Rather, a gap may exist between the faces.

72. Fiorido does not teach facial contact between the drive disk and the seed disk.

73. Precision highlights the last paragraph of the Fiorido publication, which states “the seed container 11 may be provided with a central opening 40 (Figures 1 and 2) to possibly introduce the support and driving elements [i.e., the shaft 29, cog-wheel 30, centering dowel 32, and driving pin 33] for the disk 13 from the opposite side of the device, as opposed to the arrangement shown in the accompanying drawing.” Exhibit 1007, 8:1-6. If the support and driving elements [i.e., the shaft 29, cog-wheel 30, centering dowel 32, and driving pin 33] for the disk 13 were moved from the casing 12 as shown in the drawing to the seed container 11 as proposed by the last paragraph of the Fiorido specification, then the sowing disk 13 would certainly not have the driving disk 31 contact it because the vacuum would pull in the opposite direction.

74. The reason that Fiorido can move the support and driving elements to the other side is because the sealing ring 39 keeps the sowing disk 13 in the appropriate position. Contact would risk wear to the sealing ring, one of the very problems solved by the invention recited in claims 1 and 10 of the ‘121 patent.

Fiorido simply does not care whether the driving disk 31 ever contacts the sowing disk 13.

75. Fiorido discloses nothing about an axial load produced by the disk on the seal or that the driving disk (which the Petition equates with the claimed TBE) functions to withstand such a load.

X. FIORIDO ALONE OR IN COMBINATION WITH VENHUIZEN AND AAPA DOES NOT RENDER CLAIMS 1-5, 7-14, AND 16 OBVIOUS (GROUND 3).

76. Ground 3 asserts that claims 1-5, 7-14, and 16 would have been obvious based on a combination of Fiorido, VenHuizen, and applicant-admitted prior art (AAPA). More specifically, Ground 3 asserts that independent claims 1 and 10 would have been obvious based on Fiorido alone. Precision has not met its burden of establishing that independent claims 1 and 10 are rendered obvious by Fiorido either alone or in combination with VenHuizen and AAPA. Fiorido does not teach or suggest either a movable housing portion or a TBE of the movable housing portion.

77. The Petition also fails to identify how a POSA at the time of the '121 patent's effective filing date would have been motivated to combine the asserted references with a reasonable expectation of success in reaching the claimed invention. Specifically, independent claims 1 and 10 are patentable because there is no apparent suggestion or motivation to combine the principal reference (Fiorido) with either of the secondary references (VenHuizen or AAPA) to solve the problems

addressed by inventor Enrico Bragatto when the application that issued as the ‘121 patent was filed.

78. In addressing motivation to combine at pages 73-74, the Petition provides absolutely no reason to combine Fiorido with AAPA. With respect to the combination of Fiorido with VenHuizen, the Petition states two reasons – both of which are incorrect. First, the Petition states: “both [references] have fixed and movable sides of a vacuum-operated seed meter housing.” Petition at 73. As explained above, Fiorido does not have fixed and movable sides. Second, the Petition implies that both references “address the same problem.” *Id.* The problem addressed by Fiorido is that precision-type single-seed planters have to be provided with several sets of perforated disks having perforations drilled to different diameter sizes, which must therefore be changed quite often according to the average size and shape of the seeds to be planted. The problem addressed by VenHuizen is that seeds falling away from a seed disk follow different paths as they move through the air once they make contact with the surface of the seed tube. Thus, the references do not address the same problem.

79. In addressing a reasonable expectation of success at page 74, the Petition provides absolutely no reason for a POSA to expect success in reaching the claimed invention upon combining Fiorido with AAPA. With respect to the expectation of success upon combining Fiorido with VenHuizen, the Petition

concludes, without further explanation, that “a POSA would know that Fiorido’s seed meter, as modified by VenHuizen’s teaching [of a hinge, frame, and support structure], would still be operable in the environment of the implement on which it is installed with minimal, if any modifications.” *Id.*

