

Abstract

The invention describes a loader (10). The loader (10) comprises a loader boom (12) and a tool carrier (26) or a tool arranged on the loader boom (12), wherein the tool carrier (26) or the tool is connected at a first pivot point (42, 44) to the loader boom (12) and at a second pivot point (46, 48) to a pivot linkage (24), wherein the pivot linkage (24) comprises a first and a second link (30, 32, 34, 36) which are pivotably connected to one another at a first link point (38, 40), and wherein the first link (30, 32) is pivotably connected at a second link point (54, 56) to the loader boom (12), and the second link (34, 36) is pivotably connected at a second link point (50, 52) at the second pivot point (46, 48) to the tool carrier (26) or to the tool, and furthermore a sensor (58) is provided by means of which a pivot angle between the tool carrier (26) or tool and loader boom (12) can be detected. To protect the sensor in as effective a manner as possible, it is proposed that the sensor (58) is positioned in a cavity (76) on the loader, and an actuating device (60) is provided for the sensor (58), which actuating device extends partially through an opening (74) formed on the cavity (76) and connects the sensor (58) to the pivot linkage (24).

Figure 1

We Claim:

1. Loader (10) having a loader boom (12) and having a tool carrier (26) or tool arranged on the loader boom (12), wherein the tool carrier (26) or the tool is connected at a first pivot point (42, 44) to the loader boom (12) and at a second pivot point (46, 48) to a pivot linkage (24), wherein the pivot linkage (24) comprises a first and a second link (30, 32, 34, 36) which are pivotably connected to one another at a first link point (38, 40), and wherein the first link (30, 32) is pivotably connected at a second link point (54, 56) to the loader boom (12), and the second link (34, 36) is pivotably connected at a second link point (50, 52) at the second pivot point (46, 48) to the tool carrier (26) or to the tool, and furthermore a sensor (58) is provided by means of which a pivot angle between the tool carrier (26) or tool and loader boom (12) can be detected, characterized in that the sensor (58) is positioned in a cavity (76) on the loader (10), and an actuating device (60) is provided for the sensor (58), which actuating device extends partially through an opening (74) formed on the cavity (76) and connects the sensor (58) to the pivot linkage (24).
2. Loader (10) according to Claim 1, characterized in that the cavity (76) is formed in the loader boom (12).
3. Loader (10) according to Claim 1 or 2, characterized in that the actuating device (60) comprises a rotary axle (A) which is connected to the sensor (58), a rotary lever (62) and a control arm (64), wherein the rotary lever (62) is


connected rotationally conjointly to the rotary axle (A) and the control arm (64) pivotably connects the rotary lever (62) to the pivot linkage (24).

4. Loader (10) according to Claim 3, characterized in that the control arm (64) connects the rotary lever (62) to the first link (30, 32) of the pivot linkage (24).
5. Loader (10) according to Claim 3 or 4, characterized in that a mounting plate (70) is provided to which the sensor (58) is fastened and on which the rotary axle (A) is mounted, wherein the mounting plate (70) is fastened in the region of the opening (74) of the cavity (76) in such a way that the rotary axle (A) extends through the opening (74).
6. Loader (10) according to one of the preceding claims, characterized in that the loader (10) is in the form of a front loader, wheeled loader, telescopic loader or rear loader, wherein the loader boom (12) is in the form of a loader boom of a front loader or wheeled loader, or as a jib of a telescopic loader or rear loader.
7. Loader (10) substantially as herein described with reference to the accompanying drawings.

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The invention relates to a loader having a loader boom and having a tool carrier or tool arranged on the loader boom, wherein the tool carrier or the tool is connected at a first pivot point to the loader boom and at a second pivot point to a pivot linkage, wherein the pivot linkage comprises a first and a second link which are pivotably connected to one another at a first link point, and wherein the first link is pivotably connected at a second link point to the loader boom, and the second link is pivotably connected at a second link point at the second pivot point to the tool carrier or to the tool, and furthermore a sensor is provided by means of which a pivot angle between the tool carrier or tool and loader boom can be detected.

