

ABSTRACT

The present invention teaches a controlled displacement mechanism which enables transmission of torque from a driving shaft of a motor to a driven shaft cooperating with an implement, via a coupler, thereby displacing the implement from an inoperative position to a desired position. Controlling of the displacement of the implement is achieved by appropriately positioning the constraining member to restrict displacement of the implement beyond the desired position.

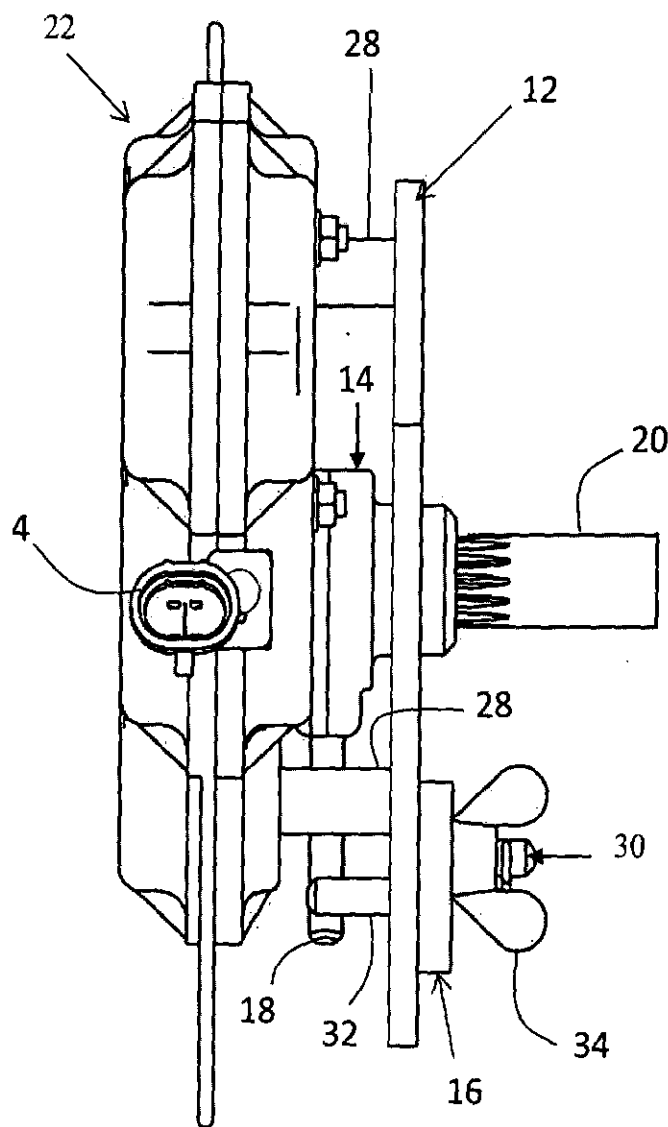


FIGURE 2

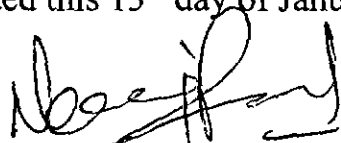
We claim:

1. A controlled displacement mechanism enabling transmission of torque from a driving shaft of a motor to a driven shaft cooperating with an implement to be displaced to a desired position, said mechanism comprising:
 - a mounting plate having a first surface and a second surface, parallel to each other, said first surface adapted to be proximal to the motor,

said mounting plate defining coupler support opening and a plurality of apertures, each of said plurality of apertures defined at a predetermined distance from each other;
 - a coupler disposed between said mounting plate and the motor, said coupler adapted to rotatably connect the driving shaft and the driven shaft along an operational axis of said coupler, at least a portion of said coupler adapted to pass-through said coupler support opening to cooperate with the driven shaft;
 - a constraining member adapted to be removably fitted to project through at least one of said plurality of apertures so as to protrude from said first surface, said constraining member adapted to be positioned corresponding to a pre-determined displacement required to displace the implement to the desired position; and
 - a stopper cooperating with said coupler and substantially perpendicular to said operational axis, said stopper adapted to abut said constraining member.
2. The mechanism as claimed in claim 1, wherein said mounting plate includes a mounting pin projecting from said second surface of said mounting plate, said mounting pin being equidistant from each of said plurality of apertures.