80. On page 72, the Petition characterizes Fiorido as disclosing that the drive element may be introduced into either side of the seed distributor housing, i.e., into the casing (12) as illustrated in the figures or (alternatively) into the seed container (11). *See also* Petition, 33 (referring to Fiorido at column 8, lines 1-6) and 65. At column 8, lines 1-6, Fiorido teaches: “Furthermore, the seed container 11 may be provided with a central opening 40 (Figures 1 and 2) to possibly introduce the support and driving elements for the disk 13 from the opposite side of the device, as opposed to the arrangement shown in the accompanying drawing.” Thus, Fiorido expressly teaches that it does not matter whether the support and driving elements for the disk 13 (namely, the perforated hub 27, bearings 28, shaft 29, cog-wheel 30, driving disk 31, centering dowel 32, and driving pin 33) are located in or on the casing (12) or the seed container (11). This teaching makes sense because both housing components are fixed. Fiorido expressly teaches away from the importance (to the claimed invention of the ‘121 patent) of arranging the various components in different housing sections.

81. The totality of the Fiorido disclosure teaches away from the claimed invention. The teaching is to be viewed as it would have been viewed by one of ordinary skill in the art. When so viewed, the Fiorido publication teaches away from a seed distribution element having both fixed and movable housing sections and, more specifically, away from the importance of arranging the various components of the seed distribution element in different housing sections. The inventor of the claimed invention, Enrico Bragatto, proceeded contrary to the teaching of Fiorido.

XI. AMAZONE IN COMBINATION WITH FIORIDO, VENHUIZEN, AND AAPA DOES NOT RENDER CLAIMS 1-3, 7-12, AND 16 OBVIOUS (GROUND 4).

82. Ground 4 asserts that independent claim 1 (and, similarly, independent claim 10) would have been obvious based on a combination of Amazone with Fiorido. Precision has not met its burden of establishing that claims 1 and 10 are rendered obvious by Amazone in combination with Fiorido because neither reference discloses or suggests a TBE. Fiorido does not disclose or suggest a TBE for the reasons stated above.

83. Nor does Amazone. The Board apparently and reasonably read the Petition to rely on Fiorido, rather than Amazone, to teach the claimed TBE recited in claims 1 and 10: “Although Petitioner contends that Amazone teaches most of the limitations of claim 1, Petitioner relies on Fiorido to teach the claimed thrust-bearing element. Pet. 83. (VenHuizen and AAPA are not relied on for any of the limitations

of claim 1.)” Institution Decision at 37. Precision’s expert confirmed the Board’s understanding, conceding that Amazone does not disclose or suggest a TBE. Fleming Deposition at 99-101.

84. To the extent that Precision intends to rely on Amazone to teach the claimed TBE, I disagree with that position. The Petition refers on its page 83 to Fig. 227 on page 166 of the Amazone manual (Exhibit 1011 to the Petition). The Petition’s reference is copied below:



Fig. 227

85. Fig. 227 illustrates a green sowing disk (1); a grey foam seal (2); and a white suction lid with a suction kidney (3). The Petition incorrectly annotated Fig. 227 with the blue lead line and the label “thrust bearing element” (no hyphen).

86. What the Petition labels as the claimed “thrust bearing element” is a silver-colored circular metal hub that has a projection extending from its center toward the sowing disk with the projection surrounded by a recessed portion that

defines a raised rim around the outer periphery of the hub. The raised rim is recessed relative to the surface of the foam seal (2) and the projection runs through the central hole of the disk (1) when the components are assembled. Provided below are Images A, B, C, D, and E, which are photographs illustrating the assembly of some of the components.



Image A



Image B



Image C



Image D



Image E

87. The silver-colored metal hub presses against the white suction lid (3) which is a plastic support for the grey foam seal (2). The suction lid (3) has a central hole that receives the hub so that the raised rim of the hub is recessed relative to the surface of the seal (2). *See Image D.* The hub functions to retain the suction lid (3). The metal hub, the suction lid (3), and the foam seal (2) are all fixed in a stationary red plastic cover.

88. Nothing in the Amazone manual indicates, as the Petition contends, that the hub meets the limitation of the independent claims of the ‘121 patent reciting “a thrust-bearing element of the sowing disc, which thrust-bearing element is supported rotatably in the movable portion in order to withstand at least some of the axial load produced by the disc on the seal.” As a matter of fact, the hub does not meet the claim limitation. First, because the hub is fixed in the stationary cover, the hub is not a thrust-bearing element “supported rotatably in the movable portion.”

