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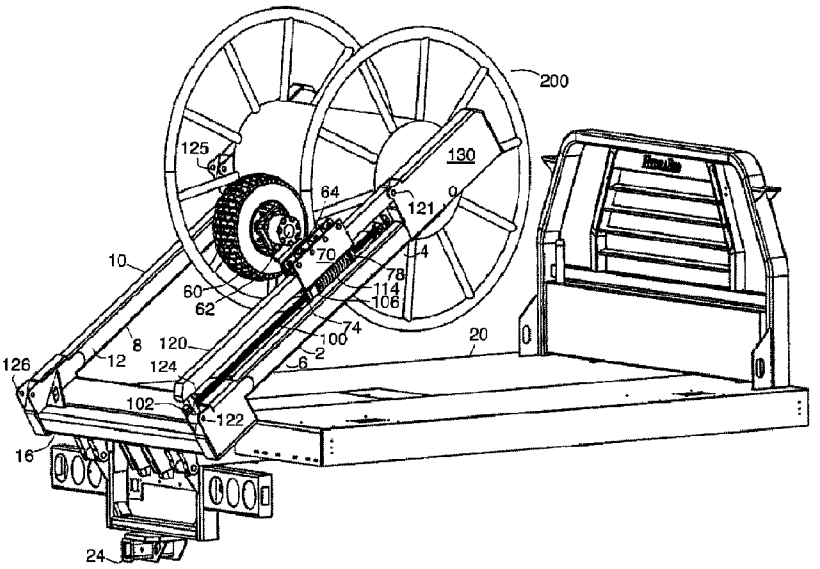
(54) Titre : APPAREIL DE LEVAGE A TAMBOUR DE PLATEFORME DE CAMION HYDRAULIQUE
(54) Title: HYDRAULIC TRUCK BED REEL LIFT APPARATUS



(57) Abrégé/Abstract:
A vehicle-mounted reel lifting apparatus for rotating the reel to dispense or wind the reelable material. A driven wheel engages the rim of the reel at a plurality of reel lifting arm pivot positions, such as sliding alongside the lifting arm in an axis parallel with the lifting arm. The driven wheel is capable of engaging with the reel at any position of the lifting arm. A linear drive mechanism allows the driven wheel to travel up and down the lifting arm to accommodate various reel sizes. The lifting arm may incorporate an automatic locking slot having a spring- driven locking mechanism. The lifting arms may also be mounted with a mounting bracket having a pattern of slots to enable the lifting arms to be selectively mounted in a narrow configuration or a wide configuration.

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Certificat de correction

Certificate of Correction

Canadian Patent No. 3,109,444
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Les corrections suivantes sont faites en raison de l'article 109 des *Règles sur les brevets* et le brevet doit être lu tel que corrigé.

The following corrections are made pursuant to section 109 of the *Patent Rules* and the patent should read as corrected.

In the Patent Grant:

The attached drawing Figures 18 to 20 should be read in place of drawing Figures 18 to 20. in the patent.

28 March 2022 (28-03-2022)

Date

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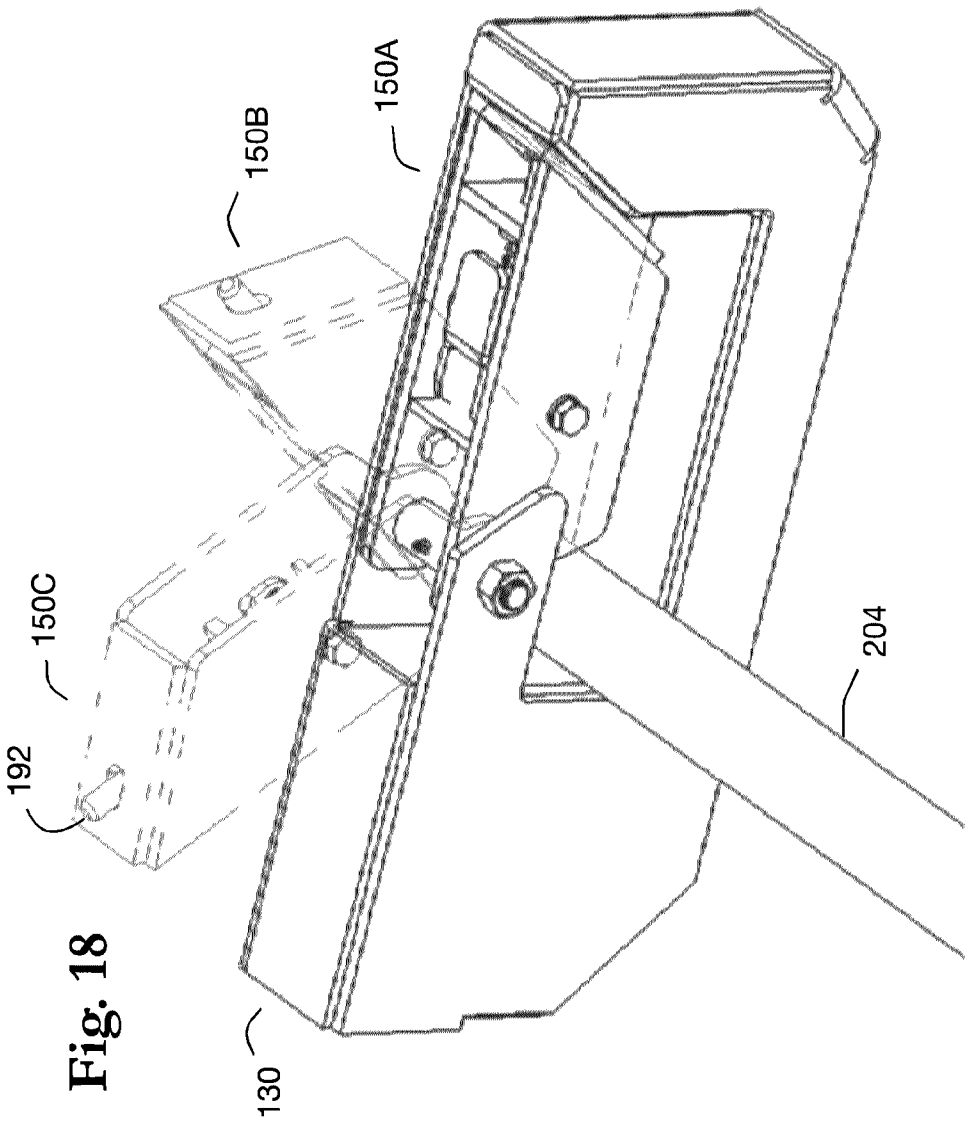

Fig. 18

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Fig. 19

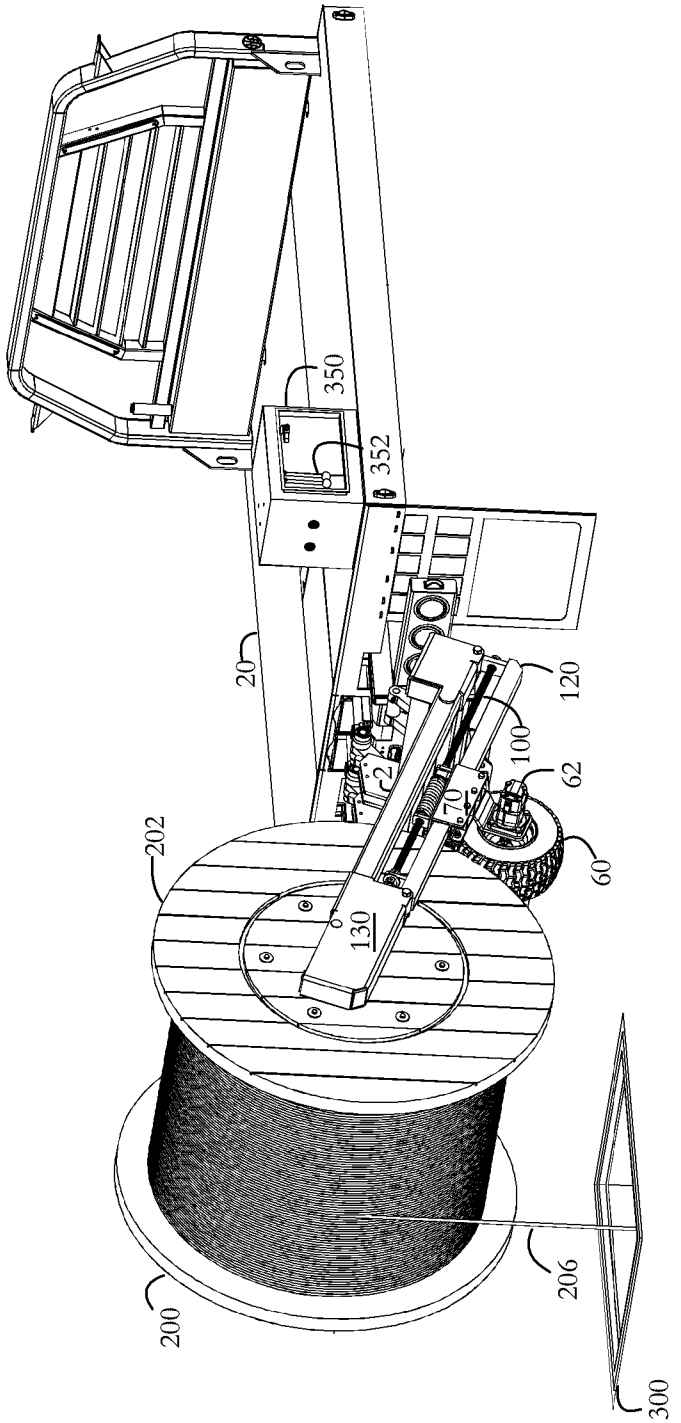

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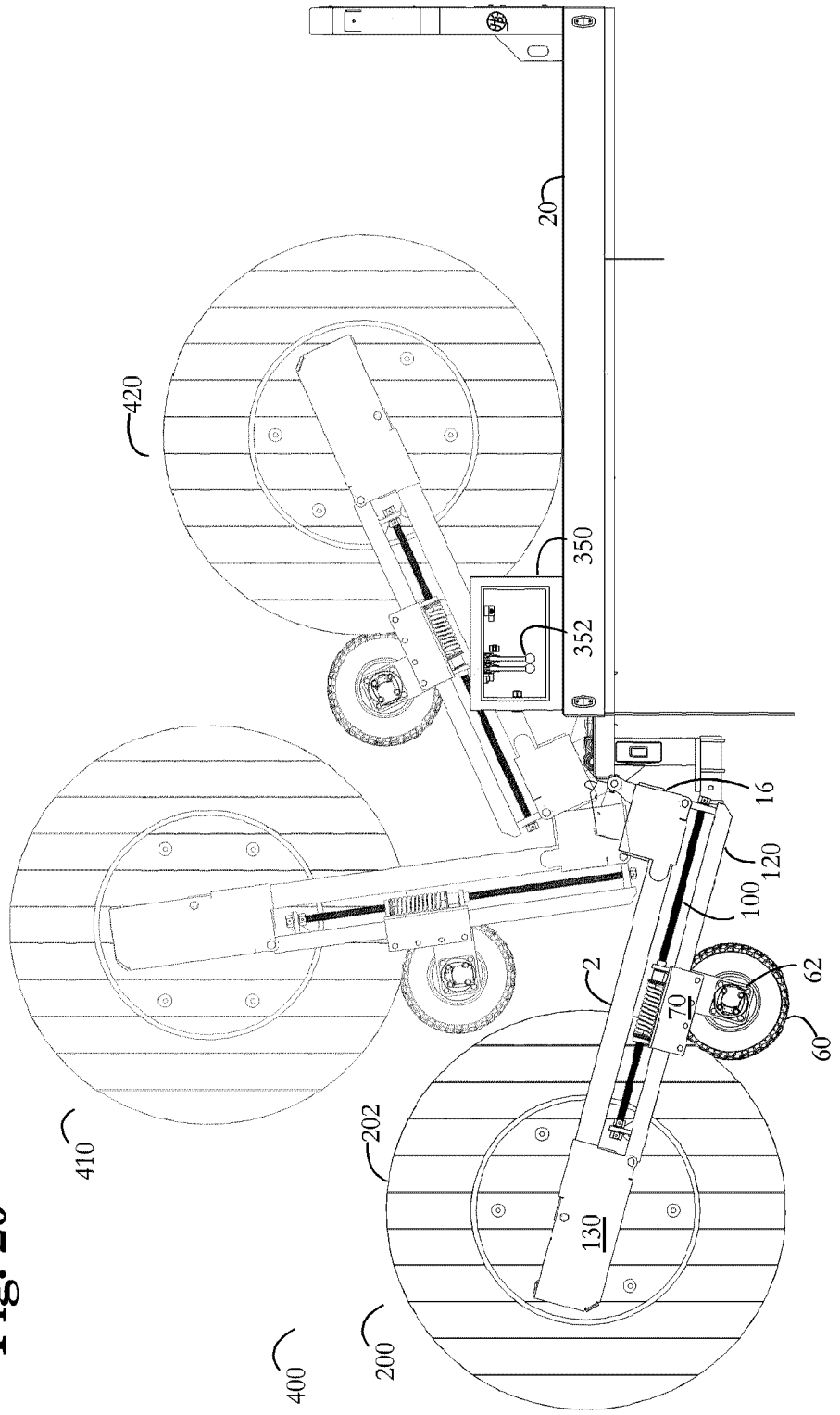
Fig. 20



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ABSTRACT

A vehicle-mounted reel lifting apparatus for rotating the reel to dispense or wind the reelable material. A driven wheel engages the rim of the reel at a plurality of reel lifting arm pivot positions, such as sliding alongside the lifting arm in an axis parallel with the lifting arm. The driven wheel is capable of engaging with the reel at any position of the lifting arm. A linear drive mechanism allows the driven wheel to travel up and down the lifting arm to accommodate various reel sizes. The lifting arm may incorporate an automatic locking slot having a spring-driven locking mechanism. The lifting arms may also be mounted with a mounting bracket having a pattern of slots to enable the lifting arms to be selectively mounted in a narrow configuration or a wide configuration.

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Hydraulic Truck Bed Reel Lift Apparatus

Field of the Invention

[0001] The present disclosure relates to vehicles adapted to transport, to carry or to comprise special loads or objects for transporting reel units and arrangements for rotating packages in which the package, core, or former is rotated by frictional contact of its periphery with a driving surface. The present disclosure also relates to mechanisms for rotating a reel for retrieving or dispensing reelable material such as cable, wire, rope or other reelable material from a reel unit.

Background

[0002] Self-loading bed assemblies for flat-bed trucks are useful for adapting a truck to pick-up, transport, and then feed or off-load one or more big round bales, as shown in U.S. Pat. No. 4,564,325.

[0003] The actuating mechanism for the lifting arms is located underneath the bed, and the lift arms are designed to pivot between a stored position where the arms are positioned on

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the top surface of the bed and an extended position for loading and unloading a reel that is positioned on the ground.

Summary

[0004] We disclose a mechanism for turning a reel engaged by lifting arms. A driven wheel engages the reel by sliding adjacent to and alongside the lifting arm. The driven wheel moves between an engaged configuration where the driven wheel is in contact with the reel and an unengaged configuration where the driven wheel slides alongside the arm away from the reel.

[0005] The driven wheel is mounted to a sleeve that travels on a rail alongside a lifting arm. Turning a lead screw causes the sleeve to slide along the lifting arm. When engaged with the reel, the driven wheel can be activated to turn the reel. Turning the reel allows the reelable material to be retrieved or dispensed.

[0006] A biasing mechanism provides traction between the driven wheel and the reel. As the driven wheel is activated, the reel turns to retrieve or dispense a reelable material.

