



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.05.2023 Bulletin 2023/21

(51) International Patent Classification (IPC):
E02F 3/36^(2006.01)

(21) Application number: **22275139.8**

(52) Cooperative Patent Classification (CPC):
**E02F 3/3618; E02F 3/3622; E02F 3/365;
E02F 3/3663**

(22) Date of filing: **09.11.2022**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(71) Applicant: **Rhinox Group Ltd**
East Yorkshire YO43 4TW (GB)

(72) Inventor: **Rogers, Kurt**
Yorkshire, YO43 4TW (GB)

(74) Representative: **Corbyn, David Jonathan**
Bailey Walsh & Co LLP
1 York Place
Leeds, LS1 2DR (GB)

(30) Priority: **17.11.2021 GB 202116534**

(54) **COUPLING APPARATUS**

(57) The present invention provides a coupling apparatus for coupling an attachment to a dipper arm of a machine. The apparatus includes a coupler body; a first, fixed engaging means mounted on the coupler body for engaging a first coupling pin of the attachment, in use; a latch member associated with and pivotable with respect to the first, fixed engaging means between latched and unlatched positions; and a locking member pivotable about a pivot point between first and second positions, and provided in mechanical communication with the latch

member. The latch member includes an aperture located therethrough, and the locking member includes a trunnion member or other such protrusion located thereon, extending into or through the aperture of the latch member and engaging the same such that when the locking member is in the first position, the latch member is in the latched position, and when the locking member is moved to the second position, the trunnion member moves the latch to the unlatched position.

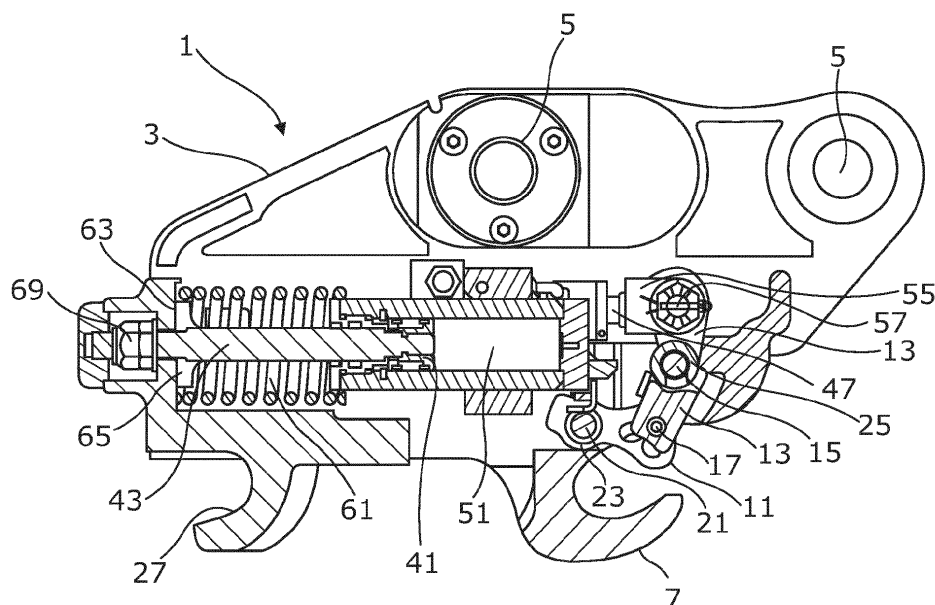


Figure 1

Description

[0001] The invention to which this application relates is a coupling apparatus.

[0002] Coupling apparatus for use in attaching a dipper arm of an excavator to various accessories are well known. The couplers are used to attach buckets of various sizes, or other construction implements, to the dipper arm for subsequent use. The couplers are usually provided to be detachably attachable to both the dipper arm and the accessory which is to be used. Usually, the coupler remains on the dipper arm and the various accessories are attached, detached, interchanged as required. The attachment between the coupler and the accessory typically involves the provision of a pair or parallel coupling pins fixed on the accessory, which then connect or otherwise engage with respective engaging members on the coupler. In most common configurations, a pair of engaging members is provided on the coupler, one of which is fixed in place with the other being movable. The fixed engaging member usually contacts one of the coupling pins first, in an engaging position, and subsequently the second engaging member will then move into position engaging the second coupling pin and securing the accessory to the coupler.

[0003] The fixed engaging member usually includes a latch or other blocking member associated with it to retain the coupling pin in position, and the movable engaging member is usually hydraulically operated. However, there are some disadvantages to such configurations, for example, wherein the hydraulic operation may fail owing to a leak or failure to provide hydraulic fluid to the hydraulic ram. The movable engaging member may then fail to engage properly and the associated coupling pin may be inadvertently released. The weight of the accessory may then be such that the coupling pin held by the fixed engaging member and latch may simply overcome the biasing strength of the latch under gravity, leading to complete release of the accessory from the coupler and consequently potentially causing a serious accident.

[0004] There is therefore a need to provide a coupling apparatus which has improved safety features which prevents or substantially reduces the possibility of accidental or inadvertent release of accessories from the coupler.

[0005] It is therefore an aim of the present invention to provide an improved coupling apparatus which overcomes the aforementioned problems associated with the prior art.

[0006] According to a first aspect of the invention there is provided a coupling apparatus for coupling an attachment to a dipper arm of a machine, the apparatus including:

- a coupler body;
- a first, fixed engaging means mounted on the coupler body for engaging a first coupling pin of the attachment, in use;
- a latch member associated with and pivotable with

respect to the first, fixed engaging means between latched and unlatched positions;

a locking member pivotable about a pivot point between first and second positions, and provided in mechanical communication with the latch member; wherein the latch member includes an aperture located therethrough, and said locking member includes a trunnion member or other such protrusion located thereon, extending into or through the aperture of the latch member and engaging the same such that when said locking member is in the first position, the latch member is in the latched position, and when said locking member is moved to the second position, the trunnion member moves the latch to the unlatched position.

[0007] Typically, the coupling apparatus includes second, movable engaging means mounted on the coupler body for engaging a second coupling pin of the attachment, in use. Preferably, said second, movable engaging means is movable between an engaged position wherein it engages the second coupling pin as the first, fixed engaging means engages the first coupling pin, in use, and a disengaged position.

[0008] In one embodiment, said latch member includes a pivot point located at or near a first, proximal end thereof.

[0009] In one embodiment, the aperture of the latch member is located at or near a second, distal end thereof.

[0010] Typically, said latch member is biased to the latched position by biasing means. In one embodiment, said biasing means are provided as a torsion spring member. Typically, said torsion spring member is located about the pivot point of the latch member.

[0011] Typically, biasing means are also provided associated with the locking member, biasing the same to the first position. Typically, said biasing means are provided located at the pivot point of the locking member. Preferably, said biasing means are provided in the form of a torsion spring member.

[0012] In one embodiment, the aperture of the latch member is formed as a slot. Typically, the trunnion member is movable within and/or along the slot.

[0013] Preferably, the path movement of the trunnion member on the locking member is provided to be at an angle relative to the slot when the latch member is in the latch position. Such an arrangement ensures that while the trunnion member moves within the confines of the slot, its path of movement as the locking member moves will consequently move the latch member from the latched position to the unlatched position, and back again as the direction of movement is reversed.

[0014] In one embodiment, the slot is formed as a substantially V-shaped slot within the latch member. Typically, when the locking member is provided in the first position and the latch member is consequently in the latched position, the trunnion member rests at an apex of the V-shaped slot.

[0015] Typically, as the locking member is movable from the first position to the second position, the trunnion member is movable along the first length of the V-shaped slot to a distal end thereof, thereby moving the latch member from the latched position to the unlatched position.

[0016] Preferably, the provision of a second length of the V-shaped slot permits pivoting movement of the latch member, while the locking member and trunnion member remain in their respective first positions, to a deadlock position, wherein the trunnion member is located at a distal end of the second length of the V-shaped slot, preventing further movement of the latch member.

[0017] The provision of such a deadlock position provides the apparatus of the present invention with an additional and improved safety feature should the coupling begin to falter, preventing unwanted or accidental full release of the accessory from the coupling apparatus. For example, if for whatever reason the movable engaging means failed to engage with or inadvertently disengaged from the second coupling pin, the weight of the accessory would then be borne by the fixed engaging means entirely. In some examples in the prior art, there then becomes a real danger that the weight of the accessory may overcome the biasing force afforded to a latch provided with the fixed engaging means, allowing the accessory to fully detach, fall and potentially cause serious accident. In the present invention, if the weight or movement of the accessory is such that the first coupling pin is urged to move out from the fixed engaging means, this movement begins to urge the latch member against its biasing force about its own pivot point. However, the locking member and hence the trunnion member are stationary in the first position and so the latch member may only be moved as far as the second length of the V-shaped slot and trunnion member will permit. As the trunnion member engages the distal end of the V-shaped slot, this creates a deadlock position preventing any further movement of the latch member and, consequently, prevents release of the first coupling pin from the fixed engaging means and hence detachment of the accessory from the coupling apparatus.

[0018] In one embodiment, the coupling apparatus is provided to be hydraulically operable. Typically, drive means are provided to affect movement of the movable engaging means and the locking member. Preferably, said drive means are hydraulically operated.

[0019] Typically, said drive means comprises a hydraulically operable dual piston rod members.

[0020] In a preferred embodiment, said drive means includes a body portion, first piston and piston rod members, and second piston and piston rod members.

[0021] Typically, the first piston rod member engages with and drives movement of the movable engaging means. Further typically, said movement is linear movement, along a longitudinal axis of the first piston rod member.

[0022] Typically, the second piston rod member engages with and drives movement of the locking member.

Further typically, said movement is linear movement, of the second piston rod member, along a longitudinal axis thereof, which drives pivoting movement of the locking member about its pivot point, in use. Consequently, pivoting movement of the locking member causes movement of the latch member between the latched and unlatched position.

[0023] In one embodiment, pivoting movement of the locking member may cause arcuate movement of the trunnion member, such that the trunnion member moves within the aperture of the latch member, moving it between the latched and unlatched positions.

[0024] In one embodiment, the body portion of said drive means comprises a manifold, a first piston chamber and a second piston chamber. Typically, said first and second piston chambers locate with and/or through the manifold.

[0025] In one embodiment, the manifold further includes ports, valves and feed means for the introduction and flow of first and second bodies or volumes of hydraulic fluid into and through the drive means. Typically, the first and second bodies or volumes of hydraulic fluid are provided to affect hydraulic movement of the first and second piston members and piston rod members.

