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(54) SYSTEM AND METHOD FOR WORK VEHICLE

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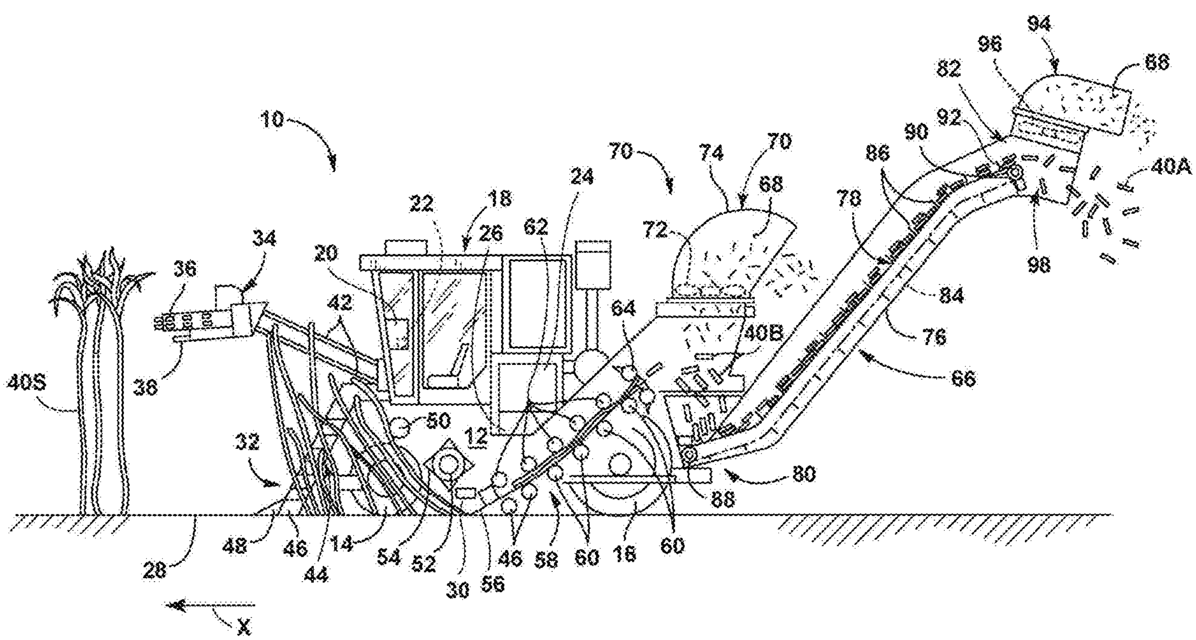
(57) **ABSTRACT**

A suspension system for a work vehicle can include one or more first support brackets configured to operably couple with a base component. One or more respective retainment brackets configured to operably couple with the one or more first support brackets and a cab. The one or more respective retainment brackets is configured to rotate relative to the one or more first support brackets about a pitch axis. One or more second support brackets is configured to operably couple with the base component. A cab crib is operably coupled with the one or more second support brackets. A suspension cylinder is coupled to the cab crib. A locking assembly is at least partially coupled with the cab crib and configured to selectively retain a cab frame.