[0007] One advantage of the present disclosure is that the reel can be rewound in any arm position. Existing reel utilities offer drive mechanisms mounted on a separate moving arm. The separate moving arm is pivotally mounted to the truck side of the bed. In order to retrieve or dispense the reelable material, the separate moving arm is pivoted into position where the wheel contacts the reel.

[0008] Since our driven wheel is mounted to a lift arm, the driven wheel maintains its proximity to the reel in any lift position. For example, the lift arms can be fully extended, positioning the reel directly behind the truck, and the driven wheel can contact the reel. Alternatively, the lift arms can position the reel just above the bed surface, and the driven wheel can maintain contact with the reel.

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[0009] Another advantage of mounting the driven wheel to a lift arm is that operating the retraction mechanism uses a single hydraulic source in addition to the hydraulic circuits that operate the lift arms. The reel lift apparatus uses a hydraulic circuit and the reel rotating mechanism arm uses a separate hydraulic circuit. Lifting the reel is operated independently of the reel rotating mechanism. Existing devices may utilize one hydraulic circuit to position the separate moving arm and a second hydraulic circuit to operate the reel rotating mechanism.

[0010] Another advantage is that the driven wheel can be slidably adjusted to engage a variety of reel sizes. The driven wheel slides toward the lifting arm's end distal of the bed mount to engage a smaller diameter reel. By sliding alongside the length of the lifting arm, the reel rotating mechanism can engage many different reel sizes.

[0011] Another advantage of incorporating the reel rotating mechanism on the lift arm is maximizing available bed surface space. Existing solutions can interfere with toolboxes, reel storage space, or other uses for the truck bed surface. By incorporating the reel rotating mechanism on the lift arm, no additional bed space is used. The reel rotating mechanism mounted alongside the lifting arm does not interfere with loading, unloading or transport.

[0012] In one embodiment, the driven wheel is engaged in contact with the reel by turning the lead screw. Rotation of the lead screw causes the travel nut to move along the lead screw. The driven wheel makes contact with the reel, which restricts the movement of the sleeve. The travel nut continues to move, compressing a spring that is held by the sleeve with a rear tab. The spring is compressed between the travel nut and the rear tab of the sleeve. The spring exerts its force against the front tab of the sleeve, thereby maintaining the driven wheel in contact with the reel, providing traction for driving the reel.

[0013] One advantage of the present disclosure is safer operation. The movement of the sleeve along the rail does not create the safety hazard of a pinch point between opposing

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hydraulically driven arms, as is seen when a hydraulic arm is brought into contact with a stationary reel. Further, there is human feedback on the pressure of the driven wheel against the reel when the operator rotates the turning mechanism.

[0014] The lift arm provides attachment points, allowing the rail to be secured to or removed from the lifting arm. The lifting arm can be configured with the appropriate attachment points. The lead screw is mounted to the rail arm. In this embodiment, the reel rotating mechanism is modular and can be attached to either lift arm or both lift arms.

[0015] Another advantage of the present disclosure is that it can be configured with two drive units, one mounted to each lift arm. A reel lift apparatus equipped with dual drive mechanisms exerts twice the torque as a single drive unit.

[0016] Another advantage of the modular design is that the reel rotating unit does not need to be purchased with the hydraulic bed. The reel rotating unit can be offered as an add on kit. Even if the user does purchase a single reel rotating mechanism, the user may later discover that more traction is required for spooling larger reels or reel rotating heavier material.

[0017] In embodiments having a first reel rotating mechanism and a second reel rotating mechanism, a first motor and a second motor can be powered in series or in parallel. For example, a pair of hydraulic motors can be plumbed in series to generate the same rotation speed and increased traction. Alternatively, the pair of hydraulic motors can be plumbed in parallel to increase the torque and traction.

[0018] The lifting arm can be reversibly mounted to the cross member. The lifting arms are mounted to a cross member to effectuate the lowering and raising of the lifting arms. Hydraulically driven linkages cause the cross member to rotate relative to the bed. When the cross member rotates, the lifting arms move with the cross member.

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[0019] The lifting arm has a mounting bracket that is mounted to the cross member. A mounting bracket is mounted perpendicular to the base member at the proximal end of the lifting arm. A latch mechanism is mounted at the distal end of the lifting arm.

[0020] Another advantage of the modular design is that the mounting brackets can be installed in two different configurations: wide configuration and narrow configuration. In the wide configuration, the reel lift apparatus can accept larger or multiple reels. In the narrow configuration, the reel lift apparatus can lift fewer or narrower reels while providing the operator more usable bed space. The modular design of the reel rotating mechanism allows the reel rotating mechanism to turn the reel in the wide configuration or the narrow configuration.

[0021] It is understood that other embodiments will become readily apparent to those skilled in the art from the following detailed description, wherein various embodiments are shown and described by way of illustration only. As will be realized, the concepts are capable of other and different embodiments and their several details are capable of modification in various other respects, all without departing from the spirit and scope of what is claimed as the invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not as restrictive.

Brief Description of Drawings

[0022] Aspects are illustrated by way of example, and not by way of limitation, in the accompanying drawings, wherein:

[0023] Figure 1 depicts a side perspective view of an embodiment of the reel lift apparatus engaged with a small diameter reel.

[0024] Figure 2 depicts an enlarged view of the embodiment of Figure 1 showing the driven wheel engaged with a small diameter reel.

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[0025] Figure 3 depicts an enlarged view of a top perspective of the driven wheel and sleeve on the rail of the embodiment of Figure 1.

[0026] Figure 4 depicts an enlarged rear side perspective view of the lead screw and turning mechanism of the embodiment of Figure 1.

[0027] Figure 5 depicts a rear side perspective view the reel lift apparatus of Figure 1 engaged with a larger diameter reel.

[0028] Figure 6 depicts an enlarged view of the embodiment of Figure 5 focused on the driven wheel engagement with a reel having a larger diameter.

[0029] Figure 7 depicts a rear perspective view of an embodiment of the modular lifting arms in the narrow configuration.

[0030] Figures 8 depicts a partially exploded view of the embodiment of Figure 7, showing the mounting brackets and lifting arms removed from the cross member.

[0031] Figure 9 depicts a top perspective view of the embodiment of Figure 7 in the narrow configuration, with the lifting arms in the stored position.

[0032] Figure 10 depicts a rear perspective view of the embodiment of Figure 7 with the lifting arms mounted in the wide configuration.

[0033] Figure 11 depicts a top rear perspective view of the embodiment of Figure 7 in the wide configuration.

[0034] Figure 12 depicts top view of the embodiment of Figure 7 in the wide configuration.

[0035] Figure 13 depicts a side perspective view of a driven wheel engaged with a larger diameter reel showing compression of the spring.

[0036] Figure 14 depicts a top inside perspective view of an embodiment of the axle slot assembly with the locking cover assembly in the closed position.

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[0037] Figure 15 depicts an inside sideview of the embodiment of Figure 14 showing the reel axle in the home position and the locking cover assembly in the closed position.

[0038] Figure 16 depicts a side view of the locking cover assembly of Figure 14 in isolation, with the side plate shown as transparent to show the reel axle engagement jaw.

[0039] Figure 17 depicts a top side perspective view of the locking cover assembly.

[0040] Figure 18 depicts a top side perspective view of an embodiment of the axle slot assembly with the motion of the axle slot assembly shown in dashed lines, showing a closed, partially opened, and fully opened locking cover assembly.

[0041] Figure 19 depicts a rear side perspective view of the lifting arms in an extended position with the reel capable of rotating directly over a hole in the ground.

[0042] Figure 20 depicts a side view showing three different pivot positions of the lifting arms holding a reel.

Detailed Description

[0043] As illustrated in Fig. 1, the reel lift apparatus has a first lifting arm **2** and a second lifting arm **8**. The lifting arms **2,8** are perpendicularly mounted to a cross member **16**. The lifting arms **2, 8** are pivotally mounted to the vehicle at a pivot mount, allowing the arms to pivot relative to the bed through a plurality of pivot positions, as shown in Fig. 20. For example, the lifting arms **2, 8** can be pivoted perpendicular to the bed **20** in a first pivot position. The lifting arms **2, 8** can also be pivoted to an acute angle relative to the bed **20** in a reel loaded pivot position **420** with the reel resting on the bed **20**. The lifting arms **2, 8** can also be pivoted to a generally perpendicular angle relative to the bed **20** in an upright pivot position **410** with the lifted vertically above the bed **20**. The lifting arms **2, 8** can also be pivoted to an obtuse angle relative to the bed **20** in an extended pivot position **400** with the

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reel extending behind the vehicle. The lifting arms **2**, **8** can also be pivoted at an acute angle to the bed **20** in a loaded position, as shown in Fig. 1. The reel lift apparatus can be configured to be continuously pivoted through any degree of pivoting the lifting arms **2**, **8**, the listed pivot positions are provided as example locations of the various pivot points.

[0044] Attached to the cross member **16**, the lifting arms **2**, **8** form a U-shape. The cross member **16** extends across the lateral width of the bed and forms the base of the U-shape. The first lifting arm **2** and the second lifting arm **8** extend perpendicularly from the cross member **16**. The first lifting arm **2** has a first distal arm portion **4** and a first proximal arm portion **6**, where the first proximal arm portion **6** is mounted to the cross member **16**. The second lifting arm **8** has a second distal arm portion **10** and a second proximal arm portion **12**, where the second proximal arm portion **12** is mounted to the cross member **16**. Each of the lifting arms **2**,**8** has a respective longitudinal axis generally parallel to the long dimension of the arm.

[0045] In the extended position, the cross member **16** is higher than the arms **2**, 8. In the retracted position, the cross member **16** can be flush with the bed surface **20**. The arms **2**,**8** lay on top of the bed surface **20** in the unloaded travel position.

[0046] The lifting arms **2**,**8** are depicted as having a rectangular cross section. The lifting arms **2**,**8** can have a square, rectangular, circular, or otherwise curved cross section. The lifting arms can be made of iron, steel, aluminum, or other sufficiently strong material. The lifting arms **2**, **8** can be directly welded upon the cross member **16**. Alternatively, the lifting arms **2**,**8** can be removably mounted to the cross member **16** with a mounting bracket **30**. The mounting bracket **30** can be bolted to the cross member **16**. As shown in Figures 7-8, the mounting bracket **30** can be slidably mounted to the cross member **16**, wherein the mounting bracket **30** receives a first end portion of the cross member **16** through a complementary aperture in the mounting bracket **30**.

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[0047] As illustrated in Fig. 2, the reel lift apparatus has a slide rail **120** upon which the sleeve **70** slides. The slide rail **120** can be mounted parallel to the longitudinal axis of one or both of the lifting arms **2**,8. As shown in Fig. 1, the rail **120** can be mounted to the distal rail mount **121** and the proximal rail mount **122**. A rail support **124** is disposed at the proximal end of the rail **120**. The slide rail **120** is mounted at an offset distance from the lifting arm **2**,8. The offset is determined by the height of the rail support **124**. The distal end of the rail is mounted to the proximal rail mount **122** located at the axle slot assembly **130**. The rail **120** is generally the same length of the lifting arm **2**,8. As such, the sliding rail **120** does not up any additional bed space relative to the lifting arms **2**, 8.

[0048] Alternatively, the sliding rail can be mounted to the third rail mount **125** and the fourth rail mount **126**. This configuration allows the driven wheel **60** to engage a rim of the reel **200** at the second lifting arm **8** to rim drive the reel. Alternatively, a second rail (not shown) can be mounted to the third rail mount **125** and the fourth rail mount **126** in addition to the first sliding rail **120**.

[0049] The rail **120** is depicted as having a rectangular cross section, such as a square iron pipe. The rail **120** can have a square, rectangular, circular, or otherwise curved cross section. The rail can be made of iron, steel, aluminum, or other sufficiently strong material. The rail **120** can be removably mounted to the lifting arms **2**,8 as discussed above. Alternatively, the rail **120** can be directly welded to the lifting arms **2**,8. Alternatively, the rail **120** can be removably mounted to the cross member **16**.

[0050] Alternatively, the sleeve can be slidably mounted to a respective lifting arm **2**,8. In this way, a separate rail **120** would not be needed, and the driven wheel would continue to travel alongside the respective lifting arms **2**, 8. The sleeve **70** would receive the respective lifting arm **2**, **8** in the same way the illustrated embodiment receives the rail **120**.

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[0051] As illustrated in Fig. 1, a sleeve **70** is mounted to the rail **120**. The sleeve **70** is shown as a rectangular pipe. The internal dimensions of the opening in the sleeve **70** correspond to the external dimensions of the sliding rail **120**. During operation, the sleeve **70** receives the sliding rail **120**. The sleeve **70** may be guided along the axis parallel to the longitudinal axis of the respective lifting arm **2**, **8** by the rail **120**. The sleeve **70** may be configured to travel back and forth in an axis parallel to the longitudinal axis of the lifting arm **2**.

[0052] The sleeve **70** is depicted as a rectangular pipe with an internal opening having a width and height that corresponds to the width and height of the rail **120**. The sleeve 70 has a cross section that corresponds with the cross section of the rail **120**. In an alternative embodiment where the sleeve **70** travels along the lifting arm **2**, **8**, the sleeve 70 has an internal opening that corresponds with the width, height, and cross section of the lifting arm **2**, 8. The length of the sleeve may correspond to the length of the spring **114** necessary to provide a sufficient traction force to ensure traction between the driven wheel **60** and the reel **200**. The traction force allows the driven wheel **60** to rotate the reel **200** by contact with the reel rim **202**.

[0053] In addition to the slide illustrated in Figures 1-3 comprising the sleeve **70** receiving the rail **120**, alternate embodiments of the slide mechanism are contemplated. Alternatively, the slide mechanism comprises an insert element configured to slide within the rail or within a lifting arm **2**,8. For example, the motor mount **64** is received into a slot in the rail **120**. A t-shaped motor mount **64** could extend through the slot in the rail **120**, thereby providing similar movement through the rail. A similar biasing mechanism and lead screw **100** could be disposed within the rail **120** or within a lifting arm **2**,8.

[0054] In another embodiment, the slide mechanism comprises a rail guide system. In a rail guide system, the rail **120** is keyed such that a non-rotating linear bearing is capable of longitudinally sliding on the rail. To that effect, the rail **120** could have a square cross

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section or a circular cross section with a notch, groove, bump, bulge, or blip that corresponds to a corresponding keyed non-rotating linear bearing. A commercially available example of this type of slide mechanism is the IGUS DryLin® line of sliders. The sliders can comprise ball bearings or plastic linear guides.

[0055] As illustrated in Fig. 1, a lead screw **100** extends along the length of the rail **120**. The lead screw **100** is a threaded shaft used to convert rotation to longitudinal motion. A turning mechanism **102** is mounted to the proximal end of the lead screw **100**. As illustrated, the turning mechanism can be a hexagonal nut secured to the shaft, such that turning the nut results in the shaft turning. The lead screw is held in place by being passed through a rail support **124** and a distal support flange **108**, as well as being held in place by a first fixed nut **104** and a second fixed nut **105**. The first fixed nut **104** and the second fixed nut **105** are free to turn with the lead screw **100**. Appropriate washers are utilized to enable the rotation of the fixed nuts **104**, **105** with the lead screw **100**. The lead screw **100** passes through the rail support **124** and a screw tab **108** as shown in Figure 2. The lead screw **100** may be disposed generally parallel to the rail **120** and the respective lifting arm **2**, 8.

