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(54) **Grapple**

(57) A grapple (200), configured to be attached to a boom (102) via a rotator unit (104), comprising: processing means for processing objects with the grapple (200), hydraulic circuitry (300) configured to control the processing means, comprising at least one input line (202) of hydraulic fluid routed through the rotator unit (104) and at least one output line (204) of hydraulic fluid routed through the rotator unit (104), electric circuitry configured to control the hydraulic circuitry (300), and configured to receive electric power from a rechargeable power supply (210) within the grapple (200), recharging means (212) for recharging the rechargeable power supply (210), and a hydraulic motor (312) connected to the hydraulic circuitry for driving the recharging means (212).

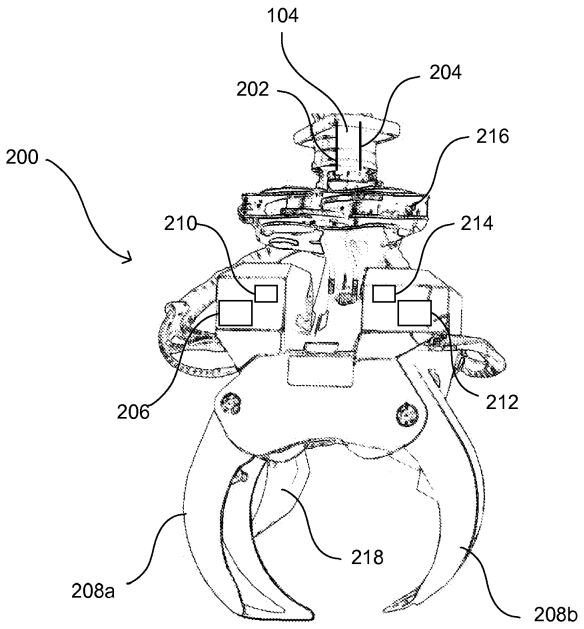

FIGURE 2

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Description

FIELD OF THE INVENTION

[0001] The invention relates to equipment and vehicles for logging, felling and handling trees, logs, or the like. More particularly, the invention relates to a grapple used to lift, move, and/or otherwise process trees, logs, so-called energy wood/clearingwood, or the like.

BACKGROUND OF THE INVENTION

[0002] In the logging industry, it is a well-known procedure to top, delimb, rough-cut, and otherwise partially process trees very close to the location where they are felled. This saves the cost of transporting entire trees, reduces the amount of waste material generated at a sawmill or a processing plant, and also makes transportation easier because the trees are in a more-or-less uniform cylindrical shape and size after topping and delimbing.

[0003] One common component used in a type of machinery used in field processing of trees is a grapple, typically attached to a moveable boom mounted for example on a skidder vehicle, a loader vehicle, a (forest) harvester vehicle, a tractor, etc. A boom can be used to move the grapple to the desired operation area in proximity of the vehicle. A grapple is a mechanism comprising processing means, such as moveable claws that enable gripping and moving objects, for handling for example trees, logs or the like.

[0004] Grapples come in different shapes and sizes, depending for example on the type of material they are designed to process and/or type(s) of task(s) they designed to perform. As an example, a grapple that is designed to process so-called energy wood/clearingwood, such as small trees, logs, brushwood, twigs, branches, etc. may be called an energy grapple. Processing means of such a grapple may include for example moveable claws and means for cutting objects. As another example, a grapple attached to a (forest) harvester vehicle may additionally include several additional processing means, such as means for delimbing trees/logs, means for moving trees/logs with respect to the grapple, means for measuring objects, etc. Such a grapple may be called a harvester head.

[0005] A grapple may be attached to a moveable boom via a rotator unit. A rotator unit enables rotating movement of the grapple with respect to the attachment to the boom.

[0006] Hydraulic circuitry is typically used to control the operation of a grapple, including controlling the processing means of the grapple. The input and output lines of hydraulic circuitry can be conveniently routed through the rotator unit. This arrangement enables a design in which the hudraulic circuitry does not limit the rotating movement of a grapple attached to a rotation unit.

[0007] Electric circuitry may be used to control the operation of the hydraulic circuitry, e.g. to control the hydraulic valves and/or other components of the hydraulic circuitry. Furthermore, electricity may also be used for other purposes in the grapple, for example to operate measurement means in a harvester head.

[0008] The electric circuitry may be powered by a power supply that is external to the grapple. The power input to the grapple may be provided via one or more power cables connecting directly to the grapple. Furthermore, the commands for controlling the electric circuitry of the grapple may be provided via the one or more electric cables. While this is a well-working conventional approach enabling power supply and other electric connections to the grapple, the drawback of this solution is that the power cables and the electric cables are likely to limit the rotating movement of the grapple. Furthermore, the cables may get tangled to external objects, making it suspectible for breakage.

[0009] Alternatively, the grapple may comprise a battery to provide power to the electric circuitry. In this approach the commands for controlling the electric circuitry of the grapple may be provided e.g. by wireless communication means. This approach enables a structure that does not require connecting external electric cables to enable controlling the electric circuitry of the grapple. Benefits of such a structure include that the electric cables are not there to limit the rotating movement of the grapple and the risk of entanglement and/or breakage of electric cables is avoided. On the other hand, a drawback of this approach is the limited capacity of the battery comprised in the grapple, which is likely to limit the operation time of the grapple and, consequently, the operation time of the vehicle or device making use of the grapple.

[0010] Accordingly, it is an object of the invention to provide a mechanism that enables both a free rotation movement of a grapple and a prolonged operation time of the grapple.