89. Moreover, as clearly illustrated in Fig. 227 above, the sowing disc has a central hole defining a cylindrical surface that receives the projection of the hub. The central hole of the sowing disk and the projection of the hub are devoid of any locking element (such as a seat for a key) which might engage the sowing disk with the hub. A person skilled in the art would understand that the sowing disk is supported on the projection of the hub, but that the sowing disc can freely rotate around and slide on the projection of the fixed hub.

90. In addition, the hub is recessed relative to the surface of the foam seal in order to avoid any contact between the surface of the hub and the surface of the sowing disk (i.e., there is a gap between the hub and the sowing disk when those components are assembled). Rather, the surface of the sowing disk contacts only the raised seal as the sowing disk rotates around the projection of and relative to the hub. *See* Image D (which shows the grey foam seal as forming the highest horizontal raised surface positioned to contact the surface of the sowing disk upon assembly of the sowing disk). The person skilled in the art would have no doubt that the surface of the sowing disk does not contact the surface of the hub because the sowing disk must rotate with respect to the hub. The allowance of any load-bearing action between the hub and the sowing disk would create additional friction -- which is exactly what should be avoided. Therefore, the seal (and not the hub) withstands the entirety of the axial load produced by the disk on the seal. The hub disclosed by Amazone is not a thrust-bearing element able “to withstand at least some of the axial load produced by the disc on the seal.”

91. Petitioner’s reliance on Amazone and Fiorido to assert that the challenged independent claims would have been obvious is therefore unsupported. Further, as stated above for Grounds 2 and 3, Fiorido itself does not disclose a thrust-bearing element able “to withstand at least some of the axial load produced by the disc on the seal.” Therefore, it is incorrect to argue, as Dr. Fleming does, that “[a]

POSA would understand that Fiorido's driving disk structure could be adapted for use in Amazone's disclosed structure to provide a rotating thrust-bearing element." Exhibit 1003, ¶ 119.

**XII. OBJECTIVE INDICIA OF NON-OBVIOUSNESS SUPPORT
PATENTABILITY, i.e., NONOBVIOUSNESS (GROUNDS 3 AND 4).**

92. Precision has advertised the interchangeability of its vSet devices with seed meters manufactured by Maschio and has provided instructions for retrofitting Maschio's sowing element by replacing the original seed meter of Maschio with a Precision seed meter.

93. A copy of the instructions are attached as Appendix B. The instructions are available on the Precision website at [https://assets2.brandfolder.io/bf-boulder-prod/x825tknv63254nm74jm3scvq/v/1081287551/original/Gaspardo%20vSet2%20Install%20\(955888\).pdf](https://assets2.brandfolder.io/bf-boulder-prod/x825tknv63254nm74jm3scvq/v/1081287551/original/Gaspardo%20vSet2%20Install%20(955888).pdf). From the website precisionplanting.com, select "Product Resources," then search on "Gaspardo," then of the six documents listed select the third document in the list titled "Gaspardo vSet2 Install 955888."

94. Fiorido was published in 1993. Precision alleges that Amazone was published in 2005, and the VenHuizen patent issued in 2007. Thus, the industry has long felt a need to improve seed drills. For almost two decades between the Fiorido publication and the filing of the '121 patent in 2010, the industry suffered without a solution to the problems that occur when attempting to reduce seal wear despite the existence of the references applied by Precision to support its obviousness position.

95. Despite the industry's long-felt need for improvement and the existence of the references cited by Precision, the industry was unable, until the claimed invention, to pinpoint the source of the subset of problems and to improve the art. The references which Precision cites as analogous are insufficient to render the claimed invention obvious. Otherwise, the reason why the sophisticated seed drill industry long suffered with inferior seed drills is unclear. If the applied art does disclose the limitations of the claimed invention, then it has done so for many years and the length of time supports a finding of nonobviousness.