[0026] In one embodiment, said first and second piston members are located in respective first and second piston chambers of the body portion, and said first and second piston rod members are linearly movable along longitudinal axes thereof, extending from and retracting towards/into the respective first and second piston chambers.

[0027] Typically, retraction of the first piston and piston rod member serves to move the movable engaging means from an engaged position to a disengaged position. Conversely, extension of the first piston and piston rod member serves to move the movable engaging means from a disengaged position to an engaged position.

[0028] In one embodiment, the movable engaging means are biased to the engaged position by biasing means. Preferably, said biasing means is provided in the form of one or more compression spring members. Typically, said compression spring member is arranged coaxially with the first piston rod member. Further typically, retraction of the first piston rod member is against and overcomes the biasing force of the compression spring member.

[0029] In one embodiment, extension of the second piston and piston rod member serves to move/pivot the locking member from the first position to the second position, and consequently move the latch member from the latched position to the unlatched position. Conversely, retraction of the second piston and piston rod member serves to move/pivot the locking member from the second position to the first position, and consequently move the latch member from the unlatched position to the latched position.

[0030] Typically, the first piston rod member includes

attachment means at a distal end thereof for attachment to the movable engaging means.

[0031] Typically, the second piston rod member includes attachment means at a distal end thereof for attachment to the locking member. In one embodiment, said attachment is at an end of the locking member spaced apart from the trunnion member. Preferably, said attachment is at an opposing side of the pivot point from the trunnion member.

[0032] In one embodiment, the manifold includes a first port and feed means provided of the introduction and flow of a first body or volume of fluid. Typically, the manifold further includes a second port and feed means provided of the introduction and flow of a second body or volume of fluid.

[0033] In one embodiment, the first piston chamber includes a first fluid receiving portion and a second, separate fluid receiving portion. Typically, said first and second fluid receiving portions are separated by and provided either side of the first piston member.

[0034] Preferably, the first fluid receiving portion is located at a proximal end of the first piston chamber and the second fluid receiving portion is located at a distal end of the first piston chamber.

[0035] In one embodiment, the second piston chamber includes a first fluid receiving portion and a second, separate fluid receiving portion. Typically, said first and second fluid receiving portions are separated by and provided either side of the second piston member.

[0036] Preferably, the first fluid receiving portion is located at a distal end of the second piston chamber and the second fluid receiving portion is located at a proximal end of the second piston chamber.

[0037] Typically, as the first body or volume of fluid is injected or otherwise introduced into and through the first port and feed means, fluid fills the respective first fluid receiving portions of the first and second piston chambers, thereby causing extension of the first piston and piston rod member, and retraction of the second piston and piston rod member.

[0038] Typically, as the second body or volume of fluid is injected or otherwise introduced into and through the second port and feed means, fluid fills the respective second fluid receiving portions of the first and second piston chambers, thereby causing retraction of the first piston and piston rod member, and extension of the second piston and piston rod member, and forces the first body or volume of fluid back out of the manifold through the first port and feed means.

[0039] In one embodiment, valve means are provided associated with the first port. Typically, said valve means are provided to prevent return flow of the first body or volume of fluid through the first port, unless forced by pressurised injection or introduction of a second body or volume of fluid through the second port and feed means.

[0040] In one embodiment, valve means are provided associated with the second port. Typically, said valve means are provided to prevent return flow of the second

body or volume of fluid through the second port, unless forced by pressurised injection or introduction of a first body or volume of fluid through the first port and feed means.

[0041] In one embodiment, movement of the locking member from the first position to the second position and consequently movement of the latch from the latched position to the unlatched position is arranged to occur subsequent to, and not simultaneously with, at least a first stage of movement of the movable engaging means from the engaged position to at least a partially disengaged position.

[0042] Typically, said partially disengaged position may be a position wherein the first piston and piston rod members are retracted from a fully extended position, but are not in a fully retracted position. Such an arrangement may provide a movement region wherein if the movable engaging means fails to properly engage the second coupling pin, the latch member may still remain in the latched position, preventing full detachment of the accessory from the coupling apparatus.

[0043] In another embodiment of the present invention, the coupling apparatus is provided to be manually operable. Typically, said coupling apparatus is manually operable such that movement of second, movable engaging means between engaged and disengaged positions is achieved by manual operation.

[0044] In one embodiment, said movable engaging means includes:

- 30 a body portion having first and second opposing ends, wherein the first end thereof engages the second coupling pin;
- 35 a shaft portion extending outwardly from the second end; and
- 40 one or more drive portions extending outwardly from the second end, parallel to but separate from the shaft portion.

[0045] Typically, the shaft portion is arranged to extend into a first end of a housing or cowling body, located within the body of the coupling apparatus. Preferably, said housing is fixed in position within the body of the coupling apparatus.

[0046] Preferably, the housing is provided as a substantially elongate member having first and second opposing ends, and a cavity extending therethrough.

[0047] In one embodiment, the shaft portion is arranged to extend into the first end of the housing and is linearly movable within the cavity along a longitudinal axis of the housing.

[0048] In one embodiment, a screw member is provided, extending into the second end of the housing. Typically, a screw thread is provided on an outer wall or surface of the screw member.

[0049] Typically, the shaft portion comprises a cavity located therein, extending towards an opening at a distal end of the shaft portion. Typically, an interior wall or sur-

face of the cavity of the shaft portion includes a screw thread, extending from the opening inwardly of the cavity along at least part of the length of the shaft portion.

[0050] Preferably, the screw member is rotatable about a longitudinal axis thereof and is threadedly engaged with the shaft portion. Typically, the outer wall or surface of the screw member is threadedly engaged with the interior wall or surface of the cavity of the shaft portion.

[0051] Typically, rotational movement of the screw member about its longitudinal axis causes linear movement of the shaft portion and hence the movable engaging means, between engaged and disengaged positions.

[0052] In one embodiment, a distal end or ends of the one or more drive portions is/are arranged to engage the locking member as the movable engaging means is moved from the engaged position to a disengaged position.

[0053] In one embodiment, as the movable engaging means are moved from an engaged position to a disengaged position via rotational movement of the screw member, in use, the distal end or ends of one or more drive portions engage the locking member, moving the locking member from the first position to the second position, and consequently moving the latch from the latched position to the unlatched position.

[0054] Conversely, as the movable engaging means are moved towards the engaged position, the one or more drive portions disengage the locking member allowing the locking member to move from the second position to the first position and consequently the latch member from the unlatched position to the latched position.

[0055] According to another aspect of the invention there is provided a coupling apparatus for coupling an attachment to a dipper arm of a machine, the apparatus including:

a coupler body;

a first, fixed engaging means mounted on the coupler body for engaging a first coupling pin of the attachment, in use;

a second, movable engaging means mounted on the coupler body for engaging a second coupling pin of the attachment, in use, and movable between an engaged position wherein it engages the second coupling pin as the first, fixed engaging means engages the first coupling pin, in use, and a disengaged position;

a latch member associated with and pivotable with respect to the first, fixed engaging means between latched and unlatched positions; and

a locking member pivotable about a pivot point between first and second positions, and provided in mechanical communication with the latch member; wherein hydraulically operated drive means are provided to affect movement of the second, movable engaging means and the locking member, said drive means including a body portion, first piston and piston rod members, and second piston and piston rod

members, the first piston rod member engaging with and driving movement of the movable engaging means, and the second piston rod member engaging with and driving movement of the locking member.

[0056] Typically, movement of the first piston rod member and movable engaging means is linear movement, along a longitudinal axis of the first piston rod member.

[0057] Typically, movement of the second piston rod member is linear movement, along a longitudinal axis thereof, which drives pivoting movement of the locking member about its pivot point, in use. Consequently, pivoting movement of the locking member causes movement of the latch member between the latched and unlatched positions.

[0058] In one embodiment, the latch member includes an aperture located therethrough, and said locking member includes a trunnion member or other such protrusion located thereon, extending into or through the aperture of the latch member and engaging the same such that when said locking member is in the first position, the latch member is in the latched position, and when said locking member is moved to the second position, the trunnion member moves the latch to the unlatched position.

[0059] In one embodiment, pivoting movement of the locking member may cause arcuate movement of the trunnion member, such that the trunnion member moves within the aperture of the latch member, moving it between the latched and unlatched positions.

[0060] Typically, said latch member is biased to the latched position by biasing means. In one embodiment, said biasing means are provided as a torsion spring member. Typically, said torsion spring member is located about the pivot point of the latch member.

[0061] Typically, biasing means are also provided associated with the locking member, biasing the same to the first position. Typically, said biasing means are provided located at the pivot point of the locking member. Preferably, said biasing means are provided in the form of a torsion spring member.

[0062] In one embodiment, the body portion of said drive means comprises a manifold, a first piston chamber and a second piston chamber. Typically, said first and second piston chambers locate with and/or through the manifold.

[0063] According to a further aspect of the present invention, there is provided a coupling apparatus including:

a coupler body;

at least first, fixed engaging means mounted on the coupler body for engaging a first coupling pin of the attachment, in use;

a latch member associated with and pivotable with respect to the first, fixed engaging means between latched and unlatched positions; and

a locking member pivotable about a pivot point between first and second positions, and provided in mechanical communication with the latch member;

wherein the locking member is movable by a driving force provided associated with the coupling apparatus.

[0064] Typically, the apparatus further includes a second, movable engaging means mounted on the coupler body for engaging a second coupling pin of the attachment, in use, and movable between an engaged position wherein it engages the second coupling pin as the first, fixed engaging means engages the first coupling pin, in use, and a disengaged position.

[0065] Typically, movement of the locking member from the first position to the second position serves to move the latch member from the latched position to the unlatched position.

[0066] In one embodiment, the driving force is provided as hydraulically operated drive means provided to affect movement of the second, movable engaging means and the locking member.

[0067] In another embodiment, the coupling apparatus is provided to be manually operable such that movement of a second, movable engaging means between engaged and disengaged positions is achieved by manual operation, and one or more drive portions are provided on the movable engaging means and arranged to engage the locking member as the movable engaging means is moved from the engaged position to a disengaged position, thereby moving the locking member from the first position to the second position, and consequently the latch member from the latched position to the unlatched position.

[0068] According to a further aspect of the present invention, there is provided an excavator apparatus or vehicle, said apparatus or vehicle comprising a dipper arm and a coupling apparatus as described above attachable to a distal end of the dipper arm.