Loaders, such as for example front loaders, wheeled loaders, telescopic loaders, rear loaders and the like, are known. It is also known for such loaders to be equipped with a sensor device by means of which a pivot angle of a tool carrier or tool arranged on the loader is measured, wherein the pivot angle indicates a pivoting position of the tool carrier in particular relative to a loader boom or a jib of the loader. The arrangement of a sensor device on the loader is often difficult or cumbersome because the sensor may be subjected to considerable loads, and in particular must withstand contamination and damage caused by load material and must be of correspondingly robust design or positioned in a protected manner. For example, magnetostrictive sensors are arranged directly on a lifting cylinder of the loader, such that the stroke of the cylinder is measured and the pivot angle at the tool can be inferred. Magnetostrictive sensors are generally cumbersome to install and are correspondingly expensive. Alternatively, it is known to arrange rotational angle or rotation sensors on the loader, for

example on the loader boom, on the tool carrier or on the pivot linkage of the loader. Here, there is the problem that additional protection must be provided for the sensor, for example by means of a robust cover. A cover may firstly restrict a view of the tool, and secondly entails additional assembly and cost outlay.

The object on which the invention is based is considered to be that of refining a front loader of the type mentioned in the introduction such that the above-stated problems are overcome.

The object is achieved according to the invention by means of the teaching of patent claim 1. Further advantageous embodiments and refinements of the invention will emerge from the subclaims.

According to the invention, a front loader of the type mentioned in the introduction is designed such that the sensor is positioned in a cavity on the loader, and an actuating device is provided for the sensor, which actuating device extends partially through an opening formed on the cavity and connects the sensor to the pivot linkage. By virtue of the fact that the sensor is arranged in a cavity on the loader, said sensor is protected against external influences, or automatically covered, such that objects acting from the outside do not have access to the sensor. Furthermore, assembly is simple because no additional covers are required. It is preferably sought for the cavity to be close to the pivot linkage, such that the actuating device can be of compact design, and a pivoting movement directly at the tool carrier or at the pivot linkage can be recorded and measured. In this way, inaccuracies are avoided, and error tolerances can be kept small. The sensor may for example be in the form of a magnetic,

potentiometric or optical rotational angle sensor or rotary sensor or rotation sensor.

The cavity may for example be formed in the loader boom, for example close to the pivot linkage. It is thus possible for the loader boom or a jib to be formed as a hollow profile, such that the opening is formed as a cutout in a hollow profile wall. Through corresponding positioning and design of the opening, assembly is also made simple and uncomplicated. A cable arrangement for the sensor may also be guided through the interior of the hollow profile, thus providing protection for the sensor and for the cable arrangement against externally-induced damage. Alternatively, the sensor could also be positioned in a cavity of the pivot linkage or of the tool carrier, for example between two spaced-part links or support plates, wherein the opening is formed either by a cutout on the links or support plates or by the spacing of the links or support plates to one another.

The actuating device comprises a rotary axle which is connected to the sensor, a rotary lever and a control arm, wherein the rotary lever is connected rotationally conjointly to the rotary axle and the control arm pivotably connects the rotary lever to the pivot linkage. Here, the rotary axle serves as a rotational angle encoder or transmitter for the sensor and may be connected to the sensor directly or indirectly for example by means of a rotational angle transmission means. The rotary lever is in the form of a rigid connecting arm to the rotary axle, and extends radially with respect thereto. The rotary lever thus transmits a movement imparted at the rotary lever directly to the rotary axle. By means of the control arm, which is in the form of a pivotable link or a connecting rod, a

movement is transmitted from the pivot linkage to the rotary lever by virtue of said pivot linkage or said rotary lever being articulatedly connected at one connecting point to the pivot linkage at one of the links and at a further connecting point to the rotary lever, such that a pivoting movement of one of the links of the pivot linkage is converted into a pivoting movement of the rotary lever and consequently into a rotational movement of the rotary axle.

The control arm may be connected to the first link of the pivot linkage and connects said first link to the rotary lever. In this way, a compact design of the actuating device is ensured because the first link is connected directly to the loader boom or to the jib and thus the opening of the cavity can be formed in the direct vicinity of the pivot linkage.