SUMMARY OF THE INVENTION

[0011] According to a first aspect of the present invention, there is provided a grapple, configured to be attached to a boom via a rotator unit, comprising: processing means for processing objects with the grapple, hydraulic circuitry configured to control the processing means, comprising at least one input line of hydraulic fluid routed through the rotator unit and at least one output line of hydraulic fluid routed through the rotator unit, electric circuitry configured to control the hydraulic circuitry, and configured to receive electric power from a rechargeable power supply within the grapple, recharging means for recharging the rechargeable power supply, and a hydraulic motor connected to the hydraulic circuitry for driving the recharging means.

[0012] According to a second aspect of the present invention, there is provided a vehicle, comprising a grapple according to the first aspect of the present invention.

[0013] According to a third aspect of the present in-

vention, there is provided a conversion kit for modifying a grapple into a grapple according to the first aspect of the present invention, comprising recharging means for recharging the rechargeable power supply, and a hydraulic motor to be connected to the hydraulic circuitry for driving the recharging means.

[0014] According to a fourth aspect of the present invention, there is provided a method for supporting operation of a grapple, the grapple being configured to be attached to a boom via a rotator unit, wherein the grapple comprises: processing means for processing objects with the grapple, hydraulic circuitry configured to control the processing means, comprising at least one input line of hydraulic fluid routed through the rotator unit and at least one output line of hydraulic fluid routed through the rotator unit, electric circuitry configured to control the hydraulic circuitry, and configured to receive electric power from a rechargeable power supply within the grapple, operating a hydraulic motor using hydraulic fluid of the hydraulic circuitry, driving a recharger using the hydraulic motor, and recharging the rechargeable power supply using the recharger.

[0015] Advantages of embodiments of the invention include prolonged operation time of a grapple without compromising the freedom of rotating movement of the grapple.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIGURE 1 provides a schematic illustration of a vehicle equipped with a grapple according to an embodiment of the invention.

FIGURE 2 provides a schematic illustration of a grapple according to an embodiment of the invention.

FIGURE 3 provides an example of a hydraulic circuit diagram illustrating a hydraulic circuit according to an embodiment of the invention.

FIGURE 4 shows a flowchart providing an example of a method according to an embodiment of the invention.

DETAILED DESCRIPTION

[0017] In the following, the invention will be described in greater detail with a reference to various embodiments of the invention and the accompanying drawings.

[0018] FIGURE 1 provides a schematic illustration of an example of a vehicle (100) comprising a grapple (200) according to an embodiment of the invention.

[0019] A moveable boom (102) is mounted on the vehicle (100), and the grapple (200) is attached to the boom (102) via a rotator unit (104). The vehicle may be for example a skidder vehicle, a loader vehicle, a (forest) harvester vehicle, a tractor, or any other vehicle suitable for mounting a boom to which a grapple can be attached.

[0020] The operation and movement of the boom (102) and the grapple (200) are controlled by the operator of the vehicle (100), typically from the cabin of the vehicle. However, it is possible that the control mechanism of the boom (102) and/or the grapple (200) is placed somewhere else in the vehicle (100) or outside the vehicle. The boom (102) may be used to move the grapple (200) to the desired operation area in proximity of the vehicle (100). Once positioned in the desired area in relation to the vehicle (100), the grapple (200) may be operated to grip and move objects, such as trees, logs, firewood, or the like.

[0021] The movements of the grapple (200) are actuated by hydraulic circuitry, controlled by electric circuitry. To this end, the grapple (200) comprises hydraulic circuitry (not shown) configured to control the processing means for processing objects with the grapple, the hydraulic circuitry having at least one input line (202) of hydraulic fluid routed through the rotator unit (104) and at least one output line (204) of hydraulic fluid routed through the rotator unit (104). At least one of the at least one input line (202) of hydraulic fluid may be connected to a first external hydraulic input line (106), such as a pressure line (P), to provide pressurized hydraulic fluid to the grapple (200), and at least one of the at least one output line (204) of hydraulic fluid may be connected to a first external hydraulic output line (108), such as a tank line (T), to provide a return line for the hydraulic fluid. Both the first external hydraulic input line (106) and the first external hydraulic output line (108) are routed to the rotator unit (104) for example via the boom (102).

[0022] The grapple (200) comprises electric circuitry (not shown) configured to control the hydraulic circuitry, which may be controlled by commands provided to the electric circuitry comprised in the grapple (200) over a wireless communication channel (110) by wireless communication means. The wireless communication channel (110) may operate for example on suitable radio frequencies. Such a remote control system makes use of transmission means (112) comprised in the vehicle (100), for example in the cabin of the vehicle, for providing commands controlling the electric circuitry configured to control the hydraulic circuitry comprised in the grapple. Furthermore, the grapple (200) comprises corresponding receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry.

[0023] FIGURE 2 provides a schematic illustration of a grapple (200) according to an embodiment of the invention. The grapple (200) is configured to be attached to a mechanism holding the grapple (200), such as a boom mounted on a vehicle, via a rotator unit (104). The rotator unit (104) is configured to enable rotating movement of the grapple (200) with respect to the attachment to the mechanism holding the grapple (200).

[0024] The grapple (200) comprises processing

means for processing objects with the grapple (200), such as trees, logs, firewood, or the like.

[0025] According to an embodiment of the invention, the processing means for processing objects with the grapple (200) comprise first moveable claws (208a, 208b) for gripping objects. The first moveable claws (208a, 208b) may comprise one or more pairs of moveable claws. A pair of moveable claws comprises a pair of opposed moveable claws that can be pivoted between an open position and a closed position for releasing and gripping objects, respectively. Each claw in a pair of opposed moveable claws can be pivoted about a dedicated axis (as shown in Figure 2 for first moveable claws (208a, 208b)) or claws of the pair of opposed moveable claws may be pivoted about a common axis (not shown). As a further example, the first moveable claws (208a, 208b) may comprise one or more pairs of claws that can be pivoted between an open position and a closed position, a pair comprising a moveable claw that can be pivoted about an axis and a non-moveable claw.

