

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

KUBOTA NORTH AMERICA CORPORATION,
Petitioner,

v.

VERMEER MANUFACTURING COMPANY,
Patent Owner.

IPR2025-00381
U.S. Patent No. 11,465,891

**DECLARATION OF MARK FLEMING, Ph.D., P.E. IN SUPPORT
OF PATENT OWNER'S RESPONSE TO PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 11,465,891**

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I, Mark Fleming, Ph.D., P.E., declare as follows:

I. INTRODUCTION AND QUALIFICATIONS

1. I have been retained by Patent Owner Vermeer Manufacturing Company (“Vermeer”) to provide technical analysis and opinions relating to U.S. Patent No. 11,465,891 (“the ‘891 Patent”) in this proceeding.

2. I am currently the Chief Technical Officer and a Principal Engineer at Fusion Engineering, LLC in Naperville, Illinois, which is a multidisciplinary engineering consulting and technical services company that offers a wide range of engineering services, including engineering analysis, testing, design and manufacturing review, and consulting services to a variety of clients. This includes the analysis of machinery for construction, agriculture, mining, and material handling, as well as other machinery designed for lifting using linkages and hydraulics.

3. I am also currently an adjunct professor of mechanical engineering at Northwestern University in Evanston, Illinois, where I teach undergraduate and graduate level courses on finite element analysis, failure analysis, and mechanistic data science. I also perform research on multiscale methods for engineering analysis.

4. Prior to joining Fusion Engineering, I was Senior Director of Mechanical Engineering at ITC Experts, Inc. in Sugar Grove, Illinois from 2011 to

2014. From 2003 to 2011, I was Senior Director of Mechanical Engineering at Packer Engineering, Inc. in Naperville, Illinois. Both ITC and Packer Engineering were multidisciplinary engineering consulting companies. As part of my consulting engineering practice, I performed design analysis of construction, agricultural and industrial equipment, including a structural design review of large mining trucks, rollover protection structure and falling object protection structure analysis of mining and industrial equipment, structural and fracture analysis of aerial lift equipment, and fracture analysis of construction equipment loader arms and power train components.

5. Prior to working at Packer Engineering, Inc., I was a design and manufacturing engineer at CNH (formerly Case Corporation) in Burr Ridge, Illinois from 1997 to 2003. CNH designs and manufactures off-highway equipment for agricultural and construction use, including skid steer loaders and track-type vehicles. During my time at CNH, I participated in the design development of skid steer loaders, including the structure, loader arms, bucket assemblies, and controls. I was also the manager of a manufacturing simulations group. In that position, I collaborated with manufacturing plants around the world.

6. I have been a registered professional engineer in the state of Illinois (license # 062.057502) since 2004.

7. I received a Bachelor of Science degree in Mechanical Engineering from the University of Nebraska in 1992. As part of my education, I took courses on machine design and kinematics, and manufacturing processes and techniques. I received a Master of Science degree in Theoretical and Applied Mechanics from Northwestern University in 1994 and a Doctor of Philosophy degree in Theoretical and Applied Mechanics from Northwestern University in 1997. I am also a member of the Pi Tau Sigma mechanical engineering honor society and the Tau Beta Pi engineering honor society.

8. I am currently a member of the American Society of Mechanical Engineers (ASME), the Society of Automotive Engineers (SAE), ASM International, and the United States Association for Computational Mechanics (USACM). I am also a member of the Northwestern University Mechanical Engineering Advisory Board.

9. Through my education, background, and work experience, I have developed a thorough understanding of machine design and manufacturing. Based on my education, training, knowledge, and professional experience, I am fully qualified to testify regarding the subject matter described and claimed in the '891 Patent.

10. My *curriculum vitae*, which includes a list of my publications, presentations, and prior testimonial matters, is attached as Appendix A to this Declaration.

II. MATERIALS CONSIDERED

11. I have been asked to analyze claims 1–10 (the “Challenged Claims”) of the ‘891 Patent.

12. In forming my opinions expressed in this Declaration, I have reviewed and considered the documents and materials identified in Appendix B to this Declaration.

13. I have further relied on my education, skill, training, and experience in the field of agricultural and construction machinery and equipment in forming my opinions. I have also considered the viewpoint of a person of ordinary skill in the art (“POSITA”) at the time of the effective filing date of the ‘891 Patent.

14. I reserve the right to supplement my opinions in this Declaration to address any new information obtained in the course of this proceeding or based on any new positions taken by the Petitioner Kubota North America Corporation (“Kubota”).

III. COMPENSATION

15. Fusion Engineering is charging an hourly rate of \$450 for my services in this matter. My compensation is not dependent on the outcome of this proceeding and does not affect the substance of my statements and opinions in this Declaration.

16. As far as I am aware, neither myself nor Fusion Engineering have any financial interest in Kubota, Vermeer, or the '891 Patent. I also have no other conflicts of interests relating to Kubota, Vermeer, or the '891 Patent.

IV. SUMMARY OF OPINIONS

17. I have been asked by counsel for Vermeer to provide my opinions regarding whether the Challenged Claims would have been obvious to, or anticipated by, a POSITA in light of the alleged prior art.

18. Based on my review of the '891 Patent, the file history of the '891 Patent, the alleged prior art, and the other documents identified in Appendix B, and relying on my education, skill, experience, common sense, and expertise in the field of agricultural and construction machinery and equipment, it is my opinion that the Challenged Claims would not have been obvious to a POSITA. The bases for my opinions are detailed throughout this Declaration.

V. LEGAL PRINCIPLES

19. Vermeer's counsel has provided me certain legal principles that I have applied in this proceeding. My analysis and opinions were developed based on the following legal principles.

20. It is my understanding that in this proceeding, the '891 Patent claims priority to Provisional Application No. 62/118,860, filed on February 20, 2015. For purposes of this Declaration, I have been asked to apply February 20, 2015 as the earliest effective filing date for the '891 Patent.

21. I understand that a patent claim is unpatentable as anticipated under 35 U.S.C. § 102 if a single prior art reference expressly or inherently describes each element of the claimed invention. I understand that for a feature to be inherently present in a prior art reference, the feature must necessarily be present. I also understand that this description must be sufficiently detailed to allow a POSITA to practice the claimed invention without undue experimentation. Finally, to anticipate, the reference must disclose not only all the limitations of the claim but also all the limitations arranged or combined in the same way as recited in the claim.

22. I understand that a patent claim is unpatentable as obvious under 35 U.S.C. § 103 if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious to a POSITA before the effective filing date of the claimed invention.

23. I understand that in conducting an obviousness analysis, one must consider (1) the scope and content of the prior art, (2) the differences between the prior art and the claimed invention, (3) the level of ordinary skill in the art as of the

earliest effective filing date, and (4) any additional considerations that may indicate the invention was obvious or not obvious.

24. I further understand that a claim may be found obvious in view of a single prior art reference or from a combination of two or more prior art references. I understand that an invention is obvious if a POSITA would have had a reason to make the invention and a reasonable expectation of success in so doing.

25. I have been informed that when relying on a combination of prior art references to establish obviousness, it is necessary to show: (1) that the claim elements were known in the prior art and (2) that a skilled artisan would have been motivated to combine these known elements.

26. To qualify as prior art, a reference must qualify as “analogous art.” A reference is considered analogous if it is from the same field of endeavor or is reasonably pertinent to the particular problem with which the inventor is involved. A reference is reasonably pertinent if it, as a result of its subject matter, logically would have commended itself to an inventor’s attention in considering the problem.

27. It is also my understanding that a patent claim can be obvious in light of a single prior art reference if it would have been obvious to modify that reference. I understand that common sense and common knowledge can be considered in determining whether it would have been obvious to modify a prior art reference if

supported by evidence and a reasoned explanation and a POSITA would have been motivated to make such a modification.

28. I understand that if a proposed modification would render the invention inoperable for its intended purpose, a POSITA would not have been motivated to combine the references.

29. I also understand that if a prior art reference teaches away from making the modification, this supports a conclusion that a POSITA would not have found the claimed invention to be obvious. The same conclusion applies where the proposed modification would make the invention more complex, less efficient, or otherwise “yield an unappetizing combination.” When considering whether a POSITA would be motivated to modify a primary reference or combine it with a secondary reference, one weighs benefits lost by the proposed modification or combination against the benefits gained.

30. I further understand that there are certain secondary considerations that must be considered when evaluating the obviousness or non-obviousness of a claimed invention. I understand that such secondary considerations include: (i) commercial success of the patented invention, (ii) skepticism of those having ordinary skill in the art at the time of invention, (iii) unexpected results of the invention, (iv) any long-felt but unsolved need in the art that was satisfied by the alleged invention, (v) the failure of others to make the alleged invention, (vi) praise

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of the alleged invention by those having ordinary skill in the art, and (vii) copying of the alleged invention by others in the field.

31. I have been informed that there must be a nexus between any such secondary consideration and the alleged invention.

VI. U.S. PATENT NO. 11,465,891

A. Overview of the ‘891 Patent

32. The ‘891 Patent is titled “LOADER APPARATUS CONFIGURED FOR STANDING OPERATOR CONTROL.” Ex. 1001 at Cover Page. The Abstract indicates that the ‘891 Patent is directed to a “[l]oader apparatus configured for standing operator control.” *Id.* at Abstract.

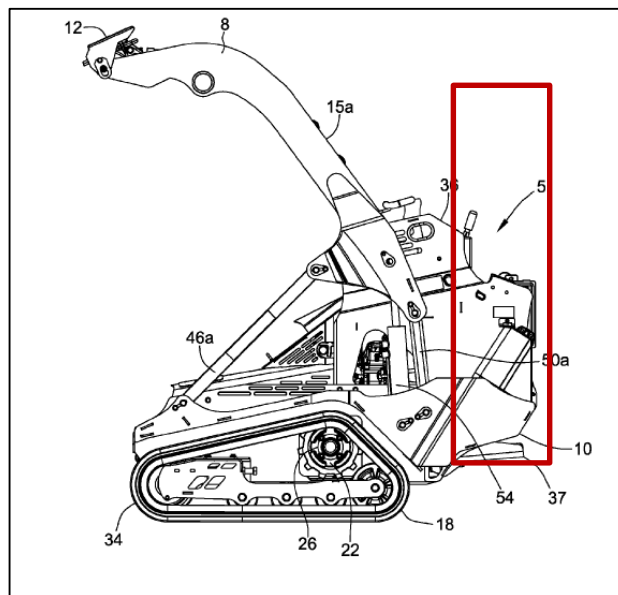
33. The ‘891 Patent was filed on August 9, 2021 and issued on October 11, 2022. *Id.* at Cover Page. The ‘891 Patent claims priority to Provisional Application No. 62/118,860, which was filed on February 20, 2015. *Id.* at Related U.S. Application Data.

34. Throughout this Declaration, I will be using the following terms interchangeably unless otherwise stated: loader apparatus, compact tool carrier, compact utility loader, mini skid steer, and mini track loader.

35. Compact tool carriers generally differ from their full-size counterparts in a number of ways including weight, size, component layout, and complexity.

36. Compact tool carriers are smaller and weigh less than full-size skid steers. Because they are smaller, compact tool carriers allow the operator to work in tight spaces including residential back yards and smaller construction sites. Their smaller size also means they weigh less, which allows them to operate on sensitive surfaces, like finished lawns and gravel driveways, without doing as much damage.

37. Unlike full-size skid steers, which are typically controlled by an operator seated inside an enclosed cab near the front of the machine, compact tool carriers are controlled by an operator standing behind or riding on the rear of the machine. The control station (36) and operator platform (37) of the '891 Patent are shown below, with the area occupied by the operator identified in red:



Ex. 1001 at Fig. 3 (annotation added).

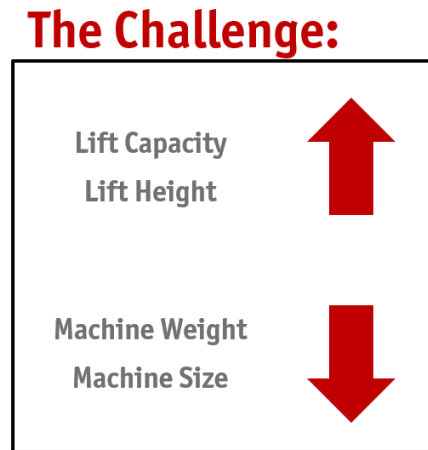
38. Because the operator and controls are located at the rear of the machine, almost all the components of a mini-skid steer (*e.g.*, the engine, hydraulic pump,

hydraulic lines, radiators, cooling lines, fuel pump, fuel tank, fuel lines, hydraulic tanks, hydraulic motors, and drive systems), are located and arranged differently than on a full-size skid steer machine. While the two categories of machine share similar names, the design and configurations of the two machines are almost entirely different.

39. Because of their smaller size and vastly different configuration, compact tool carriers present unique engineering challenges. Two significant challenges are lift capacity and lift height. Lift capacity refers to the amount of weight the machine is able to lift without tipping, and lift height refers to the maximum height to which the machine is able to lift its load. These are key performance characteristics because they allow the machine to perform a wider variety of tasks and to move a greater amount of material in fewer trips and in less time.

40. Full-size skid steer machines are wide, long, heavy, and have the engine and other substantial components located at or near the rear of the machine (which pushes the center of gravity of the machine rearward). These characteristics naturally imbue a full-size skid steer with significant lift capacity and lift height. By contrast, compact tool carriers are narrow, short, and have the engine and other heavy components located toward the front of the machine (which causes the center of gravity to be located more forward). This vastly different configuration—

combined with the need to keep the machine small and light weight—makes improving lift capacity and lift height a significant challenge:



41. As I discuss further below, it is my understanding from the prosecution history record that skilled engineers—including those working for some of the industry’s leading manufacturers—struggled for many years to find ways to meaningfully increase the lift capacity and lift height of their compact tool carriers without increasing their size and weight.

42. As this record shows, efforts to increase these metrics resulted in mundane improvements like switching from walk-behind to ride-on machines, moving fluid containers to the rear of the machine, adding “weight kits,” or attaching the lift arms to the very rear of the machine and as high as possible—all with the goal of moving the center of gravity as far back as possible to combat tipping and to lift material as high as possible. Engineers also conceived of more creative ideas, like machines that stretch or that move counterweights outward from the back of the

machine while lifting material to avoid tipping. The industry realized only fractional benefits from the more mundane ideas, and the fanciful concepts were abandoned for being too complex or expensive.

43. As disclosed in the '891 Patent, Vermeer eventually conceived of a new machine with a significantly modified mainframe and vertical-lift system.

44. By incorporating a vertical-lift mechanism, the bucket of the compact utility loader moved vertically up and down rather than along the arcuate path implemented in previous radial-lift machines. Foregoing an arcuate path allowed the load lifted by the machine to remain closer to the machine and reduced the tendency for the machine to tip forward. At the same time, the vertical-lift system also allowed loads to be lifted higher than would be with an equivalent radial-lift machine.



Photograph of Vermeer radial-lift compact utility loader; Ex. 1001 at Figs. 2 and 3 (superimposed; annotation added).

45. During the entire period that engineers were trying to enhance these characteristics of compact utility loaders, a wide variety of full-size skid steer vertical-lift machines were available on the market. But engineers at industry-leading manufacturers never considered vertical lift as a potential solution for compact utility loaders, because—as one of Vermeer’s key compact utility loader competitors stated, it was considered “difficult if not impossible due to size and durability constraints” to use vertical lift on a compact utility loader. *See* Ex. 2006 at [0007]. This is not surprising, considering compact utility loaders are much smaller in size, have lower weight, have a different operator location, and incorporate a vastly different configuration of internal components that must be considered when arranging pivot locations.

