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(54) A GUIDING ASSEMBLY AND A ROCK DRILLING APPARATUS COMPRISING THE SAME

(57) The invention provides a guiding assembly for a rock work unit, comprising a guide means for guiding the movement of a drill rod and an actuator coupled to the guide means, wherein the actuator comprises: a base portion; a first portion slidably coupled to the base portion

and operable to move or to be driven to move linearly relative to the base portion along a longitudinal axis x; and a second portion slidable coupled to the base portion and movable along the longitudinal axis x, and coupled to the first portion via a force means.

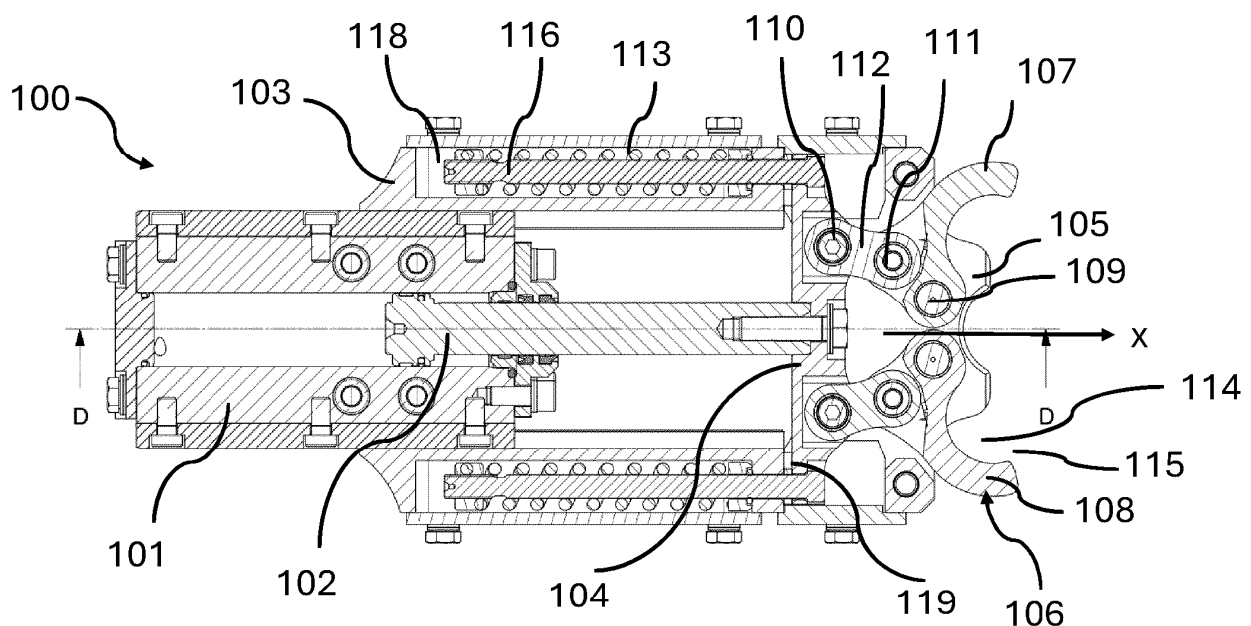


Figure 4

Description

TECHNICAL FIELD

[0001] The present invention relates to a guiding assembly for a rock work unit, such as a rock drilling apparatus. Specifically, it pertains to mechanisms for guiding and stabilizing elongate consumables used in rock drilling operations.

BACKGROUND

[0002] Existing methods and devices for manipulating and centralizing drill rods or rock bolts in rock drilling units involve mechanical and fluid actuated systems to ensure proper alignment and stability of the drill rods during drilling operations. Prior art documents, such as EP2396496 and US12044081, describe various mechanisms for rod manipulation and centralization. Typical designs may require to use two separate actuators such as cylinders to position the pliers and close/open the pliers.

[0003] The use of separate cylinders increases the complexity of the system, requiring control mechanisms to synchronize the operations of both cylinders. Further, more components mean higher potential points of failure.

