

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PRECISION PLANTING LLC

Petitioner,

v.

MASCHIO GASPARDO S.p.A.,

Patent Owner

IPR 2024-00008

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

REBUTTAL DECLARATION OF DR. MARK FLEMING

1. I am Dr. Mark Fleming and I work in Naperville, Illinois.
2. I previously submitted a declaration in support of Precision Planting LLC's petition for *inter partes* review of U.S. Patent No. 8,770,121. Since the Patent Trial and Appeal Board's institution of that IPR, I understand that Maschio Gaspardo has submitted various arguments and associated evidence responding to the petition for IPR, my declaration, and the Board's order instituting IPR of various claims of the '121 patent. This

declaration responds to factual assertions, opinions, and arguments made by Maschio Gaspardo, and particularly its witnesses Dr. Harry Dankowicz and Mr. Davide Locas, as well as positions taken by the Board in its order instituting IPR.

3. My qualifications explaining my education, training, and experience, listing of prior publications, and listing of prior cases in which I have testified at trial or by deposition are set forth in my previous declaration as well as the attached updated *curriculum vitae*, which are incorporated by reference in their entirety herein.
4. As with my initial declaration, although my time is billed at the rate of \$425 per hour for the time I spend on this matter, no part of my compensation is dependent on the outcome of this proceeding, and I have no other interest in the outcome of this case or the '121 patent.

Materials Considered

5. In addition to the material discussed or cited elsewhere in this declaration, my opinions contained in this declaration are informed by my education, training, and experience, as well as based upon my review of the following information:

- a. U.S. Patent No. 8,770,121 (Exhibit 1001)
- b. My original declaration and CV (Exhibits 1003 and 1018)
- c. The transcript of my deposition dated June 27, 2024 (Exhibit 2014)
- d. Fiorido, EP publication 0536543 (Exhibit 1007)
- e. VenHuizen, U.S. Patent No. 7,228,807 (Exhibit 1006)
- f. Amazone (Exhibit 1011)
- g. Patent Owner's Response to Petition for *Inter Partes* Review (Paper No. 17).
- h. Declaration of Dr. Dankowicz (Exhibit 2012)
- i. PTO Memo dated March 18, 2024 regarding examination of Means-Plus-Function limitations (Exhibit 2015)
- j. Declaration of Davide Locas (Exhibit 2013)
- k. Precision's IPR petition (Paper No. 2)
- l. The Board's IPR Institution Decision (Paper No. 12)
- m. Various dictionary excerpts (Exhibit 2016)
- n. U.S. Patent No. 9,127,708 (Exhibit 2017)

o. Joint Claim-Construction Brief Regarding U.S. Patent No. 8,770,121 (Document Number 57) filed in the District of Delaware on August 18, 2023 (Exhibit 1022).

p. Patent Owner Preliminary Response (Paper 7)

q. District Court's claim construction order and memorandum (Exhibit 2003, 2004)

r. Deposition transcript of Dr. Dankowicz

The Law of Means-Plus-Function Claim Construction

6. In its patent owner response, Maschio Gaspardo has taken a position that the “thrust-bearing element” limitation claimed in independent claims 1 and 10 of the '121 patent is a means-plus-function limitation. Although Maschio Gaspardo could have previously taken that position in the district court proceeding and in this proceeding when arguing about the claim construction of “thrust-bearing element” (See Exhibit 1022 at 42-56; Paper 7, at 26-28), they did not do so. Consequently, I have been informed of the various legal concepts related to determining whether a claim limitation is a means-plus-function limitation, the scope of a means-plus-function limitation, and the scope of equivalents of means-plus-function limitations.

7. I understand that 35 U.S.C. § 112(f) (2012) (formerly 35 U.S.C.A. § 112, ¶ 6), provides that “[a]n element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.” Claim limitations expressed in such a fashion are commonly referred to as “means-plus-function” claim limitations. Because means-plus-function claim limitations are limited to the corresponding structure disclosed in the patent specification, they are considered to be more restrictive and are generally entitled to a narrower scope of coverage than claim limitations not written in the means-plus-function format.
8. I further understand that determining whether a claim limitation is means-plus-function presents a question of law, since it relates to construing the claim. The test is whether or not the claim limitation recites, from the perspective of a POSA, definite structure that performs the claimed function. If a claim recites a function, but then goes on to elaborate sufficient structure, material, or acts within the claim itself to perform

entirely the recited function, the claim is not in means-plus-function format. In other words, to invoke § 112(f)/¶ 6, the alleged means-plus-function claim must *not* recite definite structure which performs the described function.

9. I further understand that, to be a sufficient recitation of structure to avoid application of § 112(f)/¶ 6, the recitation does not have to conjure in the mind of a POSA an *explicit* structure for carrying out the claimed function. Rather, a limitation has sufficient structure when it recites a claim term with a structural definition that is either provided in the specification or generally known in the art. In determining whether a claim limitation recites sufficient structure to avoid application of § 112(f)/¶ 6, a court looks at the claim limitation as a whole. Focusing on whether a single word in the limitation connotes sufficient structure generally invites error. Similarly, because the means-plus-function determination is an exercise in claim construction, the determination is not made by considering only the words of the claim. All intrinsic and extrinsic evidence relevant to claim construction should be considered. The recitation of structure in the claim need not recite every detail of structure disclosed in the specification as

performing the claimed function to avoid application of § 112(f)/¶ 6. The structure recited in the claim need only be sufficient to accomplish the claimed function.

10. I further understand that the use of the term “means” in a claim clause raises a rebuttable presumption that the applicant intended to draft a means-plus-function limitation. Likewise, the *lack* of the term “means” in a claim clause raises a rebuttable presumption that the applicant did not intend to draft a means-plus-function limitation. The party seeking to overcome the applicable presumption of whether a claim limitation is or is not means-plus-function, based on the presence or absence of the term “means,” must do so by a preponderance of the evidence.
11. I further understand that, if a claim element is construed to be means-plus-function, it does not cover every conceivable means of performing the claimed function. Instead, as the statute expressly specifies, a court may construe the limitation to encompass only the structure disclosed in the specification as performing the function, and its equivalents. The word “equivalents” as used in § 112(f)/¶ 6 should not be confused with the “doctrine of equivalents” in an infringement analysis. In applying the

doctrine of equivalents, the fact finder determines the range of equivalents to which the claimed invention is entitled in light of the prosecution history and the prior art. Then, it must be determined whether the *entirety* of the accused device is so substantially the same thing, used in substantially the same way, to achieve substantially the same result as to fall within the range of equivalents. By contrast, in applying § 112(f)/¶ 6, the sole question is whether the *single means* in the prior art reference that performs the function stated in the claim is the same as, or an equivalent of, the corresponding structure described in the specification as performing that function.