46. As evidenced by the ‘891 Patent, Vermeer overcame this “difficult if not impossible” challenge by conceiving of a new low-profile mainframe that made space for the more complicated vertical-lift mechanism.

47. The new mainframe design taught in Vermeer’s ‘891 Patent, shaded in green in the figures below, allowed for vertical-lift linkages to attach at pivot points (shaded in red) located low on the machine. This design was a significant departure

from prior art machines that all relied on pivot points located much higher on the mainframe of the machine.¹

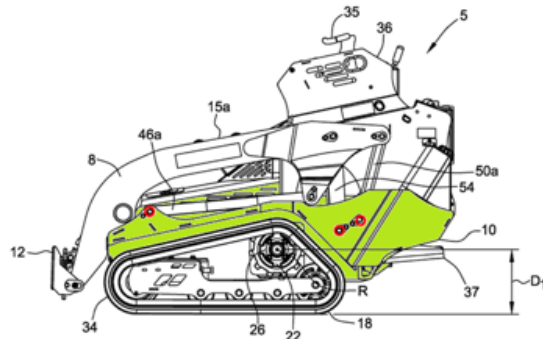


FIG. 2

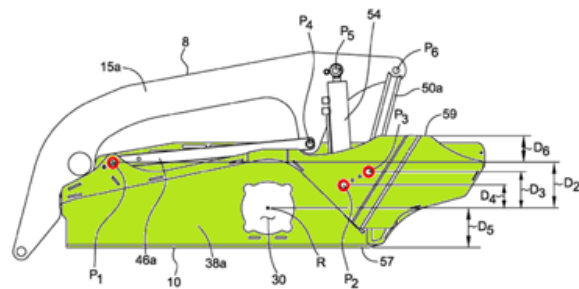


FIG. 5

Ex. 1001 at Figs. 2, 5 (mainframe shaded green, pivotal connections indicated by red circles).

48. Devising a mainframe that allowed the pivot points to be positioned low on the machine provided numerous advantages. First, it allowed the mass of the mainframe to be reduced, which provides for a lighter machine (further increasing the lift capacity to weight ratio) and lower cost. *Id.* at 6:7–9. Second, it allowed the center of gravity of the machine to be lower, further decreasing the tendency for the machine to tip forward when in operation. *Id.* at 6:10–12. Third, it allowed for

¹Conventional wisdom at the time was that placing pivots as high as possible on the mainframe would provide for higher lift height, which engineers sought to maximize on compact utility loader machines.

improved visibility, which is another key factor in compact utility loader design. *Id.* at 6:10–12.

49. The prosecution history record from the related Vermeer patents reveals that Vermeer’s engineers were surprised to learn that the new vertical-lift prototype they had invented provided more than a 30% increase in lift capacity over an equivalent machine with a traditional mainframe and radial lift. Ex. 2014 at 120–121, 142, 182.

50. Vermeer’s ‘891 Patent represented a significant step forward in the field of compact utility loaders, which—as discussed further below—was praised by the industry. It presented a novel and counterintuitive approach to machine design and gave way to significant improvements in lift capacity and lift height for compact utility loader machines.

B. Challenged Claims of the ‘891 Patent

51. I understand that Petitioner has challenged claims 1–10 of the ‘891 Patent. The Challenged Claims include one independent claim (claim 1) and nine dependent claims (claims 2–10). Claim 1 is reproduced below:

Claim 1. A loader apparatus configured for standing operator control and comprising:

a loader adapted to carry a tool, the loader being moveable between a down position and a vertically raised position, the loader comprising:

a first loader arm;

a second loader arm; and

at least one cross-member that extends from the first loader arm to the second loader arm;

a loader support having a first side and a second side, the loader being free from direct attachment to the loader support;

a first actuator for tilting of a tool connected to the loader;

a first linkage connected to the first side of the loader support and connected to the loader, the first linkage being pivotal relative to the first side of the loader support;

a second linkage connected to the first side of the loader support and connected to the loader, the second linkage being pivotal relative to the first side of the loader support;

a second actuator for raising the loader, the second actuator being connected to the loader support and connected to the loader, the second actuator being directly attached to the loader, the second actuator being pivotal relative to at least the first side of the loader support;

a control station having operator controls for propelling the loader apparatus forward and for raising and lowering the loader; and

an operator platform for standing operation of the operator controls of the control station;

a drive mechanism for propelling the loader apparatus over a supporting surface, at least a portion of the operator platform being disposed rearward of the drive mechanism relative to a longitudinal axis of the loader apparatus; and

wherein the loader apparatus does not include an operator's seat.

Exhibit 1001 at 6:47–7:18.

52. Dependent claims 2–10 relate to additional features of the loader apparatus.

C. Prosecution History for the ‘891 Patent

53. I have reviewed the prosecution history (also known as the file history or file wrapper) of the ‘891 Patent.

54. The ‘891 Patent issued from Application No. 17/397,200, which was filed on August 9, 2021. Ex. 1001 at Cover Page. Application No. 17/397,200 is a continuation of Application No. 16/270,070, which was filed on February 7, 2019 and is now abandoned. *Id.* at Related U.S. Application Data. Application No. 16/270,070 is a continuation of Application No. 15/704,685, which was filed on September 14, 2017. *Id.* Application No. 15/704,685 matured into issued U.S. Patent No. 10,202,266 (“the ‘266 Patent”). *Id.* Application No. 15/704,685 is a continuation of Application No. 15/062,801, which was filed on March 7, 2016 and matured into issued U.S. Patent No. 9,975,750 (the “‘750 Patent”). *Id.* Application No. 15/062,801 is a continuation of Application No. 14/691,649, which was filed on April 21, 2015, and matured into issued U.S. Patent No. 9,321,386 (“the ‘386 Patent”). *Id.* Application No. 14/691,649 claims priority to Provisional Application No. 62/118,860, which was filed on February 20, 2015. *Id.* The ‘891 Patent, ‘266 Patent, ‘750 Patent, and ‘386 Patent all claim priority to Provisional Application No. 62/118,860. *Id.*

55. The '386 Patent issued before the '891 Patent. *Id.* In fact, I understand that the '386 Patent was Vermeer's first issued patent concerning its vertical-lift compact utility carrier invention.

56. The examiner in the original examination of the '386 Patent rejected claims 1–20 based on various prior art references. Ex. 2001 at 73–79. None of those prior art references are raised in the instant *inter partes* petition. Rather, the prior art relied on by the examiner included full-size skid steers with vertical-lift loader arms, in addition to smaller machines. *Id.* at 76–78.

57. Patent Owner responded by adding new limitations to its claims. *Id.* at 57. These amendments focused on the loader arm configuration and the location of pivot points that connected the mainframe to the actuator and linkage. *Id.* at 57. As a result, Patent Owner differentiated its machine from the machine disclosed in U.S. Patent No. 7,695,236. *Id.* at 66–68.

58. The examiner then raised an obviousness argument based on the combination of two prior art references. *Id.* at 52–54. The combination involved a radial-lift mini skid steer (U.S. Patent No. 6,695,568) and a vertical-lift full-size utility loader (U.S. Patent No. 8,821,104). *Id.* at 52–54. In response, Patent Owner explained why the proposed combination would not have been obvious to a POSITA at the time. *Id.* at 42–48, 12–25. Specifically, Patent Owner reasoned that a POSITA would not have applied the vertical-lift loader arms of the larger machine to the

frame of the smaller machine. *Id.* at 42–48, 12–25. In addition, Patent Owner added a few limitations to further distinguish its invention from the examiner’s proposed combination of prior art references. *Id.* at 42–48, 12–25. The examiner found this was sufficient and the Patent Office issued the ‘386 Patent.

59. The ‘386 Patent underwent two separate *ex parte* reexaminations: one completed in 2018 and another in 2020. Ex. 2014; Ex. 2015. Both proceedings were initiated by the Toro Company. Ex. 2014; Ex. 2015. At the time of the reexaminations, the Toro Company was the named defendant in a patent infringement lawsuit filed by Patent Owner—not unlike the Petitioner in this proceeding. Ex. 2014 at 38; Ex. 2015 at 20, 27–28.

60. On February 18, 2016 (before the reexaminations), the Toro Company filed Patent Application No. 15/047,061, which was titled “UTILITY LOADER WITH HIGH LIFT LOADER ARMS AND UNIFYING HAND GRIP FOR DUAL TRACTION CONTROL LEVERS.” Ex. 2006 at Cover Page. Toro’s application disclosed a vertical-lift mini skid steer. The Toro Company went into detail about the engineering challenges associated with creating a compact utility loader that used vertical-lift loader arms capable of a higher reach. Ex. 2006. Specifically, the Toro Company said that, at the time of the proposed invention:

- “the vertical reach of the loader arms on compact utility loaders is somewhat limited”;

- “the use of such high lift loader arms on a compact utility loader has been considered **difficult if not impossible** due to size and durability constraints”; and
- “it would be a further advance in the art to provide a way of safely and durably providing high lift loader arms on compact utility loaders to extend the vertical reach of such loaders.”

Id. at [0007] (emphasis added).

61. In its *ex parte* reexamination requests, however, Toro made contradictory statements by arguing that using a vertical-lift loader arm configuration on a mini skid steer would be obvious. Ex. 2002 at 396–473; Ex. 2014 at 233–275. Toro provided examples of how a POSITA might replace the radial-lift loader arms of a known compact tool carrier with the vertical-lift loader arms of a full-size loader. *See, e.g.*, Ex. 2002 at 435; Ex. 2014 at 236, 244–262.

62. In response, Patent Owner offered evidence to support its non-obviousness arguments. This secondary indicia evidence demonstrated that Toro spent a significant amount of time and money attempting to maximize lift capacity on compact utility loaders. *See, e.g.*, Ex. 2002 at 161–194. Ultimately, the Patent Office confirmed that the challenged claims were patentable over the prior art.

63. The U.S. Patent Office has issued several other patents to Vermeer on its compact utility loader invention. These patents include U.S. Patent Nos. 10,202,266; 9,975,750; 11,465,891; and 12,098,063.

VII. THE PRIOR ART REFERENCES RELIED ON BY KUBOTA

64. In the sections that follow, I provide a high-level description of the three prior art references that Kubota contends render the challenged claims of the ‘891 Patent invalid.

A. KR996

65. KR996 was published on June 16, 2011 and is titled “Environmentally Friendly Construction Equipment for Building Deconstruction Work.” Ex. 1005 at Cover Page. The construction equipment disclosed in KR996 “can easily attach and detach various dismantling equipment to the vehicle” depending on the type of project. *Id.* at [0001]. The purpose of this detachable feature is to “greatly reduc[e] the economic burden of purchasing expensive heavy equipment, and significantly sav[e] time and expenses for the maintenance of heavy equipment.” *Id.* at Abstract.

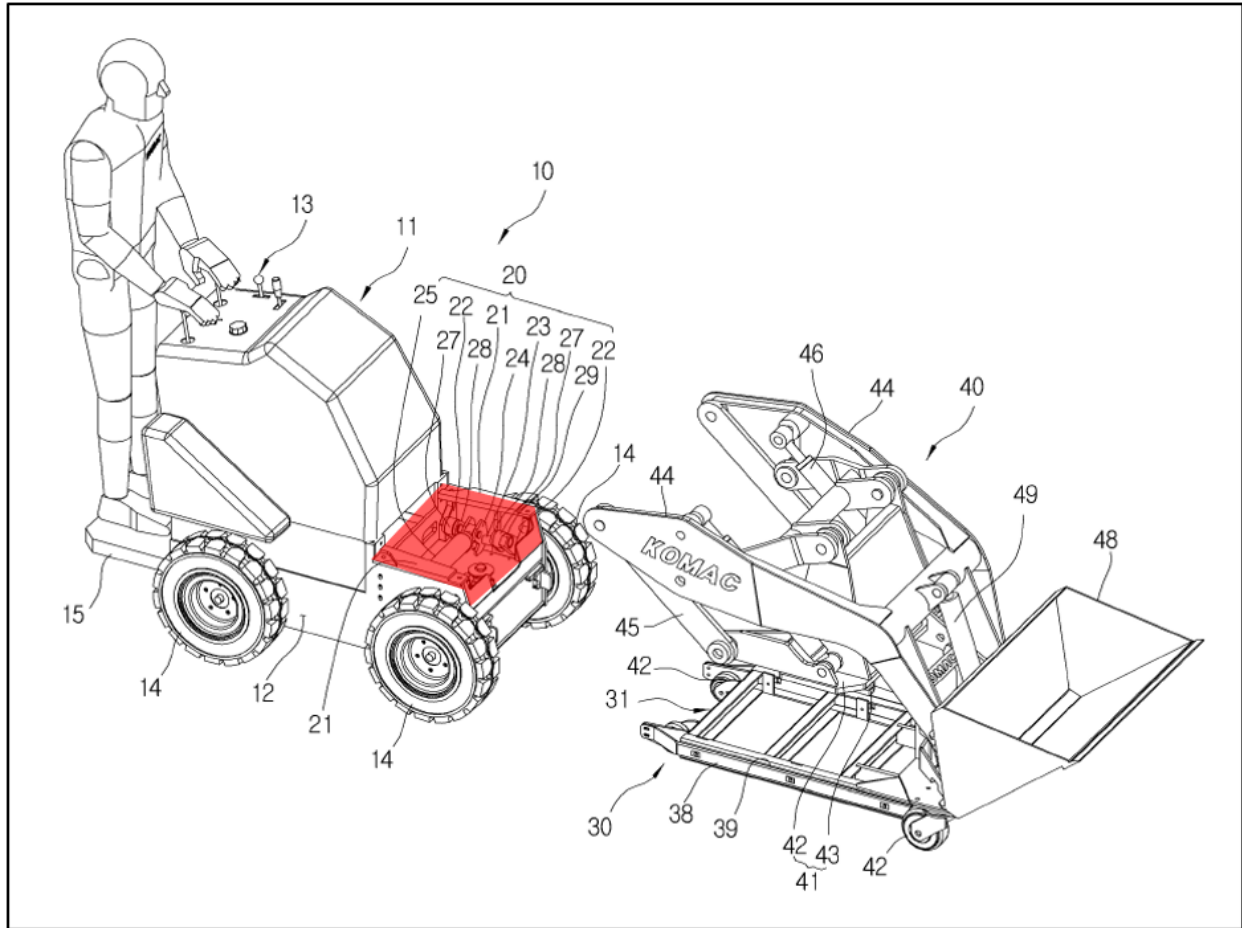
66. The KR996 machine was specifically intended to “enter narrow buildings and carry out dismantling work inside the building, and can easily attach and detach various dismantling equipment to the vehicle....” *Id.* at [0001].