[0069] Embodiments of the present invention will now be described with reference to the accompanying figures, wherein:

Figure 1 illustrates a side-on cross-sectional view of a coupling apparatus in a first arrangement, according to an embodiment of the present invention;

Figure 2 illustrates a side-on cross-sectional view of a coupling apparatus in a second arrangement, according to an embodiment of the present invention;

Figures 3a-d illustrate the movement of a locking member and a latch member of a coupling apparatus from first and latched positions to second and unlatched positions, according to an embodiment of the present invention;

Figure 4 illustrates a latch member of a coupling apparatus in a deadlock position, according to an embodiment of the present invention;

Figure 5 illustrates perspective view of a body portion of a drive means for a coupling apparatus, in accordance with an embodiment of the present invention;

Figure 6 illustrates a top-down cross-sectional view of a drive means including a body portion, first and second piston and piston rod members, according to an embodiment of the present invention;

Figures 7a-b illustrate side-on and top-down views, respectively, of a hydraulically operated drive means for a coupling apparatus, in a first arrangement, according to an embodiment of the present invention;

Figures 8a-b illustrate side-on and top-down views, respectively, of a hydraulically operated drive means for a coupling apparatus, in a second arrangement, according to an embodiment of the present invention;

Figure 9 illustrates a side-on cross-sectional view of another coupling apparatus in a first arrangement, according to an embodiment of the present invention;

Figure 10 illustrates a side-on cross-sectional view of another coupling apparatus in a second arrangement, according to an embodiment of the present invention; and

Figures 11a-b illustrate perspective and cross-sectional views of a manually operable movable engaging means of a coupling apparatus, in accordance with an embodiment of the present invention.

[0070] Referring firstly to Figures 1 and 2, there is illustrated a coupling apparatus 1 for coupling accessories such as buckets and the like to a dipper arm of an earth-moving or excavating machine. The coupler 1 includes a main body portion 3, the upper part of which includes attachment means 5 for connection with a dipper arm. The lower part includes attachment parts and mechanisms for connecting the coupler 1 to an accessory. There is provided a first, fixed engaging means in the form of a fixed jaw 7 which is formed integrally with the body 3, and which is provided to receive a first coupling pin 9 of an accessory. In order to secure the first coupling pin 9 within the fixed jaw 7, there is provided a pivotable latch 11 which is movable between a latched position, shown in Figure 1, and an unlatched position, shown in Figure 2. Movement of the latch 11 is enabled by the provision of a pivoting locking member 13, which is pivotable about a pivot point 15 between a first position, shown in Figure 1, wherein the latch 11 is in the latched position, and a second position, shown in Figure 2, wherein the latch 11 has been moved to the unlatched position. The locking member 13 affects movement of the latch 11 via the provision of a trunnion 17, which extends outwardly laterally

from the locking member 13, and extending into or through an aperture 19 formed in the latch 11. Thus, pivoting movement of the locking member 13 causes movement of the trunnion 17 within the aperture 19, which in turn moves the latch 11.

[0071] The latch 11 is provided to be pivotable about a pivot point 21 located at a first, proximal end thereof, and biasing means in the form of a torsion spring 23 is also provided at that point in order to bias the latch 11 toward the latched position. The aperture 19 of the latch 11 is generally provided at an opposing, distal end of the latch 11. Thus, as the locking member 13 is moved from its first position in Figure 1 to the second position in Figure 2, this moves the latch 11 to the unlatched position against the biasing force of the spring 23. Biasing means in the form of a further torsion spring 25 are provided with the locking member 13, located at its pivot point 15 and biasing it to the first position. Thus, a driving force is required to move the locking member 13 from the first position to the second position, and consequently the latch 11 from the latched position to the unlatched position.

[0072] In a first embodiment of the present invention, the coupler 1 further includes a second, movable engaging means in the form of a sliding jaw 27, which is arranged to receive a second coupling pin 29 of an accessory. The second coupling pin 29 is secured in place as the sliding jaw 27 is movable between an engaged position, shown in Figure 1, and a disengaged position, shown in Figure 2. In this embodiment, the driving force which is required to move the locking member 13 is also utilised to drive movement of the sliding jaw 27 between engaged and disengaged positions. The coupler 1 in this embodiment is provided as a hydraulically operable coupler 1, wherein hydraulic drive means are provided to affect movement of the locking member 13 and the sliding jaw 27, which will be discussed in more detail later.

[0073] As described above, movement of the locking member 13 between the first and second positions causes movement of the latch 11 as the trunnion 17 is movable within the aperture 19 of the latch 11. The aperture is provided as a slot at or near the distal end of the latch 11, with the trunnion 17 being movable within and/or along the slot. In practice, the path of movement of the trunnion 17 as the locking member 13 is moved about its pivot point 15 may be slightly arcuate and at an angle relative to the slot of the latch 11 when the latch 11 is in the latched position. Such an arrangement ensures that while the trunnion 17 moves within the confines of the slot, its path of movement as the locking member 13 moves will consequently move the latch 11 from the latched position to the unlatched position, and back again as the direction of movement is reversed. In a preferred embodiment, the aperture in the latch 11 is provided as a substantially V-shaped slot 19, and as the locking member 13 is moved as described above from the first position to the second position, the trunnion 17 moves from a resting position at an apex 31 of the V-shaped slot 19, along a first length of that V-shape to a distal end thereof

33. This movement causes the latch 11 to pivot from a latch position, wherein the first coupling pin 9 is secured in the fixed jaw 7, to an unlatched position, wherein the pin 9 may be freely released from the jaw. The stages of movement of the locking member 13, trunnion 17 and latch 11 are shown in more detail in Figures 3a-d as the latch 11 is moved from the latched position (Figure 3a) to the unlatched position (Figure 3d). The locking member 13 is pivoted by a driving force ensuring it pivots in the direction of Arrow A about the pivot point 15. This causes the trunnion 17 to move in the direction of Arrow B and along the first length of the V-shaped slot 19 from the apex 31 to the end 33 of the first length, which causes the latch 11 to pivot about its pivot point 21 in the direction of Arrow C and releasing the first coupling pin 9.

[0074] The latch 11 in preferred embodiments includes a substantially V-shaped slot 19, as discussed above. The second length of the V-shape may be required in instances where the latch 11 is pivoted away from a fully latched position, while the locking member 13 is maintained in the first position. Consequently, the trunnion 17 will remain static and, as the latch 11 is pivoted - for example if the coupler 1 is oriented in such a way that gravity and the weight of the accessory attempts to remove the first coupling pin 9 from the fixed jaw 7 and overcomes the biasing force of the spring 23 - the second length of the V-shape moves along trunnion 17 such that the trunnion 17 rests at a distal end 35 of the second length of the V-shaped slot 19. This prevents further pivoting movement of the latch 11, creating, along with the end of the locking member 13, a deadlock, ensuring the latch 11 is not moved to the unlatched position and ensures the first coupling pin 9 remains within the fixed jaw 7. This is illustrated in Figure 4, which shows the first coupling pin 9 moving in a direction of Arrow D within the fixed jaw 7, but being prevented from being fully released by the latch 11 and locking member 13, due to the latch 11 being moved into the deadlock position, wherein the trunnion 17 rests at the distal end 35 of the second length of the V-shaped slot 19, preventing any further movement of the latch 11. The provision of such a deadlock position provides the coupler 1 with an improved safety feature should the coupling begin to falter, preventing unwanted or accidental full release of the accessory therefrom. For example, if for whatever reason the sliding jaw 27 failed to engage with or inadvertently disengaged from the second coupling pin 29, the weight of the accessory would then be borne by the fixed jaw 7 entirely. In some examples in the prior art, there then becomes a real danger that the weight of the accessory may overcome the biasing force afforded to a latch provided with the fixed jaw, allowing the accessory to fully detach, fall and potentially cause serious accident. In the present invention, if the weight or movement of the accessory is such that the first coupling pin 9 is urged to move out from the fixed 7, this movement begins to urge the latch 11 against its biasing force about its own pivot point 21. However, the locking member 13 and hence the trunnion 17 are sta-

tionary in the first position and so the latch 11 may only be moved as far as the second length of the V-shaped slot 19 and trunnion 17 will permit. As the trunnion 17 engages the distal end 35 of the V-shaped slot 19, this creates the deadlock position preventing any further movement of the latch 11 and, consequently, prevents release of the first coupling pin 9 from the fixed jaw 7 and hence detachment of the accessory from the coupler 1.

[0075] As mentioned above, in one embodiment of the present invention, the coupler 1 may be provided to be hydraulically operable, wherein hydraulic drive means 37 are provided to affect movement of the locking member 13 and the sliding jaw 27. The hydraulic drive means 37 are provided in the form of a dual piston ram arrangement, broadly comprising a main body portion 39, a first piston 41 and associated first piston rod 43, and a second piston 45 and associated second piston rod 47. The body 39 itself comprises a manifold block 49 a first piston chamber 51 and a second piston chamber 53, wherein the piston chambers 51, 53 are generally located with and/or through the manifold block 49. The manifold block 49 also includes various ports, valves and feed pipes for the introduction and flow of hydraulic fluid to cause movement of the pistons and associated piston rods, and will be discussed in more detail later. Figure 5 illustrates in a perspective view, the body portion 39 of the drive means, including the manifold block 49 and the first and second piston chamber 51, 53. Figure 6 illustrates a top-down cross-section view of the drive means also including the first and second pistons and associated piston rods 41, 43, 45, 47. The hydraulic drive means 37 is arranged such that the first piston rod 43 attaches to and drives linear movement of the sliding jaw 27. The linear movement is along a longitudinal axis of the first piston rod 43. The second piston rod 47 is provided attached to, and to drive movement of, the locking member 13. Movement of the second piston rod 47 is linear along a longitudinal axis thereof.

[0076] At a distal end of the second piston rod 47, there is provided a clevis fastener 55 and pin 57 which attach to the locking member 13 through a slot 59 located in an end thereof. The arms of the clevis 55 extend around either side of the end of the locking member 13 and the clevis pin 57 extends through the slot 59, providing mechanical attachment between the second piston rod 47 and the locking member 13. While the rod 47, clevis 55 and pin 57 move in a linear manner, the pivoting movement of the locking member 13 is enabled by forming the slot 59, when the locking member 13 is in the first position, at an angle relative to direction of movement of the piston rod 47. This is illustrated best in Figure 3a. As the piston rod 47 extends, the clevis pin 57 moves in a linear path but also within the slot 59 from a first end to a second end thereof. This causes pivoting movement of the locking member 13 and the angular orientation of the slot 59 changes as the pin 57 drives movement and moves to the second of the slot 59, shown in stages in Figures 3a-d. This extension of the second piston rod 47 thus pivots

the locking member 13 from the first position to the second position and, consequently, moves the latch 11 from the latched position to the unlatched position.

