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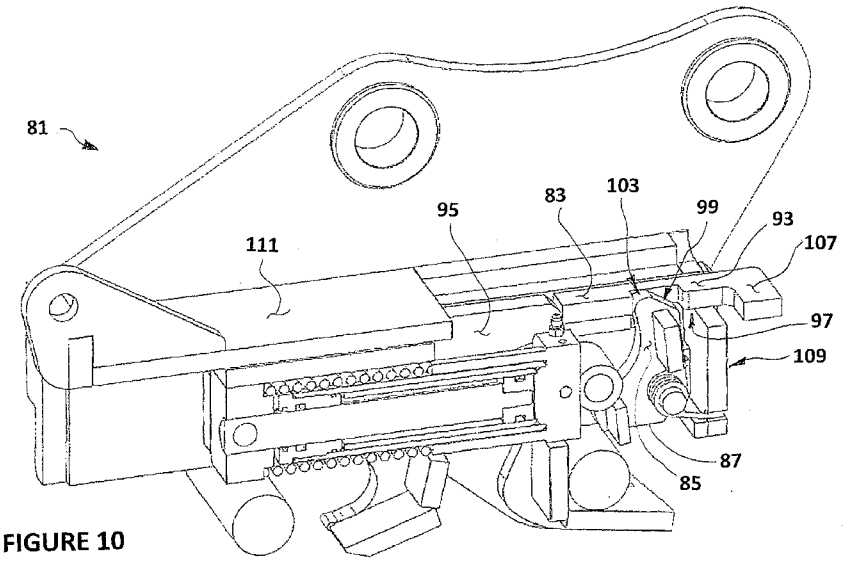

FIGURE 10

(57) Abstract: The quick hitch coupler seeks to solve the problem of holding work attachments securely to the dipper arm of an excavator, while still allowing quick change of work attachments. The present invention also seeks to solve this problem in the simplest way possible. The coupler firstly uses a spring or other biasing means to keep the two jaws of the coupler held apart to secure the two pins of a work attachment, and it uses a hydraulic lock in conjunction with a hydraulic actuator to also hold the two jaws of the coupler held apart. But in addition to these two safety features, the coupler also uses a latch on the forward jaw which is controlled by movement of a slide which forms a part of a second or aft jaw of the actuator. The latch itself is includes a locking feature to prevent inadvertent release of the latch.

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Quick Hitch Coupler

FIELD OF THE INVENTION

This invention relates to a quick hitch coupler, and in particular, but not exclusively to a quick hitch coupler for coupling implements to the dipper arm of an excavator.

BACKGROUND

Quick hitch couplers are increasing being used by excavator operators to aid in the quick and safe change of implements. For example, a wide bucket may be quickly set down and released, and then a narrower trenching bucket may be connected to the dipper arm as it may be more suitable for the next stage of the project at hand.

While these quick hitch couplers are convenient to use, the do present a potential safety hazard. If the connecting pins of an implement are not correctly engaged within the two jaws of the coupler, or if a jaw of the coupler fails, or if hydraulic pressure to an actuator of the coupler is lost, an implement can fall from the arm of the excavator, and potentially harm a person working in the vicinity of the excavator.

For this reason, in recent years, there have been many developments made to couplers to improve safety. Some of the safety improvements work well, while others tend to make the couplers difficult to operate, or the complexity of the safety features result in higher likelihood of a mechanical malfunction of some sort.

Spring biased safety latches have some merit in helping to secure the connecting pins of implements within the jaws of a coupler, however, in some circumstances. For example, when an implement that has not been engaged in both jaws is swinging from one connecting pin only, the rotating connecting pin can tend to bear against a latch and rotate the pivoting latch against the force of the spring and retract it. This can result in an implement falling from the coupler.

Also, hydraulic lines are a source of maintenance and reliability issues. Hydraulic lines to actuators and/or to latches can introduce potential safety concerns if they wear or fail.

What is needed is a coupler that is simple to use in a safe manner, and which has inherent safety features that will significantly reduce the chance of an implement falling from the arm of an excavator, without introducing unnecessary layers of complexity that introduce reliability and potential safety issues themselves.

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

It is therefore an object of the present invention to provide a quick hitch 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

Accordingly, in a first aspect, the invention may broadly be said to consist in a quick hitch coupler having a body configured for attachment to the free end of a dipper arm of an excavator, the body having a first jaw configured to receive and hold a first connecting pin of an implement, the coupler having a second jaw formed between a jaw formation on a slide of the coupler and a bottom surface of the coupler body, the coupler further having an actuator configured to move the slide away from and to toward the first jaw, the actuator having an integral biasing means configured to bias the slide in a direction away from the first jaw.

Preferably the biasing means includes a coil spring.

Preferably the spring is a compression spring.

Preferably the spring is situated between a first reaction face that is situated or supported on the slide and an opposing or second reaction face that is fixed relative to the body of the coupler.

Preferably the second reaction face is situated at or adjacent a forward end of the actuator.

Preferably the actuator is a hydraulic actuator.

Preferably a cylinder of the hydraulic actuator is connected to the body of the coupler and the spear of the hydraulic actuator is connected to the slide.

Preferably the second reaction face is a face formed on an end cap of the cylinder of the hydraulic actuator.

Preferably the hydraulic actuator is situated between two side members of the slide, the side members extending below the bottom surface of the coupler body and forming a part of the second jaw.

Preferably the coil spring is situated about the cylinder of the hydraulic actuator.

Preferably the cylinder of the hydraulic actuator comprises two lengths of tubing, a first length of tubing concentric within a second length of tubing.

Preferably the path for hydraulic fluid under pressure to reach a retract side of a piston of the actuator is via an annular duct formed between an outside diameter of the first length of tubing and an inside diameter of the second length of tubing.

Preferably a forward and closed end of the cylinder of the actuator is connected to the body of the coupler.

Preferably the hydraulic connections to the actuator are situated at the forward end of the cylinder of the hydraulic actuator.

Preferably the coupler includes a forward latch configured to allow a first connecting pin to freely enter the first jaw and configured to prevent the first connecting pin from exiting the first jaw until the slide is moved to a chosen position along its range of movement.

Preferably the slide includes a forward latch operating member configured to move the forward latch to a retracted position in which the first connecting pin is able to exit the first jaw.

Preferably the forward latch is pivotally connected to the body of the coupler.

Preferably the forward latch is biased toward an extended position in which the forward latch prevents the first connecting pin of an implement from exiting the first jaw.

Preferably the coupler further includes a locking mechanism configured to lock the forward latch in the extended position.

Preferably the locking mechanism is a part of the latch operating member.

Preferably the latch operating member is configured to lock the forward latch in its extended position when the latch operating member is within a first portion of the latch operating member's range of movement.

Preferably the latch operating member of the slide is configured to contact and push a release lever of the forward latch to move the forward latch to its retracted position when the latch operating member is moved through a second portion of the latch operating member's range of movement.

Preferably the latch operating member has a first contact surface that is configured to lock the forward latch in its extended position when the latch operating member is situated within the first portion of its range of movement.

Preferably the latch operating member has a second contact surface that is configured to contact the release lever of the forward latch and to move the forward latch to its retracted position when the latch operating member is moved through the second portion of its range of movement.

Preferably the first contact surface is a feature of the locking mechanism.

Preferably the coupler further includes an indicator configured to provide a visual indication to a user of the coupler that the forward latch is not locked in its extended position.

Preferably the indicator is operatively connected to the latch operating member.

Preferably the indicator is configured to extend out of the front end of the coupler body to provide a visual indication that the forward latch is not locked in its extended position.

Preferably the indictor is a part of the latch operating member.

Optionally the latch operating member is in the form of a finger extending forward from a main body of the slide, and the forward end of the finger is configured to bear against, and to push, the release lever of the forward latch.

In a second aspect, the invention may broadly be said to consist in an excavator incorporating at least one quick hitch coupler substantially as specified herein.

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, individually 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

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 upper forward perspective view of a first example of a quick hitch coupler according to the present invention,

FIGURE 2 is a lower aft perspective view of the first example of a quick hitch coupler,

FIGURE 3 is a side elevation view of the first example of a quick hitch coupler,

FIGURE 4 is a top plan view of the first example of a quick hitch coupler,

FIGURE 5 is an aft end elevation view of the first example of a quick hitch coupler,

FIGURE 6 is a cross sectional view of the first example of a quick hitch coupler showing the coupler in the process of engaging with the two pins of an implement,

FIGURE 7 is a cross sectional view of the first example of a quick hitch coupler showing the pins of an implement engaged and held captive within the jaws of the coupler,

FIGURE 8 is a cross sectional side elevation view of a second example of a quick hitch coupler according to the present invention, showing a forward latch in a retracted position,

FIGURE 9 is a cross sectional side elevation view of the second example of a quick hitch coupler, showing the forward latch in an extended position,

FIGURE 10 is a cross sectional perspective view of the second example of a quick hitch coupler, showing the forward latch in a retracted position,

FIGURE 11 is a cross sectional perspective view of the second example of a quick hitch coupler, showing the forward latch in an extended position,

FIGURE 12 is a top plan view of the second example of a quick hitch coupler, showing the forward latch in a retracted position,

FIGURE 13 is a top plan view of the second example of a quick hitch coupler, showing the forward latch in an extended position, and

FIGURE 14 is a perspective view of a modified end cap of an actuator for use in the first or second examples of a quick hitch coupler.