12. I understand that the doctrine of claim differentiation is a judicial doctrine that cannot supersede statutory requirements of construction when a means-plus-function claim limitation exists. That is to say, a means-plus-function limitation has a scope defined by the structure(s) clearly linked in the specification for performing the function.
13. I further understand that the March 18, 2024 Memorandum from the Commissioner of Patents entitled “Resources for Examining Means-Plus-Function and Step-Plus-Function Claim Limitations (35 U.S.C. 112(f))”

(Exhibit 2015) merely reminds patent examiners of available resources for examining means-plus-function limitations and reinforces the importance of properly interpreting such limitations and making a clear record of examiners' interpretations. Thus, the Memorandum and "does not present a change in practice for United States Patent and Trademark Office (USPTO) personnel" and, by extension, does not change the interpretation or application of any pre-March 18, 2024 statutory or case law discussed above regarding the construction of means-plus-function claim limitations.

"Thrust-Bearing Element" is Not Means-Plus-Function

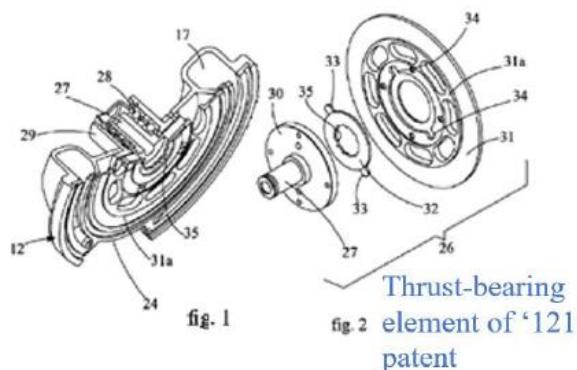
14. With the foregoing understanding of claim construction principles relating to determining whether claim limitations are means-plus-function, I conclude that the "thrust-bearing element" limitations of claims 1 and 10 of the '121 patent are not means-plus-function. First, "thrust-bearing element" is in fact a name for structure. In my first declaration I noted that "thrust-bearing element" should be understood to be broader in scope than a classic "thrust bearing" (no hyphen). This was based on the '121 patent's disclosure identifying the bracketed structure 26 as the "thrust-bearing element" as a whole: "a thrust-bearing element indicated as a whole by

26”. (Ex. 1001, 3:22-23). As shown below, none of the bracketed structure identified as 26 is a classic “thrust bearing” and therefore the claim language cannot be limited in scope to a classic “thrust bearing” as urged by Patent Owner to the district court in the co-pending proceeding (Ex. 1022 [D.I. 57] at 43-44, 50-52) or in Dr. Dankowicz’s disclosure (Ex. 2012, ¶55). Nevertheless, the claim phrase does connote a classification of structure to a POSA. A POSA would understand that to be a thrust-bearing element for a spinning disc that is exerting thrust in a known direction, a structure having a conforming surface area contacting the disc, and additional structure for transferring thrust to a fixture (i.e., the housing) where it will ultimately be absorbed would be required. Moreover, the word “bearing” of “thrust-bearing element” itself connotes resistance to force. Thus, a classification of structure is connoted or named by this phrase. Indeed, Dr. Dankowicz admits as much in his declaration (Ex. 2012, ¶55). While I might also have assumed as a POSA that the “thrust-bearing element” would include ball bearings in some form of a race, the inventor contradicted that instinct by his specific identification of the

structure that excludes those features as discussed below. Nevertheless,

“thrust-bearing element” here is a name for structure.

Traditional thrust bearing



15. The language of claims 1 and 10 convey sufficient structure to define the location, characteristic, extent, and function of the thrust-bearing element. Both independent claims of the '121 patent recite that the thrust-bearing element is an element “of the sowing disc.” (Ex. 1001, 4:37-6:3). The term “sowing disc” conveys structure, indeed, the term “disc” standing alone conveys structure. The claim language further teaches that the sowing disc:
- is “rotated by a motor-driven transmission drive shaft,” (Ex. 1001, 4:15-16, 5:7-8);

- is “interposed between the fixed and movable portions” of the housing of the seed distribution element and has “opposed surfaces delimiting the chambers,” (Ex. 1001, 4:24-26, 5:16-18);
- has “at least one ring of selector holes extending between the opposed surfaces,” (Ex. 1001, 4:27-28, 5:19-20);
- has a “facing surface” that is “capable of sliding contact” with “a seal which is arranged on the movable portion” of the housing when the two portions are closed against each other, (Ex. 1001, 4:29-32, 5:21-23).

This claim language establishes the structural environment in which the thrust-bearing element must operate and therefore imposes assumptions about the structure that must interact with it.

16. Even if “thrust-bearing element” was not a name for structure by itself, the remaining claim language in combination identifies that the thrust-bearing element is located in the movable portion, is supported rotatably, and its function is to withstand at least some of the axial load produced by the disc on the seal: “The thrust-bearing element is supported rotatably in the movable portion in order to withstand at least some of the axial load

produced by the disc on the seal” (4:38-40). A POSA would understand that this language connotes structure because a load must be absorbed in the movable portion of the housing, and the load will be absorbed by a rotatable structure that must transfer the load to a fixture to perform the required function. This clearly implies a spinning rigid structure that contacts the seed disc but nevertheless transfers the load to the housing. A finite number of structures are possible to accomplish this, and they will include a shaft connected to a rigid structure with a conforming surface area in contact with the seed disc. The shaft of the thrust-bearing element will rotate about its axis but must not translate. This rotation without translation requires a seat to support the shaft in a specific fashion. Additionally, the shaft by itself will not receive the thrust load from the seed disc unless there is a thrust-bearing plate coupled to the shaft that will interface with the seed disc. This connotes additional structure for receiving the thrust load from the seed disc and resisting the load with the seat.

17. Maschio Gaspardo’s expert Dr. Dankowicz stated in his disclosure that the term “element” of the “thrust-bearing element” is a generic place holder and is not modified by sufficient structure for performing the claimed

function (Ex. 2012, ¶50). Patent Owner has pointed out that during my deposition I agreed that the word “element” by itself is generic. But I was not asked about the language that surrounds the word “element”. To the extent that “element” is generic, the remaining language as described above tells a POSA what structure is required.

