



US 20090159303A1

(19) **United States**  
(12) **Patent Application Publication**  
**Fox et al.**

(10) **Pub. No.: US 2009/0159303 A1**  
(43) **Pub. Date: Jun. 25, 2009**

(54) **ROCKSHAFT ASSEMBLY WITH  
DETACHABLE HYDRAULIC LIFT  
CYLINDER**

**Publication Classification**

(51) **Int. Cl.**  
*A01B 59/00* (2006.01)  
(52) **U.S. Cl.** ..... 172/272

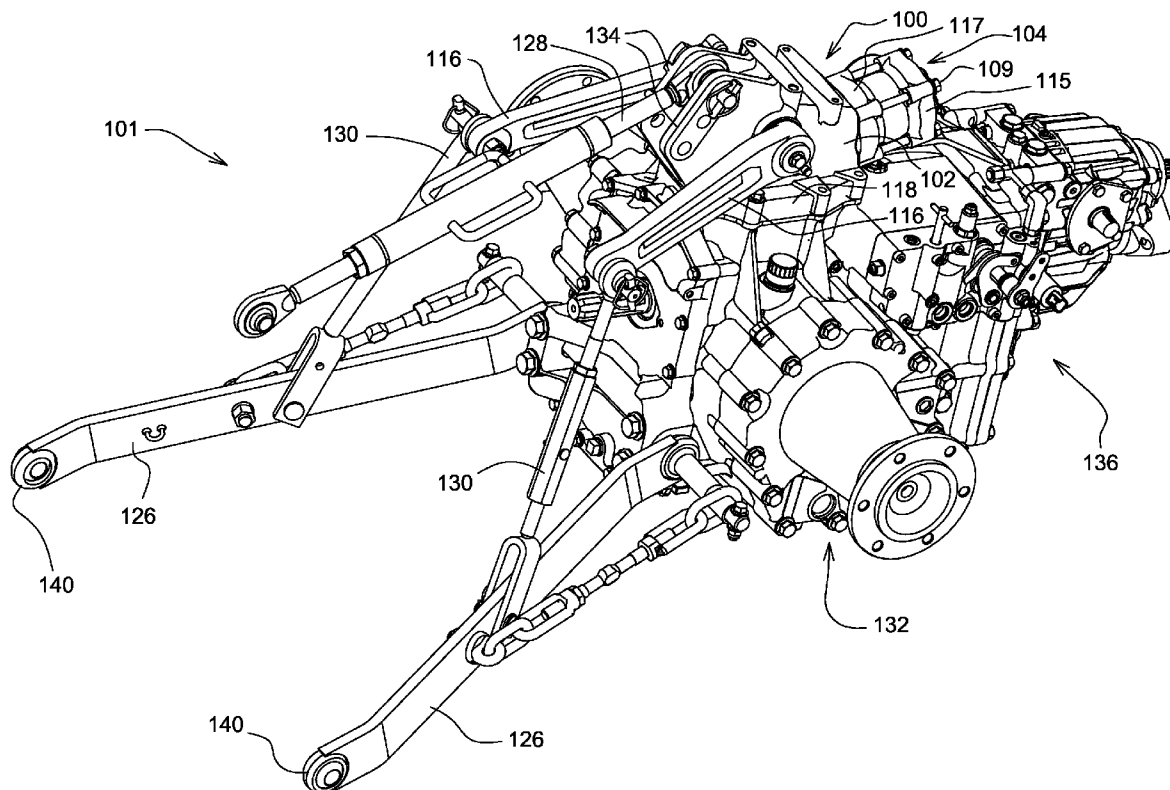
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(57) **ABSTRACT**

A rockshaft assembly includes a support casting having a pair of journeued bearings supporting a rockshaft for a three point hitch. A piston is connected to a crank on the rockshaft, and a detachable hydraulic lift cylinder is inserted through an opening in the support casting. The detachable hydraulic lift cylinder has a bore partially inside the support casting and partially outside the casting in which the piston moves.