First Example

With reference to **Figures 1** to 7, a first example of a quick hitch coupler (11) according to the present invention will now be described. The quick hitch coupler (11) has been designed for use on the dipper arm of an excavator, and is used to attach, and to quickly and conveniently change, different implements to and from the dipper arm. This type of coupler is gaining acceptance around the world as an almost integral part of any excavator, allowing the versatility of excavators to be maximised by allowing quick and safe changing of the implements used on the dipper arm of the excavators.

The quick hitch coupler (11) has a body (13) configured for attachment using two connecting pins to the free end of a dipper arm of an excavator. The body (13) has a first jaw (15) at a forward end (17) of the body (13). The first jaw (15) is configured to receive and hold a first connecting pin of an implement.

The coupler (11) also has a second jaw (19) formed between a jaw formation (21) on a slide (23) of the coupler (11) and a bottom surface (25) of the coupler body (13).

The coupler (11) also includes an actuator (27) configured to move the slide (23) away from and to toward the first jaw (15). The actuator (27) is a hydraulic actuator and can be supplied with hydraulic fluid from the hydraulic system of the excavator it is being used on. A forward and closed end (37) of a cylinder (31) of the actuator (27) is connected to the body (13) of the coupler (11).

The actuator (27) has an integral biasing means configured to bias the slide (23) in a direction away from the first jaw (15). In this example the biasing means includes a coil spring (29). The spring (29) is a compression spring and is situated about the cylinder (31) of the hydraulic actuator (27). In **Figures 6** and **7** it can be seen that the spring (29) is situated between a first reaction face (33) that is situated or supported on a transverse bulkhead (34) of the slide (23) and an opposing or second reaction face (35) that is fixed relative to the body (13) of the coupler (11).

The second reaction face (35) is situated at or adjacent the forward end (37) of the actuator (27). The second reaction face (35) is a circular face or shoulder formed on an end cap (45) of the cylinder (31) of the hydraulic actuator (27). The forward end (37) of the cylinder (31) of the hydraulic actuator (27), or the end cap (45), is connected to the body (13) of the coupler (11) via a first assembly pin (39). A spear (41) of the hydraulic actuator (27) is connected via a second assembly pin (43) to the transverse bulkhead (34) of the slide (23).

The hydraulic actuator (27) is situated between two side members (47) of the slide (23). The side members (47) include the jaw formations (21) of the second jaw (19) which extend below the bottom surface (25) of the coupler body (13). An upper member (49) of the slide (23) spans between the top edges of the side members (47) and the edges of the upper

member (49) which extend a small distance part the side members (47), slide within longitudinally aligned grooves (51) formed in the body (13).

The cylinder (31) of the hydraulic actuator (27) comprises two lengths of tubing. A first length of tubing (53) is concentric within a second length of tubing (55). A gap intentionally exists between the first length of tubing (53) and the second length of tubing (55). The two lengths of tubing (53) and (55) are both welded with full circumferential welds at their forward ends to the end cap (45). The aft end of the first length of tubing (53) is tack welded in a number of discrete locations to the inside diameter of the second length of tubing (55).

The path for hydraulic fluid under pressure to reach a retract side (57) of a piston (59) of the actuator (27) is via an annular duct formed between an outside diameter (61) of the first length of tubing (53) and an inside diameter (63) of the second length of tubing (55). The retract side of the piston (59) is the aft side of the piston (59), or left hand side of the piston as viewed in **Figures 6** and **7**. A hydraulic passage or drilling in the end cap (45) communicates with the annular duct formed between the two lengths of tubing, to supply fluid to the retract side of the piston (59), or to receive fluid returning from the retract side of the piston (59).

The piston (59) slides substantially along the length of the first length of tubing (53), and includes a seal configured to seal the gap between the outside diameter of the piston (59) and the inside diameter of the first length of tubing (53).

The aft end of the second length of tubing (55) mates with a gland (60) of the actuator (27). The second length of tubing (55) is therefore longer than the first length of tubing (53) which ends before the gland (60).

Hydraulic connections to the actuator (27) are situated at the forward end (37) of the cylinder (31), in the end cap (45). Hydraulic pressure is supplied to both the retract side (57) of the piston (59), and to an extend side (65) of the piston (59), from passages in the end cap (45), without the need for any external hydraulic tubing on the actuator (27). As mentioned above, hydraulic fluid can flow from a drilling in the end cap (45) and via the gap between the first length of tubing (53) and the second length of tubing (55) to the retract side (57) of the piston (59).

This is considered a significant safety feature since it allows the spring (29) to fit snugly over the cylinder (31), and to be held secure and to be guided by the cylinder (31), without any risk of bearing on, or wearing through, any hydraulic lines that would otherwise have been required to extend down the length of the hydraulic actuator (27), to get hydraulic fluid to the retract side (57) of the piston (59).

It is important that the actuator (27) is a double acting actuator since the actuator must push against the force exerted by the spring (29) to move the slide (23) forward, to allow an implement to be engaged by the coupler (11). And for this reason, a supply conduit to the retract side (57) of the actuator (27) is required.

The coupler (11) includes a forward latch (67) configured to allow a first connecting pin (69) of an implement to freely enter the first jaw (15). The forward latch (67) is configured to prevent the first connecting pin (69) from exiting the first jaw (15) until the slide (23) is moved to a chosen position along its range of movement. In this example, the chosen position is a position at or adjacent a forward end of the slide's (23) range of movement or travel, as shown in **Figure 6**.

The slide (23) includes a forward latch operating member (71) which is configured to move or rotate the forward latch (67) to a retracted position. When the forward latch (67) is in the retracted position the first connecting pin (69) is able to exit the first jaw (15).

The forward latch (67) is pivotally connected to the body (13) of the coupler (11) by a third assembly pin (77). A second spring (79) is situated about the third assembly pin (77) and is configured to bias the forward latch (67) to an extended position in which it prevents the first connecting pin (69) from exiting the first jaw (15).

The latch operating member (71) of the slide (23) is configured to contact and push a release lever (75) of the forward latch (67). The latch operating member (71) is in the form of a finger extending forward from one of the side members (47) of the slide (23). The forward end of the latch operating member (71) or finger is configured to bear against, and to push, the release lever (75) of the forward latch (67), and thereby to move the forward latch (67) to its retracted position.

It is important to note that the first connecting pin (69) of an implement can be received into the first jaw even if the forward latch (67) has not been retracted by the latch operating member. The first connecting pin (69) of the implement can simply push the latch (67) against the force exerted by the second spring (79) and thereby enter the first jaw. And once the first connecting pin (69) is fully home within the first jaw (15), the latch (67) can move back to its extended position under the action of the second spring (79).

In **Figure 6** the coupler is shown with the slide (23) moved fully forward by the actuator, against the force exerted by the spring (29), the forward latch (67) moved to a retracted position by the forward latch operating member (71) of the slide (23), and the first connecting pin (69) of an implement is engaged within the first jaw (15), and the back end of the coupler has been laid onto the second connecting pin (73) of the implement, ready for the slide (23) to be pushed aft to engage the second connecting pin (73) in the second jaw (19).

In **Figure 7**, the second connecting pin (73) is shown engaged within the second jaw (19) and the first connecting pin (69) is locked within the first jaw (15) by the forward latch (67). In the event of a failure of the hydraulic cylinder, or of the hydraulic supply, the spring (29) will keep the slide (23) pushed aft, and will prevent the second connecting pin (73) from becoming disengaged from the second jaw (19).

The operation of the coupler (11) is very simple. To begin with, the first connecting pin (69) is engaged within the first jaw, irrespective of the position of the slide (23), and then the coupler is crowded back onto the second connecting pin (73) with the slide moved forward, and then the slide is moved aft to capture the second connecting pin (73). As noted above, the first connecting pin (69) is then held securely within the first jaw (15) by the forward latch (67) and the spring (29) ensures that the second connecting pin (73) remains held captive by the second jaw (19) irrespective of any hydraulic failures in the coupler (11) or the hydraulic supply to the coupler from the excavator.

Second Example

With reference to **Figures 8** to **13**, a second example of a quick hitch coupler (81) according to the present invention will now be described. The second example of a quick hitch coupler

(81) is similar to the first example of a quick hitch coupler (11) described herein, except as noted in the following description.

The quick hitch coupler (81) has a different forward latch operating member (83) which has been designed to push a release lever (85) of a forward latch (87) to move the forward latch (87) to its retracted position, and also to hold or lock the forward latch (87) in its extended position.

The forward latch (87) is biased toward the extended position by a spring (89). When the forward latch (87) is in its extended position, the forward latch (87) prevents the first connecting pin of an implement from exiting the first jaw (91). The coupler (81) is distinct from the coupler (11) in that it includes a locking mechanism (93) that is configured to lock the forward latch (87) in the extended position. And in this example, the locking mechanism (93) is a part of the latch operating member (83).

The latch operating member (83) is an extension of the front end of the slide (95) and is configured to lock the forward latch (87) in its extended position when the latch operating member (83) is within a first and aft portion of the latch operating member's range of movement. And the latch operating member (83) is configured to contact and push the release lever (85) to move the forward latch (87) to its retracted position when the latch operating member (83) is moved through a second and forward portion of it range of movement.

The latch operating member (83) has a first contact surface (97) that is configured to lock the forward latch (87) in its extended position when the latch operating member (83) is situated within the first portion of its range of movement. The first contact surface (97) is a feature of the locking mechanism (93) and is configured to bear against a bearing surface (99) located at or adjacent a free end of the release lever (85) of the forward latch (87).