[0004] The present invention aims to address these limitations by providing an improved guiding assembly that enhances operational efficiency and reliability.

SUMMARY OF THE INVENTION

[0005] Disclosed herein are a guiding assembly for a rock work unit and a rock drilling apparatus mountable at a mining machine, to overcome the above-addressed technical problem of the prior arts. The technical problem is solved by a device with the features of claim 1 and by a rock drilling apparatus with the features of claim 14. Embodiments of the invention are detailed in the dependent claims.

[0006] A first aspect of the invention provides a guiding assembly for a rock work unit such as a rock drill unit, comprising a guide means and an actuator coupled to the guide means, the guide means comprising a receiver for receiving an elongate consumable extending in a drilling axis, the receiver comprising a through recess having a lateral opening which allows the consumable to move into and out of the through recess in a transverse direction, the receiver operable to form a substantially closed recess that is configured to hold the consumable and allow the consumable to move along the drilling axis and prevent the consumable from escaping in a transverse direction; wherein the actuator comprises: a base portion; a first portion slidably coupled to the base portion and operable to move or to be driven to move linearly relative to the base portion along a longitudinal axis of the guiding assembly; and a second portion slidable coupled to the base portion and movable along the longitudinal

axis, and coupled to the first portion via a force means.

[0007] The actuator is adapted to position the second portion (along with the receiver) into (or out of) a work position, and close (or open) the receiver, in sequence. It is operable to provide a linear movement along the longitudinal axis, wherein the first part of the linear movement of the actuator causes the guide means to move linearly simultaneously, and the second part causes the receiver to close or open (i.e. a translational movement is converted to rotational action of the receiver or jaw/element of the receiver). The solution uses a single actuator including a single actuator (such as hydraulic cylinder) to drive both the linear movement and the closing (or opening) of the receiver in a sequential manner.

[0008] The invention offers a compact solution of actuation mechanism. The use of a single actuator simplifies the design, reducing the number of components and the complexity of the control system, making it more cost-effective and easier to manufacture and maintain. Further, with fewer components, the system is more reliable and less prone to mechanical failures.

[0009] It is understood that the expression "the receiver closes or close the receiver" means: the lateral opening is substantially closed; the expression "the receiver opens or open the receiver" means: the lateral opening is open and allows a consumable to move into and out of the through recess in a transverse direction. The term 'linear movement' refers to movement along a line. The drilling axis indicates the height direction of the guiding assembly, the extending direction of the recess, or vertical direction. The longitudinal axis refers to the direction along the length of the guiding assembly or the extending/retraction direction of the guide means. The term "distal" refers to a position that is farther along the extension or advancing direction of the actuator. The term 'transverse direction' refers to any direction within a plane perpendicular to the drilling axis.

[0010] According to an embodiment, the base portion comprises a stopper configured to limit the linear movement of the second portion to a first length in an advancing direction x. For example, the stopper can be a protrusion on the base portion (such as cylinder body). In a preferred embodiment, during the first portion's linear movement in one direction, such as in an advancing direction, in a first stage within a first length, the force means transfers the movement of the first portion to the second portion (it is noted that the friction resulting from the slide movement is quite small and can be omitted), causing the second portion to move in the same direction by the same distance; following the above linear movement by the first length, the second portion is prevented from further movement forward by the stopper, a further linear extension movement of the first portion (in a second stage within a second length) may cause the receiver to close automatically. The first portion's retraction movement in the opposite direction (within the second length) causes the receiver to open. That is to say, a single actuator is used to drive the operation steps in sequence.

[0011] According to another embodiment, the first portion is operable to extend or to be driven to extend beyond the first length by a second length, the linear movement of the first portion beyond the first length leads to a relative movement between the first portion and the second portion, the relative movement causes the receiver to close or open. Preferably, the relative movement causes the force means to be compressed or released.

[0012] This sequential operation allows the receiver to be positioned in an extended or retracted position, and to open or close efficiently, with the force means providing necessary resistance (sufficient stiffness to overcome friction force), ensuring smooth operation.