[0077] The first and second pistons 41, 45 are located in their respective first and second piston chambers 51, 53 such that the piston rods 43, 47 are linearly movable along longitudinal axes thereof, extending from and retracting towards/into the respective first and second piston chambers 51, 53. Retraction of the first piston rod 43 from an extended position serves to retract the sliding jaw 27, moving it from an engaged position retaining the second coupling pin 29 in place to a disengaged position wherein the second coupling pin 29 may be released. Reverse movement, that is to say extension of the first piston rod 43, therefore serves to move the sliding jaw 27 into the engaged position, retaining and securing the second coupling pin 29 in place. The sliding jaw 27 is biased towards the engaged position via the provision of a compression spring 61 which is located coaxially with the first piston rod 43 and located between a wall of the manifold block 49 and an abutting wall portion 63 of the sliding jaw 27. Retraction of the first piston rod 43 overcomes the biasing force of the compression spring 61 to retract the sliding jaw 27, moving it to a disengaged position, compressing the compression spring 61. A distal end of the first piston rod 43 is provided to be fixedly attached to the sliding jaw 27. More specifically, the end of the rod 43 is arranged to extend through an aperture in the abutting wall portion 63 of the sliding jaw 27 and a plate 65 is provided on the rod 43 to abut against the wall portion 63. The distal end of the rod 43 includes a screw thread 67 around its outer surface and a locking nut 69 or similar may be screwed on, abutting against the opposing side of the wall portion 63, securing the rod 43 to the sliding jaw 27.

[0078] The manifold block 49 includes a first port 71 and associated feed pipes 73 for introducing a first body or volume of hydraulic fluid into the hydraulic drive means 37. The introduction of the first body or volume of fluid, under pressure, serves to move the pistons and piston rods 41, 43, 45, 47 in a first direction. A second port 75 and associated feed pipes 77 are provided with the manifold block 49 for introducing a second body or volume of hydraulic fluid. The introduction of the second body or volume of fluid, under pressure, serves to move the pistons and piston rods 41, 43, 45, 47 in a second, opposing direction. Each of the piston chambers 51, 53 is separated into two distinct fluid receiving portions, the portions separated by the pistons 41, 45 in their respective chambers 51, 53. The first piston chamber 51 includes first fluid receiving portion 79, located at a proximal end of the chamber 51, for receiving the first body or volume of hydraulic fluid therein, and a second fluid receiving portion 81, located at a distal end of the chamber 51, for receiving the second body or volume of hydraulic fluid therein. The second piston chamber 53 includes first fluid receiving portion 83, located at a distal end of the chamber 53, for receiving the first body or volume of hydraulic

fluid therein, and a second fluid receiving portion 85, located at a proximal end of the chamber 53, for receiving the second body or volume of hydraulic fluid therein. This is illustrated best in Figure 6.

[0079] Thus, as the first body or volume of hydraulic fluid is injected or otherwise introduced into and through the first port 71 and feed pipes 73, fluid fills the respective first fluid receiving portions 79, 83 of the first and second piston chambers 51, 53, thereby causing extension of the first piston 41 and piston rod 43, and retraction of the second piston 45 and piston rod 47 - this arrangement is illustrated in Figures 7a-b and corresponds with the arrangement of Figure 1, wherein the sliding jaw 27 is in the engaged position, the locking member 13 is in the first position and consequently the latch 11 is in the latched position, such that both the coupling pins 9, 29 may be secured in place. As the second body or volume of fluid is subsequently injected or otherwise introduced into and through the second port 75 and feed pipes 77, fluid fills the respective second fluid receiving portions 81, 85 of the first and second piston chambers 51, 53, thereby causing retraction of the first piston 41 and piston rod 43, and extension of the second piston 45 and piston rod 47, also forcing the first body or volume of fluid back out of the manifold 49 through the first port 71 and feed pipes 73 - this arrangement is illustrated in Figures 8a-b and corresponds with the arrangement of Figure 2, wherein the sliding jaw 27 is in the disengaged position, the locking member 13 is in the second position and consequently the latch 11 is in the unlatched position, such that both the coupling pins 9, 29 may be released. Further, one or more valves are provided with the first and second ports 71, 75 and are used to prevent return flow of fluid through the associated port unless forced to do so by the pressurised introduction of fluid through the opposing port. That is to say, for example, after the first body or volume of fluid has been introduced through the first port 71 and feed pipes 73, a valve 87 may be provided to prevent return flow of that fluid until the subsequent pressurised injection of the second body or volume of fluid through the second port 75 and feed pipes 77 overcomes the resistive force of the valve 87. The valve 87 then likewise prevents the return flow of fluid through the second port 75 until the pressurised introduction of fluid through the first port 71.

[0080] In another embodiment of the present invention, the coupler 1' may be provided to be manually operable. That is to say, in this embodiment, the movable engaging means and driving means to operate movement is provided as a manually operable wedge lock and drive screw combination, movable between an engaged configuration, shown in Figure 9, and a disengaged configuration, shown in Figure 10. The movable engaging means is provided as a wedge lock 91 having a body portion 93 with first and second opposing ends. The first end 95 includes a wedge or taper section and engages the second coupling pin 29 when in the engaged configuration. A shaft 97 extends outwardly from the second end 99 of

the wedge lock body 93, and is arranged to extend into a first end of a housing or cowling 101, located in a fixed position within the body 3 of the coupler 1'. One or more drive stems 103 are also provided to extend outwardly from the second end 99 of the wedge body 93, parallel to but separate from the shaft 97. The housing 101 is formed as an elongate body having first and second opposing ends with a cavity extending therethrough. The shaft 97 extends into the first end 105 of the housing 101 and is linearly movable within the cavity along a longitudinal axis thereof. A drive screw 107 is provided to extend into the second end 109 of the housing 101, which has a screw thread 111 provided on an outer wall thereof. The shaft 97 has a cavity located therein which extends out towards a distal end of the shaft 97. The interior wall of the cavity includes a screw thread 113 arranged to threadedly engage the screw thread 111 of the drive screw 107, such that the drive screw 107 is rotatable about its longitudinal axis and rotation of the drive screw 107 causes linear movement of the shaft 97 and hence the wedge lock 91 as a whole, between engaged and disengaged positions.

[0081] As the wedge lock 91 is moved from an engaged position upon rotation movement of the drive screw 107, a distal end of the drive stem or stems 103 subsequently engages an end or cam portion 115 of the locking member 13, moving the locking member from its first position to its second position, which consequently causes movement of the latch 11 from its latched position to an unlatched position. The function features of the locking member 13, latch 11, trunnion 17 and V-shaped slot 19 in the manually operable embodiment of the present invention operate in the same manner as described above in the hydraulically operable embodiment, thereby also providing the deadlock arrangement, if required, as an additional safety feature of the coupler 1'. Conversely, as the drive screw is rotated in the opposite direction, the drive stem or stems 103 eventually disengage from the locking member 13. The biasing torsion springs 23, 25 provided with the latch 11 and locking member 13 then serve to move the locking member 13 back to the first position and the latch 11 to the latched position. The wedge lock 91 continues to move away from the locking member 13 and ultimately engages the second coupling pin 29, securing the same in place.

[0082] The present invention therefore provides an improved coupler, in manually operable and hydraulically powered embodiments, having an additional safety feature preventing inadvertent opening of the latch 11 of the fixed jaw 7 resulting in premature release of the first coupling pin 9 and thus the accessory, potentially causing serious accident. The provision of a deadlock position, enabled via the provision of a V-shaped slot 19 in the latch 11 ensures the first coupling pin 9 is prevented from being released from the fixed jaw 7 inadvertently.

Claims

1. A coupling apparatus for coupling an attachment to a dipper arm of a machine, the apparatus including:
 - a coupler body;
 - a first, fixed engaging means mounted on the coupler body for engaging a first coupling pin of the attachment, in use;
 - a latch member associated with and pivotable with respect to the first, fixed engaging means between latched and unlatched positions;
 - a locking member pivotable about a pivot point between first and second positions, and provided in mechanical communication with the latch member;
 - wherein the latch member includes an aperture located therethrough, and said locking member includes a trunnion member or other such protrusion located thereon, extending into or through the aperture of the latch member and engaging the same such that when said locking member is in the first position, the latch member is in the latched position, and when said locking member is moved to the second position, the trunnion member moves the latch to the unlatched position.
2. A coupling apparatus according to claim 1, wherein the coupling apparatus includes second, movable engaging means mounted on the coupler body for engaging a second coupling pin of the attachment, in use, and is movable between an engaged position wherein it engages the second coupling pin as the first, fixed engaging means engages the first coupling pin, in use, and a disengaged position.
3. A coupling apparatus according to claim 1, wherein said latch member includes a pivot point located at or near a first, proximal end thereof, and the aperture of the latch member is located at or near a second, distal end thereof.
4. A coupling apparatus according to claim 1, wherein the aperture of the latch member is formed as a slot, and the trunnion member is movable within and/or along the slot.
5. A coupling apparatus according to claim 4, wherein the slot is formed as a substantially V-shaped slot within the latch member, and wherein when the locking member is provided in the first position and the latch member is consequently in the latched position, the trunnion member rests at an apex of the V-shaped slot.
6. A coupling apparatus according to claim 5, wherein as the locking member is movable from the first position to the second position, the trunnion member is movable along the first length of the V-shaped slot to a distal end thereof, thereby moving the latch member from the latched position to the unlatched position, and wherein the provision of a second length of the V-shaped slot permits pivoting movement of the latch member, while the locking member and trunnion member remain in their respective first positions, to a deadlock position, wherein the trunnion member is located at a distal end of the second length of the V-shaped slot, preventing further movement of the latch member.
7. A coupling apparatus according to claim 2, wherein the coupling apparatus is provided to be hydraulically operable, and hydraulically operable drive means are provided to affect movement of the movable engaging means and the locking member.
8. A coupling apparatus according to claim 7, wherein said drive means includes:
 - a body portion, first piston and piston rod members, and second piston and piston rod members;
 - the first piston rod member engaging with and driving linear movement of the movable engaging means, along a longitudinal axis of the first piston rod member; and
 - the second piston and piston rod member engaging with and driving movement of the locking member, said movement being linear movement of the second piston rod member, along a longitudinal axis thereof, which in turn drives pivoting movement of the locking member about its pivot point, in use.
9. A coupling apparatus according to claim 2, wherein the coupling apparatus is provided to be manually operable, such that movement of second, movable engaging means between engaged and disengaged positions is achieved by manual operation.
10. A coupling apparatus according to claim 9, wherein said movable engaging means includes:
 - a body portion having first and second opposing ends, wherein the first end thereof engages the second coupling pin, in use;
 - a shaft portion extending outwardly from the second end; and
 - one or more drive portions extending outwardly from the second end, parallel to but separate from the shaft portion.
11. A coupling apparatus according to claim 10, wherein the shaft portion is arranged to extend into a first end of a housing or cowling body, located within the body

of the coupling apparatus, said housing being fixed in position within the body of the coupling apparatus, the housing further being provided as a substantially elongate member having first and second opposing ends, and a cavity extending therethrough, the shaft portion being linearly movable within the cavity along a longitudinal axis of the housing. 5