The latch operating member (83) has a second contact surface (101) that is configured to contact the release lever (85) of the forward latch and to move the forward latch to its retracted position when the latch operating member (83) is moved through the second portion of its range of movement. The second contact surface (101) is a feature of the latch

operating member (83) and is configured to bear against a radiused or curved free end (103) of the release lever (85) of the forward latch (87).

The latch operating member (83) is connected to the slide (95), and the first portion of the latch operating member's range of movement is during movement of the slide (95) from its aft most point of travel to a point in which the first contact surface (97) is no longer overlying, or in contact with, the bearing surface (99) of the forward latch (87). The second portion of the latch operating member's range of movement is from when the second contact surface (101) initially contacts the free end (103) of the release lever (85) to the forward most point of travel of the latch operating member (83) or the slide (95).

In this example, the coupler (81) further includes an indicator (107) configured to provide a visual indication to a user of the coupler (81) that the forward latch (87) is not locked in its extended position. The indicator (81) is operatively connected to the latch operating member (83), and is, in this example, a forward part of the latch operating member (83).

The indicator (107) can be painted a bright colour, for example red or yellow, and is configured to extend out of, or forward of, a front face (109) at the front end of the coupler body (111) to provide a visual indication that the forward latch (87) is not locked in its extended position. The indicator (107) is retracted within the body (111) while the latch operating member (83) is situated within the first portion of its range of movement, and the indicator (107) protrudes out through the front face (109) when the latch operating member (83) is situated within the second portion of its range of movement.

VARIATIONS

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.

In the examples described above the biasing means is in the form of a spring. It is envisaged that in an alternative embodiment the biasing means could include the use of a compressed gas, or the use of an elastomeric material.

In the second example described above, the locking mechanism (93) is in the form of a portion of a profile cut section of plate steel which also forms the forward latch operating member (83) and the indicator (107). The profile cut section of plate steel is welded to the slide (95), and could be said to be a part of the slide (95) since it moves whenever the slide (95) moves. It is envisaged that in an alternative embodiment either the forward latch operating member (83), the locking mechanism (93) or the indicator (107), and any combination of these could be a discrete part, or parts, that is/are operatively connected to the slide (95), for example connected by a link member.

Figure 14 shows a modified end cap (121) that can be used in place of the end cap (45) of the first example of a quick hitch coupler (11), or of the equivalent end cap in the second example of a quick hitch coupler (81). As a result of in-service experience with the quick hitch couplers according to the present invention, it was found that hydraulic pressure could build up in the extend side of the actuator.

The increased hydraulic pressure was created by forces exerted by the attachment pins of a work attachment, which pushed against the second jaw. This pressure accumulated within the extend side of the actuator because a check valve in the hydraulic circuit of the coupler was used to hold pressure within the extend side of the actuator to hold the attachment pins securely within the jaws of the quick hitch coupler.

The end cap (121) includes a first threaded socket (123) which is configured to house the check valve in close proximity to the bore of the cylinder of the actuator. The end cap (121) has also been configured with a second threaded socket (125) to house a pressure relief valve in close proximity to the bore of the cylinder of the actuator. The pressure relief valve is used to bypass the check valve if the pressure within the cylinder of the actuator exceeds a pre-determined pressure, for example 3500 psi.

DEFINITIONS

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

Thus it can be seen that at least the preferred form of the invention provides a quick hitch coupler which has relatively few moving parts, and very simple and robust hydraulic components.

And with these few moving parts, both of the connecting pins of an implement are held securely within the coupler by the spring and the forward latch, even if hydraulic pressure is lost. Furthermore, the forward connecting pin is held securely by the forward latch (87) irrespective of anything that may happen to the slide, for example a slide structural failure.

In addition, the forward latch (87) is held or locked positively when in the extended position, and cannot be rotated out of the way by a connecting pin, for example when an implement is swinging from the front jaw only and the front connecting pin is rotating and could bind with the front latch and try to rotate it towards its retracted position.

When the forward latch is in its retracted position as shown in Figure 10, and the slide (95) is moved aft, an aft end of the first contact surface (97), or at least the aft edge of the locking mechanism (93) will nudge the forward latch (87) towards its extended position, even if the spring (89) has failed to do so. This is an added safety feature.

Furthermore, the coupler is simple to operate which minimises the possibility of operator error when engaging an implement.

In summary, the simplicity minimises the opportunity for mechanical failure, the dual locking feature maximises the chance of holding an implement securely even if a variety of mechanical failures occur, and the simple operation minimises the chance of operator error that could lead to the loss of an implement from the coupler.

CLAIMS

1. A quick hitch coupler having a body configured for attachment to the free end of a dipper arm of an excavator, the body having a first jaw configured to receive and hold a first connecting pin of an implement, the coupler having a second jaw formed between a jaw formation on a slide of the coupler and a bottom surface of the coupler body, the coupler further having an actuator configured to move the slide away from and to toward the first jaw, the actuator having an integral biasing means configured to bias the slide in a direction away from the first jaw.

2. A quick hitch coupler as claimed in claim 1, wherein the actuator is a hydraulic actuator and a cylinder of the hydraulic actuator comprises two lengths of tubing, a first length of tubing concentric within a second length of tubing.

3. A quick hitch coupler as claimed in claim 2, wherein the path for hydraulic fluid under pressure to reach a retract side of a piston of the actuator is via an annular duct formed between an outside diameter of the first length of tubing and an inside diameter of the second length of tubing.

4. A quick hitch coupler as claimed in claim 2 or claim 3, wherein a forward and closed end of the cylinder of the actuator is connected to the body of the coupler.

5. A quick hitch coupler as claimed in any one of claims 2 to 4, wherein hydraulic connections to the actuator are situated at the forward end of the cylinder of the hydraulic actuator.

6. A quick hitch coupler as claimed in any one of claims 1 to 5, wherein the coupler includes a forward latch configured to allow a first connecting pin to freely enter the first jaw and configured to prevent the first connecting pin from exiting the first jaw until the slide is moved to a chosen position along its range of movement.

7. A quick hitch coupler as claimed in claim 6, wherein the slide includes a forward latch operating member configured to move the forward latch to a retracted position in which the first connecting pin is able to exit the first jaw.

8. A quick hitch coupler as claimed in claim 6 or claim 7, wherein the forward latch is pivotally connected to the body of the coupler.

9. A quick hitch coupler as claimed in any one of claims 6 to 8, wherein the forward latch is biased toward an extended position in which the forward latch prevents the first connecting pin of an implement from exiting the first jaw.

10. A quick hitch coupler as claimed in any one of claims 6 to 9, wherein the coupler further includes a locking mechanism configured to lock the forward latch in the extended position.

11. A quick hitch coupler as claimed in claim 10, wherein the locking mechanism is a part of the latch operating member.

12. A quick hitch coupler as claimed in claim 11, wherein the latch operating member is configured to lock the forward latch in its extended position when the latch operating member is within a first portion of the latch operating member's range of movement.

13. A quick hitch coupler as claimed in claim 11 or claim 12, wherein the latch operating member of the slide is configured to contact and push a release lever of the forward latch to move the forward latch to its retracted position when the latch operating member is moved through a second portion of the latch operating member's range of movement.

14. A quick hitch coupler as claimed in claim 12 or claim 13, wherein the latch operating member has a first contact surface that is configured to lock the forward latch in its extended position when the latch operating member is situated within the first portion of its range of movement.

15. A quick hitch coupler as claimed in claim 13 or claim 14, wherein the latch operating member has a second contact surface that is configured to contact the release lever of the forward latch and to move the forward latch to its retracted position when the latch operating member is moved through the second portion of its range of movement.

16. A quick hitch coupler as claimed in claim 14 or claim 15, wherein the first contact surface is a feature of the locking mechanism.

17. A quick hitch coupler as claimed in any one of claims 6 to 16, wherein the coupler further includes an indicator configured to provide a visual indication to a user of the coupler that the forward latch is not locked in its extended position.

18. A quick hitch coupler as claimed in claim 17, wherein the indicator is operatively connected to the latch operating member.

19. A quick hitch coupler as claimed in claim 17 or claim 18, wherein the indicator is configured to extend out of the front end of the coupler body to provide a visual indication that the forward latch is not locked in its extended position.

