

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Precision Planting, LLC *and* AGCO Corporation
Petitioners

v.

Deere & Company
Patent Owner

Case No. IPR2019-01044

DECLARATION OF DOUGLAS S. PRAIRIE

PRECISION - AGCO
EXHIBIT 1002

BABY JOGGER
EXHIBIT 2101

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I, Douglas S. Prairie, declare as follows:

I. INTRODUCTION

1. I have been retained as an expert in this proceeding by counsel for Precision Planting, LLC and AGCO Corporation (“Petitioners”). I have been asked for my expert conclusions regarding the validity of claims 1-8 of U.S. Patent No. 8,813,663 (“’663 patent”). For the reasons set forth below, it is my conclusion that claims 1-8 of the ’663 patent are invalid.

II. BACKGROUND

2. I hold a B.S. in Agricultural Engineering (with a focus on power and machinery) from South Dakota State University, which I received in 1997. I also hold a M.S. in Mechanical Engineering (with a business emphasis) from Boise State University, which I received in 2004. I am a registered Professional Engineer in the State of Idaho.

3. I have worked in the agricultural and mechanical engineering industry for over twenty years. For a large portion of that time, I worked directly on the development of precision seeding technology. My present position at South Dakota State University allows me to lecture and lead the development of engineering and technical based coursework for the first four-year university in the world with a B.S.

degree in Precision Agriculture. Courses I am responsible for involve every aspect of the design, operation and ownership of agriculture machinery including planting and seeding technologies. Previous positions related directly to planting and seeding technology include five years as the global Product Manager of planting and seeding technologies for Raven Industries. This position involved being familiar with all the global planter and seeder hardware manufacturers and the technologies they utilized. A highlight of this position was the rollout of Raven's Omni-Row planter control system which interfaced with all of the leading row crop planter technologies. A leading-edge feature of this system was individual row rate control of seed population and multi-hybrid or multi-species planting controls. Early in my engineering career, I was employed as a product development engineer for CaseIH within their planter and seeder product group. During my time with CaseIH (now part of CNH Global) I was involved in multiple projects that led to a series of innovative technologies and U.S. Patents related to seed distribution and ground engaging tools for planting and seeding equipment.

4. From May 1996 until September 1996 (while I was completing my B.S.), I worked for Ag-Chem Equipment Co., where I performed product testing on the engine hydraulic systems of chemical and granular fertilizer applicators. (I understand

that, subsequent to my work there, Ag-Chem Equipment Co. was acquired by AGCO Corporation in 2001.¹)

5. From October 1996 until July 2000, I worked for Case Corporation, a large manufacturer of construction and agricultural equipment, as a New Product Development Engineer for Case's Planting and Seeding Division. In that role, I was part of a team that developed the SDX 30 and SDX 40 single disc no-till planter programs from conception to production. Some of this work is shown within U.S. Patents 6,386,127, 6,640,732, and 6,644,223. I was also involved in the development of pneumatic seed delivery systems to row crop planter seed meters (U.S. Patents 5,915,312 and 6,047,652) similar to those described within this document.

6. From December 2000 until February 2003 and again from September 2005 until December 2007, I worked for Multiquip, a manufacturer and supplier of products for construction, industrial, telecom, government, and other industries, as an Engineering Department Manager. In that role, I oversaw the development of light construction equipment, such as the HTX and STX hydraulic concrete power trowels.

¹ See <https://www.agcocorp.com/about/agco-history.html>.

7. From February 2003 until September 2005, I worked for Bratney Companies as a Construction/Mechanical Project Engineer. Bratney Companies provides equipment design, engineering, and construction services to seed, food, grain, and feed facilities around the world. In that role, I developed and managed construction projects, including for a green field alfalfa cleaning and bagging facility.

8. From December 2007 through the present, I have done freelance agricultural, mechanical, and industrial design engineering through my own company, Prairie West LLC. Some examples of this work include mechanical engineering analysis and documentation for a micro corn to ethanol production facility, structure design analysis for a mobile hydraulic car crushing system, and industrial design and product development for a consumer products company that developed child strollers.

9. From March 2010 until March 2015, I also worked for Raven Industries, first as a Project Manager for planting, seeding, and harvesting product lines and then as the North American Sales Manager for precision agriculture technology. Raven Industries is an electronics manufacturing firm, specializing in precision agriculture, high-performance specialty films, and lighter-than-air technologies. In those roles, I oversaw development and launch of multiple planting products, including OmniRow Planter Controls, OmniSeed Air Seeder Controls, UHarvest Grain Cart Monitoring

System, and SmartYield Pro Yield Monitoring System. The OmniRow product line was the first aftermarket planter control system that allowed for individual rate control of row crop planter seed meters similar to those described within this document. The OmniSeed seeder control was an aftermarket and OEM based technology that was revolutionary in its ability to provide a comprehensive seeder control package within a single platform. Leading these product development efforts and launches allowed me firsthand exposure to all of the major planter and seeding equipment manufactures and their technologies.

10. From June 2015 until June 2016, I worked for POET Research as a Mechanical Research Manager in the research and innovation group. POET Research develops and produces clean and renewable biofuels. In that role, I developed technologies related to corn ethanol, cellulosic ethanol, and corn-derived industrial products.

11. From August 2016 until the present, I have taught as an Instructor at South Dakota State University in the Agriculture and Biosystems Engineering Department. I have taught and led the development of courses for undergraduate students that go on to receive Bachelor of Science degrees in Agriculture Systems Technology (AST), Precision Agriculture (PRAG), Agriculture and Biosystems

Engineering (ABE), and Mechanical Engineering (ME). South Dakota State University is the first university in the world to offer a four-year B.S. degree in Precision Agriculture. As part of this coursework, I have assisted with the development of multiple small scale two-row planters that showcase technologies of the leading planter equipment manufactures. We also utilize the Precision Planting meter test stand within our coursework to demonstrate the inner workings of various brands of planter metering technology. Specific courses I lead and/or instruct are ABE 314 Agriculture Power and Machinery; ABE 411/422 Capstone Design; ABE 350 Hydraulic Systems; ABE 464 Monitoring and Controls; AST 412 Fluid Power Technology; and AST 313 Farm Machinery Management.

12. I am a named inventor on multiple U.S. patents and applications relating to seeding and planting technology: U.S. Patent Nos. 5,915,312, titled *Pneumatic Seed Delivery System*, which issued on June 29, 1999 (a pneumatic system for providing grain from a grain bin to a grain meter using air flow); U.S. Patent No. 6,047,652, titled *Seed Planter Distribution System*, which issued on April 11, 2000 (a system for receiving air borne seed from a source and transferring the seed to seed metering bins); U.S. Patent No. 6,116,172, titled *Shank-Mounted Row Chop Opener*, which issued on September 12, 2000 (an opener assembly used to form a furrow in the

ground with improved versatility and lower maintenance needs); U.S. Patent Nos. 6,386,127, 6,640,732, and 6,644,223, titled *Disc Opener for a Seed Planter*, which issued on May 14, 2002, November 4, 2003, and November 11, 2003, respectively (a disc-style opener assembly for opening a furrow in the ground); U.S. Patent No. 6,454,019, titled *Agricultural Implement Down Pressure System*, which issued on September 24, 2002 (a mechanism for forcing a device that opens a furrow in the ground towards and into the soil); and U.S. Patent Application No. 13/842,326, titled *Multi-Seed Planter Control System and Method for the Same*, which was filed on March 15, 2013 (a method of automatically planting two or more seed types, including monitoring a planter's location and having remotely adjustable planting characteristics).

13. I am a member of multiple professional organizations, including the American Society of Agricultural and Biological Engineers (ASABE), American Society of Mechanical Engineers (ASME), and Society of Automotive Engineers (SAE).

14. A copy of my curriculum vitae is attached as Appendix A, which contains further details regarding my experience, education, and other qualifications to render an expert opinion in connection with this proceeding.

15. I am being compensated at my normal consulting rate of \$225/hour for my work, but my opinions are based on my own views of the patented technology and the prior art. My compensation is not dependent on the outcome of this proceeding and in no way affects the substance of my statements in this Declaration.

16. I have no financial interest in the Petitioners. I similarly have no financial interests in the '663 patent.

III. MATERIALS CONSIDERED

17. In addition to the Petition in this proceeding, I have considered the following materials in preparing this Declaration:

Exhibit	Description
1001	U.S. Patent No. 8,813,663 to Garner et al. ("’663 patent")
1002	Declaration of Douglas S. Prairie ("Decl.")
1003	U.K. Published Application No. GB 2,057,835A to Hedderwick et al. ("Hedderwick")
1004	U.S. Patent No. 4,193,523 to Koning ("Koning")
1005	French Published Application No. 2,414,288 to Benac ("Benac") (Certificate with English Translation of Ex. 1006)
1006	French Published Application No. 2,414,288 to Benac (Original in French)
1007	U.S. Patent No. 6,681,706 to Sauder et al. ("Sauder")
1008	U.K. Published Application No. GB 2,012,534A to Curtis ("Curtis")

U.S. Patent No. 8,813,663
Declaration of Douglas S. Prairie
Case No. IPR2019-01044

Exhibit	Description
1009	-
1010	-
1011	-
1012	-
1013	-
1014	-
1015	U.S. Patent No. 6,651,570 to Thiemke (“Thiemke”)
1016	U.S. Patent No. 6,244,201 to Mauch et al. (“Mauch”)
1017	U.S. Patent No. 6,352,042 to Martin et al. (“Martin”)
1018	U.S. Patent No. 4,026,437 to Biddle (“Biddle”)
1019	Excerpt from Samuel N. Kramer, <i>History Begins at Sumer</i> (1959)
1020	-
1021	-
1022	File History of U.S. Patent No. 8,813,663
1023	-
1024	File History for U.S. Patent Application No. 12/364,010 to Garner et al.
1025	-
1026	-
1027	-
1028	-
1029	-
1030	U.S. Patent No. 1,376,933 to Gould (“Gould”)

18. I have reviewed the above exhibits and any other materials cited in this Declaration.

IV. LEVEL OF ORDINARY SKILL IN THE ART

19. It is my understanding that when considering the claims of the '663 patent and the prior art, I am required to do so based on the perspective of one of ordinary skill in the art at the relevant effective filing date, which I understand is February 2, 2009. I understand that there are several factors to consider in determining who would be a person of ordinary skill in the art. These factors include: (1) the types of problems encountered in the art; (2) the prior art solutions to those problems; (3) the rapidity with which innovations are made; (4) the sophistication of the technology; and (5) the educational level of active workers in the field.

20. Based on these factors together with my experience and expertise, a person of ordinary skill in the art at the time as of February 2009 would have had at least a bachelor's degree plus four years of experience in mechanical engineering, agricultural engineering, or a related field or a master's degree plus two years of experience in mechanical engineering, agricultural engineering, or a related field. This ordinary artisan would have been familiar with the mechanics and design of agricultural planters.

V. LEGAL PRINCIPLES

21. I am not an attorney. For the purposes of this Declaration I have been informed by Petitioners' counsel about certain legal principles that are relevant to my analysis and opinions. I have applied those legal principles in arriving at my conclusions expressed in this Declaration.

A. Claim Construction

22. I understand that "claim construction" is the process of determining a patent claim's meaning. I also have been informed that the proper construction of a claim term is the meaning that a person of ordinary skill in the art (i.e., the technical field to which the patent relates) would have given to that term at the time when the relevant patent application was filed in the United States Patent and Trademark Office. I also have been informed that, in this proceeding, claim construction will be determined by the Patent Trial and Appeal Board ("the Board"). I further understand that the proper construction of any term that requires construction is how a person of ordinary skill in the art would understand the term based on its use in the claims, specification, and file history of the patent.

23. I understand that claim terms that are not construed by the Board should be given their ordinary and customary meaning as understood by a person of ordinary skill in the art.

24. I have been informed and understand that a “means-plus-function” claim term is a term that recites a certain function but does not recite sufficient structure for performing that function. I understand that means-plus-function terms are limited to the function recited in the claim term and the specific structure disclosed in the patent’s specification for performing that function and structures that are equivalent to the disclosed structures. Accordingly, I have been informed and understand that construing a means-plus-function claim term is a two-step process. First, the claimed function of the term must be identified. Second, the structure described in the specification for performing that function must be identified.

B. Obviousness

25. I have been informed and understand that a patent is invalid as obvious if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

26. I have been informed and understand that when analyzing the question of obviousness, it is improper to use hindsight reconstruction, and that one should not use the patent as a road map for selecting and combining items of prior art. I am informed and understand that the relevant question is what a person of ordinary skill in the art would have understood at the time the invention was made in light of all the prior art before him or her.

27. I have been informed and understand that when analyzing obviousness, one must determine four things: (1) the scope and content of the prior art references; (2) what differences, if any, exist between the invention of the claims of the patent and the prior art; (3) what the level of ordinary skill in the art was at the time the invention was made; and (4) objective considerations of nonobviousness.

28. I have been further informed and understand that when determining any differences between the invention covered by the patent claims and the prior art, one should not look at the individual differences between the patent claims and the prior art in isolation, but rather consider the claimed invention as a whole and determine whether or not it would have been obvious in light of all of the prior art.

29. I have been informed and understand that when deciding whether to combine the various items described in the prior art, the relevant question is whether

the prior art combination would have been obvious to a person with ordinary skill in the art at the time of the invention. I have been further informed that it can be important to identify a teaching, suggestion, or motivation, in either the prior art or the knowledge of persons skilled in the art, that would have prompted a person of ordinary skill in the relevant field to combine the elements in the prior art in the way the claimed invention does.

30. I have been informed and understand that the teachings of two or more references may be combined, or a single reference may be modified, if such a combination or modification would have been obvious to a person having ordinary skill in the art. In determining whether a combination or modification would have been obvious, I have been informed and understand that it is appropriate to consider, among other factors: (1) whether the teachings of the prior art references disclose known concepts combined in familiar ways, which, when combined, would yield predictable results; (2) whether a person of ordinary skill in the art could implement a predictable variation, and would see the benefit of doing so; (3) whether the claimed elements represent one of a limited number of known design choices, and would have a reasonable expectation of success by those skilled in the art; (4) whether a person of ordinary skill would have recognized a reason to combine known elements in the

manner described in the claim; (5) whether there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; and (6) whether the alleged invention applies a known technique that had been used to improve a similar device or method in a similar way.

31. I have been informed and understand that where a person of ordinary skill in the art would have had a motivation to combine the references, and the combination discloses each of the elements of the asserted claim, the claim is invalid as obvious.

32. I have been informed and understand that a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was independently known in the prior art. I have been informed and understand that while one must look carefully at a patent that claims as an innovation the combination of known devices according to their established functions, it is important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. For example, a person of ordinary skill in the art can be motivated to combine elements described by different prior art references where the prior art discloses the benefits of such a combination or the combination would solve the problem the person of skill was attempting to solve.

33. I have been informed and understand that to show a motivation to combine, one is not required to show how the references would be physically combined to render a claim obvious. The analysis is not focused on whether the features of one reference can be physically incorporated into the structure of another reference, but rather whether a person of ordinary skill in the art would have been motivated to combine the teachings of the references to achieve the claimed invention. For example, a person of ordinary skill in the art would understand how predictable variations of known concepts could be combined and would recognize that where multiple tools were available in a toolbox, any could be chosen.

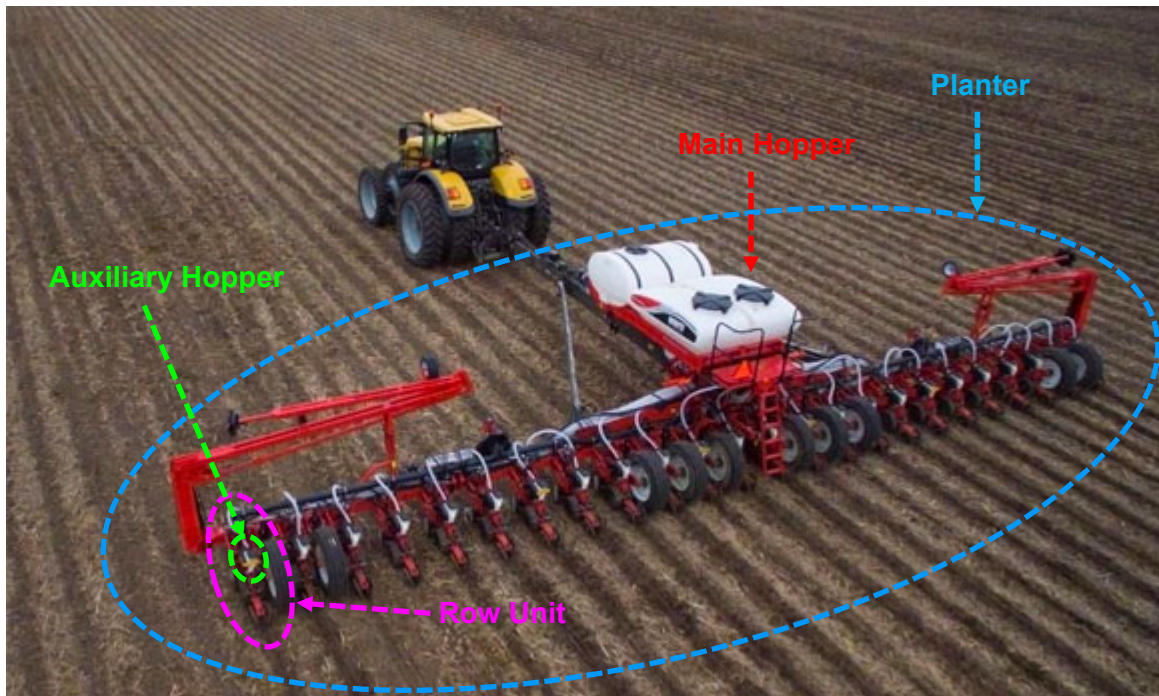
VI. OVERVIEW OF THE '663 PATENT

C. Priority Date

34. The '663 patent states that it is a continuation of U.S. Patent Application No. 12/364,010 filed on February 2, 2009. I understand that Petitioners do not concede that the '663 patent is entitled to a priority date of February 2, 2009. However, the specific priority date of the '663 patent is not relevant to my analysis because all of the prior art relied on in the Petition predates February 2, 2009 by more than one year.

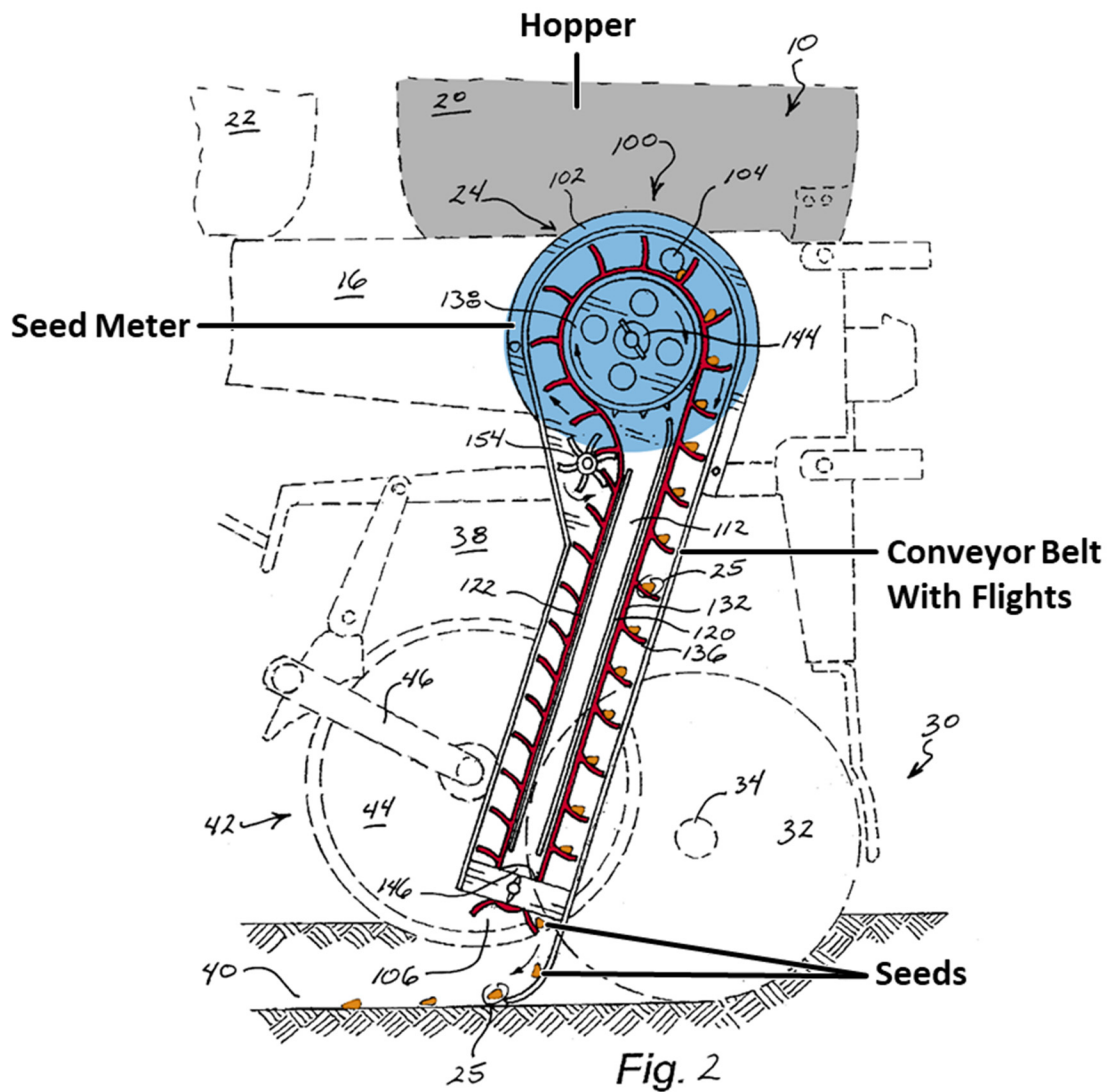
D. Background Technology

35. The '663 patent concerns seeding machines called “planters” that farmers used to plant seeds in a field. Ex. 1001, 1:19-21 (“An agricultural seeding machine such as a row crop planter or grain drill places seeds at a desired depth within a plurality of parallel seed trenches formed in soil.”). As shown below, in a typical configuration the planter is attached to a tractor that pulls the planter across the field. The planter includes a main hopper and multiple “row units,” each of which takes seeds from the main hopper, places seeds in an auxiliary hopper, and then delivers seeds to the ground. *Id.*, 1:24-27 (“Each row crop unit has a frame which is movably coupled with a tool bar. The frame may carry a main seed hopper, herbicide hopper and insecticide hopper.”), 3:16-17 (“Seed is stored in seed hopper 24 and provided to a seed meter 26”). A representative seed planter is shown below:



Each row unit digs a trench, or “furrow,” in the ground, deposits seeds in the furrow, and covers the seeds with soil. *Id.*, 3:19-23 (“From the seed meter 26 the seed is carried by a delivery system 28 into a planting furrow, or trench, formed in the soil by furrow openers 30.”). The ’663 patent recognizes that this type of planter row-unit configuration was already known before 2009. *Id.*, 1:19-33 (“An agricultural seeding machine such as a row crop planter or grain drill places seeds at a desired depth within a plurality of parallel seed trenches formed in soil....”), 3:4-33 (“From the seed meter 26 the seed is carried by a delivery system 28 into a planting furrow, or trench, formed in the soil by furrow openers 30. Gauge wheels 32 control the depth of the furrow. Closing wheels 34 close the furrow over the seed....”).