[0026] According to an embodiment of the invention, the first moveable claws (208a, 208b) are attached to the body of the grapple (200). In another embodiment the first moveable claws (208a, 208b) are attached to a lower part of the grapple (200), which is moveable with respect to the body of the grapple (200).

[0027] The grapple (200) comprises hydraulic circuitry (300) configured to control the processing means comprised in the grapple (200).

[0028] According to an embodiment of the invention, the hydraulic circuitry (300) configured to control the processing means is configured to control the first moveable claws (208a, 208b). The hydraulic circuitry (300) comprises at least one input line (202) of hydraulic fluid routed through the rotator unit (104) and at least one output line (204) of hydraulic fluid routed through the rotator unit. According to an embodiment of the invention, at least one of the at least one input line (202) of hydraulic fluid is connected to a first external hydraulic input line (106), such as a pressure line (P), to provide pressurized hydraulic fluid to the grapple (200), and at least one of the at least one output line (204) of hydraulic fluid is connected to a first external hydraulic output line (108), such as a tank line (T), to provide a return line for the hydraulic fluid.

[0029] According to embodiments of the invention, the hydraulic circuitry (300) comprised in the grapple (200) may make use of any type of hydraulic fluid. At present, hydraulic fluid typically comprises hydraulic oil. However, other types of hydraulic fluids may be used within the embodiments of the invention, for example hydraulic fluids comprising water or a combination of oil and water may be used. Furthermore, hydraulic fluids under research and development, such as electrorheological (ER) and magnetorheological (MR) fluids responsive to electricity or to a magnetic field, respectively, are equally well applicable as hydraulic fluid within various embodiments of the invention.

[0030] The grapple (200) comprises electric circuitry (not shown) configured to control the hydraulic circuitry (300). The components of the hydraulic circuitry (300) are, in turn, controlled by commands received at the grapple (200). To this end, the grapple (200) comprises receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry (300). The commands may be received for example over a wireless communication channel (110) operating on suitable radio frequencies.

[0031] According to an embodiment of the invention, the electric circuitry configured to control the hydraulic circuitry (300) comprises the receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry (300).

[0032] According to an embodiment of the invention, electric circuitry comprising the receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry (300) is separate from the electric circuitry configured to control the hydraulic circuitry (300).

[0033] According to an embodiment of the invention, the grapple (200) comprises a first electric circuitry configured to control the hydraulic circuitry and a second electric circuitry comprising receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry (300). The first electric circuitry and the second electric circuitry may be electrically coupled to each other.

[0034] In embodiments of the invention, the electric circuitry comprised in the grapple (200) may comprise a further electric circuitry in addition to the electric circuitry configured to control the hydraulic circuitry (300) and/or the electric circuitry comprising the receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry (300). The further electric circuitry may or may not be electrically coupled to the electric circuitry configured to control the hydraulic circuitry (300) and/or the electric circuitry comprising the receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry (300).

[0035] Note that in the following, unless explicitly stated otherwise, the term electric circuitry is used to refer to a single electric circuitry comprised in the grapple (200) or to jointly refer to one or more electric circuitries comprised in the grapple (200), such as the first electric circuitry configured to control the hydraulic circuitry (300) and the second electric circuitry comprising receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry (300).

[0036] Electric circuitry comprised in the grapple (200) is configured to receive electric power from a rechargeable power supply (210) within the grapple (200).

[0037] According to an embodiment of the invention, the grapple (200) comprises a rechargeable power supply (210) for providing power for the electric circuitry. The

rechargeable power supply (210) may be a battery, an accumulator, or any other suitable means known in the art for providing power to an electric circuitry. In an embodiment of the invention, the battery or the accumulator comprised in the grapple (200) may provide voltage of 12 volts and electric charge of 14 ampere-hours.

[0038] According to embodiments of the invention, the rechargeable power supply (210) may comprise one or more rechargeable power supply units, e.g. one more batteries or accumulators. Furthermore, according to embodiments of the invention, the grapple (200) may further comprise one or more non-rechargeable power supplies for providing power to the electric circuitry in addition to or as a (short-term) alternative to the rechargeable power supply (210).

[0039] According to an embodiment of the invention, a unit of the rechargeable power supply (210) comprised in the grapple (200) may be configured to supply power for all electric circuitries of the grapple (200), for example for the electric circuitry configured to control the hydraulic circuitry (300) and for the electric circuitry comprising the receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry (300). Furthermore, in an embodiment, a unit of the rechargeable power supply (210) comprised in the grapple (200) may be further configured to supply power for any additional element(s) and/or electric circuitries that may be comprised in the grapple (200).

[0040] In an embodiment of the invention, a unit of the rechargeable power supply (210) comprised in the grapple (200) may be configured to supply power for a subset of electric circuitries of the grapple (200), for example for the electric circuitry configured to control the hydraulic circuitry (300), for the electric circuitry comprising the receiving means (206) for receiving commands controlling the electric circuitry configured to control the hydraulic circuitry (300), or for any additional element or electric circuitry that may be comprised in the grapple (200).

[0041] According to an embodiment of the invention, an external power supply may be used to supply power for a subset of electric circuitries of the grapple (200), for example for the electric circuitry configured to control the hydraulic circuitry (300).

[0042] The external power supply may be connected to the grapple (200) with one or more power cables or using other suitable means.

