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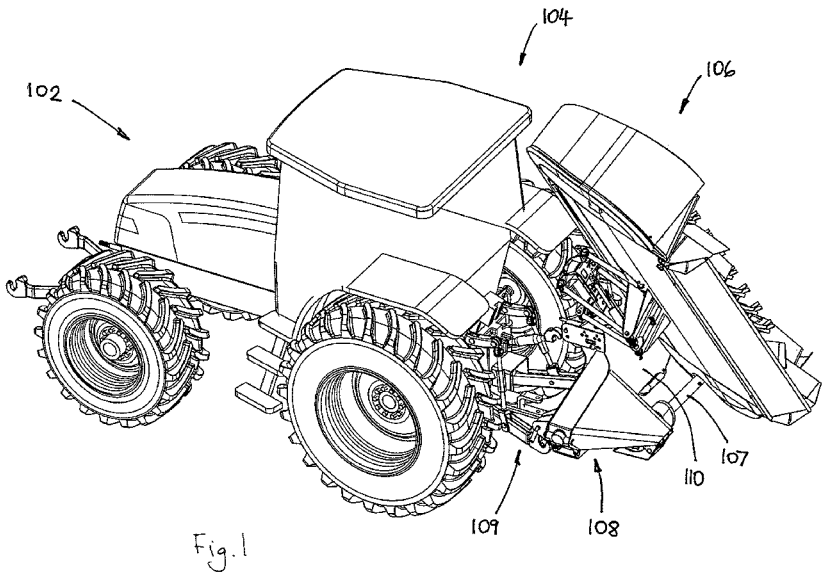

Fig. 1

(57) Abstract: A carrier arm assembly for an operating unit of an agricultural machine includes a carrier arm having a base part and an extending part that is telescopically adjustable relative to the base part to adjust the length of the carrier arm between an unextended configuration and an extended configuration. The base part and the extending part both include a set of bearing surfaces that are configured to enable sliding movement of the extending part relative to the base part. The bearing surfaces of the base part include upper inclined bearing surfaces and lower inclined bearing surfaces, and the bearing surfaces of the extending part include upper inclined bearing surfaces and lower inclined bearing surfaces, which are configured to engage respectively the upper inclined bearing surfaces and the lower inclined bearing surfaces of the base part.

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WEARABLE MODULAR CARRYING SYSTEM AND METHODS OF USE

RELATED APPLICATION

This application claims the benefit of priority under PCT Article 8 of U.S. Provisional Patent Application Ser. No. 62/218,634 filed September 15, 2015, the contents of which are incorporated herein by reference in their entirety.

FIELD AND BACKGROUND OF THE INVENTION

The present invention, in some embodiments thereof, relates to physical activity and, more particularly, but not exclusively, to a physical activity accessory.

Over the years, various hydration systems have been designed for runners, walkers, hikers and outdoor enthusiasts for the primary purpose of providing a means of carrying water hands free during strenuous exercise or recreational activity. Such products have been designed generally to be worn on the waist or on the back in order to allow for liquids to be accessibly within hands reach.

These types of product are generally available in two varieties: (1) those that use bottles that are worn around the waist; and, (2) those that use a bladder that are worn as a backpack. For the waist systems, the bottle is generally stowed inside some type of fabric sleeve or rigid (or semi rigid) cage. Removing the bottle from the sleeve or cage requires pulling the bottle upward in a vertical direction. While the current waist systems generally accomplish their primary purpose of allowing for the hands free transport of liquids, the universal complaint among end users is that it is nearly impossible to get the bottle in and out of the sleeve or cage, especially while trying to remain in motion. As a result, some end user will wear the bottle on the front of their waist in order to ease the difficulty of using the bottle. Others simply abandon using the system or choose to carry a bottle in their hand. For the backpack systems, the general complaints are that they are bulky and create too much body heat because of the large coverage of the back area. Also, the backpack systems dispense water through a hose which are difficult to clean and maintain, especially when sugary liquids collect inside the system.

Previous attempts in this area include, US20060097019, US7712196, US6666360, US6401993, US6004033, US5060833 and USD444295, the contents of which are incorporated herein by reference in their entirety.

SUMMARY OF THE INVENTION

An aspect of the present invention provides a wearable modular carrying system, comprising:

a belt;

an attachment insert held next to the belt and including at least one locking post with one of a top post prong or a bottom post prong, and a key-hole; and,

a modular object comprising at least one of a magnetic bottle mount and magnetically active bottle combination, a basket, a holder, a tool holder, a flashlight holder; and,

a locking clip including at least one slot sized and shaped as a counterpart to the locking post of the attachment insert and wherein the locking clip is disposed on a side of the modular object such that the modular object is bracketed between the locking clip and the attachment insert, wherein the locking clip includes a clip tab reversibly engageable to the attachment insert.

Another aspect of the present invention provides a method of using a wearable modular carrying system, comprising:

attaching a modular object comprising at least one of a magnetic bottle mount and magnetically active bottle combination, a basket, a holster, a tool holder, a flashlight holder, to an attachment insert including at least one locking post by,

resting a top surface of the attachment insert against the back surface of the modular object so that the at least one locking post of the attachment insert is placed within and through a slot of the modular object,

sliding the modular object longitudinally along the top surface of the attachment insert, and,

reversibly locking the modular object onto the attachment insert by sliding a portion of the modular object under a top post prong of the locking post;

attaching a locking clip to the system to reversibly lock the modular object to the attachment insert by,

placing the locking clip over the at least one locking post of the attachment insert and abutting an inner surface of the modular object, such that the modular object is

between the attachment insert and the locking clip, that is the locking clip is disposed on a side of the modular object opposite the attachment insert, and the locking post is placed in and through a slot in the locking clip sized and shaped as a counterpart to the locking post of the attachment insert,

sliding the locking clip along the inner surface of the modular object, and

reversibly locking the locking clip onto the attachment insert, with the modular object therebetween, by sliding a clip tab of the locking clip under a bottom post prong of the locking post.

Disclosed herein is a wearable modular carrying system, comprising:

a belt;

an attachment insert held next to the belt and configured with at least one of a locking post, with a top post prong and a bottom post prong, and a key-hole;

a modular object comprising at least one of a magnetic bottle mount and magnetically active bottle combination, a basket, a holster, a tool holder, a flashlight holder, configured for reversible attachment to the attachment insert; and

a locking clip configured with at least one slot sized and shaped as a counterpart to the locking post of the attachment insert.

In an embodiment, the magnetically active bottle is configured with a removable, metallic, continuous ring around a neck of the bottle and the magnetic bottle mount is configured with at least one magnet at a location on the bottle mount corresponding to the ring on the bottle when the bottle is seated in the bottle mount.

In an embodiment, the attachment insert is held next to the belt by at least one of stitching, fusing and adhesive.

In an embodiment, the at least one locking post of the attachment insert, the modular object and the locking clip interlace when reversibly attached together.

In an embodiment, the top post prong and the bottom post prong of the at least one locking post are configured differently, the top post prong configured for receipt of the modular object and the bottom post prong configured for receipt of a clip tab of the locking clip.

In an embodiment, the attachment insert is held next to the belt by a pocket configured for placement of the attachment insert therein.