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(21) **Appl. No.:** **11/962,185**  
(22) **Filed:** **Dec. 21, 2007**



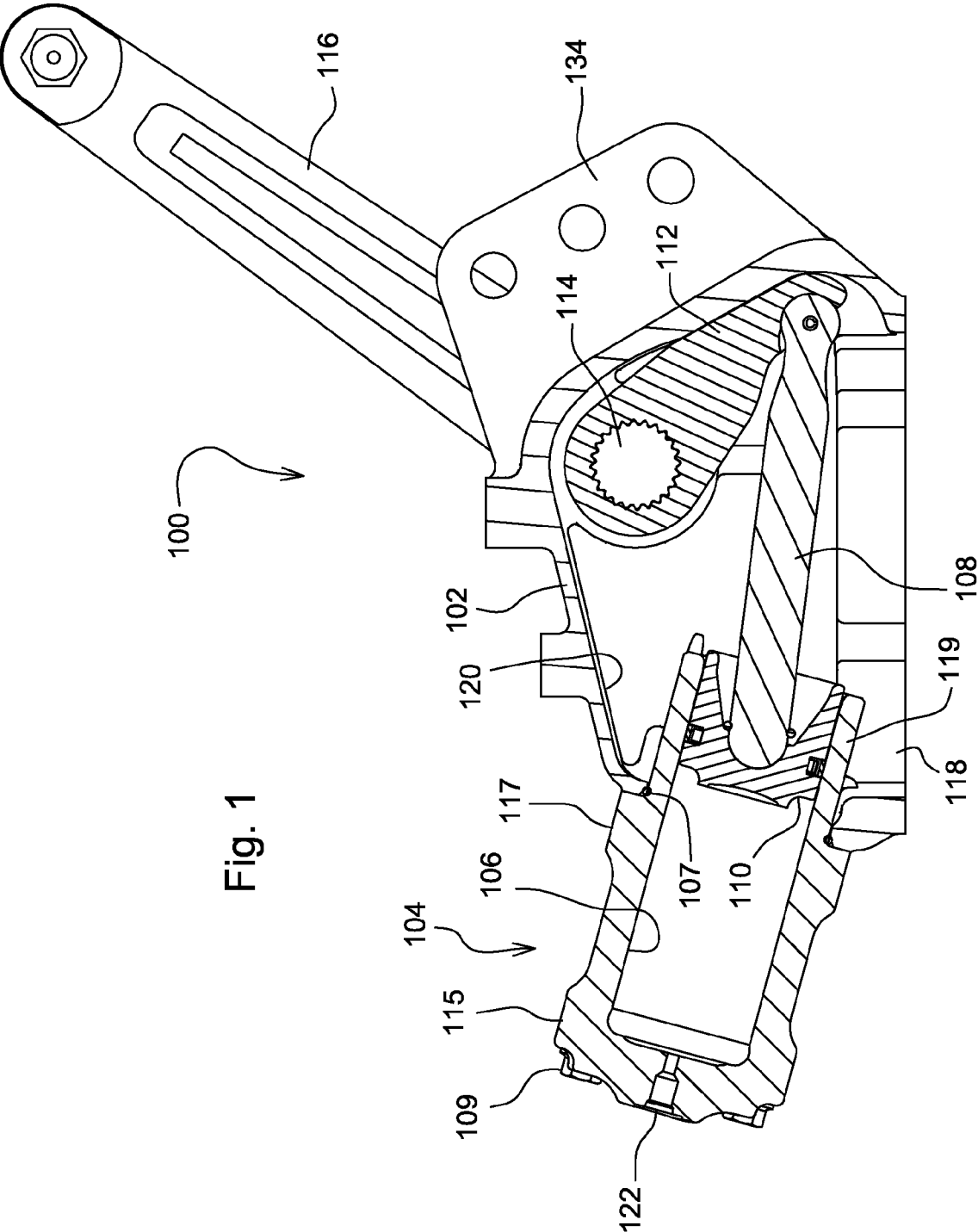


Fig. 1