67. According to KR996, building deconstruction work typically required two machines with unique purposes: a mini excavator and a mini skid loader. *Id.* at

[0003]–[0005]. First, the mini excavator would perform a crushing operation using its “concrete breaker or crusher.” *Id.* at [0006]. Then, the mini skid loader with a bucket would remove the crushed concrete and load it onto the dump truck. *Id.*

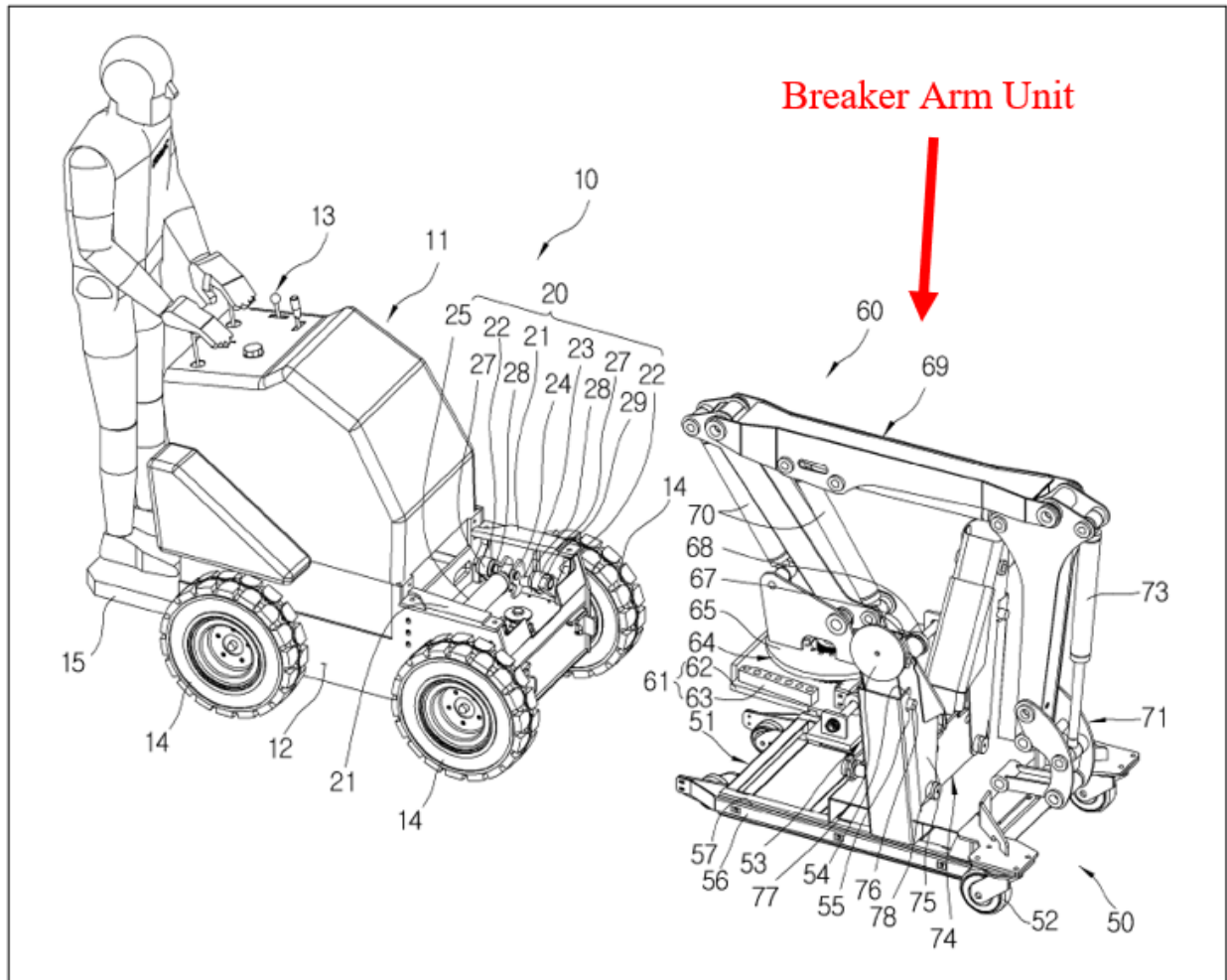
68. KR996 notes that this workflow was inefficient and expensive because (1) two separate machines must be purchased/rented, maintained, and stored, which is expensive and wasteful; and (2) either the mini excavator or the mini skid loader is idle while the other is in use, which results in inefficiencies. *Id.* at [0007]–[0008]. KR996 describes a specific solution to this problem: a single machine that can function as both a mini excavator and a mini skid loader. *Id.* at [0012]–[0015].

69. To accomplish this, KR996 discloses a modular machine with a complex, hydraulically actuated attachment mechanism that “enables the easy and quick attachment and detachment of a bucket and a breaker with a single vehicle.” *Id.* at [0012]. This quick attachment mechanism is shaded in red in Figure 1, reproduced below:



Id. at Fig. 1 (shading added).

70. The arm unit (60), which includes a breaker (72), is illustrated in Figure 14:



Id. at Fig. 14 (annotation added).

71. As Figures 1 and 14 illustrate, KR996 discloses three unique pieces of equipment: the vehicle itself (10), a loader unit (40), and an arm unit (60). The vehicle (10), which appears on the left side of Figures 1 and 14 above, includes a main body (11), control unit (13), the attachment mechanism or “detachable part” (20), and four wheels (14). *Id.* at Figs. 1, 14, [0116]–[0145]. The two detachable components—the loader unit (40) and the arm unit (60)—are separate from the vehicle (10), as illustrated on the right side of Figures 1 and 14.

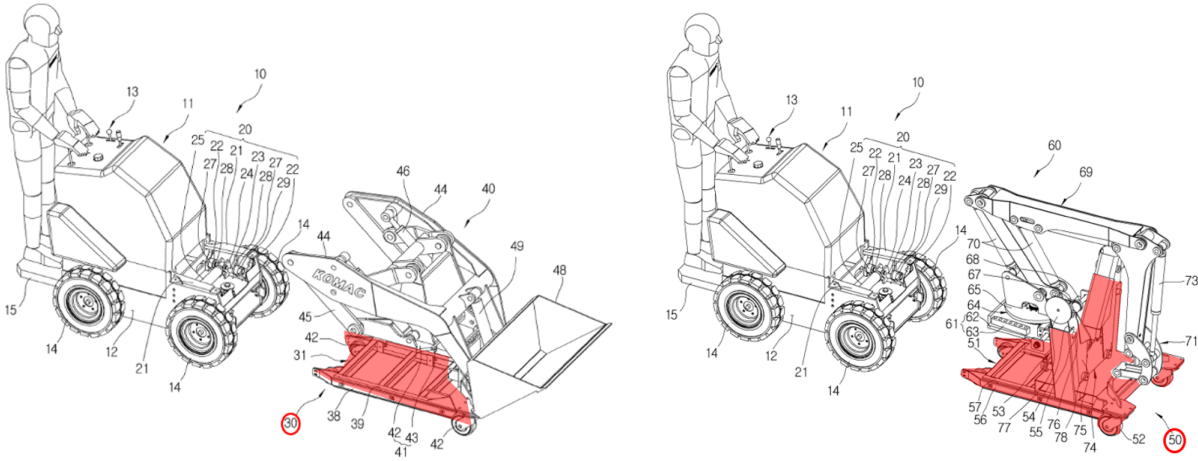
72. KR996 focuses on this easy and quick attachable/detachable feature throughout the disclosure, suggesting that this is the key inventive concept of this machine. For example, KR996 states:

- “[t]he present invention can **easily and quickly detach** the loader unit with a bucket and the arm unit with a breaker” (*Id.* at Abstract (emphasis added));
- “[t]he purpose of the present invention...enables the **easy and quick attachment and detachment** of a bucket and a breaker” (*Id.* at [0012] (emphasis added));
- elements of the machine, such as the “breaker attachment and breaker combined arm unit as a whole [are] **selectively detachable** to the vehicle’s detachable part” (*Id.* at [0013] (emphasis added));
- “the present invention...allows the loader unit (40) or the arm unit (60) to be **easily and quickly attached and detached** from the vehicle (10)” (*Id.* at [0069] (emphasis added)); and
- “the present invention relates to a vehicle (10) with a loader unit (40) installed with a bucket (48) and a breaker (72) to **easily and quickly detach** the arm unit (60)” (*Id.* at [0088] (emphasis added)).

73. To enable the quick and easy detachment of the loader unit (40) and arm unit (60), KR996 describes wheeled “bogie” units (30 and 50) on which the

loader unit (40) and arm unit (60) are stored when the other attachment is in use.

Those “bogies” are shaded in red in the figures below:



Id. at Fig. 1 (shading and annotations added), Fig. 14 (shading and annotations added), [0041] (“The construction equipment for green building deconstruction work of the present invention consists of a vehicle (10), a bogie (30) for the loader unit (40), the loader unit (40), a bogie (50) for the arm unit (60), and the arm unit (60).”).

74. KR996 explains how the design of the bogie units specifically interacts with the machine to achieve the quick-and-easy detachability of the loader unit and arm unit:

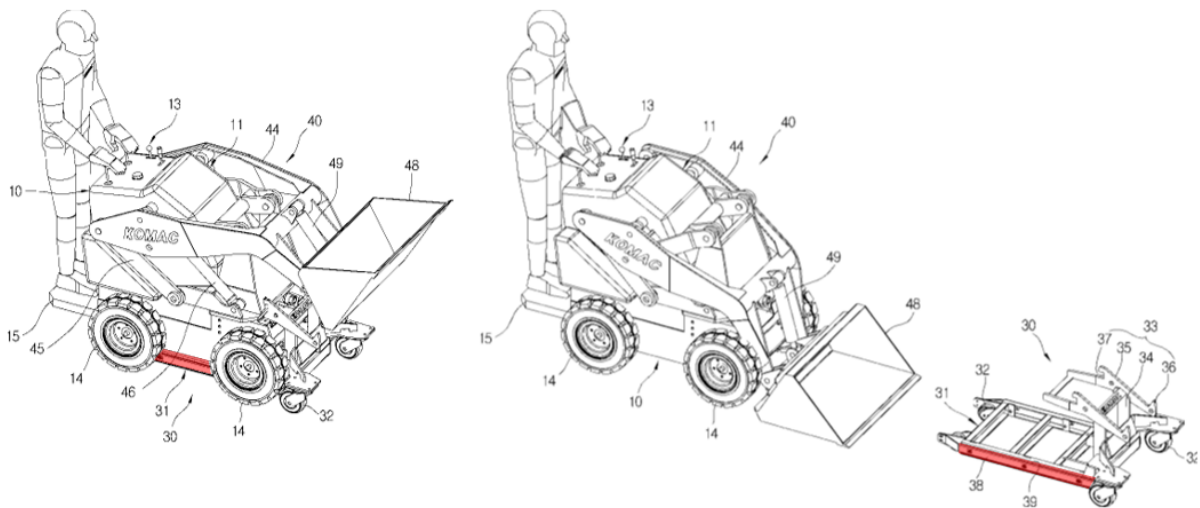
The present invention, as described above, is characterized in that when the loader unit with a bucket installed is loaded onto the bogie, the vehicle is moved forward in the direction of the bogie so that the inner sides of the vehicle wheels come into contact with the guide plates of the bogie. As the vehicle continues to move forward, the guide plates

are pulled towards the inner side of the vehicle according to the rotation direction of the wheels, and the bogie is inserted into the front inner side of the vehicle. Then, when the driving part of the detachable part is operated in a state where the bogie and the loader unit are docked at the front of the vehicle, the pressure roller rotates and presses the fixture of the loader unit upward, thereby coupling the loader unit to the main body of the vehicle. When the loader unit is coupled to the vehicle as described, as the vehicle moves backward, the guide plate in contact with the wheel is pushed to the opposite side of the vehicle, causing the bogie to detach from the vehicle. By using the mentioned operation, the empty bogie can be inserted into the vehicle side and the loader unit can be attached to the bogie. *Then, the bogie and the loader unit can be detached from the vehicle.* In the same manner, the arm unit with a breaker can be detached from the vehicle. Therefore, the present invention can easily and quickly detach and attach a loader unit with a bucket and an arm unit with a breaker installed on a vehicle, thereby significantly reducing the economic burden of purchasing expensive heavy equipment, and greatly saving time and expenses for the maintenance of heavy equipment.

Id. at [0036] (emphasis added).

75. As described above, the bogies of KR996 include guide plates (38, 56) that are designed to engage with the lower inner surface of the tires of the machine. When the vehicle is propelled forward, the rotation of the wheels—and specifically the tire sidewalls—pull the guide plates towards the machine to enable connection of the loader unit or arm unit to the machine. Once the loader unit or arm unit is

attached, the operator reverses the machine to propel it backwards, away from the bogie. The sidewall of the wheel then pushes the guide plate of the bogie away from the machine. The reference also teaches that “shims” (liners 39) are inserted between the bogie and guide plates to fine tune the positioning of the guide plates to ensure they interface properly with the interior sidewalls of the machine’s tires. *Id.* at [0053]. This interaction between the inner surface of the tires and the guide plates of the bogies is a critical feature of the invention disclosed in KR996 that enables the quick-and-easy detachability feature. *Id.* at [0052], [0060], [0069], [0071], [0074], [0078], [0080], [0083], [0086]–[0087]. Figures depicting this critical operation of the KR996 invention are presented below with the guide plates shaded in red:



Id. at Figs. 7, 8 (shading added).

76. It is important to note that the invention described in KR996 must be able to operate in a variety of different modes. In one of these modes, the machine is operated *without any attachment* so that it can be transported to the construction site and maneuvered between various attachment bogies. In a second mode, the machine is brought into contact with the breaker attachment bogie so that the attachment mechanism can be manipulated to cause the breaker to attach to the machine or be deposited onto the bogie. In a third mode, the machine is operated with the breaker attached to, for example, break up construction debris. In a fourth mode, the machine is brought into contact with the loader attachment bogie and the attachment mechanism manipulated to attach the loader to the machine or to deposit it onto the bogie. And in a fifth mode, the machine is operated with the loader attached to, for example, clear construction debris from the site. The invention of KR996 is directed to a *single machine* that is capable of performing *all* of these various modes of operation.

77. As described in more detail below, it is my opinion that a skilled artisan would understand that the quick attachment mechanism and bogie concepts of KR996 would not work in a real word construction environment for a number of reasons.

78. First, as the reference itself explains, there is a great deal of precision required in the spacing of the guide plates so that they interface properly with the

inner sidewalls of the tires of the machine. Real world construction environments contain dirt, rocks, mud and other debris. That debris would inevitably become stuck on the guide plates or the sidewalls of the tires, disrupting the precise spacing required for the guide plates to interface with the tires. That debris would prevent the machine from properly accepting the bogie and the entire system would be rendered inoperable.

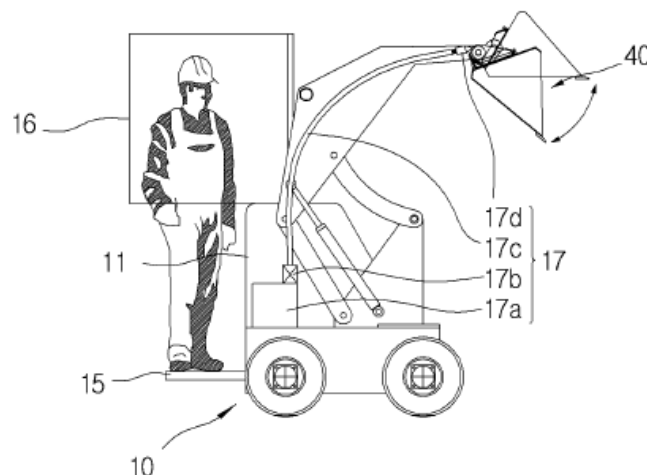
79. Second, the invention teaches that the bogie has small wheels that allow it to slide into engagement with the machine when installing or removing attachments. Those wheels must be small because the bogie must roll *under* the mainframe of the machine during coupling. But wheels with small diameters do not work on a construction site. Small wheels fall into ruts and become jammed against small rocks, sticks, mud, and other construction debris. When one of the wheels inevitably becomes stuck or jammed, the bogie will fail to roll in a coordinated way, which would again prevent the machine from accepting the bogie to exchange attachments.