In an embodiment, the attachment insert is ovoid shaped for distributing the weight of the modular object therearound.

In an embodiment, the attachment insert is provided with at least one support to provide flexibility control.

In an embodiment, the attachment insert is x-shaped for distributing the weight of the modular object among the extensions of the x-shape.

In an embodiment, the magnetic bottle mount is configured with at least one slide slot in which a slide of the locking clip is positioned, where the dimensions of the slide slot define the movement of the locking clip.

In an embodiment, the attachment insert further comprises a top latch, a bottom wedge and at least one spacer.

In an embodiment, the modular object locks onto the attachment insert between multiple stabilizing points.

In an embodiment, the multiple stabilizing points include at least one of the top latch, the bottom wedge, the at least one spacer, the top post prong and the bottom post prong.

In an embodiment, at least one of the top latch, the bottom wedge and the at least one spacer prevent the modular object from moving longitudinally, and at least one of the top post prong and the bottom post prong prevent the modular object from moving laterally.

In an embodiment, the locking clip is configured with a user interface feature.

Disclosed herein is a method of using a wearable modular carrying system, comprising:

attaching a modular object comprising at least one of a magnetic bottle mount and magnetically active bottle combination, a basket, a holster, a tool holder, a flashlight holder, to an attachment insert configured with at least one locking post by,

resting a top surface of the attachment insert against the back surface of the modular object so that the at least one locking post of the attachment insert is placed within and through a slot of the modular object, sliding the modular object longitudinally along the top surface of the attachment insert, and, reversibly locking the modular object onto the attachment insert by sliding a portion of the modular object under a top post prong of the locking post;

attaching a locking clip to the system to reversibly lock the modular object to the

attachment insert by, placing the locking clip over the at least one locking post of the attachment insert and abutting an inner surface of the modular object, such that the modular object is between the attachment insert and the locking clip and the locking post is placed in and through a slot in the locking clip sized and shaped as a counterpart to the locking post of the attachment insert, sliding the locking clip along the inner surface of the modular object, and, reversibly locking the locking clip onto the attachment insert, with the modular object therebetween, by sliding a clip tab of the locking clip under a bottom post prong of the locking post.

In an embodiment, the method further comprises removing the modular object from the wearable modular carrying system by, sliding the locking clip such that a clip tab of the locking clip becomes dislodged from a bottom post prong of the locking post, and, applying sliding force to the modular object to dislodge it from the top post prong of the locking post.

Unless otherwise defined, all technical and/or scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention pertains. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of embodiments of the invention, exemplary methods and/or materials are described below. In case of conflict, the patent specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and are not intended to be necessarily limiting.

BRIEF DESCRIPTION OF THE DRAWING(S)

Some embodiments of the invention are herein described, by way of example only, with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example, are not necessarily to scale, and are for purposes of illustrative discussion of embodiments of the invention. In this regard, the description taken with the drawings makes apparent to those skilled in the art how embodiments of the invention may be practiced.

In the drawings:

FIG. 1 is a perspective view of a wearable modular carrying system;

FIG. 2 is a partially exploded view of a wearable modular carrying system;

FIG. 3A is a partial cutaway, front view of a wearable modular carrying system with a bottle mount;

In an embodiment, the carrier arm includes an actuator that drives the extending part to adjust the length of the carrier arm. The actuator may for example be a hydraulic actuator.

In an embodiment, the carrier arm assembly further comprises a mounting structure for mounting the carrier arm on a carrier vehicle.

In an embodiment, the carrier arm assembly further comprises a pivot mechanism that enables pivoting movement of the carrier arm relative to the mounting structure. The pivot mechanism enables movement of the carrier arm between a working position and a transport position in which the operating unit is located behind the cab of the carrier vehicle. The carrier arm assembly may include a drive mechanism for driving pivoting movement of the carrier arm, allowing it to be moved easily between the different positions. The pivot mechanism may be configured to provide for pivoting movement of the carrier arm between an upright position and a lowered working position in which the arm extends substantially parallel to the ground. The upright position allows the operating unit to be stowed behind the cab of the carrier vehicle for transportation along roads or through narrow gateways/doorways.

The carrier arm may include an actuator that drives the extending part to adjust the length of the carrier arm, allowing the position of the operating unit to be adjusted laterally relative to the carrier vehicle. For example, if the operating unit is a cutter unit, this makes it possible to adjust the operating position of the cutter unit during a mowing operation, for example to ensure that the edge of the cut strip of crop is aligned correctly with the edge of a strip cut previously. Adjustment of the lateral position of the cutter unit may be carried out manually, automatically or semi-automatically, for example using an operating method as described in EP1321027B1.

In an embodiment, the first actuator is connected between a first mount that is attached to the mounting structure and a second mount that is attached to the base part of the arm, and the second actuator is connected between the second mount and a third mount that is attached to the extending part of the arm. The use of a shared second mount that is connected to both the first actuator and the second actuator means that only three mounts are required in total for the two actuators, thus simplifying the structure of the carrier arm. The arrangement is also mechanically efficient.

In an embodiment, the carrier arm assembly includes a suspension system for suspending an operating unit from the carrier arm. In an embodiment the suspension system includes a mounting structure for the operating unit and two pairs of connecting rods, comprising an upper pair of connecting rods and a lower pair of connecting rods, each said connecting rod being attached via joints to the mounting structure and the carrier arm, wherein a first pair of said upper and lower pairs of connecting rods diverge in a working direction of the operating unit and a second pair of said upper and lower pairs of connecting rods converge in a working direction of the operating unit.

The suspension system allows the operating unit to be suspended solely from its centre point, thus permitting pendular movement of the operating unit and enabling the operating unit to follow the contours of the ground. The suspension system is also stronger and less vulnerable to damage from striking obstacles on the ground than the simple pivot used in the mowing machine described in DE 29614199U1.

The suspension system allows the operating unit to move vertically relative to the carrier arm. This movement may be accommodated, for example, by an actuator or spring. Vertical movement of the operating unit, as caused for example by movement over uneven ground, can be accommodated without adjusting any energy accumulators associated with the carrier arm, regardless of the length of the arm. The suspension system operates independently of any mechanism for adjusting the position or length of the carrier arm, thereby simplifying operation of the machine.

The suspension system allows the height of the operating unit relative to the arm to be adjusted, for example by means of an actuator or spring, which can be located centrally on the rotation axis so that it does not affect pendular motion of the operating unit when working.

Furthermore, when the mowing machine is raised to a transport position, the operating unit will naturally adopt a stable position under the force of gravity. The stability of the operating unit when it is in this position may be increased by the providing an actuator or spring that exerts a self-righting force on the operating unit. This actuator/spring is preferably connected to the carrier arm at a point higher than the virtual axis of rotation of

the operating unit when it is in a raised position so that it increases the stability of the operating unit.

In an embodiment, the suspension system includes a support mechanism that supports the weight of the operating unit. The support mechanism may be located at the free end of the carrier arm, allowing the operating unit to move vertically relative to the arm and reducing or eliminating the need for the arm to pivot during working to accommodate undulations in the ground. This reduces the load on the energy accumulators associated with the arm and allows the energy level of the energy accumulators to be adjusted directly so as to influence the behaviour of the support mechanism, regardless of the position or length of the carrier arm.