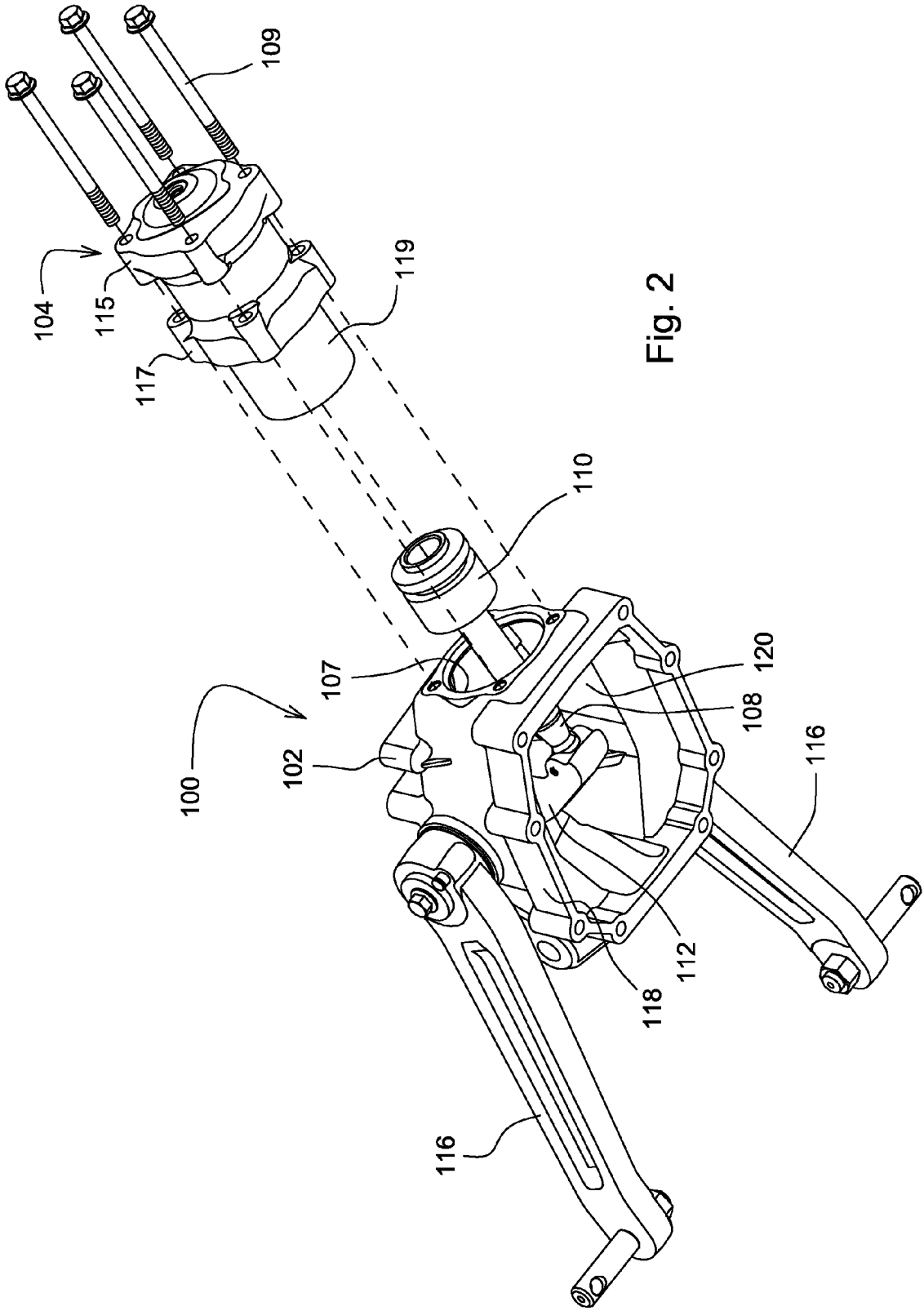


Fig. 2

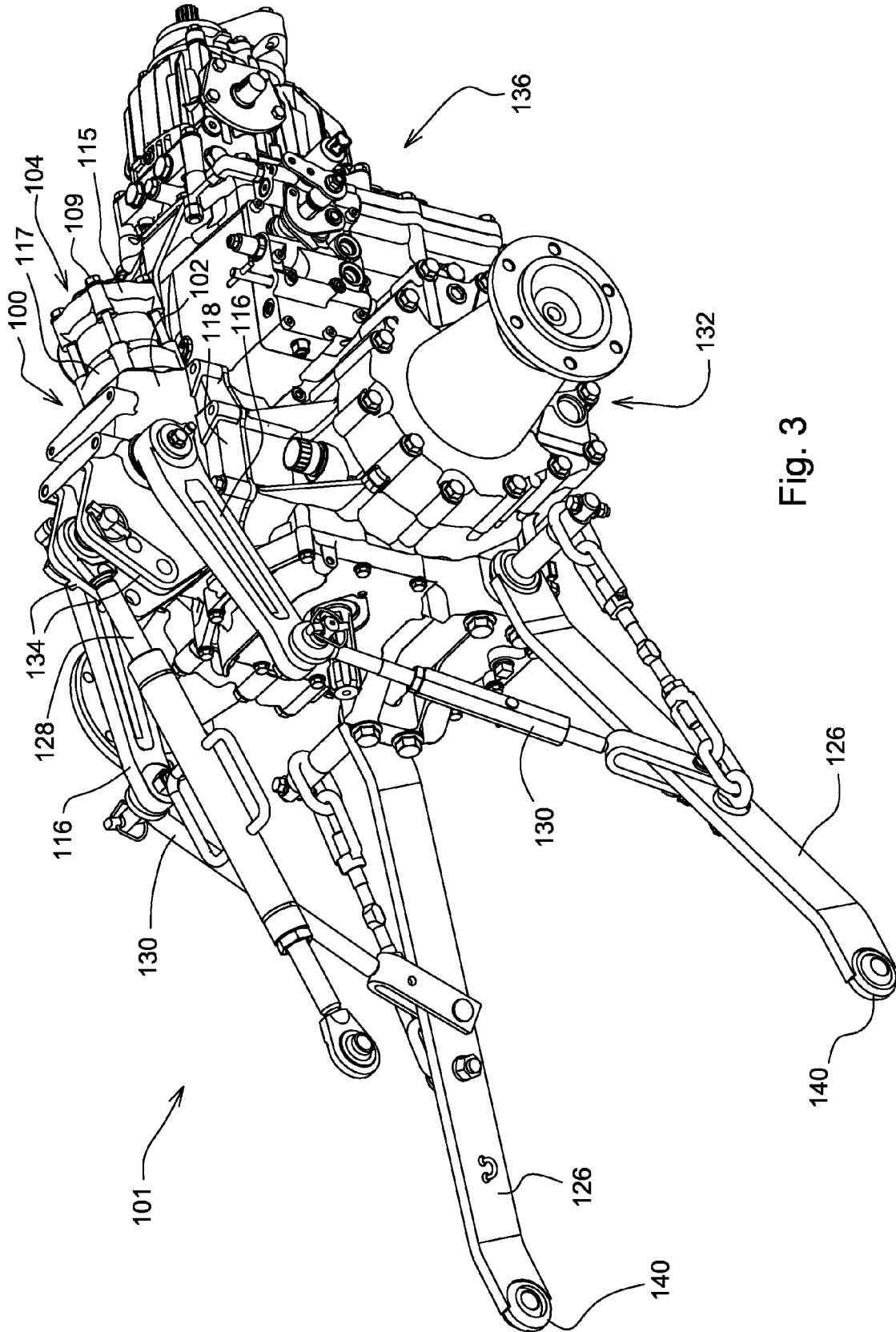


Fig. 3

**ROCKSHAFT ASSEMBLY WITH  
DETACHABLE HYDRAULIC LIFT  
CYLINDER**

FIELD OF THE INVENTION

[0001] This invention relates generally to hitches for tractors or other work vehicles, and more specifically to rockshaft assemblies for rear mounted three point hitches.