3. The mechanism as claimed in claim 1 and claim 2, wherein said a motion restricting element is provided with a mounting recess adapted to cooperate with said mounting pin, said constraining member being adapted to be integrally formed on said motion restricting plate, each of said plurality of apertures being adapted to be equi-distant from said mounting pin.
4. The mechanism as claimed in claim 1 and claim 3, wherein said constraining member is pressed fitted into an opening provided on said motion restricting element.
5. The mechanism as claimed in claim 1, wherein said coupler defines a plurality of internal serrations parallel to the operational axis thereof, said internal serrations being adapted to cooperate with complementary external serrations defined on the driving shaft and the driven shaft.
6. The mechanism as claimed in claim 1, wherein said coupler is in locking engagement with the driving shaft and the driven shaft by a keyway and a key arrangement.
7. The mechanism as claimed in claim 1, wherein said mounting plate is positioned in a spaced apart configuration from the motor.
8. The mechanism as claimed in claim 1 further comprising a locking arrangement adapted to lock the position of the implement at the desired position, said locking arrangement being adapted to be selected from the group consisting of an electronic locking arrangement, a pneumatic locking arrangement, hydraulic locking arrangement and mechanical locking arrangement.

Dated this 13th day of January, 2014



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FIELD OF THE INVENTION

The present invention relates to an arrangement for displacing an implement.

Particularly it relates to an arrangement for displacing an implement for a work vehicle.

BACKGROUND OF THE INVENTION

A large number of work vehicle, such as, tractors are majorly used in cooperation with an implement which enables performing various activities related to agriculture and construction. Particularly, in the case of tractors, a variation of implements are required to cooperate with the tractor depending on the agricultural activities, such as, tillage, sowing, crop protection, harvesting and transport of harvested product.

The agricultural implements are required to cooperate with the tractor via a hitch or three point linkages in order to be drawn across the field. The position of the implement with respect to the ground is controlled by means of an electro hydraulic power system called a rockshaft. The rockshaft enables raising and lowering of the implement connected to a tractor. The rockshaft includes mechanical linkages powered by a source of power to enable mounting and displacement of the implement connected to the lift arms of the rockshaft. The implement is caused to move up or down depending on the power supplied. The displacement of the implement is required to be in a controlled manner depending on the in-situ requirement.

Several attempts have been made for controllably raising and lowering the implement. Accordingly, electrical motor has been used for operating the rockshaft

for raising and lowering the implement connected to the tractor. Use of electrical motor for controlling the rockshaft provides a wide range of control, accuracy and improved response time and speed. However, such systems involves electronic transducers and control systems in conjunction with a motor which enable the rockshaft to quickly respond to operational requirements.

Hence, there is a need for a system which enables obviating the drawbacks of the prior art without compromising on the efficiency of the overall system during operation.

OBJECTS OF THE INVENTION

The controlled displacement mechanism enables achieving the following objects, thereby overcoming the drawbacks of prior art:

An object of the present invention is to facilitate accurate positioning of an implement.

Another object of the present invention is to minimize errors in positioning of the implement.

Yet another object of the present invention is to provide a simple mechanism for positioning the implement.

Still another object of the present disclosure is to reduce the operational cost for positioning the implement.

Other objects of the present invention will be apparent when the description of the invention is read in conjunction with the accompanying drawings. The accompanying drawings provided herein are merely illustrative and does not intend to limit the scope and ambit of the present invention.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a controlled displacement mechanism enabling transmission of torque from a driving shaft of a motor to a driven shaft cooperating with an implement to be displaced to a desired position; the mechanism comprises a mounting plate, a coupler, a constraining member, a stopper.