The support mechanism may include an actuator for adjusting the height of the operating unit relative to the carrier arm. This allows the height of the operating unit to be adjusted easily, for example between a working position and a headland position, or in the case of a mowing machine between different cutting positions providing different cutting heights. Preferably, the actuator is configured to act between the carrier arm and the mounting structure of the operating unit.

The support mechanism may optionally include a resilient support element or elements configured to support at least part of the weight of the operating unit. Each resilient support element is preferably configured to act between the carrier arm and the mounting structure of the operating unit. Alternatively, the resilient support elements may be omitted and the weight of the operating unit may be supported entirely by an actuator, for example a hydraulic actuator, which may optionally be coupled to a hydraulic accumulator.

In an embodiment the upper pair of connecting rods lie in an upper plane and the lower pair of connecting rods lie in a lower plane. In one preferred embodiment a line normal to the upper plane and a line normal to the lower plane are substantially perpendicular to a width axis of the operating unit. Preferably, the upper plane is substantially parallel to the lower plane. This arrangement ensures that the operating unit is held upright and does not rotate about a horizontal axis as it moves in a vertical direction relative to the carrier arm.

The carrier arm assembly may be supplied with an operating unit for attachment to an existing carrier vehicle. Alternatively, the carrier arm assembly may be used for retrofitting to an existing operating unit.

According to another aspect of the invention there is provided an agricultural machine including a carrier arm assembly according to any one of the preceding statements of invention, a carrier vehicle and an operating unit, wherein the carrier arm assembly is mounted on the carrier vehicle and carries the operating unit. Alternatively, the carrier vehicle may carry two operating units and two carrier assemblies, mounted on both sides of the carrier vehicle.

In one preferred embodiment, the agricultural machine is a mowing machine and the operating unit is a cutter unit. The cutter unit preferably includes a plurality of rotary cutter heads mounted on a cutter bar or support frame.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is an isometric view of a mowing machine that includes a carrier arm assembly according to an embodiment of the invention, a carrier vehicle and a cutter unit, shown in a transport position;

Figure 2 is an isometric view of the mowing machine of Figure 1, with the carrier arm assembly shown in a working position;

Figure 3 is a sectional view of the carrier arm assembly, shown in a working condition;

Figures 4a and 4b are isometric front views of a carrier arm in unextended and extended conditions;

Figures 5a and 5b are front elevations of the carrier arm in unextended and extended conditions;

Figure 6a is an end view of the carrier arm, seen from the inner end;

Figure 6b and 6c are cross-sections on lines B-B and C-C of Figures 5a and 5b; and

Figures 7a and 7b are sectional view of the carrier arm in unextended and extended conditions.

Figures 1 and 2 depict an agricultural machine 102 comprising a carrier vehicle (or tractor) 104, an operating unit 106 and a carrier arm assembly 108, which is attached to the rear of the carrier vehicle 104 through a conventional three-point mounting system 109. In this embodiment the agricultural machine 102 is a mowing machine, the carrier vehicle 104 is a tractor, and the operating unit 106 is a cutter unit. It should be understood however that the invention is also applicable to other kinds of agricultural machine including rakes, tedders, seeding machines and soil working machines, in which the cutter unit 106 is replaced by another operating unit of an appropriate type. The operating unit 106 is driven from the power take off of the vehicle 104 through a drive shaft 107.

The carrier arm assembly 108 includes a mounting structure 110 that is attached to the tractor's three-point mounting system 109, a carrier arm 112 that is attached to the mounting structure 110 through a pivot mechanism 114, and a suspension system 116 through which the cutter unit 106 is suspended from the free end of the carrier arm 112. In this embodiment the carrier arm 112 includes an inner section 112a that is connected to the pivot 114 and an outer section 112b that extends outwards to the free end of the arm and is set at an angle of about 40° relative to the inner section 112a.

The pivot mechanism 114 allows the carrier arm 112 to be pivoted about a pivot axis X that extends substantially parallel to the working direction D of the cutter unit 106. An actuator 118, for example a hydraulic ram, can be activated to drive rotation of the carrier arm 112 about the pivot axis X. The carrier arm 112 can generally be pivoted through a pivot angle in the range approximately 120° to 150° between a working position in which the outer section 112b of the arm is substantially horizontal, and a substantially upright transport position.

In Figure 1 the mowing machine is shown in a transport configuration in which the carrier arm 112 is lifted to an upright position so that the cutter unit 106 is located behind the cab of the tractor 104, while in Figure 2 the carrier arm 112 is shown in a working position in which the outer section 12b of the carrier arm 112 and the cutter unit 106 are substantially parallel to the ground. In Figure 3 the carrier arm 112 is shown in a headland position in

which the cutter unit 106 is raised slightly above the working position. The cutter unit 106 is moved to the headland position by raising the carrier arm 112 slightly, for example through a pivot angle of about 15°, and at the same time lifting the cutter unit 106 relative to the carrier arm 112 by adjusting the suspension system 116. This is described in more detail below.

As shown in Figures 4 - 7, the outer section 112b of the carrier arm includes a base part 120 and an extending part 122 that can be extended telescopically relative to the base part 120 to adjust the lateral position of the cutter unit 106 relative to the tractor 104. The structure and operation of the telescopic carrier arm 112 is described in more detail below.

Telescopic extension and retraction of the outer section is controlled by an actuator 123, for example a hydraulic ram, which is located within the base part 120 of the carrier arm 112 as shown in Figure 3. The telescopic carrier arm 112 thus allows for sideshift movement of the cutter unit 106 relative to the tractor 104. This allows the operating position of the cutter unit 106 to be adjusted laterally relative to the centreline of the tractor 104. This makes it possible to adjust the operating position of the cutter unit 106 during a mowing operation, for example to ensure that the edge of the cut strip of crop is aligned correctly with the edge of a strip that has been cut previously, or to adjust the amount of overlap between the two strips. Adjustment of the lateral position of the cutter unit 106 may be carried out manually, automatically or semi-automatically, for example using an operating method as described in EP1321027B1.

The cutter unit 106 is largely conventional and includes a plurality of cutter heads (not shown) attached to a support frame 124, and an optional conditioning unit 125 for conditioning the crop cut by the cutter heads. The cutter unit 106 is driven via a drive shaft 107 from the power take-off unit of the tractor 104.

The cutter unit 106 is suspended from the free end of the carrier arm 112 by the suspension system 116. The suspension system 116 includes a bracket 126 that is attached to the free end of the carrier arm 112, and two pairs of connecting rods, comprising a pair of upper connecting rods 128 and a pair of lower connecting rods 130. The connecting rods 128, 130 all extend approximately in the working direction D of the mowing machine and are attached at their front ends via ball joints 132 to the carrier arm 112.

The rear end of each connecting rod 128,130 is attached via a spherical ball joint 132 to a mounting structure 134 that extends upwards from the support frame 124 of the cutter unit 106 and is located approximately centrally with respect to the working width of the cutter unit. The ball joints 132 at the rear ends of the connecting rods 128,130 lie in a first plane referred to herein as the mo-unit plane. The ball joints 132 at the rear ends of the upper connecting rods 128 are positioned more closely together than the ball joints 132 at the rear ends of the lower connecting rods 130.