BACKGROUND OF THE INVENTION

[0002] For lifting, lowering and applying down pressure to implements hitched to tractors or other work vehicles, a three point hitch may be mounted on the rear of the tractor. The hitch includes a rockshaft assembly with one or more hydraulic lift cylinders connected to the rockshaft, and a pair of lower draft links for mounting and pulling the implement. Additionally, the hitch may include a third or upper link that cooperates with the rockshaft assembly and lower draft links to maintain the desired orientation of the implement.

[0003] The rockshaft assembly typically has a rockshaft splined to receive a pair of rocker arms or lift arms, and also a bell crank or lever for rotating the rockshaft in response to extension and retraction of a piston in the hydraulic lift cylinder. The rockshaft may be supported on journalled bearings either inboard or outboard of the rocker arms. The journalled bearings are typically provided in a large support casting in the form of a housing mounted and secured to the upper, rear or side surfaces of the tractor's differential housing.

[0004] To rotate the rockshaft for raising and lowering the implement, a single lift cylinder or a pair of lift cylinders may be used. If a single lift cylinder is used, the cylinder is generally located within the differential housing and cooperates with a central bell crank or lever splined to the rockshaft. If two lift cylinders are used, the cylinders are typically external to the differential housing and are mounted on either side of the tractor's rear differential. In either case, lift links connect the rocker arms to the draft links so that an implement may be raised and lowered by rotating the rockshaft and rocker arms.

[0005] Difficulties may be encountered when servicing components of the rockshaft assembly and lift cylinders. For example, routine servicing of lift cylinders located within the rear differential housing, such as replacement of worn seals, requires removal of the hitch support casting and partial dismantling of the differential. As a result, such repairs are costly and time intensive. Additionally, rebuilding or changing out the lift cylinder to increase lift capacity of the hitch is complicated and expensive. A rockshaft assembly is needed that simplifies and improves serviceability, and that allows easy removal and replacement of the hydraulic lift cylinder.

[0006] Another disadvantage of conventional rockshaft assemblies is their relatively large size and weight. For example, a typical hitch support casting has a weight of 20 kg or more. The hitch support casting has sufficient size and volume to enclose the lift cylinder and crank, and also has sufficient mass to support a typical rated lift capacity of at least 500 kg, which under industry standards is measured at a location two feet behind the lower draft link hitch balls. The substantial size and weight of the hitch support casting is disadvantageous due to material cost, and also due to the increased difficulty removing and replacing the casting during assembly or servicing. Accordingly, there is a need for a

hitch support casting that is smaller and lighter in weight for a rockshaft assembly providing a rated lift capacity of at least 500 kg.

SUMMARY OF THE INVENTION

[0007] A rockshaft assembly with a detachable hydraulic lift cylinder is provided for a three point hitch. The rockshaft assembly includes a support casting having a pair of journalled bearings, a rockshaft rotatably mounted to the journalled bearings, a crank attached to the rockshaft, and a piston attached to a rod pivotably connected to the crank. A detachable hydraulic lift cylinder is externally mounted to the support casting and has a bore in which the piston moves. A port in the cylinder is provided for introduction of hydraulic fluid into the bore to act against the piston. The detachable hydraulic lift cylinder extends through an opening in the support casting, and can easily be removed for servicing. The support casting is light in weight, smaller in size, but can provide a rated lift capacity in excess of 500 kg.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a cross section view of a rockshaft assembly with a detachable hydraulic lift cylinder according to a first embodiment of the invention.

[0009] FIG. 2 is a partially exploded perspective view of a rockshaft assembly with a detachable hydraulic lift cylinder according to a first embodiment of the invention.