[0043] According to an embodiment of the invention, the grapple (200) comprises recharging means (212) for recharging the rechargeable power supply (210). The recharging means (212) are coupled to the rechargeable power supply (210) to enable recharging. The output characteristics of the electricity provided by the recharging means (212) are preferably matched with those of the rechargeable power supply (210). In an embodiment of the invention, recharging means (212) are configured to provide voltage of 12 volts for a rechargeable battery or for a rechargeable accumulator.

[0044] According to an embodiment of the invention, the grapple (200) comprises means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) for driving the recharging means (212). In an embodiment, the hydraulic circuitry (300) comprises the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214). The means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) are operatively connected to the recharging means (212) to enable driving the recharging means (212).

[0045] According to an embodiment of the invention, means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) comprises a hydraulic motor that uses the flow of hydraulic fluid of the hydraulic circuitry (300) to provide a rotating movement. In embodiments of the invention, almost any type of hydraulic motor known in the art may be used. In an embodiment of the invention, a hydraulic motor of 12.5 cubic centimeters may be used.

[0046] According to an embodiment of the invention, the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) are connected to the hydraulic circuitry (300) in the output line of hydraulic fluid. A benefit of this approach is that the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) may be powered by the hydraulic fluid of the hydraulic circuitry (300) and therefore there is no need to provide an additional power source for the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214). Another benefit of this embodiment is that when connecting the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) to the hydraulic circuitry (300) in the output line of hydraulic fluid the pressure of the hydraulic circuitry in the input line of the hydraulic fluid is not reduced, thereby not reducing the power available for the processing means for processing objects with the grapple (200).

[0047] According to an embodiment of the invention, the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) are connected to the hydraulic circuitry (300) in the input line of hydraulic fluid.

[0048] According to an embodiment of the invention, the hydraulic circuitry (300) may comprise a subsection dedicated for generating power for driving the recharging means (212). In this embodiment, an input line of the at least one input line (202) of hydraulic fluid associated with the dedicated subsection of the hydraulic circuitry (300) is connected to a first external hydraulic input line (106) or another hydraulic input line (not shown). Similarly, an output line of the at least one output line (204) of hydraulic fluid associated with the dedicated subsection of the hydraulic circuitry (300) is connected to a first external hydraulic output line (108) or another hydraulic output line (not shown). It should be noted that the dedicated subsection of the hydraulic circuitry (300) discussed above can be equally well considered as a sec-

ond hydraulic circuitry configured to generate power for driving the recharging means (212). The second hydraulic circuitry may or may not be coupled to the hydraulic circuitry (300). A benefit of this approach is that the hydraulic circuitry comprised in the grapple (200) may be configured to power the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) without affecting the function of the hydraulic circuitry (300).

[0049] According to an embodiment of the invention, the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214), such as a hydraulic motor (312), are connected to the hydraulic circuitry (300) via a pressure reducing valve (314) in order to control, e.g. to limit or to reduce, the pressure of the hydraulic fluid provided as input to the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214).

[0050] According to an embodiment of the invention, the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214), such as a hydraulic motor (312), are connected to the hydraulic circuitry (300) in parallel to a pressure reducing valve (314) in order to control, e.g. to limit or to reduce, the pressure of the hydraulic fluid provided as input to the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214).

[0051] According to an embodiment of the invention, the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214), such as a hydraulic motor (214), are operatively connected to the recharging means (212) to enable driving the recharging means (212) via a gear mechanism, such as a belt drive, to control, e.g. to limit or to reduce, the rotation speed of the recharging means (212). In embodiments of the invention, any suitable gear ratio may be used. A suitable gear ratio may depend on the characteristics of the recharging means (212) and/or the characteristics of the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214). In an embodiment of the invention, a gear ratio of 3.1:1 may be used.

[0052] According to an embodiment of the invention, the processing means for processing objects with the grapple (200) further comprise means for cutting objects (218). Furthermore, the hydraulic circuitry (300) configured to control the processing means is further configured to control the means for cutting objects (218).

[0053] According to an embodiment of the invention, the means for cutting objects (218) comprise a blade, such as a knife or the like. In an embodiment of the invention, the means for cutting objects comprises a saw, such as a chain saw or a buzz saw or the like. The means for cutting objects (218) may be used for example to fell trees or the like and/or to cut felled trees, logs or the like.

[0054] According to an embodiment of the invention, the processing means for processing objects with the grapple (200) further comprise second moveable claws (216) for gripping objects. The description with respect to the first moveable claws (208a, 208b) for gripping objects above also applies to the second moveable claws (216). Furthermore, the hydraulic circuitry (300) configured to control the processing means is further configured to control the second moveable claws (216) for gripping objects. The second moveable claws (216) may be configured to be used as accumulating claws for holding a number of objects processed using the first moveable claws (208a, 208b).

[0055] According to an embodiment of the invention, the processing means for processing objects with the grapple (200) further comprise means for tilting the first moveable claws (208a, 208b). Furthermore, the hydraulic circuitry (300) configured to control the processing means is further configured to control the means for tilting the first moveable claws (208a, 208b).

[0056] In an embodiment of the invention where the first moveable claws (208a, 208b) are attached to the body of the grapple (200), the means for tilting the first moveable claws (208a, 208b) are configured to tilt the grapple (200) with respect to the rotator unit (104). In an embodiment of the invention where the first moveable claws (208a, 208b) are attached to a lower part of the grapple (200), which is moveable with respect to the body of the grapple (200), the means for tilting the first moveable claws (208a, 208b) may be configured to tilt the lower part of the grapple (200) with respect to the body of the grapple (200).