36. Figure 2 of U.S. Patent No. 6,681,706 (“Sauder”) (Ex. 1007), which issued in 2004,² shows an example of a previously-known row unit:



² The background section of the '663 patent discusses Sauder. Ex. 1001, 2:5-14.

Ex. 1007-Sauder, Fig. 2.³ The row unit shown includes a seed hopper (gray), a seed meter (blue), and a conveyor belt with flights (red) within a housing. *Id.*, 4:36-42 (“As is conventional, each row unit 14 includes a seed hopper 20 and a fertilizer hopper 22 mounted on the row unit frame 16. Each row unit 14 has a seed selection and dispensing device 24, commonly referred to as a seed meter, which receives seed from the seed hopper 20 and discharges the seeds 25 into a seed tube 26 at regular intervals.”), 5:53-63 (“Referring now to drawing FIG. 2, the typical agricultural planter 10 of FIG. 1, is shown with the prior art seed tube 26 and seed belt housing 60 replaced by one embodiment of the seed delivery apparatus 100 of the present invention. As is apparent, the embodiment of the seed delivery apparatus 100 shown in FIGS. 2 and 3 is similar to the commercially available flighted seed belt housing 60 shown in FIG. 1, except that the flighted seed belt assembly has been elongated and modified for delivering seeds, individually in sequence and at a controlled conveyor speed, from the seed meter 24 all the way to the open furrow 40.”), 6:39-43 (“In the embodiment of FIGS. 2 and 3, the seed conveyor comprises an endless belt 132. A series of uniformly spaced apart apertures 134 are formed through the belt 132. A

³ Unless otherwise stated, all color annotations have been added.

series of flights 136 extend outwardly from the belt 132, spaced apart from one another, by substantially the same distance.”), 7:32-43 (“As perhaps best seen from FIG. 3, the flights 136 and the belt 132 have a width substantially equal to but less than the width of the housing wall 114. Accordingly, although the flighted belt 132 moves freely within the housing 108, the space between each panel 110, 112 and the flighted belt 132 is sufficiently narrow to prevent the escape of any seed from its compartment, until the intended point of release where movement of the belt 132 around the idler pulley 146 draws each flight 136 away from the housing wall 114. Each seed, during its descent beyond the point of release, preferably encounters the seed guide 124 and is thereby gently directed to the bottom of the furrow 40.”). In operation, the seed meter retrieves individual seeds (orange) from the hopper, the meter sequentially supplies them to compartments formed by the flights of the belt in cooperation with the housing, and the flighted belt rotates clockwise to deliver the seeds to the furrow in the ground. *Id.*

37. By 2009 (the earliest claimed priority date of the ’663 patent), as demonstrated by the Sauder reference among others, planter technology was well developed. First, it was well-known that in order for a farmer to maximize the number of healthy plants per acre, the farmer would need to achieve a uniform

distribution of seeds. Ex. 1007-Sauder, 1:11-15 (“It is well recognized that uniformity in the spacing of seeds in a seed furrow is essential for maximizing a field’s crop yield and thus enhancing the profitability of the farmer's operation.”). The implements and methods used to reach such uniform distribution were similarly well-known.

38. Second, seed meters used to retrieve individual seeds from hoppers were well-known. Established types of seed meters included, for instance, finger-pickup meters, brush meters, and vacuum meters. *See, e.g.*, Ex. 1007-Sauder, 1:23-29 (“The commercially available mechanical meters include finger-pickup meters such as disclosed in U.S. Pat. No. 3,552,601, cavity-disk meters such as disclosed in U.S. Pat. No. 4,613,056, and belt meters such as disclosed in U.S. Pat. No. 5,992,338. Commercially available pneumatic meters include vacuum-type meters such as disclosed in U.S. Pat. No. 5,501,366, and compressed air meters.”); U.K. Patent App. No. GB 2,012,534A (“Curtis”) (Ex. 1008), 1:127-129 (The seed selector may be one of several types, that own [sic] for example in figure 1 is a vacuum operated drum selector[.]”); U.S. Patent No. 6,651,570 (“Thiemke”) (Ex. 1015), 1:32-34 (“Different types of seed metering systems may be used such as seed plates, finger plates, and seed discs.”); U.S. Patent No. 6,352,042 (“Martin”) (Ex. 1017), 1:21-23 (“Mechanical

seed meters used on row crop planters include seed plate meters, finger pickup meters, and ‘brush meters.’”).

39. Third, various systems for delivering the seeds from the seed meter to the ground were well-known. These included, for example, systems with gravity-based tubes, flighted conveyor belts, belts with cups that transported seeds, and belts or wheels with brush bristles. *See, e.g.*, Ex. 1015-Thiemke, 1:52-63 (disclosing a “seed tube” through which seeds “fall via gravitational force” with “rearward curvature” to “assist in directing the seed into the seed trench”); Ex. 1007-Sauder, 2:38-48 (disclosing a “belt [with] a plurality of evenly spaced-apart flights” that each “provide a seed compartment” for transporting seeds to the furrow); U.K. Published Application No. 2,057,835 (“Hedderwick”) (Ex. 1003), 4:23-28 (disclosing “an endless belt” with “a series of fins” that define “a series of moving cells, each of which carries a seed”); U.S. Patent No. 6,244,201 (“Mauch”) (Ex. 1016), 3:42-49 (disclosing a “plurality of cups attached to a belt or chain for delivering individual seeds to a crop row or furrow”); Ex. 1004-Koning, 3:12-17 (disclosing “a driven belt with brush hairs” which holds seeds “till the moment they leave the belt”); Ex. 1015-Thiemke, 2:36-45, 2:52-53 (disclosing a “seed placement system” with a “wheel”

having a “gripping outside layer” of brush bristles that “regulate[] the seeds in a positive manner”).

40. Fourth, mechanisms for reliably removing seeds from seed meters so that the seeds can be effectively delivered to the ground were similarly well-known. *See, e.g.,* Ex. 1017-Martin, 1:61-66 (disclosing a “seed knockout assembly compris[ing] a rotatable sprocket wheel” that “driv[es]” seeds from a seed meter into a seed tube); U.S. Patent No. 4,026,437 (“Biddle”) (Ex. 1018), 2:25-29 (disclosing “wheels” that “act[] as a separating device” that “permits” seeds “to be extracted” from a seed meter and “fed into transport passages” delivering the seeds to the furrow); French Published Application No. 2,414,288 (“Benac”) (Ex. 1005), 4:13-15 (disclosing a “paddle wheel” that “transport[s], one by one, the seeds” adhered to a vacuum disk).⁴

41. Fifth, it was widely known that brushes could be used in planters to control the movement of seeds. As one example, brush belts or brush wheels for delivering seeds from seed meters to the ground were well-known, as discussed above. *See, e.g.,* Ex. 1004-Koning, 3:12-17 (disclosing “a driven belt with brush hairs” which

⁴ All citations to Benac are to the certified English translation of the reference (Ex. 1005). Ex. 1006 is the original French version of Benac.

conveys seeds “till the moment they leave the belt”); Ex. 1015-Thiemke, 2:52-58 (disclosing a system with “bristles at the circumferential periphery of the wheel [that] positively engage the seeds” until the seeds are released from the wheel into the soil furrow); U.S. Patent No. 1,376,933 (“Gould”) (Ex. 1030), 1:79-82 (“This brush belt travels vertically downward toward a core and cooperates with a second brush belt 12 to move the plant from the hopper[.]”).

42. Planters could be configured with any number of combinations of these known components. For example, Sauder taught that systems with flighted belts were compatible with various metering systems. Ex. 1007-Sauder, 7:51-57 (“It should be understood that although reference has been made herein to the type of planter disclosed in U.S. Pat. No. 4,009,668, and to a finger-pickup type seed meter, the flighted belt type embodiment of the seed delivery apparatus 100 of the present invention may be used with any type of planter having any type of mechanical or pneumatic seed metering device disposed a distance above the soil surface.”). It was clear to a person of ordinary skill in the art by 2009 that various seed delivery concepts and mechanisms could be combined into different configurations depending on the needs of a particular application.

E. The Alleged Problem in the Art

43. According to the '663 patent, prior art seeding systems did not space seeds with sufficient accuracy and uniformity because such systems, again according to the '663 patent, did not sufficiently control the seeds during delivery to the furrow. Ex. 1001, 1:50-2:19. The patent states that prior art systems that allowed seeds to fall by gravity resulted in inaccurate seed spacing because the seeds bounced and ricocheted on the way to the ground. *Id.*, 1:50-51 (“The most common seed delivery system may be categorized as a gravity drop system.”), 1:60-65 (“Undesirable variation in resultant in-ground seed spacing can be attributed to differences in how individual seeds exit the metering system and drop through the seed tube. The spacing variation is exacerbated by higher travel speeds through the field which amplifies the dynamic field conditions.”). The patent itself explains that prior art systems in which there was “a gravity drop,” produced unwanted “variation in seed spacing.” *Id.*, 2:4-19 2:4-20 (“Various attempts have been made to reduce the variation in seed spacing resulting from the gravity drop. U.S. Pat. No. 6,681,706 shows two approaches. One approach uses a belt with flights to transport the seeds from the meter to the ground while the other approach uses two belts to grip the seed and transport it from the meter to the ground. While these approaches control the seed path and reduce variability due

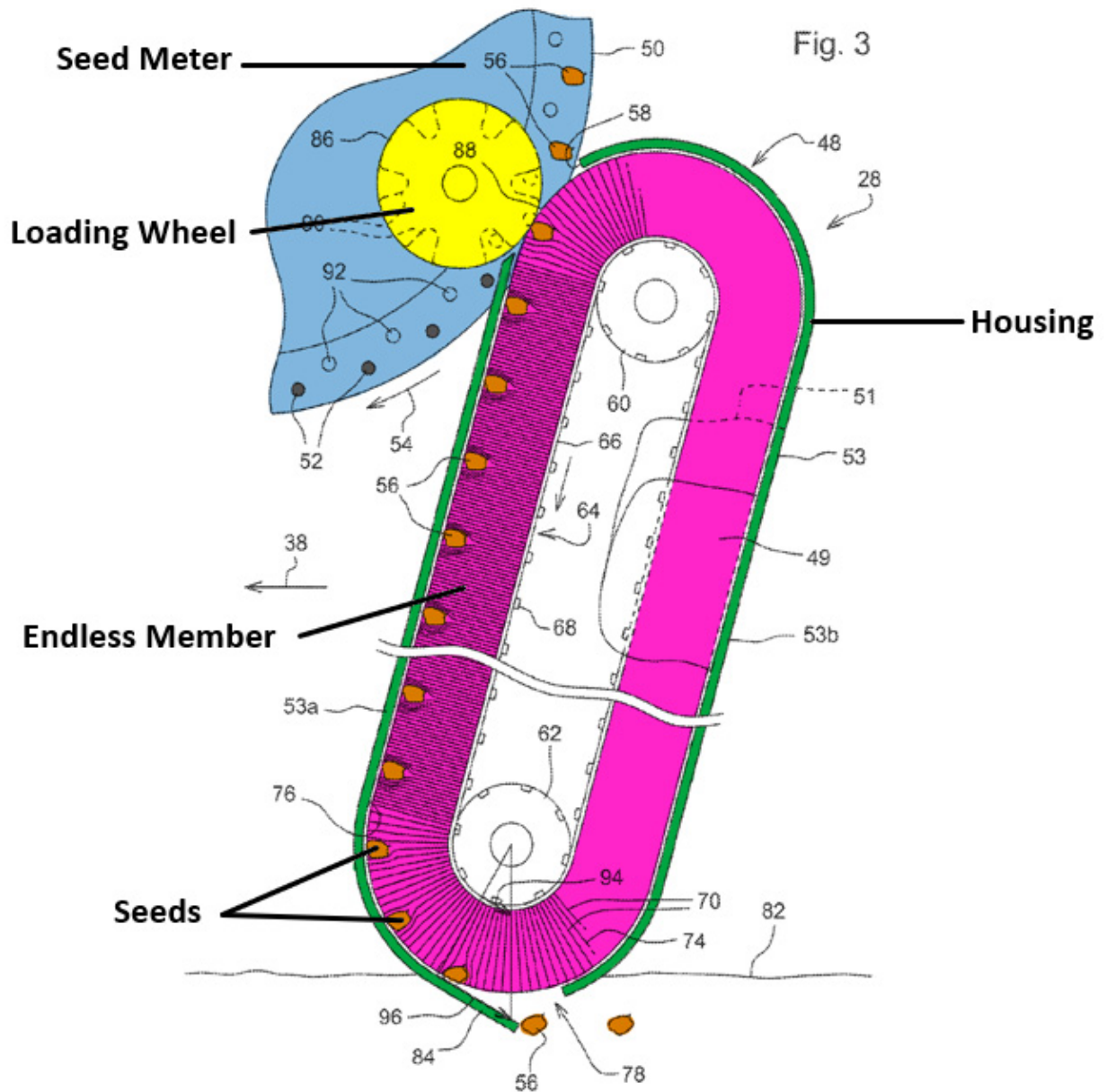
to dynamic events, neither approach seeks to deliver the seed with as small as possible horizontal velocity difference relative to the ground. U.S. Pat. Nos. 6,651,570, 7,185,596 and 7,343,868 show a seed delivery system using a brush wheel near the ground to regulate the horizontal velocity and direction of the seed as it exits the seeding machine. However, there is still a gravity drop between the seed meter and the brush wheel which produces variation in seed spacing.”).

F. The Alleged Invention

44. To address the problem it claims to have identified, the ’663 patent describes the idea of using a “loading wheel” that “engag[es] seeds adhered to the metering disk” and “guid[es] the seed into [a] single endless member,” where the “endless member ... mov[es] the seed” to a point where it is discharged from the planter into the furrow. Ex. 1001, 2:23-24 (“The present invention provides a seed delivery system that removes the seed from the seed meter by capturing the seed.”), 7:53-57 (claiming “a loading wheel engaging seeds adhered to the metering disk and moving along the seed path and guiding the seed into the single endless member whereby the single endless member moves the seed to the lower opening”), 8:24-26 (claiming “a loading wheel adjacent the housing upper opening engaging seeds adhered to the metering disk and moving along the seed path.”), 8:48-50 (claiming “a

loading wheel adjacent the housing upper opening engaging seeds adhered to the metering disk and moving along the seed path”).

45. Figure 3 shows the row unit described in the '663 patent:



Ex. 1001, Fig. 3. As shown, the row unit includes, among other components, a vacuum seed meter with a rotating metering disk (blue) that carries individual seeds (orange) on the apertures of the disk to a seed delivery system. *Id.*, 3:38-41 (“Seeds 56 are collected on the apertures from a seed pool and adhere to the disk by air pressure differential on the opposite sides of the disk 50 in a known manner.”). The ’663 patent acknowledges that seed meters, including vacuum seed meters, were well-known in the prior art. *Id.*, 3:17-18 (“Seed meter 22 is of the type that uses a vacuum disk as are well known to meter the seed.”).

46. Figure 3 also shows that each row unit includes, among other components, a “seed delivery system” with an “endless member,” depicted as a brush belt with bristles (pink), that controls the descent of the seeds by capturing the seeds in the bristles as they are delivered to the ground. Ex. 1001, 2:32-35 (“[T]he seed experiences a controlled descent from the point at which it is removed from the meter to a point very near the bottom of the trench[.]”), 5:8-11 (“From the seed meter to the discharge, the seed travel is controlled by the delivery system, thus maintaining the seed spacing relative to one another.”). The patent describes the endless member as a brush belt with bristles, or belt with other materials, that grip the seed. *Id.*, 7:25-31 (“The endless member of the delivery system has been described as being a brush belt

with bristles. In a broad sense, the bristles form an outer periphery of contiguous disjoint surfaces that engage and grip the seed. While brush bristles are the preferred embodiment, and may be natural or synthetic, other material types can be used to grip the seed such as a foam pad, expanded foam pad, mesh pad or fiber pad.”). The patent also explains that the endless member grips the seeds and controls their descent to the furrow. *Id.*, 4:20-27 (“The seeds are captured or entrapped in the bristles by insertion of the seed into the bristles in a radial direction, that is from the ends of the bristles in a direction parallel to the bristle length. This occurs just as the belt path around the pulley 60 ends, when the bristle ends are closing back together upon themselves, allowing the bristles to close upon, and capture the seeds therein.”).

47. The patent explains that pulleys rotate the endless member, which is enclosed within a housing and, together, these components maintain control of the seeds as they are transported from the seed meter to the furrow. Ex. 1001, 3:46-57 (“The seed delivery system housing 48 has spaced apart front and rear walls 49 and 51 and a side wall 53 therebetween. An upper opening 58 in the housing side wall 53 admits the seed from the metering disk 50 into the housing. A pair of pulleys 60, 62 are mounted inside the housing 48. The pulleys support a belt 64 for rotation within the housing. One of the pulleys is a drive pulley while the other is an idler pulley. The

belt has a base member 66 to engage the pulleys and elongated bristles 70 extending therefrom. The bristles are joined to the base member at proximal, or radially inner, ends of the bristles. Distal, or radially outer, ends 74 of the bristles touch, or are close to touching, the inner surface 76 of the housing side wall 53.”). The housing has a first upper opening and a second lower opening. *Id.*, 3:47-62 (“An upper opening 58 in the housing side wall 53 admits the seed from the metering disk 50 into the housing. A pair of pulleys 60, 62 are mounted inside the housing 48. The pulleys support a belt 64 for rotation within the housing. One of the pulleys is a drive pulley while the other is an idler pulley. The belt has a base member 66 to engage the pulleys and elongated bristles 70 extending therefrom. The bristles are joined to the base member at proximal, or radially inner, ends of the bristles. Distal, or radially outer, ends 74 of the bristles touch, or are close to touching, the inner surface 76 of the housing side wall 53. A lower housing opening 78 is formed in the side wall 53 and is positioned as close to the bottom 80 of the seed trench as possible. As shown, the lower opening 78 is near or below the soil surface 82 adjacent the trench. The housing side wall forms an exit ramp 84 at the lower opening 78.”). The endless member first receives seeds through the housing’s upper opening, holds the seeds as it carries them to the housing’s the lower opening, and then discharges them to the ground through

that opening. *Id.*, 4:18-28 (“There the seeds are pinched off the seed disk between the loading wheel and the bristles 70 to remove the seed from the seed disk and seed meter. The seeds are captured or entrapped in the bristles by insertion of the seed into the bristles in a radial direction, that is from the ends of the bristles in a direction parallel to the bristle length. This occurs just as the belt path around the pulley 60 ends, when the bristle ends are closing back together upon themselves, allowing the bristles to close upon, and capture the seeds therein. As the belt continues to move, the bristles move or convey the seeds downward to the housing lower opening.”).

48. The patent also explains that each row unit includes a “loading wheel” (yellow in the figure above) that transfers the seed from the seed meter to the endless member. Ex. 1001, 3:63-4:1 (“Returning attention to the upper portion of FIG. 3, a loading wheel 86 is provided adjacent the upper opening 58. The loading wheel is positioned on the opposite side of the seeds 56 from the brush 64 such that the path of the seeds on the disk brings the seeds into a nip 88 formed between the loading wheel and the distal ends 74 of the bristles 70.”). When the seed meter rotates, it carries the seeds to the loading wheel. *Id.*, 3:64-4:1 (“The loading wheel is positioned on the opposite side of the seeds 56 from the brush 64 such that the path of the seeds on the disk brings the seeds into a nip 88 formed between the loading wheel and the distal

ends 74 of the bristles 70.”). The loading wheel then engages seeds on the metering disk and moves them into the housing. *Id.*, Abstract (The loading wheel “engages seed on a metering disk to move seed into the housing.”). As the loading wheel removes the seed from the metering disk, the seeds are “captured or entrapped in the bristles” of the brush belt. *Id.*, 4:20-23. The patent explains that this is the case because the loading wheel is positioned “adjacent the upper opening” of the housing and “on the opposite side of the seeds from the brush.” *Id.*, 3:63-64. Once a seed is captured, the brush belt operates to move the seed downward until it is discharged to the ground. *Id.*, 4:27-28 (“As the belt continues to move, the bristles move or convey the seeds downward to the housing lower opening.”), 4:36-38 (“The seeds are then propelled by the bristles over the ramp 84 and discharged through the lower opening 78 into the seed trench.”).

49. The patent explains that the purported invention does not allow gravity to impact the movement of the seeds as they are conveyed to ground—for example by the bouncing of the row unit as it is being pulled through the field. Ex. 1001, 2:4-19 (“Various attempts have been made to reduce the variation in seed spacing resulting from the gravity drop. U.S. Pat. No. 6,681,706 shows two approaches. One approach uses a belt with flights to transport the seeds from the meter to the ground while the

other approach uses two belts to grip the seed and transport it from the meter to the ground. While these approaches control the seed path and reduce variability due to dynamic events, neither approach seeks to deliver the seed with as small as possible horizontal velocity difference relative to the ground. U.S. Pat. Nos. 6,651,570, 7,185,596 and 7,343,868 show a seed delivery system using a brush wheel near the ground to regulate the horizontal velocity and direction of the seed as it exits the seeding machine. However, there is still a gravity drop between the seed meter and the brush wheel which produces variation in seed spacing.”). The patent asserts that its invention, instead, controls the seed from the seed meter to the point of discharge. *Id.*, 4:16-27 (“The seeds are transferred from the seed meter to the delivery system as the seeds are brought by the disk into the nip 88. There the seeds are pinched off the seed disk between the loading wheel and the bristles 70 to remove the seed from the seed disk and seed meter. The seeds are captured or entrapped in the bristles by insertion of the seed into the bristles in a radial direction, that is from the ends of the bristles in a direction parallel to the bristle length. This occurs just as the belt path around the pulley 60 ends, when the bristle ends are closing back together upon themselves, allowing the bristles to close upon, and capture the seeds therein.”), 5:4-11 (“From the

seed meter to the discharge, the seed travel is controlled by the delivery system, thus maintaining the seed spacing relative to one another.”).

G. The Claims

50. The '663 patent has 8 claims. Claims 1, 4, and 6 are independent claims. Claims 2-3, 5, and 7-8 are dependent claims.

51. Independent claim 1 is shown below:

A seeding machine, comprising:

- a seed meter having a metering disk with a plurality of apertures in a circular array adapted to adhere seeds to the metering disk to move the seeds along a seed path as the metering disk rotates;
- a seed delivery system associated with said seed meter, said seed delivery system including:
 - a housing for seed from said metering disk, the housing having a lower opening through which seed is discharged;
 - a single endless member within said housing disposed around a first drive pulley and a second idler pulley, said endless member engaging seed from the seed meter and moving the seed to said lower opening where seed is discharged from said housing; and
 - a loading wheel engaging seeds adhered to the metering disk and moving along the seed path and guiding the seed into the single endless member whereby the single endless member moves the seed to the lower opening.

VII. OVERVIEW OF THE PRIOR ART

52. All features of the '663 system—and in particular the loading wheel and the endless member that controls movement of the seeds—were disclosed and well-known decades before February 2, 2009.