[0056] As illustrated in Fig. 2, a travel nut **106** is threadably received onto the lead screw **100**. The travel nut **106** is prevented from rotating. The travel nut **106** is in a relationship with the sleeve **70** that prevents the travel nut from rotating. This relationship is best shown in Fig. 15, where the travel nut **106** contacts the sleeve **70** to prevent rotation. Rotation of the lead screw **100** in a first direction causes the travel nut **106** to move toward the distal end of the rail **120**. Rotation of the lead screw **100** in the opposite direction causes the travel nut **106** to move toward the proximal end of the rail **120**. The sleeve **70** and the driven wheel **60** travel with the travel nut **106** until the driven wheel **60** contacts the reel **200**. Once the driven wheel **60** contacts the reel **200**, substantial movement of the sleeve **70** ceases. As the travel nut **106** continues to move, according to the rotation of the lead screw, the spring **114** is

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compressed. The spring **114** is compressed between the travel nut **106** and the rear tab **78**. In the most relaxed position of the spring **114**, the travel nut **106** is in contact with the front tab **74**. Optionally, appropriate washers may be disposed between the travel nut **106** and the front tab **74**. As the travel nut moves from the front tab **74** and toward the rear tab **78**, the spring **114** is compressed, which is shown in Figure 13. Pressure from the spring **114** unto the sleeve **70** through the rear tab **78** maintains the wheel in contact with the reel **200**. It is known that reels **200** can be out of round, meaning the diameter of the reel is not always consistent. The spring **114** maintains traction between the driven wheel **60** and the reel **200** even if the diameter of the reel **200** changes.

[0057] The linear drive mechanism is depicted as a lead screw **100**. And the lead screw **100** is depicted as an acme screw. Alternatively, the linear drive mechanism can comprise a lead screw, spindle drive, belt drive, toothed belt, linear actuator, or a linear motor. A linear motor can comprise any device capable of generating linear motion. The power source for the linear drive mechanism can be electric, hydraulic, pneumatic, or manual.

[0058] The linear drive mechanism could be positioned inside of the rail **120** or inside of the lifting arm **2, 8**. Alternatively, the linear drive mechanism can be disposed to a lateral side of the rail **120** or the lifting arm **2, 8**.

[0059] The reel lift apparatus has two general configurations: an unengaged configuration and an engaged configuration. The lead screw **100** is turned so that the travel nut **106** drives the sleeve **70** to the proximal end of the rail **120** in order to place the reel lift apparatus in the unengaged configuration. In the unengaged configuration, the driven wheel **60** is located near the proximal end of the rail **120**, and away from the axle slot assembly **130**. In this way, the driven wheel **60** does not interfere with the loading or unloading of the reel **200**. In the engaged configuration, the driven wheel **60** is in contact with the reel **200**, as shown in Fig. 1

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and Fig. 5. The location of the driven wheel **60** in the engaged configuration depends on the diameter of the reel **200**.

[0060] The lead screw **100** allows the reel lift apparatus to handle a variety of sizes of reels **200**. A smaller diameter reel is shown in Figures 1-4 and a larger diameter reel is shown in Figures 5-6 and 13. Being able to travel on the rail **120** along approximately the entire distance of the lifting arms **2,8** allows the driven wheel **60** to accommodate a variety of reel sizes. For example, the reel lift apparatus illustrated in Figures 1-6 can accommodate reels having a radius approximately as long as the longitudinal length of the lifting arms 2,8.

[0061] The turning mechanism **102** is illustrated as a hexagonal nut rotationally coupled to the lead screw **100**. As such, the turning mechanism **102** can be operating by a torque wrench or an impact wrench. Alternatively, the turning mechanism **102** can comprise a handle. Alternatively, the turning mechanism **102** can be hydraulically or electronically actuated.

[0062] As illustrated in Fig. 3, a driven wheel **60** is mounted to a motor mount **64** that travels with the sleeve **70**. The motor mount **64** elevates the driven wheel **60** above the sleeve. The wheel **60** is driven by a motor **62**. In the engaged position, the wheel **60** contacts the reel **200**. As illustrated, the wheel **60** comprises a rubber tire. In the engaged position, the driven wheel **60** is maintained in contact by the spring compression mount **72** in cooperation with the sleeve **70** as described above. The spring compression mount 72 directs the force generated by the linear drive mechanism compressing the spring **114** and applying the tension to maintain the sleeve **70** pushed toward the distal end of the lifting arm **2, 8**. The spring compression mount **72** allows the system to maintain traction between the driven wheel **60** and the sleeve **70** even with a reel **200** that has a varying diameter.

[0063] Since the driven wheel **60** is mounted to a lift arm **2,8**, the driven wheel maintains its proximity to the reel **200** in any lift position or pivot position. For example, the lift arms **2,8**

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can be fully extended thereby positioning the reel **200** directly behind the truck, and the driven wheel **60** may be configured to slide parallel to the longitudinal axis of the lifting arms to engage and contact the reel. Alternatively, the lift arms **2,8** can position the reel **200** just above the bed surface **20**, and the driven wheel **60** may be configured to slide alongside the lifting arm **2,8** in an axis parallel to the longitudinal axis of the lifting arm to contact and drive the reel **200**. Another advantage is that the driven wheel **60** can be slidably adjusted to engage a variety of reel sizes. The driven wheel **60** slides toward the distal end of the lifting arm **2,8** to engage a reel **200** having a smaller diameter. By sliding across the length of the lifting arms **2,8**, the reel rotating mechanism can engage many different reel sizes.

[0064] As illustrated in Fig. 8, the first lifting arm **2** can be mounted to the cross member **16** at each peripheral end of the cross member **16** with a first mounting bracket **30**. The first lifting arm **2** can be mounted at an arm mount portion **32** of the first mounting bracket **30**. A free portion **34** is opposite the arm mount portion **32** of the mounting bracket **30**. The mounting bracket **30** is illustrated as a square pipe with an internal opening. The internal opening has dimensions that correspond to the dimensions of the cross member **16**. The cross member 16 has a first end portion **18** and a second end portion **19**. The respective lifting arm **2, 8** is mounted to a top portion **36, 46** of the arm mount portion **32, 42** of the mounting bracket **30, 40**. As illustrated in Fig. 8, the first mounting bracket **30** can be mounted to the first end portion **18** of the cross member **16**. In this orientation, the arm mount portion **32** is disposed toward the middle of the bed surface **20**. As such, the lifting arms **2, 8** are capable of lifting a narrower reel. As illustrated in Fig. 10, the first mounting bracket **30** can be mounted to the second end portion **19**. In this orientation, the arm mount portion **32** is disposed toward the periphery of the bed surface **20**. As such, the lifting arms **2, 8** are capable of lifting a wider reel or multiple reels disposed on the same reel axle **204**.

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The first mounting bracket **30** is mounted to the first lifting arm **2** is a mirror image of the second mounting bracket **40** mounted to the second lifting arm **8**.

[0065] Similarly, the second lifting arm **8** can be mounted with a second mounting bracket **40**. The second lifting arm **8** can be mounted at an arm mount portion **42** of the mounting bracket **40**. A free portion **44** is opposite the arm mount portion **42** of the second mounting bracket **40**. The mounting bracket **40** is illustrated as a square pipe with an internal opening. The internal opening has dimensions that correspond to the dimensions of the cross member **16**. The cross member 16 has a first end portion **18** and a second end portion **19**. The respective lifting arm **2, 8** is mounted to a top portion **36** of the arm mount portion **32** of the mounting bracket **30**. As illustrated in Fig. 8, the mounting bracket **30** can be mounted to the second end portion **19** of the cross member **16**. In this orientation, the arm mount portion **42** is disposed toward the middle of the bed surface **20**. As such, the lifting arms **2, 8** are capable of lifting a narrower reel. As illustrated in Fig. 10, the second mounting bracket **40** can be mounted upon the cross member **16** at the second end portion. In this orientation, the arm mount portion **42** is disposed toward the periphery of the bed surface **20**. As such, the lifting arms **2, 8** are capable of lifting a wider reel or multiple reels disposed on the same reel axle **204**.

[0066] In one configuration, the arms **2,8** are fixed at a width more narrow than the bed. This configuration allows toolboxes to be mounted to the outside portions of the along the length of the periphery of the bed surface **20**.

[0067] In one embodiment, a reel lift apparatus could comprise both lifting arms mounted to respective first mounting brackets **30**. In this configuration, the lifting arms **2, 8** would be offset from the center of the bed surface **20**. As such, a row of toolboxes could be installed on one peripheral side of the bed surface **20**.

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[0068] In another embodiment, the first mounting bracket **30** and the second mounting bracket **40** could have a plurality of mounting slots for mounting to the cross member **16**. This embodiment is shown in Fig. 9 and 12. The first mounting bracket **30** and second mounting bracket **40** have a bolt pattern. The cross member 16 has a mounting slot pattern. The respective lifting arm **2, 8** is mounted at one end of the mounting bracket. In Fig. 13, the first mounting bracket **30** is mounted to mounting slots **48A, 48B**, and **48C** and the second mounting bracket **40** is mounted to mounting slots **48D, 48E**, and **48F**. Fig. 9 shows the narrow configuration. In Fig. 12, the first mounting bracket **30** is mounted to mounting slots **48D, 48E**, and **48F** and the second mounting bracket **40** is mounted to mounting slots **48A, 48B**, and **48C**. Fig. 12 shows the wide configuration.

[0069] In the illustrated embodiment, the arms **2, 8** are fixed at an angle perpendicular to the cross member and do not pivot relative to the cross member **16.**

[0070] In order to securely hold the reel **200**, the reel axle **204** is received into an axle slot assembly **130**, as shown in Fig. 15. An axle slot assembly **130** is located at the distal end of each arm **2, 8** – the distal end of the arm being the end distal from point where the arm connects to the bed surface **20.** As illustrated in Figures 14-18, the axle slot assembly 130 has a solid exterior wall **132** to prevent the reel axle **204** from lateral movement. The distal end of the slot has a distal sloped wall **134**, adjacent to the distal slot wall **136**, inwardly sloping down toward the slot. As such, the reel axle **204** is encouraged into the slot 138 as the arm **2, 8** is lifted up. The slot 138 has a slot floor **151** at the bottom of the slot.

[0071] The depth of the slot **138** corresponds approximately to the height of the reel axle 204 as shown in Fig. 15. In the extended arm position, the slot opening **140** faces upwards. In order to load a reel **200**, the user extends the arms **2,8** to the extended position and opens the locking cover assembly **150.** The truck is backed into position until the slot opening **140** is below the reel axle **204.** The user raises the arms **2,8** such that the reel axle **204** is received

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into the axle slot assembly **130** through the slot opening **140**. Once the arms **2, 8** lift the reel **200** off the ground and above an angle perpendicular to the ground, the reel **200** slides or rolls under force of gravity into a home position **156** under the fixed mounting assembly **142**. The user pivots the locking cover assembly **150** to the closed or locked position in which the locking cover assembly covers the slot. The biased locking mechanism, illustrated as tongue **185**, automatically engages with the stop mechanism **154** to secure the reel axle **204** in the home position **156**. The biased locking mechanism is locked when the locking cover assembly is shut without further human intervention.

[0072] The reel lift apparatus has a locking cover assembly **150** for securing the reel axle **204**. The locking cover assembly **150** is pivotally mounted to the fixed mounting assembly **142** to allow the locking cover assembly **150** to open and close. A cover pivot mount **181** allows the locking cover assembly **150** to pivot relative to the axle slot assembly **130**. In an open position, the slot opening **140** is accessible. The locking cover assembly **150** is mounted at an inset over the slot opening **140** at the proximal slot portion. As such, the axle slot 138 has a G-shape. In this configuration, the reel axle **204** rolls forward below the mounting assembly 142 as the arms **2, 8** are lifted up.

[0073] As shown in Fig. 14, in the closed position, the axle slot assembly **130** is locked closed with a locking cover assembly **150**. The locking cover assembly 150 has a biased locking mechanism **152** comprising a pawl **180**, such as a pivoted tongue or sliding pin. The biased locking mechanism **152** is held in place with a lock biasing member **186**, illustrated as a spring. Under force of the lock biasing member **186**, the biased locking mechanism **152** is prevented from opening by engaging with a stop mechanism **191** located at the distal slot portion. The stop mechanism **191** may comprise a stop block that engages a pivoting tongue or a stop slot, such as an aperture, for receiving a sliding plunger pin **192**. An opening lever **182** is provided to disengage the biased locking mechanism **152** with the stop mechanism

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191. In one implementation, the lock biasing member **186** may be a spring that includes a coil that may be secured at one end to a spring back stop **188** and another end securing the pawl in the engaged position. The spring may be guided along a spring guide **187** to direct the biasing force. The biasing member may be different types of springs or other structures that provide biasing characteristics similar to a spring including, for example, a torsion spring, a twin spring, a compression coil spring, an extension spring, a flat spring, a barrel spring, or a wave spring.

[0074] The reel axle engagement jaw may have a one-hand opening lever **182**. An easy to operate paddle lever **182** allows the locking cover assembly **150** to open to an open position to receive the reel axle **204**. In one embodiment, the opening lever **182** is disposed toward the distal portion of locking cover assembly. In this configuration, the user can grasp the lever and lift the locking cover assembly with the mechanical advantage of the locking cover assembly as a mechanical lever. The lever **182** is mounted to biased locking mechanism **152** in such a way that pulling up on the lever causes the lever **182** and the biased locking mechanism **152** to pivot. Pivoting the biased locking mechanism **152** away from the stop mechanism **154** allows the locking cover assembly to rotate, and opens the slot **138**. The biased locking mechanism and lever **182** are mounted to the locking cover assembly by a lock-lever pivot mount **183**. A finger opening **184** allows the user to grip the lever **182** from below and pull the lever upwards and towards the first distal arm portion **4**. Pulling on the lever **182** overcomes the biasing force of the lock biasing member **186**. The lock biasing member **186** is compressed between the lever **182** and the spring back stop **188**. The lock biasing member **186** is maintained in the proper orientation by the spring guide **187**. The lock biasing member **186** maintains the biased locking mechanism in the outward, lockable position. As the locking cover assembly **150** is closed, the biased locking mechanism, illustrated as tongue **185**, automatically engages the stop mechanism **154**, illustrated as a stop

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block **191**. In this way, the locking cover assembly **150** can be closed and locks automatically, without additional user involvement. The locking cover assembly may provide an audible click when secured. A grease point **189** is provided to maintain the smooth operation of the cover pivot mount **181**.

[0075] In one embodiment, the locking cover assembly has a distal cover portion **162** that is sloped complementary to the distal end wall **134** at the distal end of the axle slot **138**.

[0076] In one embodiment, the locking cover assembly **150** has a slide locking cover wall **164** that extends below the mounting assembly **142**. In the locked configuration, the depth of the channel below the locking cover assembly **150** is shorter than the reel axle **204**, this height is indicated by line **158**. A downwardly extending portion **160** extends into the slot from the proximal slot portion at a height above the slot floor equal to the diameter of the reel axle **204**. In this way, the proximal wall **164** of the downwardly extending portion **160** provides a distal wall for the reel axle **204** in the home position **156**. The proximal slot wall provides a proximal wall for the reel axle **204** in the home position **156**. This prohibits the reel axle **204** from rolling out of the home position **156** while the locking cover assembly **150** is secured. This also requires the user to lift the arms **2,8** above an angle perpendicular to the ground before locking the locking cover assembly **150**.

[0077] An advantage of the modular design is that the reel rotating mechanism does not need to be purchased with the hydraulic bed. The reel rotating mechanism can be offered as an add on kit. Even if the user does purchase a single reel rotating mechanism, the user may later discover that more traction is required for spooling larger reels or retrieving heavier material. The kit would be for rotating a reel having a reel axle supported by a lifting arm of a vehicle-mounted reel lifting apparatus. The kit may comprise: a rail configured to be mounted parallel to the lifting arm; a sleeve slidably mounted to the rail; a linear drive

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mechanism mounted to the rail and operably connected to the sleeve; a driven wheel mounted to the sleeve.