12. A coupling apparatus according to claim 11, wherein a screw member is provided, extending into the second end of the housing, and wherein a screw thread is provided on an outer wall or surface of the screw member. 10

13. A coupling apparatus according to claim 12, wherein the shaft portion comprises a cavity located therein, extending towards an opening at a distal end of the shaft portion, and an interior wall or surface of the cavity of the shaft portion includes a screw thread, extending from the opening inwardly of the cavity along at least part of the length of the shaft portion, such that the screw member is rotatable about a longitudinal axis thereof and is threadedly engaged with the shaft portion. 15 20

14. A coupling apparatus according to claim 13, wherein rotational movement of the screw member about its longitudinal axis causes linear movement of the shaft portion and hence the movable engaging means, between engaged and disengaged positions, and a distal end or ends of the one or more drive portions is/are arranged to engage the locking member as the movable engaging means is moved from the engaged position to a disengaged position. 25 30

15. An excavator apparatus or vehicle, said apparatus or vehicle comprising a dipper arm and a coupling apparatus as defined in claim 1, attachable to a distal end of the dipper arm. 35 40

45

50

55

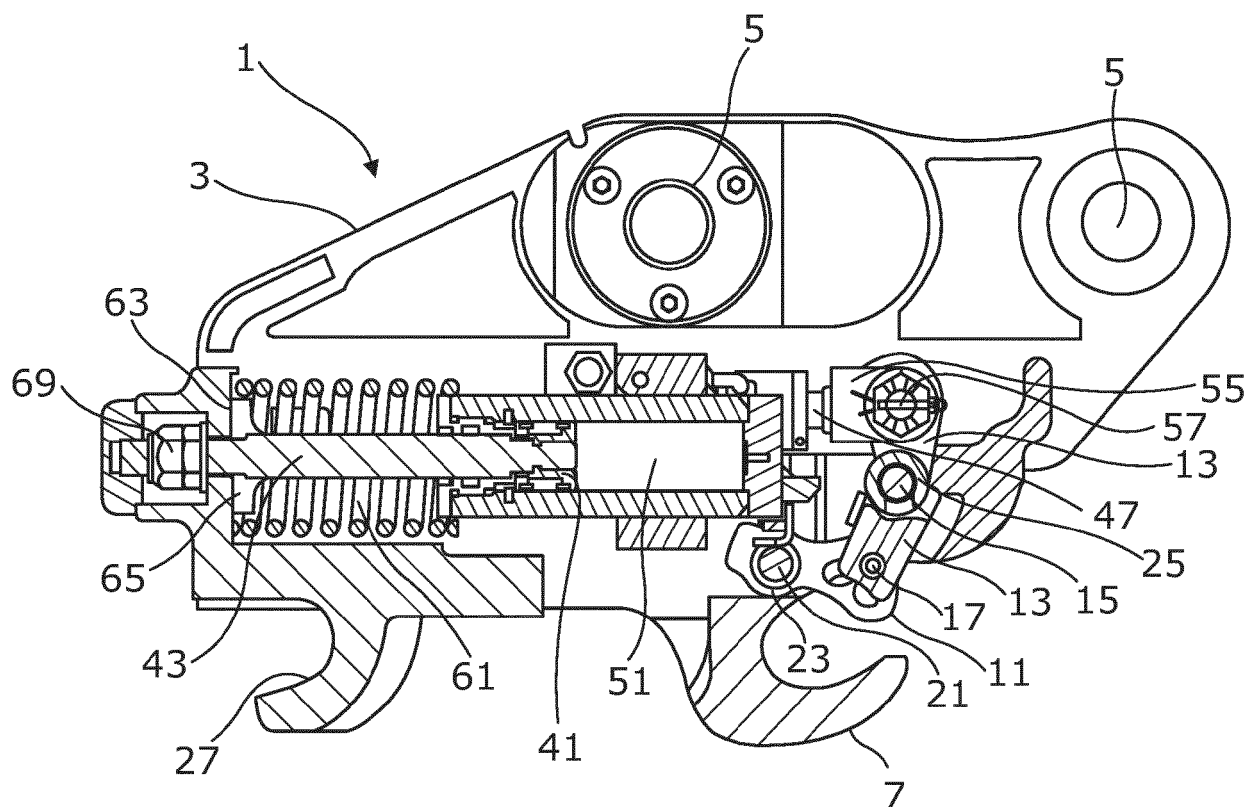


Figure 1

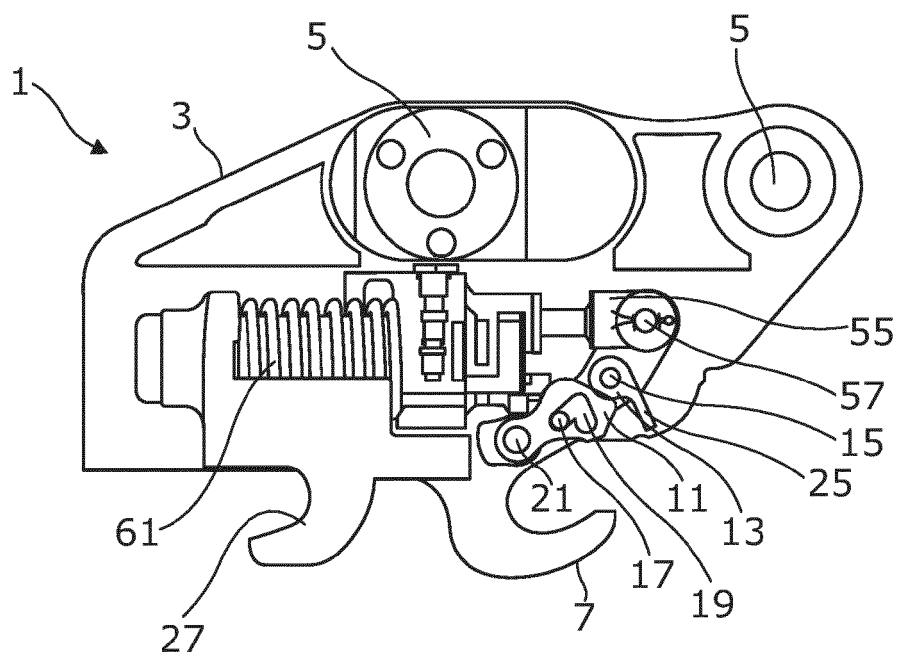


Figure 2

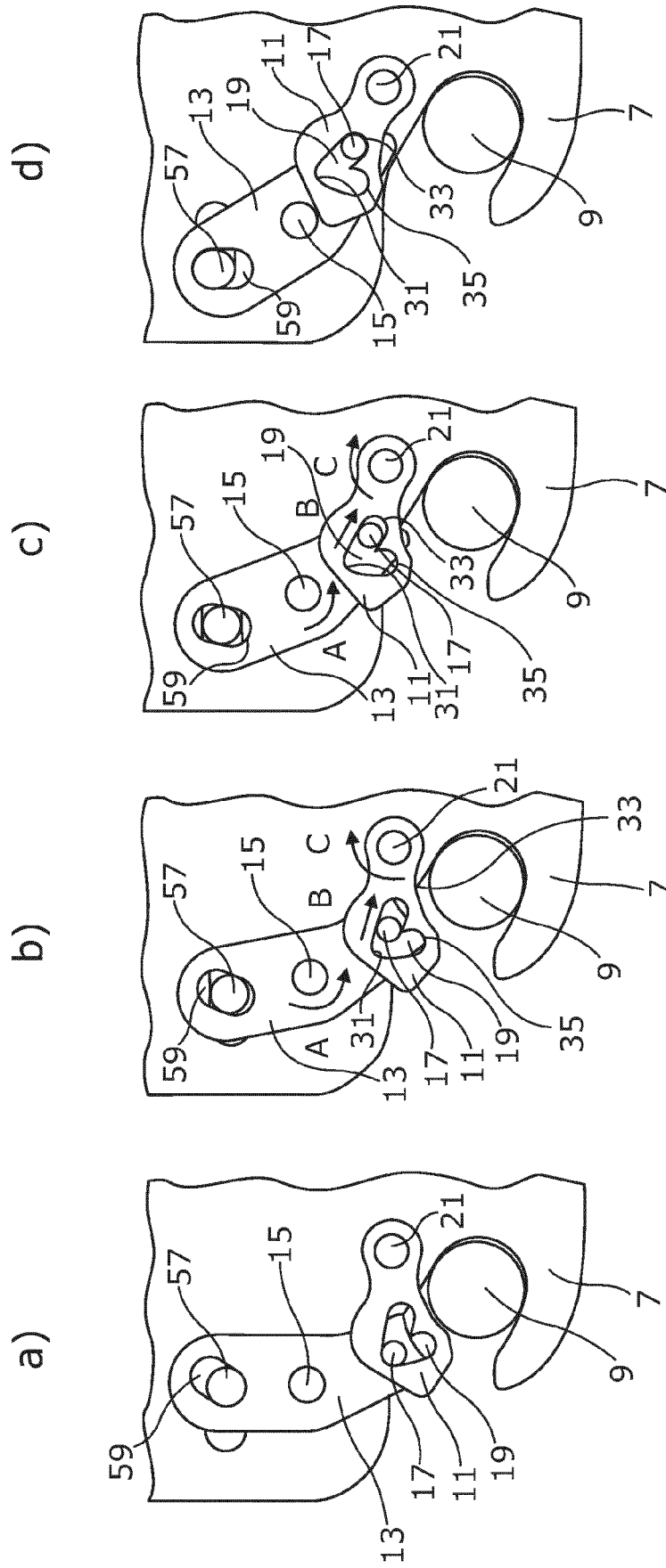


Figure 3

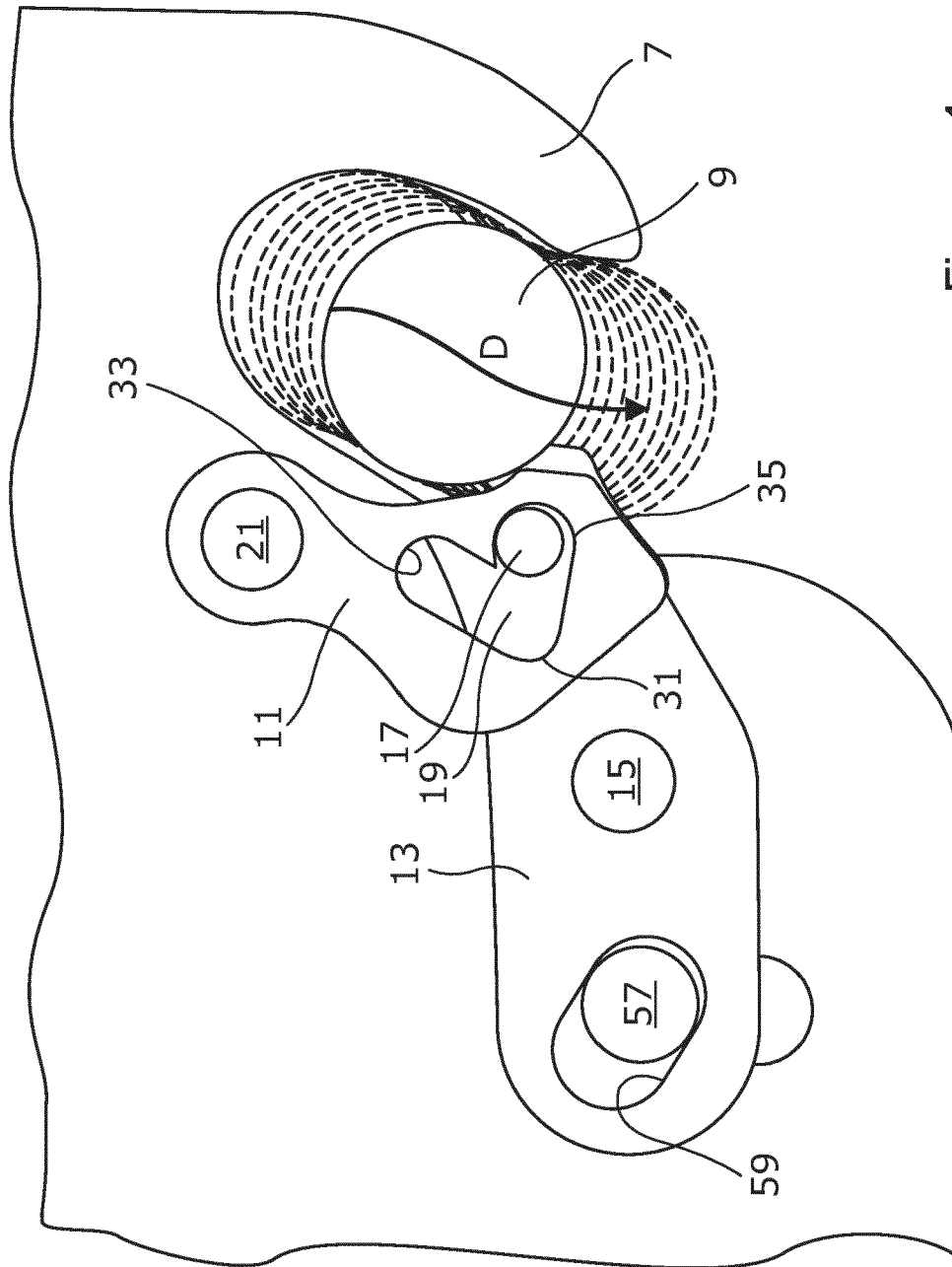


Figure 4

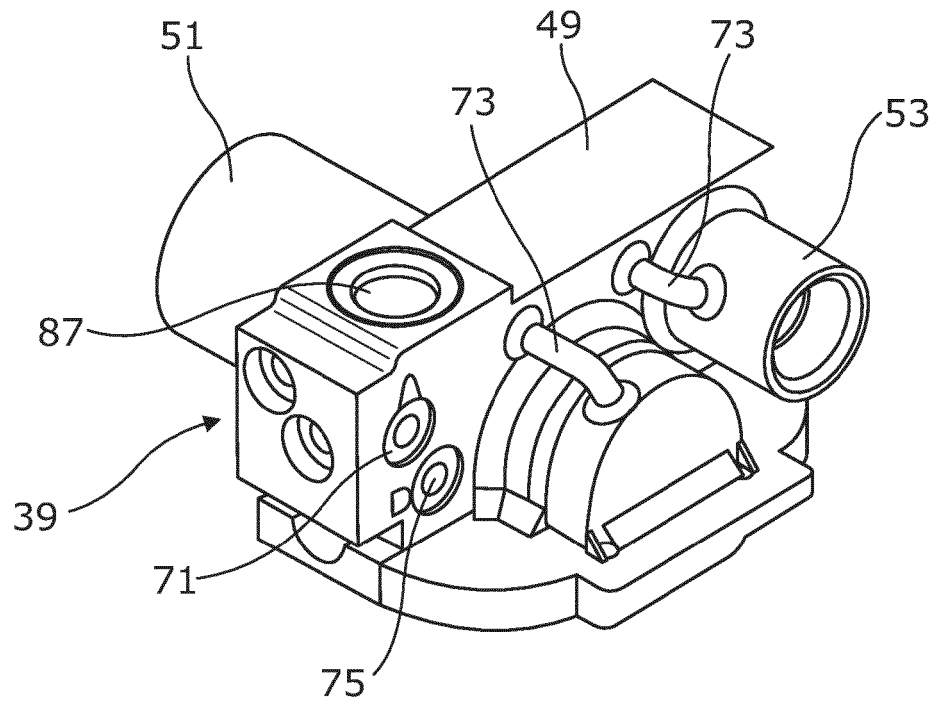


Figure 5

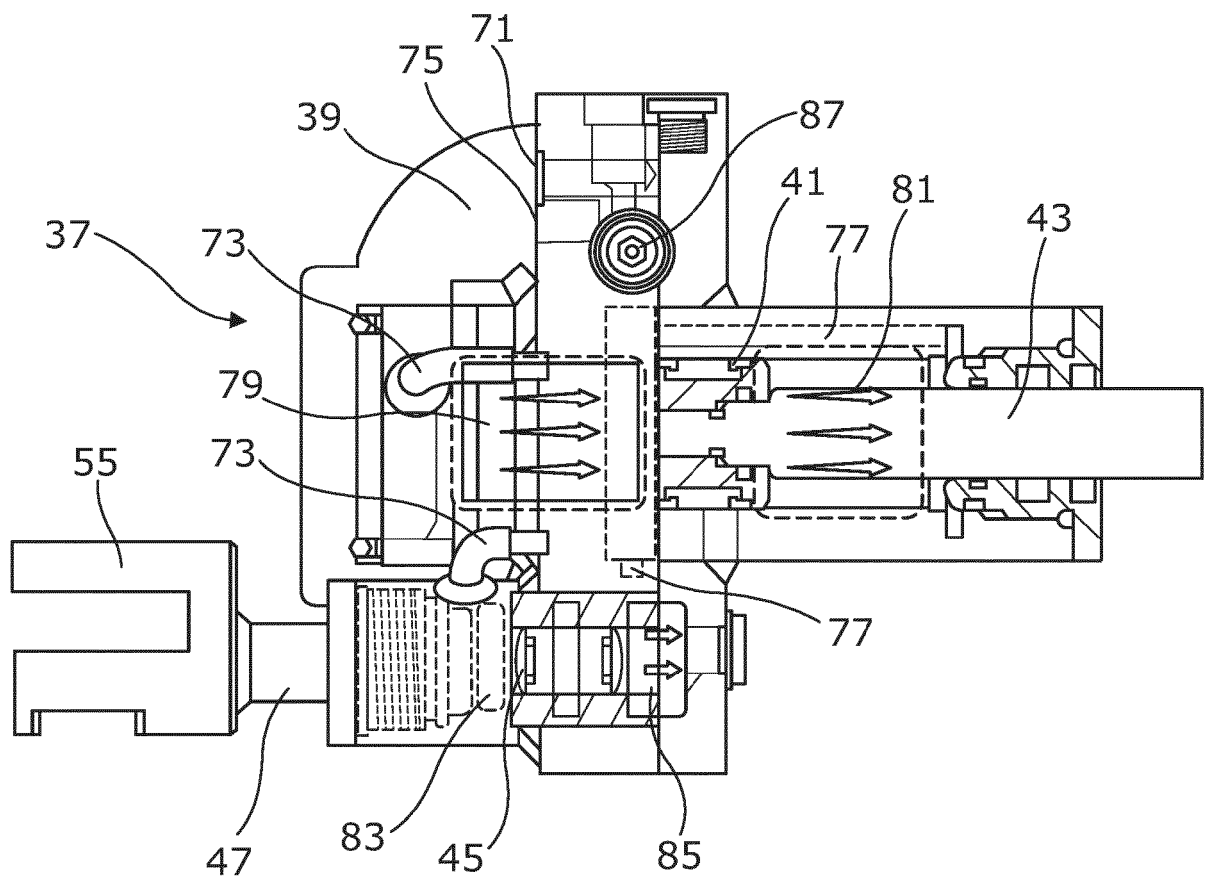
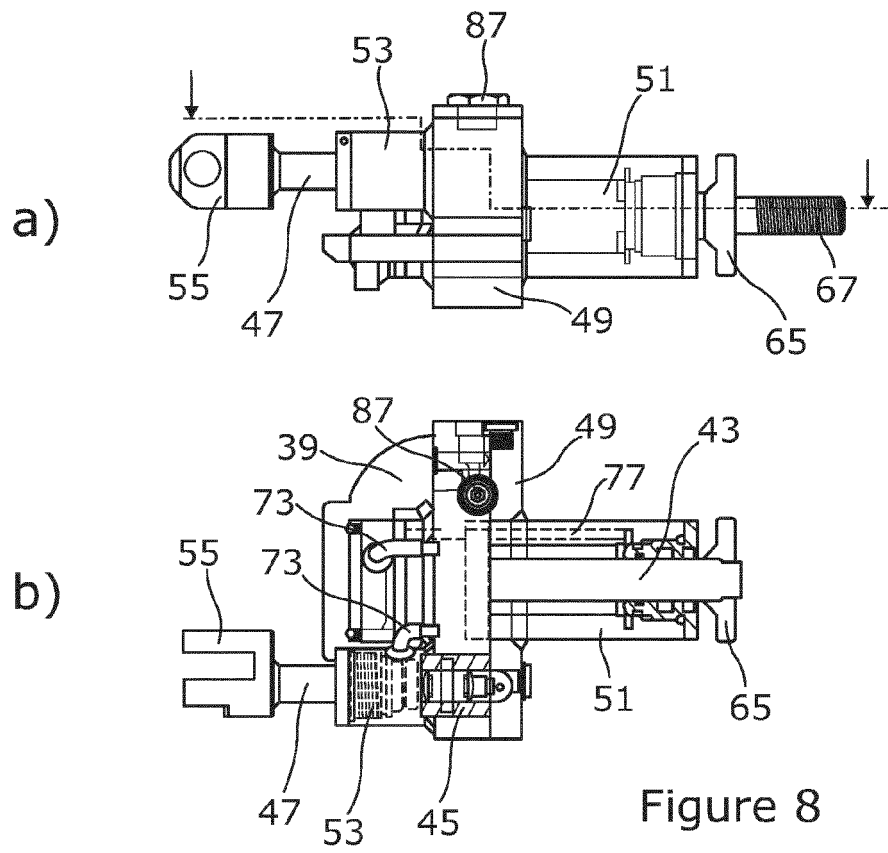
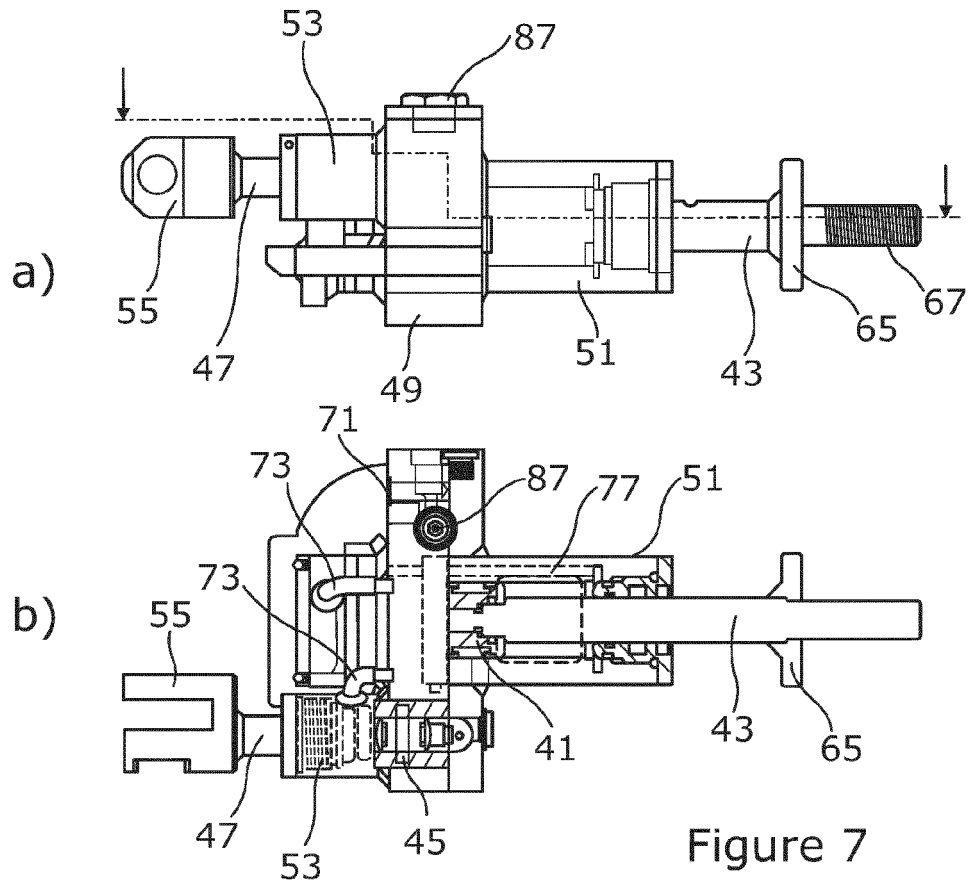