80. Third, construction sites typically have varied and uneven terrain. These machines typically operate on gravel, dirt, mud, rocks, grass, mulch or over construction debris. These surfaces are never flat, but the machine taught in KR996 requires an almost perfectly flat surface to operate. The inherent undulations on a construction site would prevent the bogie from aligning in three dimensions with the

machine, would prevent the bogie's sidewall from properly interfacing with the guide plates, and would prevent the attachment mechanism from properly aligning with the mounting plates of the attachment.

81. In sum, it is my opinion that a skilled artisan would understand that the device disclosed in KR996 would not be capable of successfully operating in any real-world environment for a compact utility loader.

82. KR996 also teaches including a safety fence (16) to protect the operator from flying debris and a watering device (17) to suppress dust generation. *Id.* at [0089]–[0092]. These two features are depicted in Figures 21 and 22 in lower resolution, with a simplified depiction of the KR996 machine depicted. These high-level schematics depict the safety fence simply as a box (16) surrounding the operator, with no further details:



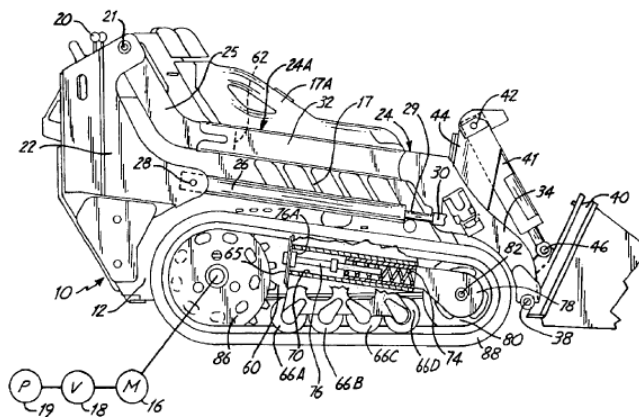
Id. at Fig. 21.

83. Although these features (safety fence and watering device) depicted in Figures 21 and 22 are not relevant to the issues before the Board, Dr. Velinsky relies

on these figures to advance of some of his obviousness assertions, which I address further below. I note that the lack of specific detail in these figures is representative of the overall lack of disclosure in KR996 regarding how to actually implement the ideas set forth therein. Attached as Exhibit 2008 I provide a summary of some of the inconsistencies and significant problems with the machine depicted in KR996.

B. Bares

84. The Bares reference was filed October 30, 2002 and is titled “LOADER FRAME AND BOLT-ON TRACK DRIVE.” Ex. 1010 at Cover Page. Bares discloses “a small loader that has a unitized central body forming a frame, and which has drive units on the body for propelling the loader.” *Id.* at 1:9–11. The Bares device has “upright supports 22 at the rear portions of the body,” which “in turn pivotally support ends of a lift arm assembly 24 on pivots 21” that “are at or near the uppermost part of the loader.” *Id.* at 2:48–54.



Id. at Fig. 1.

C. SAE

85. The Society of Automotive Engineers issued the SAE International Surface Vehicle Recommended Practice for compact tool carriers (“SAE”) in June of 2010. Ex. 1015 at 1. The SAE reference “is intended as a guide towards standard practice.” *Id.* More specifically, SAE “provides performance criteria for newly designed compact tool carriers.” *Id.*

86. SAE includes the following definition for a compact tool carrier:

A self-propelled crawler or wheeled machine having an operating mass of less than 1500 kg with a rigid frame, having either a walk-behind operator position or standing operator platform at the rear of the machine and having either front-mounted interchangeable equipment or lift arms with an attachment bracket capable of coupling to interchangeable, front-mounted attachments.

Id. at 2.

VIII. LEVEL OF ORDINARY SKILL IN THE ART

87. The ‘891 Patent is directed to a “[l]oader apparatus configured for standing operator control.” Ex. 1001 at Abstract. The Abstract of the ‘891 Patent also states:

The loader apparatus may include a loader adapted to carry a tool that is moveable between a down position and a vertically raised position. One or more linkages are

connected to the first side of the loader support and
connected to the loader.

Id.

88. Based on the subject matter of the ‘891 Patent, it is my opinion that a person of ordinary skill in the art at the time of the alleged invention would have had at least a Bachelor of Science degree in Mechanical or Agricultural Engineering and two years of experience in the design of machines, or have had equivalent knowledge and experience.

IX. CLAIM CONSTRUCTION

89. It is my understanding that the terms appearing in the claims of the ‘891 Patent should be given their ordinary and customary meaning to a person of ordinary skill in the art as of the earliest effective filing date (February 2015).

A. “loader support”

90. Petitioner’s anticipation and obviousness challenge is entirely based on an improper view of what constitutes the “loader support” of the compact tool carrier defined in the Challenged Claims. As discussed below, the ‘891 Patent uses the terms “loader support” and “mainframe” interchangeably to refer to the core structure of machine to which other components are attached. Kubota and Dr. Velinsky also use these terms interchangeably. *See, e.g.*, Petition (Paper No. 1) at 7, 30, 31, 47; Ex. 1003 at ¶¶ 74–77, 88, 94–97, 99–100, 125. Therefore, for purposes of my analysis I have construed them to have the same meaning.

91. The plain and ordinary meaning of “mainframe,” as that term has been preliminary construed by the Board in related proceedings, is “a primary supporting structure” of the machine. *See, e.g.*, IPR2025-00167, Paper 16 at 25. In my view, this construction is consistent with the plain meaning of the words “main” and “frame” and their use within the ‘891 Patent. Ex. 2009 (defining the noun “frame” as “the rigid supporting structure of a vehicle, aircraft, or other object” and defining “main” as an adjective meaning “chief in size or importance”).

92. As the primary supporting structure of the compact utility loader, the “mainframe” is the core structure of the machine to which the other components attach. This is shown in the specification of the ‘891 Patent. Ex. 1001 at 2:12–13 (“The drive mechanism is attached to the mainframe.”), 3:31–32 (same), 4:6–7 (upper frame supporting the control station is attached to mainframe), 4:20–22 (engine and drive mechanism including tracks or wheels are connected to the mainframe), 4:23–26 (loader arms connected to mainframe), 4:44–45 (actuators connected to mainframe), 5:65–66 (mainframe includes an engine bracket for connecting and supporting the engine).

93. Other patent references use mainframe in the same manner, further demonstrating the plain and ordinary meaning of this term as of February 2015. Ex. 1006 (JP705 prior art relied on by Kubota) at [0002] (“main frames . . . constitute a main part of a chassis in various types of work vehicles . . .”).

94. A person of ordinary skill in the art in February of 2015 would further understand that the “primary” supporting structure refers to a fundamental part of the machine that is always present—not selectively removable—during all aspects of operation of the machine.²

95. Construction machines with selectively removable equipment or attachments were well known in the art before the earliest effective filing date of the ‘891 Patent. *See, e.g.*, Ex. 1001 at 1:31–41 (“Compact tool carriers are generally defined (e.g., ISO 6165 (2012) and SAE J2752) as ‘a self-propelled crawler or wheeled machine having . . . either front-mounted interchangeable equipment or lift arms with an attachment bracket capable of coupling to the interchangeable, front-mounted attachments.’ The tool carriers may be attached to a variety of interchangeable tools such as buckets, augers, forks, stump grinders, tillers, rollers and the like.”); Ex. 2017 at 1:38–41 (“Attachments such as an auger, a grapple, sweeper, landscape rake, snowblower or backhoe, some of which may include their own hydraulic motor, are sometimes mounted to a boom assembly on the front of

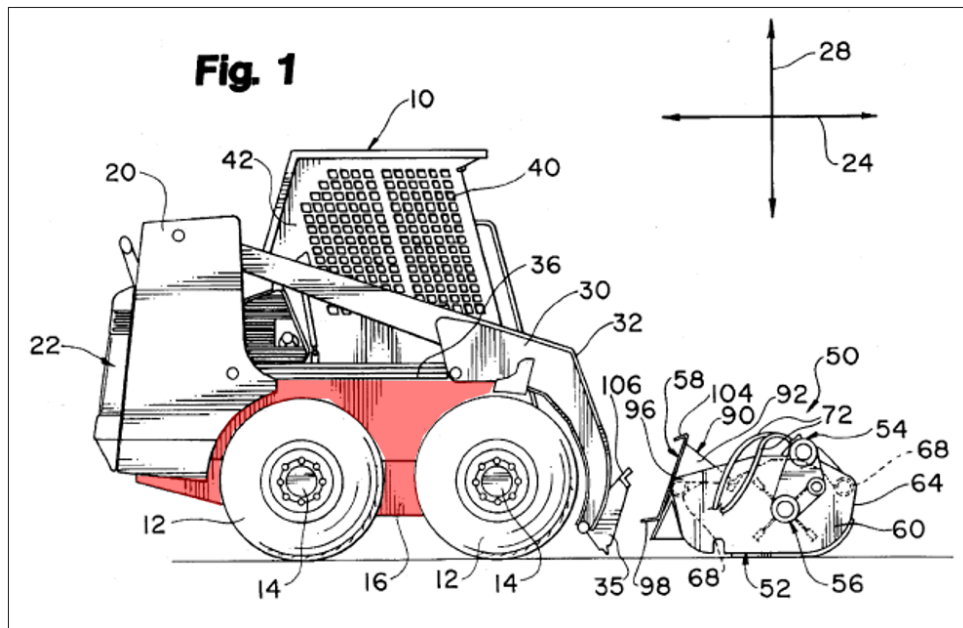
² A skilled artisan would understand that the mainframe could be disassembled for maintenance or repair. But they would also understand that the mainframe would be present and fully assembled during all phases of the operation of the machine. This is consistent with the plain and ordinary meaning of the term “mainframe.”

the skid steer loader.”); Ex. 2018 at 1:45–53 (“These numerous attachments include augers, bale handlers, brooms, buckets, cold planers, concrete pulverizers, cutters, dozer blades, fertilizer spreaders, fork lift forks, grapples, hitches, landscape rakes, mowers, mulchers, plate compactors, pole claws, pot movers, rock and tree handlers, rock saws, rollers, rotary brooms, shears, snow blowers, splitters, stump grinders, swale blades, tillers, tree spades, trenchers, and winches, among others.”); Ex. 2019 at 1:61–2:3 (“Different types of work tool accessories are interchangeably attached and released from the machine 10. For this reason, a functional appeal of skid steer loaders is the ability to use a wide variety of work tool accessories or attachments for a variety of different uses. These work tool accessories or attachments are often powered by the loader’s hydraulic system and include, for example, excavators, earth augers, specialized buckets, hydraulic breakers, snow blowers, trenchers, cement mixers, rippers, backhoes, pallet forks, wheel saws, etc.”).

96. Given the foregoing, a skilled artisan would have understood that the mainframe of the machine encompasses only the *primary* supporting structure of the machine, and not any supporting structure that selectively removable during various operations of the machine. This understanding is evident from how the term “mainframe” is used numerous references that pre-date the ‘891 Patent:

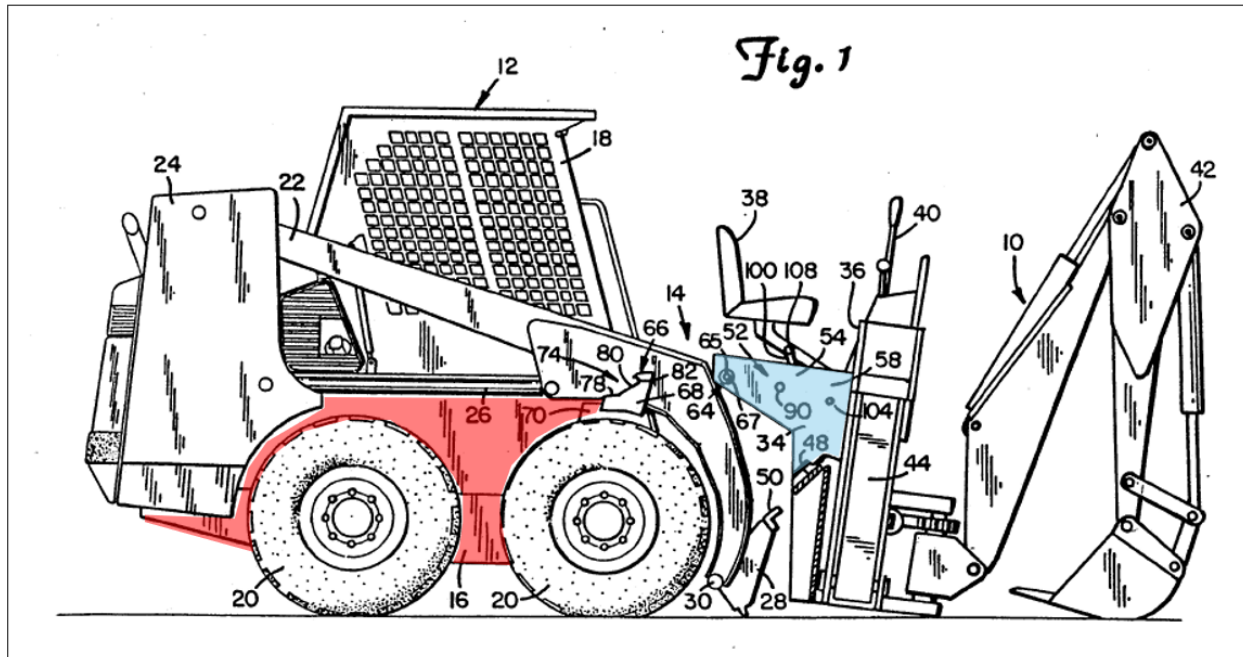
- Ex. 2017 at Fig. 1, 3:45–50, 4:45–60, 5:41–55: Distinguishing the “main frame assembly” (16), which is the primary supporting structure of the

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machine from various secondary supporting structures, including “upright members” (20) and the supporting structure of the selectively removable mower attachment (50) (e.g., the case (52) and its components, including the front and rear structural tubes (68), the quick attachment receiver (58) and its gussets (90), side plates (92), and top plate (94)).



Id. at Fig. 1 (shading added).

- Ex. 2016 at Fig. 1, 3:22–62: Distinguishing “main frame 16” (red) from the “carrier frame 34” (blue) of the selectively removable backhoe attachment 10.



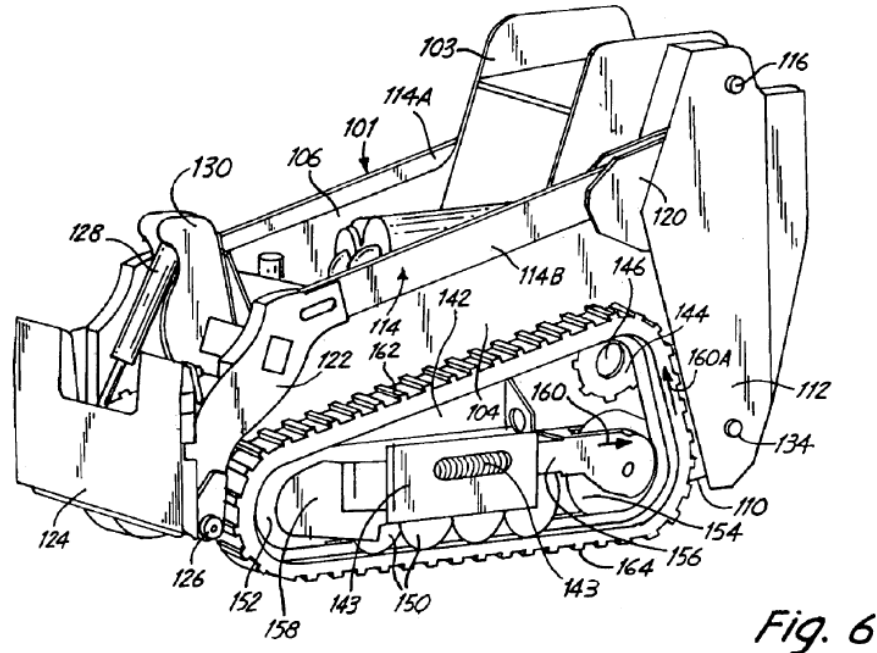
Id. at Fig. 1 (shading added).