The mounting plate has a first surface and a second surface, parallel to each other. The first surface is adapted to be proximal to the motor. The mounting plate defines a coupler support opening and a plurality of apertures. Each of the plurality of apertures is defined at a predetermined distance from each other.

The coupler is disposed between the mounting plate and the motor. The coupler rotatably connects the driving shaft and the driven shaft along an operational axis of the coupler. At least a portion of the coupler passes through the coupler support opening to cooperate with the driven shaft.

The constraining member is removably fitted to project through at least one of the plurality of apertures so as to protrude from the first surface. The constraining member is positioned corresponding to a pre-determined displacement required to displace the implement to the desired position.

The stopper cooperates with the coupler and is substantially perpendicular to the operational axis; the stopper adapted to abut the constraining member.

Optionally, the mounting plate includes a mounting pin projecting from the second surface of the mounting plate, the mounting pin being equidistant from each of the plurality of apertures.

The motion restricting element is provided with a mounting hole to cooperate with the mounting pin. The constraining member is integrally formed on the motion restricting plate. Typically, each of the plurality of apertures is equidistant from the mounting pin.

Typically, the coupler defines a plurality of serrations parallel to the operational axis thereof. The internal serrations are adapted to cooperate with complementary serrations defined on the driving shaft and the driven shaft.

Alternatively, the coupler is in locking engagement with the driving shaft and the driven shaft by a key arrangement.

Typically, the mounting plate is positioned in a spaced apart configuration from the motor by means of spacers positioned between the motor and the mounting plate.

Additionally, a locking arrangement enables locking the position of the implement at the desired position. The locking arrangement is selected from the group consisting of an electronic locking arrangement, a pneumatic locking arrangement, hydraulic locking arrangement and mechanical locking arrangement.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The controlled displacement mechanism of the present invention will now be described with respect to the accompanying drawings wherein:

Figure 1 illustrates a perspective view of the rockshaft assembly of the tractor and the control assembly for the same;

Figure 2 illustrates side view of the arrangement of a coupler and a mounting plate, in accordance with the present invention, cooperating with a motor;

Figure 3 illustrates a perspective view of the motor coupled with the coupler in accordance with the present invention;

Figure 4 to Figure 6 illustrates the coupler in accordance with the present invention;

Figure 7 to Figure 8 illustrates the mounting plate in accordance with the present invention;

Figure 9 illustrates a motion restricting element with a constraining member, in accordance with the present invention;

Figure 10 illustrates an exploded view of the mounting plate and the motion restricting element; and

Figure 11 illustrates the motion restricting element mounted on the mounting plate.

DETAILED DESCRIPTION

The present invention stems from the observation that controlled displacement of an implement or equipment using conventionally available system is complicated and increases the operational cost.

The controlled displacement mechanism will now be described with respect to the accompanying drawings which do not limit the scope and ambit of the present invention.

Although the present invention will henceforth be described with respect to rockshaft of tractors for lifting implements, however a person having ordinary skill in the art would appreciate that the mechanism of the present invention is applicable to any operation involving displacement of implement or equipment by

utilizing power from a motor. **Figure 1** illustrates a tractor rockshaft (1) having lift arms (3), actuated by lever mechanism (2), for connecting to an implement. Referring to the accompanying drawings, the controlled displacement mechanism is particularly illustrated in **Figure 2**. The controlled displacement mechanism includes a mounting plate (12), a coupler (14), a motion restraining element (16) and a stopper (18). The controlled displacement mechanism enables transmission of torque from a driving shaft (not shown in Figure) of a motor, receiving actuating signals through a connector (4), to a driven shaft cooperating with the lift arms so as to displace an implement connected to the lift arms (3), to a desired position from an inoperative position of the lift arms (3).