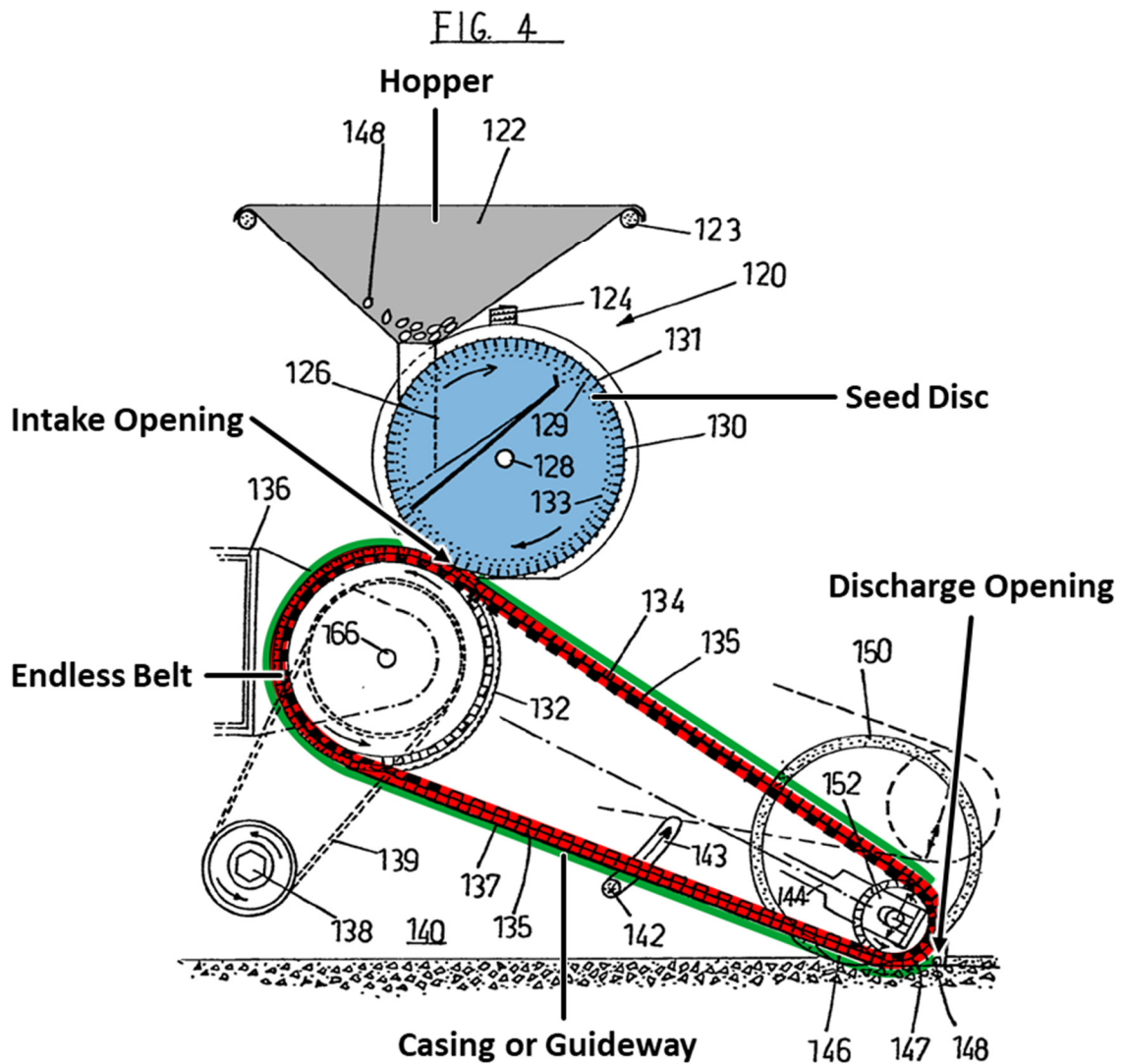
A. Hedderwick (Ex. 1003-Hedderwick)

53. The Hedderwick patent was published on April 8, 1981. Ex. 1003-Hedderwick, Cover. I understand that it is therefore prior art under 35 U.S.C. § 102(b). Hedderwick describes a “precision seeder” for planting seeds. *Id.*, Title (“Precision seeder”), 1:5-10 (“This invention relates to a precision seeder. The expression ‘precision seeder’ as used herein relates to a seeding device able to deposit single seeds at predetermined spacings in seed beds but also includes the capability of planting seeds at predetermined spacings in unprepared soil.”).

54. Hedderwick recognized the importance of planting seeds with uniform spacing, decades before the '663 patent did the same. Ex. 1003-Hedderwick, 1:11-21 (“It will be appreciated that if seeds are planted as doubles or triples the two seedlings from such a planting will tend to kill off one another. If the seedlings are too close together then they also tend to choke off one another and if they are too far apart then the economy of the nursery is adversely affected as more space than is essential would

be used.”). To tackle this problem, Hedderwick describes “[a] precision seeder for depositing single seeds at predetermined spacings in seed beds or unprepared soil.” *Id.*, Abstract, 1:5-10 (“This invention relates to a precision seeder. The expression ‘precision seeder’ as used herein relates to a seeding device able to deposit single seeds at predetermined spacings in seed beds but also includes the capability of planting seeds at predetermined spacings in unprepared soil.”), 1:22-24 (“It is an object of this invention to go some way towards overcoming the aforementioned disadvantages and to achieve the aforementioned desiderata.”).

55. In an effort to achieve this, Hedderwick provides a vacuum seed meter and an endless belt enclosed in a housing (called a “casing” or “guideway”), as shown in Figure 4, which has been annotated to show the case described in the text of Hedderwick:



Ex. 1003-Hedderwick, Fig. 4, 1:79-90 (“[S]aid seed depositing means comprises an endless belt, said belt having fins projecting outwardly, said belt and fins positioned to travel in a guideway, the guideway defining with said fins and endless belt a series of moving cells, said guideway having an intake opening, said vacuum release means

associated with said disc being disposed so as to disengage seeds into said intake opening, and a discharge opening slightly above bottom dead centre of the bottom pulley over which said endless belt rides whereby each seed rests against a fin at the moment of discharge”), 1:69-76 (“said belt and fins positioned to travel in a guideway the guideway defining with said fins and endless belt a series of moving cells, said guideway having an intake opening in registry with said opening in the circumferential face of said chamber and second discharge point slightly above bottom dead centre of the bottom pulley over which said endless belt rides whereby each seed rests against a fin at the moment of discharge.”), 5:53-56, 6:38-59. In Hedderwick, a seed disc (blue) receives seeds from a seed hopper (gray), and then picks up individual seeds and adheres them to the disc via vacuum pressure. *Id.*, 5:49-60 (“Disc 130 rotates in a clockwise direction in the embodiment shown in figure 4. Seeds 148 are picked up singly in orifices 129 [of the disc] and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137. The seed releasing means of disc 130 which is the same as that of the other embodiment of the invention releases single seeds through orifice 141 into a single cell formed by a pair of fins 135, the casing 137 and the belt 134.”), 1:32-35 (describing “vacuum release means co-operable in use with each said orifice [of the

seed disc] to release said vacuum at a predetermined release point to thereby sequentially disengage each said retained seed”), 3:49-52 (“[S]ingle seeds 98[] are received and retained in orifices 94 through the pressure differential which is provided by having a vacuum on one side and an air inlet on the other.”).

56. Hedderwick explains that the seed disc rotates to a position where it “mates with” an opening (the “intake opening” or “orifice” (shown above)) in the housing (the “casing” or “guideway” (shown in green above)) that encloses an “endless belt” (shown in red above). Ex. 1003-Hedderwick, 5:51-56 (“Disc 130 rotates in a clockwise direction in the embodiment shown in figure 4. Seeds 148 are picked up singly in orifices 129 [of the disc 130] and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137.”). From here, the seeds are transferred from the seed disc to the endless belt through the opening in the casing. *Id.*, 5:56-60 (“The seed releasing means of disc 130 which is the same as that of the other embodiment of the invention releases single seeds through orifice 141 into a single cell formed by a pair of fins 135, the casing 137 and the belt 134.”). More precisely, the seeds are deposited into a “cell” formed by the endless belt, and its fins (which project outwardly from the endless belt), and the casing surrounding the endless belt. *Id.*, 4:23-28 (“The major change in the seeder is

the provision of an endless belt 134 which has a series of fins 135 projecting upwardly therefrom. This belt rides in a casing or guideway 137 and there is a define [sic] between the belt, the fins and the casing a series of moving cells, each of which carries a seed.”), 5:56-60 (“The seed releasing means of disc 130 which is the same as that of the other embodiment of the invention releases single seeds through orifice 141 into a single cell formed by a pair of fins 135, the casing 137 and the belt 134.”). The cells formed by the endless belt then transport the seeds to a lower opening in the casing where they are discharged to the ground. *Id.*, 4:23-28 (“[The] endless belt 134 which has a series of fins 135 projecting upwardly therefrom. This belt rides in a casing or guideway 137 and there is a define between the belt, the fins and the casing a series of moving cells, each of which carries a seed.”), 5:72-81 (“Seeds 148 in the cells then proceed down the bottom run of the chain [of the endless belt] to a position behind plough 146 where the casing starts to travel upwardly again.”), 1:79-90 (“[S]aid guideway [(casing 137)] having an intake opening, said vacuum release means associated with said disc [(disc 70)] being disposed so as to disengage seeds into said intake opening, and a discharge opening slightly above bottom dead centre of the bottom pulley over which said endless belt rides whereby each seed rests against a fin at the moment of discharge.”), 6:55-59 (describing “a discharge opening slightly

above bottom dead centre of the bottom pulley over which said endless belt rides whereby each seed rests against a fin at the moment of discharge”), 6:67-72.

B. Benac (Ex. 1005-Benac)

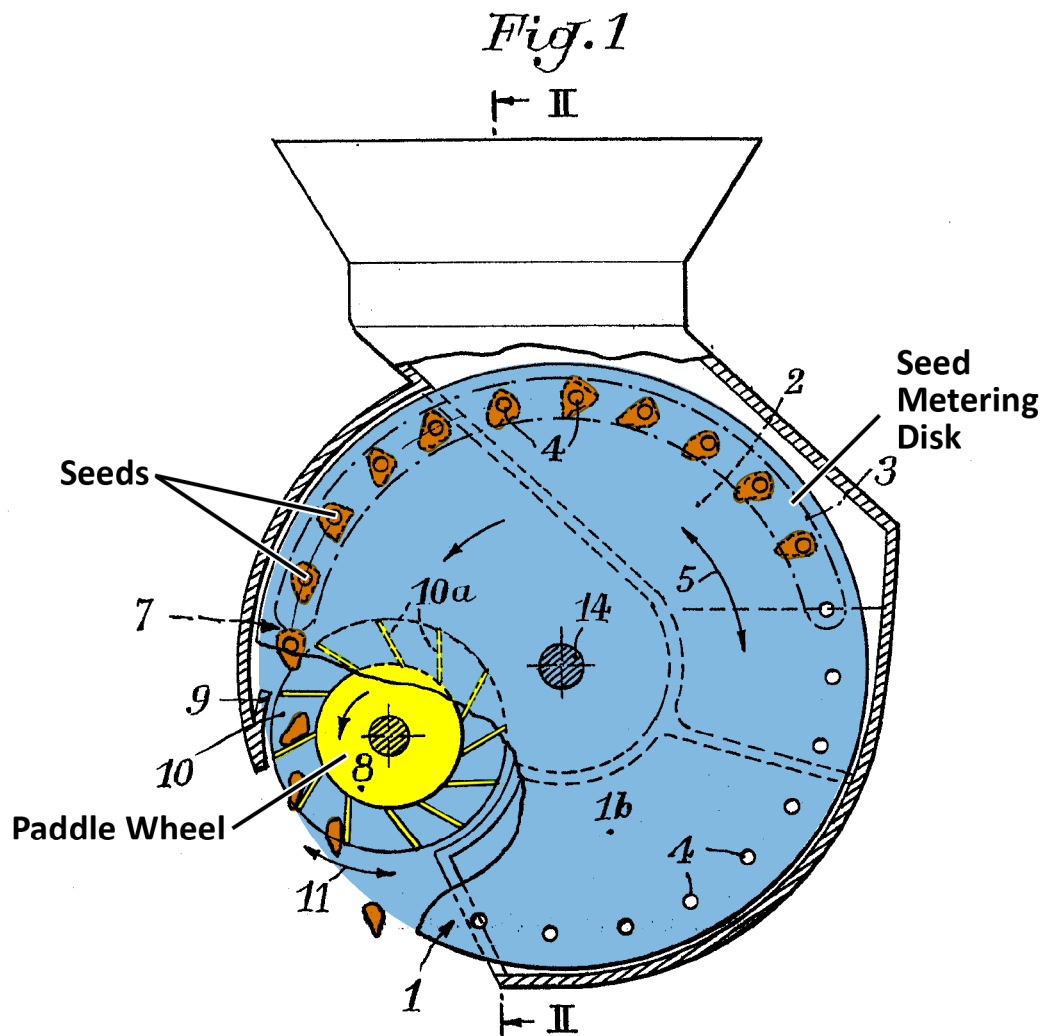
57. Benac was filed on January 16, 1978 and published on August 10, 1979. Ex. 1005-Benac, Cover. I understand that it is therefore prior art under 35 U.S.C. § 102(b). Just like the '663 patent, Benac describes a seed meter that includes a “paddle wheel” that sits on the seed metering disk and rotates in the same direction as the disk. *Id.*, 2:18-23 (“[I]t is very commonplace for the seeds to be retained simply by jamming on the suction orifices such that, if no means, and in particular the paddles of the paddle wheel, are provided to sweep the suction orifices, the detaching of the seeds remains random, which is obviously detrimental to the accuracy of the seeding.”), 4:6-9 (“A paddle wheel 8 is adjacent to the first face 1a of the disk and determines, with this face 1a and with a casing 9 that is adjacent and concentric to the paddle wheel, sealed cells 10 for the seeds.”). The paddle wheel engages seeds adhered to the metering disk and removes seeds from the apertures so they can be delivered to the furrow with increased accuracy. *Id.*, 5:4-8 (“In these conditions, the paddles 10a of the paddle wheel 8 sweep the orifices 4 of the disk between the release

zone 7 and the dropping zone 11, such that the seeds are necessarily extracted from the orifices 4 upstream of the dropping zone.”).

58. Benac recognizes the need to accurately plant seeds with uniform spacing, as both the '663 patent and the Hedderwick patent do. Ex. 1005-Benac, 2:8-12 (“[O]btaining great accuracy in the seeding involves the use of means guaranteeing that all the seeds are dropped at the same point of the seed spreader, at the same speed and in the same direction.”). Benac explains that prior art seeding systems could not plant seeds uniformly because seeds often became stuck in the apertures (called “orifices”) of the seed meter. This prevented the seed meter from dispensing the seeds at a constant rate. *Id.*, 2:17-23 (“[I]t is very commonplace for the seeds to be retained simply by jamming on the suction orifices [of the seed meter] such that, if no means, and in particular the paddles of the paddle wheel, are provided to sweep the suction orifices, the detaching of the seeds remains random, which is obviously detrimental to the accuracy of the seeding.”).

59. Just like the '663 patent, to overcome this obstacle, Benac provides a system with a seed meter (blue in Figure 1 below) and a “paddle wheel” (yellow) that engages and removes seeds (orange) adhered to the seed metering disk. Ex. 1005-Benac, 5:4-8 (“In these conditions, the paddles 10a of the paddle wheel 8 sweep the

orifices 4 of the disk between the release zone 7 and the dropping zone 11, such that the seeds are necessarily extracted from the orifices 4 upstream of the dropping zone.”).



Id., Fig. 1. The seed meter includes apertures (or “orifices”) in its periphery. *Id.*, 3:15-22 (“The disk is pierced with orifices 4 evenly distributed over a circle concentric to the disk.”). A vacuum is applied to one side of the apertures in the disk so that seeds located in a seed chamber are adhered to the other side of the apertures. *Id.*, 3:24-31 (“[A] first face 1a of the disk is directly in contact with the seeds whereas the second face 1b of the disk is subject to the suction of the vacuum chamber 3. Since the vacuum reaches, through the orifices 4, the seed chamber in the picking zone, the seeds are sucked onto these orifices and driven with the disk.”). With the seeds adhered to the orifices, the disk rotates to carry the seeds to a “release zone 7” where the vacuum is no longer applied, and the seeds may be released from the disk. *Id.*, 3:30-31 (“[T]he seeds are sucked onto the[] orifices [of the disk] and driven with the disk.”), 4:1-4 (“In a zone of releasing of the seeds 7, the seeds cease to be sucked onto the orifices 4, this zone 7 corresponding for example to the point of extreme angular extension of the vacuum chamber 3.”).

60. To ensure that the seeds are reliably removed from the apertures at the release position, and can be accurately delivered to the soil, Benac’s system includes a paddle wheel (yellow above) that engages seeds adhered to the disk and removes them from the apertures. Ex. 1005-Benac, 5:4-8 (“[T]he paddles 10a of the paddle wheel 8

sweep the orifices 4 of the disk between the release zone 7 and the dropping zone 11, such that the seeds are necessarily extracted from the orifices 4 upstream of the dropping zone.”), 1:17-23 (describing “cells each intended to transport a seed between the seed release zone and the dropping zone”).

61. Benac states that its paddle wheel had been known “for a long time” even when Benac was filed in 1978. Ex. 1005-Benac, 1:24-27 (“Moreover, the use of a paddle wheel in the seed spreaders, both mechanical and pneumatic, has been known for a long time for the production of a mechanical dispenser allowing a more even spreading.”).

C. Koning (Ex. 1004-Koning)

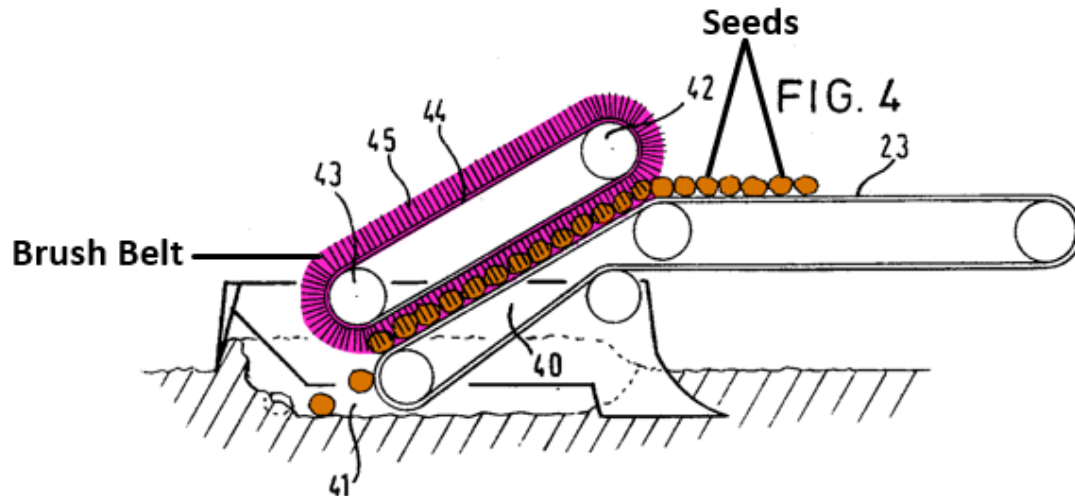
62. Finally, Koning was issued on March 18, 1980. Ex. 1004-Koning, Cover. I understand that it is therefore prior art under 35 U.S.C. § 102(b). Koning describes a “planting machine for potatoes, bulbs or similar seed crop” with “a driven belt with brush hairs” that “hold” the seeds “till the moment that they leave belt” and are delivered to the furrow. *Id.*, 1:5-6, 3:12-23.

63. Koning recognizes the need for uniform seed distribution, just as the ’663 patent does. Ex. 1004-Koning, 1:9-13 (“The invention has for its object to provide a planting machine of the kind set forth, which ensures a particularly uniform

distribution of the seed potatoes or the like, even if the seed potatoes have different sizes and if the shape of the seed crop is irregular.”), Title (“Planting Machine for Potatoes, Bulbs, or Similar Seed Crop”). Koning states that its planter can be used to plant potatoes, bulbs, or other types of “seed crop.” *Id.*, 1:5-13 (“The invention relates to a planting machine for potatoes, bulbs or similar seed crop....”). “Seed crop” is grown from seed and then itself used as seed. For example, corn seed can be used to grow corn and a kernel of corn can in turn be used to grow new corn. A person of ordinary skill in the art would have known (and would still know today) that systems used to plant seed crop can be used to plant seed. For example, I have used systems that were used to wheat, soybean, or sorghum to design systems used to plant corn. It is also common for farmers to plant both potatoes and other types of seed, such as corn or soybeans. As a result, a person of ordinary skill in the art would be familiar with systems used to plant many different types of seeds and crops and would understand that the teachings of Koning’s system could be applied to systems used to plant many different types of seeds.

64. Just like the ’663 patent, Koning addresses this problem by controlling movement of the seeds with a brush belt with bristles as they are conveyed to the

ground. The brush belt with bristles (pink)—shown in Figure 4 below—“hold[s]” the individual seeds (orange) and controls their movement all the way to the furrow.



Ex. 1004-Koning, Fig. 4, 3:12-22 (“According to the invention the conveying members can extend to a point just over the furrow and above the conveying surface of the conveying members can be provided a driven belt with brush hairs or the like, such that the brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt. In such an embodiment the potatoes or the like are held till the very last moment and the velocity of the potatoes in relation to each other is completely defined. Under all circumstances a regular distribution of the potatoes in the furrow is obtained.”), 5:8-14 (“The brush hairs 45 hold the potatoes lying on the conveying members 23 during the time they are lying on the extended

part 40 of the conveying members. This has the effect, that one is sure that the potatoes delivered by the conveying members are lying on the same distance in relation to each other in the furrow 41.”).

VIII. MOTIVATION TO COMBINE HEDDERWICK, BENAC, AND KONING

65. A person of ordinary skill in the art would have been motivated to combine the system and concepts of Hedderwick (a precision seeder with a vacuum seed meter and an endless belt for delivering seeds) with Benac’s loading wheel (for reliably releasing seeds from a vacuum seed meter) and Koning’s brush belt with bristles (for gripping the seeds and controlling their movement from the seed meter to the ground) to obtain the system claimed in the ’663 patent.

66. Each of the three references is in the field of agricultural seed planting. Each identifies the same problem in the prior art—irregular seed spacing. And each attempts to solve this problem by increasing control over the movement of seeds. A person of ordinary skill in the art would have been motivated to combine the features of Benac and Koning because the references themselves explain the benefits of using these features to increase control over the movement of seeds in a planter. In particular, Benac points out that adding its loading wheel to a vacuum seed meter provides the benefit of removing any seeds jammed in the vacuum apertures. Ex.

1005-Benac, 2:17-23 (“[I]t is very commonplace for the seeds to be retained simply by jamming on the suction orifices such that, if no means, and in particular the paddles of the paddle wheel, are provided to sweep the suction orifices, the detaching of the seeds remains random, which is obviously detrimental to the accuracy of the seeding.”). Likewise, Koning explains that using a brush belt to deliver seeds provides the benefit of ensuring the regular distribution of seeds by holding seeds while they are delivered “till the very last moment.” Ex. 1004-Koning, 3:12-22 (“According to the invention the conveying members can extend to a point just over the furrow and above the conveying surface of the conveying members can be provided a driven belt with brush hairs or the like, such that the brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt. In such an embodiment the potatoes or the like are held till the very last moment and the velocity of the potatoes in relation to each other is completely defined. Under all circumstances a regular distribution of the potatoes in the furrow is obtained.”).

