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(71) Applicant: **JB Attachments Limited**
Auckland 2104 (NZ)

(72) Inventor: **RAVINDRAN, Surajith**
2013 East Tamaki Auckland (NZ)

(74) Representative: **Heinze, Ekkehard**
Meissner Bolte Patentanwälte
Rechtsanwälte Partnerschaft mbB
Postfach 86 06 24
81633 München (DE)

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(54) **A COUPLER**

(57) A coupler assembly (161) for coupling implements having a first connecting pin (97) and a second connecting pin (95), to a vehicle, the coupler assembly having; a first recess (37) for receiving the first connecting pin, a second recess (41) for receiving the second connecting pin, a first locking member (185) for securing the first connecting pin within the first recess, a hydraulic system including at least one actuator (43) configured to enable the coupler assembly to positively engage with the first and second connecting pins of an implement, and the hydraulic system also including at least one hydraulic manifold block (167); characterised in that the coupler assembly also includes a hydraulic first lock actuator (165) which is supported on, and receives a hydraulic supply from, the hydraulic manifold block.

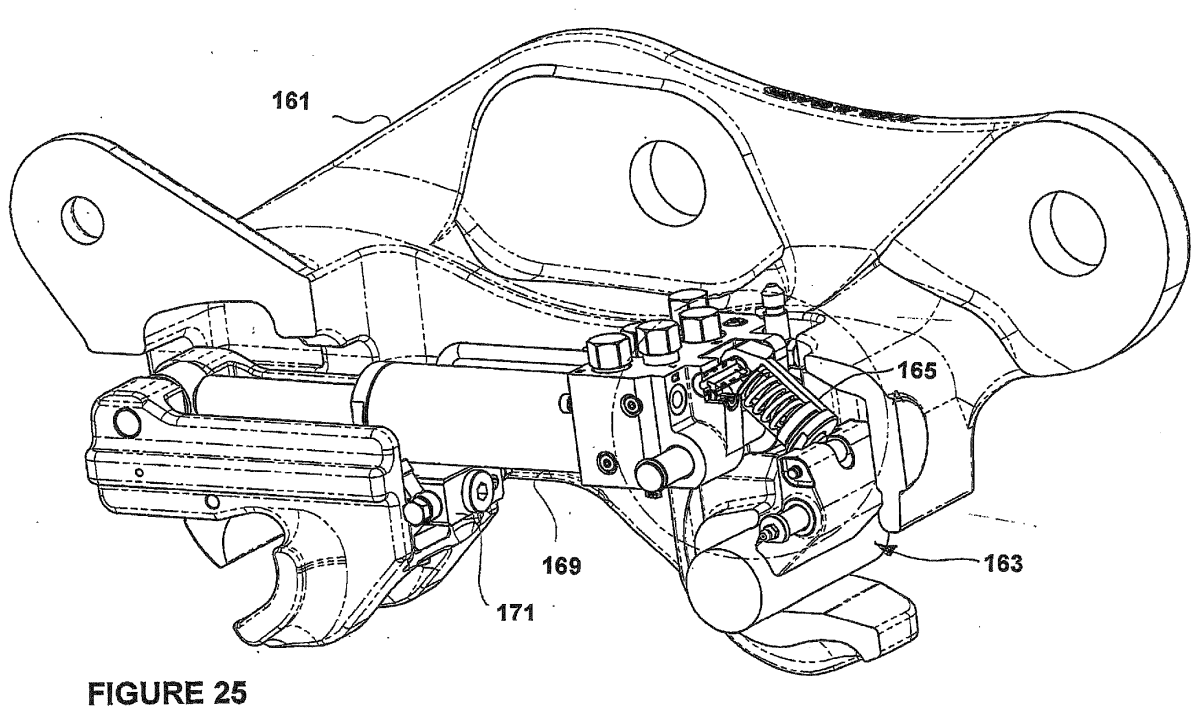


FIGURE 25

EP 3 321 427 A1

Description

FIELD OF THE INVENTION

[0001] This invention relates to a coupler, and in particular, but not exclusively to a coupler for attaching work implements to the arm or boom of an excavator or similar vehicle.

BACKGROUND

[0002] Couplers are often used to connect work attachments or implements to the booms of excavators, diggers, back hoes, etc. The couplers are sometimes also referred to as "quick hitches", or "pin grabber" couplers as they grab the two connecting pins that are attached to many attachments for the purpose of connecting the attachment to an arm.

[0003] The couplers allow implements to be changed quickly and efficiently by being able to release the connecting pins of one implement, and to grab the connecting pins of another, using remotely controlled hydraulic actuators on the coupler.

[0004] The ability to quickly change implements however, has lead to an increasing number of accidents involving implements coming loose, or falling from diggers etc. Most couplers today will have a safety locking feature that will hold one of the pins of an implement if the coupler fails, or if the other pin comes free for some reason.

[0005] Experience shows that a single safety lock feature is not sufficient. Accidents are still occurring as a result of the use of these quick change couplers having a single safety feature. While it is possible to add additional safety locks, the locks need to be robust to withstand the harsh environment and rough treatment that couplers experience at the end of an excavator arm. For example, dirt or other foreign matter can accumulate within coupler components which may affect the operation of the coupler or its safety features. For this reason any additional safety locks need to be relatively simple and durable, to ensure high levels of reliability of the locks.

[0006] There are also limitations concerning the number of hydraulic lines that are used to control hydraulic couplers. Simply adding additional lines for each additional safety lock is not always convenient and can be costly to install and maintain. There is a requirement to provide additional safety features without the need for additional hydraulic lines.

[0007] In this specification unless the contrary is expressly stated, where a document, act or item of knowledge is referred to or discussed, this reference or discussion is not an admission that the document, act or item of knowledge or any combination thereof was at the priority date, publicly available, known to the public, part of common general knowledge; or known to be relevant to an attempt to solve any problem with which this specification is concerned.

OBJECT

[0008] It is therefore an object of the present invention to provide a coupler which will at least go some way towards overcoming one or more of the above mentioned problems, or at least provide the public with a useful choice.

STATEMENTS OF THE INVENTION

[0009] Accordingly, in a first aspect, the invention may broadly be said to consist in a coupler assembly for coupling implements having a first connecting pin and a second connecting pin, to a vehicle, the coupler having;
a body component that is connectable to the vehicle, and which includes a forward recess for receiving the first connecting pin,
a movable component which is supported by the body component and which is movable through a range of travel relative to the body component, and which includes, or forms a part of, an aft recess for receiving the second connecting pin, and,
a movable component actuator for selectively moving the movable component relative to the body component,
a rear locking member which is a part of the movable component and which is movable relative to the movable component between an extended position in which the rear locking member prevents the second connecting pin from exiting the aft recess and a retracted position in which the rear locking member does not prevent the second connecting pin exiting the aft recess,
and a rear lock actuator for moving the rear locking member between its extended and retracted positions.

[0010] Preferably a connection between the rear lock actuator and the rear locking member includes a link member.

[0011] Preferably the rear locking member and the link member are configured in such a manner that;
an initial range of movement of the link member pushes the rear locking member from its retracted position to its extended position, and
a second and further range of movement of the link member positions a stop member which prevents movement of the rear locking member away from its extended position.

[0012] Preferably the stop member is a part of the link member.

[0013] Preferably the rear lock actuator is mounted on the movable component.

[0014] Preferably the movable component slides relative to the body component.

[0015] Preferably the link member slides relative to the movable component.

[0016] Preferably the rear locking member is pivotally connected to the movable component.

[0017] Preferably the coupler further includes a forward locking member which is movable relative to the body component between an extended position in which

the forward locking member prevents the first connecting pin from exiting the forward recess and a retracted position in which the forward locking member does not prevent the first connecting pin exiting the forward recess.

[0018] Preferably the coupler includes a forward lock actuator for moving the forward locking member between its extended and retracted positions.

[0019] Preferably the forward lock actuator is pivotally connected to a hydraulic manifold of the coupler assembly.

[0020] Preferably the pivotal connection between the forward lock actuator and the hydraulic manifold is configured to provide a hydraulic fluid flow path between the hydraulic manifold and the forward lock actuator.

[0021] Preferably the movable component actuator, the rear lock actuator and the forward lock actuator are all hydraulic actuators.

[0022] Preferably a hydraulic system of the coupler includes sequence valves to control the sequence of operation of the movable component actuator, the rear lock actuator and the forward lock actuator during any engagement and/or disengagement processes.

[0023] In a second aspect, the invention may broadly be said to consist in a coupler assembly for coupling implements having a first connecting pin and a second connecting pin, to a vehicle, the coupler assembly having;
a first recess for receiving the first connecting pin,
an second recess for receiving the second connecting pin,
a first locking member for securing the first connecting pin within the first recess,
a hydraulic system including at least one actuator configured to enable the coupler assembly to positively engage with the first and second connecting pins of an implement, and
the hydraulic system also including at least one hydraulic manifold block;
wherein the coupler assembly also includes a hydraulic first lock actuator which is supported on, and receives a hydraulic supply from, the hydraulic manifold block.

[0024] Preferably the first lock actuator is pivotally connected to the hydraulic manifold block.

[0025] Preferably the hydraulic supply from the hydraulic manifold block to the first lock actuator passes through a pivotal connection between the first lock actuator and the hydraulic manifold block.

[0026] Preferably the hydraulic fluid flow path between the hydraulic manifold and the first lock actuator is a path that passes through a passage within a pivot pin that is part of the pivotal connection between the first lock actuator and the hydraulic manifold block.

[0027] Preferably the coupler assembly further includes a movable component which is supported by a body component and which is movable through a range of travel relative to the body component, and which includes, or forms a part of, the second recess.

[0028] Preferably the coupler assembly further includes a movable component actuator for selectively moving the movable component relative to the body component.

[0029] Preferably the hydraulic manifold block is a part of the movable component actuator.

[0030] Preferably the first lock actuator is a single acting actuator with a spring return mechanism.

[0031] Preferably the coupler assembly further includes a second locking member which is a part of the movable component and which is movable relative to the movable component between an extended position in which the second locking member prevents the second connecting pin from exiting the second recess and a retracted position in which the second locking member does not prevent the second connecting pin exiting the second recess.

[0032] Preferably the coupler assembly further includes a second lock actuator for moving the second locking member between its extended and retracted positions.

[0033] Preferably the movable component slides relative to the body component.

[0034] Preferably the second locking member is pivotally connected to the movable component.

[0035] Preferably a hydraulic system of the coupler includes sequence valves to control the sequence of operation of the movable component actuator, the second lock actuator and the first lock actuator during any engagement and/or disengagement processes.

[0036] In a third aspect, the invention may broadly be said to consist in a vehicle incorporating at least one coupler substantially as specified herein.

[0037] Preferably the vehicle is an excavator.

[0038] In a fourth aspect, the invention may broadly be said to consist in a method of disengaging a work attachment or implement from a coupler having a body and a movable component, including the steps of;
operating a forward lock actuator to move a forward locking member from an extended position to a retracted position,
operating a rear lock actuator to move a rear locking member from an extended position to a retracted position,
and when the rear locking member is in its retracted position, operating a movable component actuator to move a movable component out of engagement with a rear pin of the work attachment,
and then disengaging a forward pin of the work attachment from the body.