[0078] Hydraulic cylinders are mounted to the frame below the bed surface. The hydraulic cylinders are mounted to the cross-member with a variety of linkages **50**. A control valve **352** can be mounted to a top body toolbox **350** mounted at the back corner of the bed **20**. The control valve **352** can be fully proportional, giving the operator reliable, safe control of the reel, heavy materials or other equipment needed to be transported to and from the job site. Engine driven hydraulics are can be utilized to power the lift mechanism. Alternatively, electric driven hydraulic can be used to power the lift mechanism. Alternatively, power take off (PTO) driven hydraulic can be used to power the lift mechanism.

[0079] The motor **62** can be a hydraulic motor. A hydraulic motor can utilize the vehicle's hydraulics. A separate hydraulic circuit can be provided to control the motor **62**. The hydraulic hoses can be secured to the rail **120** or the lifting arms **2, 8**. The motor **62** is operationally coupled to the driven wheel **60**. Alternatively, the motor **62** uses another power source, such as electric or pneumatic power.

[0080] In one embodiment, a reel lift apparatus is used for lifting, securing, transporting, and unrolling a cable reel, wire reel, or other similarly shaped equipment. The reel lift apparatus can be used with ¾ ton pickup trucks. The reel lift apparatus allows for multi-purpose trucks to be outfitted for hauling a cable reel on the bed of truck, without the need for a separate trailer. The bed is designed to carry reels over the truck axle for maximum stability.

[0081] In one embodiment, the reel lift apparatus has a bed with arms that are pivotally mounted to the bed. The arms are configured to be pivoted such that the ends of the arms are lowered to engage the reel axle. To load the reel, the arms pivot up and toward the truck.

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[0082] In one embodiment, the arms have an axle slot for receiving the reel axles. A reel axle engagement jaw opens and closes to lock the reel axle within the axle slot. A simple lever open mechanism allows for one-handed operation of the reel axle engagement jaw.

[0083] In an embodiment having lifting arms **2, 8** that are reversibly mountable to the solid exterior wall **132** is mountable to either side of the axle slot assembly **130**. In this way, the solid exterior wall **132** is mountable to the exterior side of the axle slot assembly **130** regardless of whether the respective lifting arm **2, 8** is mounted at the first peripheral end of the cross member **16** or the second peripheral end of the cross member. The solid exterior wall **132** is mounted to the exterior surface in order to prevent the reel axle **204** from lateral movement. In an alternative embodiment, a flange is mounted on the axle itself to prevent lateral movement. The flange cooperates with the axle slot assembly **130** to prevent lateral movement of the axle.

[0084] The advantages of the reel lift apparatus may include:

a. The reel lift apparatus having fixed arm width with non-pivotable arms, the arms are inset from the total bed width to allow tool boxes to be mounted to the outside edges of the bed;

b. The reel lift apparatus having fixed arm width with non-pivotable arms with a cross-tube that is flush with the truck bed when the arms are in the retracted position;

c. The reel lift apparatus arms rest flat on the surface of the bed in the retracted position

d. The reel lift apparatus having fixed arm width with non-pivotable arms with a hydraulic cylinder and piston that are below the bed in the extended and retracted position;

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e. The locking reel axle engagement jaw has a biased pawl (tongue or plunger pin) that engages with a stop block in the closed position, with a pivoting lever to open jaw;

f. The locking reel axle engagement jaw has a G-shaped slot, where the reel axle rolls under force of gravity to a home position in the slot as the arms are raised;

g. The reel axle remains in the home position between (1) the arms are positioned above perpendicular to the ground and (2) the arms are positioned where the reel is loaded and resting on the bed;

h. The reel axle engagement jaw has a slot that has a distal end wall that is inwardly and downwardly sloped;

i. The wide slot opening provides easier axle engagement and upward lift allows simple lifting of reels on uneven ground;

j. An instantly contained channel design utilizes the weight of the reel to instantly contain the axle to the home position;

k. A spring-loaded latch plunger pin, which may be made of stainless steel to prevent corrosion, secures the locking cover assembly;

l. One-handed opening is achieved with an easy, comfortable paddle lever;

m. The latch that secures the locking cover assembly is a positive close latch that securely locks the locking cover assembly in place without further operator interaction;

n. In the open position, the locking cover assembly provides a backstop when loading the reel to direct the axle into the slot, allowing the operator to back up the vehicle until the reel axle contacts the locking cover assembly;

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o. In the open position, the lock cover assembly has a downwardly sloping distal portion as shown in Fig. 18, which directs the reel axle into the slot as the lifting arms **2, 8** are lifted;

p. The reel rotation mechanism is capable of dispensing the reelable material **206** with the lifting arms **2, 8** in an extended position behind the bed **20** such that the reelable material **206** is vertically straight as it comes off the reel **200**;

q. The reel rotation mechanism is capable of dispensing the reelable material **206** with the lifting arms **2, 8** in an extended position behind the bed **20** such that the reel **200** is positioned above a hole **300** or over a ledge.

[0085] In one embodiment, the reel lift apparatus has generally U-shaped arms that pivot relative to the bed. The U-shaped arms have a cross-tube that extends across the lateral width of the arms, forming the base of the U-shaped arms. The arms have a first arm portion and a second arm portion that extend away from the cross-tube. Each arm portion has a distal end and a proximal end. In the extended position, the cross-tube is higher than the arm portions. In the retracted position, the cross-tube is mounted flush with the bed. The arm portions lay on top of the bed. The width of the arm portions can be fixed the same as the width of the cross-tube. In this embodiment, the arms are fixed at an angle perpendicular to the cross-tube and do not pivot. In one embodiment, the cross-arms are fixed a width more narrow than the bed. This configuration allows tool boxes to be mounted to the outside portions of the along the length of the bed.

[0086] In one embodiment, hydraulic cylinders are mounted to the frame below the bed surface. The hydraulic cylinders are mounted to the arm with a variety of linkages **50**. A control valve can be mounted to a top body toolbox mounted at the back corner of the bed. The valve is fully proportional and direct acting, giving the operator reliable, safe

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control of the reel, heavy materials or other equipment needed to be transported to and from the job site. Engine driven hydraulics are can be utilized to power the lift mechanism. Alternatively, electric driven hydraulic can be used to power the lift mechanism. Alternatively, power take off (PTO) driven hydraulic can be used to power the lift mechanism.

[0087] In one embodiment, the driven wheel **60** rotates the reel **200** by contact with the reel rim **202** by moving radially with respect to the reel **200**. The movement can be in an axis parallel to the lifting arms **2, 8**, as illustrated. Alternatively, the movement of the driven wheel **60** can be in an alternative radial axis. For example, the rail support **124** can be taller than the distal rail mount **121** and maintain the rail **120** in a radial axis of the reel **200**. The driven wheel **60** then enters and exits the circumference of the wheel in any pivot position of the arm, because the axis of movement is in a radial axis. The radial axis of the reel **200** moves with the reel **200** as the lifting arms **2, 8** pivot through the plurality of pivot points. In the extended position, shown in Fig. 19, the rail **120** moves with the lifting arm **2, 8**, thereby maintaining the movement of the driven wheel **60** in the radial axis.

[0088] In one embodiment, the vehicle-mounted reel lifting apparatus for lifting a reel comprises a means for moving the driven wheel **60** into contact with the rim **202** and the means for moving the driven wheel **60** is directly mounted to the first lifting arm **2** and pivots with the first lifting arm **2**.

[0089] In one embodiment, the driven wheel **60** can be configured to slide in an axis generally parallel to a radius of the circular rim **202** of the reel in the plurality of pivot positions of the lifting arm **2**, 8. For clarity, a radial axis is an axis oriented with a radius of the rim **202** of the reel **200**. In one embodiment, the driven wheel **60** is configured to move in a straight line or a curved line of movement in which the driven wheel is capable of

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entering the circumference of a larger reel and a smaller reel in any of the pivot positions of the lifting arm **2**, 8.

[0090] In one embodiment, the reelable material **206** is dispensed or retrieved vertically straight from the reel **200**, which is illustrated in Fig. 19. The lifting arms **2**, **8** are in an extended position with the reel **200** behind the bed **20**. The reel rotation mechanism is capable of contacting the rim of the reel **200** in this orientation. The driven wheel **60** travels along the rail **120** to engage the rim **202** of the reel **200**. As the reel **200** rotates, the reelable material **206** is dispensed or retrieved vertically straight as it comes off the reel **200**. In this way, the reel **200** can be positioned directly over a hole **300** or over a ledge and the reel rotation mechanism is capable of engaging the rim **202**. The free reelable material comes off in an axis that is a tangent to the circumference of the portion of the reelable material on the reel **200**.

[0091] In one embodiment, the locking cover assembly **150** pivots on a cover pivot mount **181** through an open configuration, an intermediary configuration, and a locked configuration, as shown in Fig. 18. In the locked configuration, the locking cover assembly **150** covers the slot opening **140** and prevents the reel axle **204** from exiting the slot **138**. In the intermediary configuration, the locking cover assembly **150** is raised from the locked configuration to a point where the angle between the top of the locking cover assembly **150** is less than perpendicular with the longitudinal axis of the lifting arm **2**,8. The operator can release the locking cover assembly **150** from the intermediary configuration, allowing the locking cover assembly to rotate under the force of gravity. The locking cover assembly pivots shut under the force of gravity to the locked configuration, where the biased locking mechanism **152** is held in place with the engagement between the lock biasing member **186** and the stop mechanism **191**. In the open configuration, the locking cover assembly 150 has a top portion that rests against the proximal slot wall **137** of the axle slot assembly **130** and

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downwardly extending portion **160** that is downwardly slanted toward the slot opening **140**. To load the reel **200**, the operator extends each of the lifting arms **2, 8** behind the vehicle and places each of the locking cover assemblies into the open configuration. As the operator reverses the vehicle to position the slot opening **140** under the reel axle **204**, the locking cover assembly **150** in the open configuration acts as a backstop for the reel axle **204**. The operator backs up until the reel axle **204** is above the slot opening **140** or until each end of the reel axle 204 has made contact with the respective locking cover assembly **150**. Then the operator lifts the lifting arms **2,8**. Once the lifting arms **2,8** are raised above an angle parallel with the ground level, the reel axle **204** slides forward into the home position **156**. The locking cover assembly **150** in the open configuration directs the reel axle **204** into the slot opening **140**. The operator then pushes the locking cover assembly **150** so that the locking cover assembly **150** closes under the force of gravity, with the biased locking mechanism automatically securing the locking cover assembly **150** in the locked position.

[0092] In one embodiment, the locking mechanism provides an audible click to indicate to the user that the locking mechanism is properly engaged with the stop mechanism.

[0093] In one embodiment, a drop hitch **24** with a Category **5** receiver tube as well as a 30,000 lb. rated gooseneck ball recessed is engineered into the bed beneath the deck. An optional tool circuit is also available to run hydraulic tools requiring between 5 gallons per minute (GPM) and 11 GPM of flow and up to 2,200 pounds per square inch (psi).

[0094] It is understood that other embodiments will become readily apparent to those skilled in the art from the following detailed description, wherein various embodiments are shown and described by way of illustration only. As will be realized, the concepts are capable of other and different embodiments and their several details are capable of modification in various other respects, all without departing from the spirit and scope of

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what is claimed as the invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not as restrictive.

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Claims

1. A vehicle-mounted reel lifting apparatus for reels having a reel axle, the vehicle-mounted reel lifting apparatus comprising:

    a. A lifting arm pivotally mounted to the vehicle and having:

        i. a distal arm portion that is distal to the vehicle;

    b. An axle slot assembly mounted at the distal arm portion, the axle slot assembly having:

        i. A slot comprising:

            1. a proximal slot portion that is proximal to the lifting arm;

            2. a distal slot portion that is distal to the lifting arm;

            3. A stop mechanism disposed at the distal slot portion;

        ii. A locking cover assembly pivotally mounted to the proximal slot portion, the locking cover assembly comprising:

            1. A biased locking mechanism mounted to the locking cover assembly; and

        iii. Wherein the biased locking mechanism is configured to automatically engage the stop mechanism to prevent the locking cover assembly from pivoting open.

2. The vehicle-mounted reel lifting apparatus of claim 1 wherein:

    a. The biased locking mechanism further comprises:

        i. A tongue that extends by pivoting toward the distal slot portion; and

    b. Wherein the stop mechanism is a stop block.

3. The vehicle-mounted reel lifting apparatus of claim 1 wherein:

    a. The biased locking mechanism further comprises:

        i. A plunger pin that extends toward the distal slot portion of the axle slot assembly; and

    b. Wherein the stop mechanism is a stop slot.

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4. The vehicle-mounted reel lifting apparatus of claim 1 wherein:

a. The slot further comprises:

i. a distal end wall downwardly sloped toward the slot; and

b. The locking cover assembly further comprises:

i. a distal cover portion that is sloped complementary to the distal end wall of the slot.

5. The vehicle-mounted reel lifting apparatus of claim 1 wherein the axle slot assembly further comprises:

a. an exterior wall mounted to an exterior of the slot and configured to prevent the reel axle from lateral movement.

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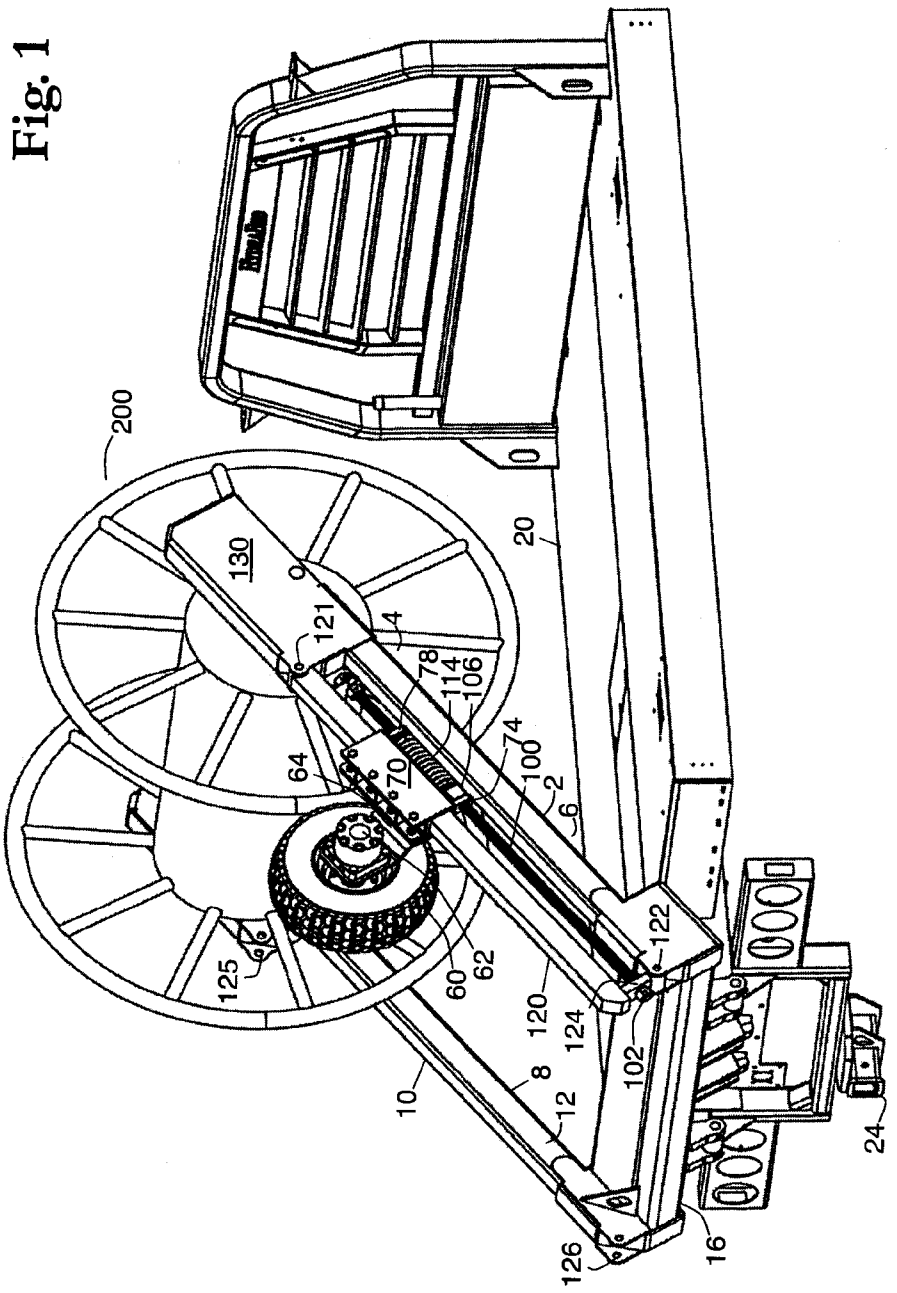
Fig. 1