Furthermore, simple mounting can be ensured by means of a mounting plate to which the sensor is fastened and on which the rotary axle is mounted, because the sensor and the actuating device can be pre-mounted and the entire arrangement can subsequently, as a compact component assembly, be located in the region of the opening by means of the mounting plate in a convenient manner using few mounting steps. Here, the mounting plate is fastened in the region of the opening of the cavity in such a way that the rotary axle extends through the opening. The mounting plate and the opening may for example be of oval shape, slotted shape or else of rectangular form, wherein fastening bores are formed on the longitudinal sides (long sides) of the opening and threaded bores are formed on the transverse sides (short sides) of the mounting plate. By rotation of the mounting plate relative to the opening after insertion into the cavity, the opening can be bridged by the

mounting plate in the transverse direction with respect to the longitudinal sides of the opening, such that the transverse sides of the mounting plate project beyond the longitudinal sides of the opening (bridge the opening in the transverse direction), such that the mounting plate can be fastened for example by means of a screw connection at the stated bores and without additional auxiliary means, for example fastening angle brackets, fastening lugs or the like.

According to the invention, the loader may be in the form of a front loader, wheeled loader, telescopic loader or rear loader, wherein the loader boom is in the form of a loader boom of a front loader or wheeled loader, or as a jib of a telescopic loader or rear loader. Front loaders and rear loaders may be used as attachment units on agricultural tractors or construction machines. The expression "loader" is also intended to encompass other loader-like assemblies and machines which have a loader boom or a jib, for example construction machines such as diggers, bulldozers or forestry machines for deforestation of woodland, or if appropriate also cranes.

The invention and further advantages and advantageous refinements and embodiments of the invention will be described and explained in more detail below on the basis of the figures, which show an exemplary embodiment of the invention.

In the figures:

Figure 1 is a perspective front view of a loader for the front region of a loader boom,

Figure 2 is a perspective side view of the loader from figure 1, showing the right-hand side, in relation to the forward direction of travel, of the loader boom in an enlarged illustration of a part of a pivot linkage and of an actuating device for a sensor, in a first pivot position,

Figure 3 is a perspective side view according to figure 2 in a second pivot position,

Figure 4 is a perspective side view according to figure 3 from another perspective,

Figure 5 is a cross-sectional view of the loader boom in the region according to figures 2 to 4,

Figure 6 is a perspective side view of the actuating device with sensor in an enlarged illustration,

Figure 7 is a plan view of an opening in the loader boom,

Figure 8 is a perspective side view of the opening from figure 7 on an outer side of the loader boom for a first mounting step during the mounting of the actuating device with sensor onto the loader boom,

Figure 9 is a perspective side view of the opening from figure 7 on the outer side of the loader boom for a second mounting step during the mounting of the actuating device with sensor onto the loader boom, and

Figure 10 is a perspective side view of the opening from figure 7 on an inner side of the loader boom for a third mounting step during the mounting of the actuating device with sensor onto the loader boom.

Figure 1 shows a part of a loader 10 in the form of a front loader. The front loader is operated in combination with a carrier vehicle, for example an agricultural tractor (not shown), and is normally used in the field of agriculture and construction machinery. In the case of a loader 10 being fixedly (non-detachably) mounted on a carrier vehicle, this is referred to as a wheeled loader, but within the context of this invention this is substantially equivalent to a carrier vehicle with a detachably mounted loader 10 (front loader).

The loader 10 comprises a loader boom 12 or jib. In the illustrated exemplary embodiment, the loader boom 12 comprises a first and a second boom part 14, 16 which are guided parallel to one another and are connected to one another by means of a crossbeam 18. The loader boom 12 or the jib may however also comprise only one boom part, such as may be the case for example in telescopic loaders, cranes, diggers or forestry machines.

The loader boom 12 furthermore comprises a first and a second lifting cylinder 20, 22, to which is connected a pivot linkage 24 with a tool carrier 26 extending transversely with respect to the loader boom 12. The tool carrier 26 may be equipped, via a tool receptacle 28, with a tool (not shown). In the case of wheeled loaders, for example, fixedly installed tools in the form of a scoop may be used, such that a tool carrier

26 may be dispensed with and the pivot linkage 24 engages directly on the tool.

As is also illustrated in figures 2 and 3, the pivot linkage 24 comprises, at both sides of the loader boom 12, that is to say on each boom part 14, 16, a first link 30, 32 and a second link 34, 36, these being articulatedly connected to one another at a first link point 38, 40, wherein the stated lifting cylinders 20, 22 engage on the first link point 38, 40. For dynamic and static reasons, the stated links 30, 32, 34, 36 are normally formed by flat profiles arranged spaced apart from one another in pairs, such that, at both sides of the loader boom 12, the pivot linkage 20 comprises a flat profile pair 30', 30'', 32', 32'', 34', 34'' and 36', 36'' for each of the stated links 30, 32, 34, 36. The stated links 30, 32, 34, 36 may however also be arranged as single-piece links 30, 32, 34, 36 (flat profile pairs 30', 30'', 32', 32'', 34', 34'' and 36', 36'' not arranged in pairs).