[0013] In one embodiment, the receiver comprises an element that is pivotably coupled to one of the first portion and the second portion at a first pivot, and coupled to the other of the first portion and the second portion in such a way that the first portion is operable to close or open the receiver. Preferably the element is a jaw, more preferably the receiver comprises a pair of opposite jaws. In one embodiment, the element of the receiver is coupled to the first portion or the second portion via a linkage member. The jaws provide secure guiding of the consumable, with the linkage member ensuring coordinated movement.

[0014] In another embodiment, the linkage member is coupled at its first end to the first portion (or a connector associated with the first portion) or the second portion (or a connector associated with the second portion) via a second pivot, and is coupled at its second end to the element of the receiver at a third pivot that is spaced apart from the first pivot. It is understood that the third pivot is offset from the first pivot in the plane perpendicular to the drilling axis, and the first, second and third pivots are not situated on a line parallel to the longitudinal axis.

[0015] The force means is understood as a mechanism configured to transmit force or movement, and to bear, allow, or undergo certain deformation, such as changes in length. For instance, it may allow potential energy and deformation to be converted into each other. In one embodiment, the force means can be a biasing means configured to bias the second portion towards (or from) a work position, it is able to bear deformation (extension or compression) to absorb force, and maintain its biasing force while accommodating changes in position or load. According to an embodiment, the force means is an elastic means, abutting against or connecting to the first portion at the proximal end, and abutting against or connecting to the second portion at the distal end. Preferably it comprises at least one spring. Optionally, the force means is a second hydraulic or pneumatic actuator such as a hydraulic cylinder. Preferably, the force means comprises at least two springs arranged symmetrically on each side of the longitudinal axis. Symmetrical arrangement ensures balanced force distribution, enhancing stability.

[0016] Alternatively or additionally, the force means comprises a spring that is arranged in the center along the longitudinal axis. In one embodiment, the guiding

assembly includes a connector connected to the first portion, the connector comprises a guide head configured to cooperate with a guide path of the second portion for slidable movement relating to each other, preferably the guide path is a sized sleeve, and the guide head is an elongate portion that is arrangeable within the sleeve of the second portion, more preferably the spring is fitted or slid onto the elongate portion and abutting against the elongate portion at the proximal end. This design ensures secure and robust attachment of the spring, enhancing reliability.

[0017] Optionally, the connector includes at least a portion operable to contact a transverse surface of the second portion, so as to drive the second portion to move backward. Alternatively, the retraction of the first portion brings the second portion to move backward, via a linkage system formed by the linkage member(s), or via the force means.

[0018] According to an embodiment, the actuator is a hydraulic or pneumatic actuator such as a hydraulic cylinder, preferably the base portion is a cylinder body, the first portion includes a piston and a piston rod of the cylinder. Optionally the actuator comprises a motor to drive the linear movement of first portion. The actuator type offers flexibility in operation, with hydraulic/pneumatic options providing stable and precise control (such as control under a hydraulic circuit using counter-balanced valves), and motor-driven options.

[0019] According to a second aspect of the application, the invention also includes a rock drilling apparatus mountable at a mining machine, comprising an elongate feed frame; and a guiding assembly according to any one of the above described embodiments mounted on the feed frame for guiding a consumable. The integration of the guiding assembly into the rock drilling apparatus enables smooth extension drilling.

[0020] Preferably, the rock drilling apparatus further comprising: a drive unit to provide rotational drive to the consumable used to create a bore hole in a mine roof or wall to receive the consumable; wherein a distance by which the guide means projects laterally from the feed frame is equal to or less than a distance by which the drive unit projects laterally from the feed frame, such that when the actuator is in the extended state, the receiver does not obscure the drive unit when the drive unit moves along the drilling axis. Preferably, the apparatus comprises a chain to bring the drive unit to move along the feed frame. This design maintains clear accessibility during drilling operations, enhancing operational efficiency.