Figure 6



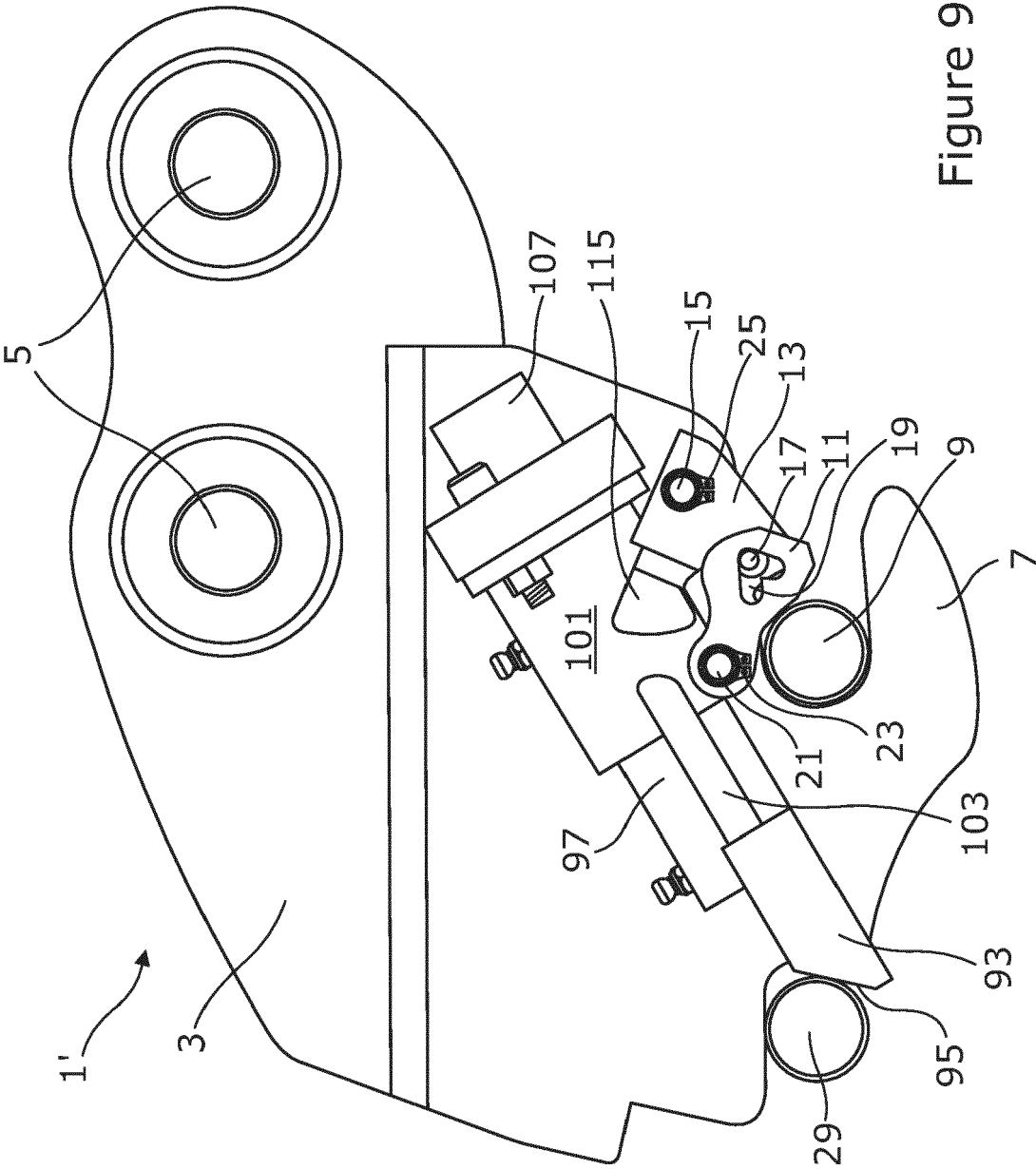


Figure 9

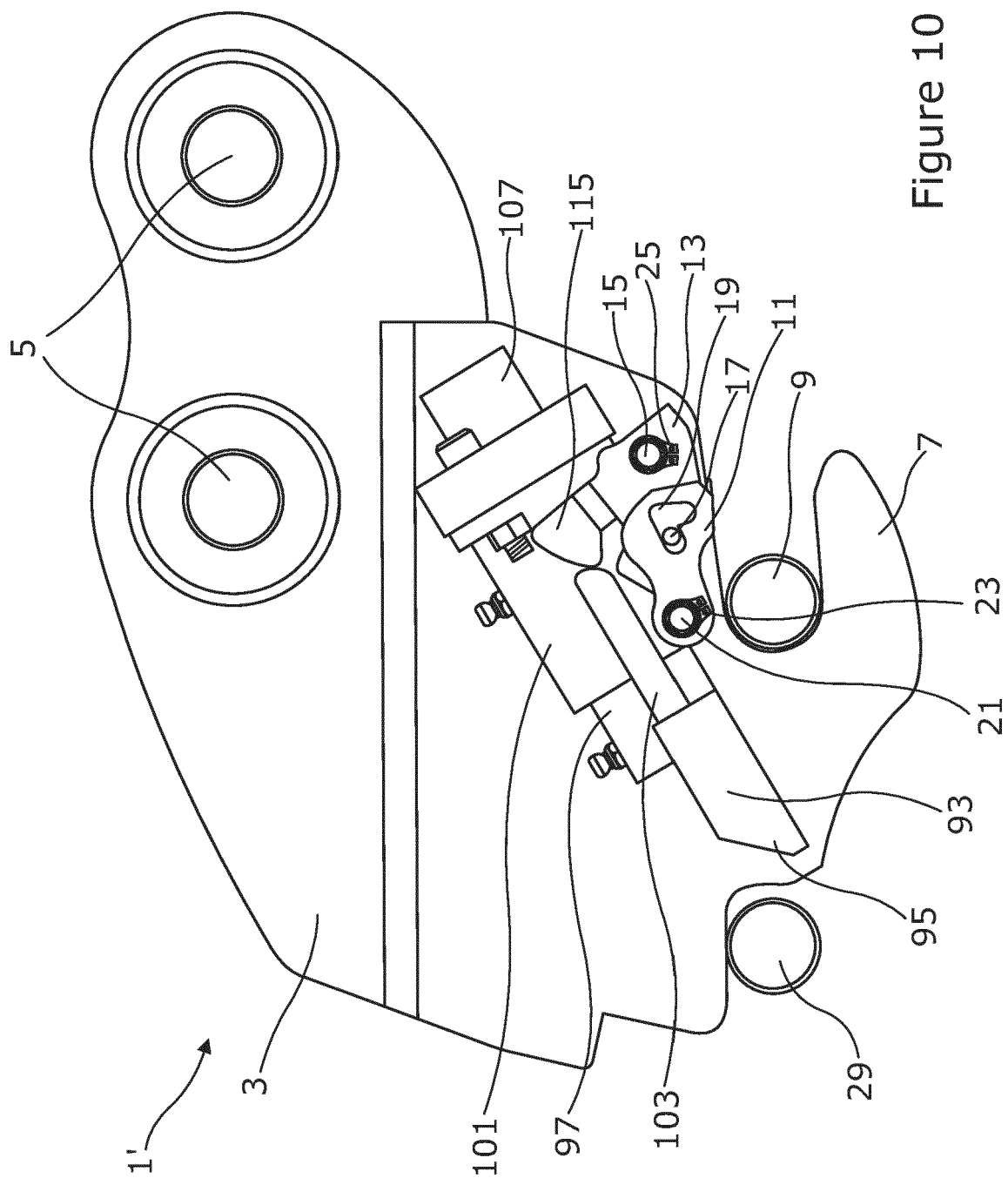


Figure 10

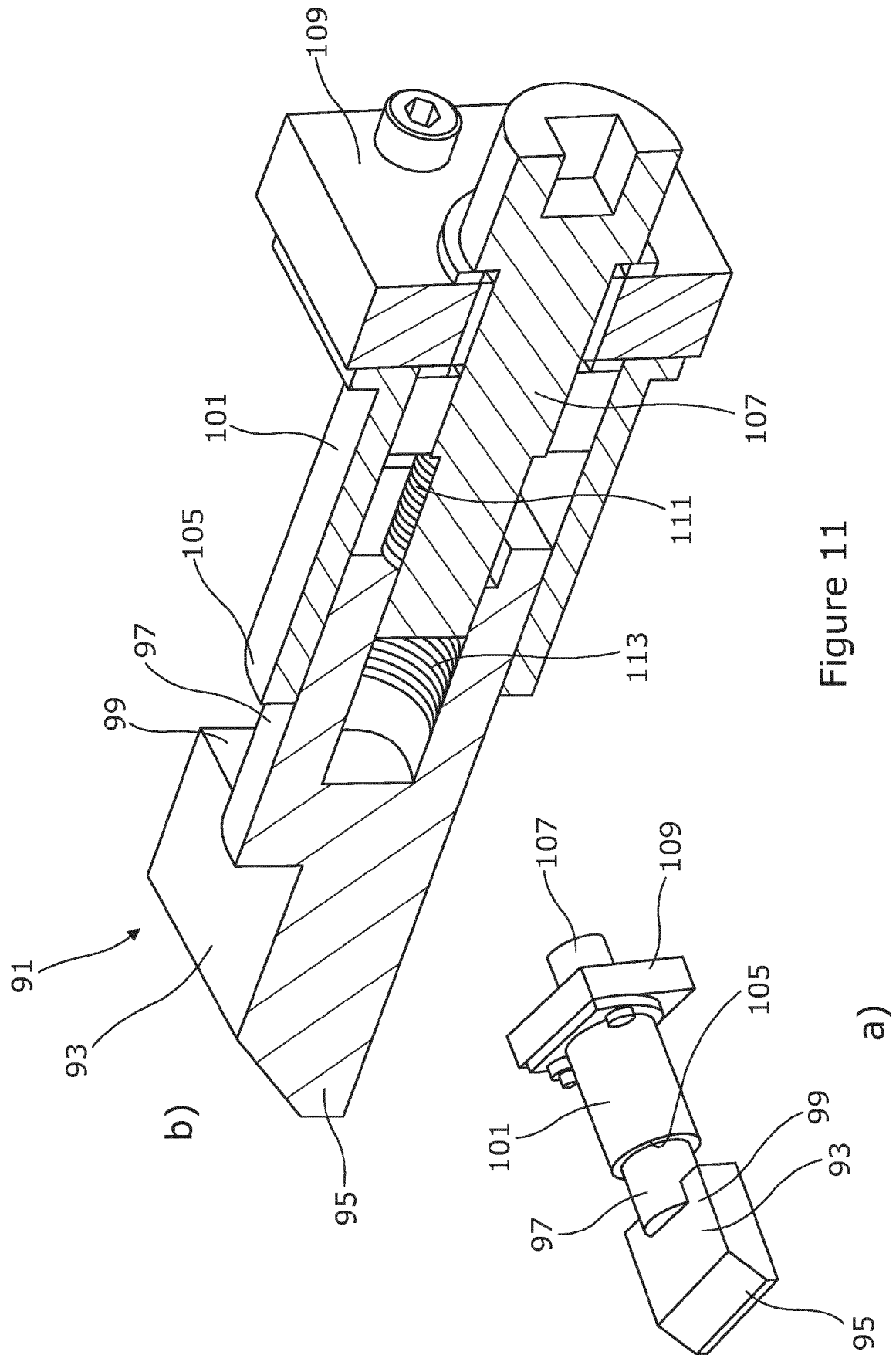


Figure 11



EUROPEAN SEARCH REPORT

Application Number

EP 22 27 5139

5

10

15

20

25

30

35

40

45

50

55

1

EPO FORM 1503 03.82 (P04C01)

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	WO 2015/049246 A1 (ORIEL FLUES LTD [IE]) 9 April 2015 (2015-04-09) * page 6, line 28 - page 9, line 30; figures 1-21 *	1-15	INV. E02F3/36
X	EP 1 112 413 A1 (MILLER DOREEN JACQUELINE [GB]; MILLER GARY [GB] ET AL.) 4 July 2001 (2001-07-04) * the whole document *	1	
X	US 5 692 325 A (KUZUTANI KAZUTERU [JP]) 2 December 1997 (1997-12-02) * the whole document *	1	
X	US 2009/007465 A1 (ROBL TROY CURTIS [US] ET AL) 8 January 2009 (2009-01-08) * the whole document *	1	
X	US 2012/210614 A1 (MCCORMICK PATRICK [IE] ET AL) 23 August 2012 (2012-08-23) * the whole document *	1	TECHNICAL FIELDS SEARCHED (IPC)
A	US 7 426 796 B2 (GEITH PATENTS LTD [IL]) 23 September 2008 (2008-09-23) * the whole document *	1-15	E02F
A	US 2016/002877 A1 (PESCH JOHN [AU] ET AL) 7 January 2016 (2016-01-07) * the whole document *	1-15	
A	AU 2012 201 264 A1 (GEITH INTERNAT LTD) 19 September 2013 (2013-09-19) * the whole document *	1-15	
A	GB 2 515 262 A (MILLER INT LTD [GI]) 24 December 2014 (2014-12-24) * the whole document *	1-15	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 March 2023	Examiner Kecman, Ivan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 27 5139

5

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-03-2023

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015049246 A1	09-04-2015	EP 3052707 A1	10-08-2016
		US 2016281320 A1	29-09-2016
		WO 2015049246 A1	09-04-2015