20. An excavator incorporating at least one quick hitch coupler as claimed in any one of claims 1 to 19.

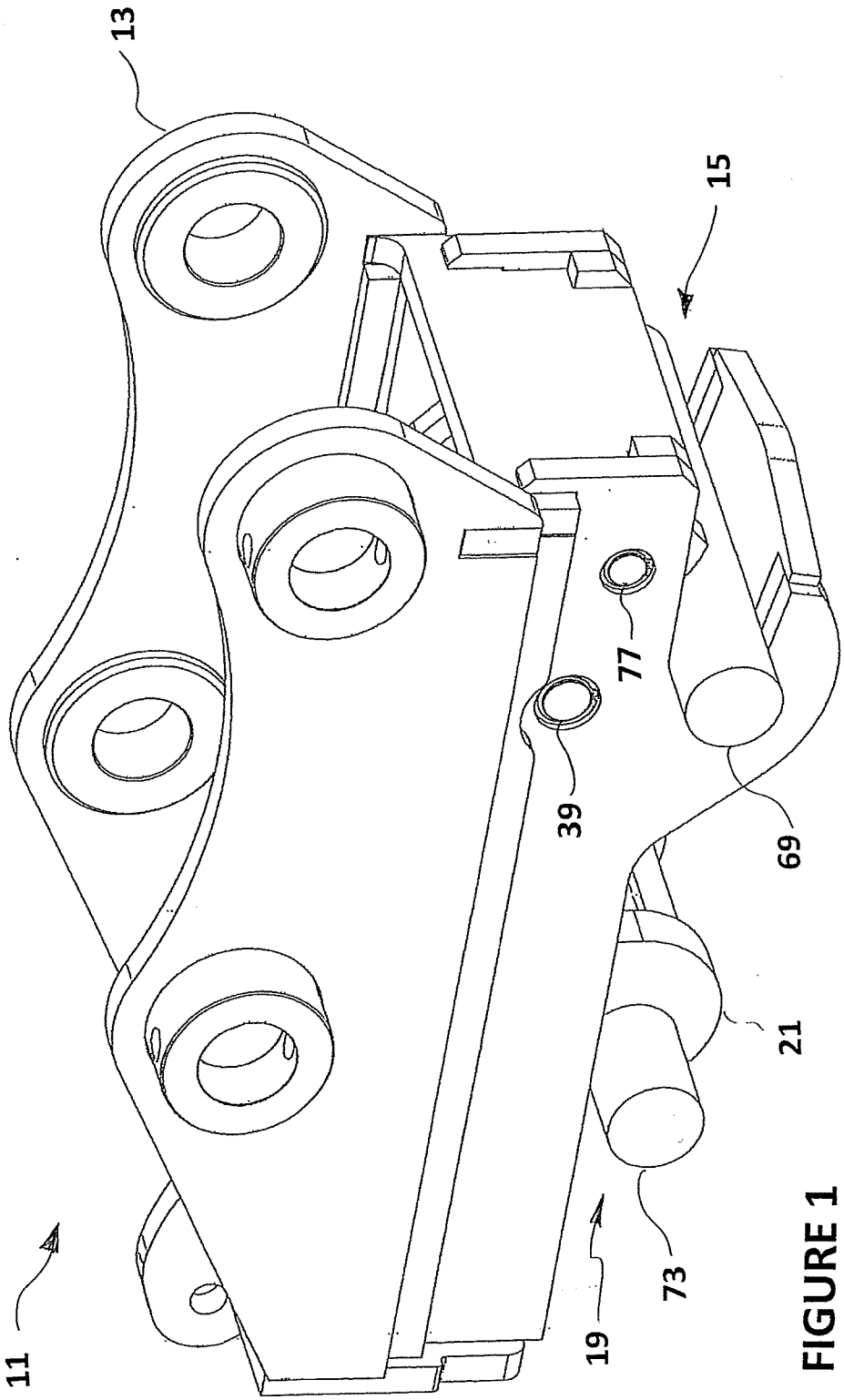


FIGURE 1

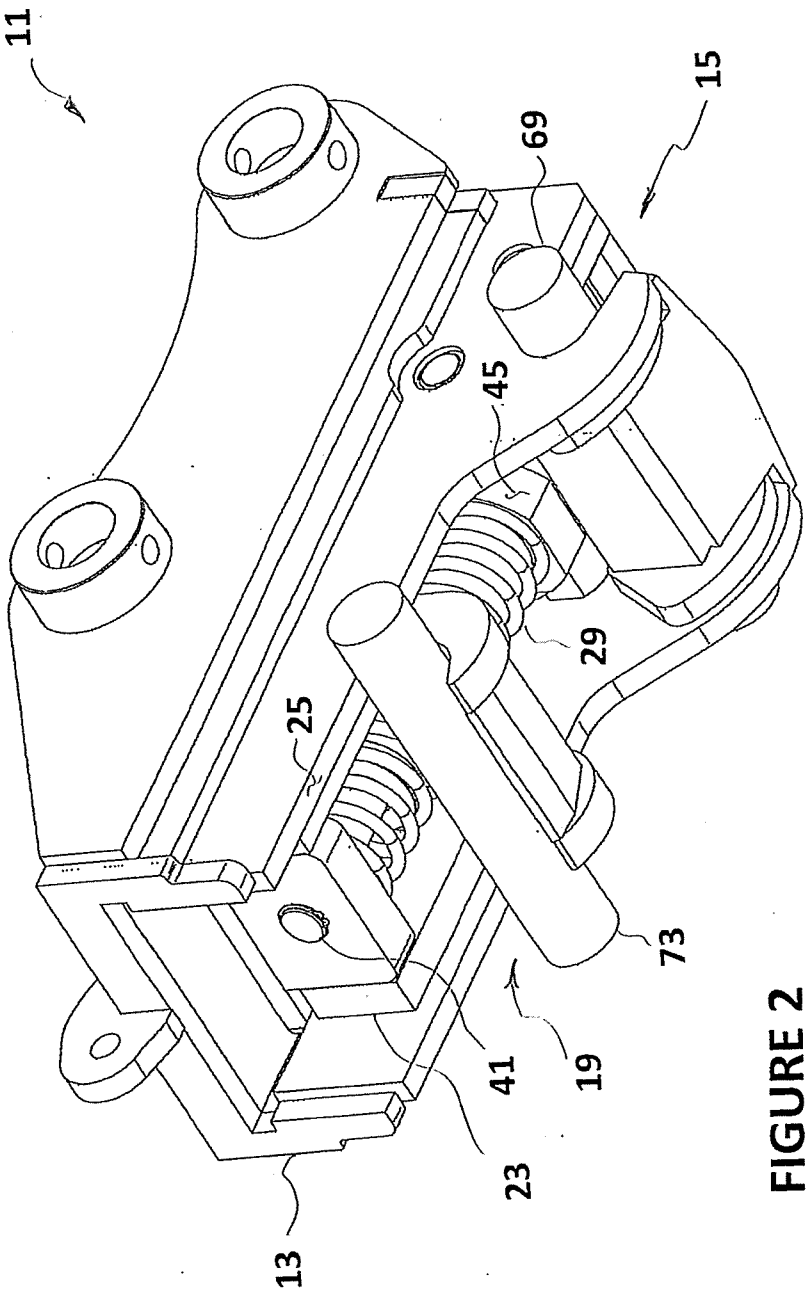
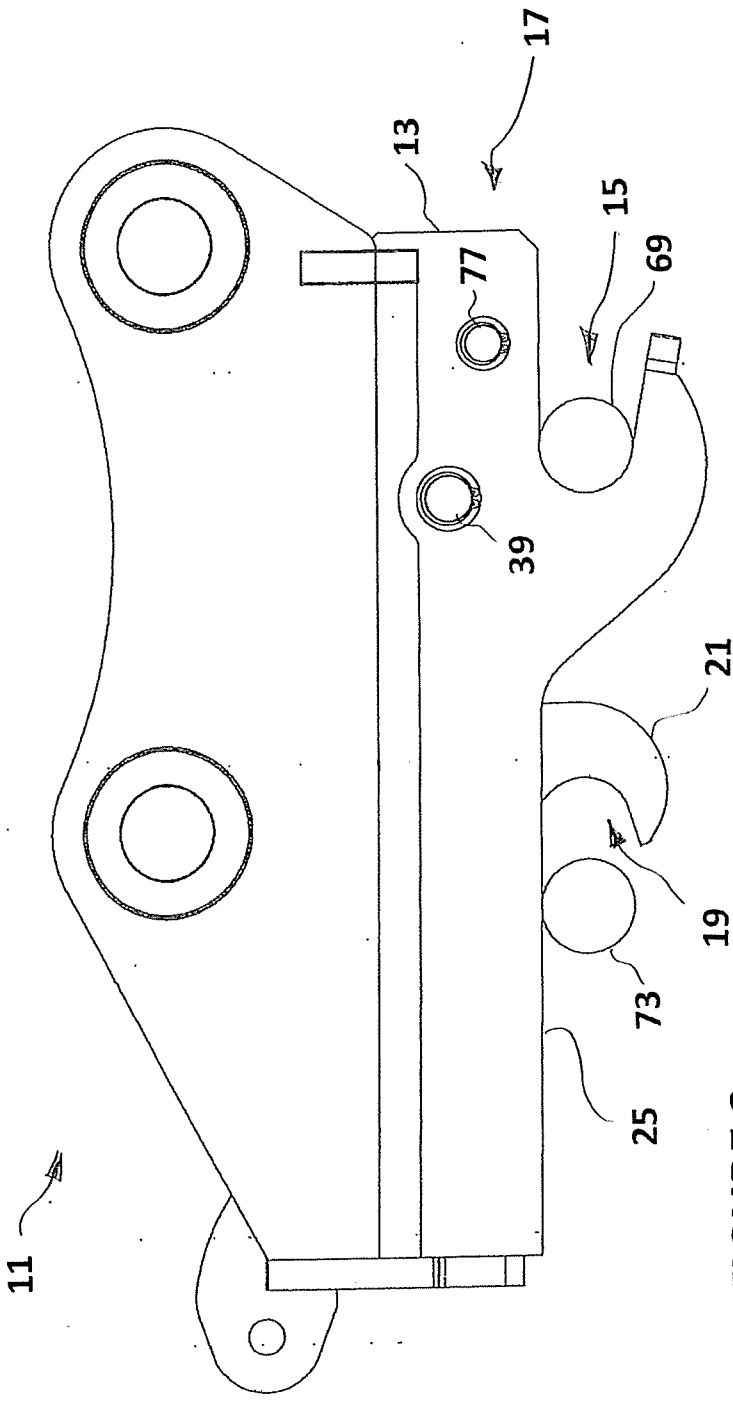