**X. LACK OF A MOTIVATION TO COMBINE THE ASSERTED
PRIOR ART REFERENCES AND NO LIKELIHOOD OF SUCCESS**

**A. A Person of Ordinary Skill in the Art Would Not have been
Motivated to Alter the KR996 Machine based on Bares.**

97. For some of the challenged claims, Kubota and Dr. Velinsky rely on a combination of KR996 with U.S. Patent No. 6,832,659 (“Bares”). Specifically, Dr. Velinsky asserts that a POSITA would have been motivated to replace the wheels of the KR996 machine with tracks, like those disclosed in Bares. Ex. 1003 at ¶¶ 157–162.

98. Bares discloses a loader frame and bolt-on track drive in which a track drive is bolted to a small loader with a unitary frame. Ex. 1010. One of the disclosed embodiments has an elevated track drive sprocket.



Id. at Fig. 6.

99. I disagree that a POSITA would have been motivated to replace the wheels of the KR996 machine with tracks for a number of reasons, each of which is described in detail below.

100. The tires of the KR996 play a critical role in achieving the quick-and-easy detachability of the loader unit and arm unit. Specifically, KR996 teaches that the wall of the front tires must be able to precisely interface with the guide plates of the bogies that carry the loader arm attachment unit and the breaker arm attachment unit. When the wheels rotate forward, the inner sidewall of the tires flex and grip the guide plates and pull those plates (and the bogie) towards the machine. This allows the bogie to cooperate with the machine to attach or detach the loader arm attachment unit or breaker arm attachment unit. When the wheels of the machine

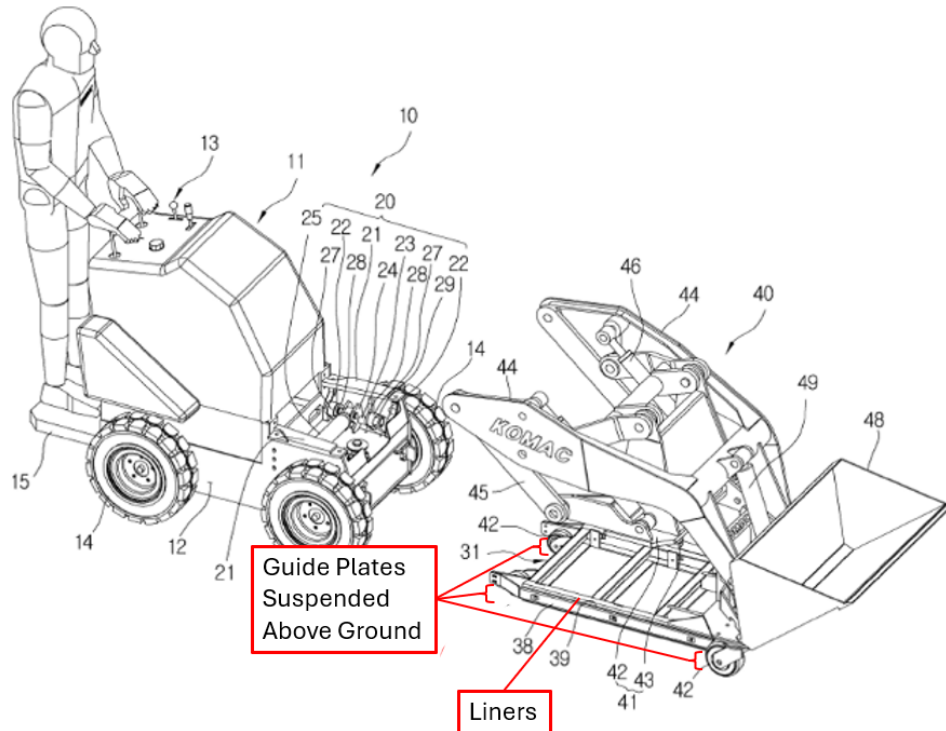
are rotated in the opposite direction, the inner sidewall of the front tires push the guide plates of the bogie away from the machine. Dr. Velinsky agrees with my interpretation of this functionality. Ex. 2020 at 84:9–15.

101. This interaction between the tires and the bogie is repeatedly identified as enabling the quick and easy attachment and detachment of the loader and arm units. Ex. 1005 at [0052], [0060], [0069], [0071], [0074], [0078], [0080], [0083], [0086]–[0087].

102. KR996 teaches that the relative spacing of the guide plates and tire sidewalls is critical to this functionality. For example, the reference teaches the use of “liners (39)” which act as shims and allow the operator to precisely adjust the distance between the guide plates so that the tire flexion can properly grip the guide plates. *Id.* at [0053]; Ex. 2020 at 95:16–96:1, 97:16–21.

103. A POSITA would recognize that, unlike tires, tracks are relatively stiff and inflexible in the lateral direction. Whereas tires have sidewalls that are flexible and bow out under the load of the machine, tracks are rigid. This rigidity prevents a track from being capable of gripping the guide plates of the bogie like a tire would.

104. Moreover, unlike the tires taught in KR996, the tread of a tracked system does not extend significantly far off the ground. As such, that tread would not have the height necessary to grip the guide plates, which themselves are suspended above the ground on the wheels of the bogie:



Ex. 1005 at Fig. 1 (annotations added).

105. Removing the tires and wheels of KR996 would also remove the key alignment feature those components provide. That alignment feature is necessary to ensure the bogie aligns properly as it slides underneath the machine. A POSITA would realize that replacing the wheels and tires with a track system would remove the alignment system and introduce a significant risk that the forks or tines of the bogie (the elongated structures that include the guide plates) enter the track system and become jammed. This could result in damage to the bogie and/or track system and could cause the bogie to tip over, which could damage the attachment or cause harm to the operator or other workers.

106. For all the reasons set forth above, a POSITA would recognize the important role that the tires of the KR996 machine play and that tracks would not be an acceptable alternative solution because they are rigid and do not extend above the operating surface sufficiently to grip the guide plates. In view of these recognitions, a POSITA would not be motivated to replace the tires of KR996 with tracks and would not have a reasonable expectation of succeeding with such a modification.

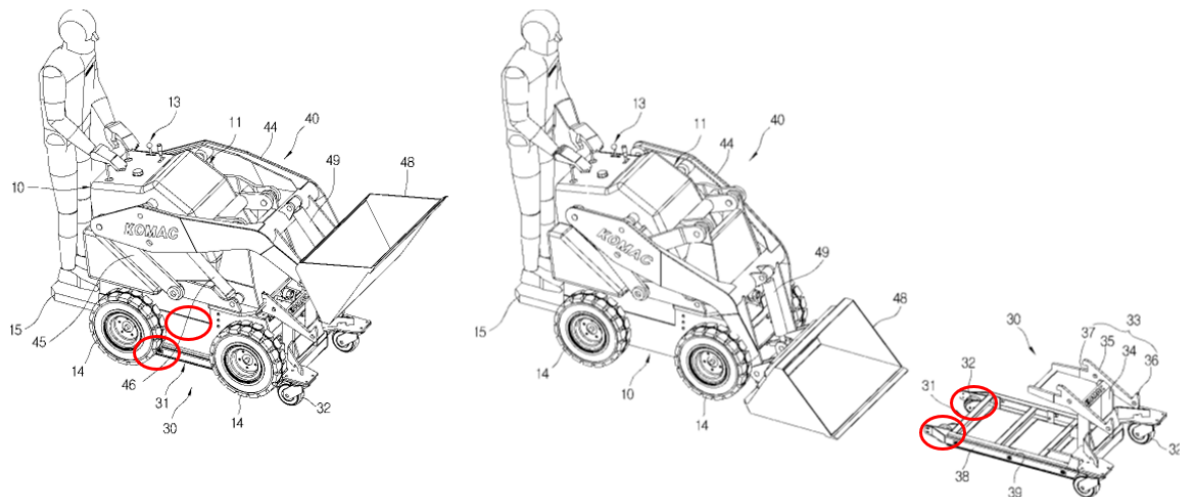
107. Dr. Velinsky does not address this issue, much less provide a reasonable explanation as to why a POSITA would be motivated to sacrifice this key functionality performed by the tires of the KR996 machine. During his deposition, it was unclear whether Dr. Velinsky was even aware that the sidewall of the tires even performed this important role in the operation of the machine. Ex. 2020 at 79:24–84:8.

108. Instead, Dr. Velinsky primarily relies on the unremarkable fact that—generally speaking—wheels and tracks were known alternatives. Ex. 1003 at ¶ 159. But this generalized conclusion does not address the specific operation of KR996 and how that operation would be adversely impacted by replacing the wheels and tires of the machine with tracks.

109. Dr. Velinsky also asserts that a POSITA would switch KR996’s wheels for tracks to accommodate uneven, rocky terrain and to lower ground pressure to avoid sinking or slipping on soft/muddy surfaces. *Id.* at ¶ 160. I disagree with this

assertion because KR996 is specifically designed for indoor deconstruction work and would not be operable on uneven, rocky terrain. *See* Ex. 1005 at [0001] (“The present invention relates to construction equipment for green building deconstruction work, particularly to construction equipment for green building deconstruction work that can enter narrow buildings and carry out dismantling work inside the building. . .”).

110. From the disclosure of KR996, a POSITA would recognize that the attachment/detachment feature can only function—if at all—indoors and on a level, clean surface (such as a concrete floor). The bogie’s wheels, designated by reference numeral (32) in the figure below, must be small to slide far underneath the machine during attachment and detachment operations:



Id. at Fig. 7, Fig. 8 (circles identifying position of rear bogie wheels added).

111. This functionality requires ensuring (1) the wheels are small enough to fit under the machine, (2) the wheels roll properly on the surface (which, given the

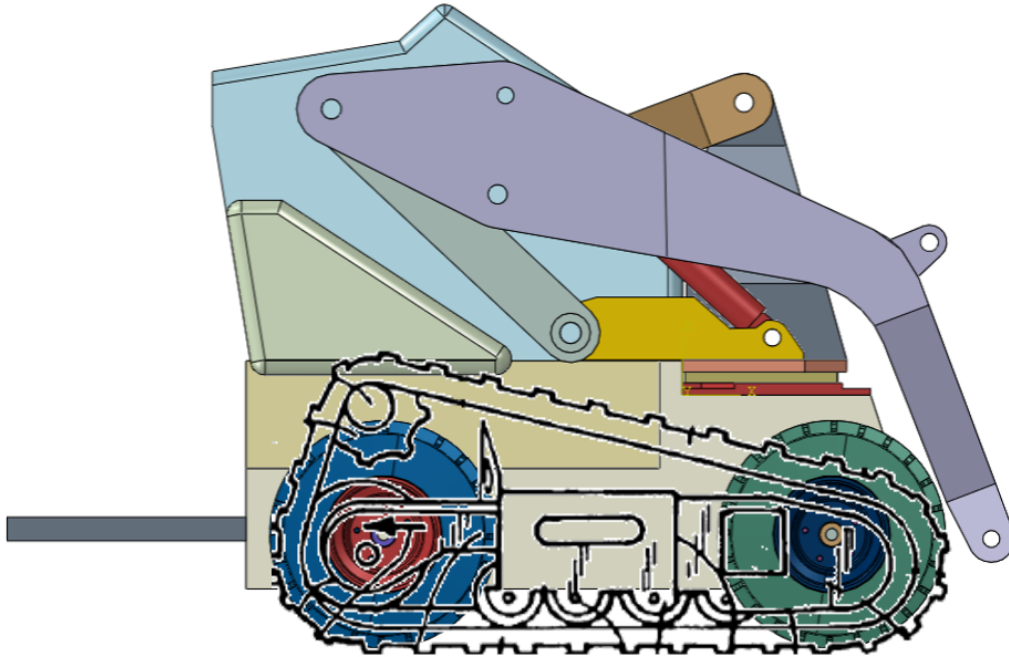
necessary small diameter of the wheels, must be clear of debris), (3) a clean work area so that mud or dirt does not collect on the inside of the wheels and upset the precise spacing required between the guide plates of the bogie and inner sidewalls of the tires, and (4) the terrain is not uneven or rocky so there is proper three dimensional alignment of the bogie with the machine and (a) the guide rails slide linearly along the bottom of the machine, (b) the sidewalls of the tires can engage with the guide plates, and (c) the attachment is able to engage properly with the hydraulic clamping mechanism (which would not be possible if the machine and bogie are sitting on the uneven terrain of a typical construction site), and (5) the terrain is not muddy or soft, which would cause the wheels of the bogie to sink into the ground, fail to roll, and fail to align in properly with the machine during attempts to install or remove attachments.

112. Dr. Velinsky agrees with this aspect of my assessment of KR996. Ex. 2020 at 93:16–94:16 (admitting that if the bogie rolls over rubble, the machine would have trouble coupling with the bogie), 94:17–95:3 (admitting that on a bumpy grass surface, the machine would have trouble coupling with the bogie), 99:22–100:24 (admitting that mud, snow and ice conditions would cause the bogie to be misaligned), 101:21–102:1 (admitting that on uneven terrain the bogie would be unable to couple with the machine).

113. Despite recognizing these significant limitations of the KR996 machine, Dr. Velinsky admitted that he did not consider the machine's coupling and uncoupling feature when conducting his validity analysis. *Id.* at 103:3–18 (“I wasn’t concerned about the coupling, uncoupling in that manner.”).

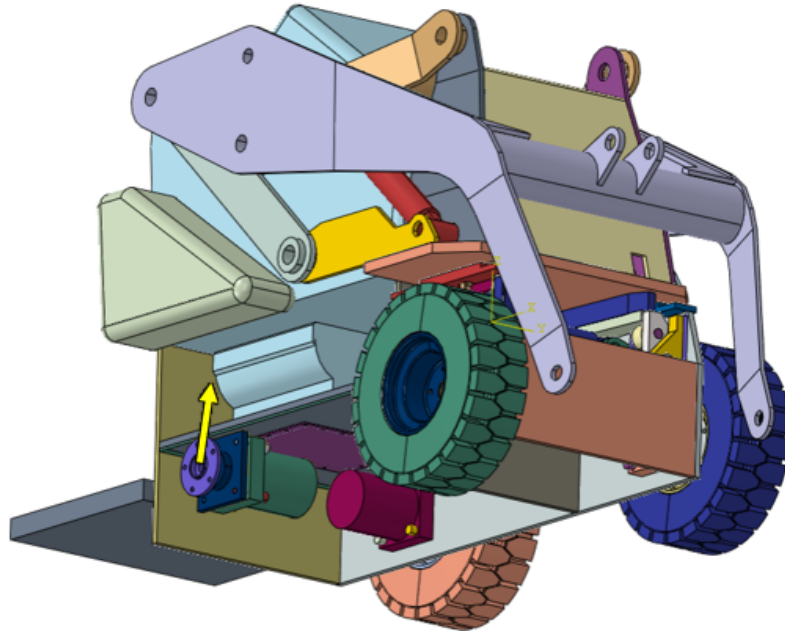
114. Given the foregoing restrictions, and the need for the KR996 machine to fulfill its intended purpose, which is to provide a platform for quickly interchanging attachments, a POSITA would not be motivated to add tracks to the KR996 machine for operation in uneven, rocky or muddy terrain, because the machine is otherwise incapable of being operated in such environments.