67. First, a person of ordinary skill in the art would have been motivated to combine the seed planter of Hedderwick with Benac’s loading wheel (“paddle wheel”) to more reliably and accurately transfer seeds from Hedderwick’s vacuum seed meter to Hedderwick’s endless belt with flights. Benac addresses the same problem as

Hedderwick: imprecise seed spacing. Ex. 1005-Benac, 2:8-12 (“[O]btaining great accuracy in the seeding involves the use of means guaranteeing that all the seeds are dropped at the same point of the seed spreader, at the same speed and in the same direction.”); Ex. 1003-Hedderwick, 1:14-21 (“[I]f seeds are planted as doubles or triples the two seedlings from such a planting will tend to kill off one another. If the seedlings are too close together then they also tend to choke off one another and if they are too far apart then the economy of the nursery is adversely affected as more space than is essential would be used.”).

68. Both Benac and Hedderwick incorporate vacuum seed meters that use a differential in air pressure to adhere individual seeds to the apertures of a metering disk. Ex. 1003-Hedderwick, 1:32-35 (describing “vacuum release means” to “sequentially disengage each said retained seed”); Ex. 1005-Benac, 3:15-19 (“The invention relates to a vacuum seed spreader comprising, as is known, a rotary vertical disk 1 forming a partition between a seed chamber 2 and a vacuum chamber 3, generally of annular form.”). Benac highlights a difficulty that arises with these types of meters: seeds jamming in the apertures and so not reliably releasing from the metering disk. *Id.*, 2:18-20 (“[I]t is very commonplace for the seeds to be retained simply by jamming on the suction orifices” of the disk). Seeds are planted unevenly if

not regularly released from the metering disk. *Id.*, 2:19-23 (“[I]f no means, and in particular the paddles of the paddle wheel, are provided to sweep the suction orifices, the detaching of the seeds remains random, which is obviously detrimental to the accuracy of the seeding.”).

69. As a solution to this problem, Benac explains that its paddle wheel engages seeds adhered to the metering disk and removes them from the metering disk. This ensures reliable seed release, even when the seeds are jammed in the apertures, and improves seeding accuracy. Ex. 1005-Benac, 1:24-27 (“Moreover, the use of a paddle wheel in the seed spreaders, both mechanical and pneumatic, has been known for a long time for the production of a mechanical dispenser allowing a more even spreading.”), 2:12-23 (“[I]t is very commonplace for the seeds to be retained simply by jamming on the suction orifices such that, if no means, and in particular the paddles of the paddle wheel, are provided to sweep the suction orifices, the detaching of the seeds remains random, which is obviously detrimental to the accuracy of the seeding.”), 5:4-8 (“In these conditions, the paddles 10a of the paddle wheel 8 sweep the orifices 4 of the disk between the release zone 7 and the dropping zone 11, such that the seeds are necessarily extracted from the orifices 4 upstream of the dropping zone.”).

70. A person of ordinary skill in the art accordingly would have been motivated to combine Benac's paddle wheel with Hedderwick's vacuum seed meter in order to achieve the identified benefits of greater control over seed movement and greater precision in seed spacing. A person of skill in the art would have known to use the paddle wheel with a vacuum seed meter such as in Hedderwick because, among other things, Benac describes using the paddle wheel with a vacuum meter. Ex. 1005-Benac, 1:1-19 ("The present invention relates to a vacuum seed spreader comprising a rotary vertical disk having, at its periphery, suction orifices of a diameter smaller than that of the seeds and evenly distributed over a circle, this disk being connected, in a picking zone extending beyond its extreme bottom part and short of its extreme top part in the direction of its rotation, on the one hand, by a first of its two faces, with seeds contained in a seed chamber and, on the other hand, by its second face, with a vacuum chamber, this vacuum chamber being extended beyond the picking zone and short of a seed release zone in which the seeds cease to be sucked onto the suction orifices, this seed spreader also comprising a paddle wheel adjacent to the first face of the disk, determining therewith, and in combination with a casing concentric to the paddle wheel and open in a bottom zone of dropping of the seeds to the ground, cells each intended to transport a seed between the seed release zone and

the dropping zone.”). A person of skill in the art would have been motivated to do so in order to achieve Benac’s disclosed benefits of using such a paddle wheel with a vacuum seed meter, including that it reliably removes seeds from the metering disk and ensures better uniform seed spacing as a result.

71. It would have been routine for a person of ordinary skill in the art to modify Hedderwick by adding Benac’s paddle wheel. He or she would have understood how to combine their teachings because each is directed to straightforward mechanical systems, just like the ’663 patent. The disclosed features and concepts would have been readily combined according to known methods to yield predictable results. Such a combination would have been applying a known technique—using a paddle wheel with a vacuum seed meter, as taught by Benac—to a known device—a seeding machine that would benefit from Benac’s paddle wheel—so a person of ordinary skill in the art would expect the combination to be successful.

72. Second, a person of ordinary skill in the art would have been motivated to combine a brush belt, such as the one disclosed in Koning, with the combination of Hedderwick’s seed planter and Benac’s paddle wheel. Koning, like Hedderwick, describes the importance of controlling the movement of seeds as they travel to the ground to ensure even spacing. Ex. 1004-Koning, 1:5-13 (“The invention relates to a

planting machine for potatoes, bulbs or similar seed crop comprising a hopper and a conveying and distributing device adjoining the outlet of said hopper for feeding the potatoes or the like to the planting foot. The invention has for its object to provide a planting machine of the kind set forth, which ensures a particularly uniform distribution of the seed potatoes or the like, even if the seed potatoes have different sizes and if the shape of the seed crop is irregular.”).

73. Koning says that it achieves even spacing because, just as in the ’663 patent, the brush belt ensures that the “velocity” of the seeds “in relation to each other is completely defined” and, as a result, the seeds are delivered such that they are “lying on the same distance in relation to each other in the furrow.” Ex. 1004-Koning, 3:12-22 (“According to the invention the conveying members can extend to a point just over the furrow and above the conveying surface of the conveying members can be provided a driven belt with brush hairs or the like, such that the brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt. In such an embodiment the potatoes or the like are held till the very last moment and the velocity of the potatoes in relation to each other is completely defined. Under all circumstances a regular distribution of the potatoes in the furrow is obtained.”), 5:8-14 (“The brush hairs 45 hold the potatoes lying on the conveying

members 23 during the time they are lying on the extended part 40 of the conveying members. This has the effect, that one is sure that the potatoes delivered by the conveying members are lying on the same distance in relation to each other in the furrow 41.”).

74. Hedderwick, on the other hand, states that the relationship between seeds is not “completely defined” by its endless belt prior to the seeds being deposited in the soil. Instead, Hedderwick explains that the seeds may move around in the cells of the finned belt. Ex. 1003-Hedderwick, 5:72-78 (“Seeds 148 in the cells then proceed down the bottom run of the chain to a position behind plough 146 where the casing starts to travel upwardly again. Gravity forces the seeds back against fins 135 to ensure that the positioning of the seeds is uniform.”). For example, Deere argued to the Patent Office during prosecution of the application to which the ’663 patent claims priority that a flighted belt, unlike the ’663 patent’s brush belt, does not fully control seed movement: “In Sauder [which describes a flighted belt], the seeds are not ‘gripped’ by the flights 132 but merely rest on the flights. The seeds are free to bounce around between adjacent flights.” File History for U.S. Patent App. No. 12/364,010 (12/6/2010 Amendment) (Ex. 1024), at 16.

75. Hedderwick's endless belt accordingly does not completely define the velocity of the seeds relative to one another and does not "hold" the seeds throughout their descent until the "moment that they leave the belt." Ex. 1004-Koning, 3:16-18 ("[T]he brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt."); *see* Ex. 1003-Hedderwick, 2:60-62 ("It is highly desirable that the rotation speed of the seeder is constant relative to the speed of travel of the seeder over the ground[.]").

76. For these reasons, a person of ordinary skill in the art seeking finer control over seeds as they are conveyed down to the furrow would realize that adding Koning's brush belt to the Hedderwick's system would provide certain benefits that further Hedderwick and Koning's common goal of achieving accurate seed spacing. In particular, the benefits would include delivering seeds the same distance apart and with a consistent relative velocity. A person of ordinary skill in the art would therefore have been motivated to combine the concepts of Hedderwick and Koning to obtain the identified benefit of greater seed control provided by Koning's brush belt.

77. A person of ordinary skill in the art would have found it straightforward to incorporate Koning's brush belt into Hedderwick's row unit, which would only require applying a known technique to a known device. The combination would

merely involve substituting Hedderwick's finned endless belt (which travels around pulleys (sprockets 132 and 152)) with Koning's brush belt (which similarly travel around pulleys (rollers 42 and 43)) to hold and control the seeds as they are delivered to the ground. Ex. 1003-Hedderwick, Fig. 4, 4:23-5:7 ("The major change in the seeder is the provision of an endless belt 134 which has a series of fins 135 projecting upwardly therefrom. This belt rides in a casing or guideway 137 and there is a define between the belt, the fins and the casing a series of moving cells, each of which carries a seed. These cells are synchronised to align with orifices 129 of disc 130. The alignment may be assisted by the use of fins 131 but these are optional. Release of seeds from disc 130 is achieved in the same fashion as with the release of seeds from disc 70. Endless belt 134 passes over driven sprocket 132 and idler sprocket 152."); Ex. 1004-Koning, Fig. 4, 5:3-14 ("The conveying members 23 are in the embodiments according to FIG. 4 extended in backward direction with a part 40. This part 40 extends to a point in the furrow 41. Above the part 40 is arranged a belt 44 guided around rollers 42 and 43, such belt provided with brush hairs 45. The brush hairs 45 hold the potatoes lying on the conveying members 23 during the time they are lying on the extended part 40 of the conveying members. This has the effect, that one is sure

that the potatoes delivered by the conveying members are lying on the same distance in relation to each other in the furrow 41.”), 2:67-3:22.

78. It would have been routine for a person of ordinary skill in the art to modify Hedderwick by adding Koning’s brush belt. He or she would have understood how to combine their teachings because each is directed to straightforward mechanical systems, just like the ’663 patent. The disclosed features and concepts would have been readily combined according to known methods to yield predictable results. Such a combination would have been applying a known technique—using brush belt rotating around rollers, as taught by Koning—to a known device—a seeding machine that would benefit from Koning’s brush belt—so a person of ordinary skill in the art would expect the combination to be successful.

79. Koning’s Figure 4 shows that the brush belt receives the seeds when its bristles are rotating around the upper roller 42. Ex. 1004-Koning, Fig. 4. Because of this, the seeds are received in the brush belt when the bristles are flexed open. A person of ordinary skill in the art would have known that Koning’s brush belt could be readily combined into Hedderwick’s system in a similar fashion, such that it receives seeds as the belt curves around Hedderwick’s driven sprocket 132 and the bristles are flexed open.

80. A person of ordinary skill in the art would have recognized Koning's brush belt and Benac's paddle wheel as known techniques, like tools in a toolbox, that could be applied to Hedderwick in a known way to provide the benefits identified in Koning and Benac of increasing control over the seed as they are transported to the ground to improve seed spacing. This is actually the same result described in Benac (improved control over seeds resulting from the loading wheel reliably removing the seeds from the seed meter) and Koning (improved control over the seeds by the brush belt holding the seeds until they are delivered to the ground). Ex. 1004-Koning, 3:12-22 ("According to the invention the conveying members can extend to a point just over the furrow and above the conveying surface of the conveying members can be provided a driven belt with brush hairs or the like, such that the brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt. In such an embodiment the potatoes or the like are held till the very last moment and the velocity of the potatoes in relation to each other is completely defined. Under all circumstances a regular distribution of the potatoes in the furrow is obtained."), 5:8-14 ("The brush hairs 45 hold the potatoes lying on the conveying members 23 during the time they are lying on the extended part 40 of the conveying members. This has the effect, that one is sure that the potatoes delivered by the conveying members

are lying on the same distance in relation to each other in the furrow 41.”); Ex. 1005-Benac, 2:12-17 (“The function of the paddle wheel is specifically primarily to retain the seeds released from the vacuum before they are dropped, in order for all the seeds to be dropped in the same way and therefore not to be subjected to the uncontrollable effects of a greater or lesser suction because of their form.”).

81. Since each of the references—like the ’663 patent—is directed to straightforward mechanical systems and predictable variations, a person of ordinary skill in the art would have understood how to combine their teachings. A person of ordinary skill in the art would have recognized the predictable benefits of these simple mechanical systems to overcome the problem of increasing control over the seed to improve seed spacing. These known techniques with predictable results would have been tools in the toolbox of a person of ordinary skill in the art seeking to obtain more precise seed spacing. Put another way, a person of ordinary skill in the art exercising his or her own judgment would have understood how to implement the brush belt of

Koning and the paddle wheel of Benac into Hedderwick's system to increase overall control of seed from the seed meter to the ground.⁵

IX. CLAIM CONSTRUCTION

82. My understanding of the legal standards for claim construction are discussed above in Paragraphs 22-24.

83. I am giving each of the terms in the '663 patent its ordinary and customary meaning in view of the claim language, the patent specification, and the prosecution history.

84. A person of ordinary skill in the art would have understood that the '663 patent describes the claimed "endless member" as a brush belt with bristles, or belt with other materials, that grip the seed. Ex. 1001, 7:25-31 ("The endless member of

⁵ Figure 4 of Hedderwick show "a series of fins 131" on "the face of the [seed meter] disc [130]," as well as "Nylon agitator bristles 133." Ex. 1003-Hedderwick, 4:6-18. However, Hedderwick also states that the fins 131 and bristles 133 "are optional ... [and] need not be employed." *Id.* Since these fins are optional, a person of ordinary skill in the art would not have understood them to prevent or discourage the combination of Benac's paddle wheel and Koning's brush belt with Hedderwick.

the delivery system has been described as being a brush belt with bristles. In a broad sense, the bristles form an outer periphery of contiguous disjoint surfaces that engage and grip the seed. While brush bristles are the preferred embodiment, and may be natural or synthetic, other material types can be used to grip the seed such as a foam pad, expanded foam pad, mesh pad or fiber pad.”), 3:52-54 (“The belt has a base member 66 to engage the pulleys and elongated bristles 70 extending therefrom.”), 4:18-31 (“There the seeds are pinched off the seed disk between the loading wheel and the bristles 70 to remove the seed from the seed disk and seed meter. The seeds are captured or entrapped in the bristles by insertion of the seed into the bristles in a radial direction, that is from the ends of the bristles in a direction parallel to the bristle length. This occurs just as the belt path around the pulley 60 ends, when the bristle ends are closing back together upon themselves, allowing the bristles to close upon, and capture the seeds therein. As the belt continues to move, the bristles move or convey the seeds downward to the housing lower opening. The side wall 53 of the housing cooperates with the bristles 70 to hold the seed in the brush bristles as the seed is moved to the lower opening.”), 5:4-5 (“With the delivery system 28, the seed is captured by the delivery system to remove the seed from the seed meter.”).

85. The patent states that the “seed delivery system” of the claimed invention does not permit gravity to impact the movement of the seeds as they are delivered to the ground. In fact, the patent criticizes prior art systems in which the seeds experience a gravity drop as they are delivered to the ground because, according to the patent, these systems do not plant the seeds with uniform spacing. Ex. 1001, 2:4-19 (“Various attempts have been made to reduce the variation in seed spacing resulting from the gravity drop. U.S. Pat. No. 6,681,706 shows two approaches. One approach uses a belt with flights to transport the seeds from the meter to the ground while the other approach uses two belts to grip the seed and transport it from the meter to the ground. While these approaches control the seed path and reduce variability due to dynamic events, neither approach seeks to deliver the seed with as small as possible horizontal velocity difference relative to the ground. U.S. Pat. Nos. 6,651,570, 7,185,596 and 7,343,868 show a seed delivery system using a brush wheel near the ground to regulate the horizontal velocity and direction of the seed as it exits the seeding machine. However, there is still a gravity drop between the seed meter and the brush wheel which produces variation in seed spacing.”). The patent states that its system, in contrast, controls the movement of the seeds from the seed meter to discharge thus maintaining the spacing of seeds relative to one another. *Id.*, 4:16-27

(“The seeds are transferred from the seed meter to the delivery system as the seeds are brought by the disk into the nip 88. There the seeds are pinched off the seed disk between the loading wheel and the bristles 70 to remove the seed from the seed disk and seed meter. The seeds are captured or entrapped in the bristles by insertion of the seed into the bristles in a radial direction, that is from the ends of the bristles in a direction parallel to the bristle length. This occurs just as the belt path around the pulley 60 ends, when the bristle ends are closing back together upon themselves, allowing the bristles to close upon, and capture the seeds therein.”), 5:8-11 (“From the seed meter to the discharge, the seed travel is controlled by the delivery system, thus maintaining the seed spacing relative to one another.”).

**X. CLAIMS 1-8 WOULD HAVE BEEN OBVIOUS OVER HEDDERWICK IN
VIEW OF KONING AND BENAC**

86. In my opinion, claims 1-8 would have been obvious to a person of ordinary skill in the art.⁶

A. Independent Claim 1

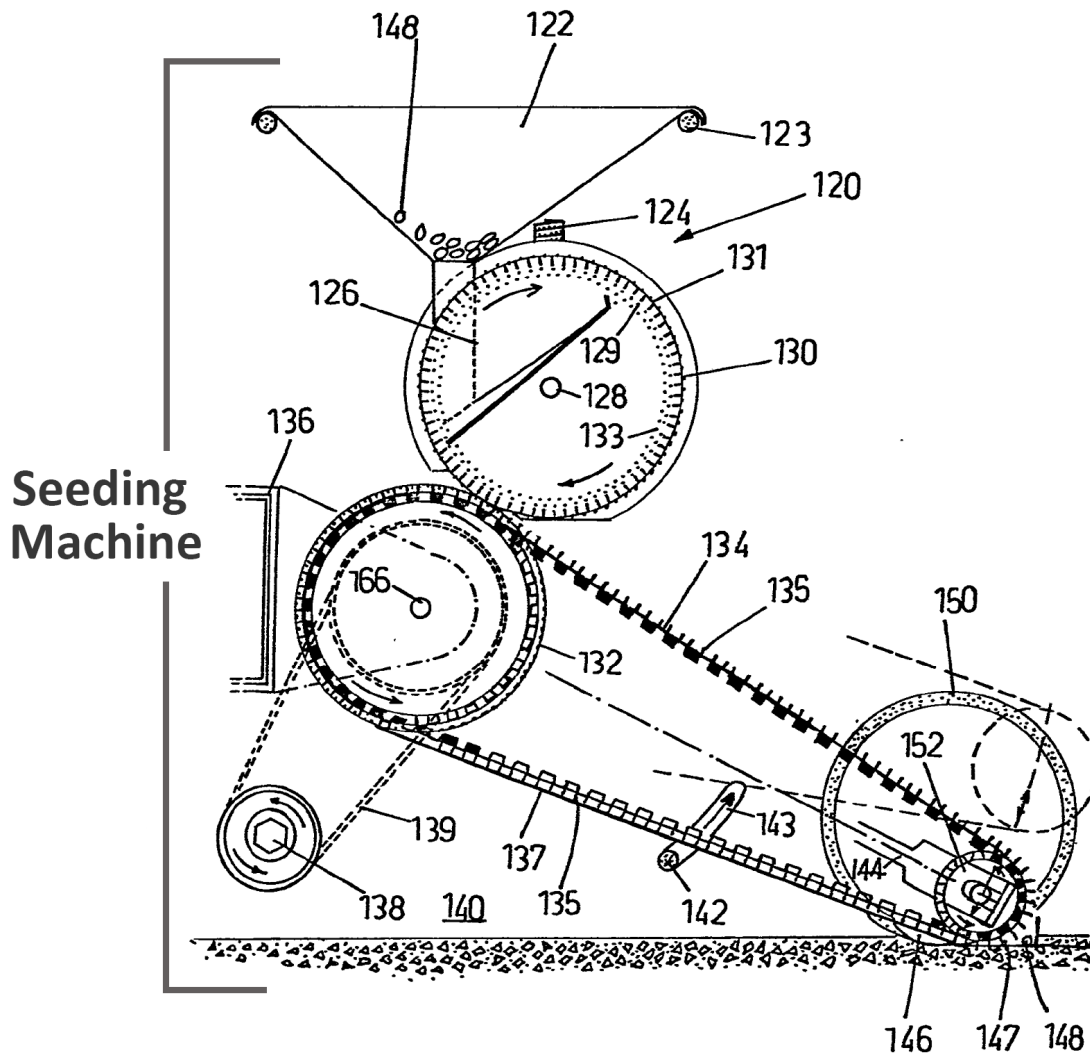
87. In my opinion, claim 1 would have been obvious to a person of ordinary skill in the art.

⁶ As I explained above in Section IX (Claim Construction), I have given all the terms in the '663 patent their ordinary and customary meaning in view of the claim language, the patent specification, and the prosecution history. As I have further explained, the patent discloses an “endless member” as a brush belt with bristles, or belt with other materials, that grip the seed. Should “endless member” be found to be broader than this, such that it includes other types of endless belt such as flighted belts or belts with cells, then the claims of the '663 patent still would have been obvious, in light of Hedderwick and Benac, either with or without Koning’s brush belt.

i. Element 1[Preamble]: “A seeding machine, comprising”

88. Hedderwick describes a seeding machine (a precision seeder). Ex. 1003-Hedderwick, Abstract (“A precision seeder for depositing single seeds at predetermined spacings in seed beds or unprepared soil, in which a vacuum pick-up (78), connected to the air intake of a tractor towing the seeder, is arranged to receive, from a hopper (122), and retain a single seed (98) in each of a plurality of discrete orifices (94).”). As shown in Figure 4 (below), Hedderwick’s precision seeder delivers seeds from a hopper to the ground.

FIG. 4



Id., Fig. 4, 1:5-10 (“This invention relates to a precision seeder. The expression ‘precision seeder’ as used herein relates to a seeding device able to deposit single seeds at predetermined spacings in seed beds but also includes the capability of planting seeds at predetermined spacings in unprepared soil.”), 1:25-26 (“Accordingly

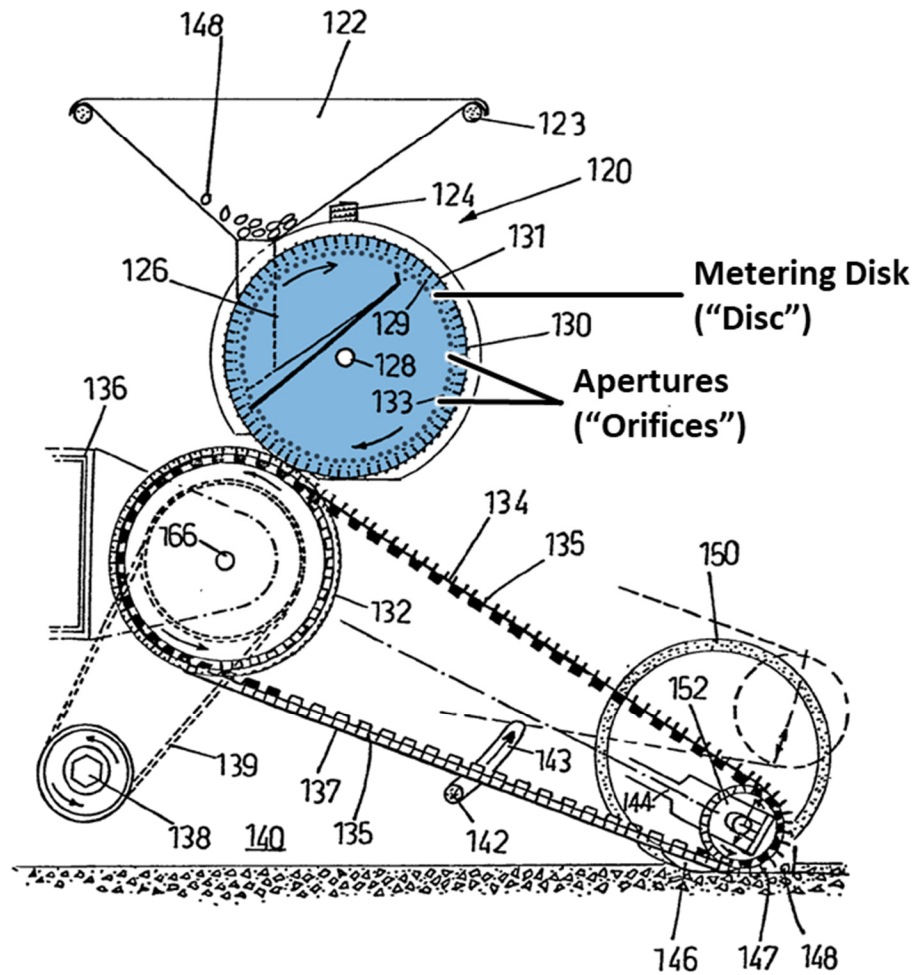
the invention may be said broadly to consist in a precision seeder[.]”), 1:97-99

(“Figure 1 is a section elevation view of a seeder mounted on a carriage being towed behind a farm tractor.”).