96. I visited the Precision website at www.precisionplanting.com/about and learned that Precision touts itself as a leading provider of agriculture technologies for farmers. On information and belief, conventional seed drills have long included finger meters for corn and brush meters for soybeans. In fact, brush meters for planting soybeans were introduced in the late 1980s by engineer Harry Deckler. *See* an article dated October 12, 2015, by Kinze Manufacturing, available on <https://www.kinze.com/great-kinze-innovations-the-brush-type-seed-meter> and provided as Appendix C. In its answer to Interrogatory No. 2 propounded by Maschio in the related district court litigation, Precision described the extensive development effort it devoted to some of its relevant products. *See* Exhibit 2019. Thus, Precision, Kinze Manufacturing, and others have long been developing new agriculture planting

technologies for farmers but have failed to solve the problems addressed by the '121 patent.

XIII. CONCLUSION

97. This Declaration represents the opinions that I have formed up to date based on the material currently available to me. I reserve the right to revise, supplement, and/or amend my opinions stated in this Declaration based on new information that becomes available to me and on my continuing analysis of the materials available to me.

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

DATED:

07/18/2024



Harry Dankowicz, Ph.D.

Appendix A

Curriculum Vitae

CURRICULUM VITAE

HARRY DANKOWICZ

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Academic Degrees

1991	M.Sc. in Engineering Physics, KTH Royal Institute of Technology, Sweden (KTH)
1995	Ph.D. in Theoretical and Applied Mechanics, Cornell University
2018	M.S. in Journalism, University of Illinois at Urbana-Champaign (UIUC)

Professional History

2024-present	Professor and Chair, Department of Mechanical Engineering, University of Maryland, College Park
2021-2023	Program Director, Division of Civil, Mechanical, and Manufacturing Innovation, National Science Foundation (NSF)
2016-2021	Associate Dean for Graduate, Professional and Online Programs, The Grainger College of Engineering, UIUC
2012-2022	Editor-in-Chief, ASME Applied Mechanics Reviews
2012-2016	Associate Editor, SIAM Journal on Applied Dynamical Systems
2011-2023	Professor in the Dept. of Mechanical Science and Engineering, UIUC
2005-2011	Associate Editor, ASME Journal of Computational and Nonlinear Dynamics
2005-2011	Contributing Editor, International Journal of Non-Linear Mechanics
2005-2011	Associate Professor in the Dept. of Mechanical Science and Engineering, UIUC
2004-2005	Associate Professor in the Dept. of Engineering Science and Mechanics, Virginia Polytechnic Institute and State University (Virginia Tech)
1999-2004	Assistant Professor in the Dept. of Engineering Science and Mechanics, Virginia Tech
1996-1999	Research Associate in the Dept. of Mechanics, KTH
1995/96	Göran Gustafsson Postdoctoral Fellow in the Dept. of Mechanics, KTH

Professional Memberships

- American Society of Mechanical Engineers (ASME), Member since 2002, Fellow since 2012
- American Society for Engineering Education (ASEE), Member since 2000
- Society for Industrial and Applied Mathematics (SIAM), Member since 1997

Areas of Research

Dynamical systems and control, computational mathematics, networks and complex systems, design optimization, robotics, and task scheduling; applications to renewable energy technologies, collective behavior of social insects and humans, constrained uncertainty quantification, large-scale field agriculture.

Scholarly Publications

[J] – Archival Journal Publications, [C] – Conference Papers, [B] – Books, [BC] – Book Chapters

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Selected Intellectual Property

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- Dankowicz, H. and Nguyen, K. (2012) "Brush Design for Seed-Delivery Systems," invention disclosure, UIUC.
- Dankowicz, H., Leo, D., Ballmer, A., Beeman, J., Dillon, T., Lassaletta, A. and O'Connor, R. (2005) "Computer-aided three-dimensional bending of spinal rod implants, other surgical implants and other articles, systems for three-dimensional shaping, and apparatuses therefor", US Patent Application.
- Dankowicz, H., Hutchison, J., and Shilt, J. (2005) "Systems and methods for multi-dimensional characterization and classification of spinal shape," US Patent Application.
- Dankowicz, H. and Dutta, A. (2003) "Active Ankle Foot Orthosis/Prosthesis to Enhance Gait Stability," invention disclosure, Virginia Tech.