The forward end of each connecting rod 128, 130 is attached via a second spherical ball joint 132 to the bracket 126 that is attached to the free end of the carrier arm 112. The second ball joints 132 lie in a second plane referred to herein as the frame plane. The ball joints at the forward ends of the lower connecting rods 130 are positioned more closely together than the ball joints at the forward ends of the upper connecting rods 128.

The connecting rods 128, 130 form a pair of four-bar linkages, which control movement of the cutter unit 106 relative to the carrier arm 112. In this embodiment the upper connecting rods 128 lie in an upper plane and the lower connecting rods lie in a lower plane, which is parallel to the upper plane. This arrangement allows the cutter unit 106 to move substantially vertically relative to the carrier arm 112 while maintaining the cutter unit in an upright position (i.e. without rotation of the cutter unit about a horizontal axis). Alternatively, the upper and lower planes may be non-parallel, in which case vertical movement of the cutter unit relative to the carrier arm will cause a degree of rotation of the cutter unit 106 about a horizontal axis, which may be permissible in certain applications.

As explained above, the ends of the upper connecting rods 128 are closer together in the mo-plane than the frame plane, and the upper connecting rods 128 therefore converge from the frame plane towards mo-plane. Conversely, the ends of the lower connecting rods 130 are further apart in the mo-plane than the frame plane and the lower connecting rods 130 therefore diverge from the frame plane to the mo-plane. The upper and lower connecting rods 128, 130 therefore act like reversed A-frames, which prevent horizontal movement of the cutter unit 116 relative to the carrier arm 112.

Because the connecting rods 128, 130 are connected to the carrier arm 112 and the mounting structure 134 of the cutter unit 106 via ball joints, the cutter unit 106 is able to

rotate relative to the carrier arm about an axis of rotation that extends approximately in the working direction D of the cutter unit. This allows the cutter unit to follow the contours of the ground while working.

It should be understood that the connecting rod arrangement may be inverted, whereby the upper pair of connecting rods 128 diverge from the frame plane to the mo-plane and the lower pair of arms 130 converge from the frame plane to the mo-plane. This does not affect operation of the suspension system 116.

The suspension system 116 also includes an actuator 152 for adjusting the height of the cutter unit 106 relative to the carrier arm 112. In this example, the actuator 152 comprises a hydraulic ram that extends from a first pivot point between the rear ends of the upper connecting rods 128 to a second pivot point between the forward ends of the lower connecting rods 130.

The suspension system 116 allows the height of the cutter unit 106 relative to the carrier arm 112 to be adjusted and allows the cutter unit to rotate about an axis that extends substantially in the working direction D, but does not allow the cutter unit 106 to move laterally relative to the carrier arm (i.e. in a direction that is parallel to the width of the cutter unit). The cutter unit 106 can therefore rotate to accommodate undulations in the surface of the ground. The height of the cutter unit 106 relative to the carrier arm 112 can also be adjusted either to adjust the height of cut of the cutter unit, or to allow the cutter unit to be positioned in a raised headland position as shown in Figure 3 that allows the tractor to perform a turn at the end of a field.

The suspension system 116 allows the cutter head 106 to move vertically relative to the arm 112. Vertical movement of the cutter head 106 can be accommodated without adjusting any energy accumulators associated with the carrier arm 112, regardless of the length of the arm. The suspension system 116 thus operates independently of any sideshift mechanism for adjusting the length of the carrier arm 112, or the pivot angle of the arm 112 about pivot axis 114, thereby simplifying operation of the machine.

Because the connecting rods 128, 130 are subjected in use only to linear forces (i.e. forces of compression or tension that act along the axes of the connecting rods) and do not

experience any bending forces they can be relatively light in weight. At the same time, the risk of damage to the suspension system when the cutter unit collides with an obstruction on the ground is substantially reduced.

When the mowing machine is in the transport configuration shown in Figure 1, the suspension system 116 supports the entire weight of the cutter unit 106 but prevents movement of the cutter unit in the width direction of the cutter unit. The cutter unit 106 can however move under gravity to a stable position relative to the carrier arm 112. This prevents unwanted movement of the cutter unit 106 during transportation along a road.

Returning to Figure 3, the carrier arm assembly 108 includes drive mechanism for adjusting the pivot angle of the carrier arm 112 about pivot joint 114, and for adjusting the telescopic extension of the carrier arm 112. This drive mechanism will now be described in more detail. The drive mechanism includes a first actuator 118 for adjusting the pivot angle of the arm 112 about the axis X of pivot joint 114, and a second actuator 123 for adjusting the length of the arm 112. The first and second actuators 118, 123 may for example be hydraulic rams.

The first actuator 118, also called the folding cylinder, is connected between a first mount 160, for example a pivot pin, which is attached to the mounting structure 110, and a second mount 162, for example a second pivot pin, which is attached to the base part 120 of the arm 112 at the junction of the inner section 112a and the outer section 112b. Extension of the first actuator 118 drives the carrier arm 112 downwards towards the working position, and retraction of the first actuator 118 lifts the carrier arm 112 upwards towards the transport position. In the headland position the arm 112 is lifted only slightly above the working position: for example, the arm 112 may be rotated about the pivot joint 114 through an angle in the range 5° - 15° above the working position. The support structure 116 may also be raised when the arm is in the headland position, to increase the clearance between the cutter unit 106 and the ground.

The first actuator 118 is preferably configured to allow stepless adjustment of the pivot angle of the carrier arm 112. This enables the possibility of making small adjustments to the angle of the carrier arm 112, for example to compensate for a loss of pressure in one or more tyres of the carrier vehicle 104. The carrier arm 112 can therefore be maintained in a

Whenever a numerical range is indicated herein, it is meant to include any cited numeral (fractional or integral) within the indicated range. The phrases "ranging/ranges between" a first indicate number and a second indicate number and "ranging/ranges from" a first indicate number "to" a second indicate number are used herein interchangeably and are meant to include the first and second indicated numbers and all the fractional and integral numerals therebetween.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination or as suitable in any other described embodiment of the invention. Certain features described in the context of various embodiments are not to be considered essential features of those embodiments, unless the embodiment is inoperative without those elements.

Although the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

All publications, patents and patent applications mentioned in this specification are herein incorporated in their entirety by reference into the specification, to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated herein by reference. In addition, citation or identification of any reference in this application shall not be construed as an admission that such reference is available as prior art to the present invention. To the extent that section headings are used, they should not be construed as necessarily limiting.

Prior art, if any, described herein is not to be taken as an admission that the prior art forms part of the common general knowledge in any jurisdiction.

The upper and lower inclined walls 120a,120b of the base part 120 and upper and lower inclined walls 122a,122b of the extending part 122 together provide a guiding function, which ensures that play between the base part 120 and the extending part 122 of the arm is minimised, even when the arm 112 is in a fully-extended condition. The weight of an operating unit attached to the outer end of the telescopic carrier arm produces a bending moment on the arm 112, which forces the inner end of the extending part 122 upwards and the outer end of the extending part 122 downwards relative to the base part 120. This produces a self-centring effect which prevents side-to-side movement of the extending part 122 relative to the base part 120.