18. Thrust-bearing elements are described in the prior art, which further supports that the term connotes structure. The AAPA discloses a thrust-bearing element that relieves the heavy load on the seal and is described as being located in the fixed portion of the housing. Further, the AAPA thrust-bearing element is disclosed to be rotatable with the seed disc.

Even if “Thrust-Bearing Element” Is Means-Plus-Function, Maschio

Misidentifies the Linked Structure Defining the Scope Thereof

19. Even if it was concluded that “thrust-bearing element” of claims 1 and 10 of the '121 patent is a means-plus-function limitation, Maschio Gaspardo and its witnesses misidentify the corresponding structure identified in the specification.

20. The only embodiment shown in Fig. 2 identifies bracket part 26 as the thrust-bearing element: “a thrust-bearing element indicated as a whole by 26” (Ex. 1001, 3:22-23). Included within the brackets of thrust-bearing element 26 are parts 27, 30, 31, 31a, 32, 33, 34, and 35. The ’121 further teaches that the thrust-bearing element comprises a shaft 27: “The thrust-bearing element 26 comprises a shaft 27”. (Ex. 1001, 3:25). The ’121 teaches that the shaft 27 is rotatably mounted in a seat 29 of the movable portion 12 using bearings 28: “shaft 27 rotatably mounted by means of bearings 28 in a seat 29 of the movable portion 12.” (Ex. 1001, 3:25-27). The ’121 patent does not teach that the bearings 28, seat 29 or the movable portion 12 are part of the thrust-bearing element.

The ’121 patent does not teach that the shaft 27 of the thrust-bearing element 26 is capable of bearing thrust by itself. Instead, the shaft includes flanging 30 which is connected to a thrust-bearing plate 31 which bears on the surface of the seed disc: “The shaft 27 has flanging 30 by means of which it is fixed to a thrust-bearing plate 31 which can bear on that surface of the disc which faces the seal 24 in a zone radially inside the ring of holes 23 in order to withstand at least some of the axial load produced by the disc 16 on the seal 24.” (Ex. 1001, 3:27-32). If

the plate 31 is eliminated from the disclosed structure, nothing contacts the seed disc and the function of the thrust-bearing element will not be performed by the remaining structure. Likewise, the '121 patent discloses a drive element that ensures the plate will rotate with the seed disk.

VenHuizen Anticipates the Claims of the '121 Patent (Ground 1)

21. Maschio Gaspardo's expert Dr. Dankowicz admitted during his deposition that VenHuizen anticipates each and every challenged claim of the '121 patent if the Board does not adopt Maschio Gaspardo's proffered means-plus-function interpretation of the "thrust-bearing element" limitation. (Dankowicz dep., 89:9-19).
22. However, even if the Board does adopt Maschio Gaspardo's means-plus-function interpretation of "thrust-bearing element," VenHuizen still anticipates the properly defined scope of that limitation. I note that Dr. Dankowicz offers no analysis of whether VenHuizen's combination of a handle, hub, and shaft are within the scope of equivalents to the structure disclosed by the '121 patent to be a "thrust-bearing element".
23. As explained above, the disclosed structure of the thrust-bearing element for performing the claimed function includes the structure bracketed by

numeral 26 in Fig. 2. Under this construction the “thrust-bearing element” is still anticipated by VenHuizen. Like the ’121 patent, VenHuizen discloses a shaft (drive shaft 55) that holds a structure (handle 58) locked to the shaft (via hub 56) to ensure it spins with the seed disc and retains the disc against forces from the vacuum. The handle has a surface area in contact with the seed disc to resist axial load, spins with the seed disc because it is connected to the drive shaft through interlocking with the hub, and the shaft transfers the force absorbed by the handle to a fixture. Thus, the VenHuizen combination at least meets the function, way, result test as equivalent to the disclosed structure of the thrust-bearing element of the ’121 patent.

- a. The function of the thrust-bearing element is to constrain the movement of the seed disk when vacuum is applied thereby absorbing some of the forces that would otherwise have been applied to the seal: “thrust-bearing element is supported rotatably in the movable portion in order to withstand at least some of the axial load produced by the disc on the seal.” (Ex. 1001, 4:38-40). As shown above and admitted

by Dr. Dankowicz, the VenHuizen thrust-bearing element performs this function.

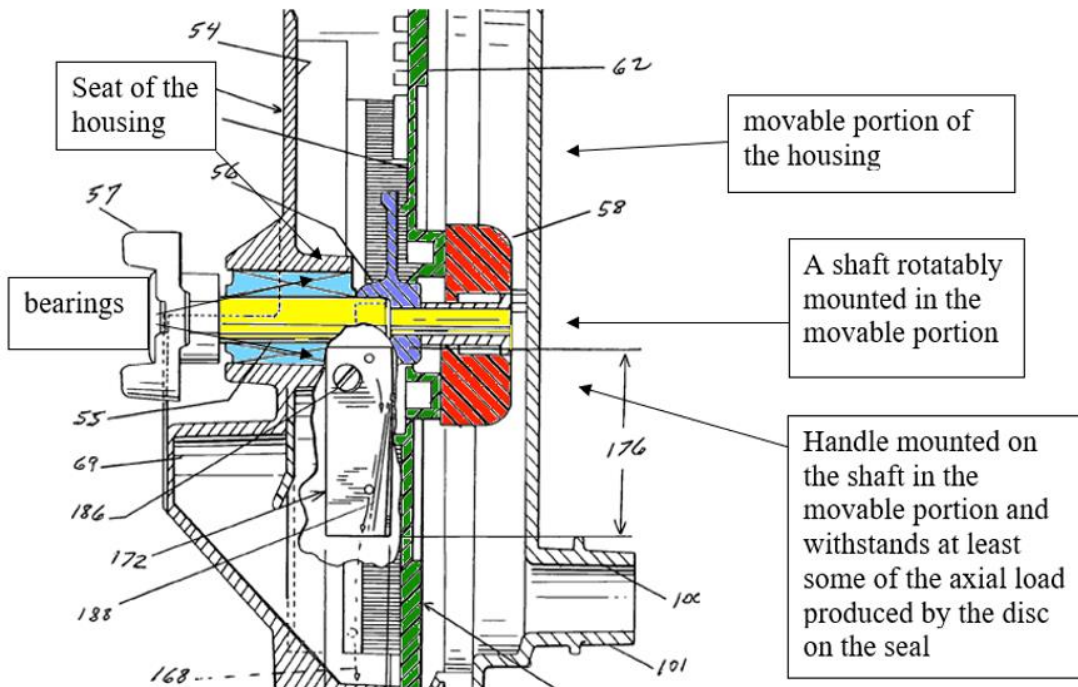
- b. The way this is accomplished is with a rotatable rigid structure located within the boundary defined by the peripheral seed holes to hold the disk from over exertion of forces on the seal and taking up some of the load by transferring that load to a fixture: “The thrust-bearing element 26 comprises a shaft 27 rotatably mounted by means of bearings 28 in a seat 29 of the movable portion 12. The shaft 27 has flanging 30 by means of which it is fixed to a thrust-bearing plate 31 which can bear on that surface of the disc which faces the seal 24 in a zone radially inside the ring of holes 23 in order to withstand at least some of the axial load produced by the disc 16 on the seal 24.” (Ex. 1001, 3:25-32). VenHuizen’s thrust-bearing element has each of these characteristics. The handle is a rotatable rigid structure locked by the hub to a shaft and located in the movable portion of the housing within a boundary defined by the peripheral seed holes. The handle holds the disk from over exertion of forces on the seal and takes up some of the load by transferring that load (via the shaft) to a fixture (the housing).