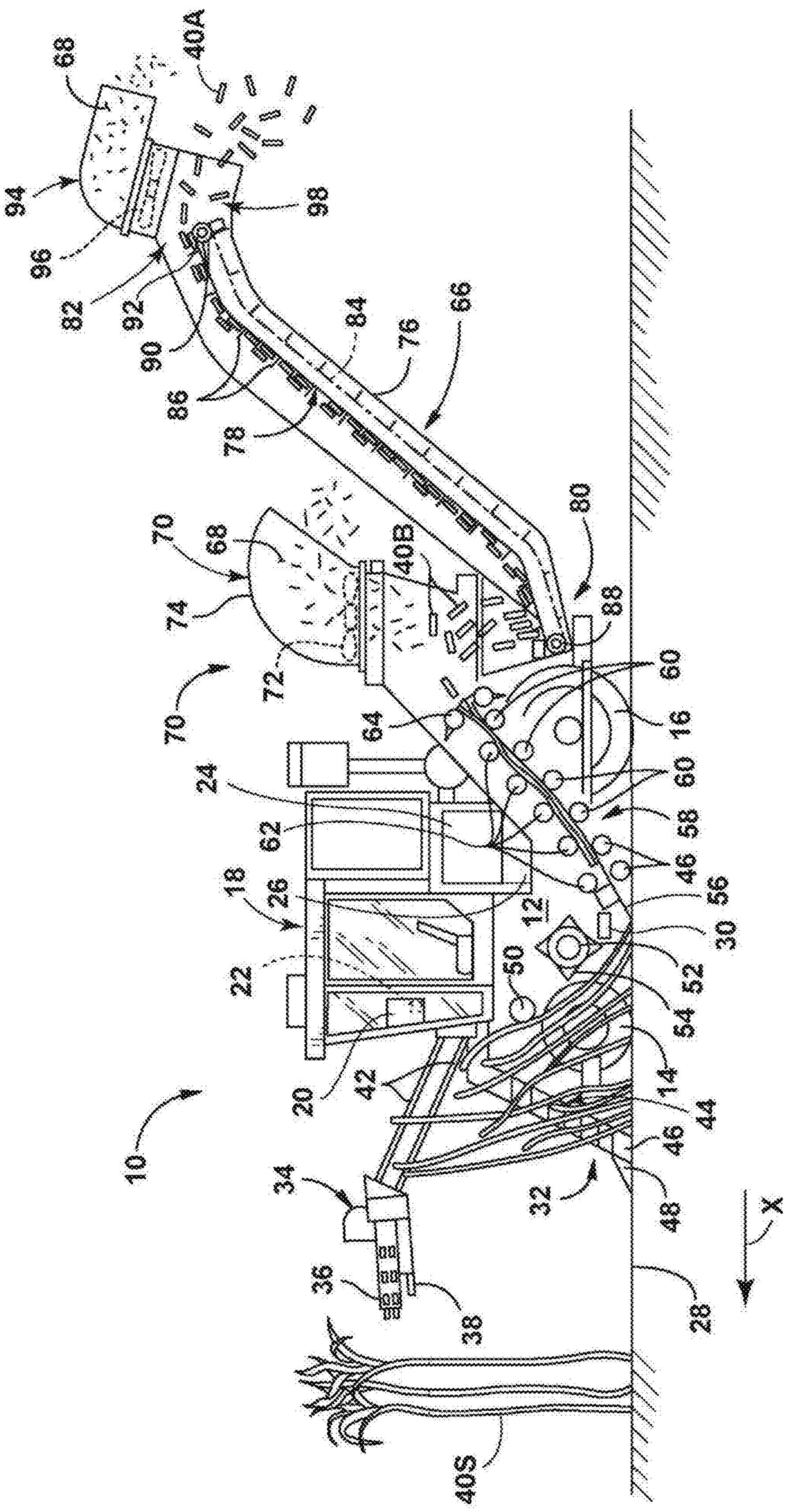

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Fig. 1

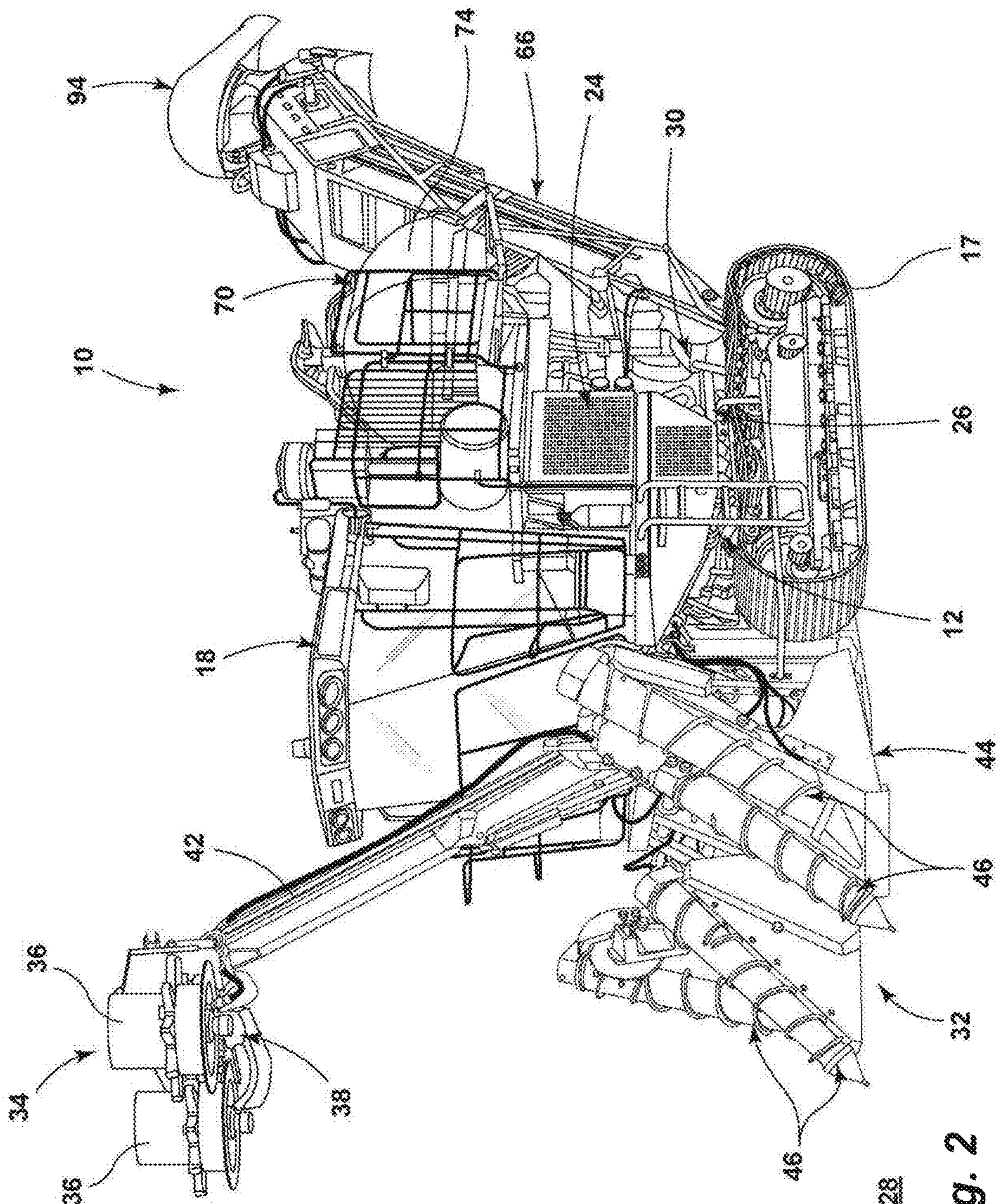

Fig. 2

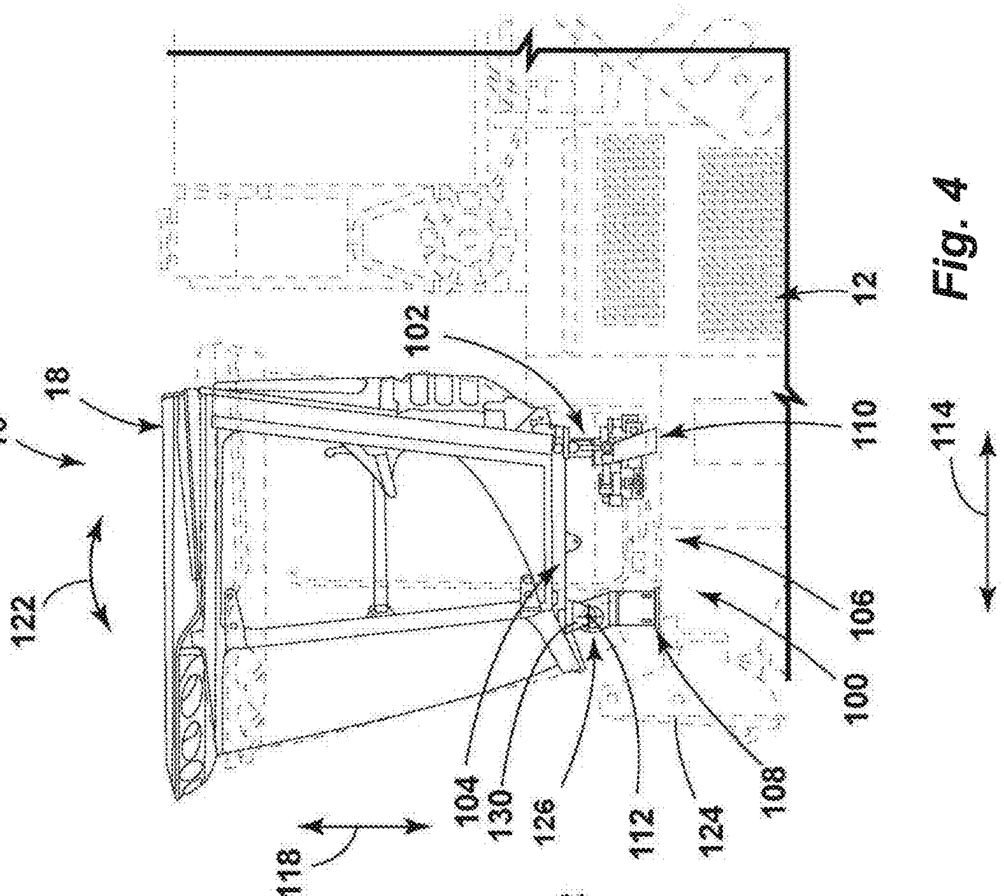
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Fig. 4

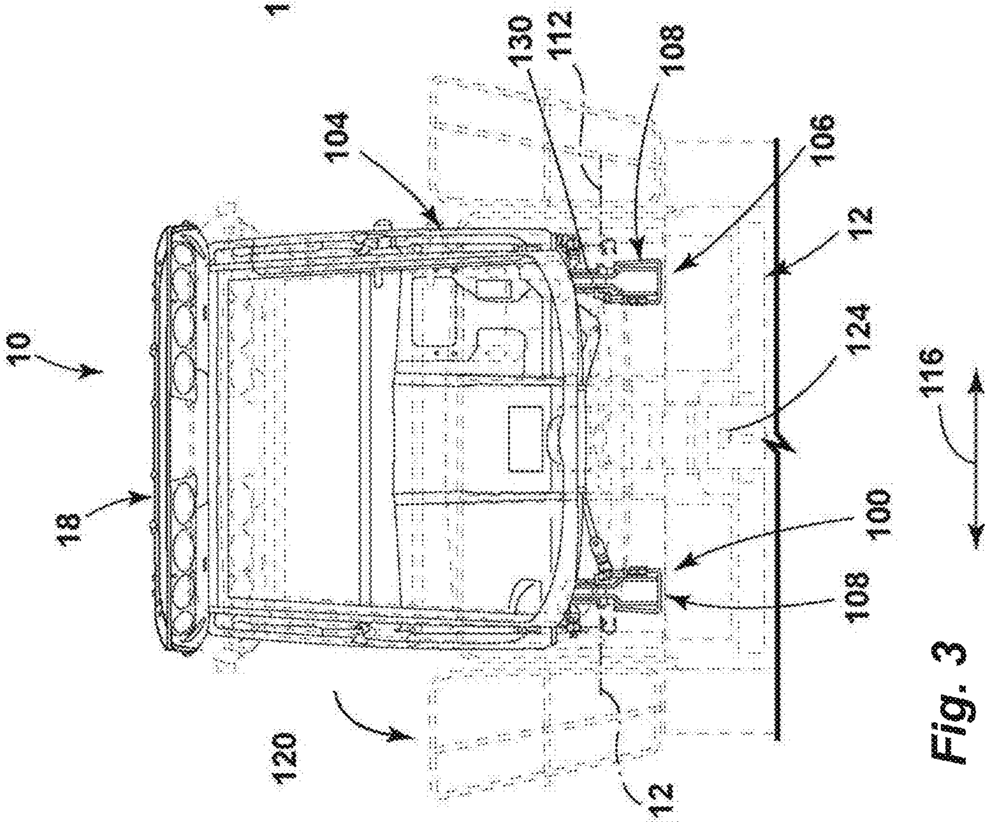
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Fig. 3