- ii. **Element 1[a]: “a seed meter having a metering disk with a plurality of apertures in a circular array adapted to adhere seeds to the metering disk to move the seeds along a seed path as the metering disk rotates”**

89. As shown in Figure 4 below, Hedderwick describes a seed meter having a metering disk (seed meter disc 130 (blue below)) with a plurality of apertures (orifices 129) in a circular array adapted to adhere seeds to the metering disk to move the seeds along a seed path as the metering disk rotates.

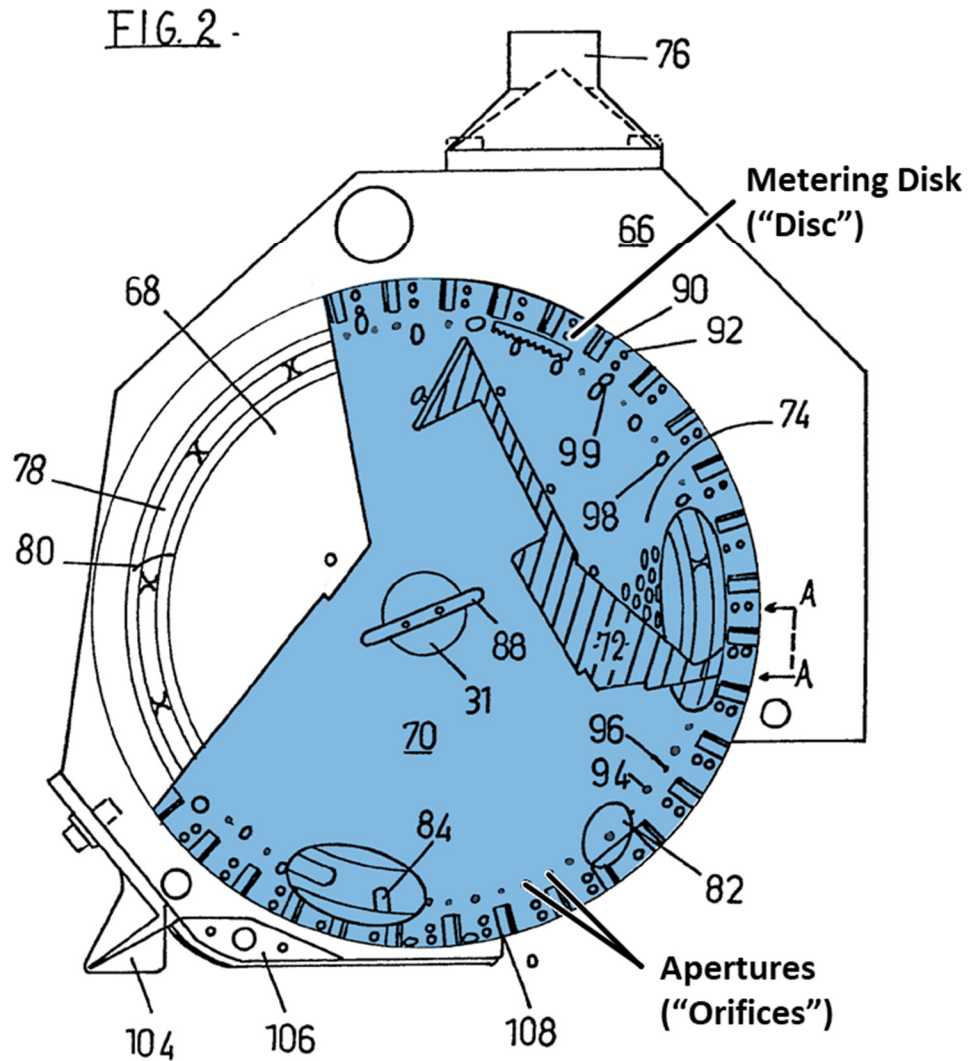
FIG. 4



Ex. 1003-Hedderwick, Fig. 4, 1:42-45 ("Preferably said vacuum pick-up means comprises a circular disc having orifices passing axially therethrough, each said orifice being radially equidistant from the centre of said disc."), 5:105-110 ("A precision seeder comprising: vacuum pick-up means comprising a source of vacuum

and a plurality of discrete orifices each adapted to receive and retain a single seed at one side thereof when said vacuum source is applied to the other side thereof[.]”), 5:121-125 (“A precision seeder according to claim 1 wherein said vacuum pick-up means comprises a circular disc having orifices passing axially there-through, each said orifice being radially equidistant from the centre of the said disc.”).

90. Figure 2 (below) similarly shows a seed metering disk (seed meter disc 70 (blue)) with a plurality of apertures (orifices 94) in a circular array, and this disc 70 may have the same construction as the disc 130 in Figure 4.



Ex. 1003-Hedderwick, Fig. 2, 4:10-13 ("In one preferred embodiment this disc 130 has a construction which is the same as that of disc 70 illustrated in figures 1 to 3."), 1:100-103 ("Figure 2 is a side elevational view of a seeder casing with the disc in place and with surface portion broken away so as to illustrate the operation of the

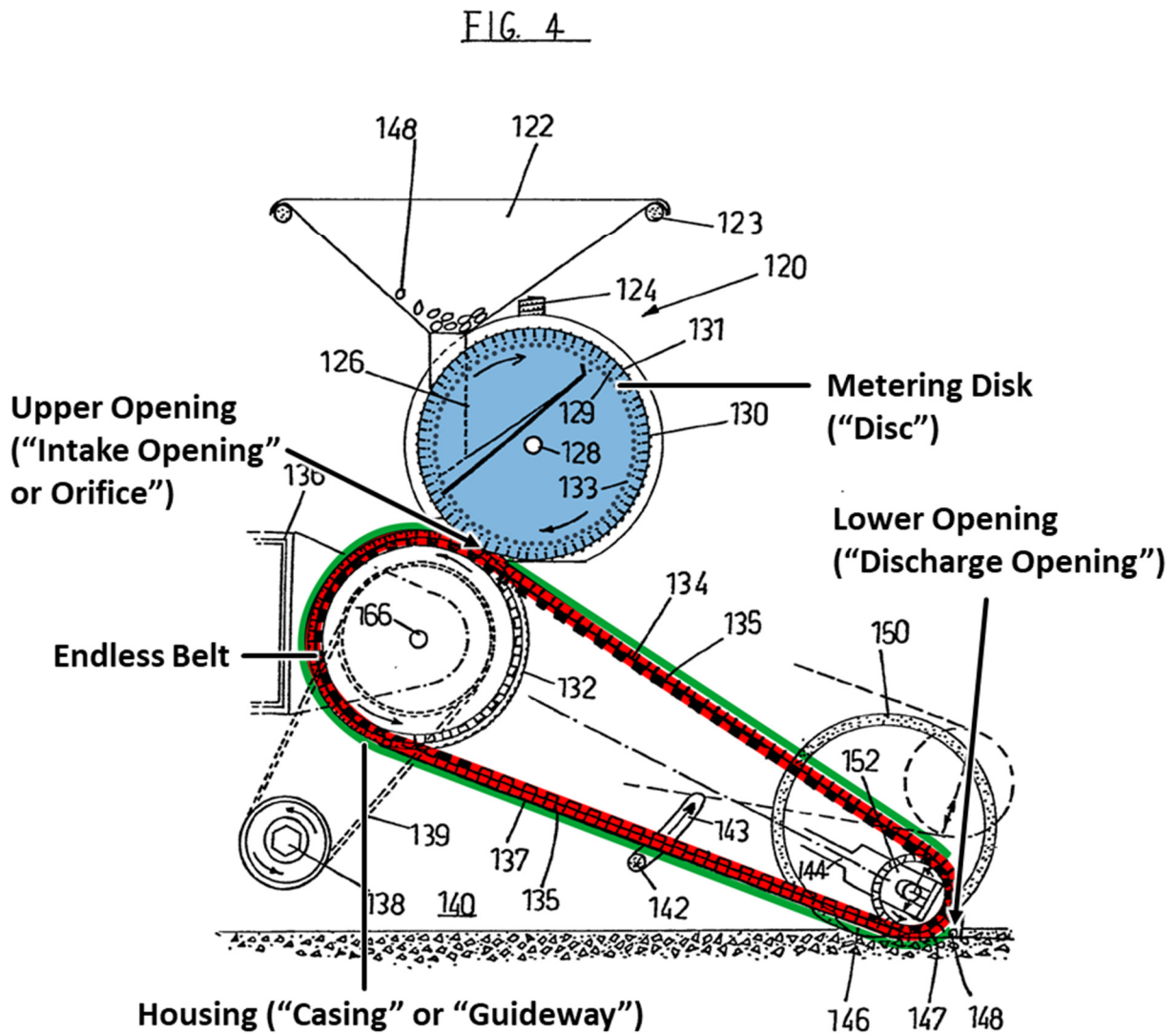
seeder.”), 2:115-117 (“In addition there is an air inlet hole 82 which is in registry with orifices 94 in disc 70 and will be described later.”).

91. Hedderwick also describes that the apertures (orifices 94 or 129) in the circular array are adapted to adhere seeds to the metering disk (disc 70 or 130) to move the seeds along a seed path (along the periphery of the disc 70 or 130) as the metering disk rotates in a clockwise direction. Ex. 1003-Hedderwick, 1:27-31 (“vacuum pick-up means comprising a source of vacuum and a plurality of discrete orifices each adapted to receive and retain a single seed at one side thereof when said vacuum source is applied to the other side thereof”), 3:20-24 (“Air inlet 112 is provided so that there is a greater pressure differential between the atmosphere side of the disc 70 and the vacuum side thereof to thus better retain the seeds 98 in orifices 94.”), 5:49-56 (“Seeds 148 in hopper 122 are fed into sub-hopper 126 in the same manner as the sub hopper 74 is fed in embodiment of figures 1 to 3. Disc 130 rotates in a clockwise direction in the embodiment shown in figure 4. Seeds 148 are picked up singly in orifices 129 [of the disc 130] and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137.”), 4:10-15 (“In one preferred embodiment this disc 130 has a construction which is the same as that of disc 70 illustrated in figures 1 to 3. A series of fins 131 project axially out of the face

of the disc. Vacuum orifices 129 align with an annular slot.”), 5:106-110 (describing “vacuum pick-up means comprising a source of vacuum and a plurality of discrete orifices each adapted to receive and retain a single seed at one side thereof when said vacuum source is applied to the other side thereof”).

iii. Element 1[b]: “a seed delivery system associated with said seed meter”

92. Hedderwick in combination with Koning shows a seed delivery system associated with said seed meter. Hedderwick describes a system (with an endless belt 134 and a casing/guideway 137) associated with the seed meter (seed meter disc 130), in which the system controls the movement of the seed from the seed meter to a discharge location.

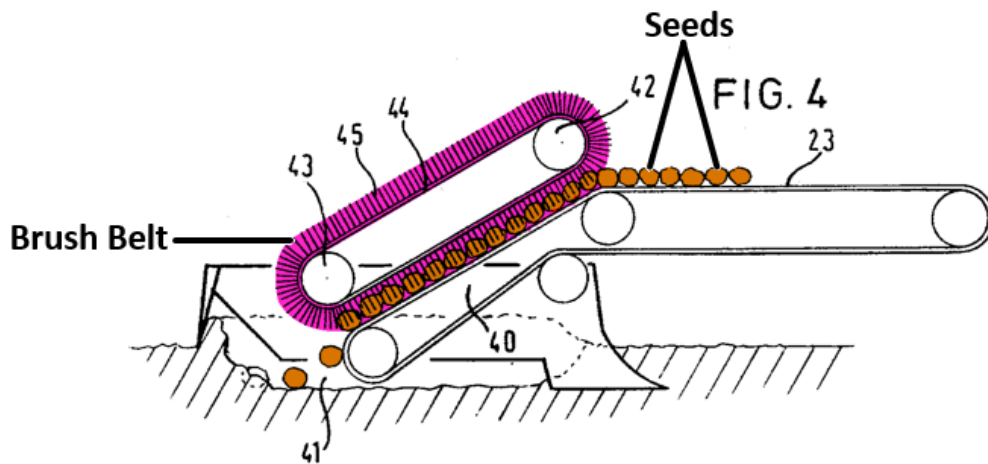


Ex. 1003-Hedderwick, Fig. 4. As shown in the figure above, the system includes a casing/guideway 137 (green) and endless belt 134 (red) that receives seeds from the seed meter disc 130 (blue). In particular, the seeds are transferred from the disc 130, through an opening ("intake opening" or "orifice") 141 in the casing 137, and into

compartments (or “cells”) formed between the fins 135 of the endless belt 134 and the casing 137. *Id.*, 5:53-60 (“Seeds 148 are picked up singly in orifices 129 [of the disc 130] and rotated to positions just above the point where the edge of the disc 130 mates with the orifices 141 through casing 137.... [S]ingle seeds [are transferred] through orifice 141 into a single cell formed by a pair of fins 135, the casing 137 and the belt 134.”). The endless belt (or “seed depositor”) 134 then delivers the seeds to the ground (or “seed bed”). *Id.*, Abstract (“a seed depositor (134) which transfers the sequentially disengaged seeds (98) to predetermined spacings in a seed bed.”), 1:36-41 (describing “seed depositing means co-operable in use with said vacuum release means to transfer sequentially each said disengaged seed from said release point to a seed bed at a predetermined spacing from its next 40 adjacent seed regardless of the speed of motion of said seeder”), 1:46-90 (“Preferably said depositing means comprises fins projecting axially from a face of the disc so as to define with the circumferential face of the said chamber and a casing comprising the other end face of said chamber a cell open radially inwardly, the vacuum release means being disposed so as to disengage seeds into said cell opening, the discharge point for discharging seeds radially outwardly of the said cells being an opening in the circumferential face of said chamber beginning slightly above bottom dead centre whereby each seed rests

against a fin at the moment of discharge.”); *see also* my discussion of Elements 1[c]-1[d] below.

93. The '663 patent states, however, that its seed delivery system does not permit gravity to impact the movement of the seeds as they are delivered to the ground. In Hedderwick, however, seeds may move about within the cells of the flighted belt. Ex. 1003-Hedderwick, 5:72-78 (“Seeds 148 in the cells then proceed down the bottom run of the chain to a position behind plough 146 where the casing starts to travel upwardly again. Gravity forces the seeds back against fins 135 to ensure that the positioning of the seeds is uniform.”). However, as shown in Figure 4 (below), Koning describes a system that uses a brush belt with bristles (as opposed to Hedderwick’s endless belt 134 with fins 135) to hold seeds (“potatoes, bulbs, or similar seed crop”) stationary with respect to each other as they are delivered to the ground so that they are planted in the furrow at a reliably uniform spacing.



Ex. 1004-Koning, Fig. 4, 1:5-6 (“The invention relates to a planting machine for potatoes, bulbs, or similar seed crop[.]”), 1:9-13 (“The invention has for its object to provide a planting machine of the kind set forth, which ensures a particularly uniform distribution of the seed potatoes or the like, even if the seed potatoes have different sizes and if the shape of the seed crop is irregular.”), 3:12-22 (“According to the invention the conveying members can extend to a point just over the furrow and above the conveying surface of the conveying members can be provided a driven belt with brush hairs or the like, such that the brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt.”), 5:8-14 (“The brush hairs 45 hold the potatoes lying on the conveying members 23 during the time they are lying on the extended part 40 of the conveying members. This has the effect, that one is sure that the potatoes delivered by the conveying members are lying on the same

distance in relation to each other in the furrow 41.”); see *my discussion* in Section VII.B.

94. Also, as shown in Figure 4, Koning’s brush belt rotates around pulleys (rollers) in the same way that Hedderwick’s endless belt rotates around drive and idler sprockets. Ex. 1004-Koning, Fig. 4, 5:6-8 (“a belt 44 guided around rollers 42 and 43, such belt provided with brush hairs 45”), 2:67-3:22; Ex. 1003-Hedderwick, Fig. 4 (showing belt 134 disposed around sprockets 132 and 153), 5:6-7 (“Endless belt 134 passes over driven sprocket 132 and idler sprocket 152.”).

95. As I described above, a person of ordinary skill in the art seeking to maximize control over the seed would have been motivated to combine the teachings of Hedderwick and Koning by replacing Hedderwick’s finned belt with Koning’s endless member in order to achieve finer seed spacing. *See my discussion* of the motivation to combine Hedderwick and Koning in Section VIII above.

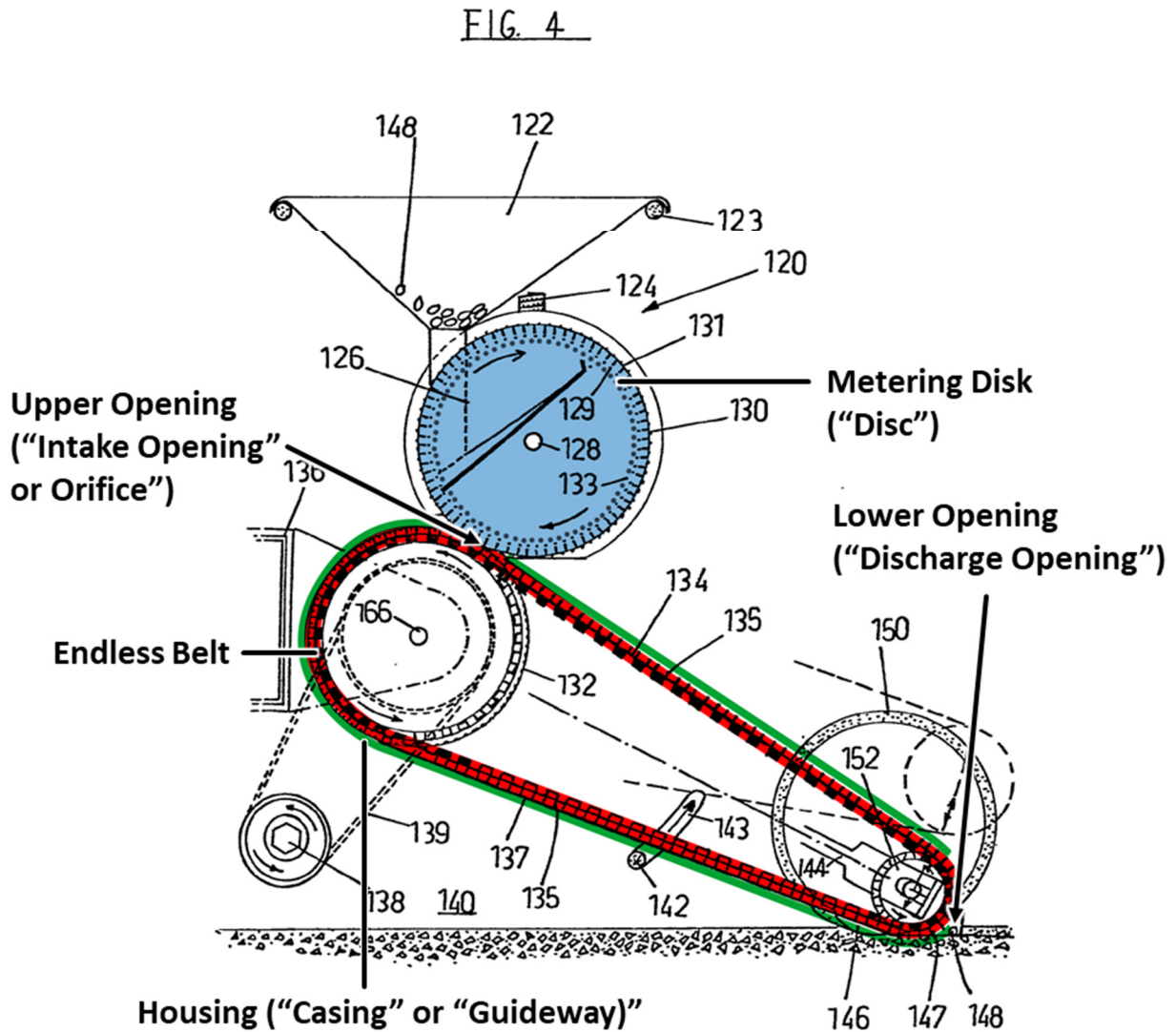
96. Accordingly, when Hedderwick’s system is combined with Koning’s brush belt, Hedderwick’s seed meter disc would rotate to transfer individual seeds to the point where the disc mates with the opening in the casing. Ex. 1003-Hedderwick, 5:53-60 (“Seeds 148 are picked up singly in orifices 129 [of the disc 130] and rotated to positions just above the point where the edge of the disc 130 mates with the orifices

141 through casing 137.”). At this mating point, Koning’s brush belt would capture the seeds from the disc and hold them in place with respect to each other as it delivers them to the ground. Ex. 1004-Koning, 3:12-22 (“[A] driven belt with brush hairs or the like, such that the brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt.”), 5:8-14 (“This has the effect, that one is sure that the potatoes delivered by the conveying members are lying on the same distance in relation to each other in the furrow 41.”) It follows that the combination of Hedderwick and Koning make the seed delivery system of the ’663 patent obvious.

iv. Element 1[c]: “said seed delivery system including a housing for seed from said metering disk, the housing having a lower opening through which seed is discharged”

97. Hedderwick in combination with Koning shows a seed delivery system including a housing for seed from said metering disk, where the housing has a lower opening through which seed is discharged. As I explained above in Element 1[b], Hedderwick in combination with Koning shows a seed delivery system. Further, as shown in Figure 4 (below), Hedderwick describes a housing (casing/guideway (green)) for seed from the metering disk (blue) which has a lower opening (discharge

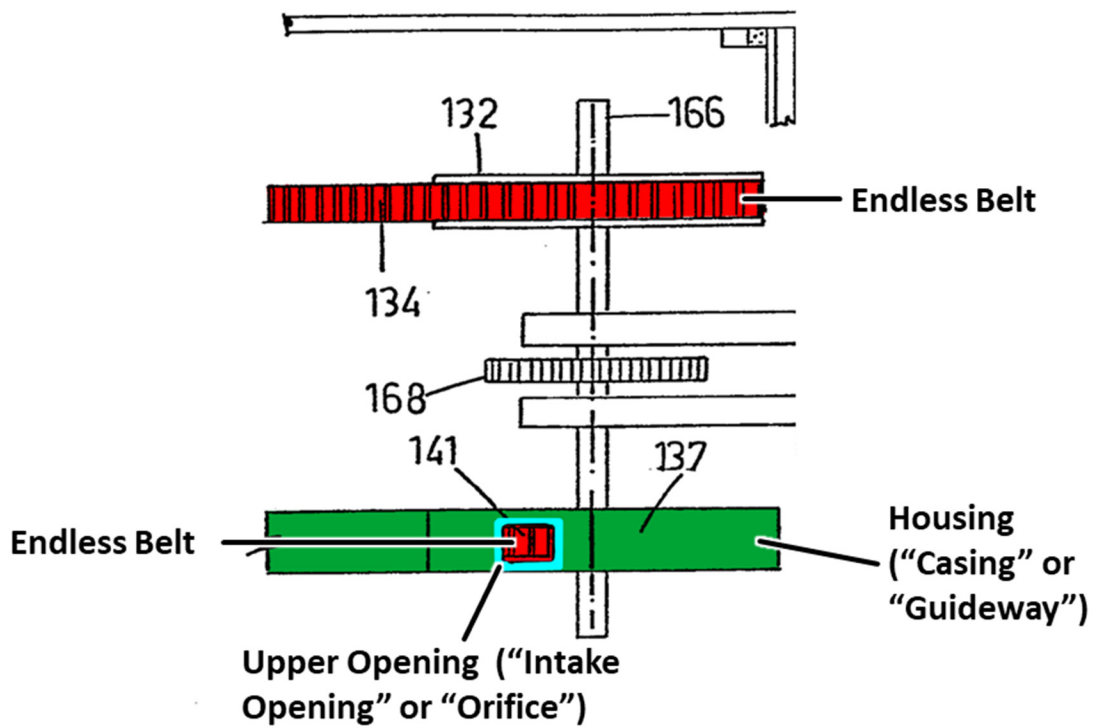
opening) through which seed is discharged after being carried by the endless belt
(red).