- c. The result is that some of the forces are applied to the rigid structure rather than the seal, thereby elongating the life of the seal: “thrust-bearing element is supported rotatably in the movable portion in order to withstand at least some of the axial load produced by the disc on the seal.” (Ex. 1001, 4:38-40). The VenHuizen thrust-bearing element obtains this result as even Dr. Dankowicz admits.
24. Dr. Dankowicz argues that the '121 patent defines the structure of the thrust-bearing element as bearings, a seat, and a shaft (Ex. 2012, para 51). Each of these components are also disclosed by VenHuizen. VenHuizen discloses a thrust-bearing element in the form of handle 58 in Fig. 6. The handle 58 is located in the movable portion. The handle 58 comprises a shaft (drive shaft 55 in Fig. 6) which is rotatably supported by bearings (represented by X's in Fig. 6¹) in a seat (first housing member 50 in Fig. 6). Even if Dr. Dankowicz's narrow identification of disclosed structure is adopted, the disclosed structure of VenHuizen is at least equivalent if not identical for the reasons described immediately above. In fact, the only true distinction between the shaft, bearings, and seat of the two disclosures is

¹ Agreed to by Maschio Gaspardo's expert Dr. Dankowicz (dep, p. 91).

that the shaft that transfers the axial force to relieve wear on the seal is in tension in VenHuizen versus in compression in the '121 patent. But the structures are performing the claimed function in substantially the same way (transfer load through the shaft to a fixture) to achieve substantially the same result (reduce the load on the seal to relieve the wear).

25. As explained above, even if Maschio Gaspardo’s means-plus-function definition of “thrust-bearing element” is adopted by the Board, each of the elements present in VenHuizen as shown below in an excerpt of Figure 6 of VenHuizen.



**Amazone in Combination with Fiorido and Applicant Admitted Prior Art
Renders Obvious the Challenged Claims**

26. As stated in my Declaration, Amazone explicitly disclosed every limitation in claims 1 and 10 except that it does not state whether the circular element contacts the singling disk. Dr. Dankowicz does not dispute the presence of any of the claim limitations in Amazone except for the thrust-bearing element (Ex. 2012, ¶83). The AAPA identifies the problem of seal wear. The Amazone manual itself identifies seal damage as an issue to be concerned about, and seal wear is a form of seal damage (see Figure below). Furthermore, the AAPA identifies a rotatable thrust-bearing element as a solution to the problem of seal wear: “seed drills have been developed which are equipped with a thrust-bearing element which relieves the heavy load on the seal.” (Ex. 1001, 1:53-55). Even though the AAPA identifies the thrust-bearing element as being on the fixed portion of the housing in the prior art, a POSA looking at Amazone would recognize or have a reason to modify Amazone with a thrust-bearing element to address the known seal wear issue. As stated in my disclosure, a POSA would modify the

circular element with the disclosure of Fiorido such that the circular element would contact the seed disk (Ex. 1003, ¶204).

Checking the following functional parts for damage, exchanging if necessary:

1. Singling disc (Fig. 227/1)
2. PE-foam profile sealing (Fig. 227/2)
3. Suction lid with suction kidney (Fig. 227/3)

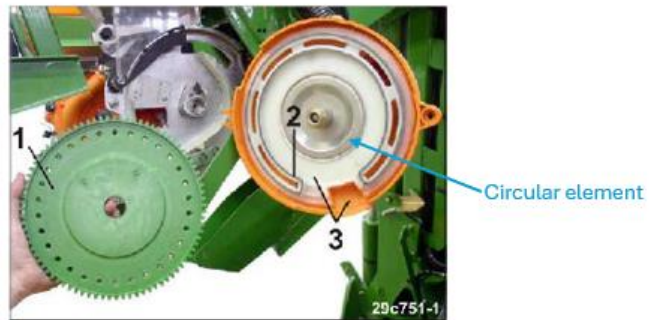
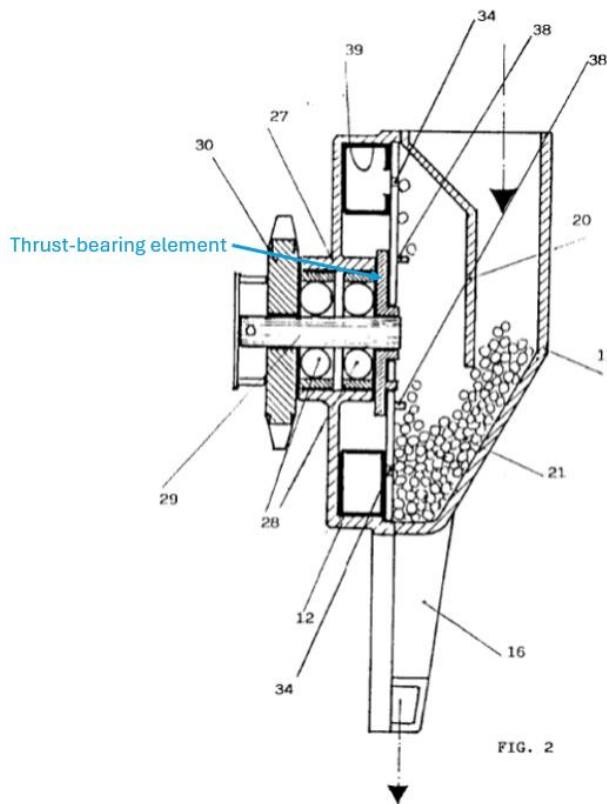


Fig. 227

27. Fiorido teaches a thrust-bearing element in the form of the driving disk on the seal side of the seed disk and in contact with the seed disk, therefore bearing some of the load of the seed disk on the seal. (Ex. 1007, Fig. 2).