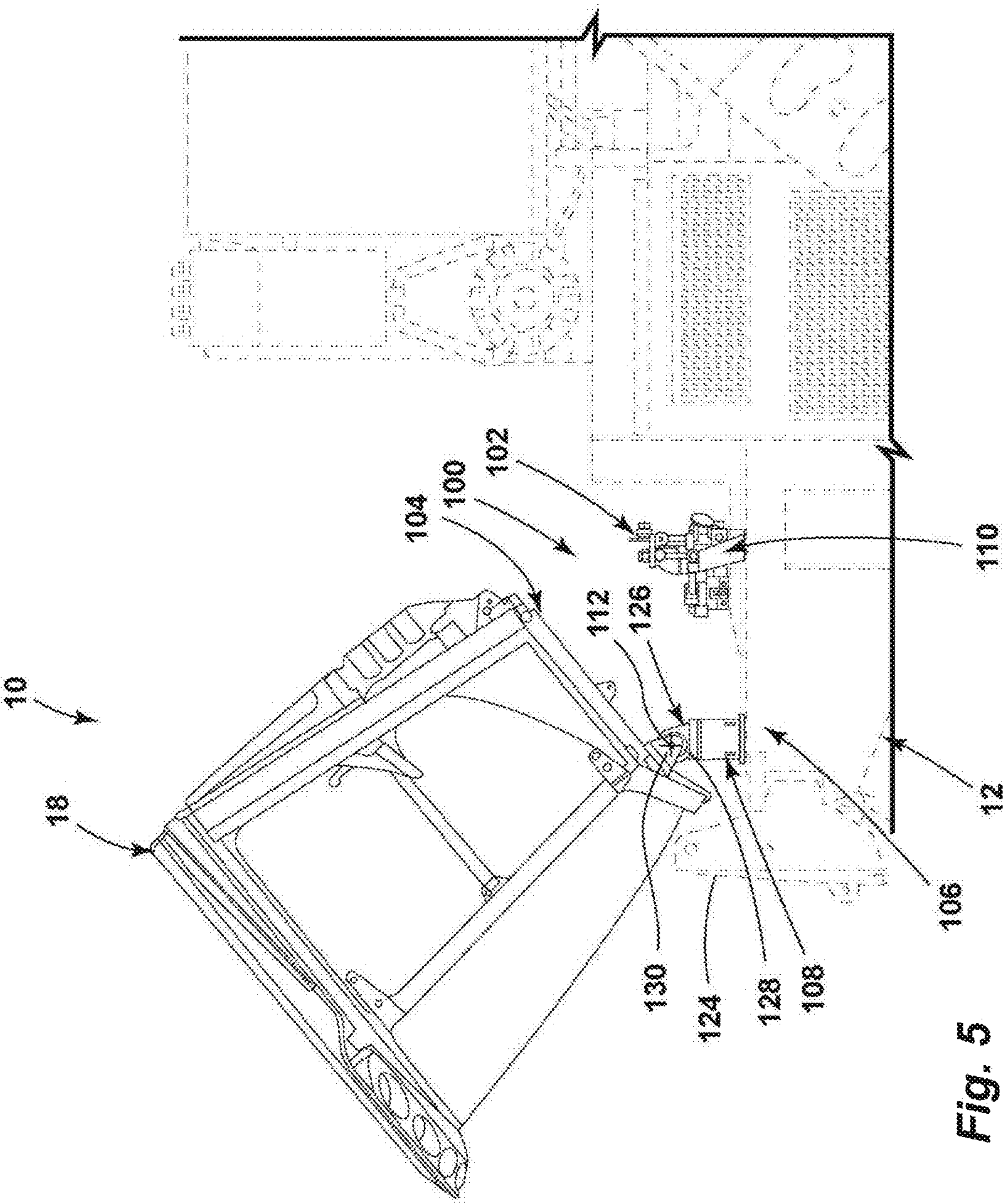

Fig. 5

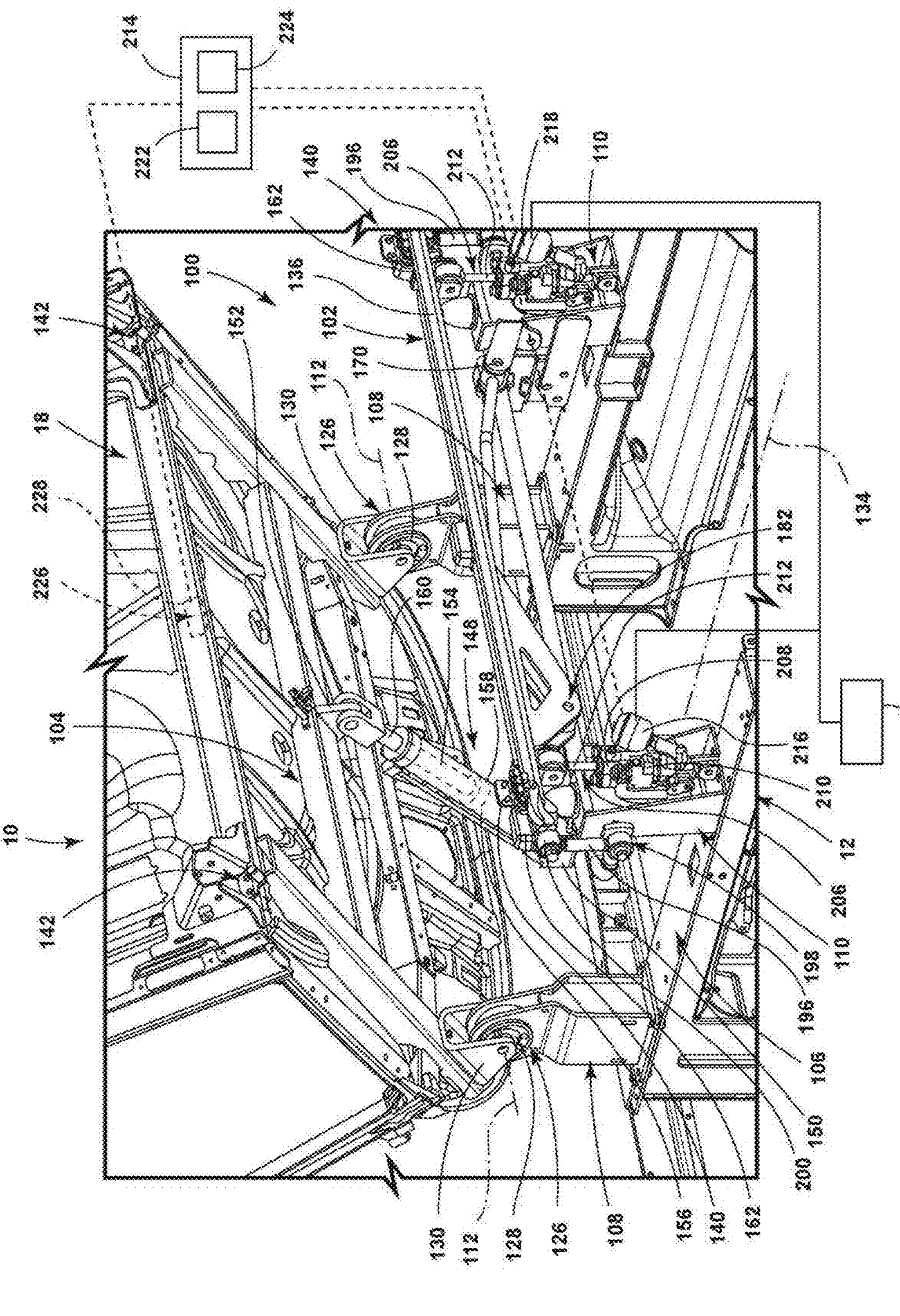
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Fig. 6

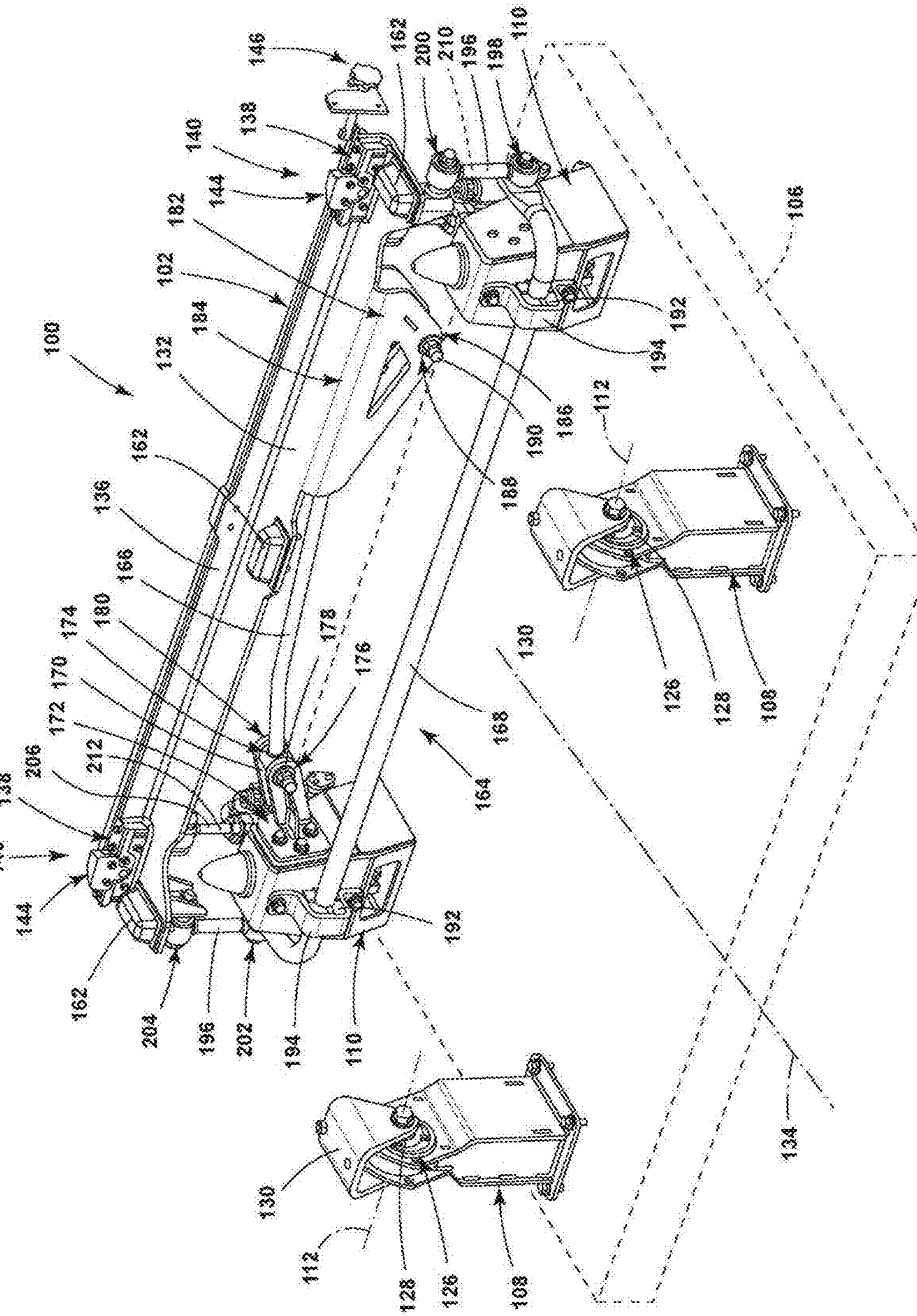
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Fig. 7