The coupler (14), as illustrated in **Figure 2**, enables coupling a driving shaft (not shown in Figure) and the driven shaft (20). The driven shaft (20) cooperates with the coupler (14) at one end and with the lift arms (3) at the other end. It is understood that although the driven shaft (20) has been explained to be cooperating with the lift arms (3) of the rockshaft, the driven shaft (20) can cooperate with any other linkage, equipment or implement. As illustrated in **Figure 2**, the driving shaft cooperates with a motor (22) in order to transmit torque from the motor (22) to the driven shaft (20) via the coupler (14). **Figure 3** illustrates the coupler (14) cooperating with the driving shaft of the motor (22). The coupler (14) enables transmission of torque in the axial direction along an operational axis of the coupler (14). Serrations are defined on the coupler (14), illustrated in **Figure 4** to **Figure 6**, such that, the serrations are parallel to the operational axis of the coupler (14). Typically, the serrations are internal serrations (19), as illustrated in **Figure 4** to **Figure 5**, defined within a hollow of the coupler (14). Alternatively, the serrations are external serrations (not shown in the accompanying drawings) which are defined on the external surface of the coupler (14). The serrations enable the

coupler (14) to cooperate with complementary serrations defined on the driving shaft and the driven shaft (20). Optionally, the coupler (14) is lockingly engaged with the driving shaft and the driven shaft (20) by a keyway and key arrangement. The stopper (18), particularly illustrated in **Figure 4** to **Figure 6**, cooperates with the coupler (14) and is substantially perpendicular to the operational axis of the coupler (14). The stopper (18), in an operational configuration is angularly displaceable corresponding to a pre-determined angular distance required to displace the lift arms (3) to the desired position.

As illustrated in **Figure 2**, the mounting plate (12) is positioned such that the coupler (14) is sandwiched between the mounting plate (12) and the motor (22). The mounting plate (12), particularly illustrated in **Figure 7** and **Figure 8**, has a first surface (23a) and a second surface (23b), parallel to each other. The mounting plate (12) is configured such that the first surface (22a) is proximal to the motor (22). The mounting plate (12) defines a coupler support opening (24) and apertures (26a, 26b and 26c). The coupler support opening (24) is provided to enable cooperation between the coupler (14) and the driven shaft (20). Each of the apertures (26a, 26b and 26c) is defined at a predetermined distance from each other. The mounting plate (12) is maintained in a spaced apart configuration from the motor (22) by means of spacers (28), shown in **Figure 8**. The spacers (28) cooperate with support means (28a), shown in **Figure 3**, of the motor (22). Further, the second surface (23b) of the mounting plate (12) includes a mounting pin (30), protruding therefrom. Typically, the mounting pin (30) is integral with the mounting plate (12) and is equidistant from each of the apertures (26a, 26b and 26c).

The motion restricting element (16), illustrated in **Figure 9**, includes a constraining member (32) which is required to be removably fitted into the

apertures (26a, 26b or 26c) so as to project from the first surface (23a), in the operational configuration of the controlled displacement mechanism. The constraining member (32) is either integral with the motion restricting element (16) or is pressed fitted into an opening provided on the motion restricting element (16). The motion restricting element (16) defines a mounting recess (31) for positioning the motion restricting element (16) on the mounting pin (30), as illustrated in **Figure 10**. The motion restricting element (16) is fitted onto the mounting recess (31) by means of a nut (34) and pin (34a) arrangement, illustrated in **Figure 10** and **Figure 11**. The constraining member (32) is positioned in one of the apertures (26a, 26b or 26c) corresponding to the pre-determined displacement required to displace the lift arms to the desired position. In an alternate embodiment, the constraining member (32) is in the form of a stud which is removably fitted into one of the apertures (26a, 26b or 26c).