28. The Amazone manual discusses the problem of seal damage (seal wear is a form of seal damage): (Ex. 1011, p. 166). The AAPA teaches that thrust-bearing elements have been used to relieve the heavy load on the seal: “seed drills have been developed which are equipped with a trust-bearing element which relieves the heavy load on the seal.” (Ex. 1001, 1:53-55). A POSA would be motivated to combine the structure of Fiorido (including the driving disk 31, rotatable shaft 29, centering dowel 32, driving pin 33, and bearings 28) of Fiorido with Amazone to relieve the heavy load on the seal

and alleviate seal damage. A POSA would know to seat the shaft in a bearing race, but no cog wheel or other drive elements are required because Amazone is powered through a peripheral gear drive (Ex. 1003, ¶193, Ex. 1011, Fig. 39).

Maschio Gaspardo's expert, Dr. Dankowicz, agreed that a POSA looking at Amazone would have a reason to address seal wear prior to the '121 patent. (Dankowicz dep, 136:23 – 137:3). He further agreed that rotatable thrust bearing elements had been a prior art solution to the problem of seal wear. (Dankowicz dep, 137: 4-7)

29. A POSA would have a reasonable expectation of success with this modification since it is a simple combination of concepts which already existed in the prior art. Maschio Gaspardo's expert, Dr. Dankowicz stated in his deposition that "These are not complicated things". (Dankowicz dep, 143:25). He further states a POSA would have had a reasonable expectation of success in modifying the driving disk, the shaft, and the bearings to act as a thrust-bearing element in Amazone. (Dankowicz dep, 147:2-20).

30. The Board has questioned if this would result in a thrust-bearing element supported rotatably in the movable portion. The answer is yes for the following reasons:

- a. Amazone has a seal on the movable side.
- b. Amazone has a circular element on the movable side, although the manual does not state whether the circular element contacts the singling (seed) disk.
- c. Fiorido has a thrust-bearing element on the same side of the seed disk as the seal.
- d. In view of the AAPA, a POSA would be motivated to modify the circular element of Amazone to rotatably contact the seed disk to provide the precise benefit explained in AAPA, namely to reduce seal wear.
- e. A POSA would have a reasonable expectation of success because the art recognized the need to use these basic structures (e.g., the thrust-bearing element and seal) in combination and the substituted parts would continue to work in the same manner to achieve the same function.

31. Thus, Amazone in combination with the teachings of Fiorido and AAPA renders obvious each challenged claim of the '121 patent.
32. Moreover, even if the Board concludes that “thrust-bearing element” is a means-plus-function limitation, Fiorido’s teaching is within the scope of equivalents thereof.
33. As explained above, a POSA would be motivated to modify the raised circular element of Amazone with the drive disk, drive pin, drive hub, rotatable shaft, bearings, and seat of Fiorido to address the known seal wear problem. Further, a POSA would have a reasonable expectation of success in making this modification which is straightforward and uses known structure that a POSA would understand could be used for this function. Indeed, Dr. Dankowicz agrees, testifying that a POSA would consider this modification to be very straightforward (Dankowicz dep, 147:2-20).
34. The structure proposed to modify Amazone is nearly identical to, and at least equivalent to, the disclosed structure from the '121 patent. As explained above, the disclosed structure of the thrust-bearing element for performing the claimed function includes the structure bracketed by numeral 26 in Fig. 2 of the '121 patent. Like the '121 patent, the proposed

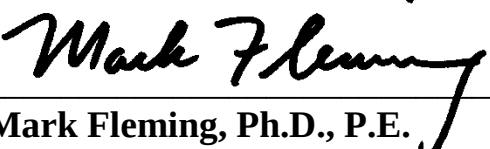
combination would include a shaft, which in combination with the drive disk, centering dowel, and pin, is the same as, or equivalent to, the shaft, flanging, drive element and plate of the '121 patent.

35. The modified structure would perform substantially the same function (withstand at least come of the axial load produced by the disc on the seal), in substantially the same way (a rotatable rigid structure located within the boundary defined by the peripheral seed holes to hold the disc from over exertion of forces on the seal and taking up some of the load by transferring that load to a fixture), to achieve substantially the same result (some of the forces are applied to the rigid structure rather than the seal).
36. Likewise, using Dr. Dankowicz's identification of disclosed structure for the thrust-bearing element, the proposed combination includes a thrust-bearing element that is identical or at least equivalent. Dr. Dankowicz identifies a shaft in combination with bearings and a seat. Fiorido discloses a shaft 29 that holds a structure (driving disk 31) and is seated in bearings 28. Thus, Amazone in combination with Fiorido and AAPA at least meets the function, way, result test as equivalent to the disclosed structure of the thrust-bearing element of the '121 patent. The function of the thrust-

bearing element is to constrain the movement of the seed disk when vacuum is applied thereby absorbing some of the forces that would otherwise have been applied to the seal: “thrust-bearing element is supported rotatably in the movable portion in order to withstand at least some of the axial load produced by the disc on the seal.” (Ex. 1001, 4:38-40). The Amazone/Fiorido combination obtains this function. The way this is accomplished is with a rotatable rigid structure located within the boundary defined by the peripheral seed holes to hold the disk from over exertion of forces on the seal and taking up some of the load by transferring that load to a fixture: “The thrust-bearing element 26 comprises a shaft 27 rotatably mounted by means of bearings 28 in a seat 29 of the movable portion 12. The shaft 27 has flanging 30 by means of which it is fixed to a thrust-bearing plate 31 which can bear on that surface of the disc which faces the seal 24 in a zone radially inside the ring of holes 23 in order to withstand at least some of the axial load produced by the disc 16 on the seal 24.” (Ex. 1001, 3:25-32). The Amazone/Fiorido combination uses a rigid disk (31) in combination with a shaft (29) that is rotated in a bearing race (28) and seat. The result is that some of the forces are applied to the rigid structure

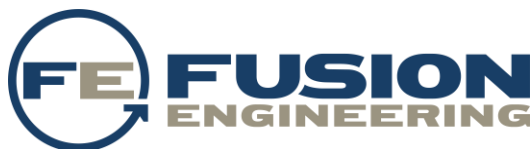
rather than the seal, thereby elongating the life of the seal: “thrust-bearing element is supported rotatably in the movable portion in order to withstand at least some of the axial load produced by the disc on the seal.” (Ex. 1001, 4:38-40). The Amazone/Fiorido combination obtains this result.