FIGURE 2



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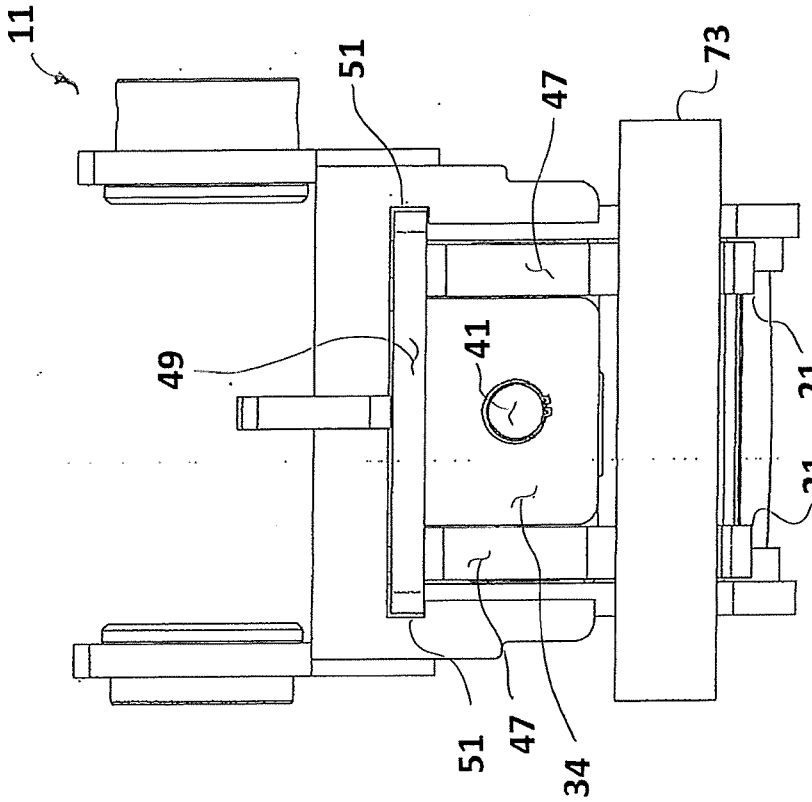
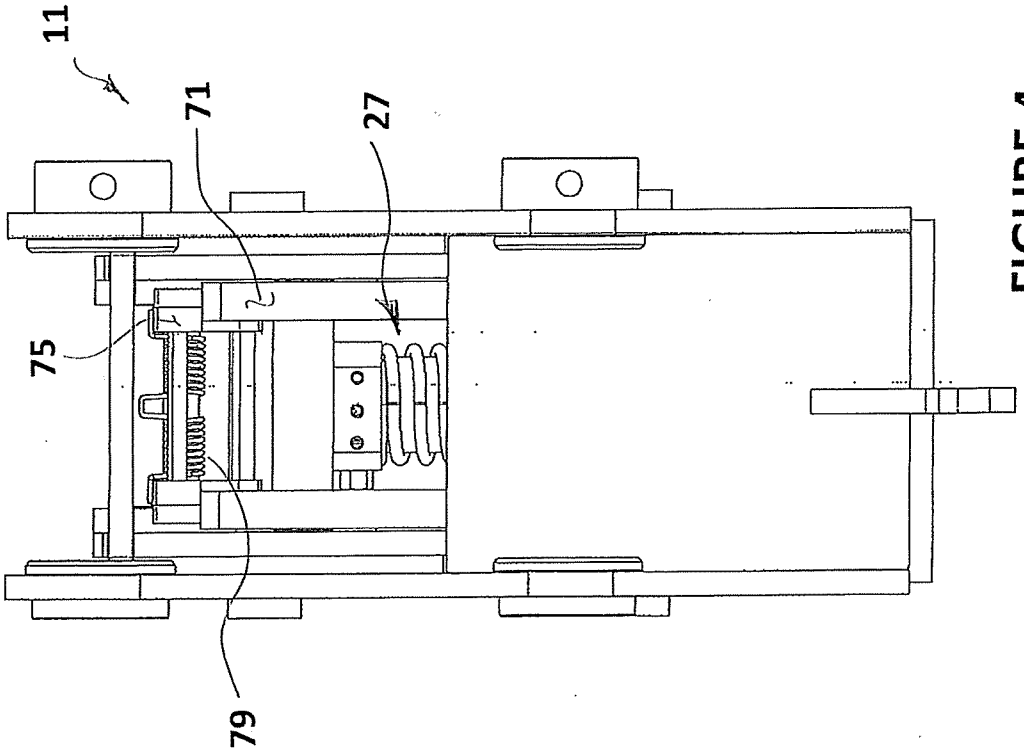


FIGURE 5



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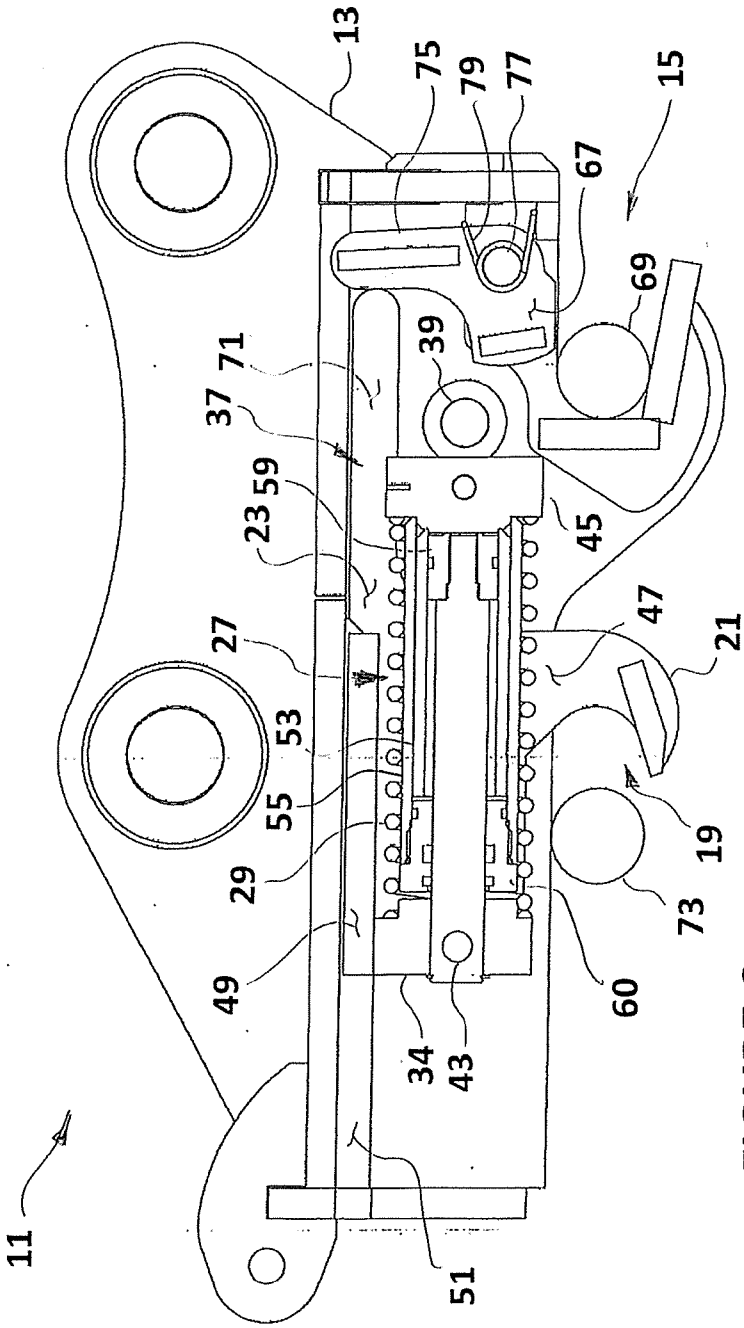
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FIGURE 6