[0039] Preferably the method of disengaging includes an automatic operation of the forward lock actuator to move the forward locking member from the retracted position to the extended position a pre-determined time period after the operation of the forward lock actuator, the rear lock actuator or the movable component actuator to disengage the coupler from an implement.

[0040] The invention may also broadly be said to consist in the parts, elements and features referred to or indicated in the specification of the application, individu-

ally or collectively, and any or all combinations of any two or more of the parts, elements or features, and where specific integers are mentioned herein which have known equivalents, such equivalents are incorporated herein as if they were individually set forth.

DESCRIPTION

[0041] Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

FIGURE 1 is an exploded perspective view of a first example of a coupler according to the present invention,

FIGURE 2 is a cutaway perspective view of the first example of a coupler,

FIGURE 3 is a cutaway perspective view of a slide assembly of the first example of a coupler,

FIGURE 4 is a perspective view of a slide component of the slide assembly,

FIGURE 5 is a perspective view of a forward locking member of the first example of a coupler,

FIGURE 6 is a perspective view of a rear locking member of the slide assembly,

FIGURE 7 is a perspective view of a link member of the slide assembly,

FIGURE 8 is a perspective view of a slide assembly actuator of the first example of a coupler,

FIGURE 9 is a right side elevation view of the first example of a coupler,

FIGURE 10 is a cutaway side elevation view of the first example of a coupler,

FIGURE 11 is a perspective view of a rear lock actuator of the first example of a coupler,

FIGURE 12 is a cutaway side elevation view of the coupler showing a first stage of a coupling sequence,

FIGURE 13 is a cutaway side elevation view of the coupler showing a second stage of a coupling sequence,

FIGURE 14 is a cutaway side elevation view of the coupler showing a third stage of a coupling sequence,

FIGURE 15 is a cutaway side elevation view of the coupler showing a fourth stage of a coupling sequence,

FIGURE 16 is a cutaway side elevation view of the coupler showing a first stage of an uncoupling sequence,

FIGURE 17 is a cutaway side elevation view of the coupler showing a second stage of an uncoupling sequence,

FIGURE 18 is a cutaway side elevation view of the coupler showing a third stage of an uncoupling sequence,

FIGURE 19 is a cutaway side elevation view of the coupler showing a fourth stage of an uncoupling sequence,

FIGURE 20 is a cutaway side elevation view of the coupler showing a fifth stage of an uncoupling sequence,

FIGURE 21 is a schematic diagram of a hydraulic circuit which includes components of the coupler as well as hydraulic components of a vehicle, to which the coupler is attached,

FIGURE 22 is an electrical diagram used to control the operation of the coupler,

FIGURE 23 is a partially cutaway side elevation view of a second example of a coupler according to the present invention, showing a forward locking member of the coupler in an extended configuration,

FIGURE 24 is a partially cutaway side elevation view of the second example of a coupler showing the forward locking member in a retracted configuration,

FIGURE 25 is a partially cutaway perspective view of the second example of a coupler which defines an exploded view A, and

FIGURE 26 is the exploded view A which shows the hydraulic supply routing to a forward lock actuator which controls the positioning of the forward locking member.

FIRST EXAMPLE

[0042] With reference to Figures 1 to 22, a first example of a coupler assembly (31) is shown in an exploded perspective view and in a series of perspective and cutaway views. Included also are hydraulic and electrical circuits used to control the operation of the coupler assembly (31). The coupler assembly (31) is of the type typically

used for coupling implements having a first connecting pin and a second connecting pin, to a vehicle such as an excavator or a back hoe.

[0043] It can be seen in Figures 1 and 2 that the coupler assembly (31) has a body component (33) that is connectable to the vehicle. The body component (33) itself includes two coupler mounting pins (35) which are used to connect the coupler assembly (31) to the end of an arm of the vehicle. The body component (33) also includes a forward recess (37) for receiving the first connecting pin of an implement.

[0044] The coupler assembly (31) also includes a movable component or slide assembly (39) which is supported by the body component (33). The slide assembly (39) is movable through a range of travel relative to the body component (33). The range of travel of the slide assembly (39) is substantially in a fore and aft direction relative to the body (33). The slide assembly (39) includes, or at least forms a part of, an aft recess (41) for receiving the second connecting pin of an implement.

[0045] A movable component actuator or slide assembly actuator (43) of the coupler assembly (31) is used to selectively move the slide assembly (39) relative to the body component (33). With reference to Figure 4 it can be seen that a slide component (45) of the slide assembly (39) includes elongate tabs (47). These elongate tabs (47) engage with corresponding slots (49) on the body component (33), allowing the slide assembly (39) to slide in a fore and aft direction relative to the body component (33).

[0046] The slide assembly (39) includes a rear locking member (51). The rear locking member (51) is movable relative to the slide assembly (39), between an extended position in which the rear locking member (51) prevents the second connecting pin from exiting the aft recess (41) and a retracted position in which the rear locking member (51) does not prevent the second connecting pin exiting the aft recess (41).

[0047] The slide assembly (39) also includes a rear lock actuator (53) (refer Figures 2, 3 and 11) for moving the rear locking member (51) between its extended and retracted positions. The rear lock actuator (53) is mounted on the slide assembly (39), and moves with the slide assembly (39). The rear lock actuator (53) includes a rear lock actuator spring (54) which biases the actuator toward an extended configuration in which the rear lock actuator (53) pushes the rear locking member (51) to its extended position.

[0048] A feature of the coupler assembly (31) is the connection between the rear lock actuator (53) and the rear locking member (51). The connection includes a link member (55). The rear locking member (51) is pivotally connected to the slide component (45) by a rear lock connecting pin (57). The link member (55) slides fore and aft relative to the slide assembly (39) under the influence of the rear lock actuator (53).

[0049] The rear locking member (51) and the link member (55) are configured in such a manner that an initial range of movement of the link member (55) pushes the rear locking member (51) from its retracted position to its extended position. And a second and further range of movement of the link member (55) positions a stop member (59) which prevents movement of the rear locking member (51) away from its extended position. In this example, the stop member (59) is a part of the link member (55).

[0050] It can be seen in Figure 7 that the link member (55) is in the form of a substantially rectangular shaped plate (61), having tabs (63) extending from the plate (61) for connection to the rear lock actuator (53). The plate (61) includes a rectangular shaped hole (65) positioned substantially centrally within the principal plane of the plate (61). Alternatively, it could be said that the link member (55) comprises a forward transverse member (67), and aft transverse member (69), and side plates (71), one on the left side and one on the right side of the link member (55). The side plates (71) each span between the outermost extremities of the forward and aft transverse members (67) and (69).

[0051] The side plates (71) of the link member (55) engage with, and slide within, slide grooves (73) on each side of the slide assembly (39).

[0052] Similarly, it can be seen in Figure 6 that the rear locking member (51) includes an upwardly protruding control tab (75), and two rearwardly extending locking tabs (77). The two rearwardly extending locking tabs (77) each include a locking surface (79). The locking surfaces (79) are situated on an upper part of each locking tab (77) and are substantially aligned with a lower edge (81) of the slide grooves (73) when the rear locking member (51) is in its fully extended position.

[0053] When the slide assembly (39) is assembled, the link member (55) is held within the slide grooves (73). And when the rear locking member (51) is in its fully extended position, the control tab (75) of the rear locking member (51) is situated within the rectangular hole (65) in the link member (55). The rectangular hole (65) is of sufficient size to allow a range of movement of the link member (55) relative to the rear locking member (51) without contact being made between the link member (55) and the rear locking member (51). However, movement of the link member beyond this range of movement does result in contact between the link member (55) and the rear locking member (51). And this contact is used to move the rear locking member (51) between its retracted position and its extended position as will be explained below.

[0054] Movement of the rear locking member (51) from its retracted position to its extended position is achieved as follows. The link member (55) is moved from its forward most position, and in an aft direction, by the rear lock actuator (53). During an initial range of movement of the link member (55) in an aft direction, an aft edge (83) of the side plates (71) contacts a forward edge (85) of the locking tabs (77). This contact causes rotation of the rear locking member (51) about the rear lock con-

necting pin (57), and rotation of the rear locking member (51) to its fully extended position.

[0055] Continued movement of the link member (55) in an aft direction does not cause any further movement of the rear locking member (51), however the continued movement positions the side plates (71) of the link member (55) over the locking surfaces (79) of the rear locking member (51). The rectangular hole (65) in the link member (55) is configured to allow continued aft movement of the link member (55) even though the control tab (75) is now situated within the rectangular hole (65). Also, the slide assembly (39) is configured such that the locking surfaces (79) are immediately adjacent the side plates (71) when the link member (55) is fully aft. In this way, the side plates (71) act as stops preventing movement of the rear locking member (51) away from its fully extended position.

[0056] Any forces experienced by the rear locking member (51), for example if the second connecting pin of a work implement was trying to exit the aft recess (41), would result in the locking surfaces (79) bearing upwards against the under side of the side plates (71). This upward force from the locking surfaces (79) would be restrained by the engagement of the link member (55) within the slide grooves (73). This is advantageous in that these forces experienced by the rear locking member (51) are not felt directly by the rear lock actuator (53).

[0057] Movement of the rear locking member (51) from its extended position to its retracted position is achieved as follows. The link member (55) is moved forward by the rear lock actuator (53). An initial range of forward movement of the link member (55) moves the side plates (71) away from their location above the locking surfaces (79). This unlocks the rear locking member (51) allowing it to be moved to its retracted position. A second range of forward movement of the link member (55) initially brings a forward edge (87) of the rear transverse member (69) into contact with a rear surface (89) of the control tab (75).

[0058] Continued forward movement of the link member (55) pushes the control tab (75) forward causing the rear locking member (51) to move to its retracted position. The rear locking member (51) is held in its retracted position by the rear transverse member (69) which lies above the control tab (75) and adjacent to it, when the rear locking member (51) is in its retracted position.

[0059] The coupler assembly (31) further includes a forward locking member (91). The forward locking member (91) is movable relative to the body component (33) between an extended position, in which the forward locking member (91) prevents the first connecting pin from exiting the forward recess (37), and a retracted position, in which the forward locking member does not prevent the first connecting pin exiting the forward recess (37).

[0060] The coupler assembly (31) also includes a forward lock actuator (93) for moving the forward locking member (91) between its extended and retracted positions.

[0061] In this example, the coupler assembly (31) is used with a hydraulic control system (111) and an electrical control circuit (113) as shown in Figures 21 and 22 respectively.

[0062] The electrical control circuit (113) includes two manually controlled switches and a timer, and the hydraulic control system (111) includes solenoid operated control valves and sequence valves, to control the sequence of operation of the slide assembly actuator (43), the rear lock actuator (53) and the forward lock actuator (93), during any engagement and/or disengagement processes. The design of the hydraulic control system (111) allows the coupler assembly (31) to be controlled using only two hydraulic lines. The electrical and hydraulic control systems will now be explained in further detail.

[0063] The electrical control circuit (113) has a master switch (115) which is used to supply or disconnect electrical power to the control circuit. When the master switch (115) is switched on an alarm (117) sounds and optionally a warning light operates also. This warns personal in the vicinity of the vehicle that the coupler (31) will be operated to release and/or engage implements from the arm of the vehicle.