Ex. 1003-Hedderwick, Fig. 4. Hedderwick describes that its housing receives seed from the metering disk (and thus the housing is “for seed from said metering disk”).

For example, the annotated excerpt of Figure 5 (below) shows how seed enters the housing.

FIG. 5



Id., Fig. 5. Figure 5 is a top view and shows different components of multiple row units. *Id.*, 1:111-113 (“Figure 5 is a top plan view with portions broken away of the

seeder according to the second embodiment of the invention illustrated in figure 4.”).

In the portion of Figure 5 shown, the lower row unit is shown without the hopper or seed meter to reveal the housing (“casing 137” (green) and opening (“intake opening” or “orifice 141”) in the housing through which seed is transferred from the seed meter to the endless belt. *Id.*, 1:84-87 (“said vacuum release means associated with said disc being disposed so as to disengage seeds into said intake opening”), 5:53-60 (“Seeds 148 are picked up singly in orifices 129 [of the disc 130] and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137. The seed releasing means of disc 130 which is the same as that of the other embodiment of the invention releases single seeds through orifice 141 into a single cell formed by a pair of fins 135, the casing 137 and the belt 134.”). The upper row unit is shown without the hopper, seed meter, or casing, to reveal the flighted belt (red). *Id.*, 1:111-113 (“Figure 5 is a top plan view with portions broken away of the seeder according to the second embodiment of the invention illustrated in figure 4.”).

98. Hedderwick further describes that the housing (casing/guideway) has a lower “discharge opening” through which seeds are discharged to the ground. Ex. 1003-Hedderwick, 1:79-90 (“said belt and fins positioned to travel in a guideway, the guideway defining with said fins and endless belt a series of moving cells, said

guideway having an intake opening, said vacuum release means associated with said disc [(disc 70)] being disposed so as to disengage seeds into said intake opening, and a discharge opening slightly above bottom dead centre of the bottom pulley over which said endless belt rides whereby each seed rests against a fin at the moment of discharge”), 5:26-31 (“It will be seen that the inner portion of casing 137 behind plough 146 passes beyond the bottom dead centre position and raises upwardly slightly into a lip 147 which provides for even depositing of seeds 148 as will be explained below.”), 5:53-56 (“Seeds 148 are picked up singly in orifices 129 and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137.”), 6:51-72 (“said [endless] belt and fins positioned to travel in a guideway the guideway defining with said fins and endless belt a series of moving cells, said guideway having an intake opening in registry with said opening in the circumferential face of said chamber and a discharge opening slightly above bottom dead centre of the bottom pulley over which said endless belt rides whereby each seed rests against a fin at the moment of discharge”).

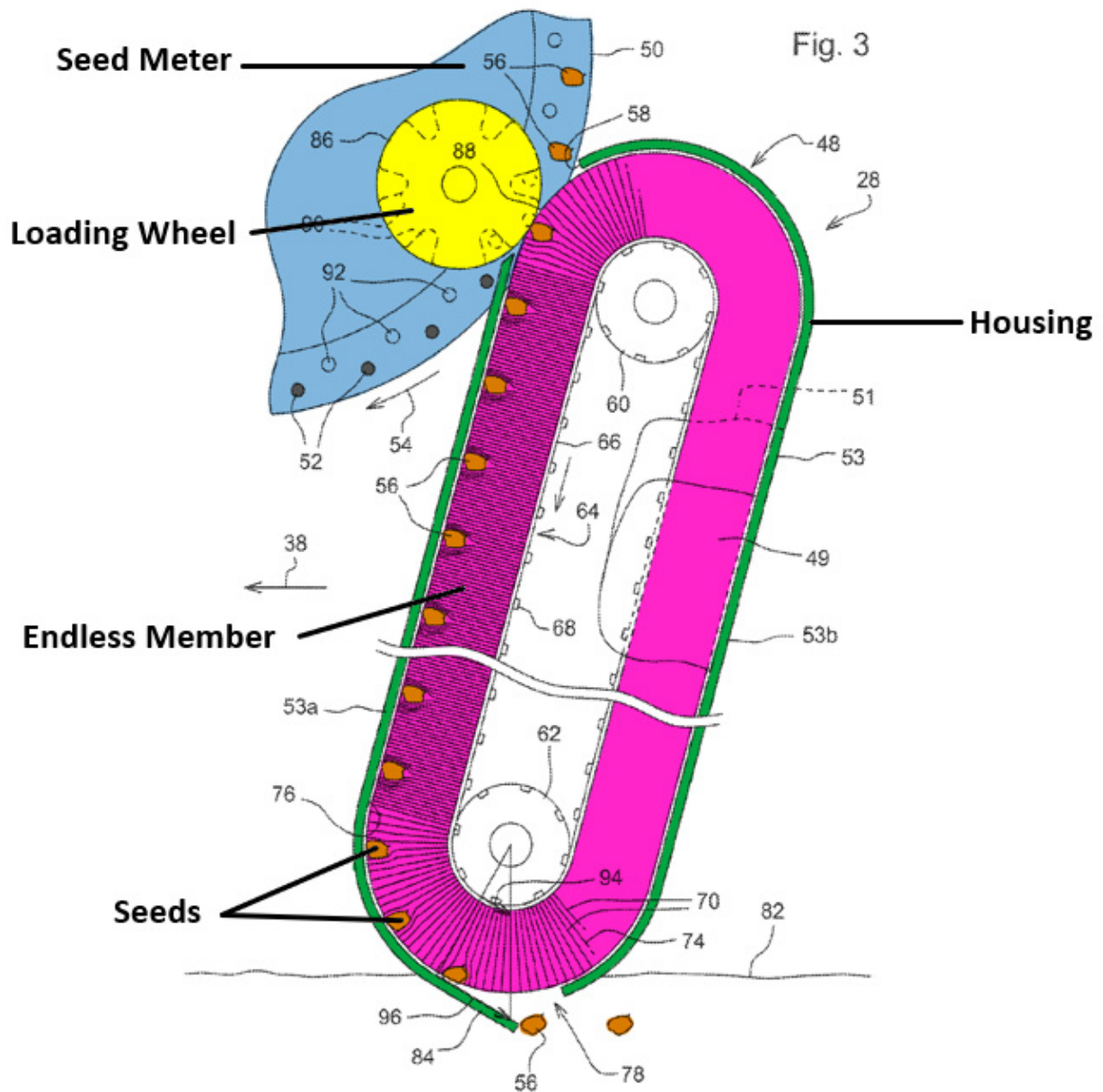
v. Element 1[d]: “said seed delivery system including ... a single endless member within said housing disposed around a first drive pulley and a second idler pulley”

99. Hedderwick in combination with Koning shows a seed delivery system including a single endless member (Koning’s brush belt with bristles) within said housing (Hedderwick’s casing/guideway) disposed around a first drive pulley and a second idler pulley (Hedderwick’s driven and idler sprockets). As shown in Figure 4 of Hedderwick (below), the system of Hedderwick includes a single endless belt (red) within the housing (casing/guideway (green)) that is disposed around a drive pulley (pink) and an idler pulley (yellow).

therefrom. This belt rides in a casing or guideway 137 and there is a define between the belt, the fins and the casing a series of moving cells, each of which carries a seed.”), 1:79-82 (“Alternatively, said seed depositing means comprises an endless belt, said belt having fins projecting outwardly, said belt and fins positioned to travel in a guideway[.]”), 6:49-53 (“said seed depositing means further comprising an endless belt, said belt having fins projecting outwardly, said belt and fins positioned to travel in a guideway the guideway defining with said fins and endless belt a series of moving cells[.]”), 6:61-64 (“said seed depositing means comprises an endless belt, said belt having fins projecting outwardly, said belt and fins positioned to travel in a guideway[.]”); *see also* my discussion of Elements 1[b]-1[c] above. The belt is disposed around a first drive pulley (driven sprocket) and a second idler pulley (idler sprocket (or bottom pulley)). Ex. 1003-Hedderwick, 5:6-14 (“Endless belt 134 passes over driven sprocket 132 and idler sprocket 152.”), 1:72-78 (“said guideway having an intake opening in registry with said opening in the circumferential face of said chamber and second discharge point slightly above bottom dead centre of the bottom pulley over which said endless belt rides whereby each seed rests against a fin at the moment of discharge.”), 1:87-90 (describing a “discharge opening slightly above bottom dead centre of the bottom pulley over which said endless belt rides whereby

each seed rests against a fin at the moment of discharge.”), 5:72-81 (“Sprocket 132 illustrated in figure 4 is travelling in a counter-clockwise direction as illustrated by the arrow. Seeds 148 in the cells then proceed down the bottom run of the chain to a position behind plough where the casing starts to travel upwardly again. Gravity forces the seeds back against fins 135 to ensure that the positioning of the seeds is uniform. Thus the fins 135 serve the same function as the depositing of seeds by fins 90 over lip 108 on disc 70 in the earlier illustrated embodiment.”).

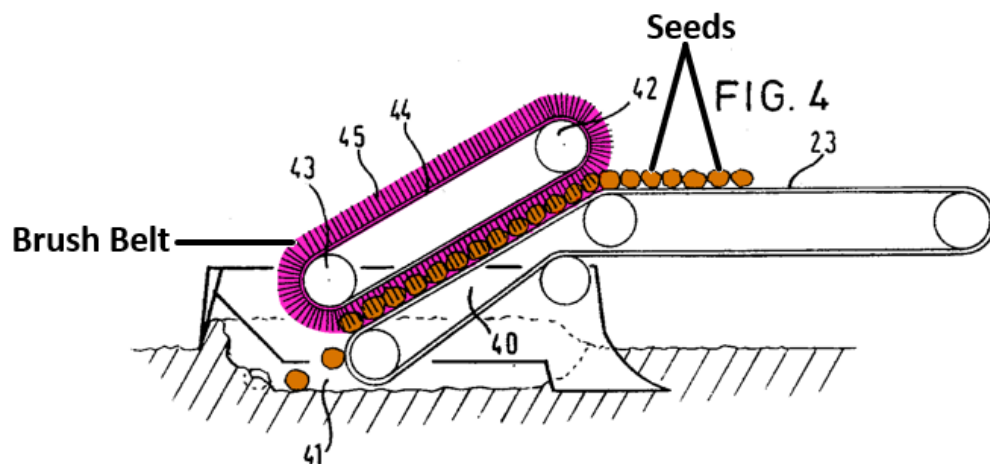
100. Hedderwick describes a single “endless belt” within a housing and disposed around a first drive pulley and a second idler pulley, Element 1[d] recites an “endless member.” And Koning discloses an “endless member,” as taught by the ’663 patent. As shown in Figure 3 of the ’663 patent (below), the ’663 patent describes the “endless member” (pink) as a brush belt with bristles, or belt with another material, that grips the seeds.



Ex. 1001, Fig. 3, 4:45 (“The belt shown in FIG. 3 has relatively long bristles.”), 7:25-31 (“The endless member of the delivery system has been described as being a brush belt with bristles. In a broad sense, the bristles form an outer periphery of contiguous

disjoint surfaces that engage and grip the seed. While brush bristles are the preferred embodiment, and may be natural or synthetic, other material types can be used to grip the seed such as a foam pad, expanded foam pad, mesh pad or fiber pad.”). According to the ’663 patent, the claimed endless member is a brush belt with bristles, or belt with other material, that grips the seeds.

101. As shown in Figure 4 (below), Koning describes a planter that uses an endless member—a brush belt with bristles (pink) that grip seeds (potatoes, bulbs or similar seed crop (orange)) as they are delivered to the ground.



Ex. 1004-Koning, Fig. 4. Koning describes the use of the brush belt with bristles to hold the seeds in place with respect to each other as they are delivered to the ground so that they are planted in the furrow at a reliably uniform spacing—the same objective described in the ’663 patent. *Id.*, 1:5-6 (“The invention relates to a planting

machine for potatoes, bulbs, or similar seed crop[.]”), 1:9-13 (“[The] planting machine of the kind set forth [] ensures a particularly uniform distribution of the seed potatoes or the like, even if the seed potatoes have different sizes and if the shape of the seed crop is irregular.”), 3:12-22 (“According to the invention the conveying members can extend to a point just over the furrow and above the conveying surface of the conveying members can be provided a driven belt with brush hairs or the like, such that the brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt.”), 5:8-14 (“The brush hairs 45 hold the potatoes lying on the conveying members 23 during the time they are lying on the extended part 40 of the conveying members. This has the effect, that one is sure that the potatoes delivered by the conveying members are lying on the same distance in relation to each other in the furrow 41.”); *see* my discussion in Section VII.B.

102. Moreover, as shown in Figure 4 (above), Koning’s brush belt is disposed around pulleys (rollers) in the same way that Hedderwick’s endless belt is disposed around a first drive pulley and a second idler pulley. Ex. 1004-Koning, Fig. 4, 5:6-8 (“a belt 44 guided around rollers 42 and 43, such belt provided with brush hairs 45”), 2:67-3:22.

103. As I explained above, a person of ordinary skill in the art seeking to maximize control over the seed would have been motivated to combine the concepts of Hedderwick and Koning by replacing Hedderwick's finned belt with Koning's endless member to achieve the identified benefits of finer seed spacing. *See* my discussion of the motivation to combine Hedderwick and Koning in Section VIII above. Accordingly, the combination of Hedderwick and Koning would include a seed delivery system with a single endless member (Koning's brush belt) within a housing (Hedderwick's casing/guideway) disposed around a first drive pulley (Hedderwick's driven sprocket) and a second idler pulley (Hedderwick's idler sprocket).

vi. Element 1[e]: “said endless member engaging seed from the seed meter and moving the seed to said lower opening where seed is discharged from said housing”

104. Hedderwick in combination with Koning shows an endless member (Koning's brush belt) engaging seed from the seed meter and moving the seed to said lower opening where seed is discharged from said housing (the discharge opening of Hedderwick's casing/guideway), as I explained above. *See* my discussion of Elements 1[a], 1[c]-1[d]. Specifically, Hedderwick describes that “[s]eeds 148 are picked up singly in orifices 129 [of the seed meter disc 130] and rotated to positions to

the point where the edge of the disc 130 mates with orifices 141 through casing 137.”

Ex. 1003-Hedderwick, 5:53-56. At that point, Koning’s brush belt in Hedderwick’s casing would engage the seeds by capturing them within the brush bristles and transports them to the lower opening. *Id.*, 1:80-90 (“vacuum release means associated with said disc being disposed so as to disengage seeds into said intake opening, and a discharge opening slightly above bottom dead centre of the bottom pulley over which said endless belt rides whereby each seed rests against a fin at the moment of discharge.”), 5:56-60 (“The seed releasing means of disc 130 which is the same as that of the other embodiment of the invention releases single seeds through orifice 141 into a single cell formed by a pair of fins 135, the casing 137 and the belt 134.”); Ex. 1004-Koning, 3:12-22 (“According to the invention the conveying members can extend to a point just over the furrow and above the conveying surface of the conveying members can be provided a driven belt with brush hairs or the like, such that the brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt. In such an embodiment the potatoes or the like are held till the very last moment and the velocity of the potatoes in relation to each other is completely defined. Under all circumstances a regular distribution of the potatoes in the furrow is obtained.”), 5:8-14 (“The brush hairs 45 hold the potatoes lying on the conveying

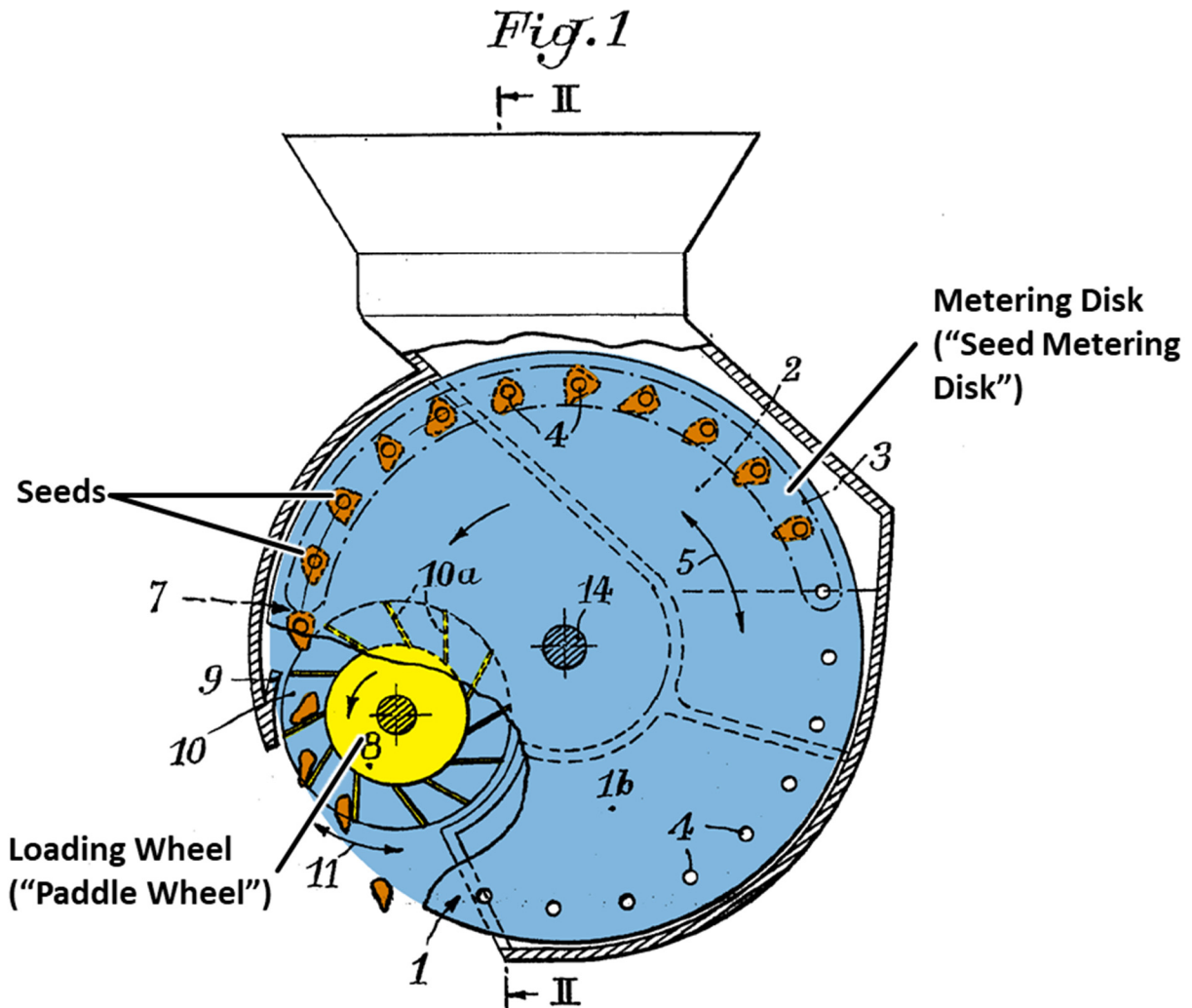
members 23 during the time they are lying on the extended part 40 of the conveying members. This has the effect, that one is sure that the potatoes delivered by the conveying members are lying on the same distance in relation to each other in the furrow 41.”).

vii. Element 1[f]: “a loading wheel engaging seeds adhered to the metering disk and moving along the seed path and guiding the seed into the single endless member whereby the single endless member moves the seed to the lower opening”

105. Hedderwick in combination with Benac and Koning shows a loading wheel engaging seeds adhered to the metering disk and moving along the seed path and guiding the seed into the single endless member whereby the single endless member moves the seed to the lower opening. As discussed above (see my discussion of Hedderwick in Section VII.A and Elements 1[a]-1[c] above), Hedderwick describes seeds adhered to a metering disk moving along a seed path, to a position where the seed disk “mates with” an opening in a housing that encloses an “endless belt.” Ex. 1003-Hedderwick, 5:53-56 (“Disc 130 rotates in a clockwise direction in the embodiment shown in figure 4. Seeds 148 are picked up singly in orifices 129 [of the disc 130] and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137.”). At that point, the seeds are transferred from the seed disc through the intake opening in the casing. *Id.*, 5:56-60 (“The seed

releasing means of disc 130 which is the same as that of the other embodiment of the invention releases single seeds through orifice 141 [of the casing 137] into a single cell formed by a pair of fins 135, the casing 137 and the belt 134.”).

106. As shown in Figure 1 (below), Benac—like Hedderwick—describes a metering disk (blue). The seed disk in Benac rotates counterclockwise, and the “seeds [orange] are sucked onto ... orifices and driven with the disk” as it rotates.