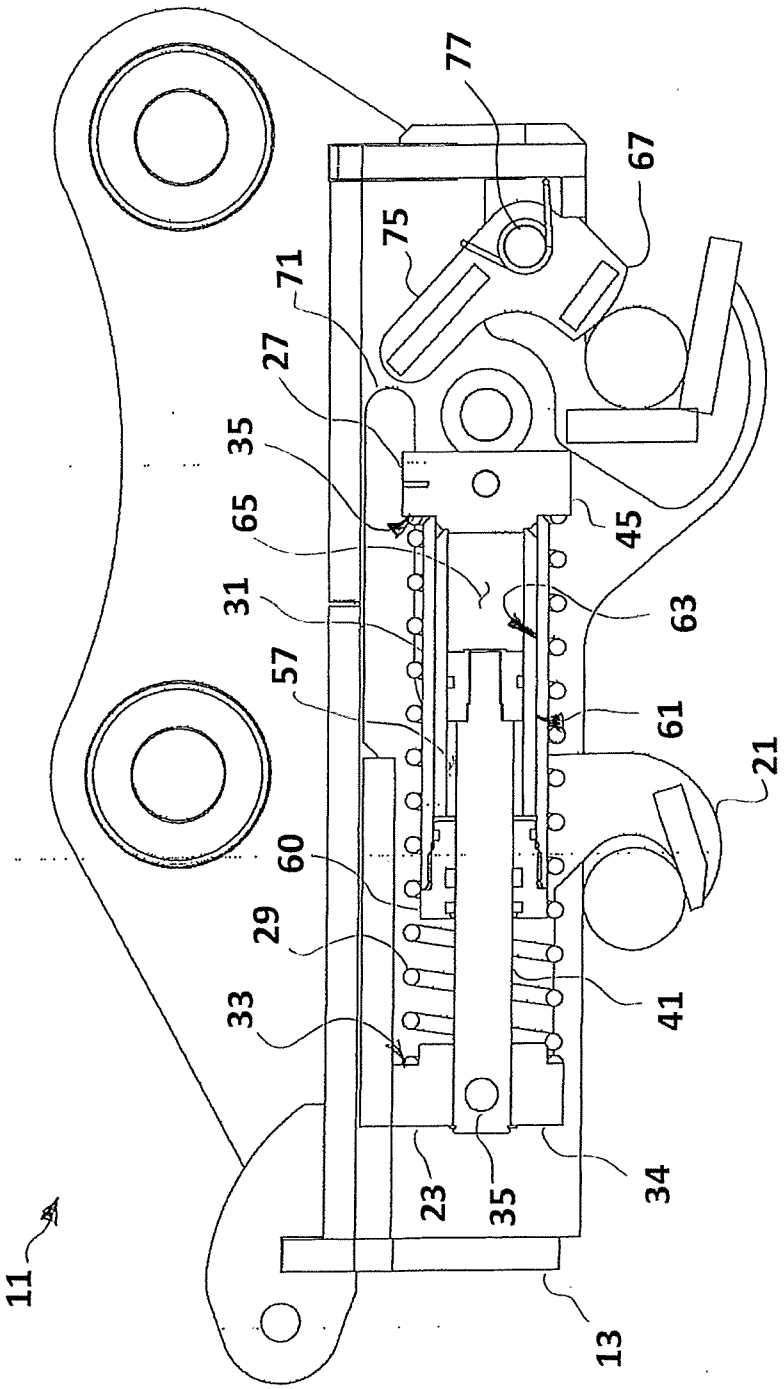
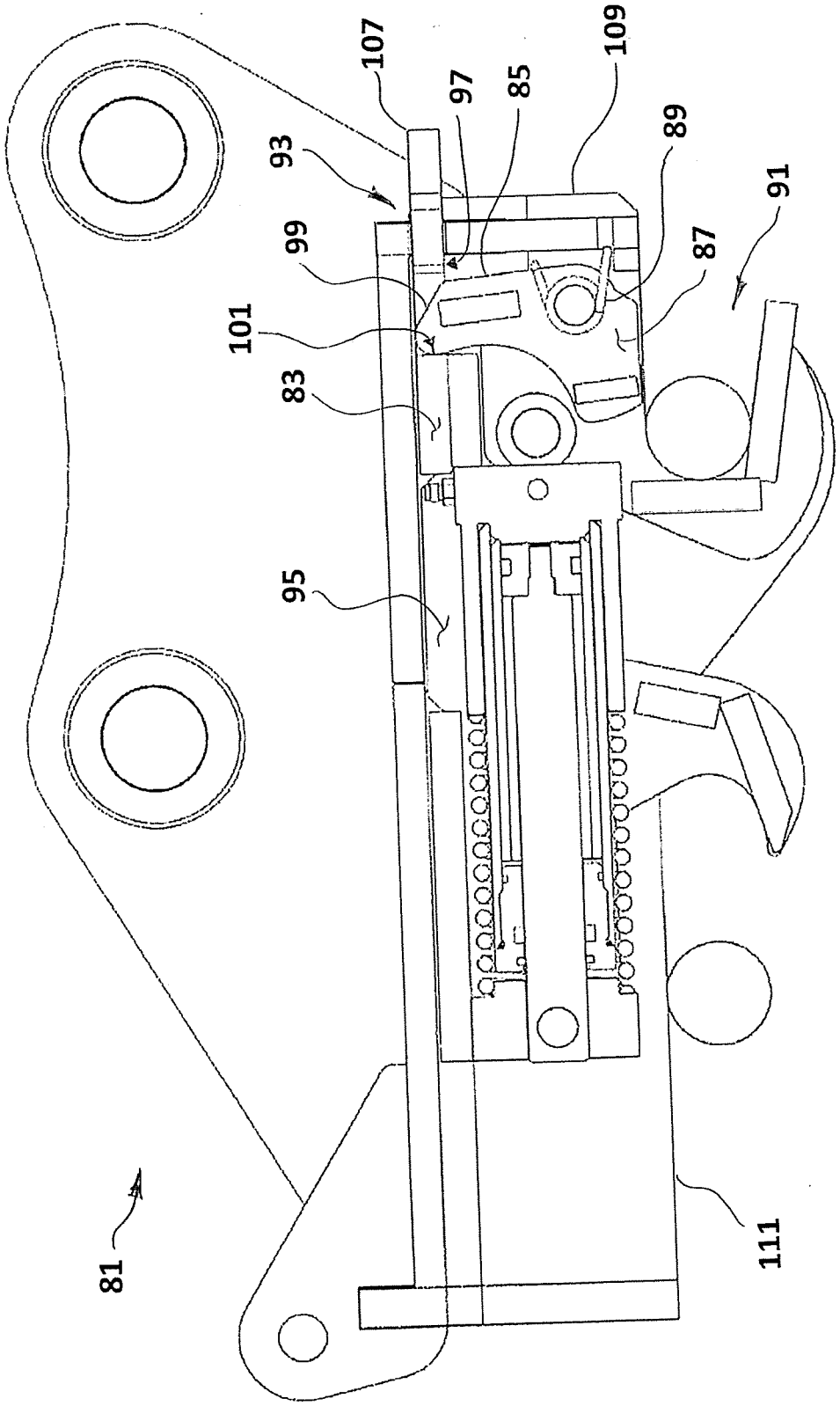


FIGURE 7



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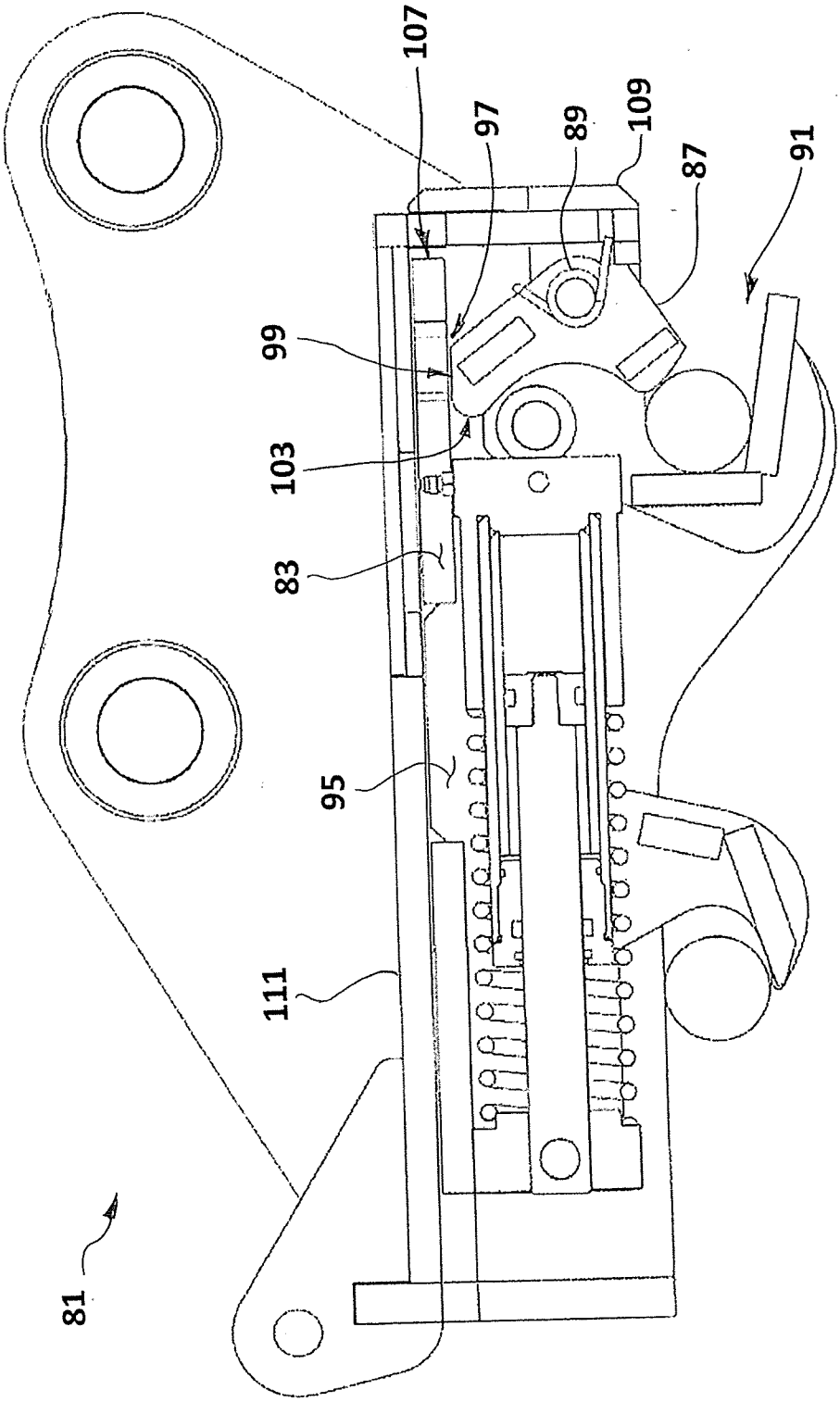