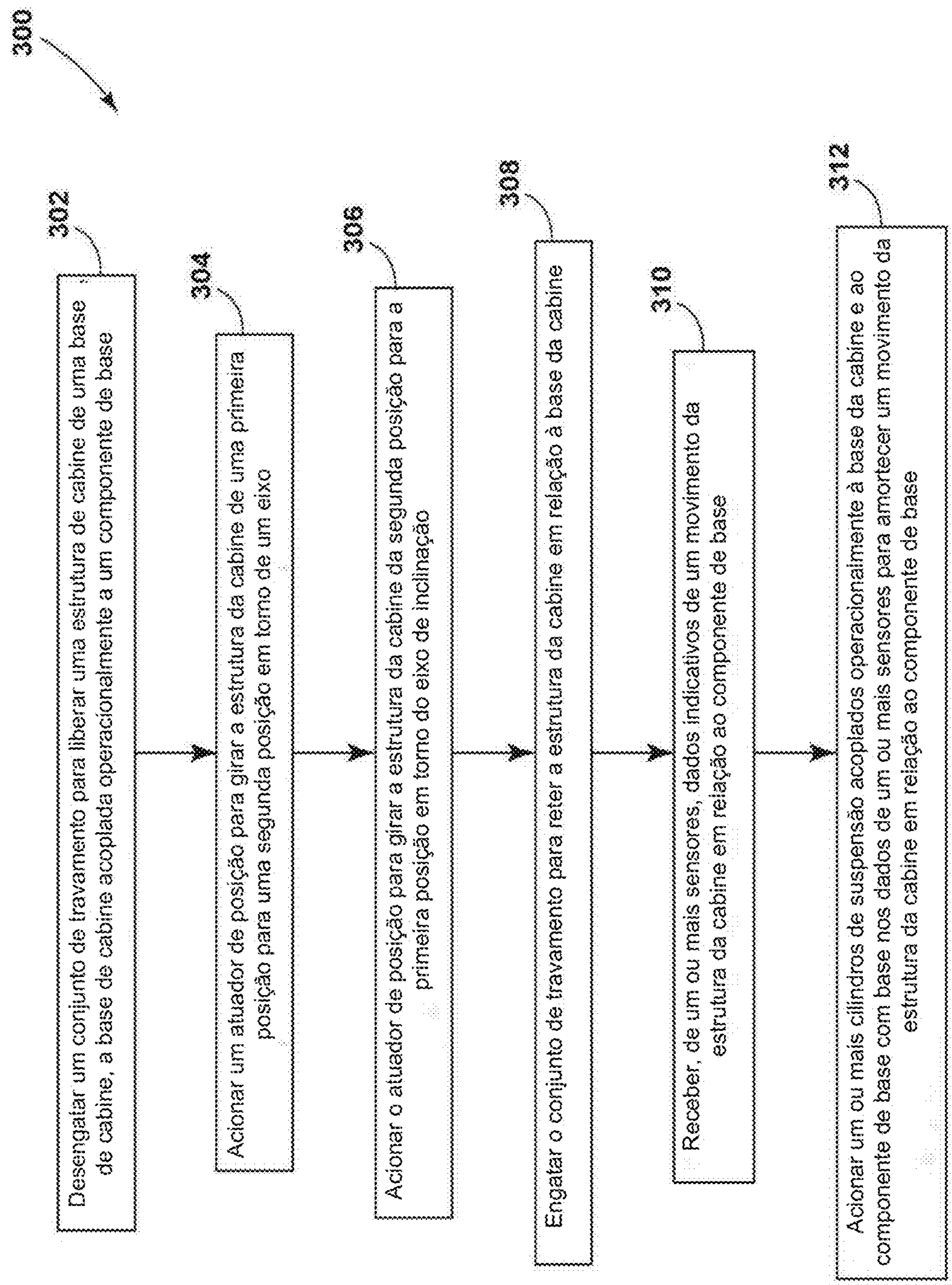
300
302
Desengatar um conjunto de travamento para liberar uma estrutura de cabine de uma base de cabine, a base de cabine acoplada operacionalmente a um componente de base
304
Acionar um atuador de posição para girar a estrutura da cabine de uma primeira posição para uma segunda posição em torno de um eixo
306
Acionar o atuador de posição para girar a estrutura da cabine da segunda posição para a primeira posição em torno do eixo de inclinação
308
Engatar o conjunto de travamento para reter a estrutura da cabine em relação à base da cabine
310
Receber, de um ou mais sensores, dados indicativos de um movimento da estrutura da cabine em relação ao componente de base
312
Acionar um ou mais cilindros de suspensão acoplados operacionalmente à base da cabine e ao componente de base com base nos dados de um ou mais sensores para amortecer um movimento da estrutura da cabine em relação ao componente de base

Fig. 8

SYSTEM AND METHOD FOR WORK VEHICLE

FIELD

[0001] The present disclosure generally relates to systems and methods for a cab suspension system for a work vehicle, such as sugar cane harvesters.

BACKGROUND

[0002] Several models of work vehicles include a cab that is mounted onto a chassis of the work vehicle. As the vehicle traverses a field or roadway, vibrational and/or impact forces may be imparted from the chassis to the cab, which in turn reduces ride quality and operator comfort. Such forces may cause the cab to jounce, rotate from side to side and/or front to back, or vibrate.

[0003] Accordingly, a system and method for a cost-effective and efficient cab suspension system would be welcomed in the technology.

BRIEF DESCRIPTION

[0004] Aspects and advantages of the technology will be set forth in part in the following description, or may be obvious from the description, or may be learned through practice of the technology.

[0005] In some aspects, the present subject matter is directed to a suspension system for a work vehicle that includes one or more first support brackets configured to operably couple with a base component. One or more respective retainment brackets configured to operably couple with the one or more first support brackets and a cab. The one or more respective retainment brackets is configured to rotate relative to the one or more first support brackets about a pitch axis. One or more second support brackets is configured to operably couple with the base component. A cab crib is operably coupled with the one or more second support brackets. A suspension cylinder is coupled to the cab crib. A locking assembly is at least partially coupled with the cab crib and configured to selectively retain a cab frame.

[0006] In some aspects, the present subject matter is directed to a method of operating a suspension system of a harvester. The method includes disengaging a locking assembly to release a cab frame from a cab crib. The cab crib operably is coupled with a base component. The method also includes actuating a position actuator to rotate the cab frame from a first position to a second position about a pitch axis.

[0007] In some aspects, the present subject matter is directed to a work vehicle that includes a cab frame, a base component, and a suspension system operably coupled with the cab frame and the base component. The suspension system includes one or more first support brackets configured to operably couple with the base component. The suspension system also includes one or more respective retainment brackets configured to operably couple with the one or more first support brackets and a cab. The one or more respective retainment brackets is configured to rotate relative to the one or more first support brackets about a pitch axis. In addition, the suspension system includes one or more second support brackets configured to operably couple with the base component. A cab crib is operably coupled with the one or more second support brackets. A suspension cylinder is coupled to the cab crib. A position actuator is operably coupled with the cab frame and is configured to assist in moving the cab frame from a first position to a second position about the pitch axis.

[0008] These and other features, aspects, and advantages of the present technology will become better understood with reference to the following description and appended claims. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the technology and, together with the description, serve to explain the principles of the technology.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] A full and enabling disclosure of the present technology, including the best mode thereof, directed to one of ordinary skill in the art, is set forth in the specification, which makes reference to the appended figures, in which:

[0010] FIG. **1** illustrates a schematic side view of a work vehicle for the harvesting of tall and stalky vegetable crops, such as sugarcane and sorghum, in accordance with aspects of the present subject matter;

[0011] FIG. **2** illustrates a schematic side view of a portion of an agricultural in accordance with aspects of the present subject matter;

[0012] FIG. **3** is a front view of a portion of a work vehicle and a cab suspension system in accordance with aspects of the present subject matter;

[0013] FIG. **4** is a side view of a portion of a work vehicle and a cab suspension system with a cab in a first position in accordance with aspects of the present subject matter;

[0014] FIG. **5** is a side view of a portion of a work vehicle and a cab suspension system with a cab in a first position in accordance with aspects of the present subject matter;

[0015] FIG. **6** is a rear perspective view of the cab suspension system in accordance with aspects of the present subject matter;

[0016] FIG. **7** is a front perspective view of the cab suspension system in accordance with aspects of the present subject matter; and

[0017] FIG. **8** is a flow diagram of a method of operating a suspension system of a harvester in accordance with aspects of the present subject matter.

[0018] Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the present technology.

DETAILED DESCRIPTION

[0019] Reference now will be made in detail to embodiments of the disclosure, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the discourse, not limitation of the disclosure. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present disclosure without departing from the scope or spirit of the disclosure. For instance, features illustrated or described as part can be used with other examples to yield a still further embodiment. Thus, it is intended that the present disclosure covers such modifications and variations as come within the scope of the appended claims and their equivalents.

[0020] In this document, relational terms, such as first and second, top and bottom, and the like, are used solely to distinguish one entity or action from another entity or action, without necessarily requiring or implying any actual such relationship or order between such entities or actions. The terms "comprises," "comprising," or any other variation thereof are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element preceded by "comprises . . . a" does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element.

[0021] As used herein, the terms "first," "second," and "third" may be used interchangeably to distinguish one component from another and are not intended to signify a location or importance of the individual components. The terms "coupled," "fixed," "attached to," and the like refer to both direct coupling, fixing, or attaching, as well as indirect coupling, fixing, or attaching through one or more intermediate components or features, unless otherwise specified herein. The terms "upstream" and "downstream" refer to the relative direction with respect to an agricultural product through a system. For example, "upstream" refers to the direction from which an agricultural product moves, and "downstream" refers to the direction to which the agricultural product moves. The term "selectively" refers to a component's ability to operate in various states (e.g., an ON state and an OFF state) based on manual and/or automatic control of the component.

[0022] The terms "fore" and "aft" refer to relative positions along the work vehicle relative to a fore-aft axis. The fore direction is a direction along the fore-aft axis that may also be referred to as a forward motion direction of the vehicle. In addition, an aft direction along the fore-aft is a direction along the fore-aft axis that may also be referred to as a rearward motion direction of the vehicle. A lateral direction may be defined by a transverse axis that extends between a right side and a left side of the vehicle and may be perpendicular to the fore-aft axis. As such, any component that is "laterally inward" of another component may be positioned in closer proximity to the fore-aft axis, and any component that is "laterally outward" of another component may be positioned in closer proximity to the fore-aft axis along the transverse axis. A longitudinal direction may be defined as a third direction in a three-dimensional plane that is perpendicular to the fore-aft axis and the transverse axis. For example, the height of the vehicle may be defined in the longitudinal direction.