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



Mark Fleming, Ph.D., P.E.

Date: October 11, 2024



Mark Fleming, Ph.D., P.E.

Chief Technical Officer

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Dr. Mark Fleming, Chief Technical Officer for Fusion Engineering, LLC, is an experienced mechanical engineer specializing in engineering analysis and accident investigation for vehicles and other machines. He is a consultant for accident investigation and reconstruction, failure analysis, design review and evaluation of products, and machinery and product testing. Dr. Fleming has a Ph.D. in theoretical and applied mechanics studying fracture mechanics and computer simulation methods, a M.S. degree in theoretical and applied mechanics studying reliability and fracture mechanics, and a B.S. degree in mechanical engineering. Dr. Fleming is also an Adjunct Professor of Mechanical Engineering at Northwestern University, where he teaches finite element analysis. He is a licensed professional engineer in the state of Illinois and a member of the American Society of Mechanical Engineers (ASME) and Society of Automotive Engineers (SAE).

Profile

- **Stress Analysis:** Applies finite element analysis to compute stress, strain and deformation of mechanical structures.
- **Fracture Mechanics and Fatigue Analysis:** Analyzes effects of pre-existing flaws and cracks in a structure.
- **Vehicle Engineering and Fuel System Crashworthiness:** Conducts analysis of vehicles under service loads and crash loads. Analyzes the effects of vehicle structure, material selection, and crash energy effects on fuel system integrity.
- **Bolted and Welded Joint Design and Analysis:** Provides understanding of how bolts and welds perform in service and analyzes fracture of these components.

Education

Academic Degrees

- **Ph.D. in Theoretical and Applied Mechanics**, Northwestern University, Evanston, IL, 1997
- **M.S. in Theoretical and Applied Mechanics**, Northwestern University, Evanston, IL, 1994
- **B.S. in Mechanical Engineering**, University of Nebraska, Lincoln, Nebraska, 1992

Expertise Computer Specialization

- Finite element software: ABAQUS/Standard and Explicit, Optistruct, Hypermesh, LS-Dyna
- CAD software: Pro/Engineer, AutoCAD, Solidworks
- Programming Language: Matlab, Python
- Accident reconstruction software: EDCrash, EDSMAC, Simon

Expertise Equipment and Applications

Accident Investigation and Reconstruction	Fuel System Integrity
Agricultural Equipment	Off-highway equipment
Automotive Engineering	Machinery and Product Testing
Bolt Analysis	Product Design Review and Evaluation
Construction Equipment	Stress Analysis
Crashworthiness	Theoretical and Applied Mechanics
Fatigue and Fracture Mechanics	Vehicle Engineering
Finite Element Analysis	Weld Analysis

Experience

Engineering Analysis, Simulation and Testing/Machinery and Vehicles

- Performed accident investigation and reconstruction.
- Inspected and analyzed more than 100 vehicles involved in crashes.
- Conducted design analysis and reviews of products.
- Specialized in the analysis of rollover protective structures (ROPS) and topology optimization.
- Coordinated analysis activities for three product lines, including planning, budgeting, and holding analysis reviews.
- Developed and deployed advanced simulation technologies for the optimization of agricultural and construction machinery.
- Performed testing and finite element simulations in the analysis of design performance.
- Conducted machinery and product testing.
- Was responsible for a corporate-wide analysis team for manufacturing simulations ranging from manufacturing process simulations to factory layout and factory flow simulations.
- Worked with 20 factories worldwide providing analysis and solutions related to the manufacture of agricultural and construction equipment products.

Studies Professional Development

Technical:

- Reliability assessment for welded structures, 1999
- Probabilistic Analysis and Design: Computational Methods and Applications, 1999
- Operations research, 2000
- Logistics, 2000
- Fatigue design analysis with MSC.Fatigue, 2000
- Fatigue data analysis using nCode, 2003
- Vehicle Accident Reconstruction Methods, 2005
- HVE Introductory Training, 2005
- Fundamentals and Automotive Fuel Delivery Systems, 2007
- Vehicle Dynamics for Passenger Cars and Light Trucks, 2009
- Advanced Vehicle Dynamics for Passenger Cars and Light Trucks, 2011

Licenses Professional Registration

- Licensed Professional Engineer in Illinois (License No. 62057502)

Employment Roles and Responsibilities

Fusion Engineering, Naperville, IL **2014 to Present**

Principal Engineer

Consult on a broad range of products, equipment and structures in the areas of failure analysis, accident investigation and reconstruction, design review and evaluation, and machinery and product testing.

Northwestern University, Evanston, IL **2013 to Present**

Adjunct Professor of Mechanical Engineering

Teach Finite Element Analysis to graduate students.

Core faculty member in the Simulation Driven Engineering (SDE) program.

Research in manufacturing methods and multiscale methods for fatigue, fracture, and damage

ITC Experts, Inc., Sugar Grove, IL **2011 to 2014**

Senior Director of Mechanical Engineering

Manage projects in a broad range of products, equipment and structures for ITC Experts, Inc., a for-profit subsidiary of the Institute of Tribology and Coatings, Inc., which is an advanced Research and Development organization providing technical solutions to the military and industry.

Responsible for consultation in the areas of failure analysis, accident investigation and reconstruction, design review and evaluation, and machinery and product testing.

Packer Engineering, Naperville, IL

2003-2011

Senior Director, Mechanical Engineering

Performed accident investigation and reconstruction, product design review and evaluation, and machinery and product testing. Utilized finite element analysis for mechanical design evaluation and vehicle crashworthiness analysis.