[0021] The rock drilling apparatus may further comprise a base frame and/or a timber jack that is extendable from the base frame, wherein the feed frame can be driven to move on the base frame or the timber jack. The rock drilling apparatus may further include a head mounted on the upper end of the base frame or a timber jack, configured to brace against the roof or wall of the mine during drilling.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] To illustrate the technical features of embodiments of the present invention more clearly, the accompanying drawings provided for describing the embodiments are introduced briefly in the following. The accompanying drawings in the following description are merely some embodiments of the present invention. Modifications on these embodiments are possible without departing from the scope of the present invention as defined in the claims.

- Figure 1 shows in a perspective view a guiding assembly in the fully retracted and the receiver in open position, in accordance with an embodiment of the invention;
- Figure 2 shows in a plan view of the guiding assembly of figure 1 in the fully extended and the receiver in open position;
- Figure 3 illustrates a front elevation view of the guiding assembly of figure 2;
- Figure 4 depicts a section view E-E of the guiding assembly of figure 3;
- Figure 5 shows a section view D-D of the guiding assembly of figure 4;
- Figure 6 illustrates a section view of the guiding assembly of figure 4 in the extended but the receiver in closed position;
- Figure 7 illustrates a section view of the guiding assembly in the extended and the receiver in open position; in accordance with another embodiment of the invention;
- Figure 8 shows rock drilling apparatus in a perspective view.

[0023] DETAILED DESCRIPTION OF EMBODIMENTS

[0024] Figure 1 shows in a perspective view a carriage guider mechanism (guiding assembly) in accordance with an embodiment of the invention; it is in the fully retracted, the receiver is in open position.

[0025] Figure 2 shows in a plan view of the guiding assembly of figure 1, wherein the guiding assembly is in the fully extended position, the receiver is in open position.

[0026] Figure 4 depicts a section view E-E of the guiding assembly of figure 3, the guiding assembly 100 comprises a cylinder having a cylinder body 101 and a piston rod 102, extending along a longitudinal axis x, the piston rod may be driven to move in the advancing direction x. The guiding assembly 100 includes a slidable cover 103 movably mounted on the cylinder, which has a front transverse connector 105 for mounting a pair of oppositely arranged jaws 107 and 108.

[0027] The pair of jaws are cooperated to form an recess 114 that has a lateral opening 115 which allows a drill rod to move into and out of the through recess 114 in a transverse direction, the receiver is operable to form a

substantially closed recess 601 (Figure 6) that is configured to hold the drill rod and allow the drill rod to move along the drilling axis z and prevent the drill rod from escaping in a transverse direction.

[0028] A transverse connector 104 is connected to the piston rod at the distal end, connected to the transverse piston rod connector 104 at its distal end is an elongate element 116. The cover 103 comprises on each side of the longitudinal axis x a sleeve 118 sized to accommodate a spring 113 and the elongate element 116. A spring 113 is inserted on the elongate element 116 and abuts against the elongate element 116 at the proximal end, and abutting against the cover 103 at the distal end. The guiding assembly has a symmetrical structure with respect to its longitudinal axis x.

[0029] Each jaw 107, 108 is arranged on the jaw connector 105 via a first pivot 109 respectively. Each jaw is coupled to the piston rod connector 104 via a linkage member 112, wherein the linkage member 112 is coupled at its first end to the connector 104 via a second pivot 110, and is coupled at its second end to the jaw at a third pivot 111 that is spaced apart from the first pivot 109.

[0030] In operation, the cylinder is actuated by hydraulic medium, and the extension and retraction movement of the piston rod are controlled via a control circuit.

[0031] When the piston rod is driven to extend, the force is transmitted via the spring 113 to the sleeve housing of the cover 103 thus brings the cover to move in advancing direction x, causing the cover to move in the same direction by the same distance. Upon the cover 103 reaching a certain position, the cover is stopped by a protrusion 117 (figure 5) on the cylinder body, which prevents the cover to move further in the advancing direction x. When the piston rod extends further ahead, it causes the springs to compress, the connector 104 moves further forward, causing a relative movement between the piston rod connector 104 and the jaw connector 105. Since pivot points 109, 110 and 111 are not situated on a line in the horizontal plane, the forward movement of the piston rod connector 104 brings the jaws 107, 108, via linkage member 112, to rotate about the pivot 109 clockwise, until the lateral opening 115 is closed.