[0023] Furthermore, any arrangement of components to achieve the same functionality is effectively "associated" such that the functionality is achieved. Hence, any two components herein combined to achieve a particular functionality can be seen as "associated with" each other such that the desired functionality is achieved, irrespective of architectures or intermedial components. Likewise, any two components so associated can also be viewed as being "operably connected" or "operably coupled" to each other to achieve the desired functionality, and any two components capable of being so associated can also be viewed as being "operably couplable" to each other to achieve the desired functionality. Some examples of operably couplable include, but are not limited to, physically mateable, physically interacting components, wirelessly interactable, wirelessly interacting components, logically interacting, and/or logically interactable components.

[0024] The singular forms "a," "an," and "the" include plural references unless the context clearly dictates otherwise.

[0025] Approximating language, as used herein throughout the specification and claims, is applied to modify any quantitative representation that could permissibly vary without resulting in a change in the basic function to which it is related. Accordingly, a value modified by a term or terms, such as "about," "approximately," "generally," and "substantially," is not to be limited to the precise value specified. In at least some instances, the approximating language may correspond to the precision of an instrument for measuring the value or the precision of the methods or apparatus for constructing or manufacturing the components and/or systems. For example, the approximating language may refer to being within a ten percent margin.

[0026] Moreover, the technology of the present application will be described in relation to examples. The word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments. Additionally, unless specifically identified otherwise, all embodiments described herein should be considered exemplary.

[0027] As used herein, the term "and/or," when used in a list of two or more items, means that any one of the listed items can be employed by itself, or any combination of two or more of the listed items can be employed. For example, if a composition or assembly is described as containing components A, B, and/or C, the composition or assembly can contain A alone; B alone; C alone; A and B in combination; A and C in combination; B and C in combination; or A, B, and C in combination.

[0028] In general, the present subject matter is directed to suspension systems and methods for a work vehicle. In some instances, the system can include one or more first support brackets configured to operably couple with a base component. One or more respective retainment brackets can be operably coupled with the one or more first support brackets and can be configured to rotate relative to the first support brackets about a pitch axis. One or more second support brackets can be configured to operably couple with the base component. A cab crib can be operably coupled with the one or more second support brackets. A locking assembly can be at least partially coupled with the cab crib and configured to selectively retain the cab.

[0029] In various examples, the system may also include a sensor assembly communicatively coupled to a computing system. In general, the sensor assembly may be configured to detect changes in the position of a given location on the cab frame relative to a base component. The data from one or more sensors provided by the sensor assembly may then be transmitted to the computing system to allow the computing system to monitor the position of the cab frame relative to the base component. Based on the monitored position, the computing system may the control the actuation of one or more suspension cylinders (e.g., via controlling the operation of valves operably coupled with each of the one or more suspension cylinders) in a manner that dampens or reduces the overall magnitude of the relative movement between the cab frame and the base component.

[0030] In various instances, the cab frame may be allowed to rotate about two or more axes (e.g., pitch rotation and roll rotation) and may be allowed to translate linearly in three directions (e.g., forward-to-aft movement, side-to-side movement, and vertical movement).

[0031] Referring now to the drawings, FIGS. **1** and **2** respectively illustrate a side view of a work vehicle **10** and a side perspective view of a work vehicle **10** in accordance with aspects of the present subject matter. As shown, the vehicle **10** is configured as a sugarcane harvester. However, in other embodiments, the vehicle **10** may be configured as any other suitable agricultural vehicle or any other work vehicle.

[0032] As shown in FIGS. **1** and **2**, the vehicle **10** can include a chassis **12**, a pair of front wheels **14** (FIG. **1**), a pair of rear wheels **16** (FIG. **1**), and an operator's cab **18** or any other form of operator's station for permitting the operator to control the operation of the vehicle **10**. Alternatively, the vehicle **10** may be a track-driven vehicle and, thus, may include a track assembly **17** (FIG. **2**) driven by the power source **24** as opposed to the wheels **14**, **16** illustrated in FIG. **1**. As illustrated in the example shown in FIGS. **1** and **2**, the vehicle **10** may include a human-machine interface (HMI) **20** for displaying information (e.g., messages and/or alerts) to the operator and/or for allowing the operator to interface with various systems and components of the vehicle **10**.

[0033] The HMI **20** may also receive a user input through one or more input devices **22** (e.g., levers, pedals, control panels, buttons, and/or the like) within the cab **18** and/or in any other practicable location. In some cases, the HMI **20** can include a pair of displays, and the information provided on each display may be altered based on various vehicle conditions. The information provided may include operational information that may impact harvesting performance, which may be presented on a clear interface with minimal visual pollution for the operator or another individual. Additionally, or alternatively, the HMI **20** may provide support information that can include a vehicle information, such as vehicle status, vehicle maintenance, and/or the like, that may be intermittently monitored by the operator or another individual.

[0034] The vehicle **10** may also include a power source **24** (e.g., an engine mounted on the chassis **12**) that powers one or both pairs of the wheels **14**, **16** and/or the track assembly **17** via a driveline assembly **26** (e.g., a transmission) to traverse a field **28**. The power source **24** may also drive a hydraulic fluid pump **30** configured to generate pressurized hydraulic fluid for a hydraulic circuit, which may be configured to power various components of the vehicle **10**, including the driveline assembly **26**.

[0035] The vehicle **10** may also include a crop processing system **32** incorporating various components, assemblies, and/or sub-assemblies of the vehicle **10** for cutting, processing, cleaning, and discharging sugarcane as the cane is harvested from an agricultural field **28**. For instance, the crop processing system **32** may include a topper assembly **34** positioned at the front end portion of the vehicle **10** to intercept sugarcane as the vehicle **10** is moved in a forward direction. As shown, the topper assembly **34** may include both a gathering disk **36** and a cutting disk **38**. The gathering disk **36** may be configured to gather the sugarcane stalks **40**S so that the cutting disk **38** may be used to cut off the top of each stalk **40**S. As is generally understood, the height of the topper assembly **34** may be adjustable via a pair of arms **42**, which may be raised and lowered (e.g., hydraulically).

[0036] The crop processing system **32** may further include a crop divider **44** that extends upwardly and rearwardly from the field **28**. In general, the crop divider **44** may include one or more spiral feed rollers **46**. Each feed roller **40** may include a ground shoe **48** at its lower end portion to assist the crop divider **44** in gathering the sugarcane stalks **40**S for harvesting. Moreover, as shown in FIGS. **1** and **2**, the crop processing system **32** may include a knock-down roller **50** positioned near the front wheels **14** and a fin roller **52** positioned behind the knock-down roller **50**. As the knock-down roller **50** is rotated, the sugarcane stalks **40**S being harvested are knocked down while the crop divider **44** gathers the stalks **40**S from agricultural field **28**. Further, as shown in FIGS. **1** and **2**, the fin roller **52** may include a plurality of intermittently mounted fins **54** that assist in forcing the sugarcane stalks **40**S downwardly. As the fin roller **52** is rotated during the harvest, the sugarcane stalks **40**S that have been knocked down by the knock-down roller **50** are separated and further knocked down by the fin roller **52** as the vehicle **10** continues to be moved in the forward direction relative to the field **28**.

[0037] Referring still to FIGS. **1** and **2**, the crop processing system **32** of the vehicle **10** may also include a base cutter assembly **56** positioned behind the fin roller **52**. The base cutter assembly **56** may include blades for severing the sugarcane stalks **40**S as the cane is being harvested. Additionally, in several embodiments, the blades may be angled downwardly to sever the base of the sugarcane as the cane is knocked down by the fin roller **52**.

[0038] Moreover, the crop processing system **32** may include a feed roller assembly **58** located downstream of the base cutter assembly **56** for moving the severed stalks **40**S of sugarcane from base cutter assembly **56** along the processing path of the crop processing system **32**. As shown in FIGS. **1** and **2**, the feed roller assembly **58** may include a plurality of bottom rollers **60** and a plurality of opposed top rollers **62**. The various bottom and top rollers **60**, **62** may be used to pinch the harvested sugarcane during transport. As the sugarcane is transported through the feed roller assembly **58**, debris **68** (e.g., rocks, dirt, and/or the like) may be allowed to fall through bottom rollers **60** onto the field **28**.

[0039] In addition, the crop processing system **32** may include a chopper assembly **64** located at the downstream end section of the feed roller assembly **58** (e.g., adjacent to the rearward-most bottom roller **60** and the rearward-most top roller **62**). In general, the chopper assembly **64** may be used to cut or chop the severed sugarcane stalks **40**S into pieces or "billets" **40**B, which may be, for example, six (6) inches long. The billets **40**B may then be propelled towards an elevator assembly **66** of the crop processing system **32** for delivery to an external receiver or storage device.

[0040] The pieces of debris **68** (e.g., dust, dirt, leaves, etc.) separated from the sugarcane billets **40**B may be expelled from the vehicle **10** through a primary extractor **70** of the crop processing system **32**, which may be located downstream of the chopper assembly **64** and may be oriented to direct the debris **68** outwardly from the vehicle **10**. Additionally, an extractor fan **72** may be mounted within an extractor housing **74** of the primary extractor **70** for generating a suction force or vacuum sufficient to force the debris **68** through the primary extractor **70**. The separated or cleaned billets **40**B, which may be heavier than the debris **68** expelled through the extractor **70**, may then fall downward to the elevator assembly **66**.