Selected Research Funding

- "INSPIRE: Asynchronous Communication, Self-Organization, and Differentiation in Human and Insect Networks," NSF, 2012-2018
- "Cooperative Human-Robot Networks for Agricultural Applications," National Institute of Food and Agriculture, 2014-2018
- "An Algorithm Suite for Computational Nonlinear Analysis of Power Systems," NSF, 2010-2014
- "Ultrafast and Robust, Resettable Threshold Sensors Based on Discontinuity-Induced Nonlinearities," NSF, 2009-2012
- "Self-Calibrating Mass-Flow Sensor," John Deere & Company, 2008-2010
- "Suppression of Catastrophic Loss of Stability of Low-Velocity Impacting Motions," Swedish Science Council, 2004-2008
- "GOALI: Minimum-Contact Tapping-Mode Atomic Force Microscopy for Nondestructive Characterization of Soft Nanostructures," NSF, 2005-2009
- "PECASE: Analysis and Design of Discontinuity-Driven Bifurcations," NSF, 2003-2010

Selected Honors

- Archie Higdon Distinguished Educator Award, ASEE, 2017
- Fred Merryfield Design Award, ASEE, 2013
- Presidential Early Career Award for Scientists and Engineers, NSF, 2003
- Professor Gunnar Wallquist Medal, KTH, 1992

Appendix B

Gaspardo Install

Step 1:

Prepare OEM meter for removal.

- Remove the ground drive and shaft from the OEM meter.
- Loosen the vacuum hose clamp and remove the vacuum hose. Keep the hose clamp to be used later.



Step 2:

Remove OEM Meter.

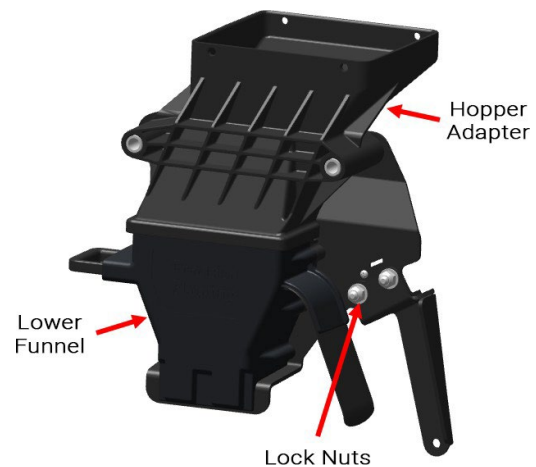
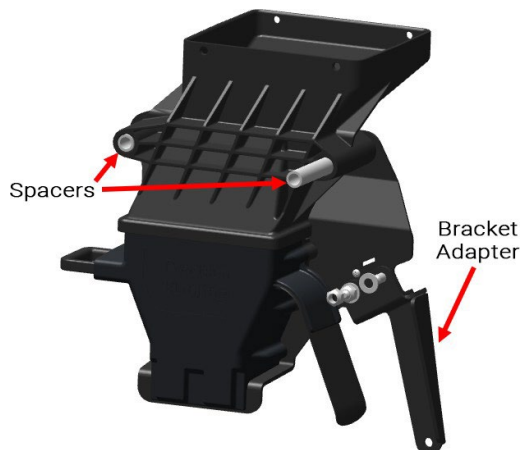
- Remove the nuts and bolts that secure the meter to the row unit shank.
- Remove the OEM meter and hopper from the shank and set them aside.



Step 3:

Prepare vSet2 Hopper Assembly.

- Fasten the bracket adapter to the base. Make sure the lock nuts are located on the correct side of the bracket, as shown.
- Insert the spacers into the hopper adapter.

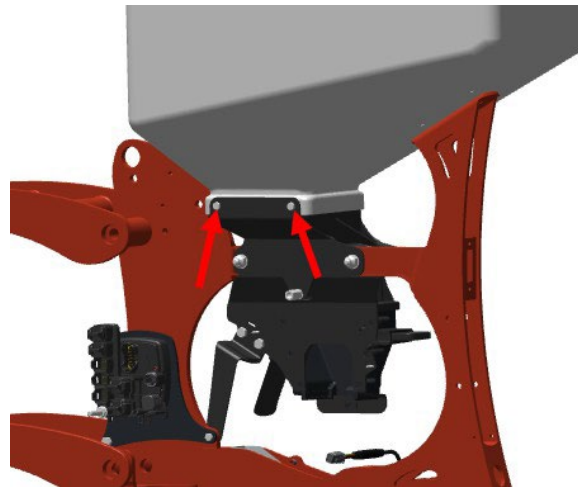


Step 4:

Install vSet2 Hopper Assembly.