[0064] A second switch (119) is a 'hold to run' style of switch, meaning that the contacts of the switch are only engaged while the operator continues to hold the switch down. When the second switch (119) is pushed "on" a second alarm (121) and warning light operates, and power is supplied to a first solenoid operated valve (123) of the hydraulic control system (111). A timer (125) is also initiated, which in turn provides power to a second solenoid operated valve (127) via a timer relay (128), after a pre-determined time period, for example a time period in the range of three to eight seconds.

[0065] The first and second solenoid operated valves (123) and (127) of the hydraulic control system (111) are situated on the vehicle along with a pressure regulating valve (129) for regulating the hydraulic pressure to a set value and minimising pressure spikes. The first solenoid operated valve (123) is used to initiate the disengage or engage signals to the coupler (31). The second solenoid operated valve (127) controls the draining of hydraulic fluid from the forward lock actuator (93) after the predetermined time delay period to allow a forward lock actuator spring (99) within the forward lock actuator (93) to move the forward locking member (91) backs to its extended position.

[0066] Two hydraulic lines, a supply line (131) and a return line (133), are used to power and control the coupler assembly (31).

[0067] The coupler assembly (31) itself includes a first sequence valve (135) which controls the sequencing of the three actuators and ensures that the rear lock actuator (53) and the forward lock actuator (93) operate to retract their respective locking members (51) and (91) prior to the retraction of the slide assembly actuator (43) to move the slide assembly (39) forward.

[0068] A first pressure operated check valve (137) and

a second pressure operated check valve (139) act as safety locks to lock the position of the slide assembly actuator (43) in case of a hydraulic failure. The locked slide assembly actuator (43) holds the slide assembly (39) fixed preventing the pins of an implement from exiting the forward and aft recess (37) and (41) of the coupler (31).

[0069] A second sequence valve (141) controls the sequencing of the slide assembly actuator (43) and the rear lock actuator (53) to ensure that the rear lock actuator (43) moves the rear locking member (51) to its retracted position before the slide assembly actuator (43) begins to move the slide assembly (39) aft.

[0070] A third pressure operated check valve (143) isolates the rear lock actuator (53) from the forward lock actuator (93) when fluid is drained from the forward lock actuator (93) by the second solenoid operated valve (127) as described above.

[0071] With reference to Figures 15 to 20 the dis-engagement sequence will now be described.

[0072] At the beginning of this sequence (refer figure 15) the slide assembly actuator (43) is at least partly extended and is holding the slide assembly (39) in engagement with an aft connecting pin (95) of an implement. The rear lock actuator (53) is extended under hydraulic pressure and the rear locking member (51) is in its extended position and is able to prevent the aft connecting pin (95) from exiting the aft recess (41). The forward lock actuator is retracted under spring tension only and is holding the forward locking member (91) in its extended position and is able to prevent a forward connecting pin (97) from exiting the forward recess (37).

[0073] To initiate the disengagement procedure, the master switch (115) is switched on. Then the second switch (119), the 'hold to run switch' is depressed. The first solenoid operated valve (123) then operates to provide hydraulic pressure to the return line (133). Due to the configuration of the first sequence valve (135) the hydraulic pressure is initially directed to the rear lock actuator (53) and the forward lock actuator (93) to retract the rear and forward locking members (51) and (91) - refer to figure 16.

[0074] When the rear lock actuator (53) and the forward lock actuator (93) have operated, pressure in the return line (133) builds until the first sequence valve (135) opens to allow pressure to the retract side of the slide assembly actuator (43) and to the pilot line of the first pressure operated check valve (137), allowing the slide assembly actuator (43) to retract and to move the slide assembly (39) fully forward - refer to figure 17. This disengages the aft connecting pin (95) from the aft recess (41).

[0075] Then the coupler assembly (31) is rotated, for example by using the crowd actuator of the excavator, to allow the coupler assembly (31) to be moved aft without re-engaging with the aft connecting pin (95) in the aft recess (41) - refer figure 18.

[0076] Then the coupler assembly (31) is moved aft to disengages the forward connecting pin (97) from the forward recess (37) to complete the disengaging procedure - refer figure 19.

[0077] Figure 20 shows the subsequent movement of the forward locking member (91) to its extended position after the time delay period. After the set time period, the second solenoid operated valve (127) operates to vent the fluid from the forward lock actuator (93), allowing a spring (99) within the forward lock actuator (93) to retract the actuator and move the forward locking member (91) to its extended position. The pressure operated check valves (137), (139) and (143) prevent any movement of fluid from the slide assembly actuator (43) and the rear lock actuator (53). This automatic resetting of the forward locking member (91) to its extended position is a safety feature ensuring that the forward locking member (91) is ready to hold and secure the forward connecting pin (97) of the next implement in the forward recess (37) as soon as the pick up or engagement procedure begins.

[0078] With reference to Figures 12 to 15 the engagement sequence will now be described.

[0079] The rear locking member (51) is retracted, and as noted above, the forward locking member (91) is extended and ready to hold and secure the forward connecting pin (97). The coupler assembly (31) is manipulated, for example using the arm of the excavator, to engage the forward connecting pin (97) of the next implement within the forward recess (37). The forward locking member (91) is configured so that it is pushed away from its extended position by the forward connecting pin (97) as it enters the forward recess (37) - refer to figure 12. The coupler assembly (31) is configured such that the spring (99) pushes the forward locking member (91) back to its extended position once the forward connecting pin (97) has passed fully into the forward recess (37) - refer to figure 13.

[0080] The operator of the excavator then rotates the coupler assembly (31) until the body (33) touches the aft connecting pin (95) of the implement. And then the 'hold to run' or second switch (119) is released by the operator. This causes the first solenoid operated valve (123) to become de-energised and it returns to its steady state configuration as shown in figure 21. This connects the hydraulic supply pressure to the supply line (131). This supplies hydraulic pressure to the extend side of the slide assembly actuator (43) and opens the second pressure operated check valve (139) allowing the slide assembly actuator (43) to extend and to move the slide assembly (39) aft toward the aft connecting pin (95) - refer to figure 14.

[0081] When the slide assembly (39) engages with the aft connecting pin (95) the pressure builds on the extend side of the slide assembly actuator (43) until there is sufficient pressure to operate the second sequence valve (141). Then pressure is supplied to the extend side of the rear lock actuator (53), the rear lock actuator (53) then extends and moves the rear locking member to its extended position - refer to figure 15.

[0082] This is the configuration that the coupler assembly (31) remains in while the excavator or other vehicle is using the coupler assembly (31) to hold an implement. A first locking feature is provided by the first and second pressure operated check valves (137) and (139) which hydraulically lock the slide assembly actuator (43) in the case of a hydraulic failure, for example a rupture of the supply or return lines (131) or (133). A second locking feature is provided by the forward locking member (91) which holds the forward connecting pin (97) within the forward recess (37). And a third locking feature is provided by the rear locking member (51) which holds the aft connecting pin (95) within the aft recess (41).

[0083] It can be said that in use, the coupler assembly (31) employs the following method of disengaging a work attachment or implement from the coupler assembly (31);
the forward lock actuator (93) is operated to move the forward locking member (91) from its extended position to its retracted position,
the rear lock actuator (53) is operated to move the rear locking member (51) from its extended position to its retracted position,
and when the rear locking member (51) is in its retracted position, the slide assembly actuator (43) is operated to move the slide assembly (39) out of engagement with a rear pin (95) of the work attachment,
and when the forward locking member (91) is retracted and the rear pin (95) is no longer engaged within the slide assembly (39), the forward pin (97) of the work attachment is disengaged from the body (33).

[0084] With the coupler assembly (31), the method of disengaging also includes an automatic operation of the forward lock actuator (93) to move the forward locking member (91) from the retracted position to the extended position a pre-determined time period after the operation of;
the forward lock actuator (93),
the rear lock actuator (53), or
the slide assembly actuator (43),
to disengage the coupler (31) from an implement.

SECOND EXAMPLE

[0085] With reference to Figures 23 to 26, a second example of a coupler assembly (161) will now be described. The operation of the coupler assembly (161) is similar to that of the first example of a coupler assembly (31), and the only significant difference between the first and second examples is the configuration of a forward locking assembly (163).

[0086] In this second example, a forward lock actuator (165) of the forward locking assembly (163) is pivotally connected at its aft end to a hydraulic manifold block (167) of the coupler assembly (161). In this way the forward lock actuator (165) is supported by the hydraulic manifold block (167). The hydraulic manifold block (167) routes fluid for a slide actuator (169) and a rear lock actuator (171), and also routes hydraulic fluid directly to the forward lock actuator (165).

[0087] A pivot pin (173) connects an aft end of the forward lock actuator (165) to the hydraulic manifold block (167). A first passage (175) within the hydraulic manifold block (167) communicates with a second passage (177) within the pivot pin (173). The second passage (177) communicates with the hydraulic cylinder (179) of the forward lock actuator (165) via a third passageway (181) in an end fitting (183) of the forward lock actuator (165).

[0088] In this way, hydraulic fluid can be directed to or from the forward lock actuator (165) to extend or retract a forward locking member (185). As can be seen in Figure 26, the forward lock actuator (165) is a single acting actuator with a spring return mechanism. For this reason the forward lock actuator (165) only requires a single hydraulic supply.

[0089] This configuration eliminates the need for an external hydraulic connection to the forward lock actuator (165), while at the same time allowing the forward lock actuator (165) to pivot as it moves the forward locking member (185). This allows a compact configuration of the forward locking assembly (163), and the configuration is expected to have a high reliability.

VARIATIONS

[0090] To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

[0091] In the examples described above, the slide assembly actuator, the rear lock actuator and the forward lock actuator are all hydraulic actuators. However it is envisaged that alternative actuators could be used, for example electrically operated linear actuators.

DEFINITIONS

[0092] Throughout this specification the word "comprise" and variations of that word, such as "comprises" and "comprising", are not intended to exclude other additives, components, integers or steps.

ADVANTAGES

[0093] Thus it can be seen that at least the preferred form of the invention provides a coupler which provides a high level of safety. The rear locking member locks the aft connecting pin positively within the aft recess and the arrangement of the rear lock actuator and its connection to the rear locking member provides a positive and robust lock of the rear locking member in its extended position. The configuration of the locks is relatively simple and not excessively prone to interference from dirt or other foreign matter that may accumulate around the compo-

nents.

[0094] The coupler assembly can be controlled using only two hydraulic lines which is advantageous as it eliminates the need for additional lines where two are already available.

[0095] Also, the hydraulic actuators for the slide assembly, for the forward lock and the rear lock are all isolated from one another, meaning that in the event of a failure of one of the actuators, the other two will continue to provide their safety locking features. In addition, each actuator includes a biasing means in the form of a spring which biases each actuator toward a fail-safe configuration, that is, a configuration which retains the pins of the implements within the coupler.

Claims

1. A coupler assembly (161) for coupling implements having a first connecting pin (97) and a second connecting pin (95), to a vehicle, the coupler assembly having;
   a first recess (37) for receiving the first connecting pin,
   a second recess (41) for receiving the second connecting pin,
   a first locking member (185) for securing the first connecting pin within the first recess,
   a hydraulic system including at least one actuator (43) configured to enable the coupler assembly to positively engage with the first and second connecting pins of an implement, and
   the hydraulic system also including at least one hydraulic manifold block (167);
   characterised in that the coupler assembly also includes a hydraulic first lock actuator (165) which is supported on, and receives a hydraulic supply from, the hydraulic manifold block.