[0041] As shown in FIGS. **1** and **2**, the elevator assembly **66** may include an elevator housing **76** and an elevator **78**

extending within the elevator housing **76** between a lower, proximal end portion **80** and an upper, distal end portion **82**. In some examples, the elevator **78** may include a looped chain **84** and a plurality of flights or paddles **86** attached to and spaced on the chain **84**. The paddles **86** may be configured to hold the sugarcane billets **40**B on the elevator **78** as the sugarcane billets **40**B are elevated along a top span of the elevator **78** defined between its proximal and distal end portions **80**, **82**. Additionally, the elevator **78** may include lower and upper sprockets **88**, **90** positioned at its proximal and distal end portions **80**, **82**, respectively. As shown in FIGS. **1** and **2**, an elevator motor **92** may be coupled to one of the sprockets (e.g., the upper sprocket **90**) for driving the chain **84**, thereby allowing the chain **84** and the paddles **86** to travel in a loop between the proximal and distal end portions **80**, **82** of the elevator **78**.

[0042] Moreover, in some embodiments, pieces of debris **68** (e.g., dust, dirt, leaves, etc.) separated from the elevated sugarcane billets **40**B may be expelled from the vehicle **10** through a secondary extractor **94** of the crop processing system **32** coupled to the rear end portion of the elevator housing **76**. For example, the debris **68** expelled by the secondary extractor **94** may be debris **68** remaining after the billets **40**B are cleaned and debris **68** expelled by the primary extractor **70**. As shown in FIGS. **1** and **2**, the secondary extractor **94** may be located adjacent to the distal end portion **82** of the elevator **78** and may be oriented to direct the debris **68** outwardly from the vehicle **10**. Additionally, an extractor fan **96** may be mounted at the base of the secondary extractor **94** to generate a suction force or vacuum sufficient to force the debris **68** through the secondary extractor **94**. The separated, cleaned billets **40**B, heavier than the debris **68** expelled through the primary extractor **70**, may then fall from the distal end portion **82** of the elevator **78**. In some instances, the billets **40**B may fall through an elevator discharge opening **98** defined by the elevator assembly **66** into an external storage device, such as a sugarcane billet cart.

[0043] During operation, the vehicle **10** traverses the agricultural field **28** for harvesting sugarcane. After the height of the topper assembly **34** is adjusted via the arms **42**, the gathering disk **36** on the topper assembly **34** may function to gather the sugarcane stalks **40**S as the vehicle **10** proceeds across the field **28**, while the cutting disk **38** severs the leafy tops of the sugarcane stalks **40**S for disposal along either side of the vehicle **10**. As the stalks **40**S enter the crop divider **44**, the ground shoes **48** may set the operating width to determine the quantity of sugarcane entering the throat of the vehicle **10**. The spiral feed rollers **46** then gather the stalks **40**S into the throat to allow the knock-down roller **50** to bend the stalks **40**S downwardly in conjunction with the action of the fin roller **52**. Once the stalks **40**S are angled downward, as shown in FIGS. **1** and **2**, the base cutter assembly **56** may then sever the base of the stalks **40**S from the field **28**. The severed stalks **40**S are then, by the movement of the vehicle **10**, directed to the feed roller assembly **58**.

[0044] The severed sugarcane stalks **40**S are conveyed rearwardly by the bottom and top rollers **60**, **62**, which compresses the stalks **40**S, makes them more uniform, and shakes loose debris **68** to pass through the bottom rollers **60** to the field **28**. At the downstream end portion of the feed roller assembly **58**, the chopper assembly **64** cuts or chops the compressed sugarcane stalks **40**S into pieces or billets **40**B (e.g., 6-inch cane sections). The processed crop discharged from the chopper assembly **64** is then directed as a stream of billets **40**B and debris **68** into the primary extractor **70**. The airborne debris **68** (e.g., dust, dirt, leaves, etc.) separated from the billets **40**B is then extracted through the primary extractor **70** using suction created by the extractor fan **72**. The separated/cleaned billets **40**B then be directed to an elevator hopper into the elevator assembly **66** and travel upwardly via the elevator **78** from its proximal end portion **80** to its distal end portion **82**. During normal operation, once the billets **40**B reach the distal end portion **82** of the elevator **78**, the billets **40**B fall through the elevator discharge opening **98** to an external storage device. If provided, the secondary extractor **94** (with the aid of the extractor fan **96**) blows out trash/debris **68** from the vehicle **10**, similar to the primary extractor **70**.

[0045] Referring now to FIGS. **3-5**, a front view of a cab of the work vehicle **10**, a side view of the cab **18** of the work vehicle **10** in a first position, and a side view of the cab **18** of the work vehicle **10** in a second position are respectively illustrated. As shown, a suspension system **100** may include a cab crib **102** operably coupled with the chassis **12**. In various instances, the suspension system **100** may be generally designed to allow movement of a cab frame **104** relative to the chassis **12** or other base component **106** to which it is suspended. For instance, the cab frame **104** may be allowed to rotate about two or more axes (e.g., pitch rotation and roll rotation) and may be allowed to translate linearly in three directions (e.g., forward-to-aft movement, side-to-side movement, and vertical movement). It will be appreciated that the base component **106** may generally correspond to any suitable frame, block, and/or other component of the work vehicle **10** (including any combination of such components) above which the cab frame **104** is configured to be suspended. For instance, in some examples, the base component **106** may correspond to the transmission block encasing the various components of the vehicle's transmission. In other examples, the base component **106** may correspond to a frame(s) and/or any other structural member(s) forming all or part of the vehicle's chassis **12**.

[0046] In several examples, the cab frame **104** may have any suitable configuration that allows it to function as the structural frame for the operator's cab **18**. Thus, in several embodiments, the cab frame **104** may include a plurality of structural members configured to be coupled together to form the structural frame. However, the cab frame **104** may have any other suitable frame-like configuration including any combination of structural members.

[0047] As shown in FIGS. **3-5**, the suspension system **100** may include a first set of brackets **108** and/or a second set of brackets **110** each configured to extend vertically between portions of the cab frame **104** and the base component **106**. For example, the suspension system **100** can include a pair of front brackets **108** configured to be coupled between the base component **106** and a front portion of the cab frame **104**. In some instances, each of the first support brackets **108** may be coupled to the cab frame **104** via a pinned or pivotal connection to allow the cab frame **104** to rotate relative to the first support brackets **108** about a pitch axis **112**.

[0048] The second support brackets **110** can be coupled between the base component **106** and the opposed, rear portions of the cab frame **104**. As shown in FIGS. **3-5**, the second support brackets **110** may be coupled to the cab frame **104** via the cab crib **102** to permit the cab frame **104**

to move relative to the brackets **110** as the position and/or orientation of the cab frame **104** relative to the base component **106** is varied.

[0049] In several embodiments, the connections provided between the cab frame **104** and the front and second support brackets **108**, **110** may allow for small lateral movements of the cab frame **104** relative to the support brackets **108**, **110**, such as small longitudinal (fore-to-aft) movements (indicated by arrow **114** in FIG. **3**), small latitudinal (side-to-side) movements (indicated by arrow **116** in FIG. **3**) and/or vertical movements (indicated by arrow **118** in FIG. **4**). In addition, the connections provided between the cab frame **104** and the front and second support brackets **108**, **110** may allow for rotation of the cab frame **104** relative to the brackets **108**, **110**, such as pitch rotation (indicated by arrow **120** in FIG. **3**) about the pitch axis **112** and roll rotation (indicated by arrow **122** in FIG. **4**) about an axis.

[0050] In some instances, a feature of the vehicle **10**, such as a topper support bracket **124**, may be positioned forwardly of the cab **18**. In such instances, the amount of rotation between the first position, as shown in FIG. **4**, and the second portion, as shown in FIG. **5**, may be determined based on the spacing between the cab **18** and the feature. To assist in rotating the cab **18**, each of the first support brackets **108** can include a rotation assembly **126**, which may be in the form of a bearing assembly **128**. In such instances, respective retainment brackets **130** may be operably coupled with the cab frame **104** and the bearing assembly **128** so that the respective retainment brackets **130** are rotated relative to the first support brackets **108** about the pitch axis **112**.

[0051] Referring now to FIGS. **6** and **7**, the cab crib **102** may also be operably coupled with each of the second support brackets **110**. In some instances, the cab crib **102** can include a first section **132** that extends latitudinally relative to a longitudinal axis **134** and a second section **136** that is offset from the first section **132**. In some examples, the second section **136** may extend from a first side of the first section **132** and one or more components of the suspension system **100** may be operably coupled with a second, opposing side of the first section **132**.

[0052] The cab crib **102** can further include one or more attachment structures **138**. In some cases, the attachment structure **138** may be coupled to the first section **132** and/or the second section **136**. However, the attachment structures **138** may be integrally formed with the cab crib **102** without departing from the teachings provided herein. In several instances, one or more locking assemblies **140** can selectively retain and release the cab frame **104** relative to the cab crib **102**. When released, the cab **18** may be rotated relative to the first support brackets **108** about a pitch axis **112**. In some cases, the lock assembly can include a first component, which may be in the form of a locking pin **142**, operably coupled with the cab **18**. The lock assembly can also include a second component, which may be in the form of a latch assembly **144**, operably coupled with the cab crib **102**. As illustrated, the locking assembly **140** can include a pair of first components operably coupled with the cab **18** and positioned on opposing sides of a longitudinal centerline of the vehicle **10** and a pair of second components operably coupled with the cab crib **102**. It will be appreciated that the locking assembly **140** can include any number of first components and second components without departing from the teachings provided herein. Moreover, it will be appreciated that the first component may be operably coupled with the cab **18** and/or the cab crib **102** and the second component may be oppositely operably coupled with the cab crib **102** without departing from the scope of the present disclosure.