115. Despite the foregoing, I did evaluate the feasibility of replacing the wheels of the KR996 patent with the track system taught in Bares. As shown in the image below, this replacement causes significant interference between the track system and the tank structure on the mainframe.

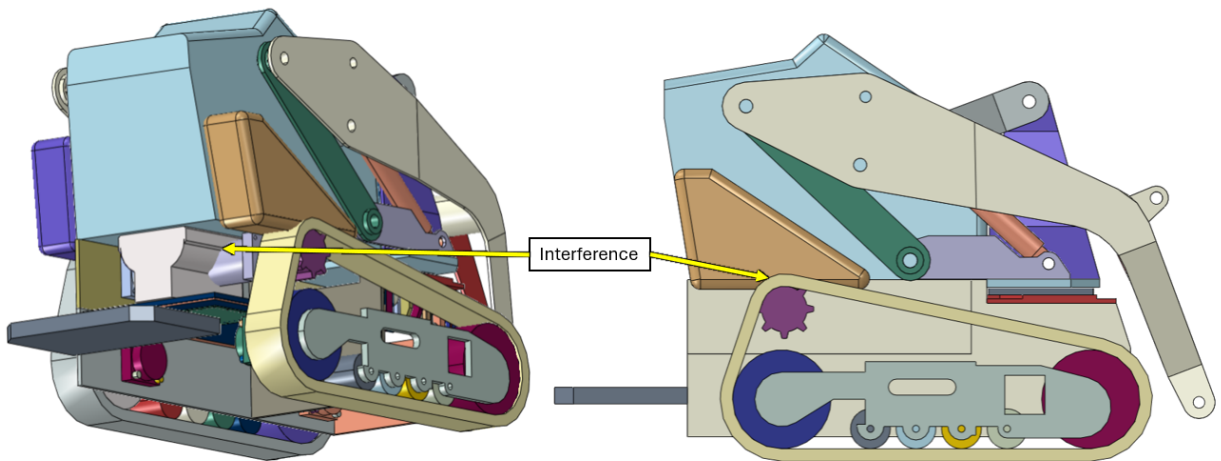


KR996 CAD model with Bares track superimposed.

116. Additionally, this configuration would require a redesign of the fundamental structure and drivetrain of the KR996 patent. As shown in the following figure, the drive motor and sprocket of Bares would directly interfere with the engine and support structure of the machine.



KR996 CAD model showing limited room to move rear wheel drive motor.



Given these issues, a POSITA would not be motivated to combine the track system of Bares with KR996 and would not have a reasonable expectation of success in doing so.

117. Further, even if a POSITA had considered the potential benefits of replacing the tires of KR996 with tracks, the critical loss of the key removability

feature associated with the tires' interaction with the bogie and the additional complications and substantial redesign work required to achieve this modification would substantially outweigh any potential benefit that could possibly be gained by replacing the tires. This further confirms that a POSITA would not have had a motivation to modify KR996 as Dr. Velinsky asserts.

XI. KUBOTA'S GROUND 1 AND GROUND 2 ARGUMENTS FAIL

A. KR996 Fails to Disclose the Linkages and Actuator Attached to the Loader Support, as Required by the Challenged Claims.

118. In Ground 1 and Ground 2 of its Petition, Kubota asserts that claims 1–8 and 10 of the '891 Patent are anticipated or obvious in light of KR996. Petition at 20–60. For the reasons described below, I disagree that the subject matter defined in these claims is anticipated by KR996 or would have been obvious to a POSITA in light of KR996.

119. As explained below, the KR996 machine fails to satisfy the following limitations of claims 1–8 and 10:

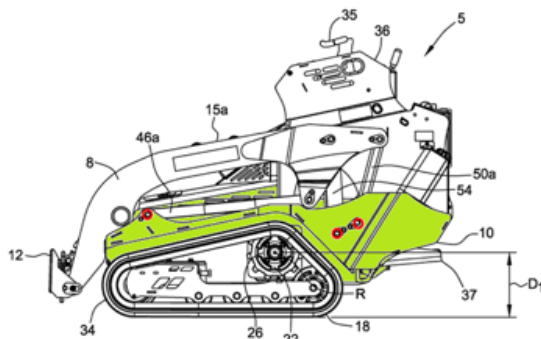
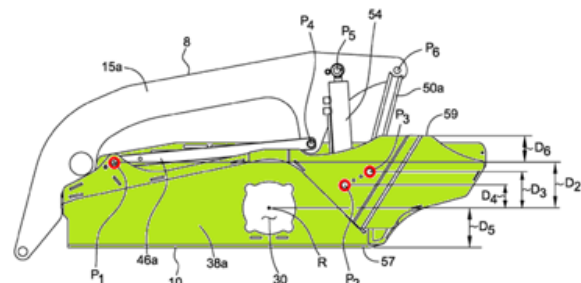
- “a first linkage *connected to the first side of the loader support* and connected to the loader, the first linkage being pivotal relative to the first side of the loader support” (independent claim 1 and claims 2–8 and 10, which depend from claim 1)
- “a second linkage *connected to the first side of the loader support* and connected to the loader, the second linkage being pivotal relative to the

first side of the loader support” (independent claim 1 and claims 2–8 and 10, which depend from claim 1)

- “a second actuator . . . *connected to the loader support* and connected to the loader, the second actuator being directly attached to the loader, the second actuator being pivotal relative to at least the first side of the loader support” (independent claim 1 and claims 2–8 and 10, which depend from claim 1)

See Ex. 1001.

120. The limitations of the Challenged Claims require pivotal connections between the loader support and linkages or an actuator. The locations of these pivotal connections on the loader support are depicted, for example, in Figures 1 and 5:



Id. at Figs. 2, 5 (mainframe shaded green, pivotal connections indicated by red circles).

121. As discussed above, the Board has preliminarily determined (and I agree) that a POSITA would interpret the term “mainframe” to mean “the *primary* supporting structure” of the machine. And I have construed “mainframe” and “loader support” to have the same meaning.

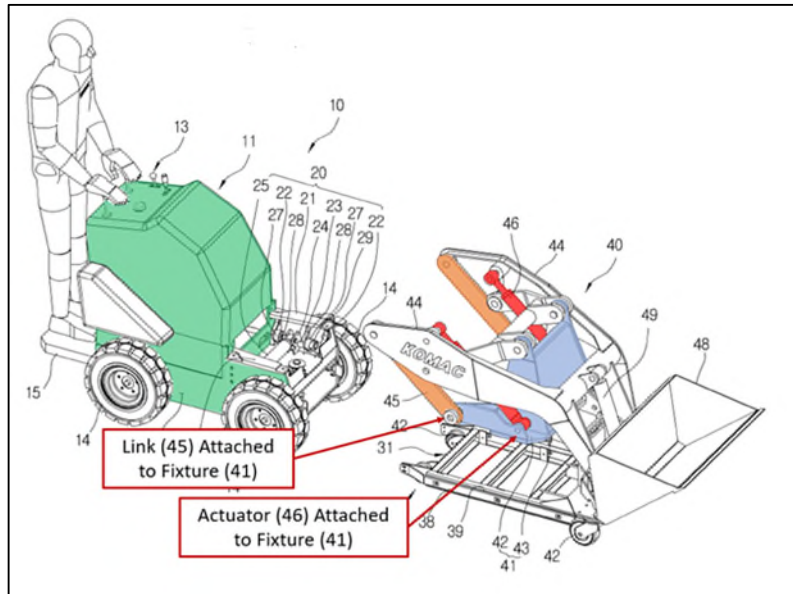
122. Dr. Velinsky does not expressly identify a construction for any of the terms of the ‘891 Patent, including “mainframe”/“loader support”. Ex. 1003 at ¶ 51.

123. To present their anticipation and obviousness positions, Dr. Velinsky and Kubota argue that multiple discrete components disclosed in KR996, when combined, constitute a “loader support.” See, Petition at 29–30, 31, 48–51; Ex. 1003 at ¶¶ 72–73, 75, 86–87, 90, 93–94, 102, 127–129.

124. To satisfy the pivotal-attachment limitations appearing in the Challenged Claims, Kubota and Dr. Velinsky assert that the removable fixture (41) constitutes part of the “loader support” of the machine. *Id.*³

125. The removable fixture Kubota and Dr. Velinsky assert constitutes a part of the “loader support” is depicted below in blue:

³ It is worth noting that Dr. Velinsky applied an interpretation of the term mainframe/loader support that did not require the mainframe/loader support to be the “primary” frame of the machine.



Ex. 1005 at Fig. 1 (shading and annotations added).

126. I disagree with Kubota and Dr. Velinsky’s contention that the blue component above constitutes part of the loader support. A POSITA would not consider the detachable fixture (41) to be a part of the loader support (*i.e.*, *primary* supporting structure) of KR996’s machine.

127. A POSITA would understand that the *primary* supporting structure of KR996 is the “main body (11)” of the machine that is present during *all* phases of the machine’s operation.

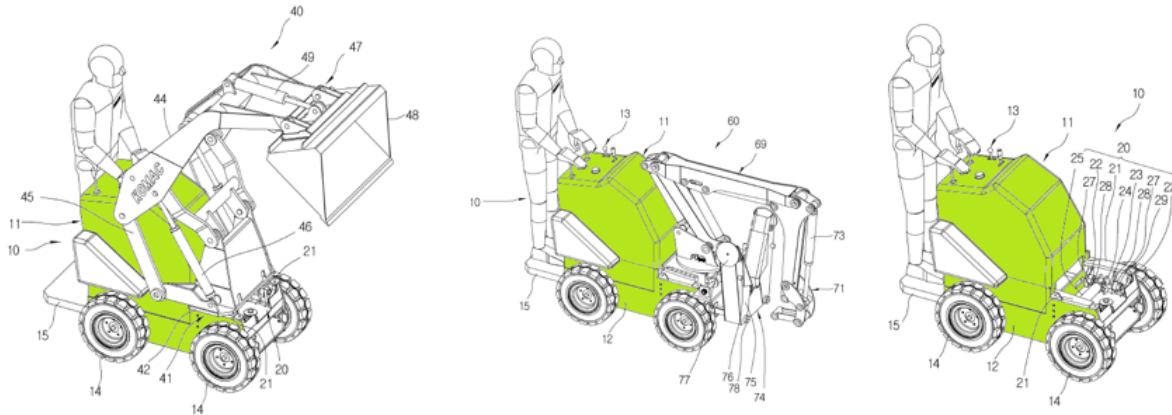
128. As discussed above, the machine described in KR996 operates in a number of different modes. Dr. Velinsky agrees with this assessment of KR996. Ex. 2020 at 84:23–86:3.

129. During many of those modes (*e.g.*, when (1) neither attachment is mounted, (2) the breaker unit attachment is mounted or (3) when the machine is

performing its attaching or detaching function) the machine is operated with the structure Kubota and Dr. Velinsky call the “loader support” *completely disconnected from the machine*.

130. KR996 expressly teaches that fixture (41) is routinely detached from the machine and left aside while the machine performs other work. Ex. 1005 at Abstract (“Therefore, *the present invention can easily and quickly detach the loader unit with a bucket and the arm unit with a breaker installed on a vehicle*, thereby greatly reducing the economic burden of purchasing expensive heavy equipment, and significantly saving time and expenses for the maintenance of heavy equipment.” (emphasis added)), [0001], [0011], [0012] (“The purpose of the present invention is to provide construction equipment for green building deconstruction work, *which enables the easy and quick attachment and detachment of a bucket and a breaker with a single vehicle*, to solve the aforementioned problems.” (emphasis added)), [0013].

131. Accordingly, a POSITA would consider fixture (41) to be secondary structure, in contrast to the true “loader support”—that being the “main body (11)” —which is present during all modes of operation (shaded in green below):



Id. at Figs. 1, 9, 19 (shading added).

132. KR996 expressly corroborates this perspective by distinguishing fixture (41) from the “main body (11)” in descriptions of the invention. *Id.* at [0018], [0043], [0054], Fig. 1.

133. For the reasons set forth above, the combination of KR996 does not satisfy every limitation the Challenged Claims, and therefore does not anticipate those claims or render them obvious.

B. KR996 Fails to Disclose the Linkages and Actuator Attached to a Single-Weldment Loader Support, as Required by Claims 2.

134. Claim 2 depends from independent claim 1, and further requires that the “loader support incorporates a single weldment.” This additional claim limitation requires that all of the portions of the loader support constitute a single, unitary weldment, as shown, for example, in the embodiment shown in Figure 4 of the ‘891 patent. As discussed above, Kubota and Dr. Velinsky argue that multiple discrete structures from the machine disclosed in KR996 constitute the “loader

support” (e.g., the main body (11) combined with fixture (41) of the detachable loader unit). Therefore, for claim 2, they argue a POSITA would have been motivated to weld the various components of the “mainframe” together to create a single weldment.

135. In support of this position, Kubota and Dr. Velinsky rely on the fact that welding is “a well-known method of fabrication” and that the prior art teaches the use of a welded mainframe. *See* Petition at 46–48; Ex. 1003 at ¶¶ 121–125. Kubota and Dr. Velinsky fail, however, to provide any motivation for a POSITA to weld the fixture (41) to the main body (11) of the KR996 machine.

136. To the contrary, KR996 teaches *away* from fusing fixture (41) to the main body (11) of the machine. A POSITA would recognize that welding those components together would destroy the key detachability feature that characterizes the KR996 invention. Ex. 1005 at Abstract, *see also id.* at [0001], [0011]–[0015].

137. Because KR996 affirmatively teaches away from permanently fusing its purposefully detachable components together, KR996 would not have rendered the subject matter of claim 2 obvious.

XII. KUBOTA’S GROUND 3 ARGUMENTS FAIL

138. In Ground 3 of its Petition, Kubota asserts that claim 9 of the ‘891 Patent is obvious in light of KR996 and Bares. I disagree.

139. Claim 9 depends from claim 1, and therefore incorporates all of the limitations of claim 1 while adding the requirement that the “the loader apparatus comprises a drive mechanism for propelling the loader apparatus over a supporting surface, the drive mechanism having a drive sprocket defining a rotational axis R, at least a portion of the operator platform being disposed rearward to the rotational axis R relative to a longitudinal axis of the loader apparatus.” Ex. 1001 at 8:21–27.

140. For the reasons discussed above in Section X.A, a POSITA would not have been motivated to alter the KR996 machine based on Bares, and certainly not in the manner proposed by Petitioner. Also, as discussed in Section XI, KR996 does not satisfy all of the limitations of claim 1. Therefore, Kubota’s Ground 3 arguments fail for the reasons explained above for Ground 1.

XIII. KUBOTA’S GROUND 4 ARGUMENTS FAIL

141. In Ground 4 of its Petition, Kubota asserts that claim 8 of the ‘891 Patent is obvious in light of KR996 and SAE. I disagree.

142. Claim 8 depends from claim 1, and therefore incorporates all of the limitations of claim 1 while adding the requirement that the “the loader apparatus has a mass of less than 1500 kg.” Ex. 1001 at 8:19–20.

143. For the reasons in Section XI, KR996 does not satisfy all of the limitations of claim 1. Therefore, Kubota’s Ground 4 arguments fail for the reasons explained above for Ground 1.

XIV. SECONDARY INDICIA OF NON-OBVIOUSNESS

144. I understand that other elements called “secondary indicia of non-obviousness” should also be considered in an obviousness analysis. It is my understanding that these elements often provide necessary context about the invention and its industry, both before the patent owner filed a patent application and after the invention is available for sale, and help to ward against the hindsight bias that can improperly affect the obviousness analysis.