[0010] FIG. 3 is a perspective view of a three point hitch having a rockshaft assembly with a detachable hydraulic lift cylinder according to a first embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] In a first embodiment shown in FIGS. 1-3, rockshaft assembly 100 may be provided on an agricultural or utility tractor, and preferably on a rear mounted three point hitch 101. The rockshaft assembly may be adapted to fit on any three point hitch adapted to vertically displace a work implement. For example, in FIG. 3 rockshaft assembly 100 is shown mounted on the rear differential housing or rear transaxle 132 of a compact utility tractor.

[0012] The rockshaft assembly includes hitch support casting or housing 102. The hitch support casting or housing is a one piece structural casting, and may be mounted to the rear transaxle or differential assembly 132 using threaded fasteners inserted through mounting holes provided in mounting surface or base 118. The hitch support casting or housing also may include a pair of upright projections 134 for pivotably mounting upper draft arm 128.

[0013] In one embodiment, rockshaft 114 has opposing ends rotatably mounted by journalled bearings at the left and right sides of the hitch support casting or housing. Rocker arms or lift arms 116 may be mounted to splined portions of the rockshaft. Lower draft links 130 may be suspended between lift arms 116 and lower draft arms 126. Crank arm also is mounted on a splined portion of rockshaft 114. The interior of the hitch support casting or housing provides sufficient volume for crank arm 114 to pivot between a position where the rocker arms or lift arms 116 are fully raised as shown in FIG. 1, and a position where the rocker arms or lift arms are lowered, and any position between fully raised and lowered.

**[0014]** In one embodiment, detachable hydraulic lift cylinder **104** is externally mounted and fastened to the hitch support casting or housing with a plurality of threaded fasteners **109**. The threaded fasteners may extend through a first flange **115** around the first end of the cylinder, and a second flange **117** intermediate the cylinder that abuts the support casting or housing **102** adjacent opening **107**. The second end **119** of the detachable hydraulic lift cylinder may have a cylindrical shape that extends through opening **107** into the interior **120** of the hitch support casting or housing.

**[0015]** As shown in FIG. 2, detachable hydraulic lift cylinder **104** can be easily removed from the hitch support casting or housing for servicing and/or replacement by removing threaded fasteners **109**. Once the detachable hydraulic lift cylinder is unfastened and removed from the hitch support casting or housing, access is provided to piston **110**. Lift capacity can be easily changed by replacing the detachable hydraulic lift cylinder and piston with another cylinder and piston having different diameters. Thus, external mounting of the detachable hydraulic lift cylinder improves serviceability of the rockshaft assembly. The complete rockshaft can be rebuilt on the tractor without removing the hitch support casting or housing.

**[0016]** In one embodiment, detachable hydraulic lift cylinder **104** is partially outside or external to the hitch support casting or housing. The first end **115** of the hydraulic lift cylinder, which is outside the hitch support casting or housing, includes port **122** for introducing or withdrawing hydraulic fluid from the cylinder. In one embodiment, the detachable hydraulic lift cylinder **104** also is partially inside the hitch support casting or housing. Specifically, the second end **119** of the detachable hydraulic lift cylinder may extend through opening **107** at the front end of the hitch support casting or housing.

**[0017]** In one embodiment, bore **106** in the detachable hydraulic lift cylinder is located partially inside and partially outside the hitch support casting or housing. As a result, the stroke of piston **110**, extends from the inside of the hitch support casting or housing to the outside of that structure. The rear of piston **110** is pivotably connected to a first end of rod **108**. The second end of rod **108** is pivotably connected to crank arm **112**. The crank arm is mounted on a splined portion of rockshaft **114**, which has opposing ends rotatably mounted by journalled bearings at the left and right sides of the hitch support casting or housing.