[0053] In various examples, the locking assembly **140** may further include a release assembly. The release assembly may be configured to release each of the first components and/or any of the first components from the respective second components. When the locking assembly **140** includes more than one respective first component and the second component, the release assembly may independently release each first component through the actuation of the latch assembly **144**. Additionally or alternatively, when the locking assembly **140** includes more than one respective first component and the second component, the release assembly may contemporaneously release each first component through the actuation of the latch assembly **144**. In various examples, the release assembly may be manually and/or electronically actuated.

[0054] In some examples, the suspension system **100** may further include a position actuator **148** that is configured to rotate the cab frame **104** between at least a first position and a second position. The position actuator **148** can be operably coupled with a base structure **150** that may be operably coupled with the base component **106** and/or any other structure and a cab attachment assembly **152**, which may be operably coupled with and/or integrally formed with the cab **18**. In some examples, the position actuator **148** may be in the form of a position cylinder **154**. As shown in FIG. **6**, the position cylinder **154** may generally include a cylinder housing **156** and a piston **158** disposed within the housing **156**. In addition, the position cylinder **154** may include a rod **160** extending from the piston **158** to a location exterior of the housing **156**. As illustrated in FIG. **6**, an actuating end portion of the rod **160** may be coupled to the cab frame **104**.

[0055] Referring further to FIGS. **6** and **7**, the suspension system **100** may further include one or more bumpers **162**, which may be operably coupled with the cab frame **104**, the base component **106**, and or any other component of the vehicle **10**. The bumpers **162** may be configured to mitigate vibration or contact forces generated between the cab frame **104** and the base component **106**, whether during the movement of the cab **18** relative to the base component **106** and/or during the operation of the vehicle **10**.

[0056] In some instances, the suspension system **100** can further include one or more suspension linkages **164**, such as a Panhard bar **166** and an anti-roll bar **168**. The suspension linkage **164** may be operably connected to the cab **18** and the base component **106**. In general, the suspension linkage **164** may be configured to limit a rotation of the cab **18** about the longitudinal axis **134** of the vehicle **10**.

[0057] In some cases, a first Panhard bracket **170** may be operably coupled with one (or more) of the second support brackets **110**. For instance, in the example illustrated in FIGS. **6** and **7**, the first Panhard bracket **170** may be cantilevered from a second support bracket **110** and/or otherwise extend laterally inward from the second support bracket **110**. In such instances, a first end portion **172** of the first Panhard bracket **170** may be operably coupled with the second support bracket **110**, such as through one or more fasteners. A second end portion **174** of the first Panhard bracket **170** may define a first channel **176**. A bolt **178**, or other fastener, may be positioned through the first channel **176** and operably support a first portion of the Panhard bar

166. A second Panhard bracket **182** may be operably coupled with the cab crib **102**. For instance, in the example illustrated in FIGS. **6** and **7**, the second Panhard bracket **182** may extend from the cab crib **102**. In such instances, a first portion **184** of the second Panhard bracket **182** may be operably coupled with the cab crib **102**, such as through one or more fasteners. A second portion **186** of the second Panhard bracket **182** may define a second channel **188**. A bolt **190**, or other fastener, may be positioned through the second channel **188** and operably support a second portion of the Panhard bar **166**.

[0058] Additionally or alternatively, the suspension linkage **164** may include an anti-roll bar **168**. The anti-roll bar **168** may extend latitudinally outward of the one or more second support brackets **110**. In some cases, the anti-roll bar **168** may be configured in the form of a U-shaped bar. However, the anti-roll bar **168** may have any desired shape. As illustrated, the anti-roll bar **168** can be operably coupled with a pair of bushings **192** and bushing retention brackets **194**. The bushings **192** may surround the anti-roll bar **168** at two separate locations such that one bushing **192** is located on one side of the longitudinal axis **134** of the chassis **12** and the other bushing **192** is located on the other side of the longitudinal axis **134** of the chassis **12**. The bushings **192** may be in the form of any desired bushings. The bushing retention brackets **194** may at least partially surround and retain the bushings **192**. The bushing retention brackets **194** serve to connect the anti-roll bar **168** to the second support brackets **110**. As illustrated, each bushing retention bracket **194** can have a U-shape with opposing leg portions coupled with one of the second support brackets **110**.

[0059] As illustrated, opposing end portions of the anti-roll bar **168** may be respectively coupled with a link **196**. In some cases, each of the links **196** may be rotatably coupled with the anti-roll bar **168** proximate to a first end portion of the link **196**. Moreover, each of the links **196** may be rotatably coupled with the cab crib **102** proximate to a second end portion of the link **196**. For instance, a first link **196** may be operably coupled with a first end portion **198** of the anti-roll bar **168** and a first segment **200** of the cab crib **102** and a second link **196** may be operably coupled with a second end portion **202** of the anti-roll and a second segment **204** of the cab crib **102**. In some instances, the first segment of the cab crib **102** and the second segment of the cab crib **102** may be positioned on opposing sides of a longitudinal axis **134**.

[0060] With further reference to FIGS. **5-7**, one or more suspension cylinders **206** may be operably coupled between the cab frame **104** and the base component **106**. In various examples, each suspension cylinder **206** may generally include a cylinder housing **208** and a piston **210** disposed within the housing **208**. In addition, each cylinder **206** may include a rod **212** extending from the piston **210** to a location exterior of the cylinder housing **208**. As shown in FIG. **6**, an actuating end portion of the rod **212** may be coupled to the cab crib **102**.

[0061] With further reference to FIGS. **6** and **7**, the suspension cylinders **206** may generally be configured to dampen and/or reduce the movement of the cab frame **104** relative to the base component **106** during operation of the work vehicle **10**. In several embodiments, the actuation of the suspension cylinders **206** may be configured to be actively controlled to regulate the movement of the cab frame **104** relative to the base component **106**. For example, as shown in FIG. **6**, the suspension system **100** may include a computing system **214** communicatively coupled to suitable valves **216**, **218** (e.g., suitable pressurize regulating valves, such as solenoid-activated valves) configured to regulate the pressure of hydraulic fluid supplied to each suspension cylinder **206** (e.g., from a hydraulic fluid tank **220** of the work vehicle **10**. In some cases, the first and second valves **216**, **218** may be provided in fluid communication with each suspension cylinder **206**. In such examples, the computing system **214** may be configured to independently regulate the actuation of each suspension cylinder **206** by controlling the operation of its associated valves **216**, **218**. For instance, a current command supplied to each valve **216**, **218** from the computing system **214** may be directly proportional to the pressure supplied to each suspension cylinder **206**, thereby allowing the computing system **214** to control the displacement of the suspension cylinder **206**.

[0062] In general, the computing system **214** may correspond to any suitable processor-based device, such as a computing device or any suitable combination of computing devices. Thus, in several examples, the computing system **214** may include one or more processor(s) **222** and associated memory device(s) **224** configured to perform a variety of computer-implemented functions. As used herein, the term "processor" refers not only to integrated circuits referred to in the art as being included in a computer, but also refers to a controller, a microcontroller, a microcomputer, a programmable logic controller (PLC), an application specific integrated circuit, and other programmable circuits. Additionally, the memory device(s) **224** of the computing system **214** may generally comprise memory element(s) including, but not limited to, computer-readable medium (e.g., random access memory (RAM)), computer-readable non-volatile medium (e.g., a flash memory), a floppy disk, a compact disc-read only memory (CD-ROM), a magneto-optical disk (MOD), a digital versatile disc (DVD) and/or other suitable memory elements. Such memory device(s) **224** may generally be configured to store suitable computer-readable instructions that, when implemented by the processor(s) **222**, configure the computing system **214** to perform various computer-implemented functions, such as any methods and/or other automated functions described herein. In addition, the computing system **214** may also include various other suitable components, such as a communications circuit or module, one or more input/output channels, a data/control bus, and/or the like.

[0063] It will be appreciated that the computing system **214** may correspond to an existing controller of the work vehicle **10** or the computing system **214** may correspond to a separate processing device. For instance, in several examples, the computing system **214** may form all or part of a separate plug-in module that may be installed within the work vehicle **10** to allow for the disclosed suspension system **100** to be implemented without requiring additional software to be uploaded onto existing control devices of the vehicle **10**.

[0064] Referring particularly to FIGS. **6** and **7**, the suspension system **100** may also include a sensor assembly **226** communicatively coupled to the computing system **214**. In general, the sensor assembly **226** may be configured to detect changes in the position of a given location on the cab frame **104** relative to the base component **106**. The data from the one or more sensors provided by the sensor assembly

226 may then be transmitted to the computing system **214** to allow the computing system **214** to monitor the position of the cab frame **104** relative to the base component **106**. Based on the monitored position, the computing system **214** may the control the actuation of the suspension cylinders **206** (e.g., via controlling the operation of the valves **216**, **218**) in a manner that dampens or reduces the overall magnitude of the relative movement between the cab frame **104** and the base component **106**.

[0065] In several examples, the sensor assembly **226** may include a sensor **228** mounted to a portion of the cab frame **104**. For instance, as shown in FIG. **6**, the sensor **228** may be mounted at the aft end portion of the cab frame **104**. It should be appreciated that the sensor **228** may generally correspond to any suitable sensor and/or sensing device configured to detect the motion of the cab frame **104** moves relative to the base component **106**. For instance, in some cases, the sensor **228** may correspond to an inertial measurement unit (IMU) that measures a specific force, angular rate, and/or an orientation of the cab frame **104** using a combination of accelerometers, gyroscopes, magnetometers, and/or any other practicable device. The accelerometer may correspond to one or more multi-axis accelerometers (e.g., one or more two-axis or three-axis accelerometers) such that the accelerometer may be configured to monitor the movement of the cab **18** in multiple directions, such as by sensing the cab acceleration along three different axes. It will be appreciated, however, that the accelerometer may generally correspond to any suitable type of accelerometer without departing from the teachings provided herein.