It should be understood that the base and extending parts 120, 122 of the carrier arm 112 may alternatively have a number different profiles without affecting operation of the invention. For example, the side walls 120c, 122c may be omitted so that the base past 120 and the extending part 122 of the carrier arm both have a diamond-shaped profile. In the illustrated embodiment the upper and lower inclined walls 120a,120b of the base part 120 and the upper and lower inclined walls 122a,122b of the extending part 122 are all inclined at an angle of about 45° relative to the vertical. However, they may alternatively be inclined at some other angle, for example in the range 30° to 60° relative to the vertical.

Various modifications of the apparatus described above are of course possible. For example, the arrangement of the connecting rods 128, 130 of the suspension mechanism 116 may be reversed, so that the upper connecting rods 128 diverge from the frame plane towards the mo-plane and the lower connecting rods 130 converge from the frame plane to the mo-plane. The ball joints 132 may also be replaced by any other joints that allow rotation about two orthogonal axes, including for example universal joints (Cardan joints).

The hydraulic actuator 152 may be replaced by any other suitable actuator including, for example, an electric linear motor or a motor driven screw. Alternatively, the actuator 152 may be omitted entirely and the weight of the cutter unit may then be supported by resilient support elements, for example springs or other resilient components.

The suspension mechanism may alternatively be replaced any other suitable mechanism for attaching the operating unit to the carrier arm.

As previously indicated, the invention is not limited to mowing machines but is also applicable to other kinds of agricultural machine including rakes, tedders, seeding machines and soil working machines in which an operating unit is attached to the rear of a tractor 104.

The carrier arm assembly can be used to mount a single operating unit on one side of a carrier vehicle, or alternatively two operating units may be used to mount operating units on both sides of the vehicle.

WHAT IS CLAIMED IS:

1. A wearable modular carrying system, comprising:

a belt;

an attachment insert held next to the belt and including at least one locking post with one of a top post prong or a bottom post prong, and a key-hole; and,

a modular object comprising at least one of a magnetic bottle mount and magnetically active bottle combination, a basket, a holder, a tool holder, a flashlight holder; and,

a locking clip including at least one slot sized and shaped as a counterpart to the locking post of the attachment insert and wherein the locking clip is disposed on a side of the modular object such that the modular object is bracketed between the locking clip and the attachment insert, wherein the locking clip includes a clip tab reversibly engageable to the attachment insert.

2. A wearable modular carrying system according to claim 1, wherein a removable, metallic, continuous ring is disposed around a neck of the magnetically active bottle and the magnetic bottle mount includes at least one magnet at a location on the bottle mount corresponding to the ring on the bottle when the bottle is seated in the bottle mount.

3. A wearable modular carrying system according to claim 1, wherein the attachment insert is held next to the belt by at least one of stitching, fusing and adhesive.

4. A wearable modular carrying system according to claim 1, wherein the at least one locking post of the attachment insert, the modular object and the locking clip interlace when reversibly attached together.

5. A wearable modular carrying system according to claim 1, wherein the top post prong and the bottom post prong of the at least one locking post are of different configurations.

6. A wearable modular carrying system according to claim 1, wherein the attachment insert is held next to the belt by a pocket sized and shaped for placement of the attachment insert therein.

7. A wearable modular carrying system according to claim 1 wherein the attachment insert is ovoid shaped for distributing the weight of the modular object therearound.

8. A wearable modular carrying system according to claim 7, wherein the attachment insert is provided with at least one support to provide flexibility control.

9. A wearable modular carrying system according to claim 1, wherein the attachment insert is x-shaped for distributing the weight of the modular object among the extensions of the x-shape.

10. A wearable modular carrying system according to claim according to claim 1, wherein the magnetic bottle mount includes at least one slide slot in which a slide of the locking clip is positioned, were the dimensions of the slide slot define the movement of the locking clip.

11. A wearable modular carrying system according to claim 1, wherein the attachment insert further comprises a top latch, a bottom wedge and at least one spacer.

12. A wearable modular carrying system according to claim 11, wherein the modular object locks onto the attachment insert between multiple stabilizing points.

13. A wearable modular carrying system according to claim 12, wherein the multiple stabilizing points include at least one of the top latch, the bottom wedge, the at least one spacer, the top post prong and the bottom post prong.

14. A wearable modular carrying system according to claim 13, wherein at least one of the top latch, the bottom wedge and the at least one spacer prevent the modular object from moving longitudinally, and at least one of the top post prong and the bottom post prong prevent the modular object from moving laterally.

15. A wearable modular carrying system according to claim 1, wherein the clocking clip includes a user interface feature.

16. A method of using a wearable modular carrying system, comprising:

attaching a modular object comprising at least one of a magnetic bottle mount and magnetically active bottle combination, a basket, a holster, a tool holder, a flashlight holder, to an attachment insert including at least one locking post by,

resting a top surface of the attachment insert against the back surface of the modular object so that the at least one locking post of the attachment insert is placed within and through a slot of the modular object,

sliding the modular object longitudinally along the top surface of the attachment insert, and,

reversibly locking the modular object onto the attachment insert by sliding a portion of the modular object under a top post prong of the locking post;

attaching a locking clip to the system to reversibly lock the modular object to the attachment insert by,

placing the locking clip over the at least one locking post of the attachment insert and abutting an inner surface of the modular object, such that the modular object is between the attachment insert and the locking clip, that is the locking clip is disposed on a side of the modular object opposite the attachment insert, and the locking post is placed in and through a slot in the locking clip sized and shaped as a counterpart to the locking post of the attachment insert,

sliding the locking clip along the inner surface of the modular object, and

reversibly locking the locking clip onto the attachment insert, with the modular object therebetween, by sliding a clip tab of the locking clip under a bottom post prong of the locking post.

17. A method of using a wearable modular carrying system according to claim 16, further comprising:

removing the modular object from the wearable modular carrying system by,

sliding the locking clip such that a clip tab of the locking clip becomes dislodged from a bottom post prong of the locking post, and,

applying sliding force to the modular object to dislodge it from the top post prong of the locking post.