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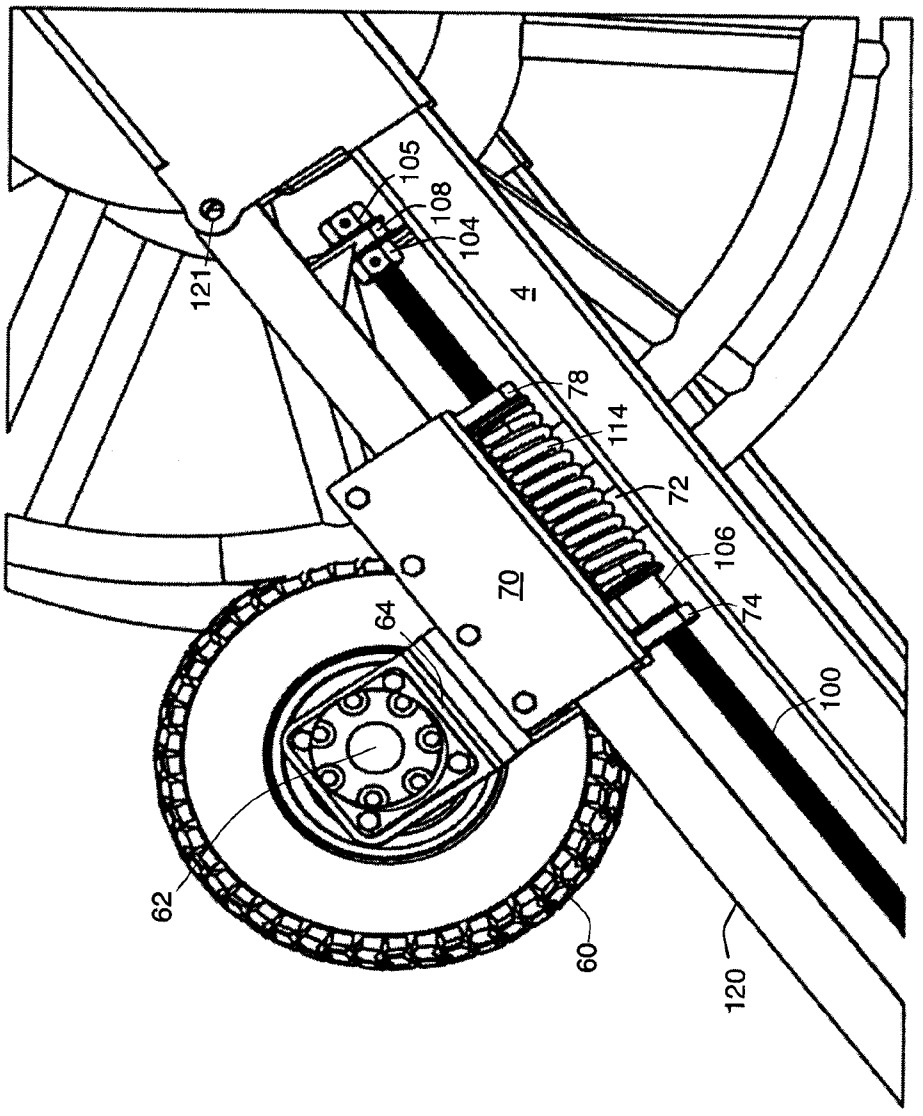

Fig. 2

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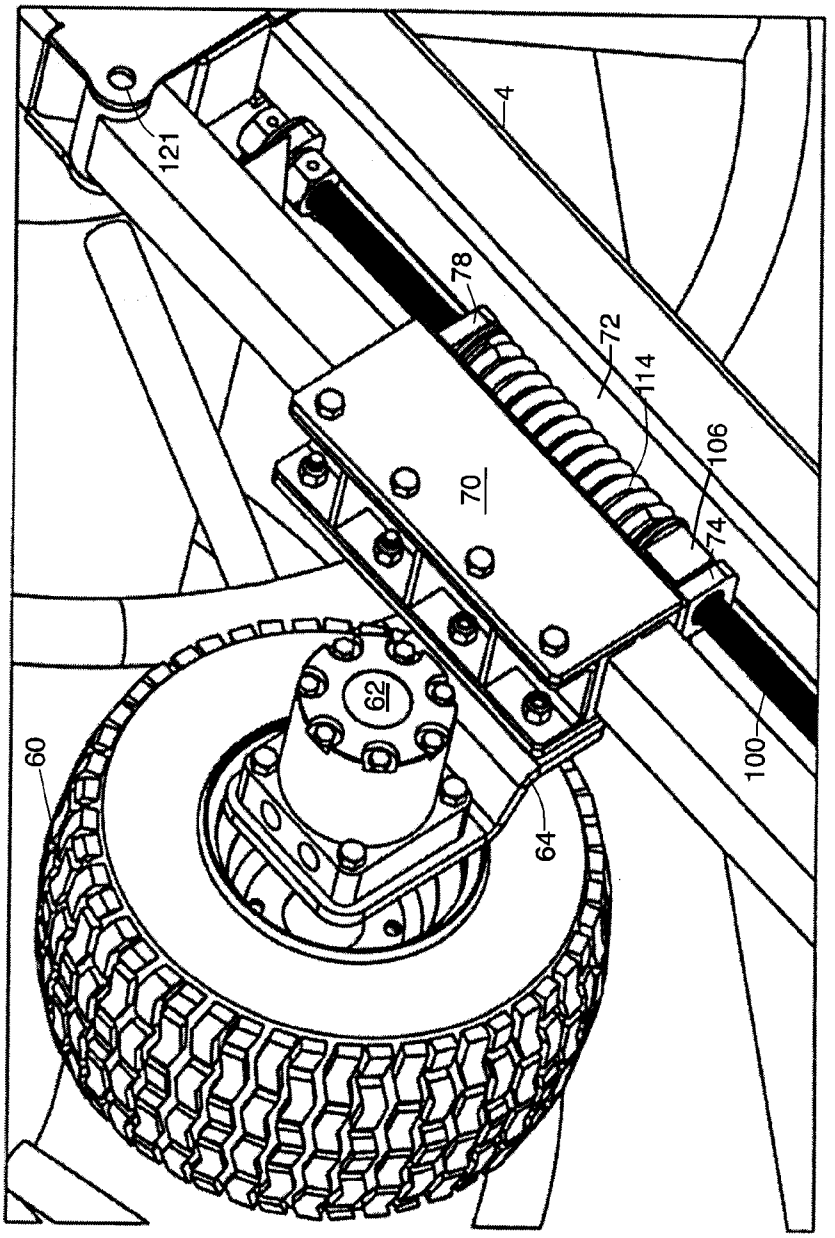

Fig. 3

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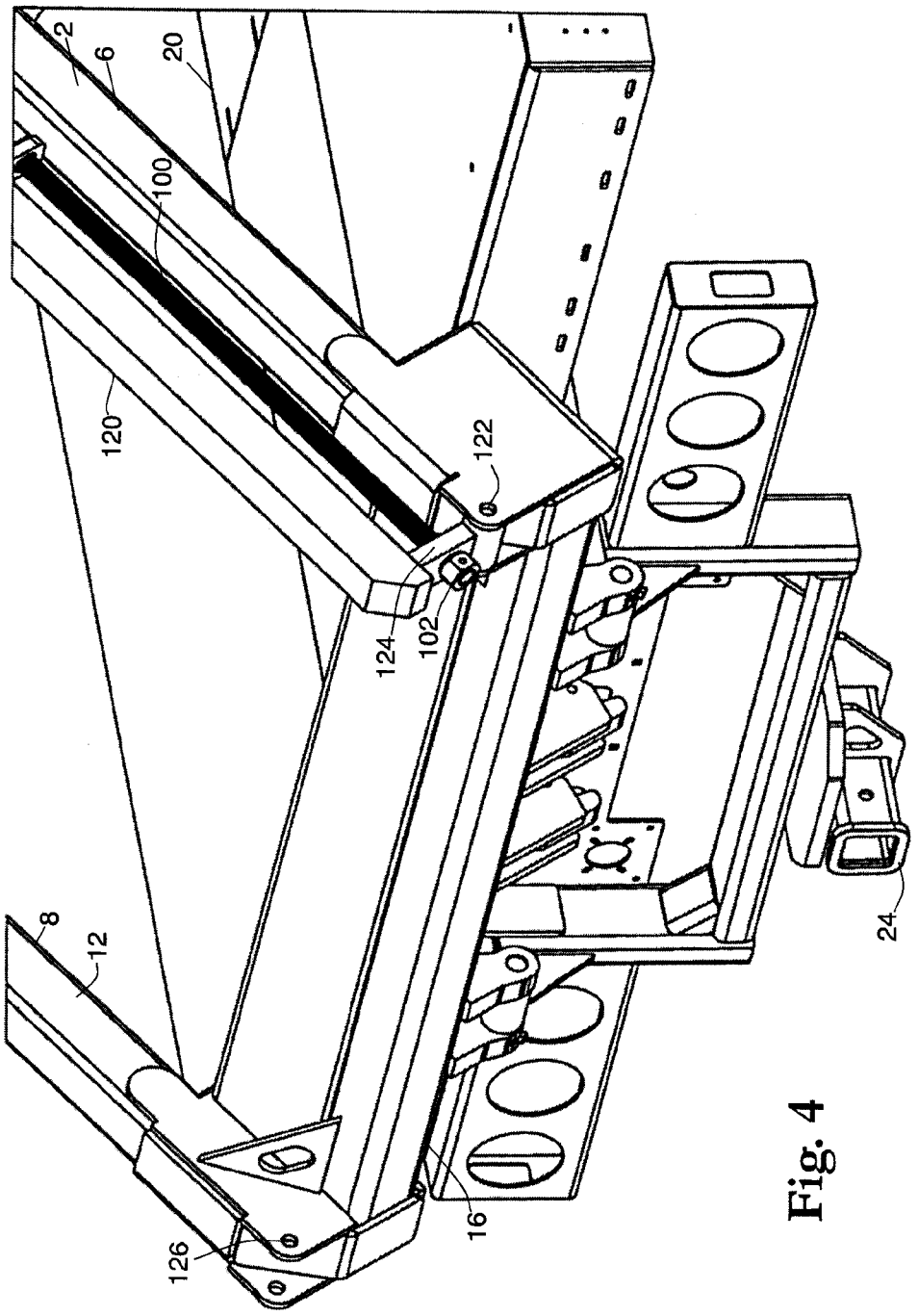