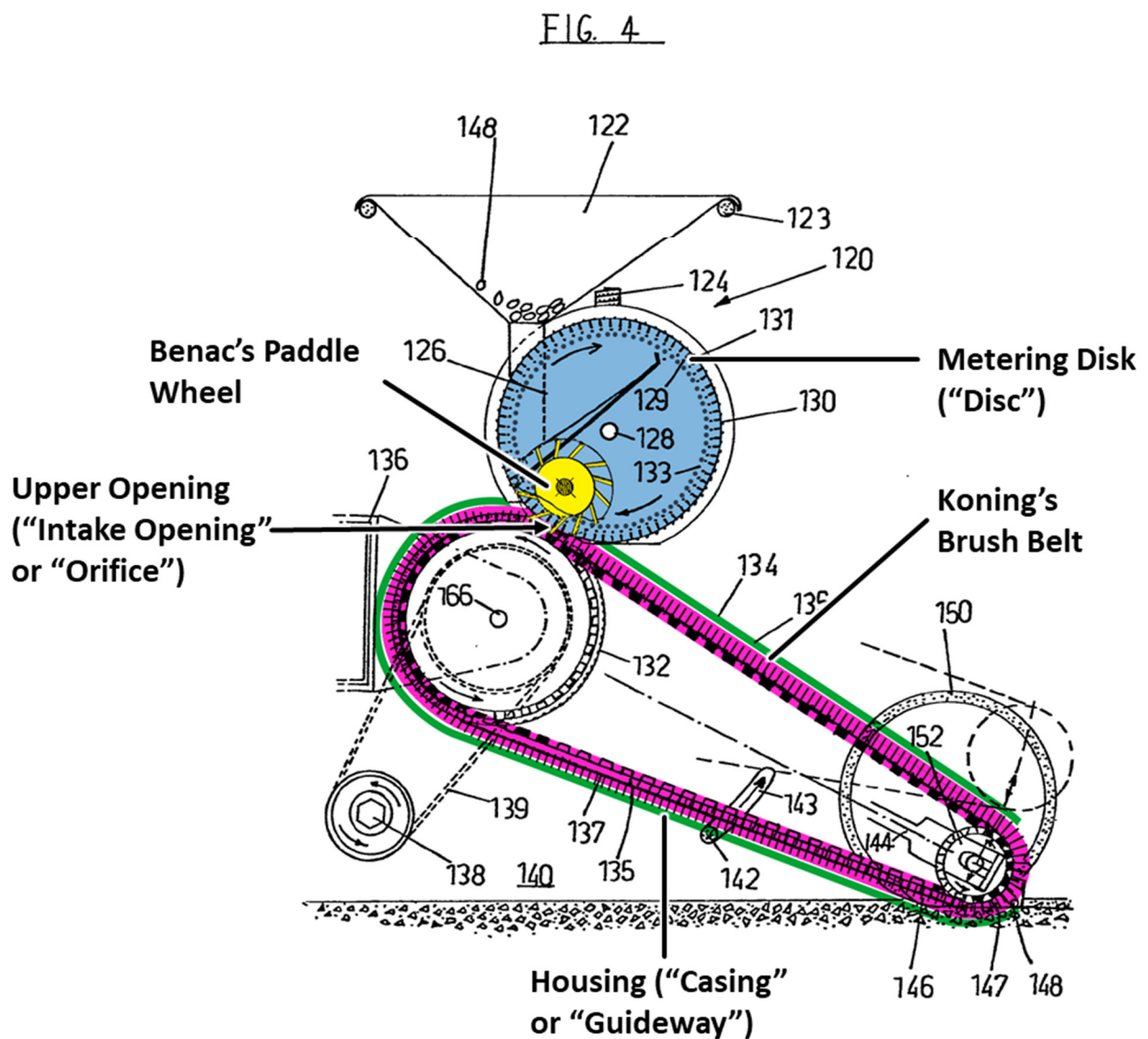
Ex. 1005-Benac, Fig. 1, 3:29-31 ("Since the vacuum reaches, through the orifices 4, the seed chamber in the picking zone, the seeds are sucked onto these orifices and driven with the disk."); Ex. 1001, Fig. 3. Also, just like Figure 3 of the '663 patent, Benac describes a loading wheel (a "paddle wheel" (yellow)) in which "paddles 10a

of the paddle wheel 8 sweep the orifices 4 of the disk ..., such that the seeds are necessarily extracted from the orifices 4 upstream of the dropping zone.” Ex. 1005-Benac, 5:4-9 (“In these conditions, the paddles 10a of the paddle wheel 8 sweep the orifices 4 of the disk between the release zone 7 and the dropping zone 11, such that the seeds are necessarily extracted from the orifices 4 upstream of the dropping zone.”). Benac explains that using the paddle wheel prevents inaccurate seed planting that might otherwise result from seeds being jammed in the apertures of the seed meter. *Id.*, 2:17-23 (“[I]t is very commonplace for the seeds to be retained simply by jamming on the suction orifices such that, if no means, and in particular the paddles of the paddle wheel, are provided to sweep the suction orifices, the detaching of the seeds remains random, which is obviously detrimental to the accuracy of the seeding.”). Since Hedderwick has a seed meter disc 130 that uses a vacuum to retain seeds in the apertures 129 of the disc 130, a person of ordinary skill in the art would have looked to the components described in Benac as a way to ensure “that seeds are necessarily extracted from the orifices” of the disc 130 and transferred through the orifice 141 of the casing 137. *See* my discussion of Elements 1[a]-1[c] above.

107. As I discussed above, the combination of Hedderwick and Koning yields an endless member within a housing, where the single endless member moves the seed

to the lower opening in the housing. *See* my discussion of Elements 1[c]-1[e] above.

When added to the combination of Hedderwick and Koning, Benac's paddle wheel guides the seeds from the seed metering disk into the bristles of the endless member through the upper opening in the housing, as shown here:



As the paddle wheel (yellow) sweeps the orifices of the seed meter disc, it guides the seeds through the opening in the housing into the bristles of the endless member (formed by substituting Koning's brush belt for Hedderwick's finned belt) at the point where "the edge of disc 130 mates with orifice 141 through casing 137." Ex. 1003-Hedderwick, 5:53-60 ("Disc 130 rotates in a clockwise direction in the embodiment shown in figure 4. Seeds 148 are picked up singly in orifices 12 and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137. The seed releasing means of disc 130 which is the same as that of the other embodiment of the invention releases single seeds through orifice 141 into a single cell formed by a pair of fins 135, the casing 137 and the belt 134."). Further, in the combination of Hedderwick, Koning, and Benac, after the seeds are guided into Koning's endless member by Benac's paddle wheel, the endless member holds the seeds and moves them to the lower discharge opening. *See my discussion of Elements 1[c]-1[e] above.*

108. As I discussed above in Section VIII, a person of ordinary skill in the art would have been motivated to modify Hedderwick's seeder to add Benac's paddle wheel for the purpose of reliably removing seeds from the seed meter and controlling their delivery. Ex. 1005-Benac, 2:12-15 ("The function of the paddle wheel is

specifically primarily to retain the seeds released from the vacuum before they are dropped, in order for all the seeds to be dropped in the same way[.]”), 4:13-15 (“The cells 10 of the paddle wheel therefore transport, one by one, the seeds released from the vacuum in the zone 7 just into the dropping zone 11.”).

109. A person of ordinary skill in the art would also recognize that this combination could be successfully created and operated. Benac itself explains how its paddle wheel should be placed and used with a vacuum disk seed meter. Ex. 1005-Benac, 4:6-9 (“A paddle wheel 8 is adjacent to the first face 1_a of the disk and determines, with this face 1_a and with a casing 9 that is adjacent and concentric to the paddle wheel, sealed cells 10 for the seeds.”), 4:17-19 (“According to the present invention, the paddle wheel 8 is off-center relative to the disk 1 and extends outside of the picking zone 5.”), 4:21-27 (“In order for each seed to be able to be held captive in a cell, the paddle wheel is driven in rotation in synchronism with the disk, for example by means of pinions 12 and a chain 13, the disk being, for its part, driven in a conventional manner by means of a transmission system linking it to a wheel adhering to the ground (not represented).”), 4:36-5:2 (“In figure 1, it can be seen that the paddle wheel can be internally tangential to the disk in the vicinity of its bottom part and contain between the periphery of the disk and the axis 14 thereof, such that the

diameter of the wheel is close to half the diameter of the disk.”). Accordingly, the combination could be formed using known methods with a predictable result—improving accuracy of seed spacing.

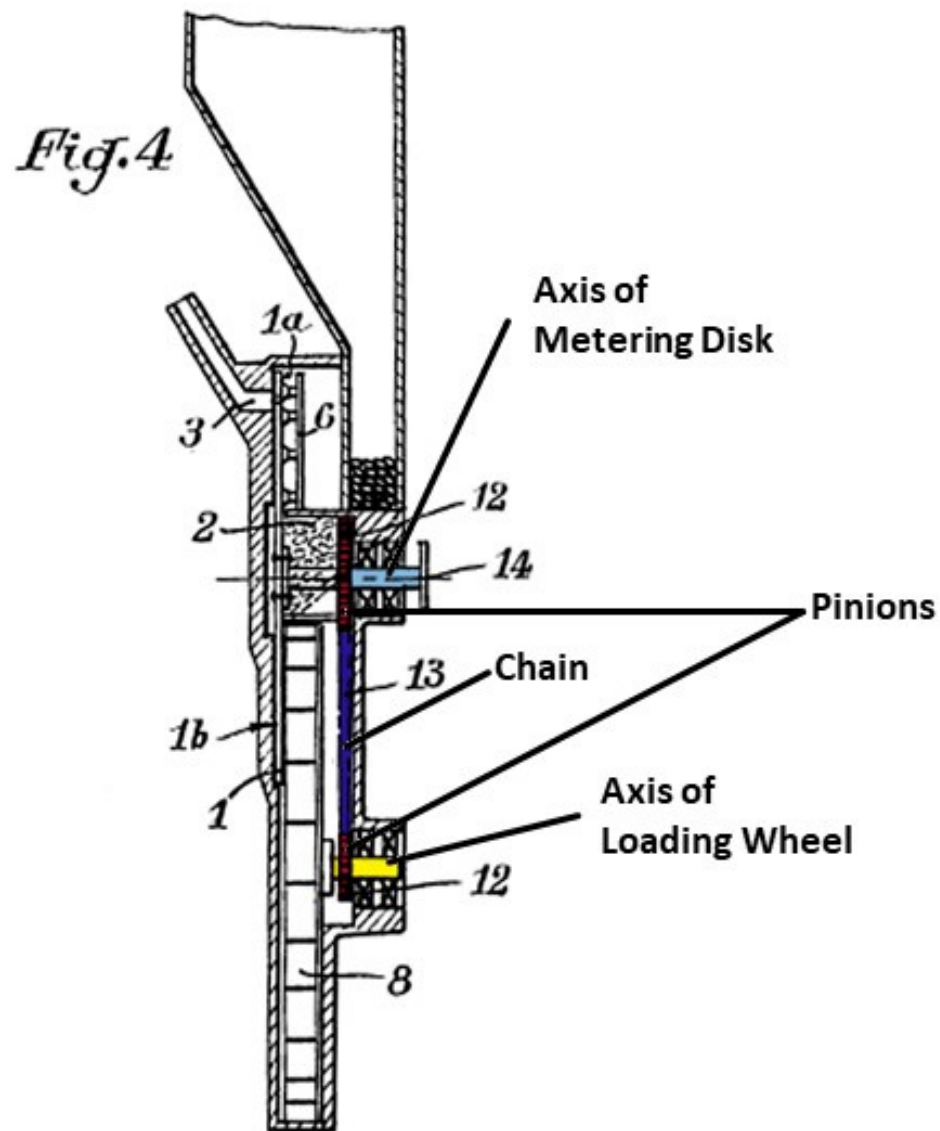
110. Incorporating Benac’s paddle wheel and Koning’s brush belt into Hedderwick’s row unit would be simple for a person of ordinary skill in the art to implement. This combination would yield predictable results, and a person of ordinary skill in the art exercising his or her own independent judgment would have understood how to implement the brush belt of Koning and the paddle wheel of Benac into Hedderwick to increase overall control of seed from the seed meter to the ground.

B. Dependent Claim 2

i. Element 2[a]: “The seeding machine of claim 1 wherein the metering disk and loading wheel are driven by a common drive”

111. As I discussed above, claim 1 would have been obvious in view of Hedderwick in combination with Benac and Koning. Claim 2 also would have been obvious in view of this combination. Specifically, Benac describes a metering disk and loading wheel (Benac’s paddle wheel) that are driven by a common drive (the drive for the metering disk). According to Benac, the paddle wheel is “driven in rotation in synchronism with the disk.” Ex. 1005-Benac, 4:22-23. Benac describes that this may be achieved “by means of pinions 12 and a chain 13,” which as shown in

the alternative embodiment of Figure 4 (below), connect the axis of the paddle wheel to the axis of the disk such that driving the axis of the disk in turn drives the axis of the paddle wheel. *Id.*, 4:23-24.



Id., Fig. 4. When combining Benac's paddle wheel with Hedderwick's metering disk, it would be obvious to a person of ordinary skill in the art that this technique could be used when combining Benac's paddle wheel with Hedderwick's seed meter.

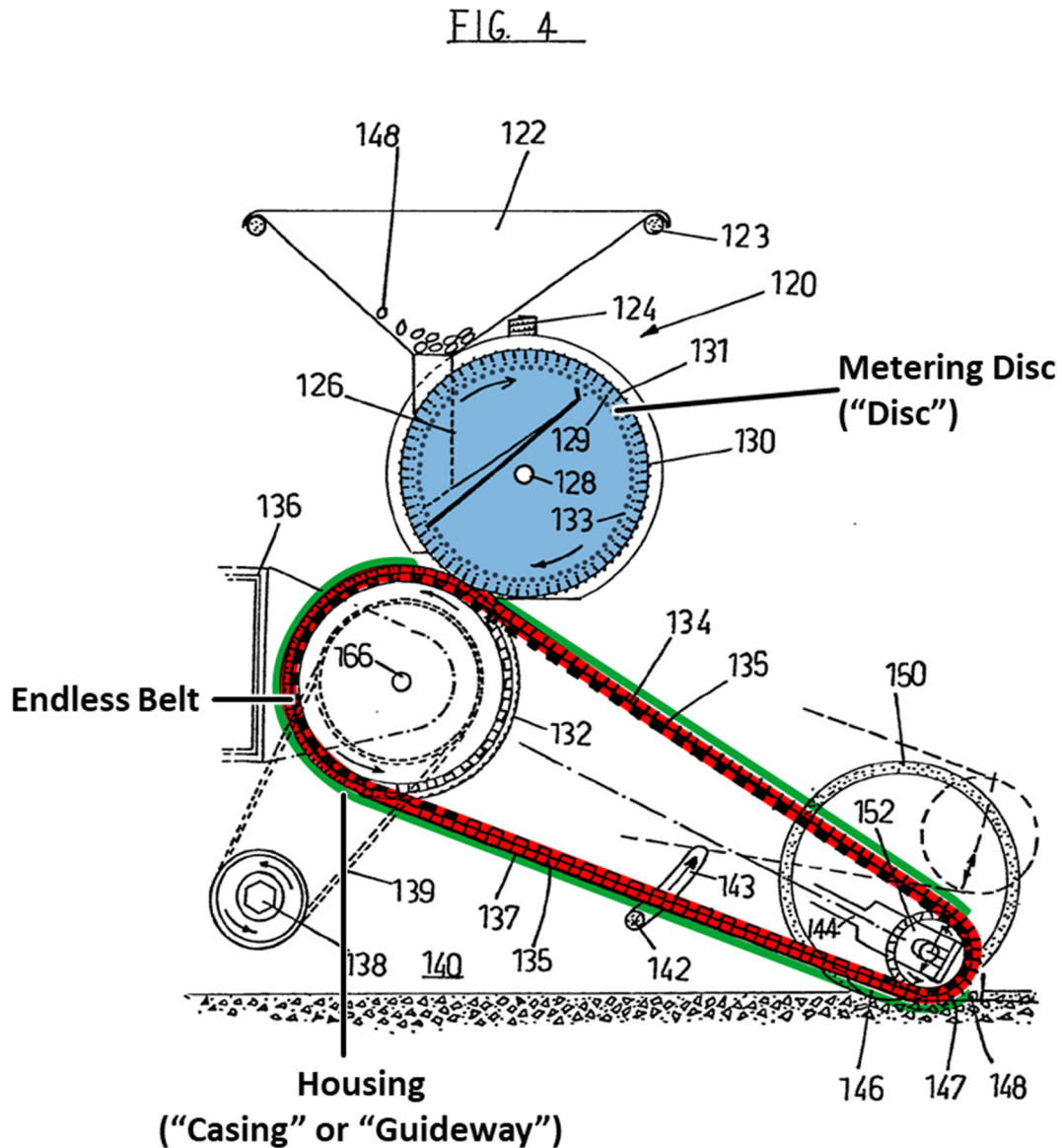
C. Dependent Claim 3

- i. Element 3[a]: “The seeding machine of claim 1 wherein the metering disk defines a first plane and the endless member defines a second plane substantially parallel to the first plane”**

112. As I discussed above, claim 1 would have been obvious in view of Hedderwick in combination with Benac and Koning. Claim 3 also would have been obvious in view of this combination. Specifically, Hedderwick's metering disk defines a first plane (the plane of the disk⁷) and Hedderwick's endless belt defines a second plane (the plane in which the endless belt rotates, which would be the same as the plane in which Koning's endless member rotates when it replaces Hedderwick's endless belt). Figure 4 of Hedderwick demonstrates that these planes are parallel to

⁷ Although not defined in the '663 patent, I interpret a “plane” as being the two-dimensional plane parallel to the disk or endless member that goes through the center of said disk or endless member.

each other, because both Hedderwick's seed meter (blue) and endless belt (red) are shown as rotating in the same "side elevational view":

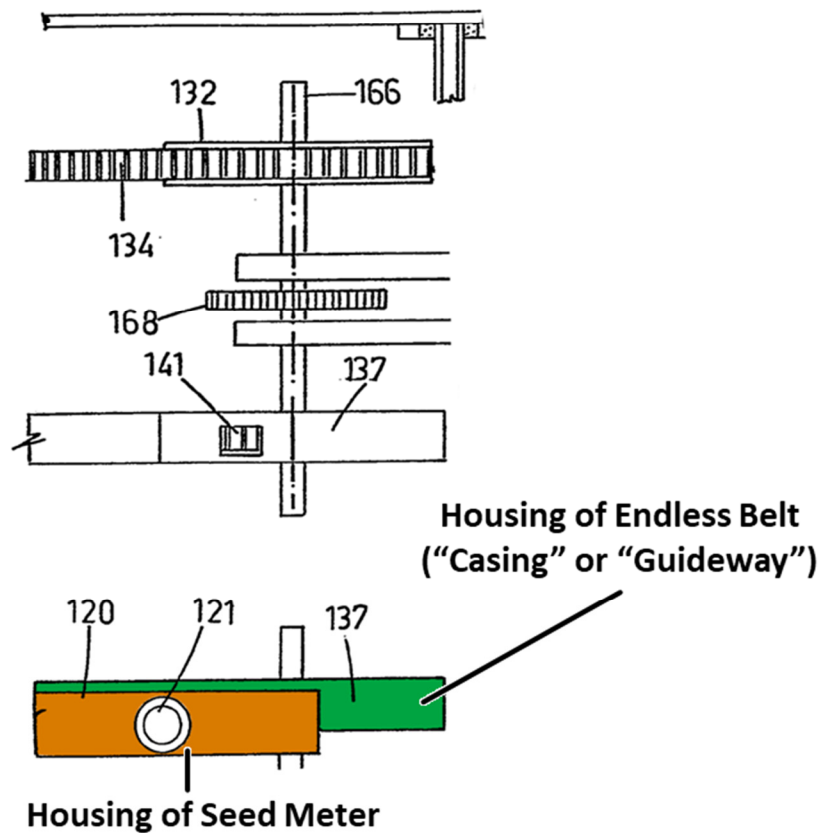


Ex. 1003-Hedderwick, Fig. 4, 1:108-110 ("Figure 4 is a side elevational view with

parts broken away of a seeder according to a second embodiment of the invention.”).

A person of ordinary skill in the art would recognize that the parallel planes in Hedderwick are offset from one another, as shown in Figure 5 of Hedderwick, below, which is a top view showing the housing (orange) of the seed meter 120 offset from the housing of the endless belt 137 (green) (*i.e.*, the seed meter housing is not directly on top of the housing):

FIG. 5



Ex. 1003-Hedderwick, Fig. 5. This is a logical and obvious arrangement because, in order for the seeds to be deposited in the center of the cells of the endless belt, the cells would have to be aligned with the seeds sitting on the surface of the face of the disk, and not with the center of the disk itself. *Id.*, 5:53-60 ("Seeds 148 are picked up

singly in orifices 129 and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137. The seed releasing means of disc 130 which is the same as that of the other embodiment of the invention releases single seeds through orifice 141 into a single cell formed by a pair of fins 135, the casing 137 and the belt 134.”), 5:60-63 (noting that the disk may use fins to “align[] seeds with a cell on the belt”). Therefore, the plane defined by the center of the endless belt as it rotates would be parallel to, but offset from, the plane defined by the center of the disk as it rotates.

113. For the same reasons, when combining the concepts of Koning and Hedderwick by replacing Hedderwick’s endless belt with Koning’s endless member, Koning’s endless member would define a second plane substantially parallel to the first plane defined by Hedderwick’s metering disk. *See* my discussion of the motivation to combine Hedderwick and Koning in Section VIII above.

ii. Element 3[b]: “The seeding machine of claim 1 ... wherein the loading wheel lies substantially in the second plane”

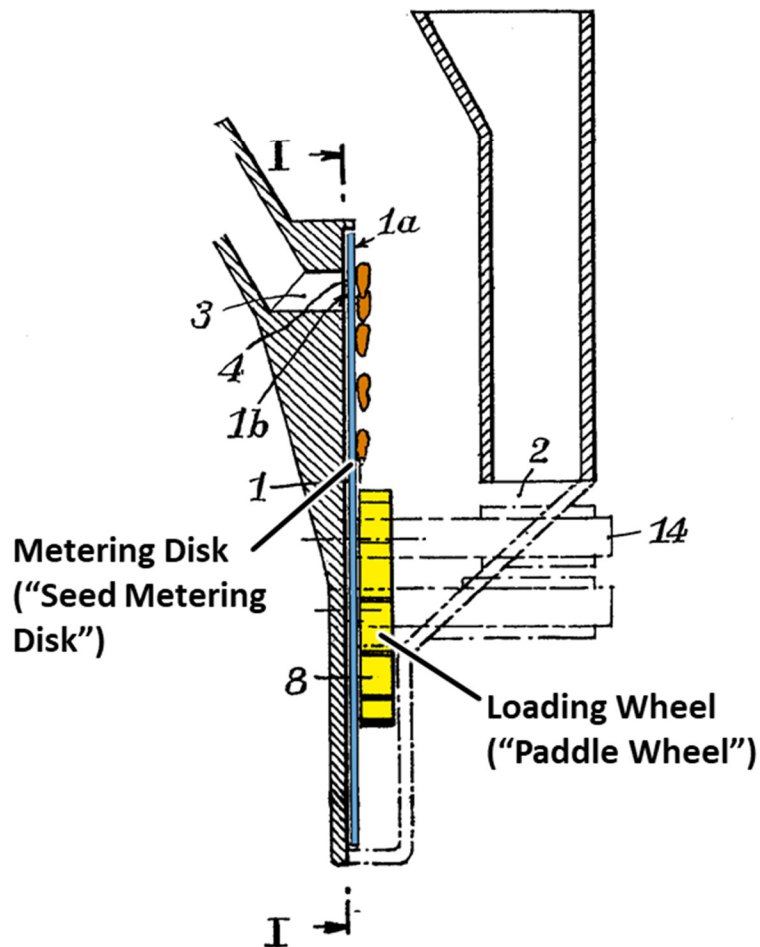
114. It would have been obvious that when combined with Hedderwick and Koning, Benac’s loading wheel would lie substantially in the second plane (the plane in which Hedderwick’s endless belt, or Koning’s endless member, rotates).