2. A coupler assembly as claimed in claim 1, wherein the first lock actuator is pivotally connected to the hydraulic manifold block.

3. A coupler assembly as claimed in claim 2, wherein the hydraulic supply from the hydraulic manifold block to the first lock actuator passes through a pivotal connection between the first lock actuator and the hydraulic manifold block.

4. A coupler assembly as claimed in claim 3, wherein the hydraulic fluid flow path between the hydraulic manifold and the first lock actuator is a path that passes through a passage within a pivot pin (173) that is part of the pivotal connection between the first lock actuator and the hydraulic manifold block.

5. A coupler assembly as claimed in any one of claims 1 to 4, wherein the coupler assembly further includes a movable component (39) which is supported by a body component (33) and which is movable through a range of travel relative to the body component, and which includes, or forms a part of, the aft recess.

6. A coupler assembly as claimed in claim 5, wherein the coupler assembly further includes a movable component actuator (43) for selectively moving the movable component relative to the body component.

7. A coupler assembly as claimed in claim 6, wherein the hydraulic manifold block is a part of the movable component actuator.

8. A coupler assembly as claimed in any one of claims 1 to 7, wherein the first lock actuator is a single acting actuator with a spring return mechanism.

9. A coupler assembly as claimed in any one of claims 1 to 8, wherein the coupler assembly further includes a second locking member (51) which is a part of the movable component and which is movable relative to the movable component between an extended position in which the second locking member prevents the second connecting pin from exiting the aft recess and a retracted position in which the second locking member does not prevent the second connecting pin exiting the aft recess.

10. A coupler assembly as claimed in claim 11, wherein the coupler assembly further includes a second lock actuator (53) for moving the second locking member between its extended and retracted positions.

11. A coupler assembly as claimed in any one of claims 5 to 10, wherein the movable component slides relative to the body component.

12. A coupler assembly as claimed in any one of claims 9 to 11, wherein the second locking member is pivotally connected to the movable component.

13. A coupler assembly as claimed in any one of claims 10 to 12, wherein a hydraulic system of the coupler includes sequence valves to control the sequence of operation of the movable component actuator, the second lock actuator and the first lock actuator during any engagement and/or disengagement processes.