The tool carrier 26 has, at both sides, a first pivot point 42, 44 at which it is pivotably connected in each case to a boom part 14, 16 of the loader boom 12 (pivot point 42 on boom part 14, pivot point 44 on boom part 16). Furthermore, the tool carrier 26 has, at both sides, a second pivot point 46, 48 at which it is connected to the second link 34, 36 in each case at a second link point 50, 52 thereof. At a second link point 54, 56 of the first link 30, 32, said first link is pivotably connected, in each case above the connection of the tool carrier 26 to the loader boom 12 at the first pivot points 42, 44, to a boom part 14, 16 of the loader boom 12. The above-described arrangement has the effect that the tool carrier 26 can be tilted in a controlled manner with defined kinematics by the

stated lifting cylinders 20, 22 via the first and second links 30, 32, 34, 36 or via the pivot linkage 24, wherein a certain tilt angle of the tool carrier 26 is associated with a defined pivoting movement of the first and second links 30, 32, 34, 36 (see in particular figure 2 and figure 3).

For the measurement and optical and/or numerical reproduction of the pivot angle or tilt angle of the tool carrier 26, a sensor 58 is provided which is connected via an actuating device 60 to the pivot linkage 26, in particular to the first link 30 or to the flat profile 30' thereof. The sensor permits for example the reproduction of a pivot angle relative to the loader boom 12.

The actuating device 60 comprises a rotary axle A, a rotary lever 62 and a control arm 64. The rotary lever is connected rotationally conjointly to the rotary axle A, such that, by actuation of the rotary lever 62, the rotary axle A is rotated and the sensor 58 is actuated. In a known way, the sensor information is transmitted via corresponding data transfer for example by cable or radio (not shown) to a data processor or to a data display (not shown) and is displayed. The rotary axle A may transmit the angle information directly to the sensor (as in the exemplary embodiment illustrated), or a further transmission may take place in mechanical form, for example by means of a gearwheel stage. The control arm 64 is pivotably, that is to say articulatedly, connected at a joint point 66 to the rotary lever 62, and forms with the latter a pivot axle B. Furthermore, the control arm 64 is pivotably, that is to say articulatedly, fastened at a further joint point 68 to the first link 30, in particular to the

flat profile 30', as a result of which a further pivot axle C is formed.

The sensor 58 is mounted on a mounting plate 70, wherein the rotary axle A extends through an opening in the mounting plate 70 so that the actuating device 60 extends on the opposite side of the mounting plate 70. For the bearing of the rotary axle A, a bearing point 72 for bearing the rotary axle A is furthermore provided on the mounting plate 70.

The loader boom 12 has, on its inner side on the boom part 14 in the region of the pivot linkage 24, an opening 74 which, in the wall of the loader boom 12 or of the boom part 14, forms an access to a cavity 76 in the loader boom 12 or of the boom part 14. The opening 74 is formed as a slotted cutout in an oval shape and has fastening bores 78 on its long sides. The opening 74 may alternatively also be rectangular, as a rectangular cutout. The fastening bores 78 are formed as through bores.

The mounting plate 70 is likewise of oval shape, wherein the dimensions of the mounting plate are selected such that the mounting plate 70 can be inserted through the opening 74. On the short sides of the mounting plate 70 there are provided corresponding fastening bores 80 which overlap the fastening bores 78 at the opening 74. The fastening bores 80 on the mounting plate 70 are equipped with a thread, in such a way that the mounting plate 70 can be fastened to the wall of the loader boom 12, or of the boom part 14, by means of threaded screws 82 (see figures 6 and 10).