145. I understand that secondary indicia of non-obviousness may include: (i) commercial success of the patented invention, (ii) skepticism of those having ordinary skill in the art at the time of invention, (iii) unexpected results of the invention, (iv) any long-felt but unsolved need in the art that was satisfied by the alleged invention, (v) the failure of others to make the alleged invention, (vi) praise of the alleged invention by those having ordinary skill in the art, and (vii) copying of the alleged invention by others in the field.

146. I have reviewed evidence relevant to these secondary indicia of non-obviousness from the prosecution histories of Vermeer’s patents, including the reexamination proceedings initiated by Toro and documents from Kubota produced in this case. This evidence further supports my opinions above that the claimed invention would not have been obvious to a POSITA based on the prior art and arguments presented by Kubota and Dr. Velinsky.

A. Commercial Success and Praise

147. The prosecution histories of the related Vermeer patents included evidence of commercial success and praise of products that practice the '891 Patent. I have reviewed this evidence, and it is consistent with my conclusion that the claimed invention was not obvious.

148. This evidence related to three early vertical-lift compact utility loaders: Vermeer's CTX50, Vermeer's CTX100, and Toro's TX1000.



Vermeer's CTX50



Vermeer's CTX100



Toro's TX1000

149. Vermeer's CTX machines and Toro's TX1000 machine embody the features of the '891 Patent. This is shown, for example in Ex. 2022, Ex. 2023, and Ex. 2024.

150. The evidence I reviewed in the prosecution histories shows that the increased lift height and lift capacity achieved by these vertical-lift compact utility carriers garnered industry praise. For example, shortly after the release of the CTX50, Vermeer received an "Innovative Iron Award" from Compact Equipment Magazine. Ex. 2025 at 1–2; Ex. 2014 at 125, 183; Ex. 2015 at 126, 215. This award is given to companies "that have changed the commercial equipment market...with

their unique, interesting, and innovative machines, engines, and technologies.” Ex. 2025 at 1. Compact Equipment Magazine also celebrated Toro’s TX1000 and noted that “Toro and Vermeer were the first manufacturers to introduce vertical lift to the compact tool carrier market.” *Id.* at 1–2. Compact Equipment Magazine specifically cited the vertical-lift path as an enhancement that made Vermeer’s CTX50 a “game-changer.” *Id.* at 2; Ex. 2014 at 125, 183; Ex. 2015 at 126, 215.

151. This industry praise was consistent with the machine’s commercial success. During the Toro reexaminations, Vermeer’s Product Manager for compact utility loaders testified that the popularity of vertical-lift machines caused its total sales of compact utility loaders to double, and that the percentage of those sales comprising vertical-lift machines increased from 11% to 37% within the first three years. Ex. 2015 at 128, 298–299, 301–302. Toro’s 2015 Annual Statement similarly boasted a significant increase in compact utility loader sales following the launch of its TX1000 machine. Ex. 2014 at 185; Ex. 2015 at 128–129, 218.

B. Skepticism at the Time of Invention

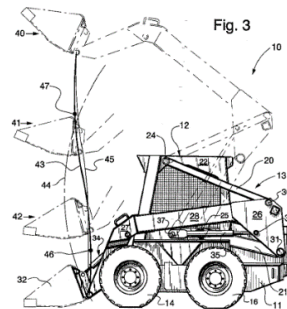
152. The evidence submitted to the Patent Office during the reexaminations further shows that at the time of Vermeer’s invention, there was skepticism within the industry that compact utility loaders could achieve meaningful vertical lift.

153. For example, Toro opined in internal documents that the ability to provide vertical lift would potentially be a “key differentiator” for a compact utility

loader because it would provide “unprecedented” lift capacity. Ex. 2002 at 188, 734. But Toro’s engineers identified significant challenges inhibiting the development of a vertical-lift mechanism, including “failures” caused by “[l]oader arm complexity and durability,” as well as the “[i]ncreased weight, cost, and time” required “to develop the arm.” Ex. 2002 at 187, 736.

154. Toro filed a patent application for its vertical-lift compact utility loader. In its application, Toro noted that this loader-arm configuration had been “considered difficult if not impossible due to size and durability constraints.”

[0007] Finally, the vertical reach of the loader arms on compact utility loaders is somewhat limited. While high lift loader arms are known on full size skid steer loaders as disclosed in U.S. Pat. No. 5,542,814, the use of such high lift loader arms on a compact utility loader has been considered difficult if not impossible due to size and durability constraints. Accordingly, it would be a further advance in the art to provide a way of safely and durably providing high lift loader arms on compact utility loaders to extend the vertical reach of such loaders. For example, this would allow a compact utility loader to dump debris or materials at higher elevations than previously, thus allowing the use of larger trucks to accept such debris or materials for transport.



Ex. 2006 at [0007]; Ex. 2007 at Fig. 3.

C. Unexpected Results of the Invention

155. The prosecution histories relating to the ‘891 Patent also contained evidence showing that the claimed invention surpassed expectations. For example, this evidence showed that the machine claimed in the ‘891 Patent achieved 32% *greater* lift capacity than its non-vertical lift counterpart. Ex. 2014 at 74, 120–121, 124, 142, 182. During reexamination, the Patent Office recognized that Vermeer’s

32% increase in lift capacity—without increasing the machine’s weight—“was unexpected.” *Id.* at 34, 74.

D. Long-Felt but Unsolved Need and Prior Failures

156. I have also reviewed evidence of long-felt and unsolved need in the prosecution history record. Compact tool carriers have been commercially available since 1986. Ex. 2014 at 121, 173. The evidence showed customers desired greater lift capacity for these machines, but “not at the expense” of a heavier machine or wider footprint. Ex. 2002 at 174–175, 542. The evidence also showed that prior to Vermeer’s invention, others attempted to solve the known problem of increasing lift capacity of compact tool carriers in a variety of ways.

157. For example, the prosecution history record shows that early attempts to solve this problem focused on shifting or adding weight to the rear of the machine. Ex. 2002 at 175–176, 517–518. One way to do so was to weld weights to the rear of the machine. *Id.* To this day, manufacturers sell “weight kits” or “weight packages” as accessories to utility loaders of all sizes. *See id.*, at 217–218. Customers have been adding makeshift weight kits to their own machines for years in an attempt to increase lift capacity. *Id.* at 218.

158. Weight kits, however, only provide only a minimal increase in lift capacity while incurring the significant disadvantages of adding mass to the machine, such as higher costs (Ex. 2015 at 632), less ground clearance (Ex. 2014 at

177), and more damage to the terrain. *See generally* Ex. 2014 at 178. A relatively light weight is an important feature for compact utility loaders. Ex. 2020 at 35:4–15.

159. The evidence further shows that manufacturers tried to increase lift capacity by shifting the fuel tank to the rear of the machine. Ex. 2014 at 175.

160. Another attempt to increase lift capacity was the shift from walk-behind to stand-on or ride-on compact utility carriers. Stand-on compact utility carriers have an operator platform at the rear of the machine. Ex. 1001 at 3:49–51. This solution added the operator’s weight (a standard of 165 pounds) to the back of the machine. Ex. 2014 at 176. This, too, resulted in a minimal improvement to the lift capacity. *Id.* at 175.

161. The prosecution history record shows that traditional methods of increasing lift capacity were minimally effective, and often resulted in a less desirable machine overall. Competitors in the industry tried, and failed, to find a novel solution for increasing lift capacity. For example, Toro spent years testing different modifications on compact utility carriers without thinking to employ a vertical-lift arm. Ex. 2002 at 173–178, 548, 703. Indeed, the Patent Office ultimately concluded, based on the evidence of Toro’s attempts to solve the lift capacity problem, that Toro “did not find it obvious to employ a vertical lift loader arm arrangement on a CUL.” Ex. 2002 at 151.

E. Copying

162. I have reviewed internal documents produced by Kubota in this proceeding regarding [REDACTED].

These documents show [REDACTED]

[REDACTED]

[REDACTED].

1. Results from Kubota's Dealer Surveys

163. Vermeer and Toro were the first companies to launch vertical-lift compact utility carriers in 2015. Ex. 2025 at 1–2. At that time, Kubota had no compact utility loader on the market or in development.

164. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

165. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

166.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

167.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

168. Kubota admits that it heavily relied on the results of its industry surveys to develop its first compact utility loader, the SCL1000. For example, when debuting the SCL1000 at a 2020 trade show, Kubota explained that it decided to launch a vertical-lift compact utility loader after it “did several surveys, took the

machine out as a prototype, got feedback, [and] made changes” based on that feedback. Ex. 2028 at 6; Ex. 2029 at 2–4, 15, 27–30; Ex. 2030 at 6, 15, 35; Ex. 2031 at 2; Ex. 2027 at 1 (“The SCL1000...specifically fill[s] the requests from contractors in the marketplace.”)

2. Kubota’s Competitor Research

169.

[REDACTED]

[REDACTED]

[REDACTED]; see also Ex. 2029 at 2–4, 15; Ex. 2030 at 35. [REDACTED]

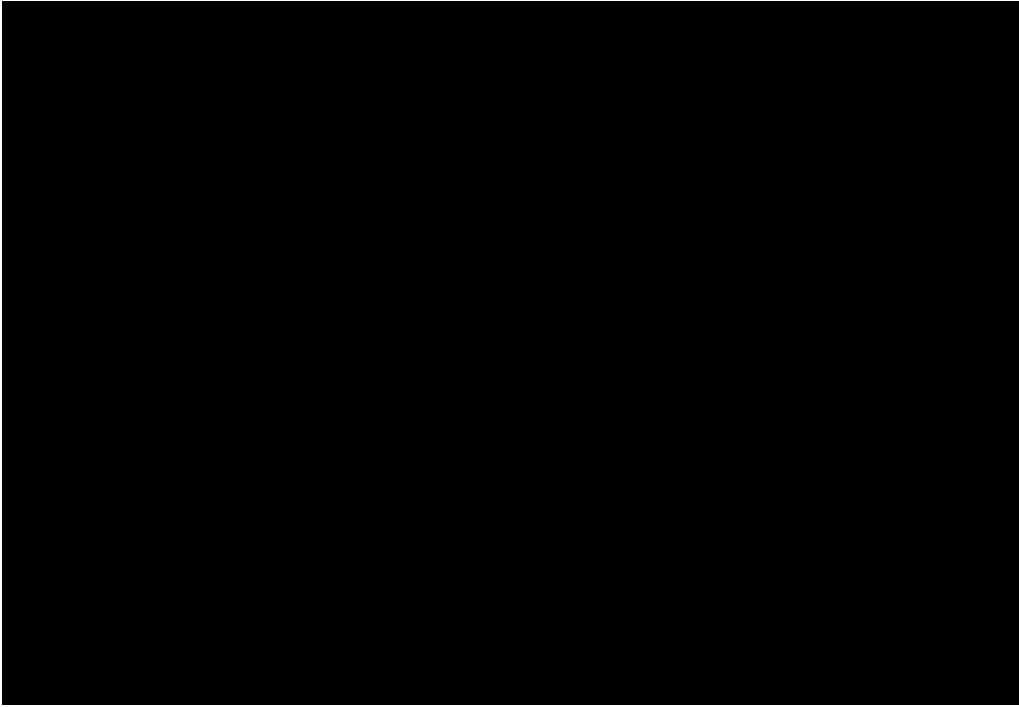
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170.

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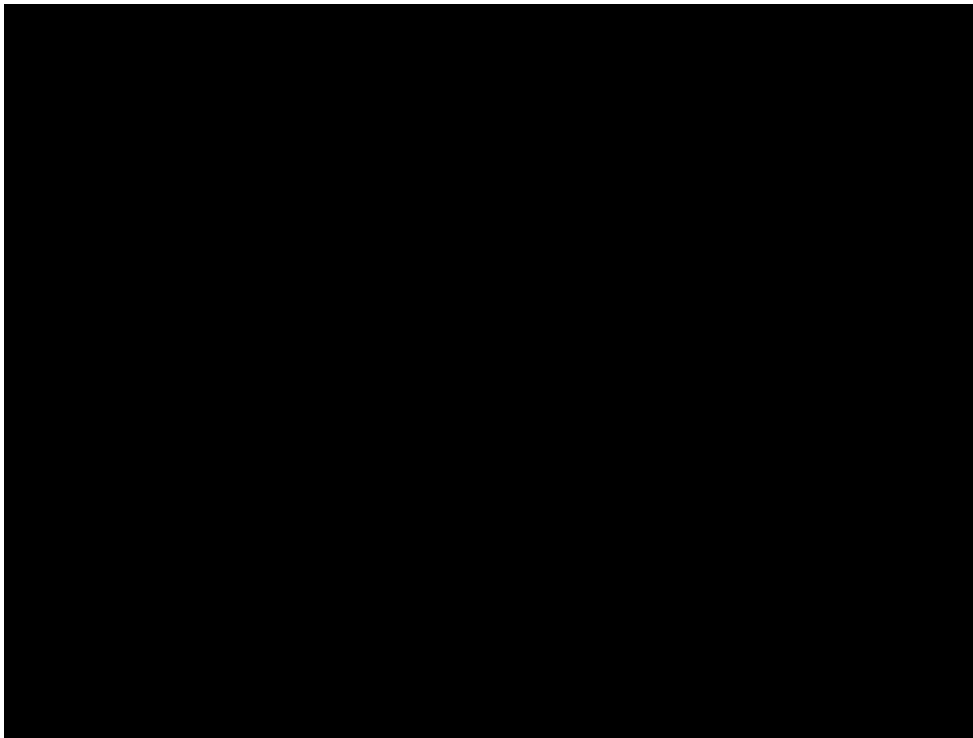


[REDACTED]

171.

[REDACTED]

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172.

[REDACTED]

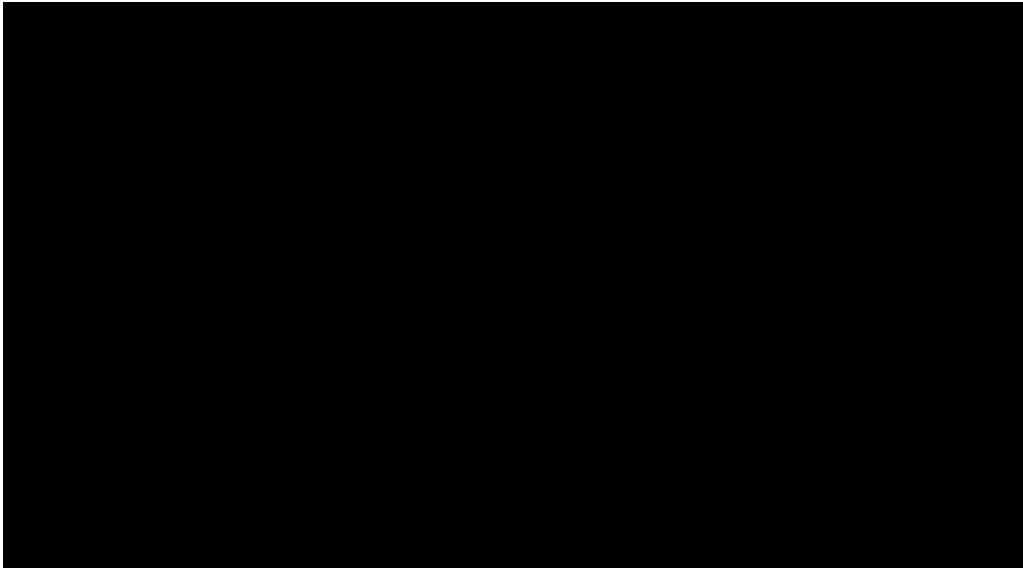
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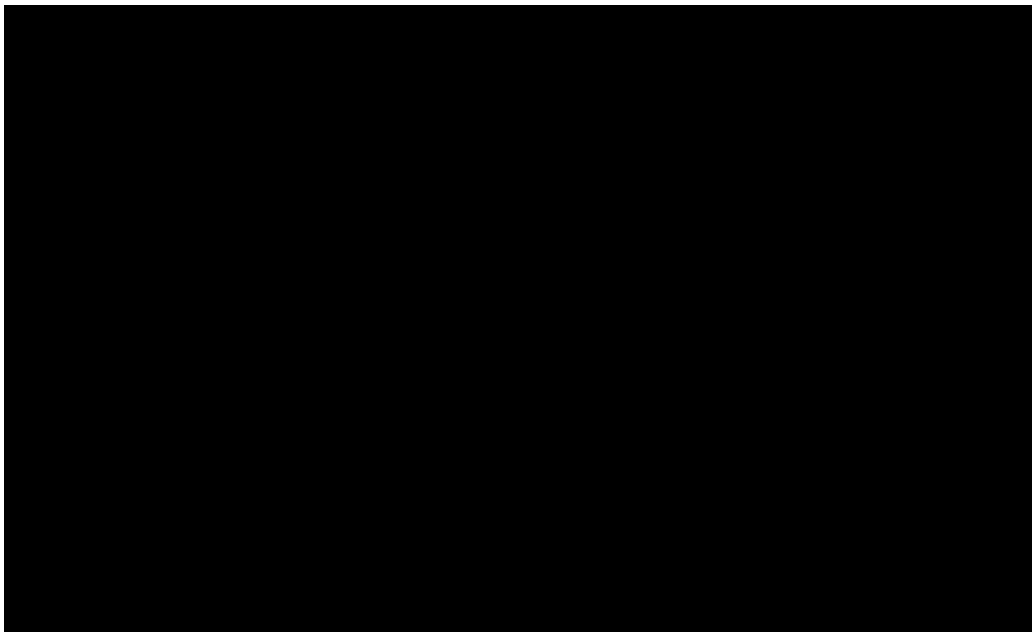
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173.