14. A vehicle incorporating at least one coupler as claimed in any one of claims 1 to 13.

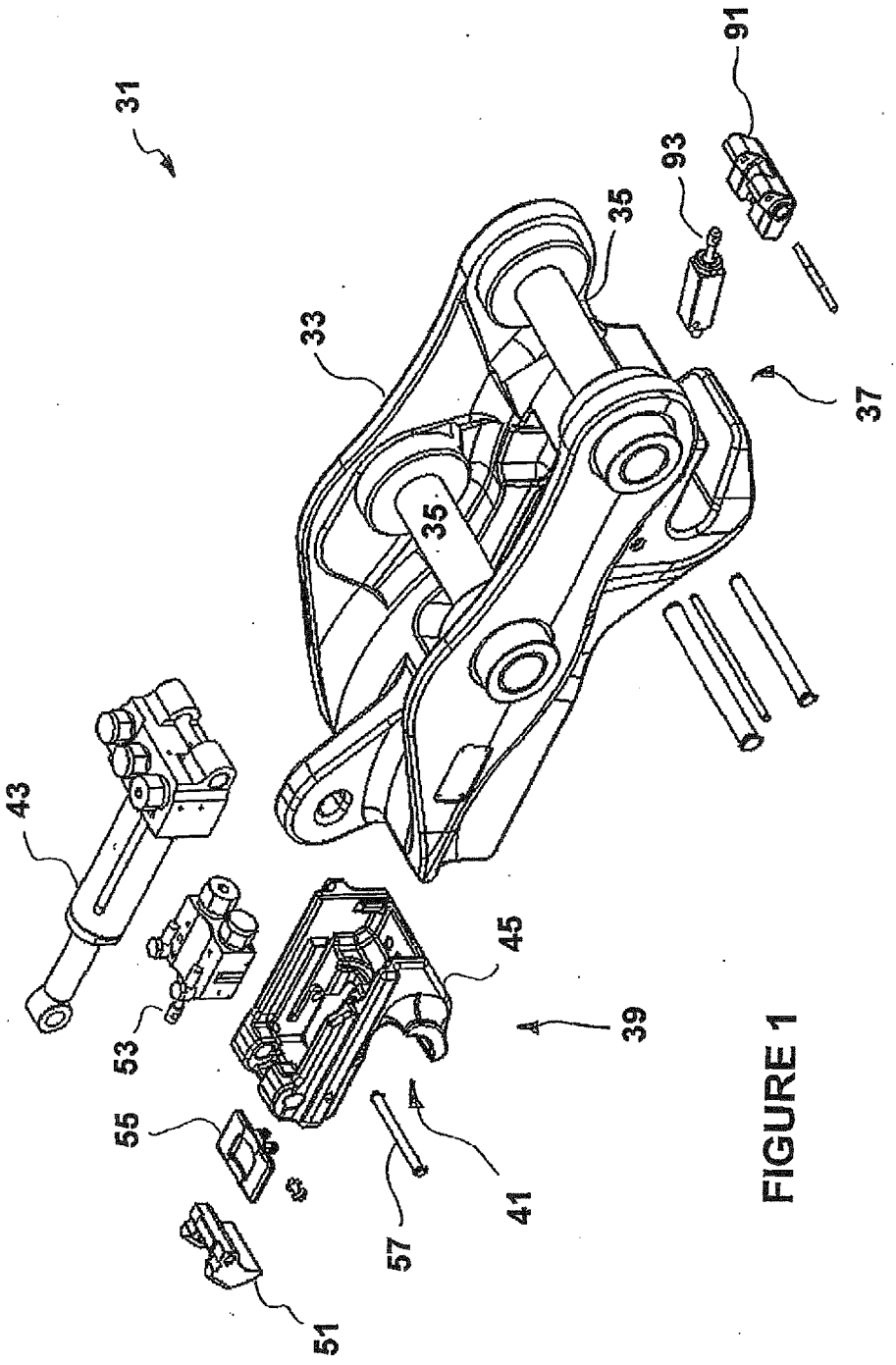


FIGURE 1

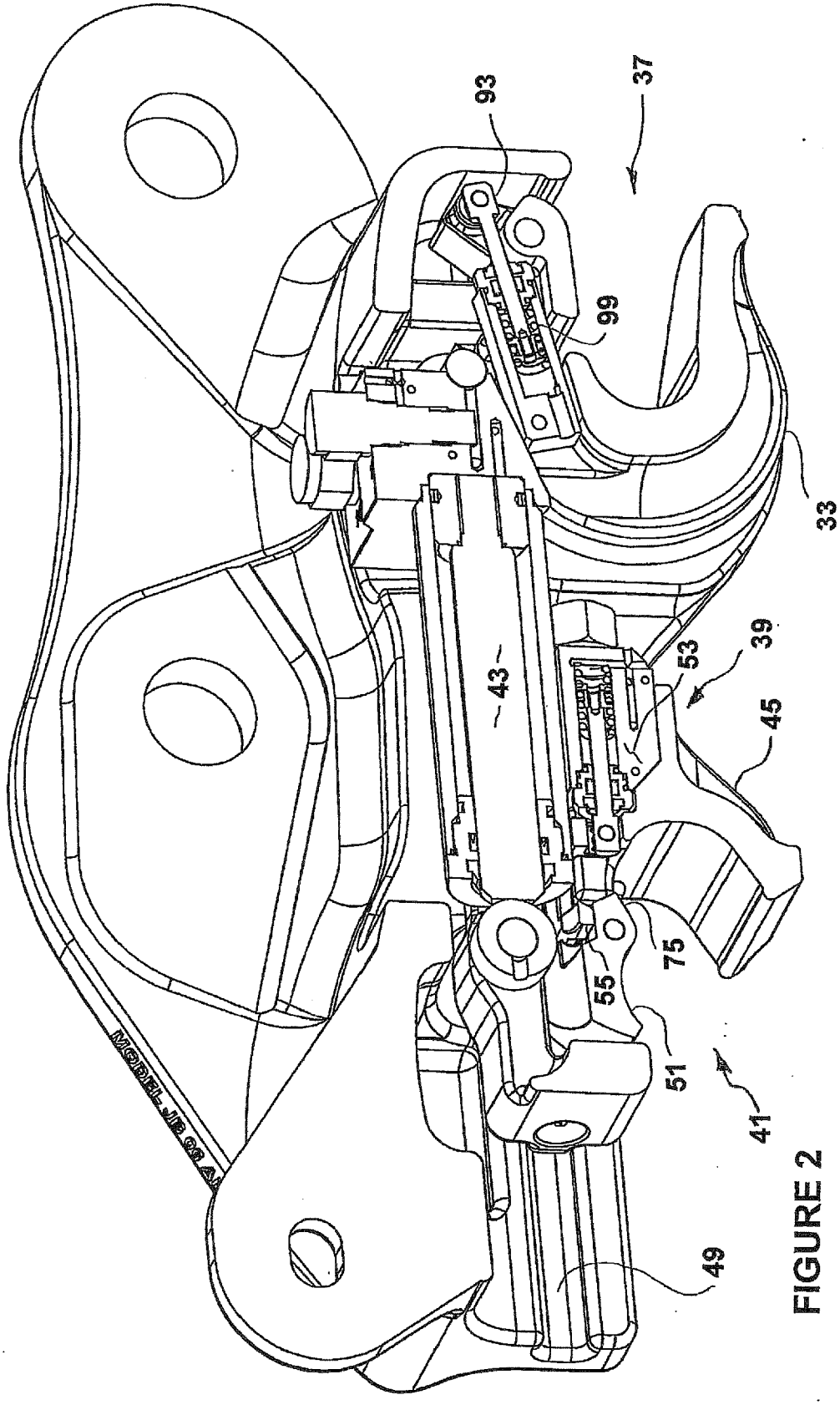


FIGURE 2

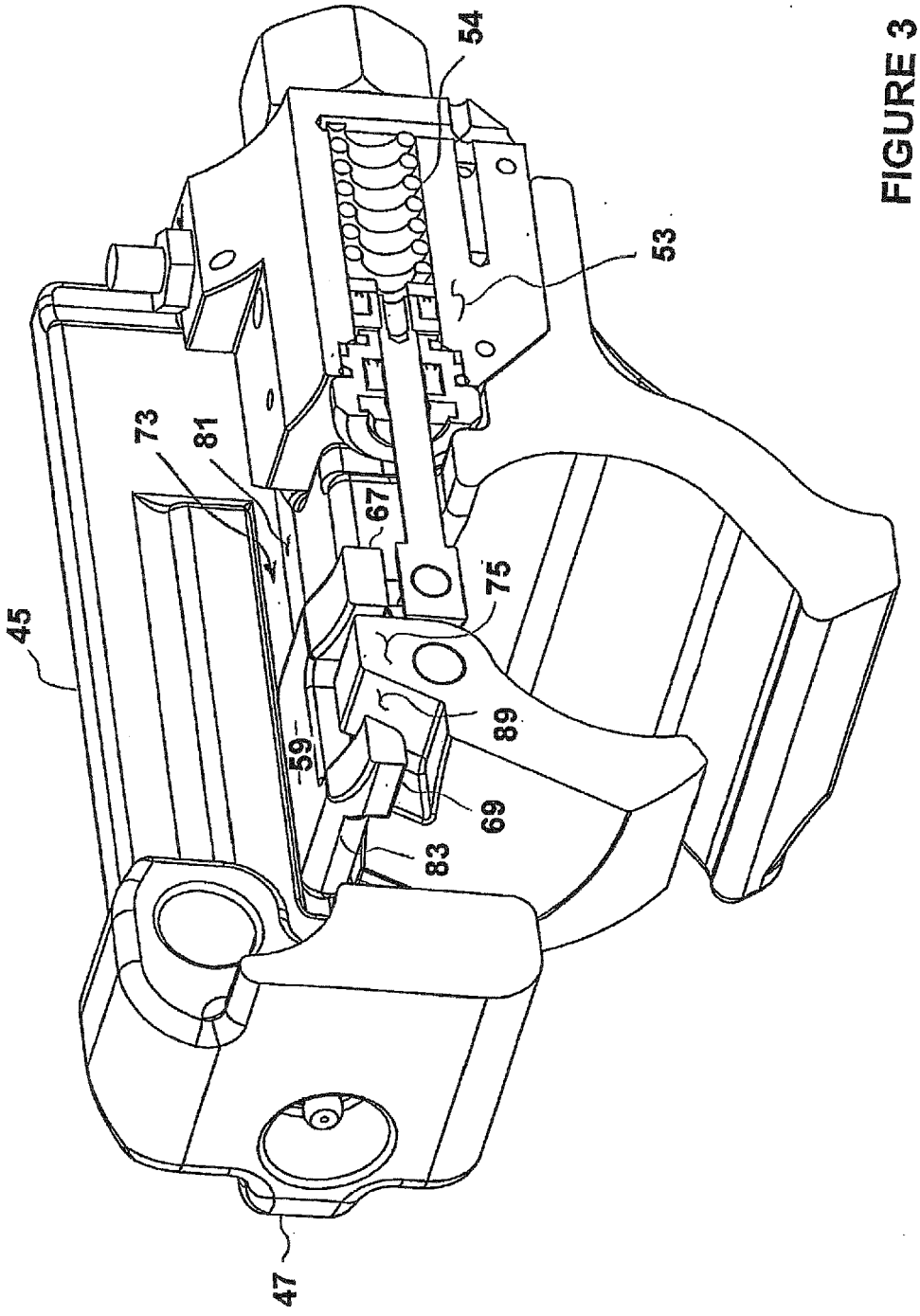


FIGURE 3

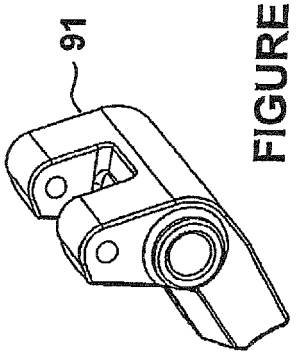
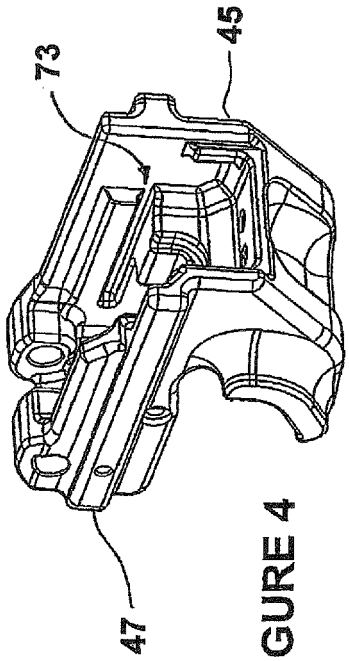


FIGURE 5



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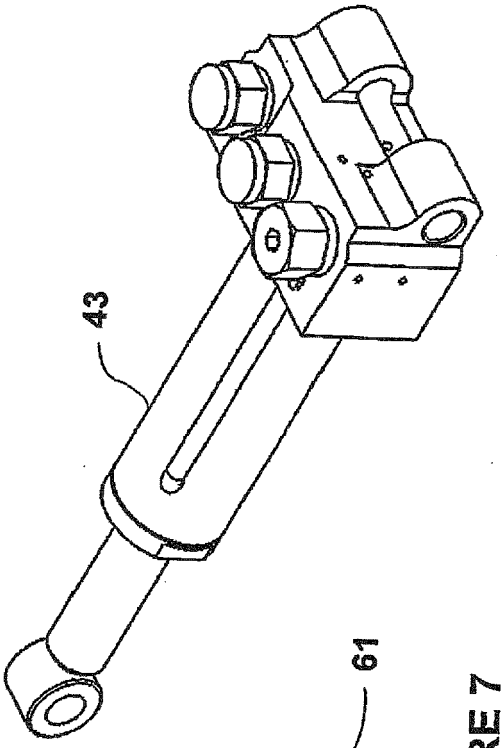

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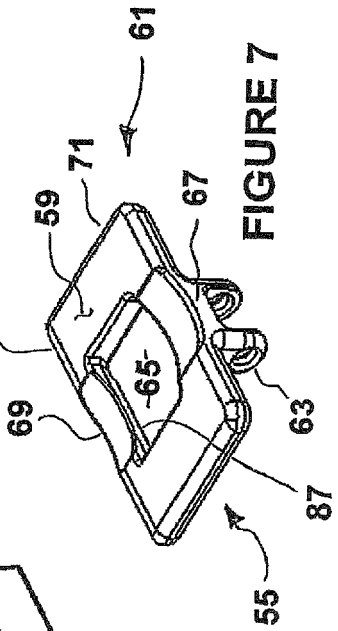
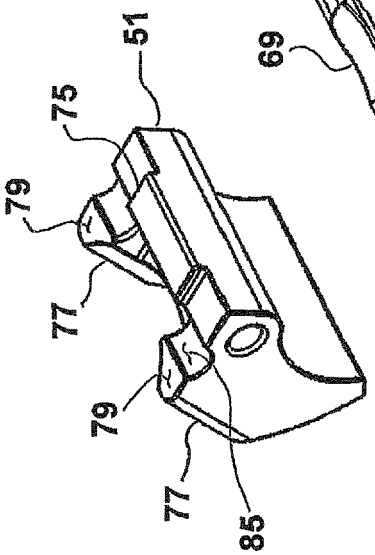


FIGURE 7



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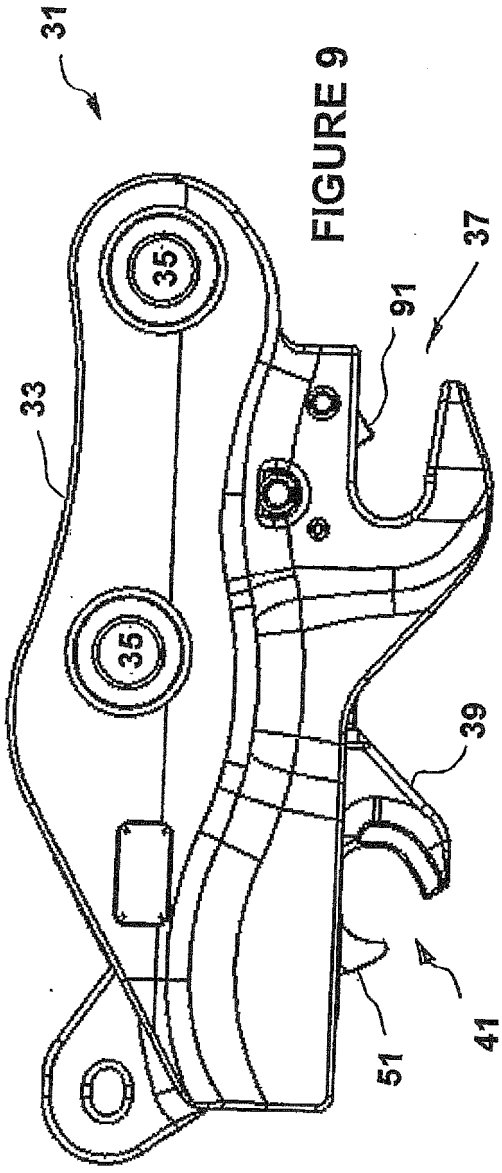