CNH Global/Case Corporation, Burr Ridge, IL

1997-2003

Principal Engineer

Advanced Engineering Analysis - 2001-2003

Developed and deployed advanced simulation technologies for the optimization of agricultural and construction machinery. Specialized in vehicle dynamic shake simulations, particle flow methods, and optimization methods. Wrote methodology and “best practices” documents, taught analysis seminars, and coordinated software acquisition and usage.

Manager, Manufacturing Simulations - 2000-2001

Responsible for a corporate-wide analysis team for manufacturing simulations ranging from manufacturing process simulations to factory layout and factory flow simulations. Worked with 20 factories worldwide providing analysis and solutions related to the manufacture of agricultural and construction equipment products.

Engineering Analysis - 1997-2000

Specialized in analysis of rollover protective structures (ROPS) and topology optimization. Introduced a new technology to the design teams such as topology optimization, manufacturing process simulation, and reliability-based design analysis. Coordinated analysis activity for three product lines, including planning, budgeting, and holding analysis reviews.

Affiliations

Memberships

American Society of Mechanical Engineers (ASME)

Society of Automotive Engineers (SAE)

SAE Fire Safety Committee member

ASM International

United States Association for Computational Mechanics

Pi Tau Sigma, Tau Beta Pi (engineering honor societies)

Northwestern University Mechanical Engineering Advisory Board member

Publications:

1. "Fatigue Reliability Method with In-Service Inspections, M.S. Thesis (1994).
2. Belytschko T., Krongauz, Y., Fleming, J., Organ, D.J., and Liu, W.K., "Smoothing and Accelerated Computations in the Element-Free Galerkin Method," Journal of Computational and Applied Mathematics, 74:111-126 (1996).
3. Belytschko, T., Krongauz, Y., Organ, D., Fleming, M., and Krysl, P., "Meshless Methods: An Overview and Recent Developments," Computer Methods in Applied Mechanics and Engineering, 139:3-47 (1996).
4. Organ, D., Fleming, M., Terry, T., and Belytschko, T., "Continuous Meshless Approximations for Nonconvex Bodies by Diffraction and Transparency," Computational Mechanics, Volume 18, Number 3, 225-235 (1996).
5. "Meshless Methods of Fatigue Crack Propagation," PhD Thesis (1997)
6. Fleming, M., Chu, Y., Moran, B., and Belytschko, T., "Enriched Element-Free Galerkin Methods for Crack Tip Fields," International Journal for Numerical Methods in Engineering, 40:1483-1504 (1997).
7. Belytschko, T. and Fleming, M., "Smoothing, Enrichment and Contact in the Element-Free Galerkin Method," Computers and Structures, 71(2):173-195 (1999).
8. Roy, S. and Fleming, M., "Non-Linear Subgrid Embedded Element-Free Galerkin Method for Monotone CFD Solutions," Proceedings of the 3rd ASME/JSME FED Conference (1999).
9. Yi, T. and Fleming, M., "Dynamic Simulations for Self-Propelled Sprayer With a Large Flexible Boom," LMS Conference for Physical and Virtual Prototyping (2002).
10. Olson, J., Fleming, M., Krishnaswami, R. and Pellillo, R., "Fuel Filler System Check Valves – Dynamic Evaluation," SAE Technical Paper 2017-01-1350.
11. Liu, Z., Fleming, M., and Liu, W.K., "Microstructural Material Database for Self-consistent Clustering Analysis of Elastoplastic Strain Softening Materials," Computer Methods in Applied Mechanics and Engineering, 330:547-577 (2018).
12. Zhang, G., Guo, T., Guo, X., Tang, S., Fleming, M., and Liu, W.K., "Fracture in Tension-Compression-Asymmetry Solids via Phase Field Modeling," Computer Methods in Applied Mechanics and Engineering, 357 (2019).
13. Han, X., Gao, J., Fleming, M., Xu, C., Xie, W., Meng, S., Liu, W.K., "Efficient multiscale modeling for woven composites based on self-consistent clustering analysis," Computer Methods in Applied Mechanics and Engineering, 364 (2020).
14. Fleming, M., Krishnaswami, R., and Nakamoto, K., "Fuel Tank Strain Measurement using Computer Vision Analysis," SAE Technical Paper 2020-01-0924.

15. Tang, S., Yang, H., Qui, H., Fleming, M., Liu, W.K., Xu, G., "MAP123-EPF: A mechanistic-based data-driven approach for numerical elastoplastic modeling at finite strain," Computer Methods in Applied Mechanics and Engineering, 373 (2021).
16. Liu, W.K., Z. Gan, M. Fleming, *Mechanistic Data Science for STEM Education and Applications*, Springer, January 2022.
17. Huang, H., Mojumder, S., Suarez, D., Al Amin, A., Fleming, M., Liu, W.K., "Knowledge database creation for design of polymer matrix composite," Computational Materials Science, accepted for publication (2022).

Presentations:

1. "Design and Analysis for Optimizing Manufacturing Processes," Design Engineering Conference at National Manufacturing Week (March 18-21, 2002).
2. "Manufacturing Simulations," Northwestern University (October 2000).
3. "Elemento Finitos Sin Malla," Universidad Politecnica de Madrid, Madrid, Spain (December 1996).
4. "The Element-Free Galerkin Method for Fatigue Crack Propagation," University of Nebraska, Lincoln, Nebraska (April 1996).
5. "There is a Substitute – Engineering Perspective on the Use of Computer Simulations," ACMIE SLG Workshop, DRI, Las Vegas, NV (February 2006).
6. "The Good, the Bad, and the Ugly – Computer Simulations for Product Development, Failure Analysis, and Mischief," ASM Material Science and Technology 2006 Conference and Exhibition, Cincinnati, OH (October 2006).
7. "Finite Element Analysis in Products Litigation: What you See is Nice, What's Covered is Vital," E.M. Caulfield, M. Fleming, and K. Schiferl, ABA 2008 Emerging Issues in Motor Vehicle Product Liability Litigation, Phoenix, AZ (April 2008).
8. "A New Approach to an Old Topic – Using Finite Element Analysis to Analyze Spot Weld Claims in Crashworthiness Cases," M. Fleming and A. Jones, ABA 2009 Emerging Issues in Vehicle Product Liability Litigation, Phoenix, AZ (April 2009).
9. "Science and Engineering: from Theory to Application", Arantzazu Alarcon-Fleming and Mark Fleming, North Central College Science Seminar, Naperville, IL (May 2011).
10. "Investigating Fires Involving Plastic Fuel Tanks: The Problem with Self-Consuming Evidence", P.W. Miles IV and M. Fleming, ABA 2013 Emerging Issues in Motor Vehicle Liability Litigation, Phoenix, AZ (April 2013).
11. "Fatigue Fracture Analysis using XFEM Combined with Fracture Surface Analysis", M. Fleming and K. Jones, *Advances in Computational Mechanics with Emphasis on Fracture and Multiscale Phenomena workshop honoring Professor Ted Belytschko's 70th Birthday*, Evanston, IL (April 2013).