EP 1112413 A1	04-07-2001	AT 259450 T	15-02-2004
		AU 4527199 A	27-03-2000
		DE 69914774 T2	09-12-2004
		DK 1112413 T3	01-06-2004
		EP 1112413 A1	04-07-2001
		ES 2216524 T3	16-10-2004
		GB 2330570 A	28-04-1999
		JP 3962213 B2	22-08-2007
		JP 2002524673 A	06-08-2002
		PT 1112413 E	30-06-2004
		US 6422805 B1	23-07-2002
		US 6481124 B1	19-11-2002
		WO 0014342 A1	16-03-2000
US 5692325 A	02-12-1997	JP 2793165 B2	03-09-1998
		JP H09209391 A	12-08-1997
		US 5692325 A	02-12-1997
US 2009007465 A1	08-01-2009	AU 2008275755 A1	15-01-2009
		CN 101688381 A	31-03-2010
		EP 2167738 A2	31-03-2010
		JP 5150724 B2	27-02-2013
		JP 2010532438 A	07-10-2010
		US 2009007465 A1	08-01-2009
		WO 2009009000 A2	15-01-2009
US 2012210614 A1	23-08-2012	AU 2010310925 A1	21-06-2012
		CA 2779368 A1	05-05-2011
		CN 102713081 A	03-10-2012
		EP 2496774 A1	12-09-2012
		GB 2474905 A	04-05-2011
		IE 20100702 A1	11-05-2011
		KR 20120088821 A	08-08-2012
		KR 20180036809 A	09-04-2018
		KR 20190089097 A	29-07-2019
		NZ 600253 A	31-10-2014
		US 2012210614 A1	23-08-2012
		WO 2011051923 A1	05-05-2011
		ZA 201204046 B	31-01-2013
US 7426796 B2	23-09-2008	AT 342406 T	15-11-2006
		DE 60215289 T2	24-05-2007

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 27 5139

5 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 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-03-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		EP 1318242 A2	11-06-2003
		EP 1637659 A2	22-03-2006
		ES 2275827 T3	16-06-2007
		PT 1318242 E	31-01-2007
		US 2003204972 A1	06-11-2003
		US 2006037220 A1	23-02-2006
US 2016002877 A1	07-01-2016	AU 2014203664 B1	23-10-2014
		US 2016002877 A1	07-01-2016
AU 2012201264 A1	19-09-2013	AU 2012201264 A1	19-09-2013
		IE S86256 B2	28-08-2013
GB 2515262 A	24-12-2014	NONE	