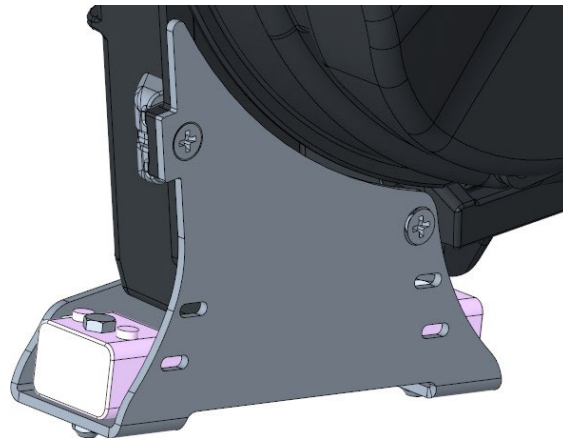
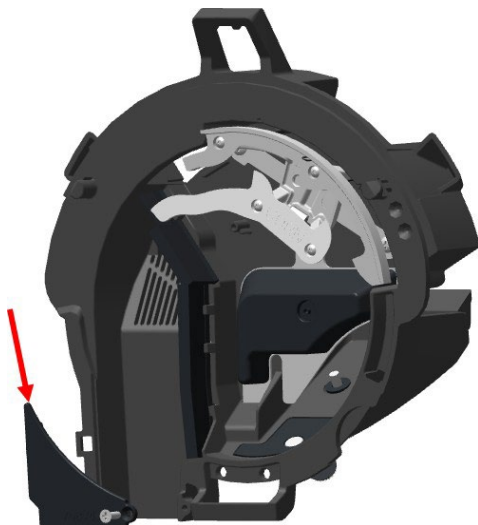
- Insert the hopper adapter into the OEM hopper as shown. It should fit tightly in the hopper.
- Use the supplied hardware to fasten the Hopper Assembly to the shank. The two M10 x 150 mm bolts pass through the hopper adapter spacers. The M10 x 25 mm bolt fastens the bracket adapter to the shank.
- Make sure the M10 x 25 mm bolt head is on the side of the shank as shown.
- Re-attach the OEM hopper using the original nuts and bolts. If needed use the M6 hardware supplied in the 768772 hardware kit.

Note: Wait to fully re-tighten all hardware until after the vSet2 meter and OEM hopper are both installed.



Step 5:

Remove the lower cover from the meter cover to install the seed tube sensor.



Step 6:

Install vSet2 Meter Cover Assembly (768748)

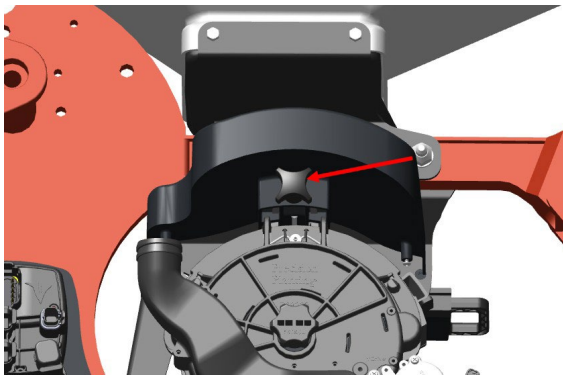
- Install the exit chute boot onto the meter cover assembly as shown.
- Slide the meter into the hopper assembly. It should fit tightly against the bracket; slide down until the hook is securely against the bracket.
- Using the #2 Phillips screwdriver, install 2x plastite screws to hold the meter cover to the bracket. Tighten the screws to seated + 1/8 turn.



Step 7:

Install Meter Vent & vDrive.