Hedderwick describes that its seed meter disc 130 rotates such that “the edge of [the]

disc 130 mates with orifice 141 through casing 137” surrounding its endless belt. Ex. 1003-Hedderwick, 5:53-56 (“Seeds 148 are picked up singly in orifices 129 and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137.”), 4:23-28 (“The major change in the seeder is the provision of an endless belt 134 which has a series of fins 135 projecting upwardly therefrom. This belt rides in a casing or guideway 137 and there is a define between the belt, the fins and the casing a series of moving cells, each of which carries a seed.”). Benac shows that its paddle wheel sits on the disk surface, as shown in Figures 1 and 2:



Fig. 2



Ex. 1005-Benac, Figs. 1, 2. When Benac's paddle wheel is added to Hedderwick's seed metering disk—according to the instructions in Benac as to its placement—the paddle wheel would be placed on the same surface of the disk as the seeds, and—like the seeds—would be in the same plane as the plane of endless belt. By placing

Benac's paddle wheel on the surface of the disk, it would ensure the seed is properly transferred by the paddle wheel into the endless belt through the "orifice 141" in the "casing 137." Ex. 1003-Hedderwick, 5:51-56 ("Disc 130 rotates in a clockwise direction in the embodiment shown in figure 4. Seeds 148 are picked up singly in orifices 129 and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137."). Accordingly, it would have been obvious to place the paddle wheel "substantially" in the second plane (*i.e.*, the plane in which Hedderwick's endless belt rotates, which would be the same plane when Koning's endless member is added). *See* my discussion of the motivation to combine Hedderwick and Benac in Section VIII above.

115. Also, as I noted above, the combination of Koning and Hedderwick shows an endless member that defines the second plane. *See* my discussion of Element 3[a] above.

D. Independent Claim 4

i. Element 4[preamble]: "A seeding machine, comprising"

116. In my opinion, claim 4 would have been obvious to a person of ordinary skill in the art. The preamble of claim 4 is the same as the preamble of claim 1. It is

therefore shown for the same reasons that I have stated above. *See* my discussion of Element 1[preamble] above.

- ii. **Element 4[a]: “a seed meter having a metering disk with a plurality of apertures in a circular array adapted to adhere seeds to the metering disk to move the seeds along a seed path as the metering disk rotates”**

117. Element 4[a] is the same as Element 1[a]. It is therefore shown for the same reasons that I have stated above. *See* my discussion of Elements 1[a] above.

- iii. **Element 4[b]: “a seed delivery system associated with said seed meter”**

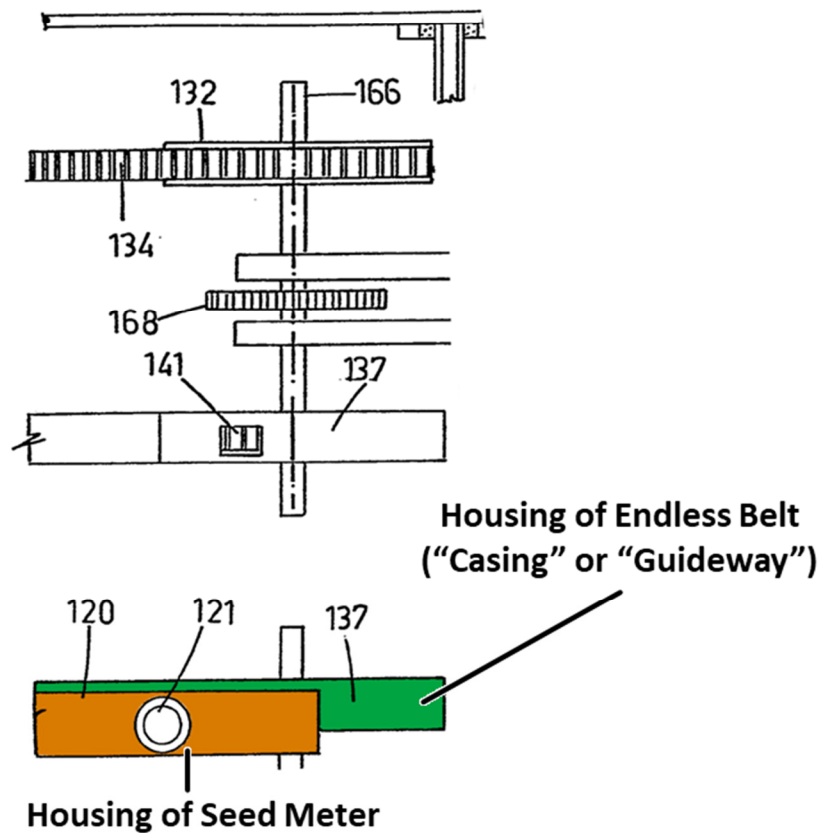
118. Element 4[b] is the same as Element 1[b]. It is therefore shown for the same reasons that I have stated above. *See* my discussion of Element 1[b] above.

- iv. **Element 4[c]: “said seed delivery system located transversely adjacent the metering disk”**

119. As I explained above, Hedderwick in combination with Koning shows a seed delivery system (Koning’s brush belt within Hedderwick’s casing/guideway) associated with a metering disk (Hedderwick’s metering disk). *See* my discussion of Elements 1[b] and 1[d] above and my discussion in Sections VII.A-B above. This combination also shows that it would have been obvious for the seed delivery system to be located transversely adjacent the metering disk. Specifically, Hedderwick describes that its endless belt is adjacent to the metering disk, and is in a different, but

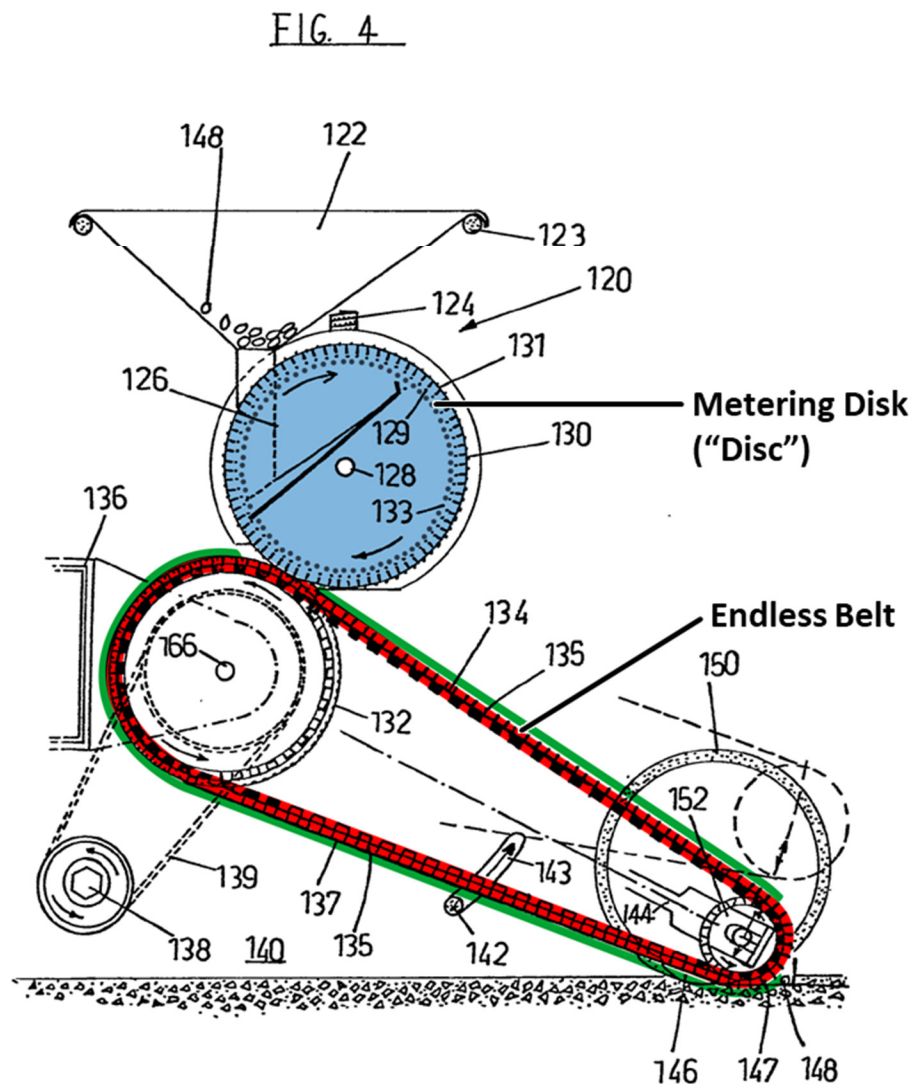
parallel, plane as the disk, where the second plane is offset in a direction that is cross-wise to the plane of the disk (and also the direction of travel of the planter). This is shown in Figure 5 of Hedderwick, below, which shows the housing (orange) of the seed meter 120 offset from, but parallel to, the housing of the endless belt 137 (green) (*i.e.*, the seed meter housing is not directly on top of the housing):

FIG. 5



Ex. 1003-Hedderwick, Fig. 5. *See also* my discussion of Element 3[a] above where I explain that Hedderwick shows that the plane of the endless belt and plane of the metering disk are parallel to, but offset from, one another.

120. In addition, Figure 4 shows that the seed disk and endless belt of Hedderwick are positioned in a direction that is cross-wise to the plane of the disk—just as in the '663 patent's Figure 3:



Ex. 1003-Hedderwick, Fig. 4, 1:108-110 (“Figure 4 is a side elevational view with parts broken away of a seeder according to a second embodiment of the invention.”), 4:1-5:5.

121. Upon combining the concepts of Koning and Hedderwick by replacing Hedderwick’s endless belt with Koning’s endless member, the resulting seed delivery system would similarly be transversely adjacent to the metering disk. *See my* discussion of the motivation to combine Hedderwick and Koning in Section VIII above.

- v. **Element 4[d]: “said seed delivery system ... including ... a housing for seed from said metering disk, the housing having a lower opening through which seed is discharged”**
- vi. **Element 4[e]: “said seed delivery system ... including ... a single endless member within said housing disposed around a first drive pulley and a second idler pulley”**
- vii. **Element 4[f]: “said endless member engaging seed from the seed meter”**

122. Elements 4[d]-4[f] are identical to Elements 1[c]-1[e] and are shown for the same reasons. *See my* discussion of Elements 1[c]-1[e] above.

viii. Element 4[g]: “said endless member ... in cooperation with the housing moving the seed to said lower opening where seed is discharged from said housing”

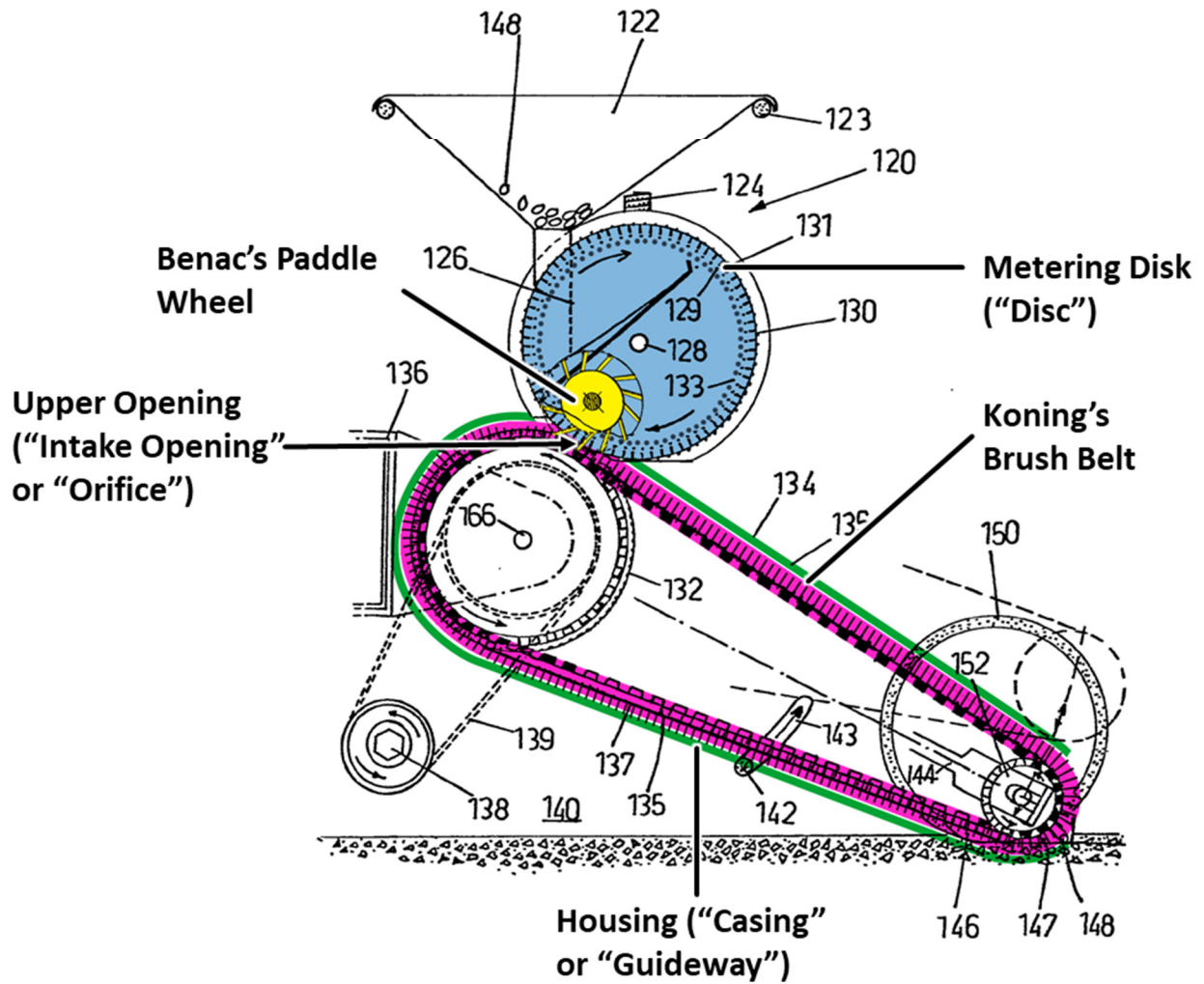
123. As I explained above, Hedderwick in combination with Koning shows an endless member (Koning’s brush belt) that in cooperation with the housing moves seed to the lower opening (Hedderwick’s discharge opening) where seed is discharged from the housing (Hedderwick’s casing/guideway). *See* my discussion of Elements 1[c]-1[e] above. Hedderwick describes that the endless belt (replaced by the endless member of Koning) is surrounded by the casing and that the casing helps “define” the cells that carry the seeds. Ex. 1003-Hedderwick, 4:25-28 (“This belt rides in a casing or guideway 137 and there is a define between the belt, the fins and the casing a series of moving cells, each of which carries a seed.”). By incorporating Koning’s endless member into Hedderwick’s planter, Koning’s endless member would cooperate with Hedderwick’s casing to move the seed to Hedderwick’s lower discharge opening. *See* my discussion of Elements 1[c]-1[e] above.

ix. Element 4[h]: “a loading wheel adjacent the housing upper opening engaging seeds adhered to the metering disk and moving along the seed path”

124. As I explained above, Hedderwick in combination with Benac shows a loading wheel (Benac’s paddle wheel) engaging seeds adhered to the metering disk

(Hedderwick's metering disk) and moving along the seed path. *See* my discussion of Element 1[f] above. The combination of Hedderwick and Benac further shows that the loading wheel (Benac's paddle wheel) is adjacent the housing upper opening (the "intake opening" or "orifice" in Hedderwick's casing/guideway): Benac describes that the paddle wheel is located where the seeds are intended to be released from the vacuum. Ex. 1005-Benac, 4:11-15 ("The casing 9 is open in its bottom part in a dropping zone 11 in which the seeds are dropped or projected toward the ground. The cells 10 of the paddle wheel therefore transport, one by one, the seeds released from the vacuum in the zone 7 just into the dropping zone 11."). And, Hedderwick describes that the vacuum is removed "just above the point where the edge of disc 130 mates with orifice 141 through casing 137" so that the seed can be transferred into a cell of the belt through the opening in the casing. Ex. 1003-Hedderwick, 5:53-56 ("Seeds 148 are picked up singly in orifices 129 and rotated to positions just above the point where the edge of disc 130 mates with orifice 141 through casing 137."). Accordingly, a when combining Benac's paddle wheel with Hedderwick's seeder, the paddle wheel would be located adjacent the "orifice 141 through casing 137"—the upper opening of the housing—as shown here:

FIG. 4



E. Dependent Claim 5

- i. Element 5[a]: “The seeding machine of claim 4 wherein the metering disk defines a first plane and the endless member defines a second plane substantially parallel to the first plane”**

125. As I discussed above, claim 4 would have been obvious in view of Hedderwick in combination with Benac and Koning. Since claim 5 is identical to claim 3, this claim also would have been obvious in view of the same combination for the same reasons. *See* my discussion of Element 3[a] above.

F. Independent Claim 6

126. In my opinion, claim 6 would have been obvious to a person of ordinary skill in the art.

- i. Element 6[preamble]: “A seeding machine, comprising”**
- ii. Element 6[a]: “a seed meter having a metering disk with a plurality of apertures in a circular array adapted to adhere seeds**

to the metering disk to move the seeds along a seed path as the metering disk rotates”

- iii. Element 6[b]: “a seed delivery system associated with said seed meter”**
- iv. Element 6[c]: “said seed delivery system including a housing for seed from said metering disk, the housing having a lower opening through which seed is discharged”**
- v. Element 6[d]: “said seed delivery system including a single endless member within said housing disposed around a first drive pulley and a second idler pulley”**

127. Elements 6[preamble]-6[d] are identical to Elements 1[preamble]-1[d] and are obvious for the same reasons. *See* my discussion of Elements 1[preamble]-1[d] above.

- vi. Element 6[e]: “said endless member engaging seed from the seed meter, entrapping the seed between the endless member and the housing, moving the seed to said lower opening as the endless member moves about the first and second pulleys and discharging the seed from said housing through the lower opening”**

128. As I explained above, Hedderwick in combination with Koning shows an endless member (Koning’s brush belt) engaging seed from the seed meter (Hedderwick’s seed meter disc), moving the seed to said lower opening (Hedderwick’s discharge opening) as the endless member moves about the first and second pulleys (Hedderwick’s drive and idler sprockets), and discharging the seed

from said housing (Hedderwick's casing/guideway) through the lower opening. *See* my discussion of Elements 1[c]-1[f] above. The combination also shows that the endless member (Koning's brush belt) entraps the seed between the endless member and the housing (Hedderwick's casing/guideway). For example, Hedderwick describes that "there is define[d] between the belt, the fins [of the belt], and the casing a series of moving cells, each of which carries a seed." Ex. 1003-Hedderwick, 4:25-28 ("This belt rides in a casing or guideway 137 and there is a define between the belt, the fins and the casing a series of moving cells, each of which carries a seed."). Accordingly, when the concepts of Hedderwick and Koning are combined, the seeds would be entrapped between Koning's brush belt and Hedderwick's casing. Ex. 1004-Koning, 3:12-18 ("According to the invention the conveying members can extend to a point just over the furrow and above the conveying surface of the conveying members can be provided a driven belt with brush hairs or the like, such that the brush hairs hold the potatoes or the like lying on the conveying surface till the moment that they leave the belt."). *See* my discussion of Element 4[g] above.

- vii. Element 6[f]: “a loading wheel adjacent the housing upper opening engaging seeds adhered to the metering disk and moving along the seed path”**

129. Element 6[f] is identical to Element 4[h] and is shown for the same reasons. *See* my discussion of Element 4[h] above and, in addition, my discussion of Elements 1[f] and 6[e].

G. Dependent Claim 7

- i. Element 7[a]: “The seeding machine of claim 6 wherein the metering disk defines a first plane and the endless member defines a second plane substantially parallel to the first plane”**

130. As I discussed above, claim 6 would have been obvious in view of Hedderwick in combination with Benac and Koning. Since claim 7 is identical to Element 3[a], this claim also would have been obvious in view of the same combination. *See* my discussion of Element 3[a] above.

H. Dependent Claim 8

- i. Element 8[a]: “The seeding machine of claim 7 wherein the loading wheel is substantially in the second plane”**

131. As I discussed above, claim 7 is obvious in view of Hedderwick in combination with Benac and Koning. Since claim 8 is substantively the same as Element 3[b]—the only difference being that claim 8 requires that “the loading wheel is substantially in the second plane” while Element 3[b] requires that the “loading

wheel lies substantially in the second plane”—this claim also would have been obvious for the same reasons. *See* my discussion of Element 3[b] above.

XI. AVAILABILITY FOR CROSS-EXAMINATION

132. By signing this Declaration, I recognize that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If a cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

XII. RIGHT TO SUPPLEMENT

133. I reserve the right to supplement my opinions in the future to respond to any arguments that the Patent Owner raises, as well as to take into account new information as it becomes available to me.

134. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the full knowledge that willful false

statements and the like so made are punishable by fine or imprisonment, or both,
under Section 1001 of Title 18 of the United States code.

Dated: May 29, 2019

A handwritten signature in black ink that reads "Douglas S. Prairie". The signature is written in a cursive, flowing style.

Douglas S. Prairie
Sioux Fall, South Dakota

Appendix A

Douglas S. Prairie

Address

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Sioux Falls, South Dakota 57105

Education

M.S. Mechanical Engineering with Business Emphasis, Boise State University, 2004
Project Paper: Design of a Conceptual Biodiesel Production Facility

B.S. Agricultural Engineering with Power and Machinery Focus, South Dakota State University,
1997

Professional Experience

2016 – present	Instructor for Ag Power and Machinery, Fluid Power, and Engineering Senior Design courses, South Dakota State University, Brookings, SD
2015-2016	Mechanical Research Manager for POET's Research and Innovation Group, POET Research, Sioux Falls, SD
2014-2015	North American Sales Manager of Precision Agricultural Technology, Raven Industries, Sioux Falls, SD
2010-2014	Product Manager of Planting, Seeding and Harvest Control Product Lines, Raven Industries, Sioux Falls, SD
2007-2010	Freelance Agriculture, Mechanical and Industrial Design Engineer, Prairie West LLC, Sioux Falls, SD
2003-2006	Construction/Mechanical Project Engineer of Industrial Processes, Bratney Companies, Boise, ID
2005-2007	Engineering Department Manager for Light Construction Equipment Manufacturer, Multiquip, Boise, ID
1996-2000	New Product Development Engineer for Planting and Seeding Division, Case Corporation
1996-1996	Product Testing, Ag-Chem Equipment Co., Jackson, MN

Patents

- Inventor on U.S. Patent # 5,915,312 & 6,047,652: *Pneumatic Seed Delivery System*
- Inventor on U.S. Patent # 6,116,172: *Shank Mounted Row Crop Opener*
- Inventor on U.S. Patent # 6,386,127 6,640,732 & 6,644,223: *Disc Opener for a Seed Planter*
- Inventor on U.S. Patent # 6,454,019: *Ag Implement Down Pressure System*
- Inventor on U.S. Patent # 7,497,522: *Concrete Saw Stay Level Handlebars,*
- Patent Pending: *Multi-Hybrid Planter Controls and Combine Yield Monitor Systems.*

Software

SST Summit, SMS, SolidWorks CAD and Simulation, MathCAD, Visio, PDM Works, Pro Engineer, AutoCAD, SAP R/3, AS400, Visual Basic, Working Model, Microsoft Office and Microsoft Project

Associations

- Member of FarmHouse Fraternity www.farmhouse.org
- Member of Society of Automotive Engineers www.sae.org
- Member of American Society of Mechanical Engineers www.asme.org
- Member of American Society of Agricultural and Biological Engineers www.asabe.org
- SolidWorks User Group