[0066] In some cases, the data provided by the sensor may be used to confirm that the cab **18** is in the retained position relative to the cab crib **102**. For instance, an initial, retained position may be determined by the computing system **214** based on the data from the sensor. If the operation of the vehicle **10** is initiated with the cab **18** offset from the initial position, as determined by the computing system **214** based on the data from the sensor (and/or any other input, such as the cylinders), instructions may be provided to a vehicle notification system (e.g., including components configured to provide visual, auditory, or haptic feedback, such as lights, speakers vibratory components, and/or the like) and/or a remote electronic device.

[0067] Referring now to FIG. **8**, a method **300** of operating a suspension system of a harvester is illustrated in accordance with aspects of the present subject matter. In general, the method **300** will be described herein with reference to the vehicle **10** described above with reference to FIGS. **1-7**. However, the disclosed method **300** may generally be utilized with any suitable harvesting assembly. In addition, although FIG. **8** depicts steps performed in a particular order for purposes of illustration and discussion, the methods discussed herein are not limited to any particular order or arrangement. One skilled in the art, using the disclosure provided herein, will appreciate that various steps of the methods disclosed herein can be omitted, rearranged, combined, and/or adapted in various ways without deviating from the scope of the present disclosure.

[0068] As shown in FIG. **8**, at (**302**), the method **300** can include disengaging a locking assembly to release a cab frame from a cab crib. As provided herein a suspension system may be positioned between the cab crib and the chassis. In various instances, the suspension system may be generally designed to allow movement of a cab frame relative to the chassis or other base component to which it is suspended. For instance, the cab frame may be allowed to rotate about two or more axes (e.g., pitch rotation and roll rotation) and may be allowed to translate linearly in three directions (e.g., forward-to-aft movement, side-to-side movement, and vertical movement). It will be appreciated that the base component **106** may generally correspond to any suitable frame, block, and/or other component of the work vehicle (including any combination of such components) above which the cab frame is configured to be suspended.

[0069] Moreover, the locking assembly can selectively retain and release the cab frame relative to the cab crib. When released, the cab frame may be rotated relative to the first support brackets about a pitch axis. In some cases, the lock assembly can include a first component, which may be in the form of a locking pin, operably coupled with the cab frame. The lock assembly can also include a second component, which may be in the form of a latch assembly, operably coupled with the cab crib.

[0070] At (**304**), the method **300** can include actuating a position actuator to rotate the cab frame from a first position to a second position about a pitch axis. In some instances, the position actuator can configured to rotate the cab frame between at least a first position and a second position.

[0071] At (**306**), the method **300** can include actuating the position actuator to rotate the cab frame from the second position to the first position about the pitch axis. At (**308**), the method **300** can include engaging the locking assembly to retain the cab frame relative to the cab crib.

[0072] At (**310**), the method **300** can include receiving data indicative of the motion of the cab frame relative to the base component from one or more sensors. In general, the sensor assembly may be configured to detect changes in the position of a given location on the cab frame relative to the base component. The data from the one or more sensors provided by the sensor assembly may then be transmitted to a computing system to allow the computing system to monitor the position of the cab frame relative to the base component.

[0073] At (**312**), the method **300** can include actuating one or more suspension cylinders operably coupled with the cab crib and the base component based on the data from the one or more sensors to dampen the movement of the cab frame relative to the base component.

[0074] In various examples, the method **300** may implement machine learning methods and algorithms that utilize one or several machine learning techniques including, for example, decision tree learning, including, for example, random forest or conditional inference trees methods, neural networks, support vector vehicles, clustering, and Bayesian networks. These algorithms can include computer-executable code that can be retrieved by the computing system and/or through a network/cloud and may be used to evaluate and update a cab frame position model. In some instances, the machine learning engine may allow for changes to the cab frame position model to be performed without human intervention.

[0075] It is to be understood that the steps of any method disclosed herein may be performed by a computing system upon loading and executing software code or instructions that are tangibly stored on a tangible computer-readable medium, such as on a magnetic medium, e.g., a computer hard drive, an optical medium, e.g., an optical disc, solidstate memory, e.g., flash memory, or other storage media known in the art. Thus, any of the functionality performed by the computing system described herein, such as any of the disclosed methods, may be implemented in software code or instructions that are tangibly stored on a tangible computer-readable medium. The computing system loads the software code or instructions via a direct interface with the computer-readable medium or via a wired and/or wireless network. Upon loading and executing such software code or instructions by the controller, the computing system may perform any of the functionality of the computing system described herein, including any steps of the disclosed methods.

[0076] The term "software code" or "code" used herein refers to any instructions or set of instructions that influence the operation of a computer or controller. They may exist in a computer-executable form, such as vehicle code, which is the set of instructions and data directly executed by a computer's central processing unit or by a controller, a human-understandable form, such as source code, which may be compiled in order to be executed by a computer's central processing unit or by a controller, or an intermediate form, such as object code, which is produced by a compiler. As used herein, the term "software code" or "code" also includes any human-understandable computer instructions or set of instructions, e.g., a script, that may be executed on the fly with the aid of an interpreter executed by a computer's central processing unit or by a controller.

[0077] This written description uses examples to disclose the technology, including the best mode, and also to enable any person skilled in the art to practice the technology, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the technology is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they include structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

What is claimed is:

1. A suspension system for a work vehicle, the suspension system comprising:

one or more first support brackets configured to operably couple with a base component;

one or more respective retainment brackets configured to operably couple with the one or more first support brackets and a cab, the one or more respective retainment brackets configured to rotate relative to the one or more first support brackets about a pitch axis;

one or more second support brackets configured to operably couple with the base component;

a cab crib operably coupled with the one or more second support brackets;

a suspension cylinder coupled to the cab crib; and

a locking assembly at least partially coupled with the cab crib and configured to selectively retain a cab frame.

2. The suspension system of claim **1**, further comprising:

an anti-roll bar extending latitudinally outward of the one or more second support brackets and operably coupled with each of the one or more second support brackets through respective bushings.

3. The suspension system of claim **2**, further comprising:

one or more bushing retention brackets at least partially surrounding each respective bushing, wherein each respective bushing retention bracket is coupled with one of the one or more second support brackets.

4. The suspension system of claim **2**, further comprising:

a first link operably coupled with a first end portion of the anti-roll bar and a first segment of the cab crib; and

a second link operably coupled with a second end portion of the anti-roll bar and a second segment of the cab crib, wherein the first segment of the cab crib and the second segment of the cab crib are positioned on opposing sides of a longitudinal axis.

5. The suspension system of claim **1**, further comprising:

a Panhard bar operably coupled with one of the one or more second support brackets and the cab crib on opposing end portions.

6. The suspension system of claim **1**, further comprising:

a first Panhard bracket operably coupled with one of the one or more second support brackets, wherein the first Panhard bracket is cantilevered from one of the one or more second support brackets; and

a second Panhard bracket operably coupled with the cab crib.

7. The suspension system of claim **1**, wherein the locking assembly includes a latch assembly operably coupled with the cab crib that is configured to interact with a locking pin operably coupled with the cab frame.

8. The suspension system of claim **7**, wherein the locking assembly includes a release assembly that releases the locking pin from the latch assembly.

9. The suspension system of claim **1**, further comprising:

a sensor operably coupled with the cab frame and configured to detect a change in a position of the cab frame.

10. The suspension system of claim **9**, further comprising:

a computing system communicatively coupled to the sensor, the computing system being configured to control an actuation of the suspension cylinder based on data received from the sensor.

11. The suspension system of claim **10**, further comprising:

a valve provided in fluid communication with the suspension cylinder, the computing system being configured to control operation of the valve to regulate a supply of fluid to the suspension cylinder.

12. A method of operating a suspension system of a harvester, the method comprising:

disengaging a locking assembly to release a cab frame from a cab crib, the cab crib operably coupled with a base component; and

actuating a position actuator to rotate the cab frame from a first position to a second position about a pitch axis.

13. The method of claim **12**, further comprising:

actuating the position actuator to rotate the cab frame from the second position to the first position about the pitch axis; and

engaging the locking assembly to retain the cab frame relative to the cab crib.

14. The method of claim **12**, further comprising:

receiving, from one or more sensors, data indicative of a motion of the cab frame relative to the base component.

15. The method of claim **14**, further comprising:

actuating one or more suspension cylinders operably coupled with the cab crib and the base component based on the data from the one or more sensors to dampen a movement of the cab frame relative to the base component.

16. A work vehicle comprising:

a cab frame;

a base component; and

a suspension system operably coupled with the cab frame and the base component, the suspension system comprising:

one or more first support brackets configured to operably couple with the base component;

one or more respective retainment brackets configured to operably couple with the one or more first support brackets and a cab, the one or more respective retainment brackets configured to rotate relative to the one or more first support brackets about a pitch axis;

one or more second support brackets configured to operably couple with the base component;

a cab crib operably coupled with the one or more second support brackets;

a suspension cylinder coupled to the cab crib; and

a position actuator operably coupled with the cab frame and configured to assist in moving the cab frame from a first position to a second position about the pitch axis.

17. The work vehicle of claim **16**, further comprising:

a locking assembly at least partially coupled with the cab crib and configured to selectively retain the cab frame.

18. The work vehicle of claim **17**, wherein the position actuator is configured as a hydraulic cylinder.

19. The work vehicle of claim **16**, further comprising:

a sensor operably coupled with the cab frame and configured to detect a change in a position of the cab frame relative to the cab crib.

20. The work vehicle of claim **19**, further comprising:

a computing system communicatively coupled to the sensor, the computing system being configured to control an actuation of the suspension cylinder based on data from the sensor.

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