[0057] According to an embodiment of the invention, the processing means for processing objects with the grapple (200) may comprise further processing means, such as means for delimbing trees or logs, feed rollers for moving objects (trees, logs, or the like) with respect to the body of the grapple (200), and/or means for measuring a length of an object being processed by the grapple (200). Furthermore, the hydraulic circuitry (300) configured to control the processing means may be further configured to control respective further processing means.

[0058] A grapple (200) according to an embodiment of the invention may be for example an energy grapple, a saw grapple, or a harvester head.

[0059] A conversion kit for modifying a grapple into a grapple according to an embodiment of the invention may be provided, comprising recharging means (212) for recharging a rechargeable power supply (210) and means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214), such as a hydraulic motor, to be connected to the hydraulic circuitry (300) for driving the recharging means.

[0060] FIGURE 3 provides an example of a hydraulic circuit diagram illustrating a hydraulic circuitry (300) configured to control the processing means comprised in the grapple (200) according to an embodiment of the invention.

[0061] The example hydraulic circuitry of Figure 3 comprises a first subsection (302) configured to control the first moveable claws (208a, 208b) for gripping objects, a second subsection (304) configured to control the means

for cutting objects (218), a third subsection (306) configured to control the second moveable claws (216) for gripping objects and a fourth subsection (308) configured to control the means for tilting the first moveable claws (208a, 208b).

[0062] The example hydraulic circuitry of Figure 3 further comprises an input line (202) of hydraulic fluid and an output line (204) of hydraulic fluid, routed through the rotator unit (104).

[0063] The example hydraulic circuitry of Figure 3 further comprises a fifth subsection (310), comprising a hydraulic motor (312) connected to the hydraulic circuitry in the output line (204) of hydraulic fluid for driving the recharging means (212), in parallel to a pressure reducing valve (314). Furthermore, also a non-return valve (316) is connected to the fifth subsection (310) comprised in the hydraulic circuitry in parallel to the pressure reducing valve (314).

[0064] Figures 1 to 3 illustrate the functional elements of a grapple according to one or more embodiments of the invention. Consequently, the sizes, positions and the relationships between the sizes and positions of various elements comprised in Figures 1 to 3 are merely illustrative and may be varied without departing from the scope of the invention.

[0065] FIGURE 4 illustrates a flowchart providing an example of a method (400) for supporting operation of a grapple (200) according to an embodiment of the invention.

[0066] The method (400) comprises operating means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214), for example operating a hydraulic motor (312) using hydraulic fluid of the hydraulic circuitry to provide a rotating movement, as indicated in step 402. The means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) may comprise making use of the flow of the hydraulic fluid from the output line of hydraulic fluid. Furthermore, the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) may comprise routing the hydraulic fluid via a pressure reducing valve (314), for example by connecting the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214) in the hydraulic circuitry in parallel to a pressure reducing valve.

[0067] The method (400) further comprises driving recharging means (212) using the means for transforming the flow of hydraulic fluid of a hydraulic circuitry into movement (214), for example driving a recharger using the hydraulic motor, as indicated in step 404.

[0068] The method (400) further comprises using the recharging means (212) to recharge a rechargeable power supply (210), for example recharging a rechargeable power supply using the recharger, as indicated in step 406.

[0069] Although the steps of a method (400) for supporting operation of a grapple (200) according to an embodiment of the invention in Figure 4 are illustrated as a sequence of steps (402, 404, 406) comprised in the method (400), it should be clear for a skilled person that the steps (402, 404, 406) merely illustrate the functional relationship therebetween, not necessarily a sequential order of processing steps (402, 404, 406).

[0070] The foregoing description of embodiments of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the present invention to the precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of the present invention. The embodiments were chosen and described in order to explain the principles of the present invention and its practical application to enable one skilled in the art to utilize the present invention in various embodiments and with various modifications as are suited to the particular use contemplated. Various modifications and adaptations may become apparent to those skilled in the relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings and the appended claims. However, all such and similar modifications of the teachings of this invention will still fall within the scope of this invention as defined in the appended claims.

[0071] In this invention, the terms "comprising", "to comprise" and derivatives thereof are used to indicate an open-ended structure. I.e. an entity comprising a specified element or function may or may not comprise any number of further elements or functions.

Claims

1. A grapple (200), configured to be attached to a boom (102) via a rotator unit (104), comprising:

- processing means for processing objects with the grapple (200),
- hydraulic circuitry (300) configured to control the processing means, comprising at least one input line (202) of hydraulic fluid routed through the rotator unit (104) and at least one output line (204) of hydraulic fluid routed through the rotator unit (104),
- electric circuitry configured to control the hydraulic circuitry (300), and configured to receive electric power from a rechargeable power supply (210) within the grapple (200),

characterized in that the grapple comprises

- recharging means (212) for recharging the rechargeable power supply (210), and
- a hydraulic motor (312) connected to the hydraulic circuitry for driving the recharging means (212).

2. A grapple according to claim 1, wherein the hydraulic motor is connected to the hydraulic circuitry in the output line of hydraulic fluid.

3. A grapple according to claim 1 or 2, further comprising a rechargeable power supply for providing power for the electric circuitry.

4. A grapple according to any of claims 1 to 3, further comprising receiving means for receiving commands controlling the electric circuitry.

5. A grapple according to any of claims 1 to 4, wherein the processing means comprise first moveable claws for gripping objects.

6. A grapple according to any of claims 1 to 5, wherein the processing means comprise means for cutting objects.

7. A grapple according to claim 6, wherein the means for cutting objects comprise at least one of a blade and a saw.

8. A grapple according to any of claims 1 to 7, wherein the processing means comprise second moveable claws for gripping objects.