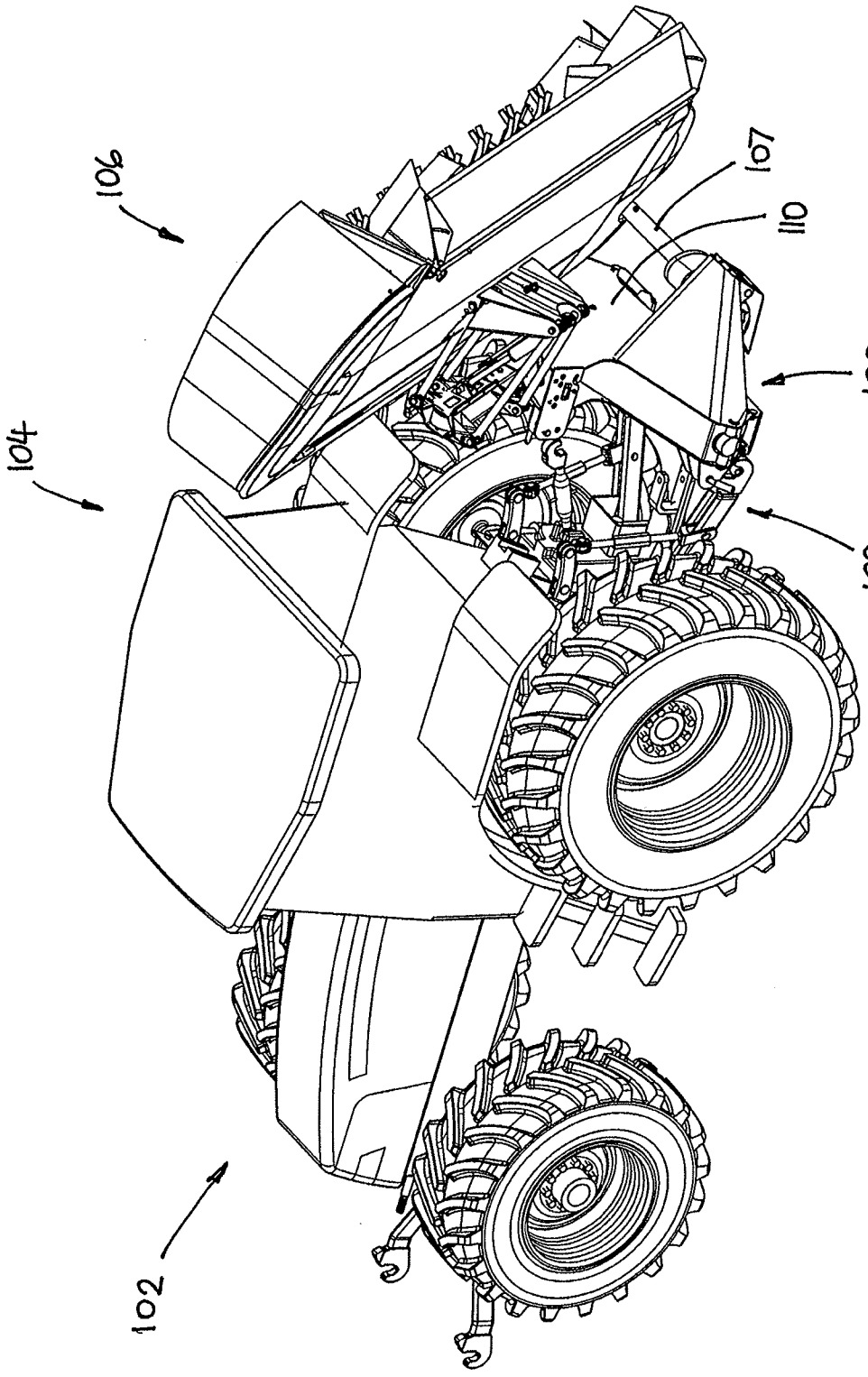
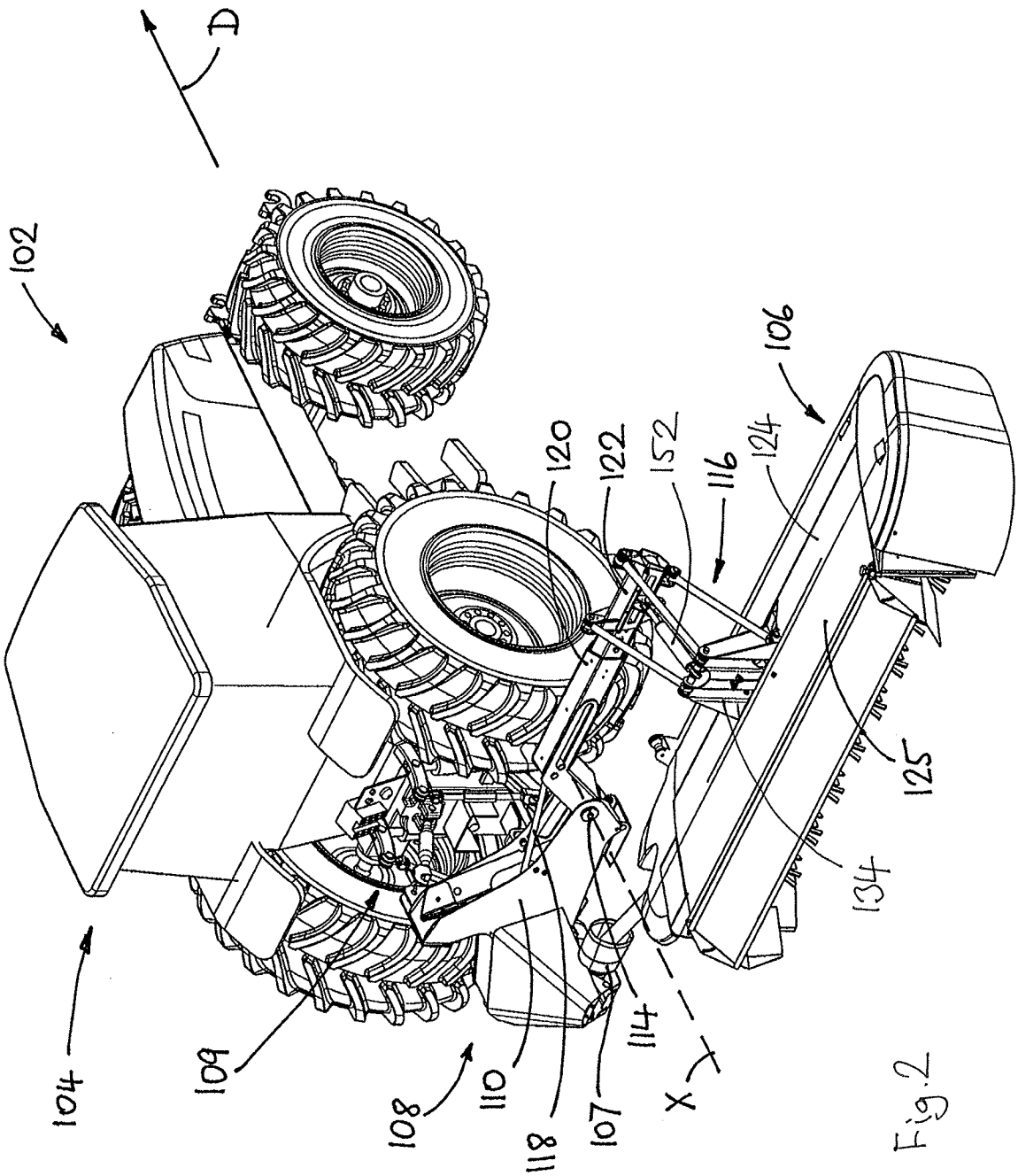


Fig. 1


D
102
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122
152
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124
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134
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109
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110
118
107
111
X