FIGURE 9

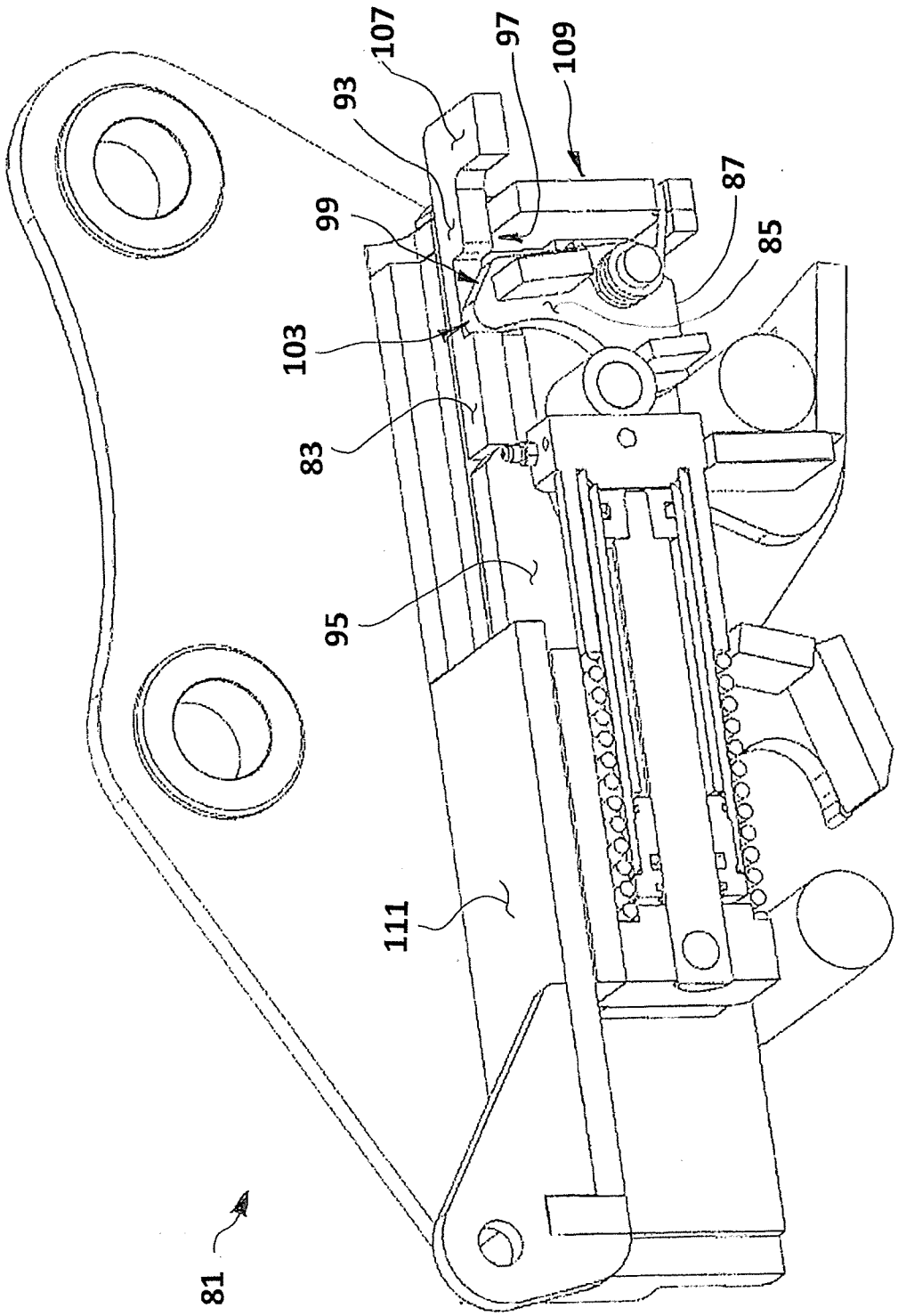

FIGURE 10

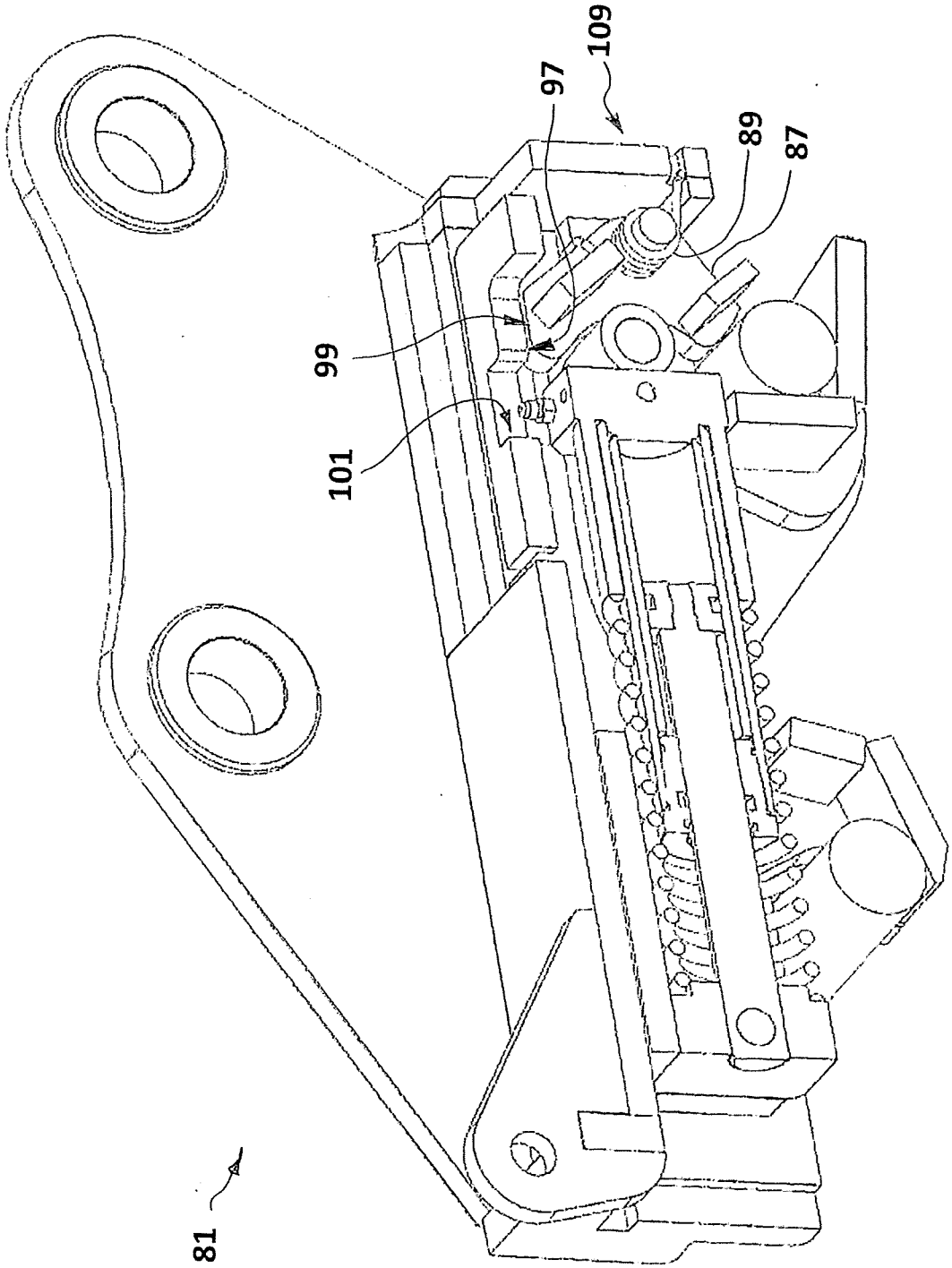

FIGURE 11

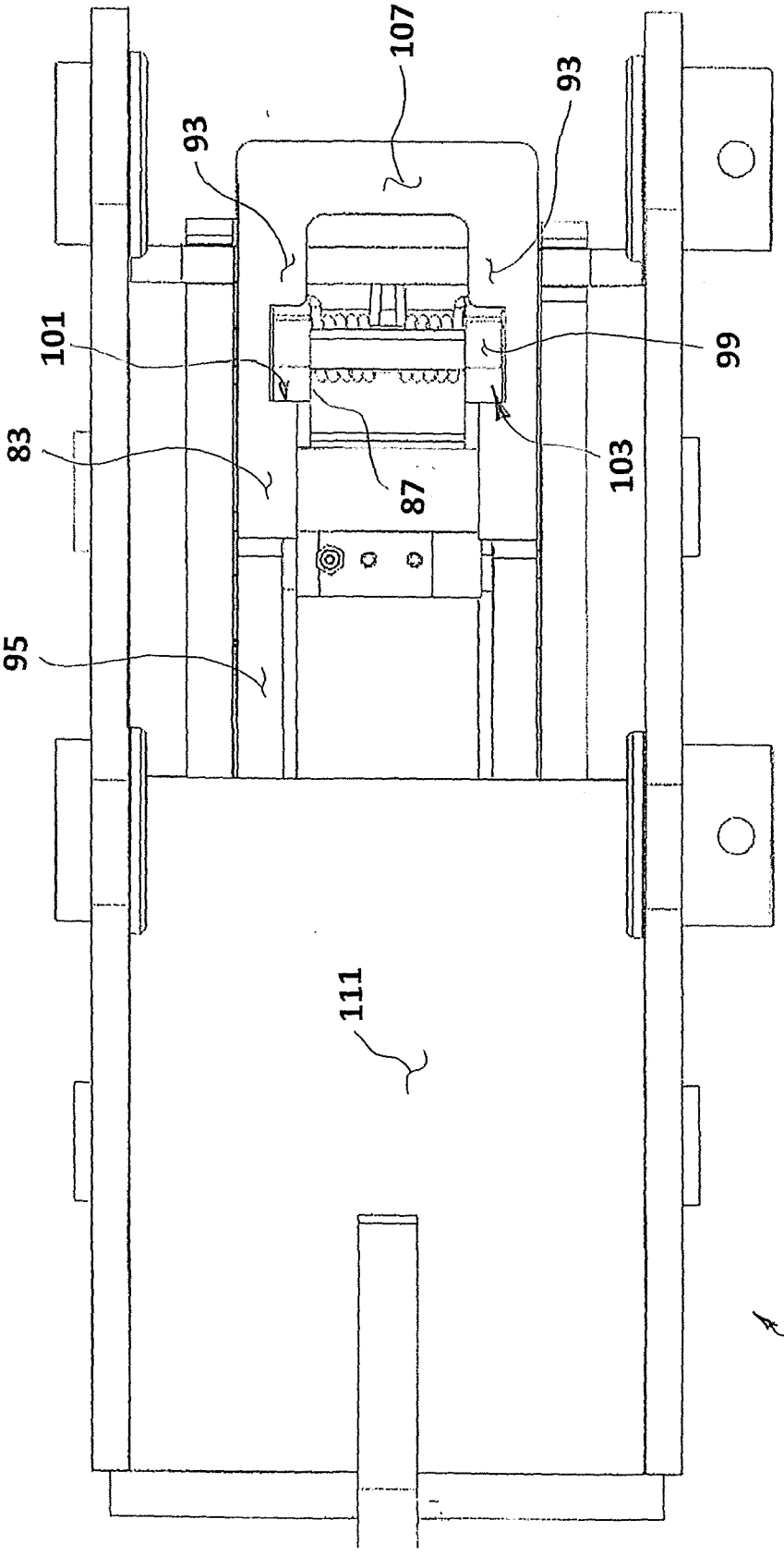

FIGURE 12

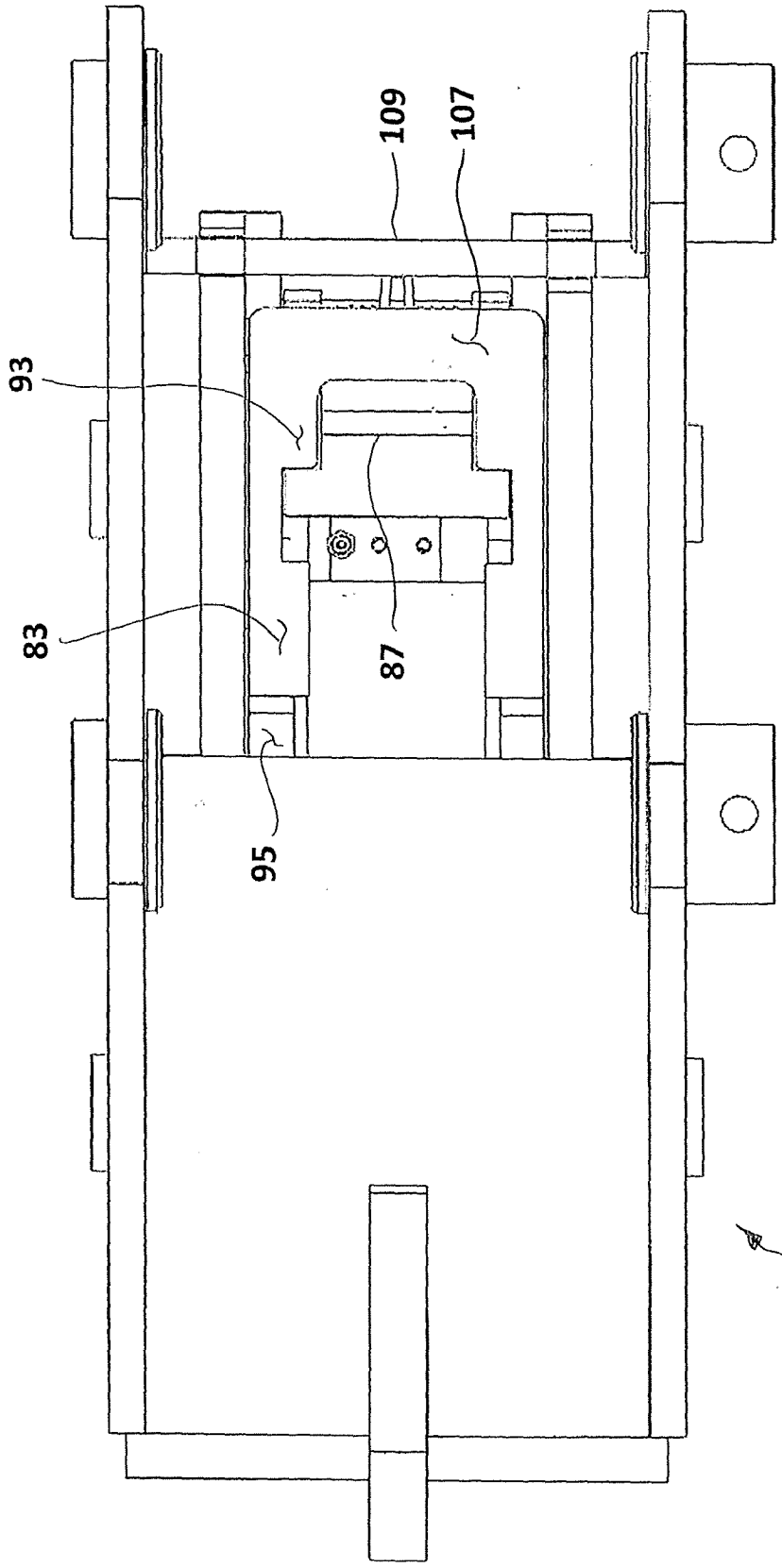

FIGURE 13

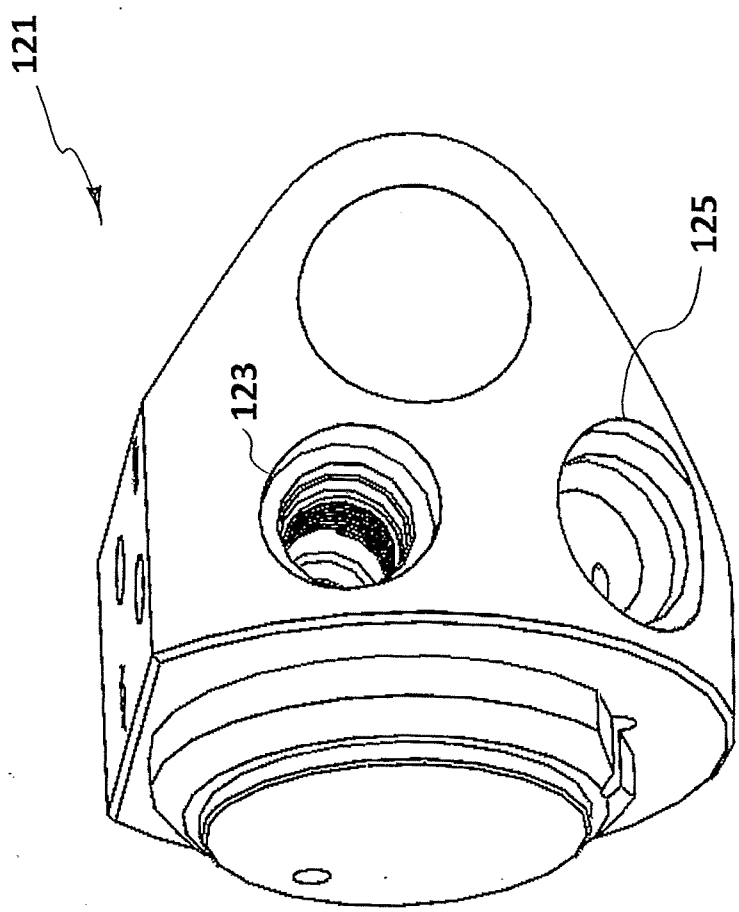

FIGURE 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2017/050122

A. CLASSIFICATION OF SUBJECT MATTER

E02F 3/36 (2006.01) E02F 9/24 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CPC marks E02F3/3609, E02F3/365, E02F3/96, E02F3/36, E02F9/24 and keywords: hydraulic, piston, pneumatic, jaw, bracket, slide, lateral, glide, safe, secure, latch, lock, catch, quick, instant, hitch couple and similar terms.

Search query: Applicant or inventor "SHORT, Bruce Archibald".

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 January 2018	05 January 2018

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INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/NZ2017/050122**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015/0330053 A1 (JB ATTACHMENTS LIMITED) 19 November 2015 Fig 2, 10, para 92-99.	1-12, 14, 20
Y	WO 2015/199081 A1 (KOMATSU LTD.) 30 December 2015 & family member AU2015281831 Fig 5-6	13, 15-16
Y	US 6379075 B1 (SHAMBLIN et al.) 30 April 2002 col. 7, line 22-33	17-19
X	US 2014/0301779 A1 (S T COUPLERS LIMITED) 06 October 2014 Figs 1-15, first embodiment.	1-14 and 20
A	AU 2013205373 A1 (FEEL INDUSTRIAL ENGINEERING CO., LTD) 25 September 2014 All	1-20

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/NZ2017/050122**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		**Patent Family Member/s**	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
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		WO 2014137031 A1	12 Sep 2014

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/NZ2017/050122**

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Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.