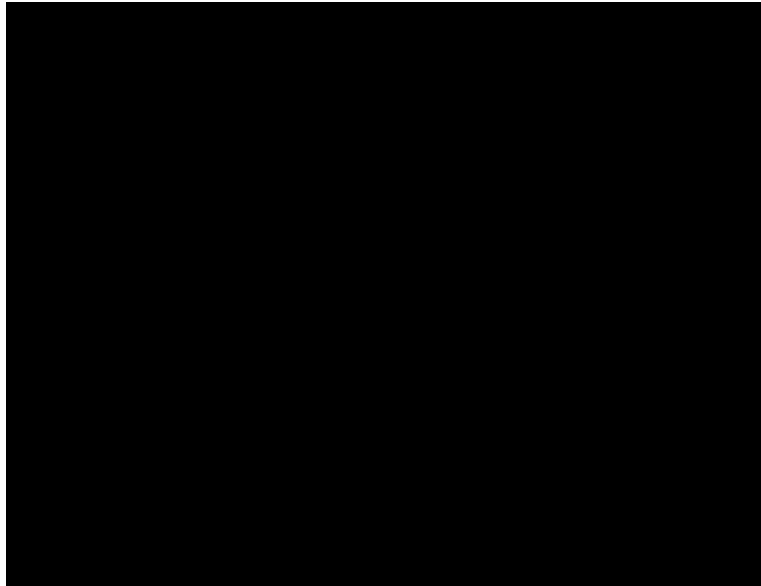
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[REDACTED]



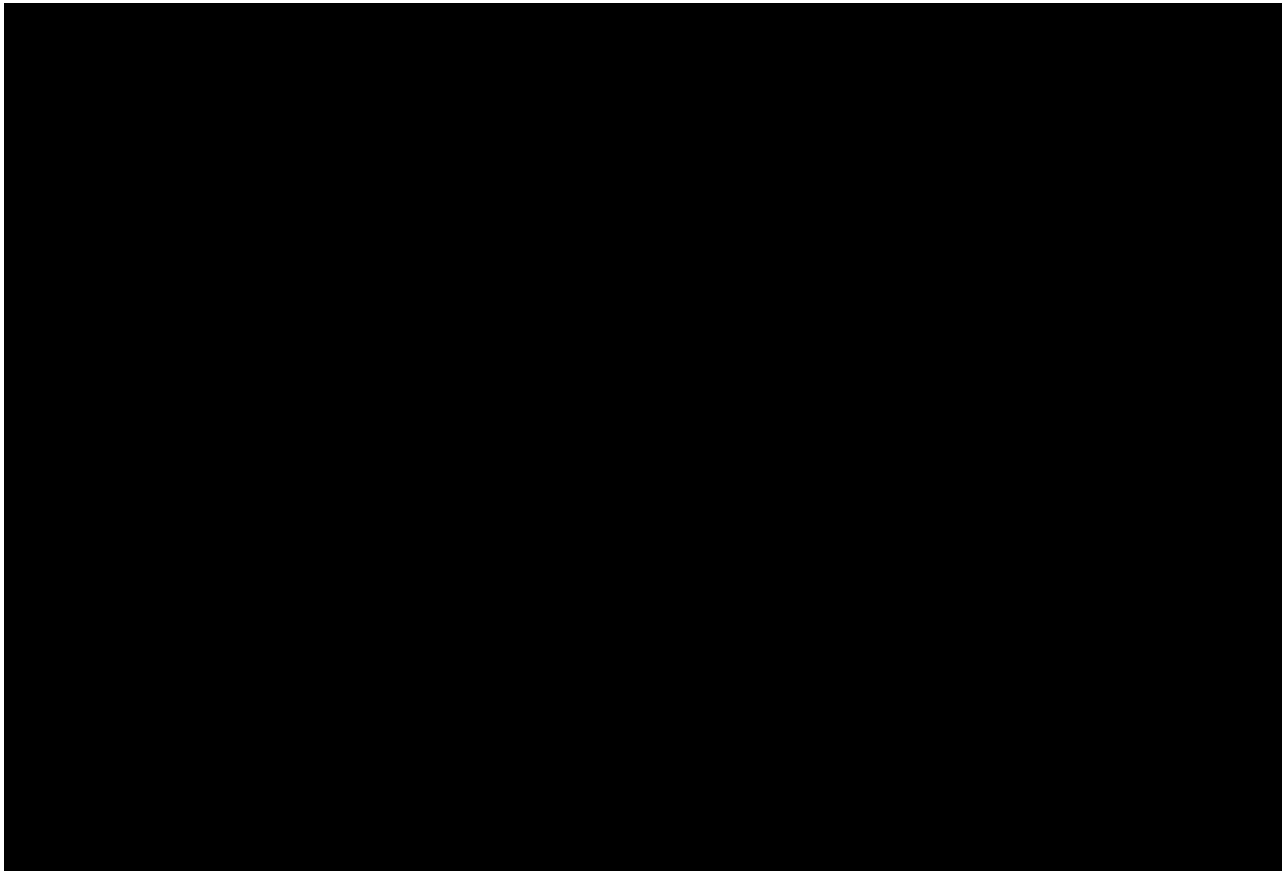
[Redacted]

3. Kubota's Proposed Specifications for its Compact Utility Loader

174.

[Redacted]

[Redacted]



175. Based on my review of the prosecution history evidentiary record, the documents produced by Kubota, and the other information I have identified, it is my opinion that the secondary indicia of non-obviousness factors further confirm my conclusion that the invention claimed in the '891 Patent would not have been obvious to a POSITA based on the prior art identified by Kubota.

XV. CONCLUSION

176. As explained above, it is my opinion that the Challenged Claims describe a compact utility loader with features that would not have been obvious to

Declaration of Mark Fleming
IPR2025-00381 to U.S. Patent No. 11,465,891

one of ordinary skill in the art at the time of the effective filing date in 2015 in light of the prior art and arguments presented by Kubota and Dr. Velinsky.

177. I reserve the right to supplement my opinions in the future to respond to any arguments that Kubota may raise and to take into account new information as it becomes available to me.

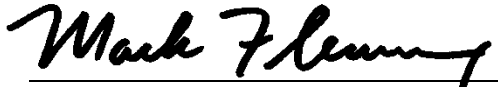
178. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment,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

179. In signing this Declaration, I understand 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 acknowledge that I may be subject to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for cross examination within the United States during the time allotted for cross examination.

Declaration of Mark Fleming
IPR2025-00381 to U.S. Patent No. 11,465,891

I declare under penalty of perjury that the foregoing is true and correct.

Executed on September 14, 2025.


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

APPENDIX A



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

Chief Technical Officer

Direct: (331) 229-3328; Cell: (630) 947-2238

MFleming@fusioneng.com

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: 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 States 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 States 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 States 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: Eighth 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

Project Name: McNamara v Neal and FCA
Case Number: 23-2-13067-7 SEA
Location: Superior Court of the State of Washington for King County
Date: November 18, 2024

Deposition

Project Name: Maschio Gaspardo v Precision Planting
Case Number: 1:22-cv-01394-RGA-LDH
Location: United States District Court for the District of Delaware
Date: January 15, 2025

Deposition

Project Name: Lacy Bibelhauser v Ford Motor Company and Christopher Bibelhauser
Case Number: 20-CI-005047
Location: Commonwealth of Kentucky Jefferson Circuit Court
Date: January 24, 2025

Deposition

Project Name: Philbeck, Rodney v Ford Motor Company
Case Number: 2:23-cv-00339
Location: United States District Court for the Eastern District of Washington
Date: January 31, 2025

Deposition

Project Name: Landers, Rick and Salinas Zarling v Ford Motor Company
Case Number: 2:23-cv-915-PA-PVC
Location: United States District Court Central District of California
Date: March 18, 2025
Deposition

Project Name: Van Tussenbrook, Justin v Yamaha Motor Corporation, et al.
Case Number: 30-2022-01273750-CU-PL-CJC
Location: Superior Court of the State of California, County of Orange-Central
Date: June 24, 2025
Deposition

APPENDIX B

MATERIALS CONSIDERED

Exhibit	Description
1001	U.S. Patent No. 11,465,891 (the “’891 patent”)
1002	Prosecution History of U.S. Patent No. 11,465,891
1003	Declaration of Steven Velinsky under 37 C.F.R. § 1.68
1004	<i>Reserved</i>
1005	Korean Patent No. 10-1041996 including original Korean language document, certified English translation, and certification of translation (“KR996”)
1006	JP2004017705A including original Japanese language document, certified English translation, and certification of translation (“JP705”)
1007	U.S. Patent No. 6,397,967 (“McIlwraith”)
1008	U.S. Patent No. 3,586,195 (“Beltrami”)
1009	U.S. Patent No. 6,695,568 (“Bares ‘568”)
1010	U.S. Patent No. 6,832,659 (“Bares”)
1011	<i>Reserved</i>
1012	<i>Reserved</i>
1013	U.S. Patent Application No. 2008/0197588 to Azure (“Azure”)
1014	Korean Patent No. 10-1023528 including original Korean language document, certified translation, and certification (“KR528”)
1015	SAE International J2752 JUN2010 (“SAE J2752”), Surface Vehicle Recommended Practice, Personal Protection — Compact Tool Carriers
1016	International Organization for Standardization (ISO) 6165 (2012)
1017	<i>Reserved</i>
1018	<i>Reserved</i>
1019	First Amended Complaint, 4:24-cv-00799-P
1020	Claim Construction in Case No: 4-17-CV-76-CRW-HCA (Vermeer Corporation v. The Toro Company) (terminated)
1021	<i>Reserved</i>
1022	U.S. Patent No. 8,545,163 (“Yasuda”)
1023	N. Sclater, et al., Mechanisms and Mechanical Devices Sourcebook, Fourth Edition, Table of Contents, Chapter 1, Chapter 5
1024	N. Nariman-Zadeh, et al., “Pareto optimal synthesis of four-bar mechanisms for path generation,” 26 March 2008
1025	Four-Bar Coupler-Point Curves, Chapter 6

1026	H Nolle, Linkage Coupler Curve Synthesis: A Historical Review — II. Developments after 1875*, 7 July 1973
1027	Wen-Tzong Lee, et al., "Developments in quantitative dimensional synthesis (1970-present): four-bar path and function generation" 2017
1028	Theory of Machines and Mechanisms, Shigley, J.E. and Uicker, J.J. Jr., McGraw Hill, 1980, Table of Contents, Chapter 1, Chapter 2
1029	<i>Reserved</i>
1030	<i>Reserved</i>
1031	<i>Reserved</i>
1032	U.S. Patent Publication Appl. 2010/0168933 (“Rorabaugh”)
1033	<i>Reserved</i>
1034	United States District Court — National Judicial Caseload Profile
1035	<i>Reserved</i>
1036	<i>Curriculum Vitae</i> of Steven Velinsky
1037	Scheduling order 4:24-cv-00799-P
1038	Order Granting Motion to Stay, Case No. 4:24-cv-00799-P, March 19, 2025
1039	Vermeer Manufacturing Company’s Opening Claim Construction Brief, Case No. 4:19-cv-00050-CRW-HCA, August 23, 2019
1040	Vermeer Manufacturing Company’s Rebuttal Claim Construction Brief, Case No. 4:19-cv-00050-CRW-HCA, September 13, 2019
1041	Websters Dictionary (select portions)
2001	Prosecution History of U.S. Patent No. 9,321,386
2002	<i>Ex Parte</i> Reexamination 90/014,269
2003	U.S. Patent No. 7,695,236 (“Green”)
2004	U.S. Patent No. 8,821,104 (“Yasuda”)
2005	U.S. Patent Pub. Appl. 2009/0116943
2006	U.S. Patent Pub. Appl. 2016/0244937A1
2007	U.S. Patent No. 5,542,814
2008	Summary: Problems with the Disclosure in KR996
2009	Excerpts from Oxford Dictionary
2010	JPH 11140900 to Komatsu (“Komatsu”)
2011	Dingo Operators Manual
2012	Dingo Parts Catalog
2013	Declaration of Mark Fleming
2014	<i>Ex Parte</i> Reexamination 90/013915, which was submitted by Petitioner in IPR2025-00167

2015	Excerpts from <i>Ex Parte</i> Reexamination 90/014109, which was submitted by Petitioner in IPR2025-00167
2016	U.S. Patent No. 5,004,398
2017	U.S. Patent No. 5,666,794
2018	U.S. Patent No. 8,160,785
2019	U.S. Patent No. 9,039,344
2020	August 19, 2025 Deposition Transcript of Steven Alan Velinsky
2021	Exhibit 2 to August 19, 2025 Deposition Transcript of Steven Alan Velinsky
2022	TX1000 Infringement Contentions
2023	CTX50 Claim Charts
2024	CTX100 Claim Charts
2025	“Innovative Iron Awards: Toro and Vermeer Compact Tool Carriers”, Compact Equipment Magazine, December 22, 2015.
2026	Petitioner’s Confidential Document Production
2027	“Kubota enters stand-on track-loader segment with new SCL1000”, SAE, March 12, 2020.
2028	Transcript for “Kubota’s New SCL 1000 Stand-on Skid Steer” Video, ForConstructionPros, March 11, 2020
2029	Transcript for “Kubota Gets into the Stand-on Track Loader Market” Podcast, ForConstructionPros, March 11, 2020
2030	Transcript for “Kubota Expert Breaks Down the SCL1000” Video, EquipmentWorld, September 30, 2020
2031	“Kubota unveils its first mini skid steer, the SCL1000”, Equipment World, March 12, 2020 (updated March 14, 2020)
2032	Declaration of Richard L. Brophy
2033	Stipulated Protective Order