FIGURE 9

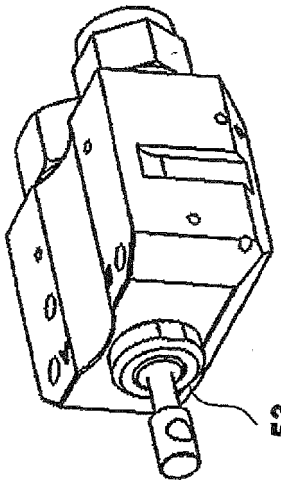

FIGURE 11

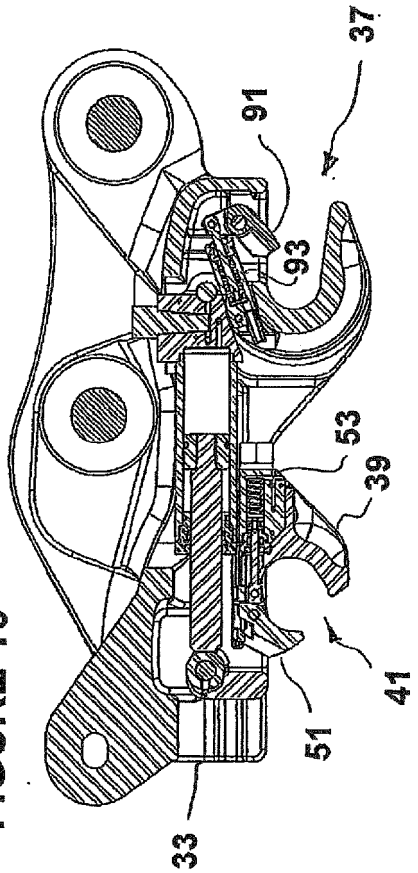

FIGURE 10

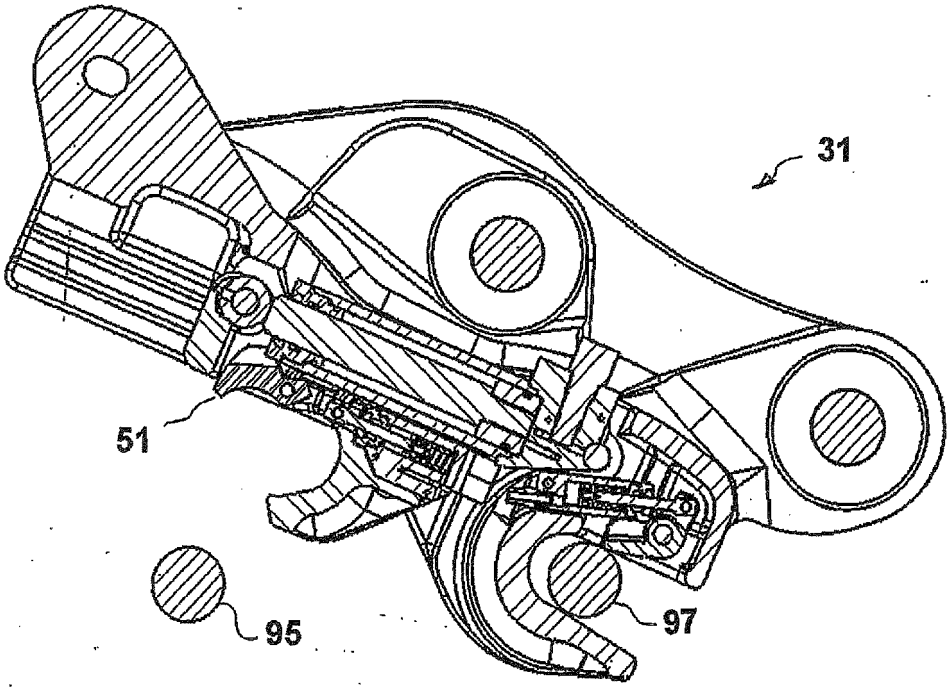

FIGURE 12

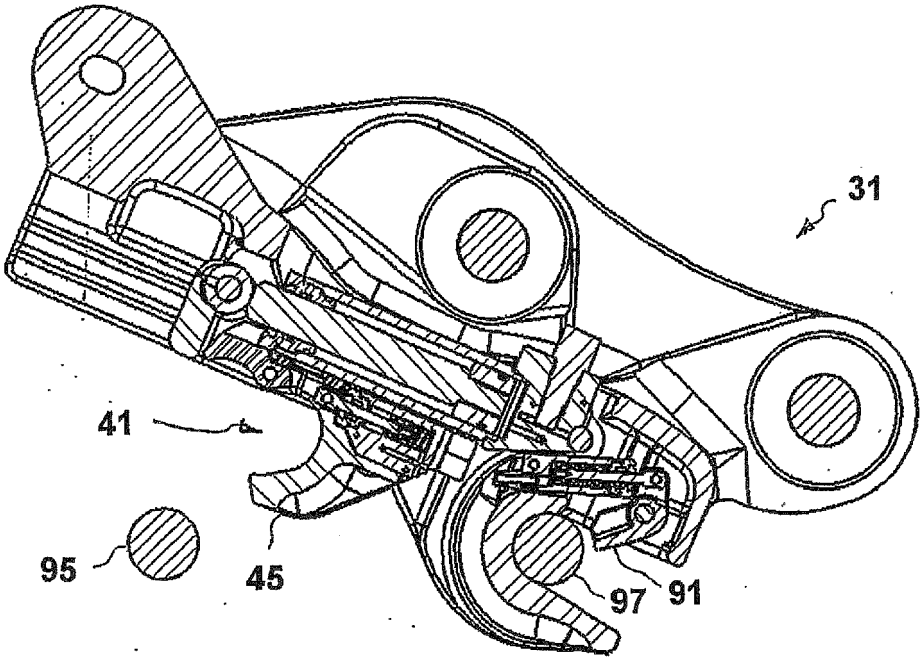

FIGURE 13

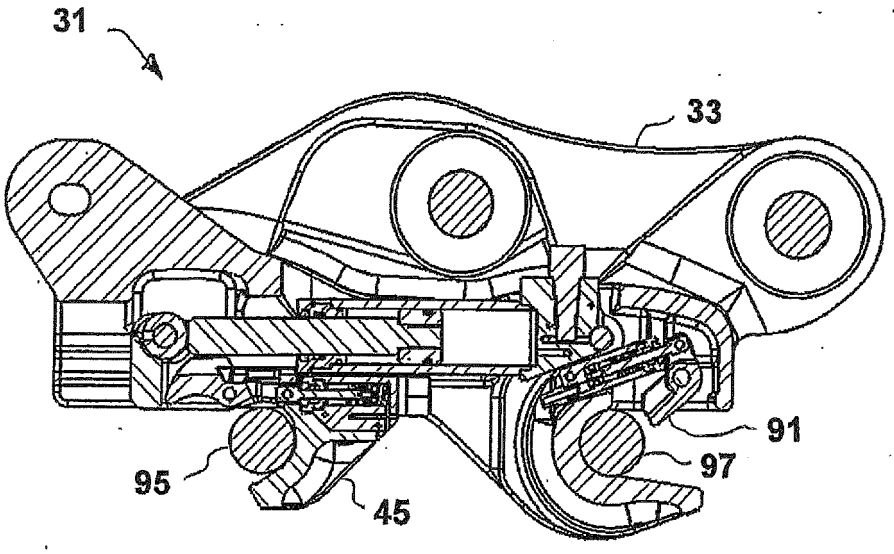

FIGURE 14

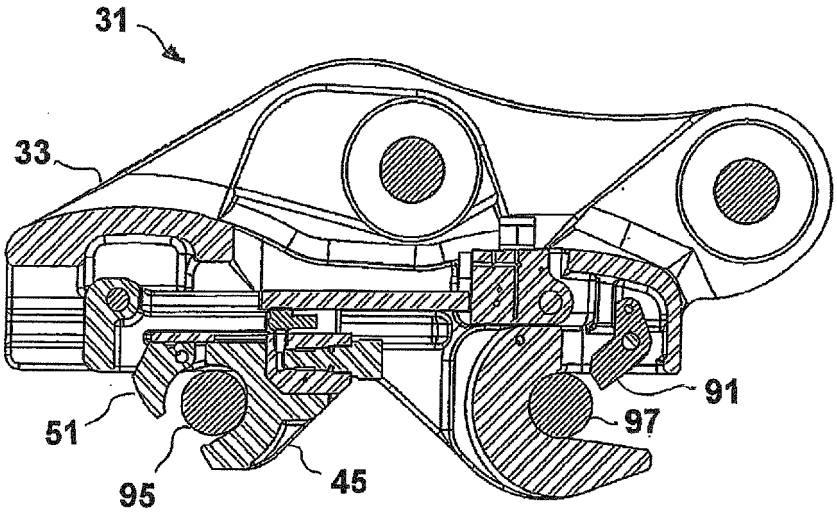

FIGURE 15

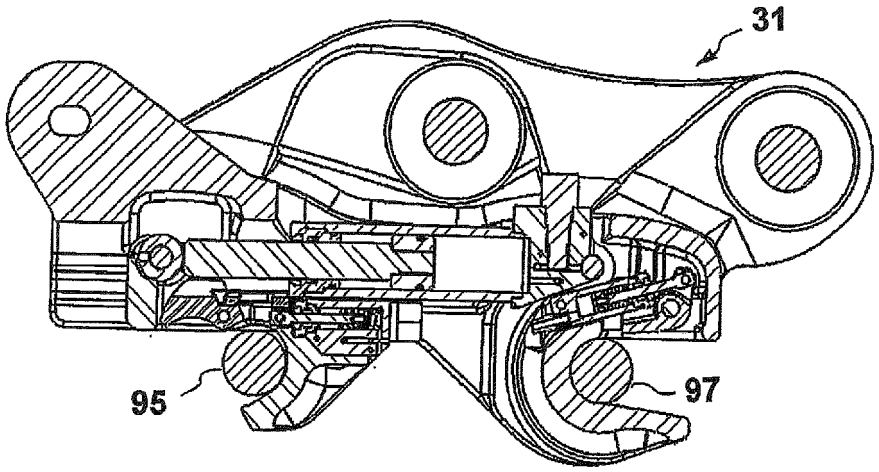

FIGURE 16

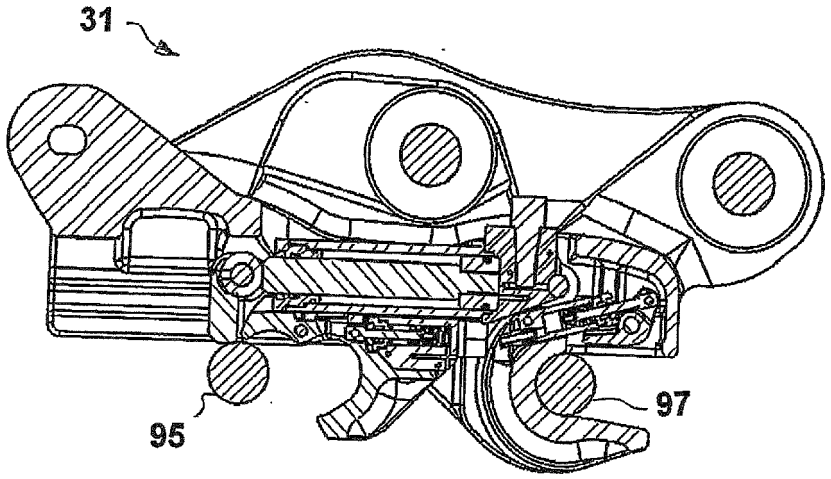

FIGURE 17

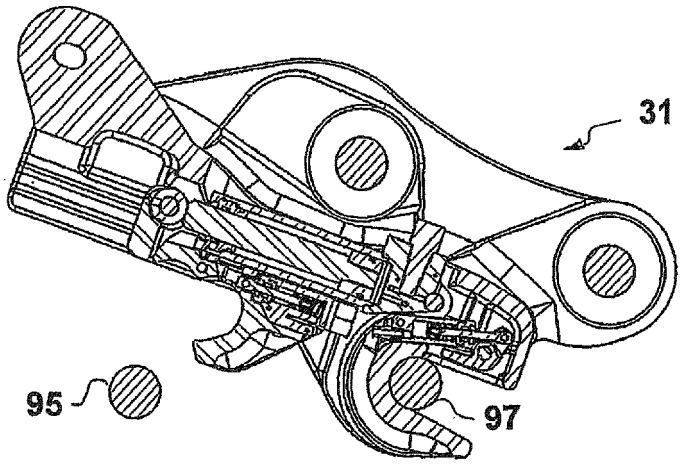

FIGURE 18

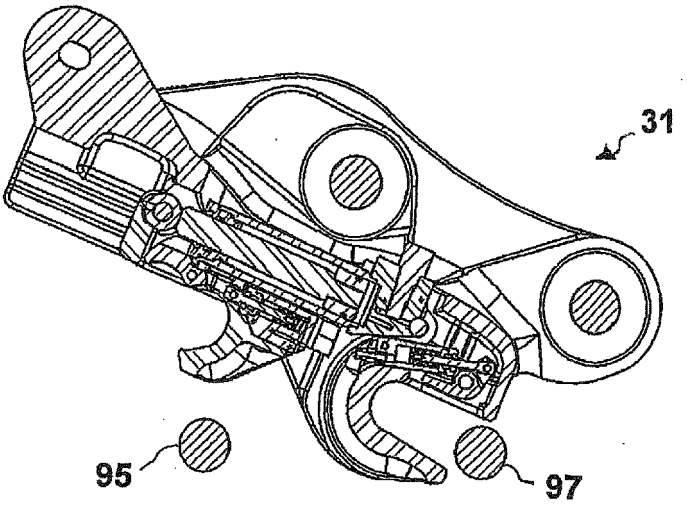

FIGURE 19

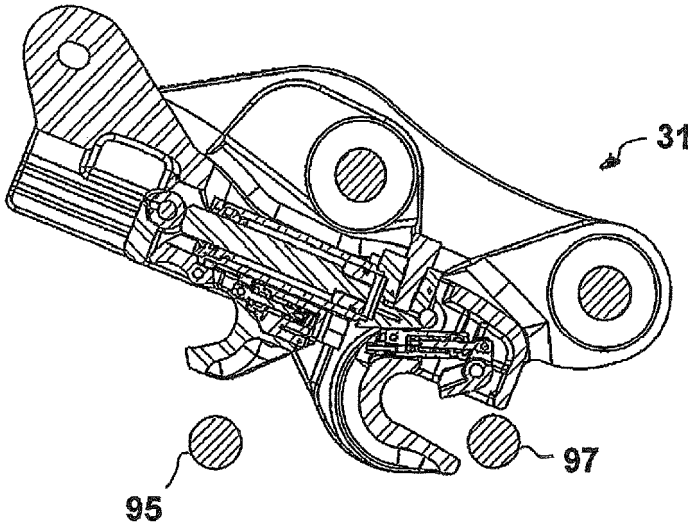

FIGURE 20

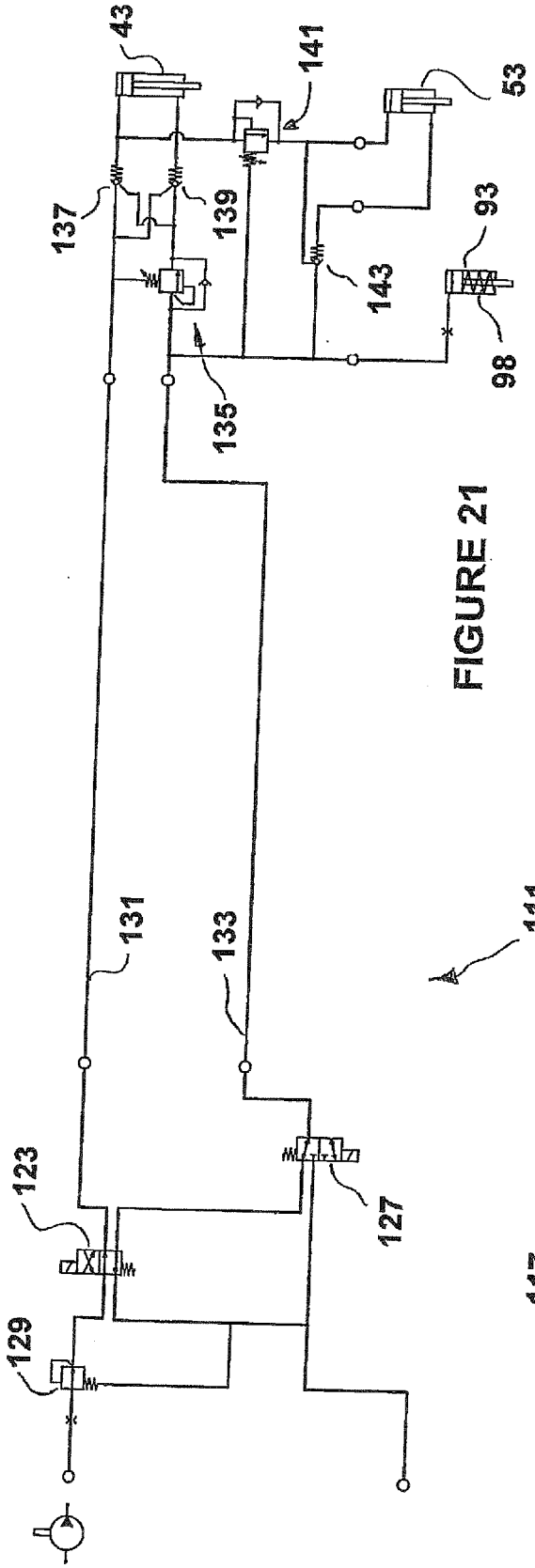

FIGURE 21

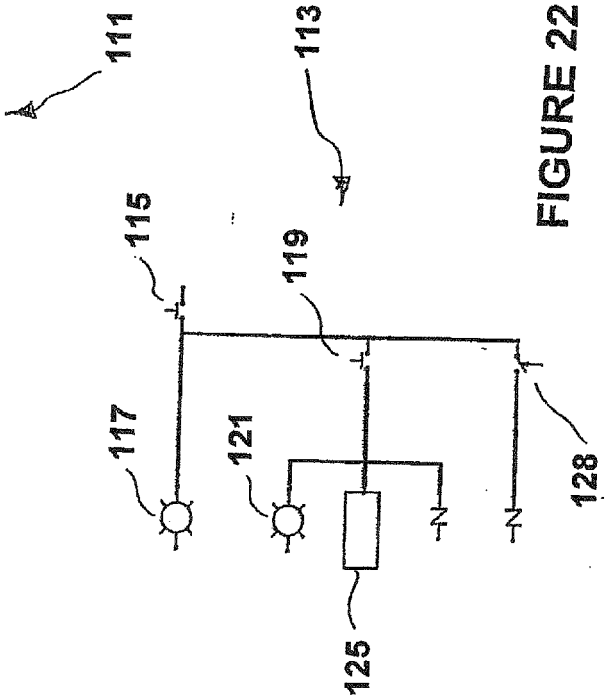

FIGURE 22

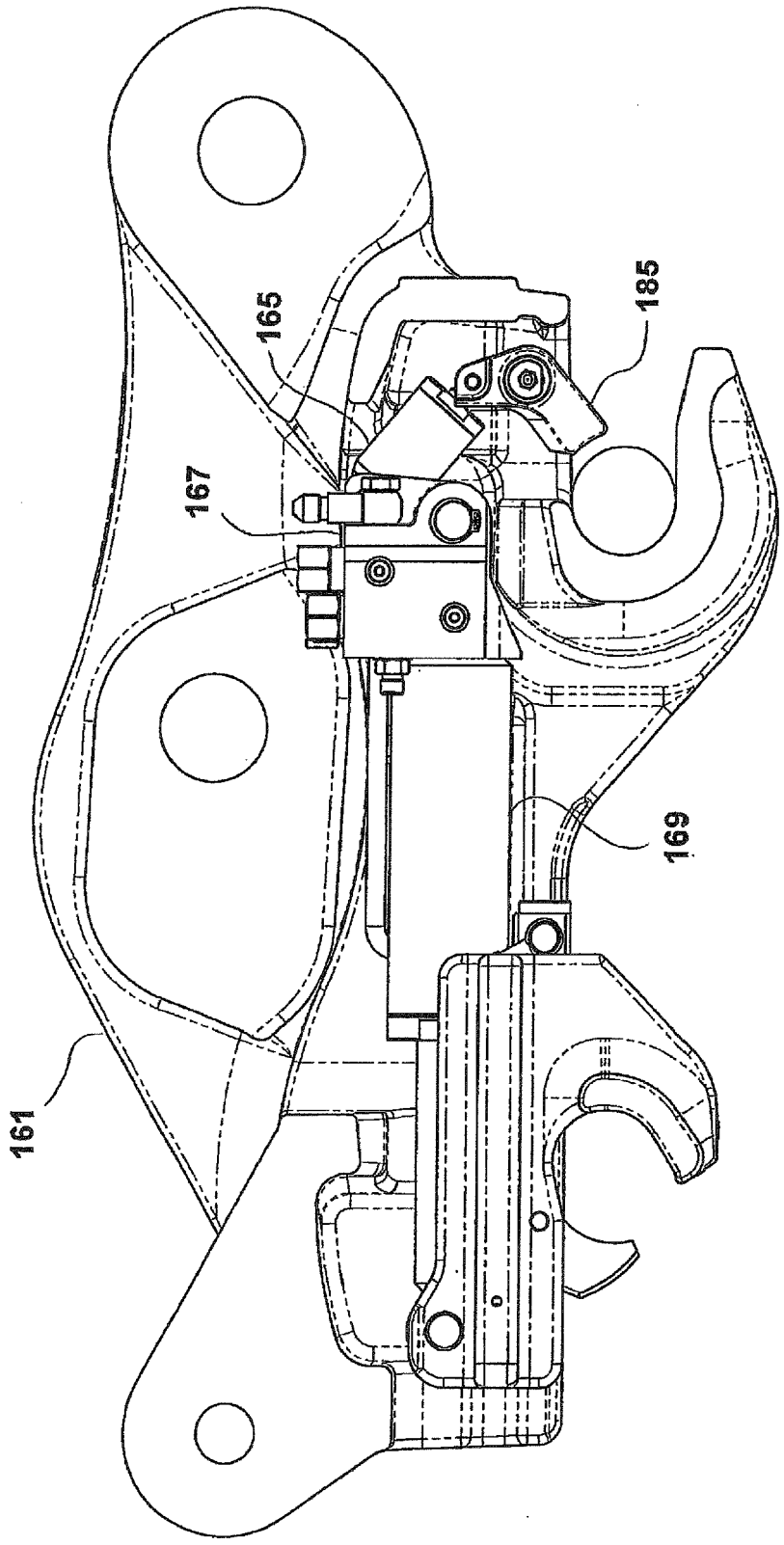

FIGURE 23

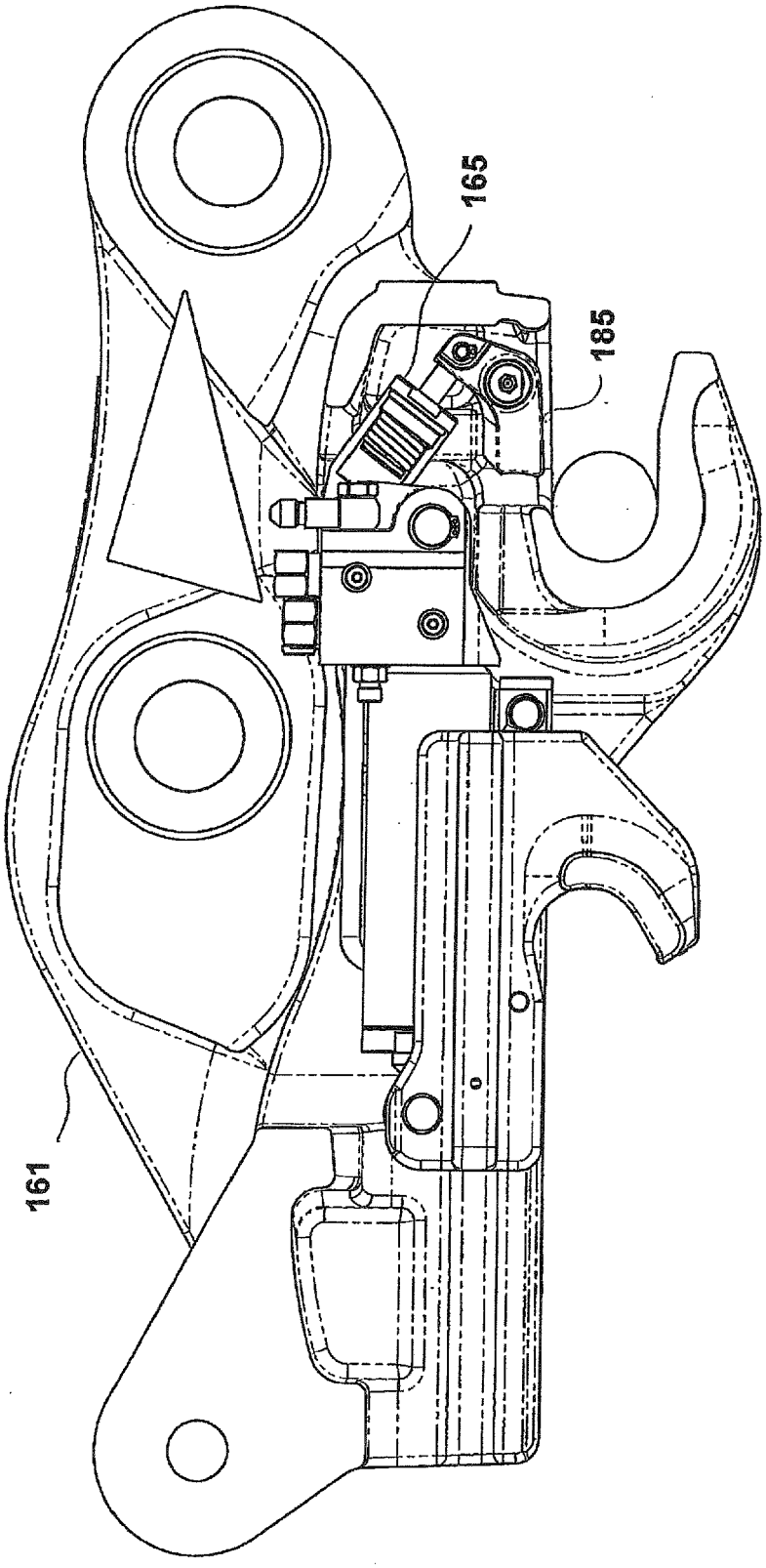

FIGURE 24

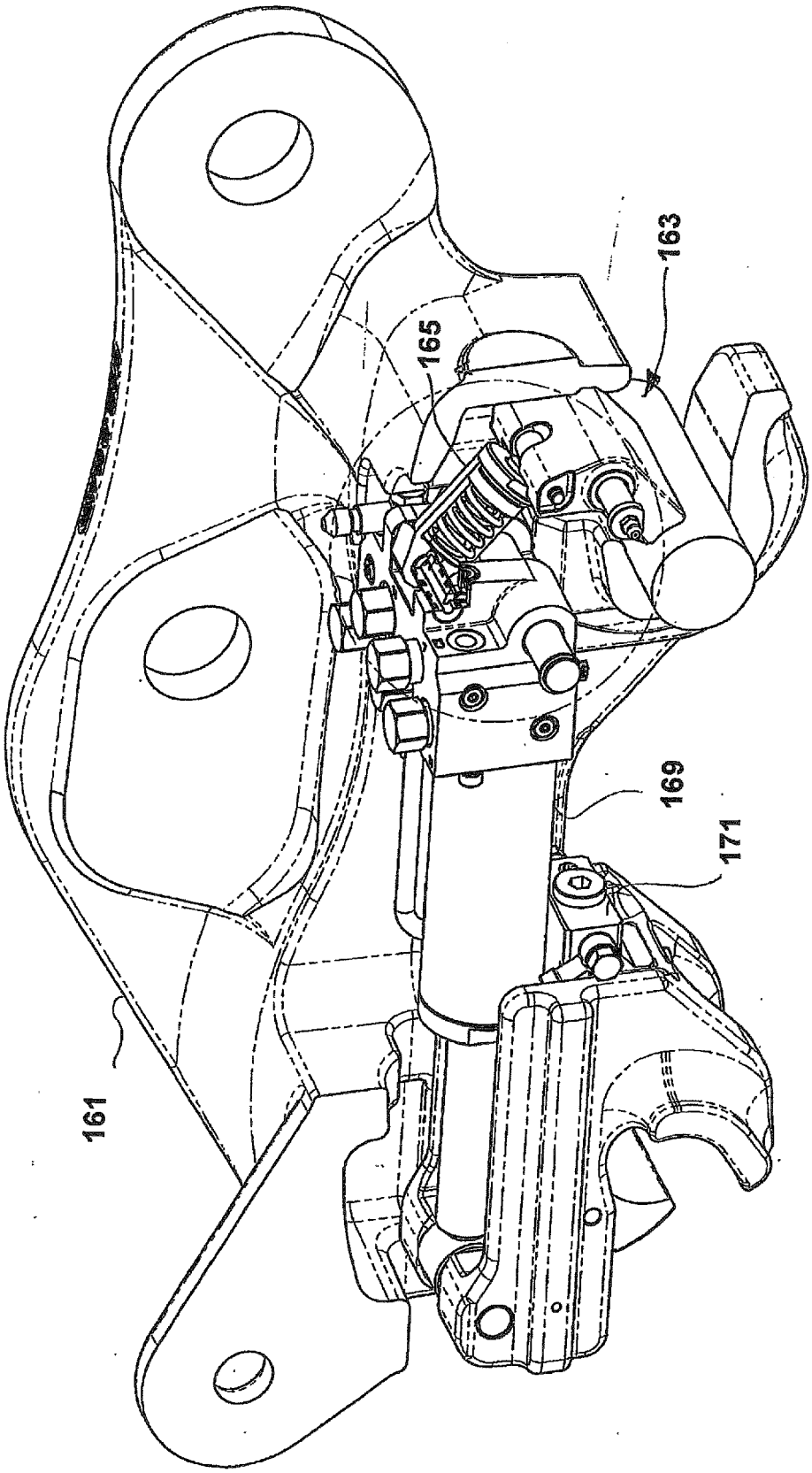

FIGURE 25

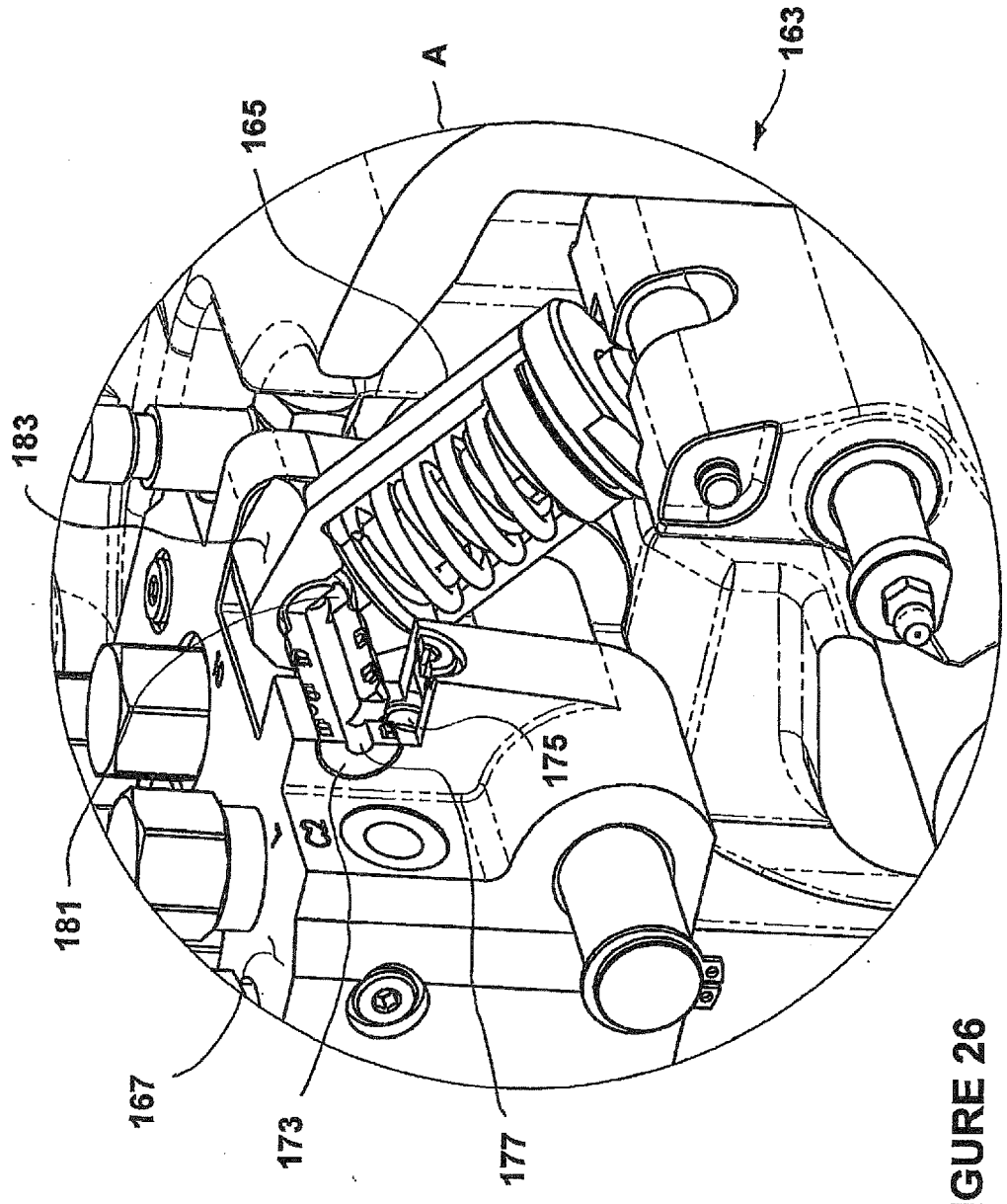

FIGURE 26

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EUROPEAN SEARCH REPORT