Fig. 4

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Fig. 5

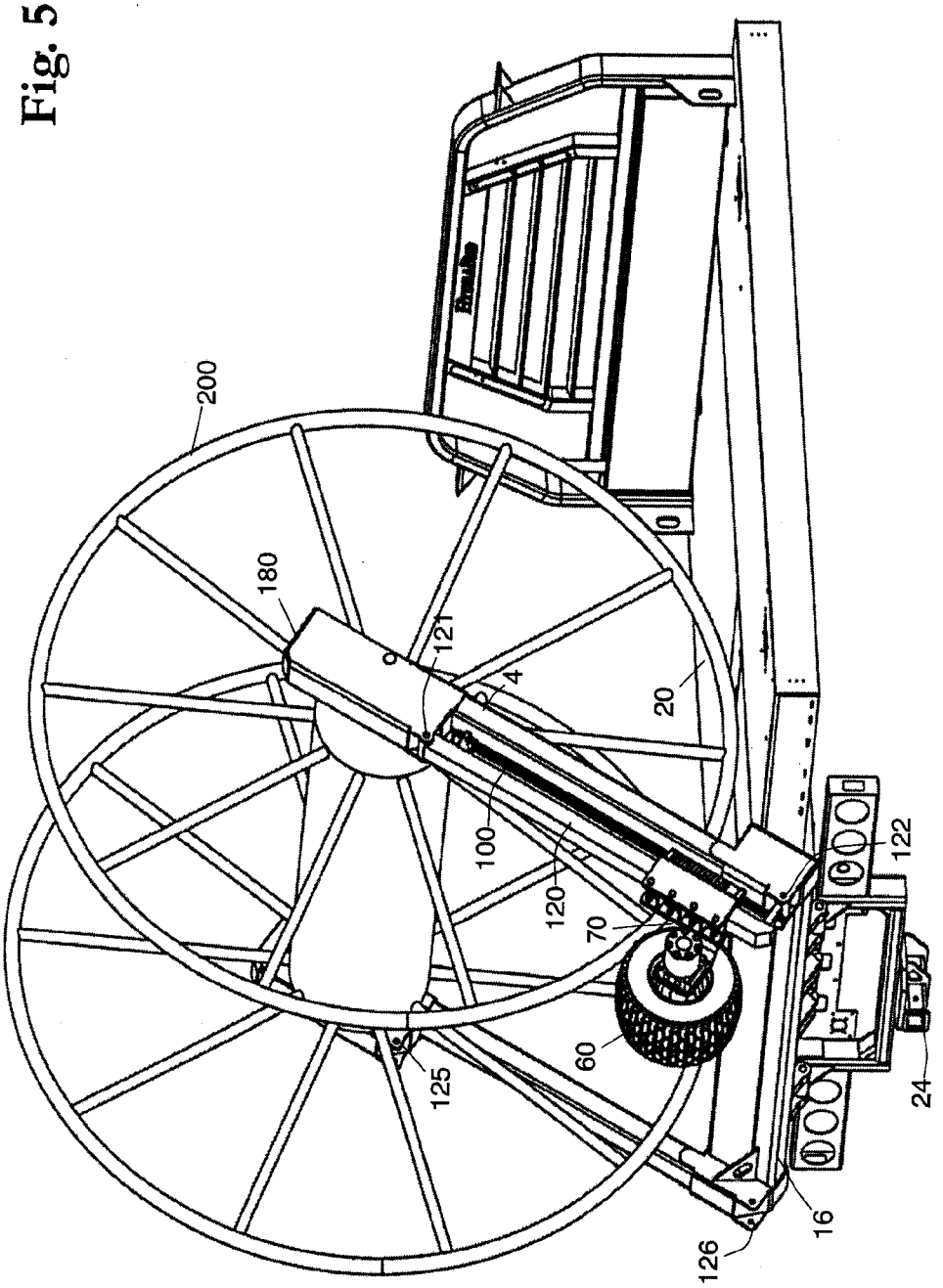

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Fig. 6

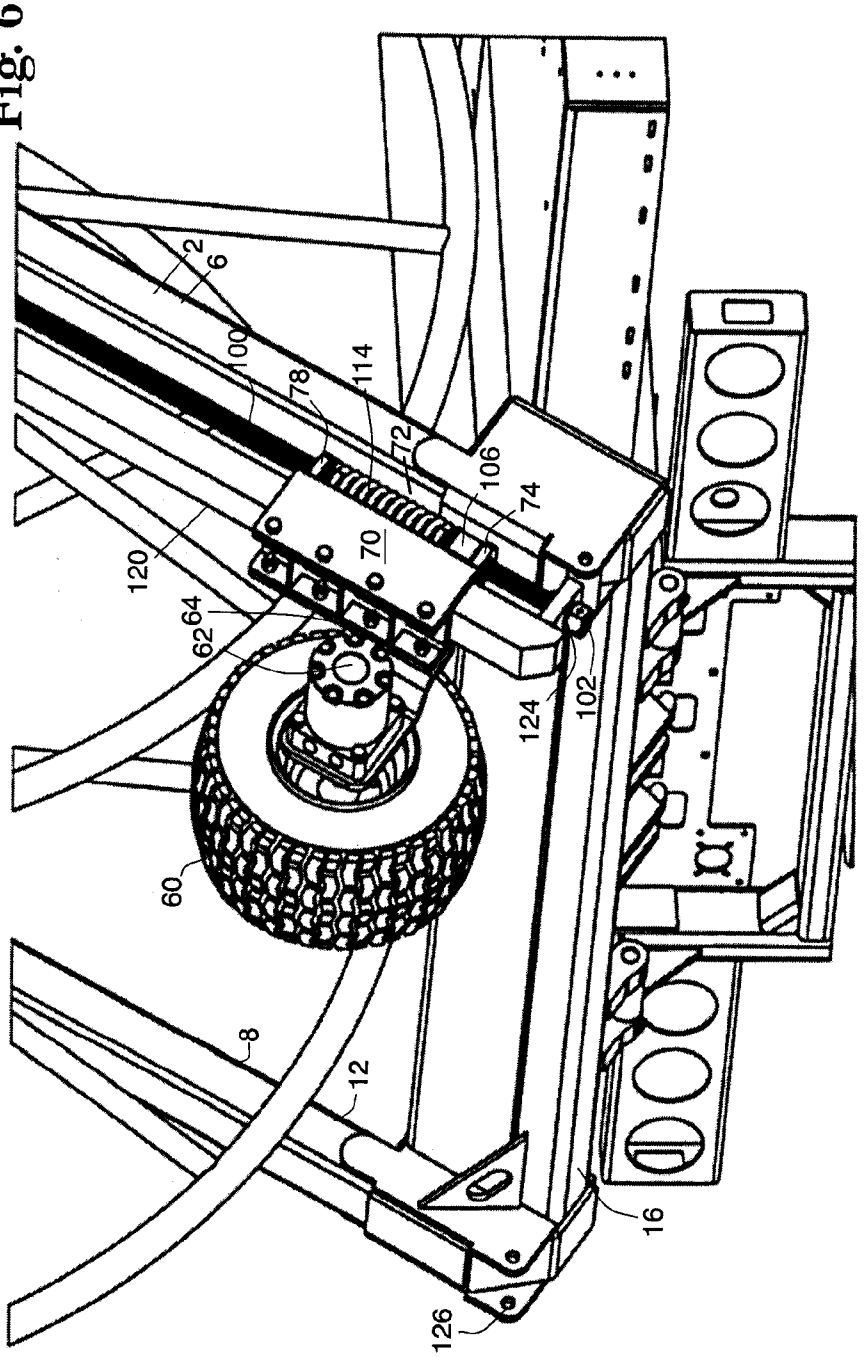

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Fig. 7

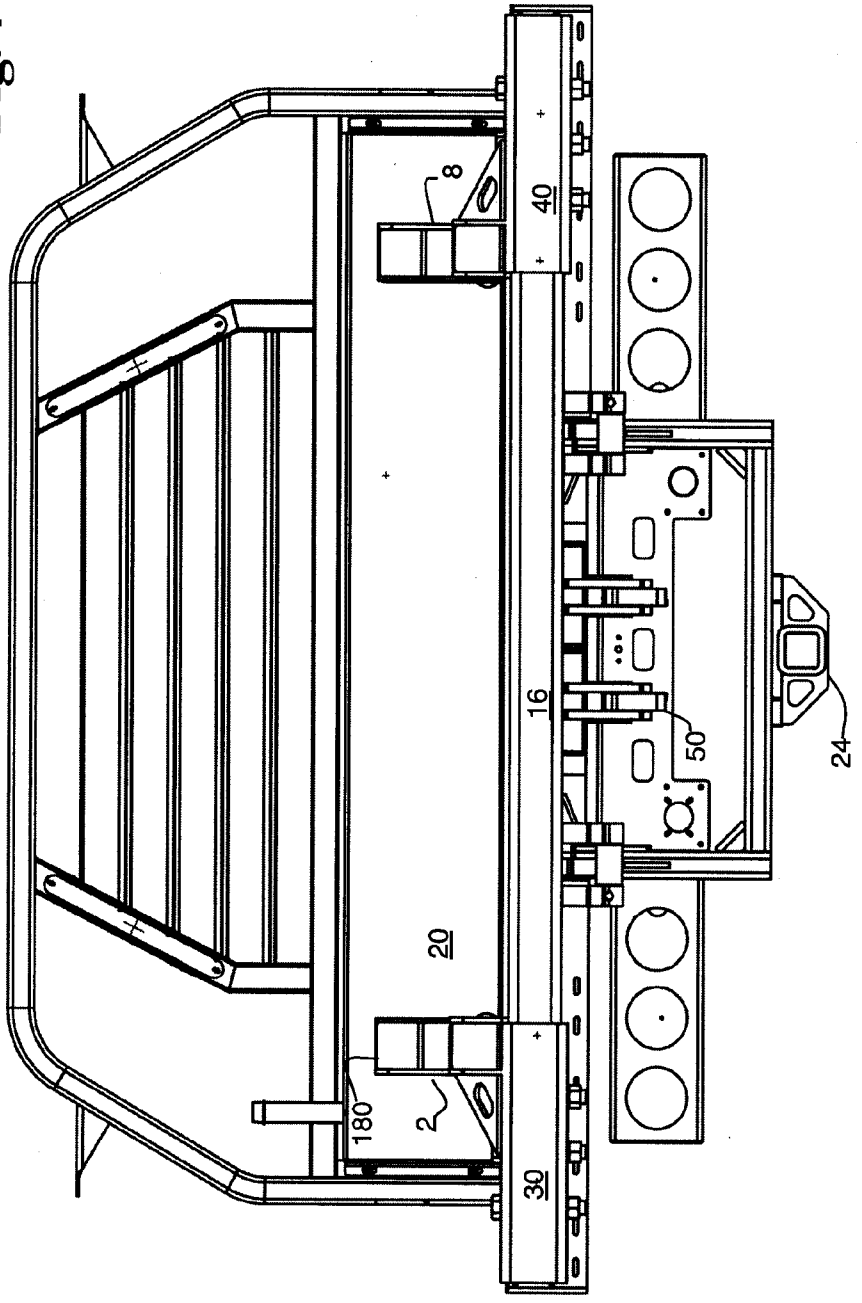

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Fig. 8

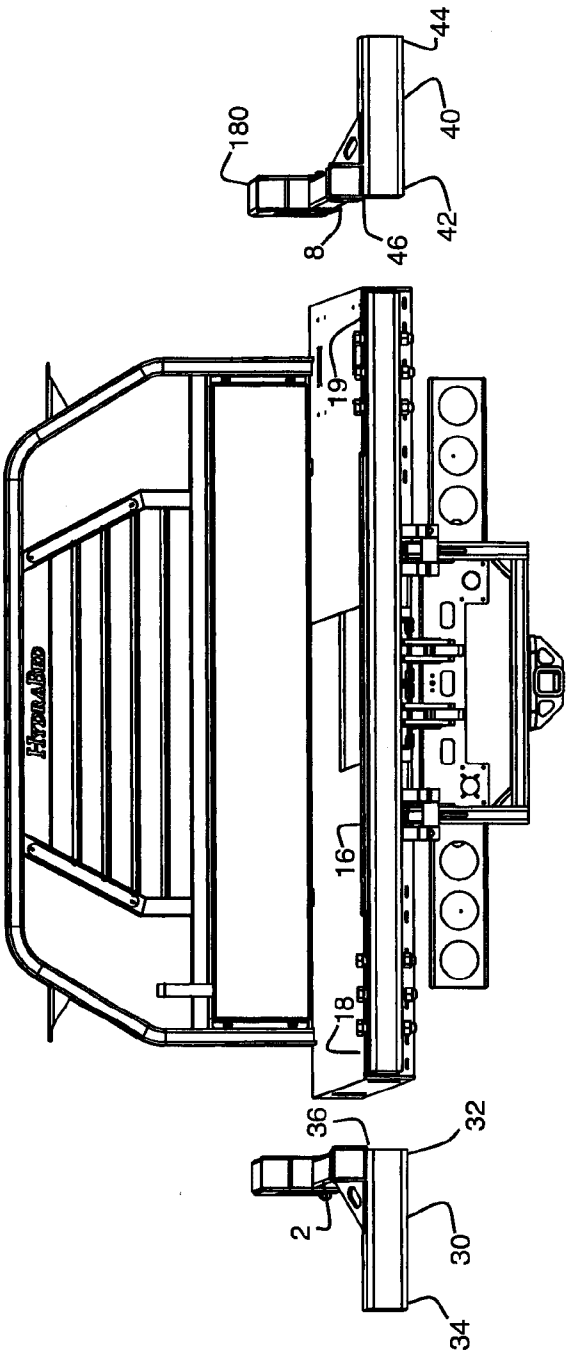

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Fig. 9

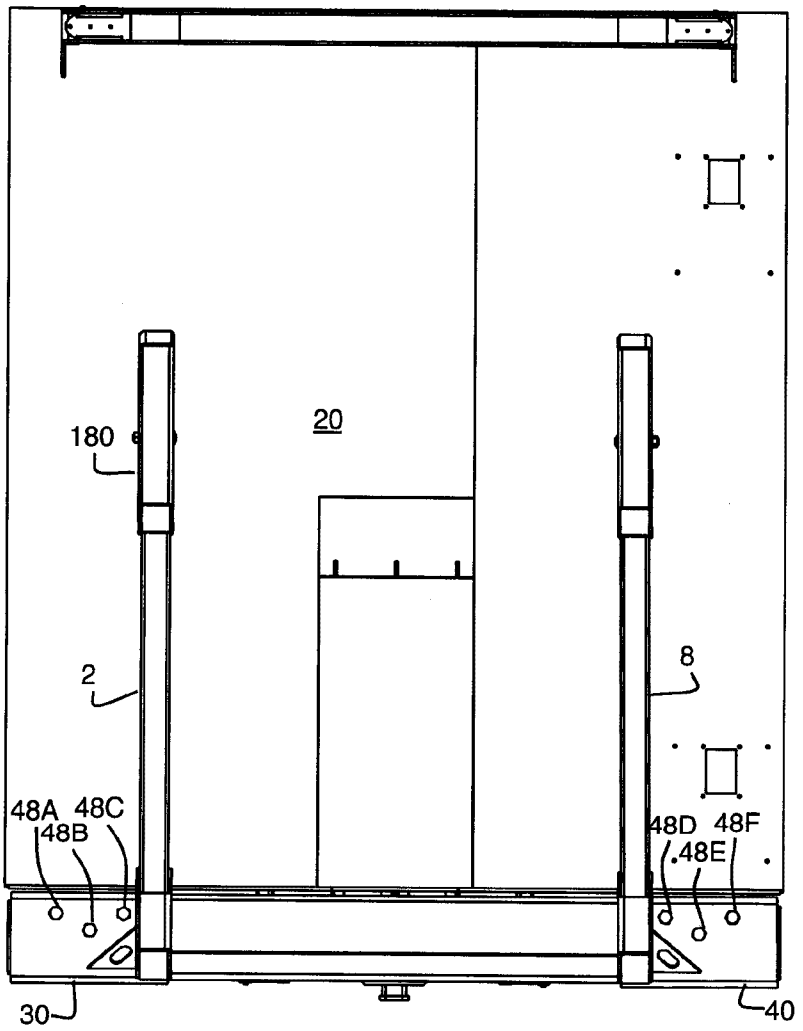