Mounting of the actuating device 60 and of the sensor 58 onto the loader boom 12 takes place in such a way

that, firstly, the sensor 58 is pre-mounted on the mounting plate 70 by screwing and the actuating device 60 is also pre-mounted at the bearing point 72 on the mounting plate 70, as shown in particular in figure 8. The sensor 58 and the mounting plate 70 are then inserted through the opening 74 into the cavity 76, as shown by figures 8 and 9. By subsequent rotation of the sensor and the mounting plate 70 in the cavity 76, the mounting plate 70 is positioned transversely with respect to the opening 74, such that the fastening bores 78, 80 overlap and the mounting plate 70 bridges the opening in terms of width (in the transverse direction). By means of the threaded screws 82, the mounting plate 70 is fastened to the wall of the loader boom 12 or of the boom part 14, wherein the threaded screw heads are situated outside the cavity 76, on the outer side of the wall, and the mounting plate 70 with sensor 58 are situated within the cavity 76, on the inner side of the wall, so that the actuating device 60, or the rotary axle A of the actuating device 60, extends through the opening 74. The sensor 58 itself is then situated in the cavity 76 of the loader boom 12 (see figure 10) and is protected against any external influences by the wall of the loader boom 12. The same applies to a cable arrangement of the sensor, which can be led conveniently through the cavity 76. As a result of connection of the control arm 64 to the first link 30 of the pivot linkage or to the flat profile 30' of the link 30 at the joint point 68, the actuating device 60 is placed in connection with the pivot linkage 24. Said connection is produced for example by means of a simple pin connection by virtue of a pin 84 formed on the control arm 64 being passed through a bore 86 formed on the first link 30 and being secured by means of a circlip 88 (see figures 4, 6, 9).

A pivoting movement of the tool carrier 26 or of a tool fastened thereto is thus transmitted by the first link 30 of the pivot linkage 24 to the control arm 64, which in turn actuates the rotary axle A via the rotary lever 62 and transmits a corresponding pivot angle signal to the sensor 58. Here, the pivot angle signal represents a pivot angle or a change in the pivot angle between the tool carrier 26 and loader boom 12. As a result of the positioning of the sensor 58 close to the pivot linkage 24, measurement errors are kept small. Furthermore, the actuating device 60 can be of compact form with a small design, such that overall, in addition to the protection of the sensor 58 provided by the wall at the cavity 76, a small engagement surface for external objects is provided, and mounting can be realised in a simple manner.

We Claim:

1. Loader (10) having a loader boom (12) and having a tool carrier (26) or tool arranged on the loader boom (12), wherein the tool carrier (26) or the tool is connected at a first pivot point (42, 44) to the loader boom (12) and at a second pivot point (46, 48) to a pivot linkage (24), wherein the pivot linkage (24) comprises a first and a second link (30, 32, 34, 36) which are pivotably connected to one another at a first link point (38, 40), and wherein the first link (30, 32) is pivotably connected at a second link point (54, 56) to the loader boom (12), and the second link (34, 36) is pivotably connected at a second link point (50, 52) at the second pivot point (46, 48) to the tool carrier (26) or to the tool, and furthermore a sensor (58) is provided by means of which a pivot angle between the tool carrier (26) or tool and loader boom (12) can be detected, characterized in that the sensor (58) is positioned in a cavity (76) on the loader (10), and an actuating device (60) is provided for the sensor (58), which actuating device extends partially through an opening (74) formed on the cavity (76) and connects the sensor (58) to the pivot linkage (24).
2. Loader (10) according to Claim 1, characterized in that the cavity (76) is formed in the loader boom (12).
3. Loader (10) according to Claim 1 or 2, characterized in that the actuating device (60) comprises a rotary axle (A) which is connected to the sensor (58), a rotary lever (62) and a control arm (64), wherein the rotary lever (62) is


connected rotationally conjointly to the rotary axle (A) and the control arm (64) pivotably connects the rotary lever (62) to the pivot linkage (24).

4. Loader (10) according to Claim 3, characterized in that the control arm (64) connects the rotary lever (62) to the first link (30, 32) of the pivot linkage (24).
5. Loader (10) according to Claim 3 or 4, characterized in that a mounting plate (70) is provided to which the sensor (58) is fastened and on which the rotary axle (A) is mounted, wherein the mounting plate (70) is fastened in the region of the opening (74) of the cavity (76) in such a way that the rotary axle (A) extends through the opening (74).
6. Loader (10) according to one of the preceding claims, characterized in that the loader (10) is in the form of a front loader, wheeled loader, telescopic loader or rear loader, wherein the loader boom (12) is in the form of a loader boom of a front loader or wheeled loader, or as a jib of a telescopic loader or rear loader.
7. Loader (10) substantially as herein described with reference to the accompanying drawings.

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