9. A grapple according to any of claims 1 to 8, wherein the processing means comprise means for tilting the first moveable claws.

10. A grapple according to any of claims 1 to 9, wherein the grapple is an energy grapple.

11. A grapple according to any of claims 1 to 9, wherein the grapple is a harvester head.

12. A vehicle, comprising a grapple according to any of claims 1 to 11.

13. A conversion kit for modifying a grapple into a grapple (200) according to any of claims 1 to 12, comprising

- recharging means (212) for recharging the rechargeable power supply, and
- a hydraulic motor (312) to be connected to the hydraulic circuitry for driving the recharging means (212).

14. A method for supporting operation of a grapple (200), the grapple (200) being configured to be attached to a boom (102) via a rotator unit (104), wherein the grapple (200) comprises:

- processing means for processing objects with the grapple (200),
- hydraulic circuitry (300) configured to control the processing means, comprising at least one input line (202) of hydraulic fluid routed through the rotator unit (104) and at least one output line (204) of hydraulic fluid routed through the rotator unit (104),
- electric circuitry configured to control the hydraulic circuitry, and configured to receive electric power from a rechargeable power supply (210) within the grapple (200),

characterized in that the method comprises

- operating a hydraulic motor (312) using hydraulic fluid of the hydraulic circuitry,
- driving a recharger (212) using the hydraulic motor (312), and
- recharging the rechargeable power supply (210) using the recharger (212).

15. A method according to claim 14, wherein using the hydraulic fluid comprises using the hydraulic fluid from the output line of hydraulic fluid.