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Fig. 10

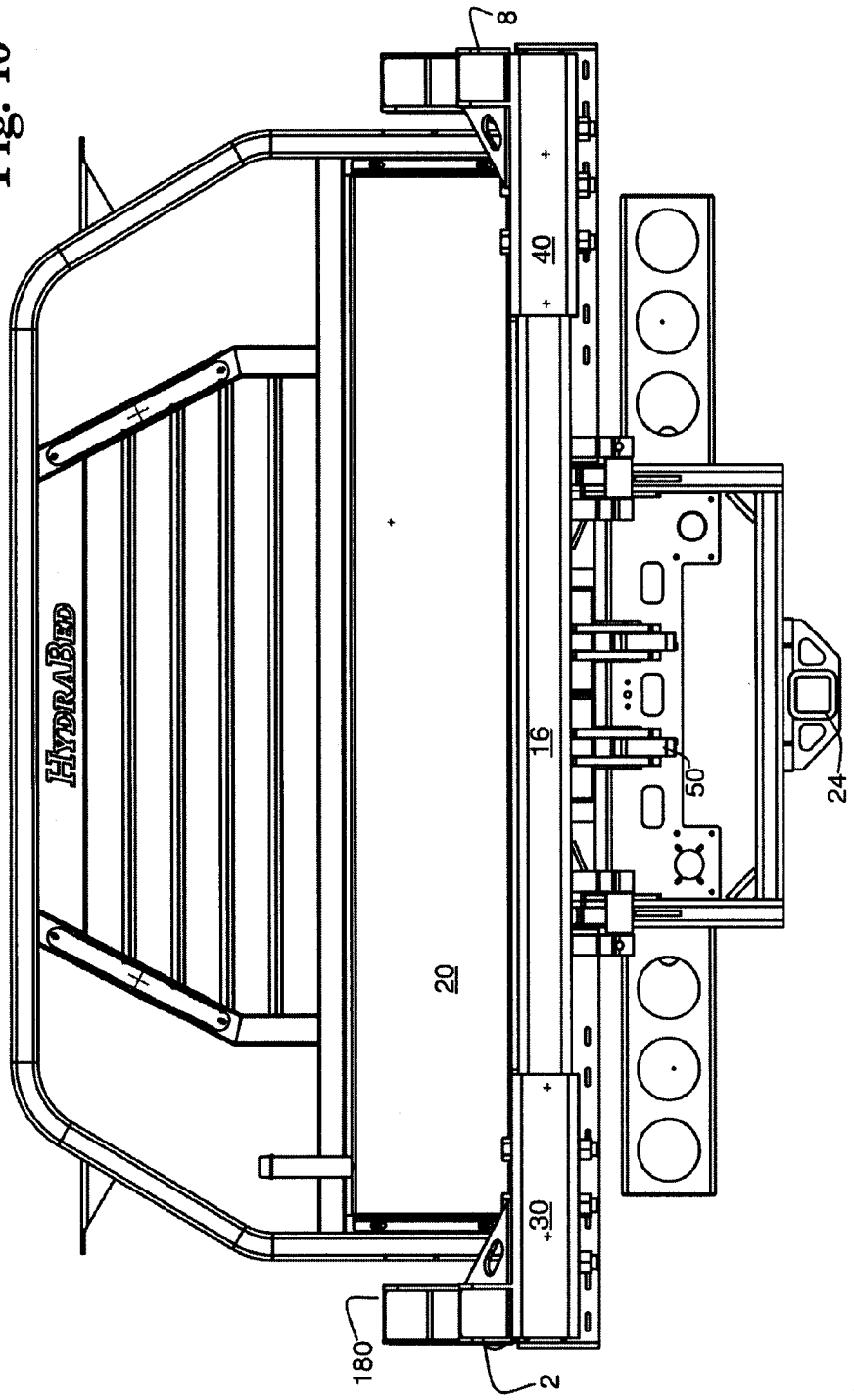

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Fig. 11

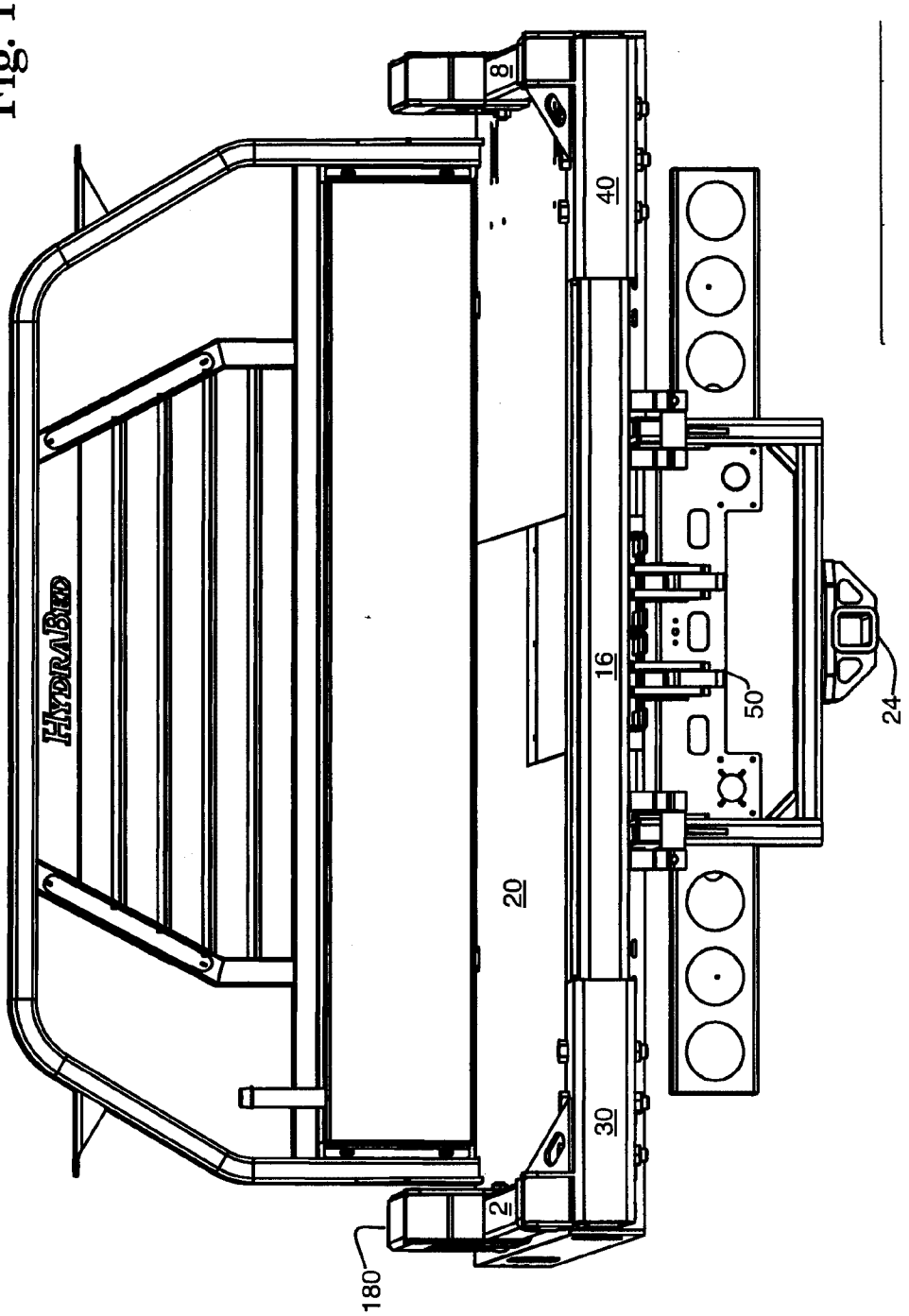

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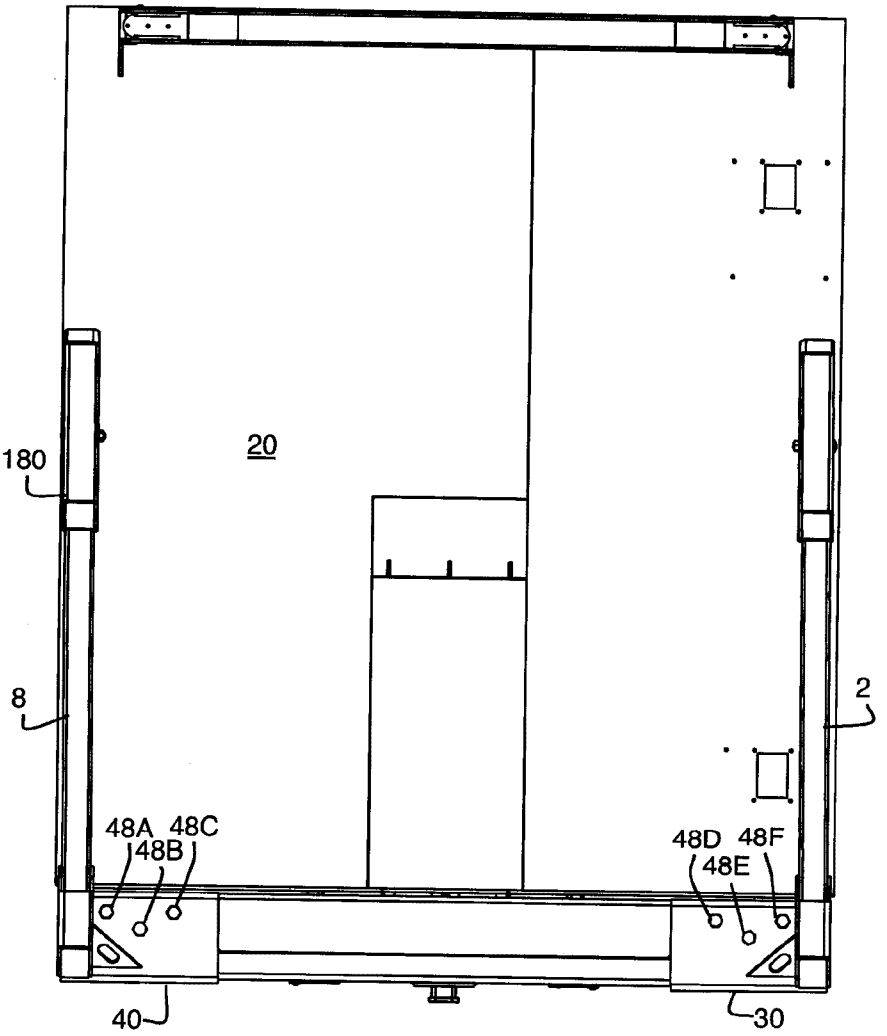
Fig. 12



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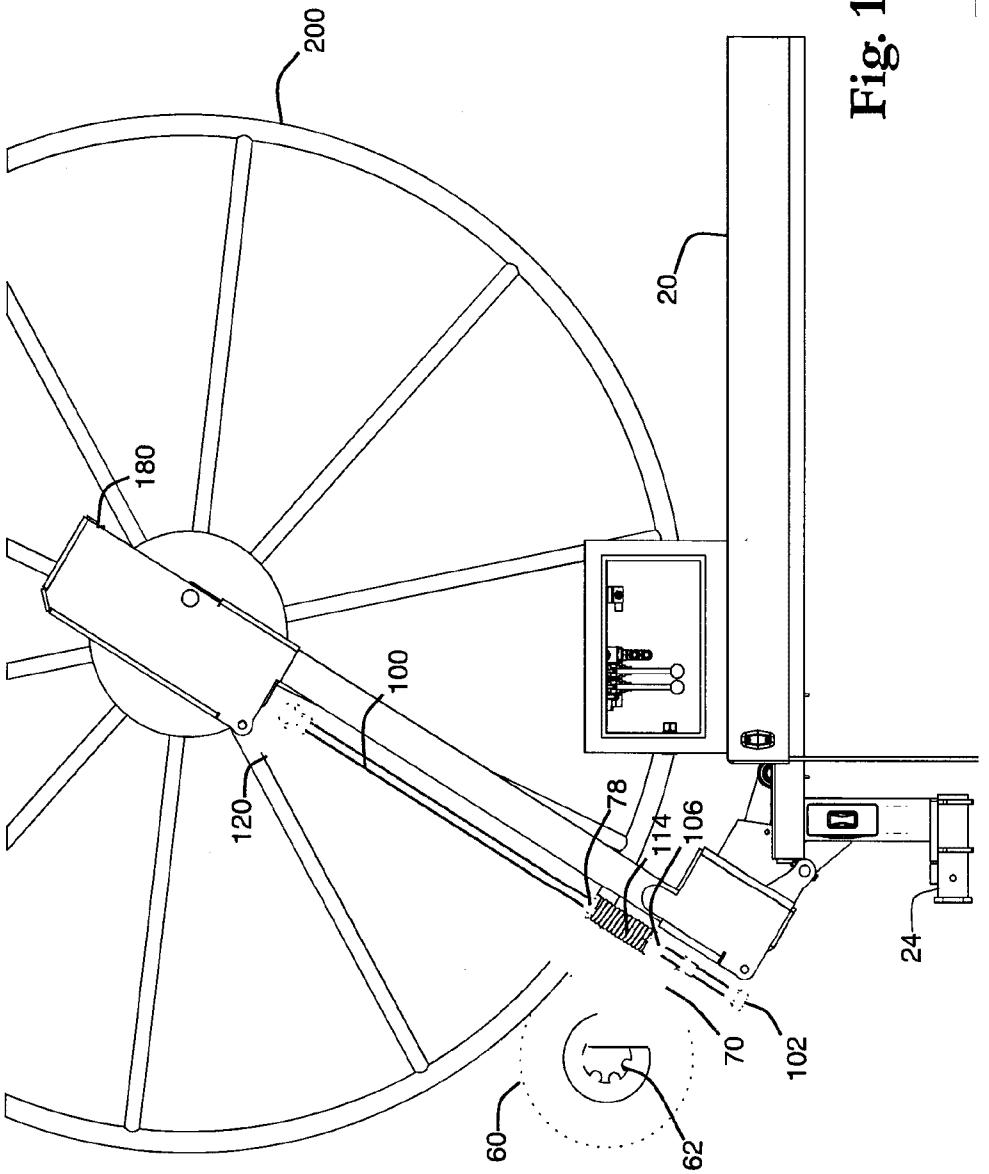

Fig. 13

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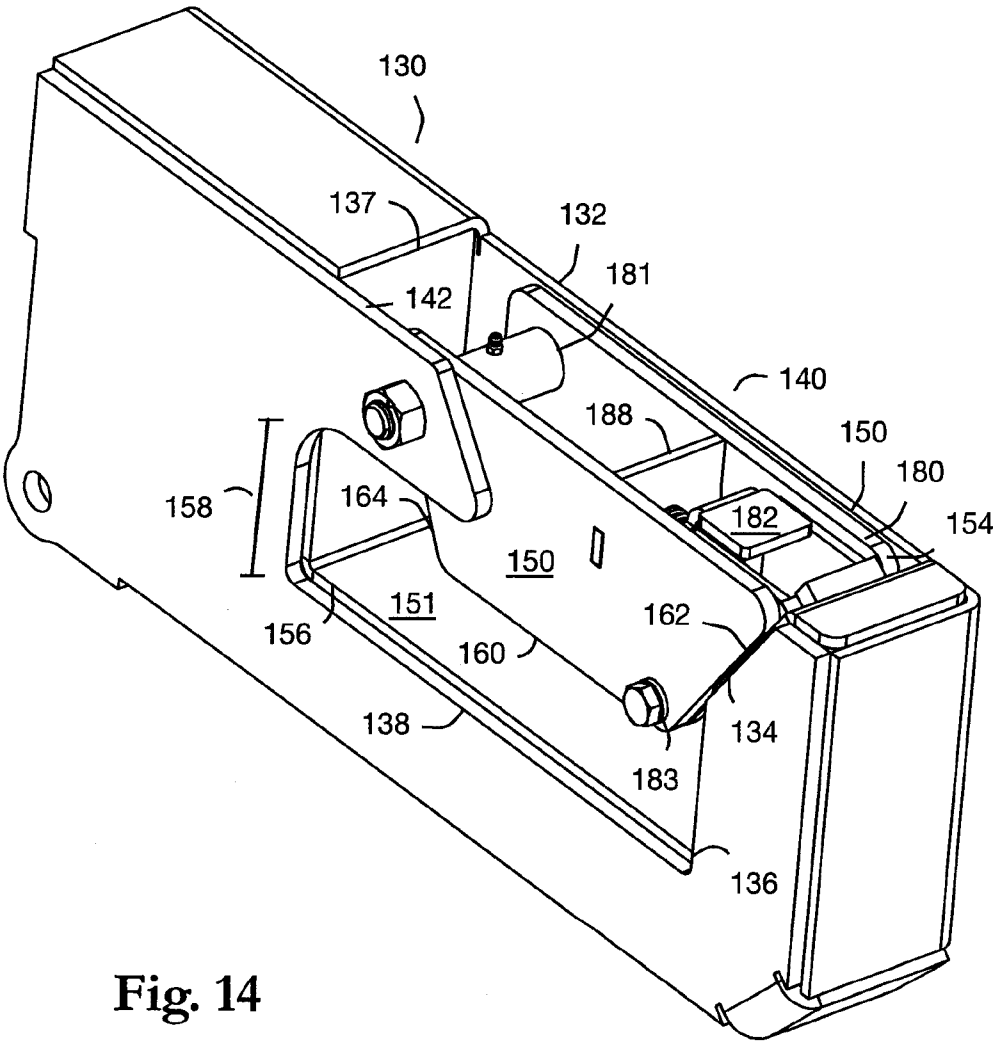