Fig.2

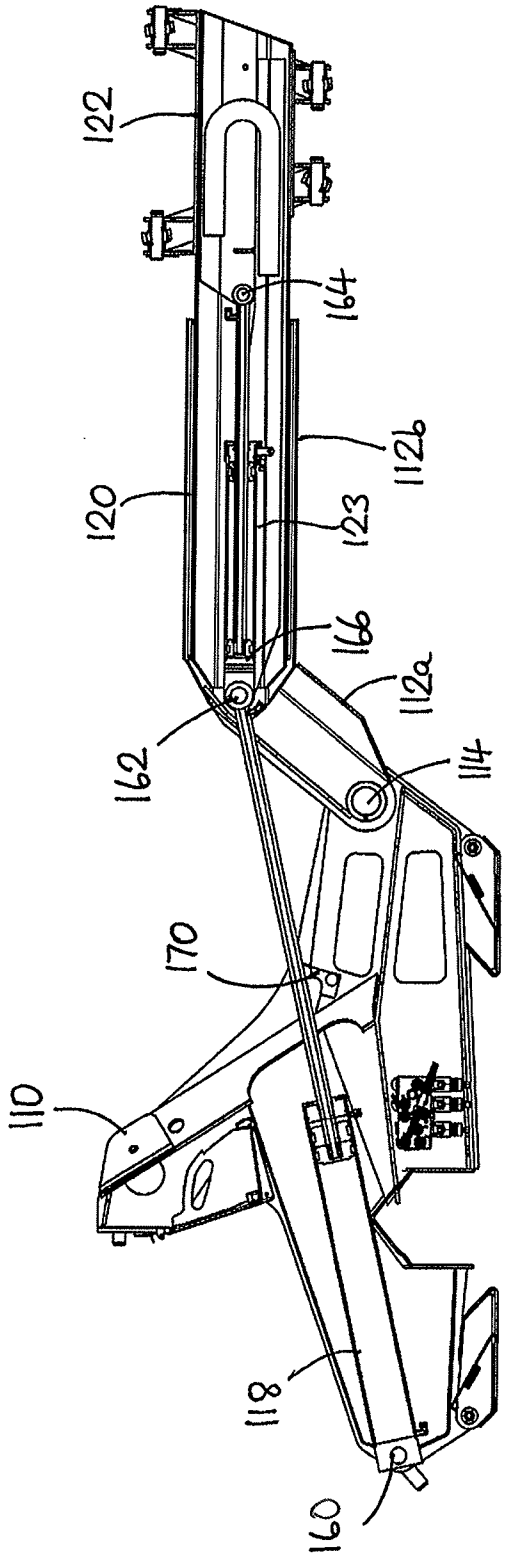
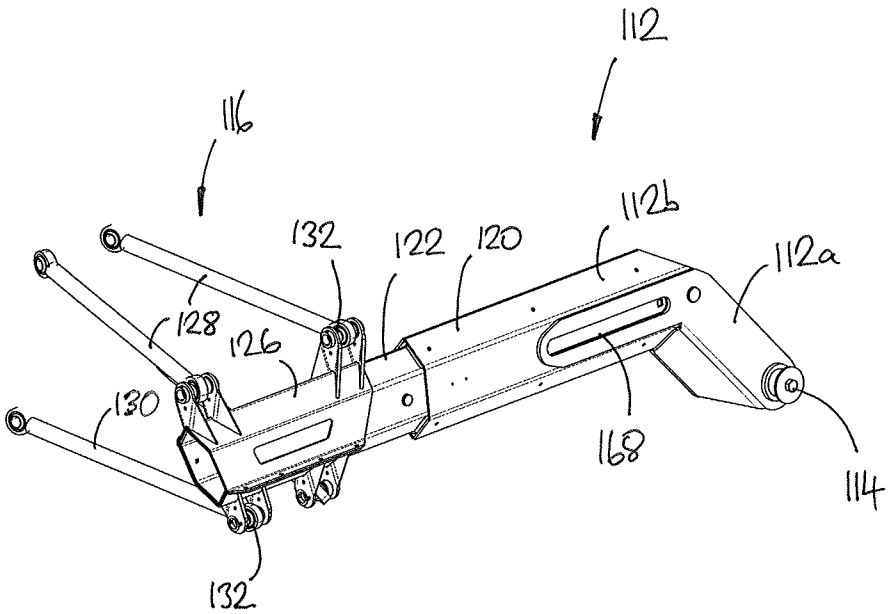


Fig.3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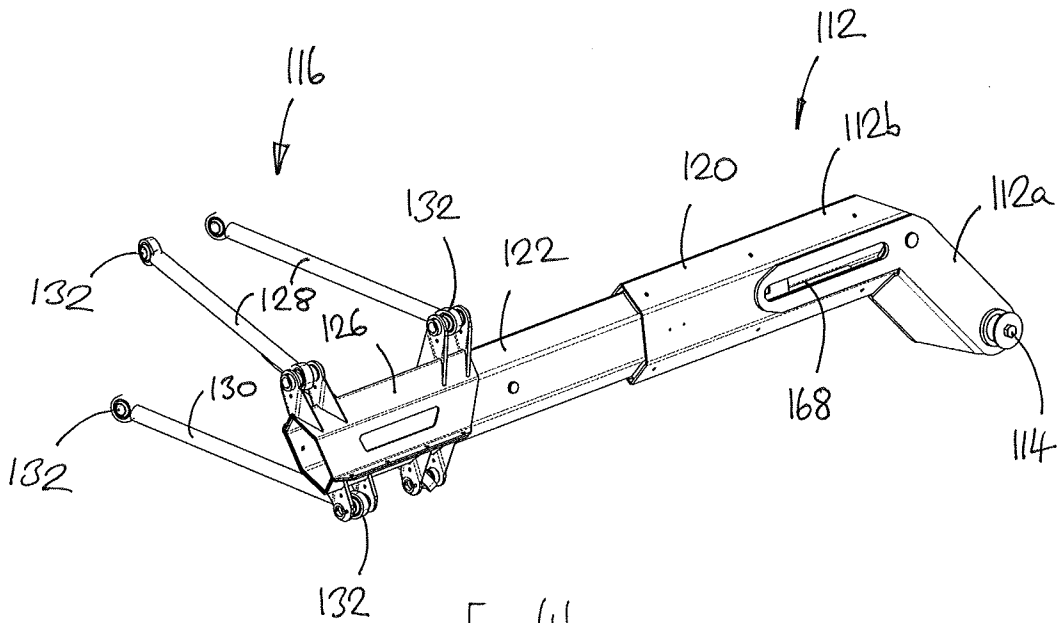
116
132
122
120
112b
112a
128
126
130
168
114
132

Fig. 4a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112a
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122
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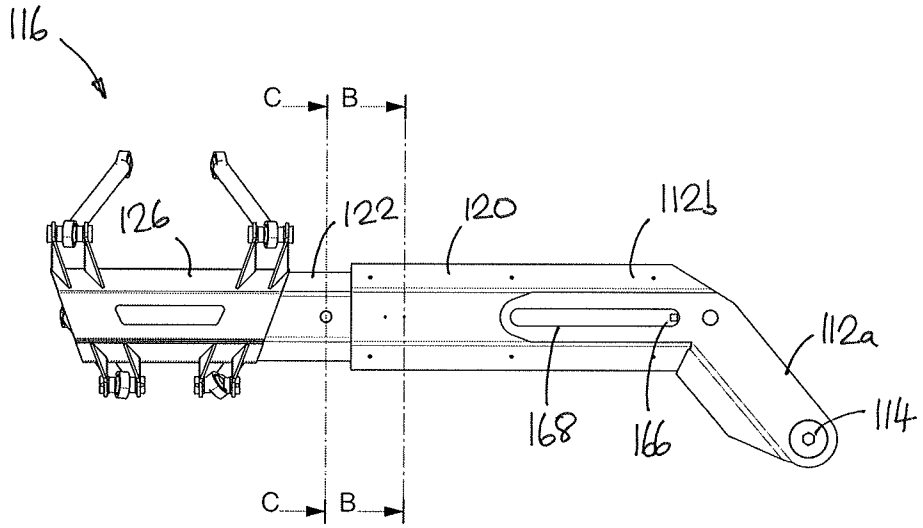
114
132
132