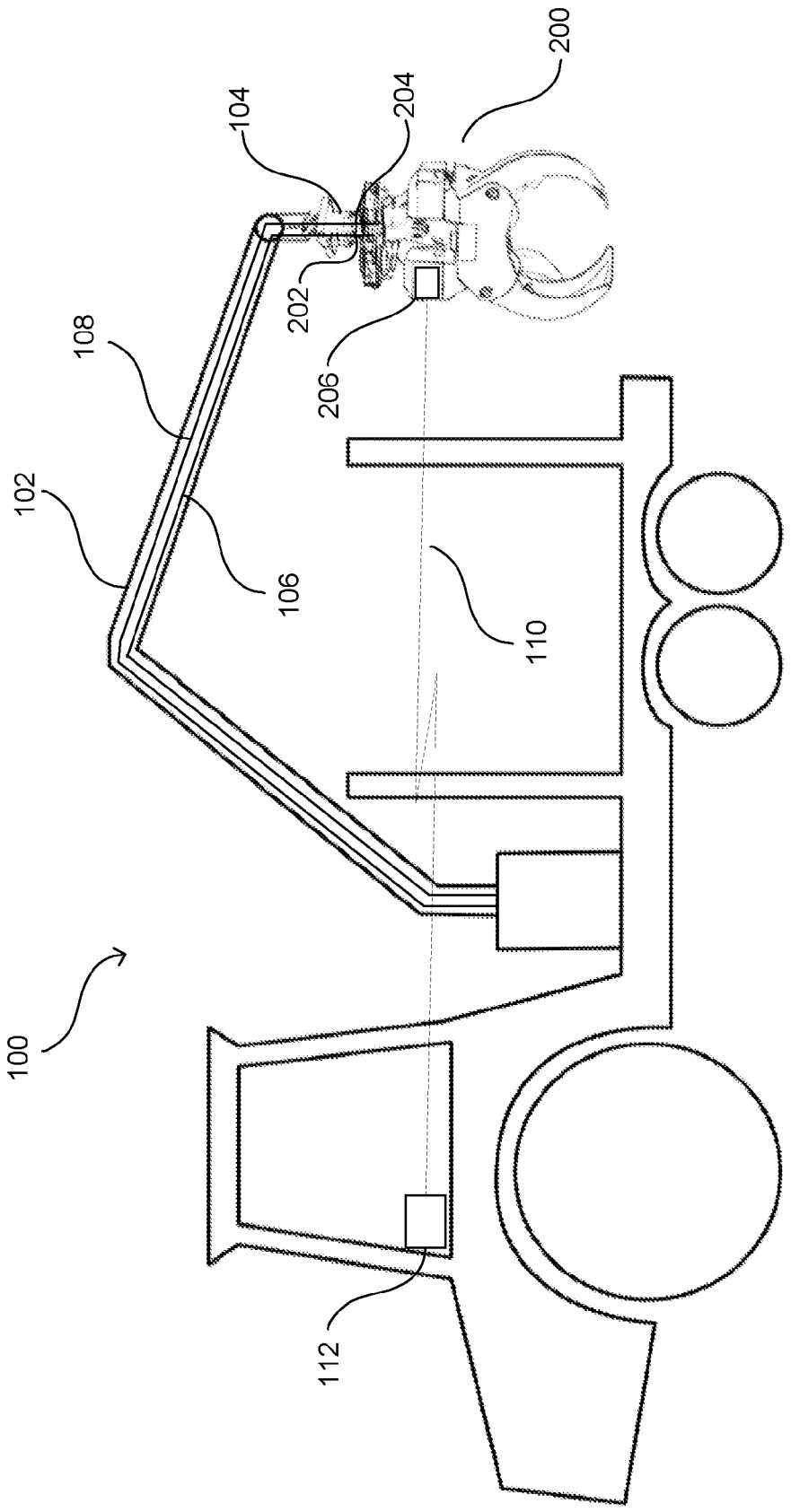

FIGURE 1

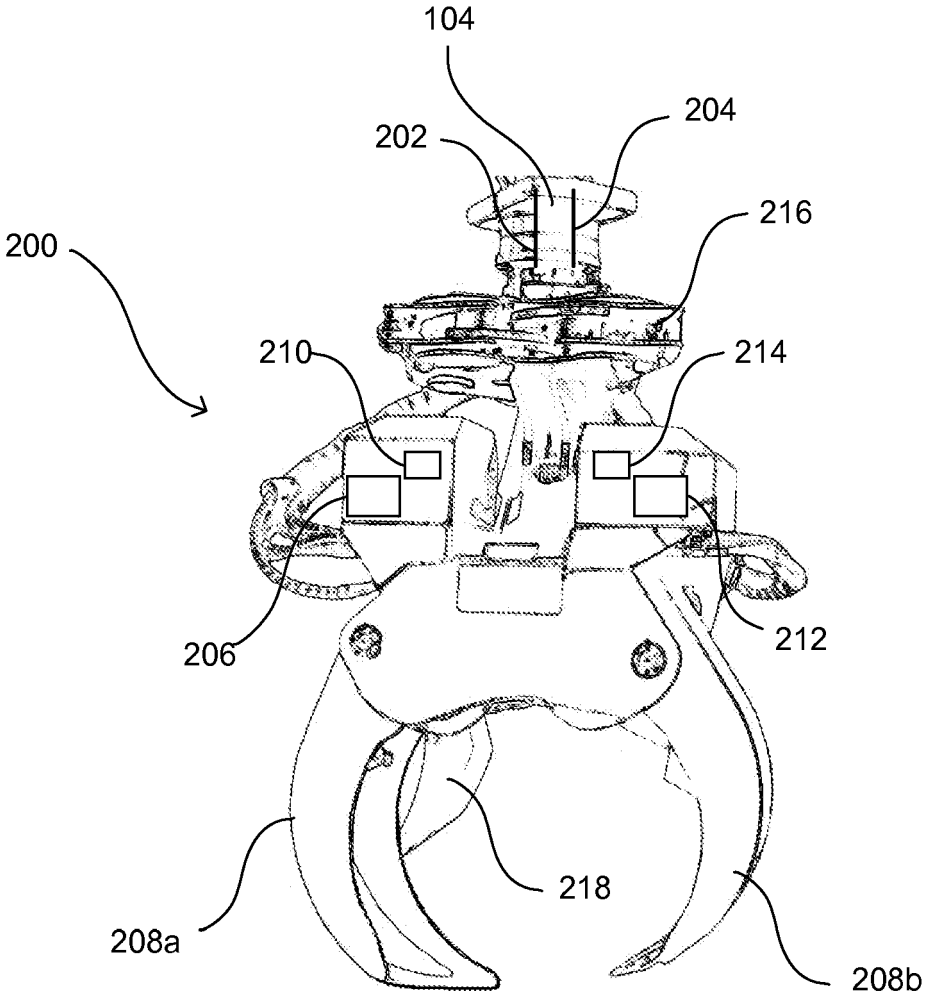

FIGURE 2

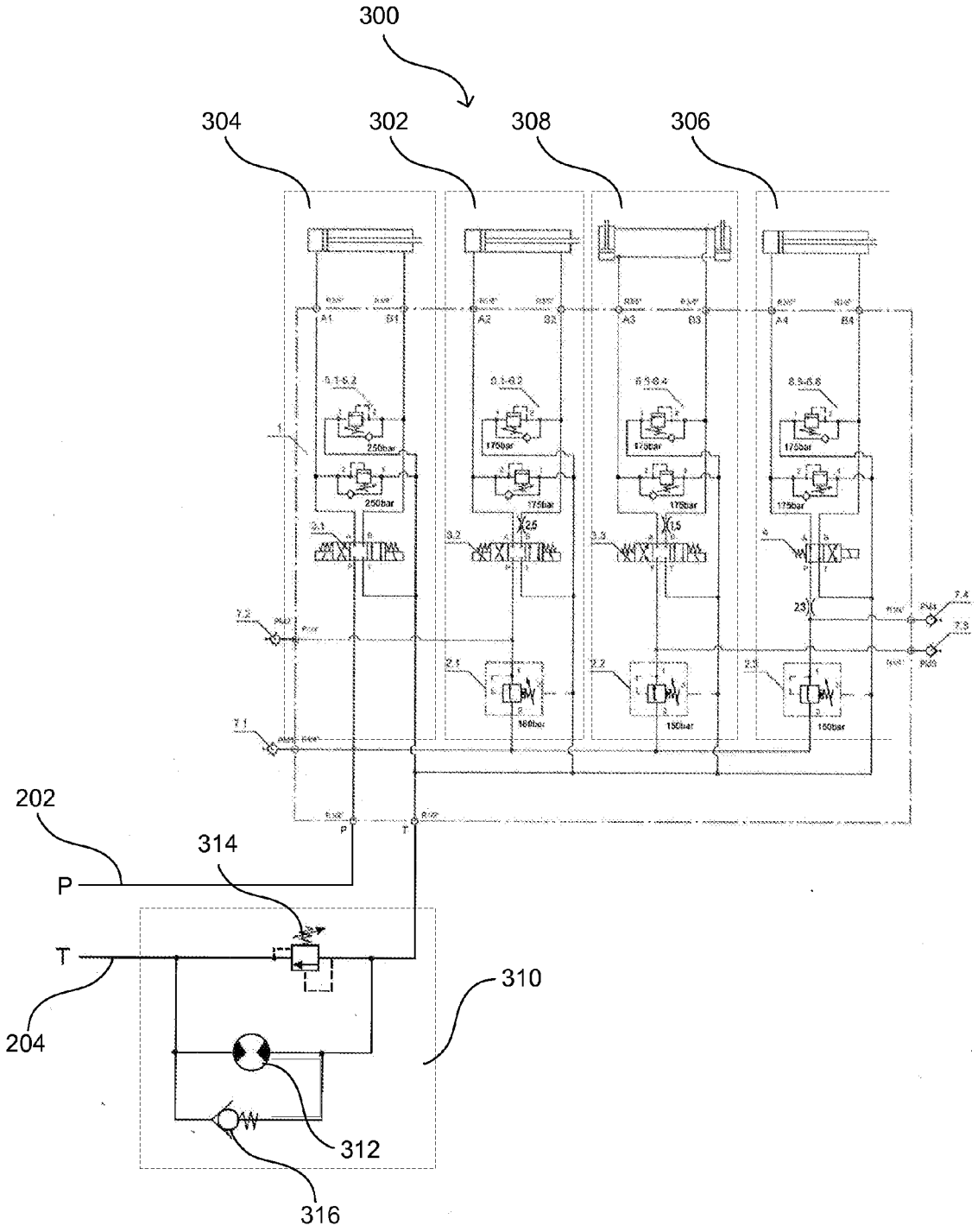

FIGURE 3

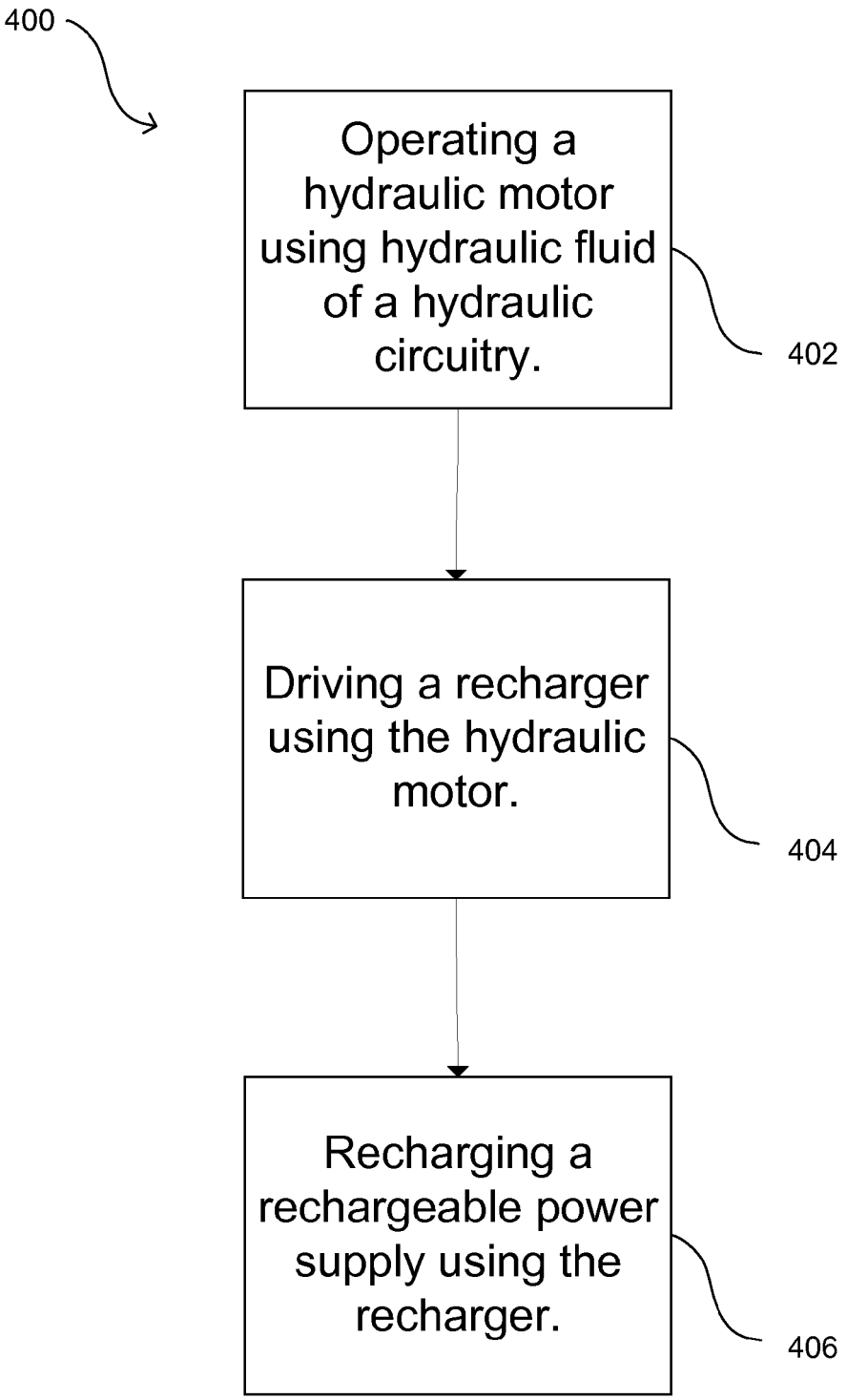
400
Operating a hydraulic motor using hydraulic fluid of a hydraulic circuitry.
402
Driving a recharger using the hydraulic motor.
404
Recharging a rechargeable power supply using the recharger.
406

FIGURE 4

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EUROPEAN SEARCH REPORT

Application Number
EP 10 15 8938

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2005/064090 A2 (HOLP GMBH [DE]; HOLP GUENTER [DE]) 14 July 2005 (2005-07-14) * abstract; figures 1,2 * -----	1	INV. B66C1/58
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TECHNICAL FIELDS SEARCHED (IPC)

B66C
B66D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 August 2010	Faymann, L

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23-08-2010

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