In the operative condition of the controlled displacement mechanism, the coupler (14), torque transmittingly couples the driving shaft and the driven shaft (20). When the motor is actuated, the coupler (14) is rotated along the operational axis thereof during transmission or the torque. The rotation of the stopper (18) in turn enables angularly displacing the stopper (18) along a plane substantially orthogonal to the operational axis of the coupler (14). The angular displacement of the stopper (18) continues until the stopper (18) abuts the constraining member (32) on achieving the desired position of the lift arms (3). The constraining member (32) restricts further angular displacement of the stopper (18) after abutting the constraining member (32). Locking of the lift arms (3) at the desired position is achieved by means of a locking arrangement (not shown in Figure) selected from the group consisting of an electronic locking arrangement, a pneumatic locking arrangement, a hydraulic locking arrangement and a mechanical

locking arrangement. The desired position of the lift arms (3) is variable by changing the position of the constraining member (32) between the apertures (26a, 26b and 26c). The lift arms (3) are displaced from an inoperative position to the desired position. The stopper (18) on being restricted from being angularly displaced after abutting the constraining member (32) results in terminating the operation of the motor (22).

Thus, the controlled displacement mechanism of the present invention facilitates accurate positioning of an implement while minimizing errors in positioning of the implement.

TECHNICAL ADVANCEMENT /ECONOMIC SIGNIFICANCE

The controlled displacement mechanism of the present invention has several technical advancements, including but not limited to the realization of:

- facilitating accurate positioning of an implement;
- minimizing errors in positioning of the implement;
- a simple mechanism for positioning the implement; and
- reduction in the operational cost for positioning the implement.

While the foregoing specification has been described with respect to at least one embodiment, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure which comes within known or customary practice in the art to which this invention pertains.

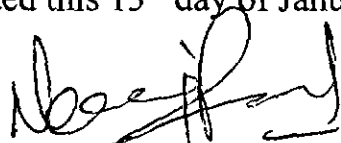
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said mounting plate defining coupler support opening and a plurality of apertures, each of said plurality of apertures defined at a predetermined distance from each other;
 - a coupler disposed between said mounting plate and the motor, said coupler adapted to rotatably connect the driving shaft and the driven shaft along an operational axis of said coupler, at least a portion of said coupler adapted to pass-through said coupler support opening to cooperate with the driven shaft;
 - a constraining member adapted to be removably fitted to project through at least one of said plurality of apertures so as to protrude from said first surface, said constraining member adapted to be positioned corresponding to a pre-determined displacement required to displace the implement to the desired position; and
 - a stopper cooperating with said coupler and substantially perpendicular to said operational axis, said stopper adapted to abut said constraining member.
2. The mechanism as claimed in claim 1, wherein said mounting plate includes a mounting pin projecting from said second surface of said mounting plate, said mounting pin being equidistant from each of said plurality of apertures.

3. The mechanism as claimed in claim 1 and claim 2, wherein said a motion restricting element is provided with a mounting recess adapted to cooperate with said mounting pin, said constraining member being adapted to be integrally formed on said motion restricting plate, each of said plurality of apertures being adapted to be equi-distant from said mounting pin.
4. The mechanism as claimed in claim 1 and claim 3, wherein said constraining member is pressed fitted into an opening provided on said motion restricting element.
5. The mechanism as claimed in claim 1, wherein said coupler defines a plurality of internal serrations parallel to the operational axis thereof, said internal serrations being adapted to cooperate with complementary external serrations defined on the driving shaft and the driven shaft.
6. The mechanism as claimed in claim 1, wherein said coupler is in locking engagement with the driving shaft and the driven shaft by a keyway and a key arrangement.
7. The mechanism as claimed in claim 1, wherein said mounting plate is positioned in a spaced apart configuration from the motor.
8. The mechanism as claimed in claim 1 further comprising a locking arrangement adapted to lock the position of the implement at the desired position, said locking arrangement being adapted to be selected from the group consisting of an electronic locking arrangement, a pneumatic locking arrangement, hydraulic locking arrangement and mechanical locking arrangement.

Dated this 13th day of January, 2014



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