Fig. 4b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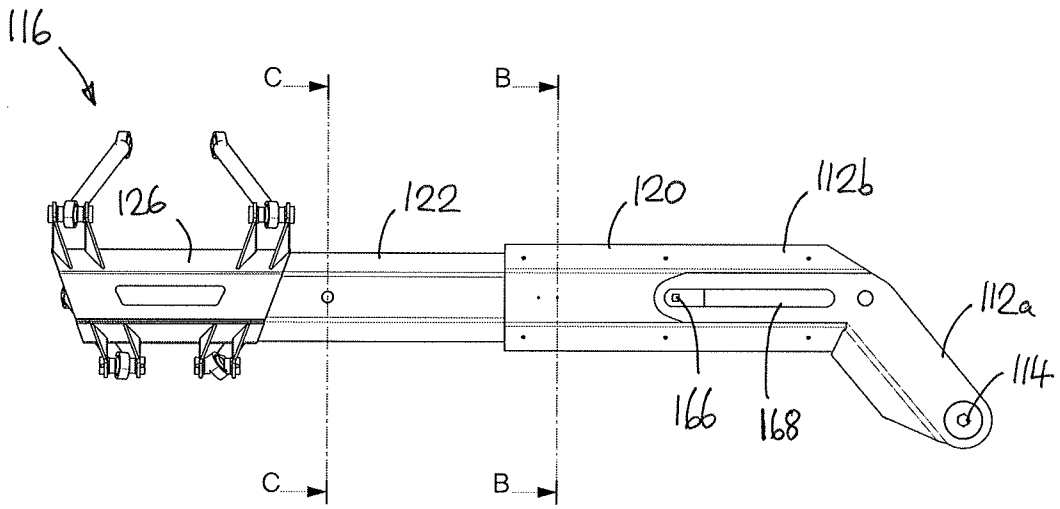
122
120
112b
112a
114
168
166
C
B

Fig. 5a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122
120
112b
112a
114
166
168
C
B

Fig. 5b

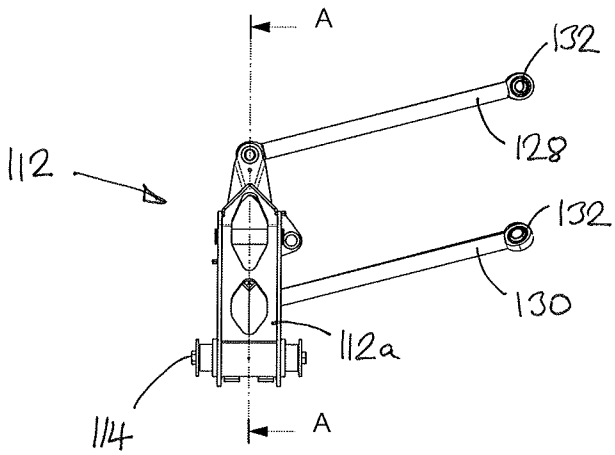


Fig. 6a

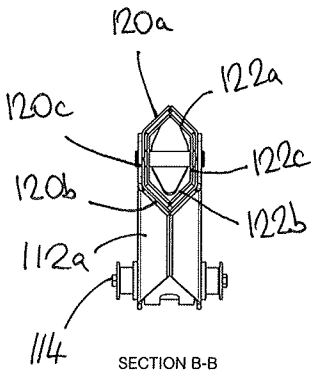


Fig. 6b

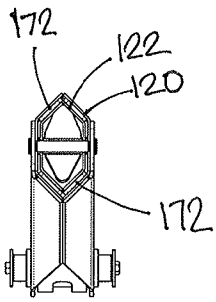
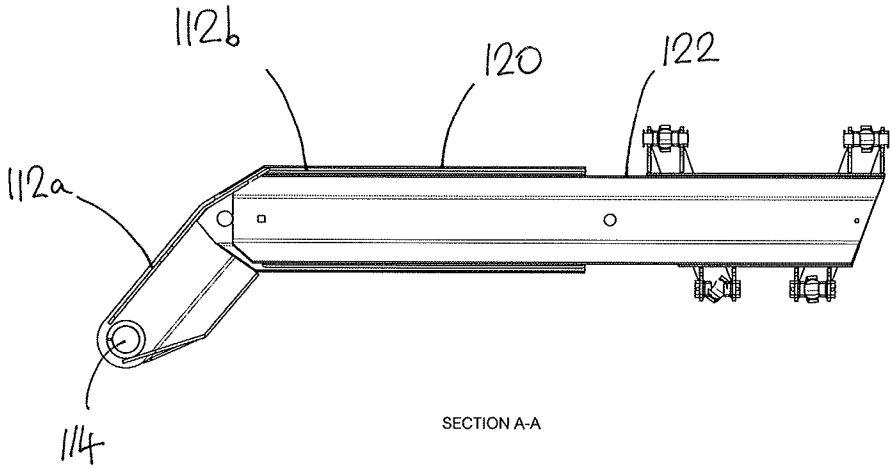


Fig. 6c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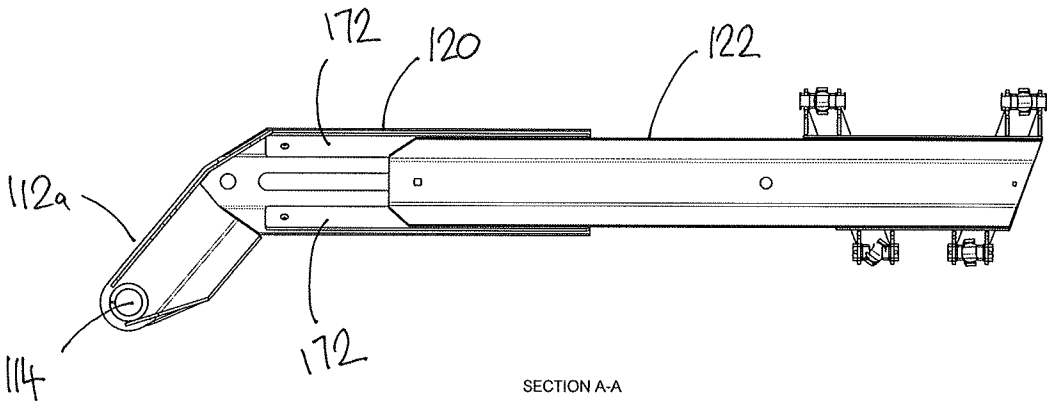
122
112a
114
SECTION A-A

Fig. 7a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122
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114
172
SECTION A-A

Fig. 7b