12. "Computational Methods for Evaluating Variability in Optimization and Product Performance Evaluation", Key Note Presentation, M. Fleming, Symposium: Multidisciplinary Computer-Aided Design and Simulation-Based Optimization – Recent Applications and Future, Evanston, IL (December 2014).
13. "Investigation of an Automotive Spring Fatigue Fracture with Abaqus XFEM", ASM Material Science & Technology 2015 Conference, Columbus, OH (October 7, 2015).
14. "Elastic Cloud Based Make – A New Frontier for Manufacturing Optimization", M. Fleming, Symposium: Multidisciplinary Computer –Aided Design and Simulation-Based Optimization – Recent Applications and Future, Sponsored by Northwestern University and Altair Engineering, Evanston, IL (December 2016).
15. "Multiscale Analysis Methods for Failure Analysis: Industry and Research Perspective", M. Fleming, WCCM 2018 Short Course: Mechanistic Data-Driven Multiscale Analysis and Applications, New York City, NY (July 2018).
16. "Mechanistic Data Science and Computer Vision for Forensic Engineering", M. Fleming, T. Bundorf, K. Nakamoto, MMLDT-CSET, San Diego, CA (September 2021).
17. "Mechanistic Data Science (MDS) for STEM Education and Applications", short course presented at MMLDT-CSET, San Diego, CA (September 2021).

End of CV

Trial/Deposition Testimony
for
Mark A. Fleming

Project Name: Crume, Allison D. and Lonnie J. v WSDOT
Case Number: 17-2-05188-34
Location: Superior Court of Washington for Thurston County
Date: December 18, 2019
Deposition

Project Name: Tyler, Angel v Ford Motor Company
Case Number: 18-C-182
Location: Circuit Court of Kanawha County, West Virginia
Date: December 11, 2020
Deposition

Project Name: Wheeler, George v Ford Motor Company
Case Number: 8:19-CV-02-132-DCC
Location: United States District Court, District of South Carolina, Anderson Division
Date: August 27, 2021
Deposition

Project Name: Thompson, Nancy and Weibin Lam v Joe-K Used Cars and GM
Case Number: 1922-CC10777-02
Location: Circuit Court of the City of St. Louis, State of Missouri
Date: November 17, 2021
Deposition

Project Name: Smage, Sarah v Zero Motorcycles and Feld Motor Sports
Case Number: 17cv6355
Location: United States District Court for the Northern District of Illinois
Date: January 14, 2022
Deposition

Project Name: Deere & Co. v Agco Corporation
Case Number: 18-827 (CFC)
Location: United Stated District Court for the District of Delaware
Date: February 16, 2022
Deposition

Project Name: Tyler, Angel v Ford Motor Company
Case Number: 18-C-182
Location: Circuit Court of Kanawha County, West Virginia
Date: May 12-13, 2022
Trial

Project Name: Tolle v AGL
Case Number: 19CV-181
Location: Superior Court of Clinch County, Georgia
Date: June 23, 2022
Deposition

Project Name: Deere & Co. v Agco Corporation
Case Number: 18-827 (CFC)
Location: United Stated District Court for the District of Delaware
Date: July 7, 2022
Trial

Project Name: Smage, Sarah v Zero Motorcycles and Feld Motor Sports
Case Number: 17cv6355
Location: United Stated District Court for the Northern District of Illinois
Date: July 21, 2022
Deposition

Project Name: Graham (Matilda) v Buchheit Trucking Service, Purcell Tire
Case Number: 20CL-CC00018
Location: Circuit Court of Caldwell County, Missouri
Date: August 30, 2022
Deposition

Project Name: Bustos/Salazar v Robert Jesus Lucero, et al
Case Number: D-412-CV-2016-00072
Location: County Court of San Miguel, New Mexico
Date: November 17, 2022
Deposition

Project Name: Hetsler v Ford Motor Company, Roush Performance, World Imports
Case Number: 16-2020-CA-002410
Location: Fourth Judicial Circuit, Duval County, Florida
Date: March 8, 2023
Deposition

Project Name: Cappel v Sage Parts, Inc., et al
Case Number: 2:21-CV-01928
Location: United States District Court for the Eastern District of Pennsylvania
Date: June 16, 2023
Deposition

Project Name: Parish v Ford Motor Company
Case Number: 03-CV-2019-900896
Location: Circuit Court for Montgomery County, Alabama
Date: August 25, 2023
Deposition

Project Name: Hetsler v Ford Motor Company
Case Number: 16-2020-CA-002410
Location: Fourth Judicial Circuit, Duval County, Florida
Date: February 15, 2024
Trial

Project Name: Alailefaleula v FCA
Case Number: A-22-854317-C
Location: Eight Judicial District Court, Clark County, Nevada
Date: April 25, 2024
Deposition

Project Name: Loyal v Ford
Case Number: 19 CVS 1486
Location: General Court of Justice, Superior Court Division, Orange County, North Carolina
Date: May 23, 2024
Deposition

Project Name: Brogdon Mills v Ford
Case Number: 4:23-cv-00088-CDL
Location: United States District Court, Middle District of Georgia, Columbus Division
Date: June 12, 2024
Deposition

Project Name: Precision Planting v Maschio Gaspardo
Case Number: IPR2024-00008
Location: United States Patent and Trademark Office Before the Patent Trial and Appeal Board
Date: June 27, 2024
Deposition

Project Name: Amber Hall-January v Ford Motor Company and Missouri
Highways and Transportation Commission

Case Number: 23DG-CC00045

Location: Circuit Court of Douglas County, Missouri

Date: July 26, 2024

Deposition

Project Name: Marr v Ford

Case Number: CIV2103904

Location: Superior Court of the State of California for the County of
Marin

Date: August 16, 2024

Deposition

Project Name: Yraguen v Ford

Case Number: 6:23-cv-01366AA

Location: United States District Court District of Oregon Eugene Division

Date: August 21, 2024

Deposition