Application Number
EP 17 17 5927

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2008/193210 A1 (BEALES ROBERT WILLIAM [CA]) 14 August 2008 (2008-08-14) * figures 33, 34, 37, 38 * * paragraph [0001] *	1-3,5-7, 14	INV. E02F3/36 E02F9/00
X Y	WO 2011/071394 A1 (S T COUPLERS LTD [NZ]) 16 June 2011 (2011-06-16) * figure 1 to 14 * * figure 15 to 23 * * figure 24 to 30 * * page 1, line 7 - line 8 * * figure 27 to 38 * * figure 18 to 22 * * page 1, line 3 - line 5 *	1,5-7,9, 11,12,14 1-4, 8-10,13	
X	US 2005/169703 A1 (FATEMI RAY S [US]) 4 August 2005 (2005-08-04) * figure 1 to 5 * * column 1, line 18 - line 25 *	1-3,5-7, 14	
X	GB 2 474 576 A (HILL IAN [GB]) 20 April 2011 (2011-04-20) * page 1, line 5 - line 6 *	1,5-7,14	TECHNICAL FIELDS SEARCHED (IPC) E02F
X	GB 2 482 515 A (MILLER INT LTD [GI]) 8 February 2012 (2012-02-08) * page 1, line 3 - line 5 *	1,2,5,6, 14	