**[0018]** In one embodiment, a hydraulic conduit (not shown) may be connected between cylinder port **122** and operator controlled valve **136** to control hydraulic pressure into the bore that applies force to move the piston. If the valve is turned to a first position, sufficient hydraulic force moves the piston toward the first end of the bore, as shown in FIG. 1, pivoting crank arm **112**, turning rockshaft **114** on its longitudinal axis, and raising rocker arms or lift arms **116**. If the valve is turned to a second position, hydraulic fluid is withdrawn from the bore, the piston moves toward the second end of the bore, and the rockshaft is turned in the opposite direction to lower the rocker arms or lift arms. The valve also may regulate the hydraulic fluid in the bore at one or more positions between the fully raised and fully lowered positions.

**[0019]** In one embodiment, the weight of the hitch support casting or housing is about 11.7 kg, and the rated lift capacity exceeds 500 kg when measured at a point two feet behind the lower draft link hitch balls **140**. For example, the rated lift capacity of the rockshaft assembly with a detachable hydraulic

lift cylinder having a 60 mm diameter bore hydraulic cylinder is 615 kg, and the rated lift capacity of a rockshaft assembly having a detachable hydraulic lift cylinder with a 56 mm bore is 525 kg. Thus, the ratio of the rated lift capacity to the weight of the hitch support casting or housing is at least 40. Thus, the externally mounted detachable hydraulic lift cylinder reduces the mass of the hitch support casting or housing.

**[0020]** Having described a preferred embodiment, it will become apparent that various modifications can be made without departing from the scope of the invention as defined in the accompanying claims.

1. A rockshaft assembly comprising:
  - a support casting having a pair of journalled bearings;
  - a rockshaft rotatably mounted to the journalled bearings;
  - a crank attached to the rockshaft;
  - a piston attached to a rod pivotably connected to the crank; and
  - a detachable hydraulic lift cylinder externally mounted to the support casting and having a bore in which the piston moves and having a port for introduction of hydraulic fluid into the bore to act against the piston, a pair of flanges integral with the cylinder, and threaded fasteners urging both flanges toward the support casting.
2. The rockshaft assembly of claim 1 wherein the detachable hydraulic lift cylinder extends through an opening in the support casting.
3. The rockshaft assembly of claim 1 further comprising a pair of lower rocker arms mounted to the rockshaft.
4. The rockshaft assembly of claim 1 further comprising a pair of upright projections extending from the support casting.
5. The rockshaft assembly of claim 4 further comprising an upper draft link pivotably attached to the pair of upright projections.
6. The rockshaft assembly of claim 1 wherein the detachable hydraulic lift cylinder extends through the support casting into an interior of the support casting.
7. A rockshaft assembly comprising:
  - a rockshaft extending through a support casting mounted to a differential housing;
  - a hydraulic lift cylinder attached to the support casting and having an internal bore, and a piston in the bore connected to a crank on the shaft, the piston moving to turn the rockshaft between a raised position and a lowered position;
  - a pair of flanges integral with the hydraulic lift cylinder to detachably mount the cylinder to the support casting such that a first flange around a first end of the cylinder is outside the support casting, a second flange around an intermediate portion of the cylinder abuts the support casting adjacent an opening in the support casting, and a second end of the cylinder extends past the opening into the support casting.
8. The rockshaft assembly of claim 7 further comprising a pair of lift arms mounted to the rockshaft.
9. (canceled)
10. The rockshaft assembly of claim 7 wherein the rated lift capacity of the rockshaft assembly is at least 40 times the weight of the support casting.

**11.** A rockshaft assembly comprising:  
a support casting having a pair of journalled bearings supporting a rockshaft for a three point hitch, an opening and an interior;  
a piston connected to a crank on the rockshaft; and  
a detachable hydraulic lift cylinder inserted through the opening into the interior of the support casting and having a bore partially inside the support casting and partially outside the casting in which the piston moves, a first flange around a first end of the cylinder, a second

flange intermediate the cylinder that abuts the support casting adjacent the opening, and a plurality of threaded fasteners extending through both flanges and into the support casting.

**12.** The rockshaft assembly of claim **11** further comprising a port in the detachable hydraulic cylinder for introduction of hydraulic fluid.

**13.** (canceled)

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