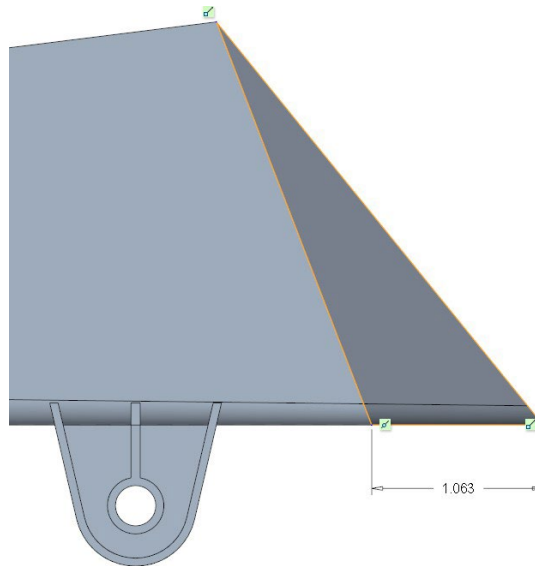
- Slide the meter vent assembly (768755) over meter cover until it is flush against the bracket.
- Use the knob (200156) to secure the vent to the coupling nut in the bracket assembly.
- Install the meter with vDrive.



Step 8:

The Gaspardo seed tube will need to be modified.

- Make a mark 1-1/16" or 27mm down from the top of the seed tube.
- Draw a line across the tube and cut the top of the tube off.



Step 9:

Connect the vSet2 to the Gaspardo vac system.

- Cut the stock hose around the parallel arms as shown below.
- Next install the (731101) adapter from kit 731309 onto the Gaspardo vac hose.
- Install the 1.5" Precision vac hose from the adapter to the elbow (731104).
- Secure the elbow to the (768718) vac inlet on the meter.



Appendix C

KINZE

[Home](#)[Innovation in Agriculture](#)[Great Kinze Innovations: the Brush Type Seed Meter](#)

October 12, 2015 by [Kinze Manufacturing](#)

It was the late 1980s when engineer Harry Deckler came up with a big idea for a new seed meter that would allow farmers to plant soybeans with unmatched accuracy. Deckler was wholly confident in his idea, but his current employer didn't share his enthusiasm and vision.

So Deckler reached out to Jon Kinzenbaw of Kinze Manufacturing. What followed would change the row crop planter industry forever.



Until that time, soybeans were planted with a grain drill and were not accurately singulated. Deckler's idea was to design a disc with seed pockets located around the periphery, which would agitate and singulate the seeds as the disc rotated within the seed reservoir. Kinzenbaw recognized its potential right away.

"The companies were holding Harry back and wouldn't let him move forward with his product idea. So he came to me and said he had an idea to build a soybean meter that would singulate the seed. And I said why don't you come to work for us and we'll build that," Jon recalls. "We struck up a deal, hired Harry, he came here to Kinze, and within a month of him being here he had a working model of what we called the brush meter. It was so simple it was almost comical to watch it."

In the beginning, Jon and Harry agreed to keep the project top secret.

"Jon thought it was an idea worth pursuing. When I first started working for him we talked about it and I started working over at his farm machine shop to keep it quiet what we were working on. I spent most of my time over there developing the brush seed meter," Harry said.

A very soft-bristled brush that made contact with the face of the disc held the seeds in place while also brushing away the extra seeds. The brush meter had a very high accuracy rate (in the high 90th percentile), with no doubles and no skips. What's more, it had only one moving part.

It was a simple yet profound idea. And much to Jon and Harry's surprise, Harry hadn't been the only one who'd come up with it. When an engineer named Gene Keaton shared a similar prototype with Jon and Harry, the two just laughed. At first, Keaton mistook their reaction as a criticism of his invention. But then Jon and Harry showed him their prototype.

"We took Gene Keaton over to the farm and showed him our version of the meter and he started laughing," Jon said. "But it was just one of those things where three of us got together and agreed on a deal, and didn't fight each other, and we ended up with a good solid patent on the brush meter. We sold that meter by the tens of thousands and still do."

The Kinze brush meter nearly eliminated the need for grain drills, and immediately revolutionized the planting of soybeans. Today it remains one of our most popular seed meters, which goes to show simplicity, accuracy and efficiency never go out of style.

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