Y	JP 2012 012779 A (TAGUCHI KOGYO KK) 19 January 2012 (2012-01-19) * abstract; figures 1-4 *	1-4, 8-10,13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 March 2018	Bultot, Coralie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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13-03-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008193210 A1	14-08-2008	NONE	
WO 2011071394 A1	16-06-2011	AU 2010328742 A1	28-06-2012
		AU 2016225818 A1	22-09-2016
		CA 2783802 A1	16-06-2011
		CN 102782220 A	14-11-2012
		EP 2510159 A1	17-10-2012
		KR 20120110113 A	09-10-2012
		US 2012266432 A1	25-10-2012
		US 2014301779 A1	09-10-2014
		WO 2011071394 A1	16-06-2011
US 2005169703 A1	04-08-2005	US 2005169703 A1	04-08-2005
		US 2008175657 A1	24-07-2008
GB 2474576 A	20-04-2011	GB 2474576 A	20-04-2011
		US 2011091267 A1	21-04-2011
		US 2014219714 A1	07-08-2014
GB 2482515 A	08-02-2012	GB 2482515 A	08-02-2012
		WO 2012017191 A1	09-02-2012
JP 2012012779 A	19-01-2012	JP 5416047 B2	12-02-2014
		JP 2012012779 A	19-01-2012

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