Fig. 14

Date reçue/Date Received 2021-02-17

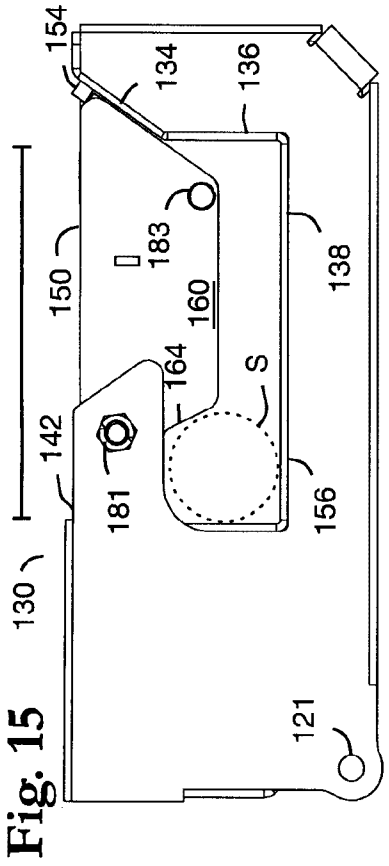


Fig. 15

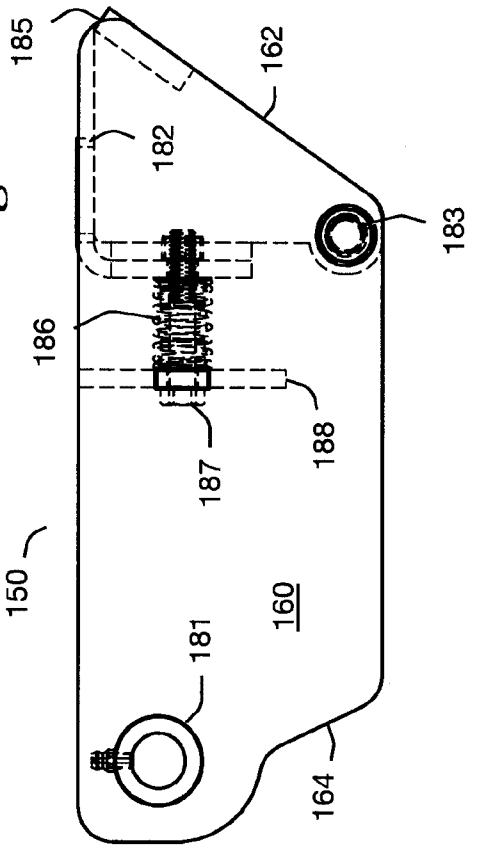


Fig. 16

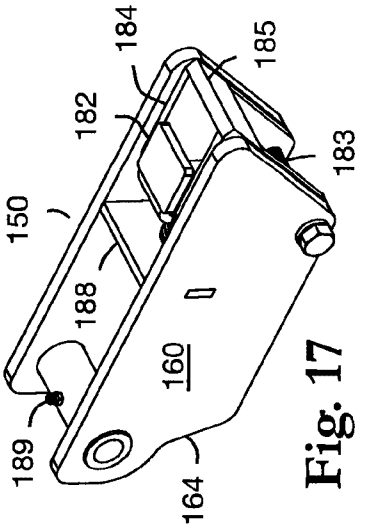


Fig. 17

Date reçue/Date Received 2021-02-17

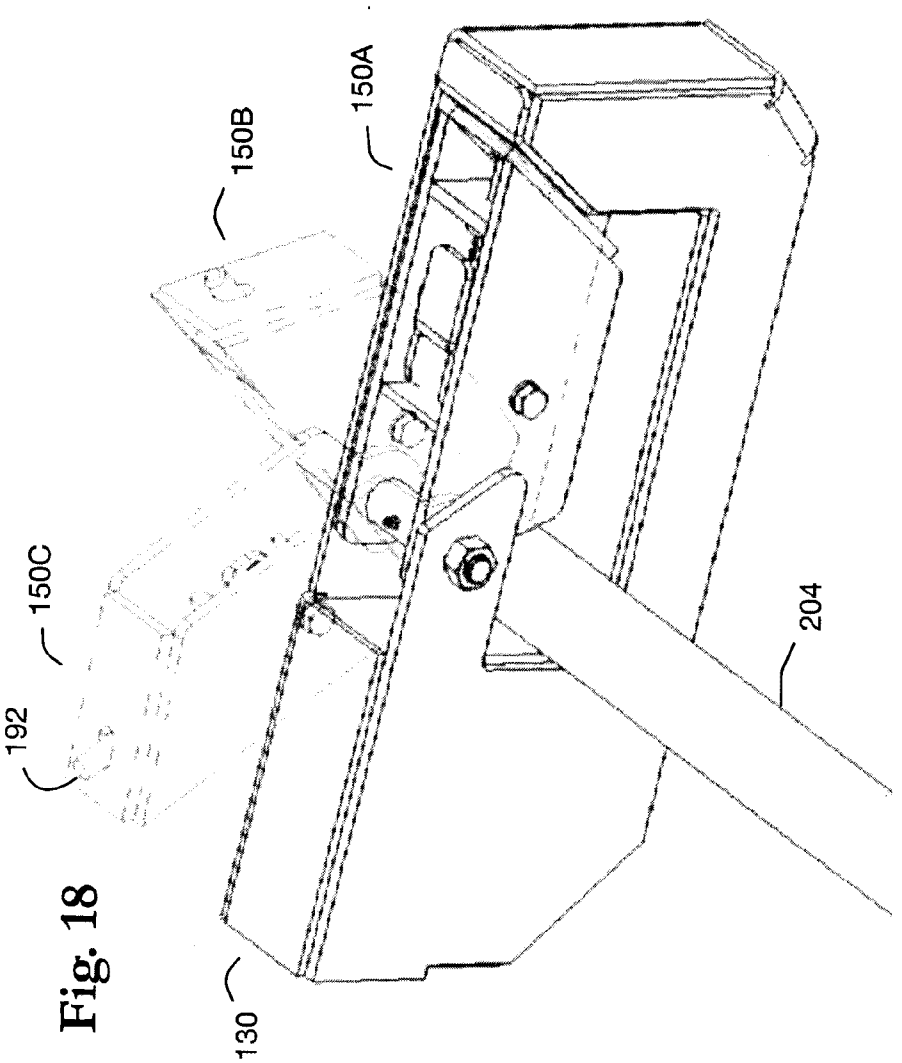


Fig. 18

Date reçue/Date Received 2021-02-17

Fig. 19

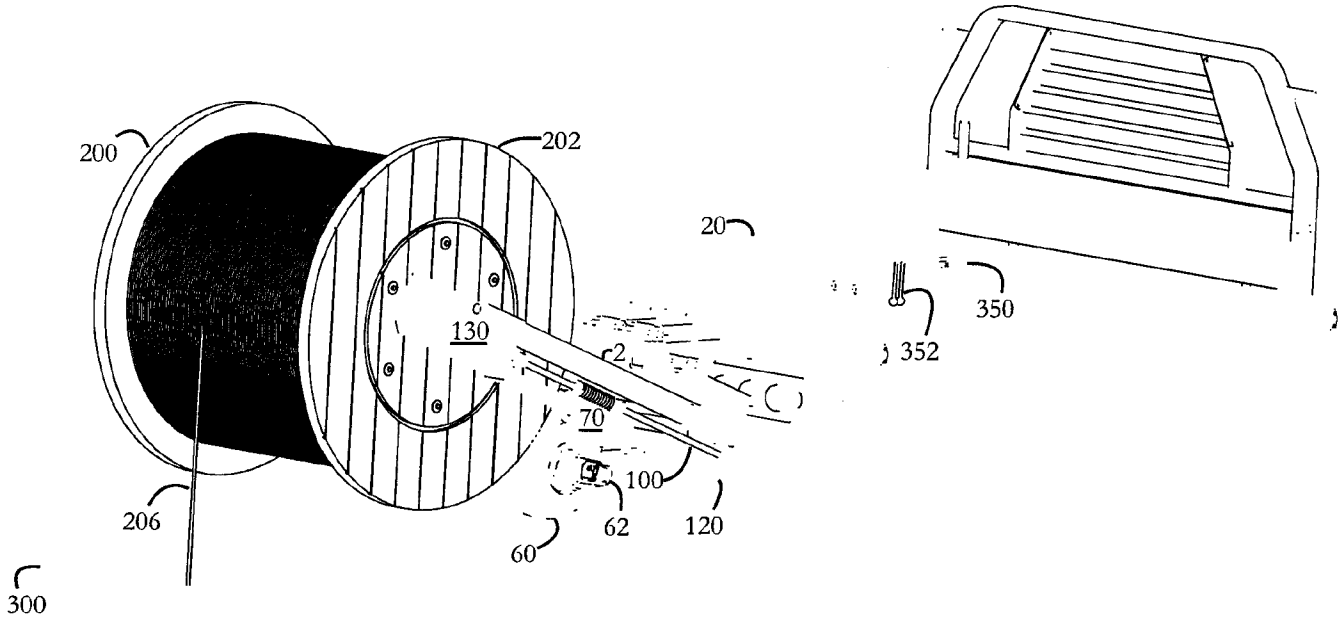
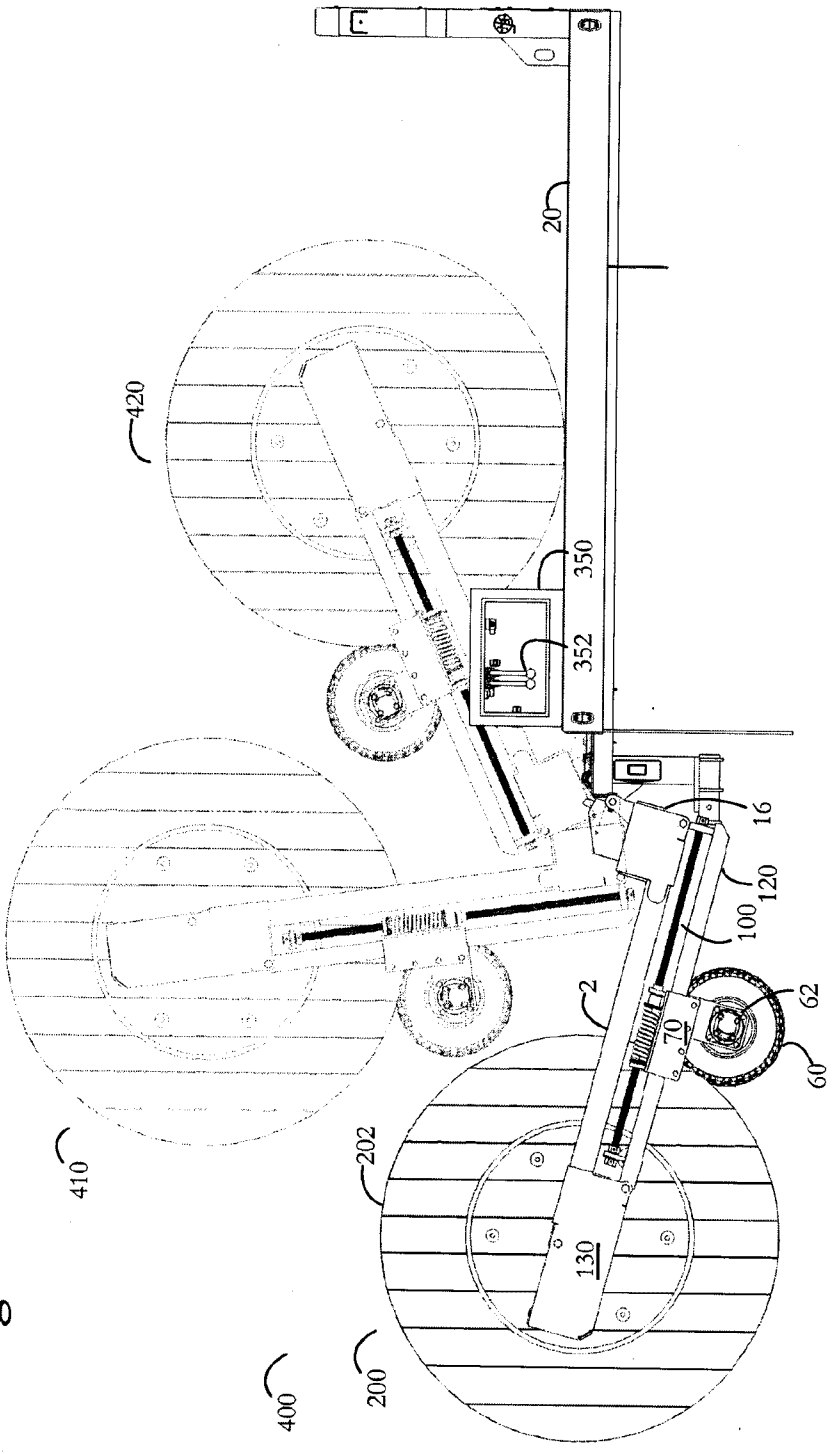


Fig. 20



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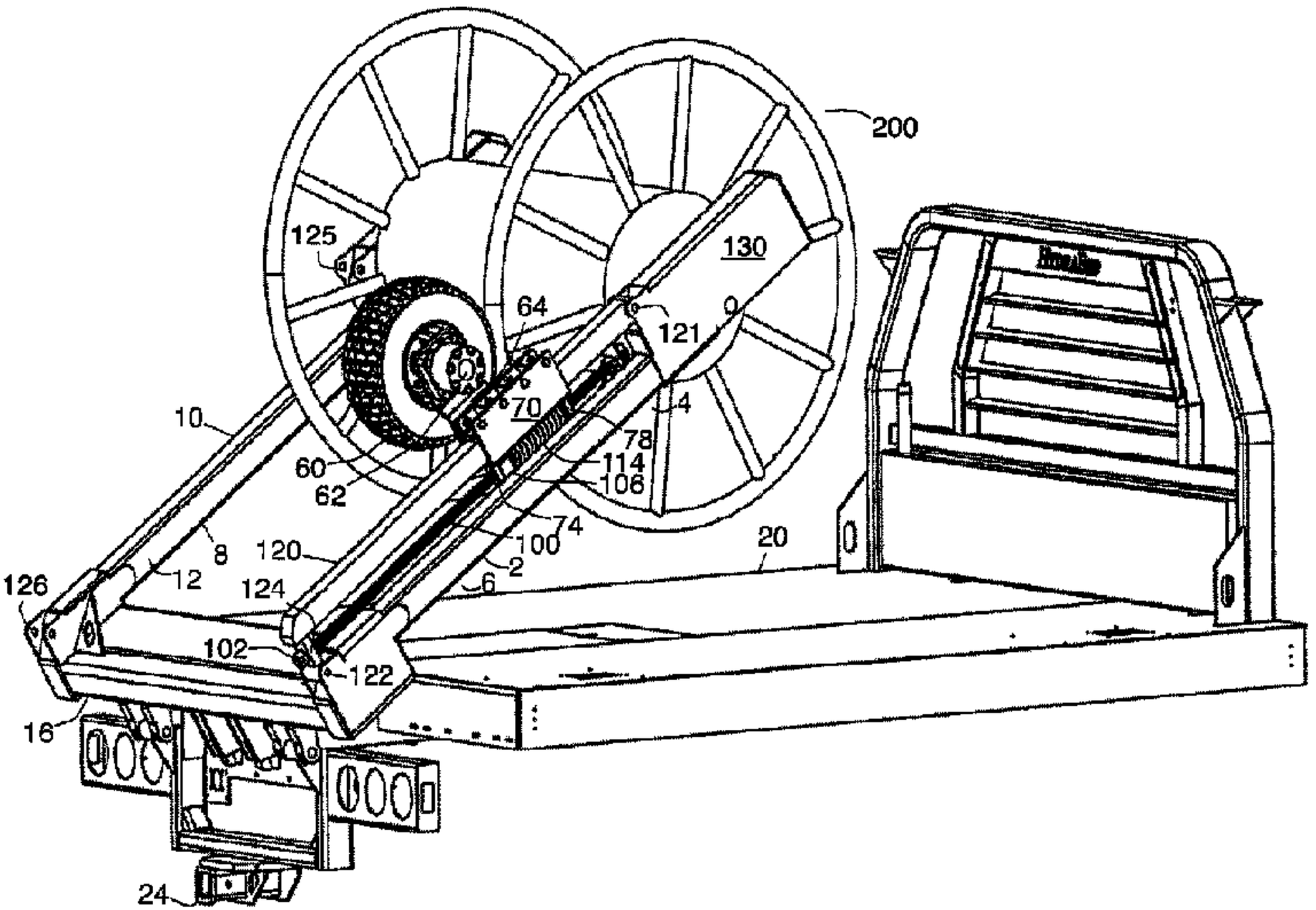
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