[0032] When the piston rod retracts, the spring becomes released, the piston rod connector's 104 retraction brings the jaws to rotate about the pivot point 109 counter-clockwise via the linkage member 112, the recess becomes gradually open until the spring is fully released. At this position, the piston rod connector 104 will abut the sleeve housing at a transverse surface 119 at the distal end, so that a further retraction of the piston rod causes the connector 104 to bring the cover 103 to move backward, until the cylinder is fully retracted.

[0033] Many modifications can be provided for the guiding assembly without leaving the scope of the invention. For example, in a second embodiment as shown in figure 7, a spring is arranged in the middle along the longitudinal axis x, two or more springs are arranged

symmetrically on both sides of the axis x, attached between the piston rod connector 104 and jaw connector 105.

[0034] Figure 8 illustrates a drill rig 200 in fully extended state, the drill rig comprises a base frame 201 and a timber jack 202 extendable from the base frame, an elongate feed frame 206 slidably mounted on the base frame, a drill unit 203 mounted on the feed frame 206 and configured to be driven by a chain drive 205 to move along a drilling axis z on the feed frame 206. A head 204 is mounted on the upper end of the timber jack 202 for bracing a mine roof during drilling operation. A guiding assembly 100 is mount on the upper end of the feed frame 206 for guiding a drill rod.

[0035] In operation, the receiver may be left open, allowing a drill rod to be inserted or removed; the timber jack 202 extends such that the head 204 braces against the roof or wall of the mine; a drill rod is applied either manually or by a manipulator onto the drill unit 203 and aligned with the axis z, the guiding assembly 100 extends to receive and hold the drill rod by the receiver; the drill unit 203 is started, thus rotating the drill rod and driving it upwards. Meanwhile, the feed frame 206 may be driven by a hydraulic cylinder to move upward. When the drill unit 203 approaches the guiding assembly 100, the receiver of the guiding assembly 100 starts to open and release the drill rod, subsequently the guiding assembly retracts so that it does not obstruct the way of the drill unit 203. In this manner, the drill unit 203 can send the drill rod completely into the mine roof or wall, without leaving any segment outside of the mine roof or wall.

Claims

1. A guiding assembly (100) for a rock work unit such as a rock drill unit, comprising:

a guide means (106), comprising a receiver for receiving an elongate consumable extending in a drilling axis (z), the receiver comprising a through recess (114) having a lateral opening (115) which allows the consumable to move into and out of the through recess (114) in a transverse direction, the receiver operable to form a substantially closed recess that is configured to hold the consumable and allow the consumable to move along the drilling axis and prevent the consumable from escaping in a transverse direction;

an actuator coupled to the guide means (106), the actuator comprises:

a base portion (101);

a first portion (102) slidably coupled to the base portion (101) and operable to move or to be driven to move linearly relative to the base portion (101) along a longitudinal axis

(x); and

a second portion (103) slidably coupled to the base portion (101) and movable along the longitudinal axis (x), and coupled to the first portion (102) via a force means (113).

2. A guiding assembly according to claim 1, wherein the base portion (101) comprises a stopper (117) configured to limit the linear movement of the second portion (103) to a first length in an advancing direction (x).
3. A guiding assembly according to claim 1 or 2, wherein a relative movement between the first portion (102) and the second portion (103) causes the receiver to close or open. Preferably, the relative movement causes the force means to be compressed or released.
4. A guiding assembly according to claim 2 or 3, wherein the first portion (102) is operable to extend or to be driven to extend beyond the first length by a second length, the linear movement of the first portion (102) beyond the first length leads to a relative movement between the first portion (102) and the second portion (103), the relative movement causes the receiver to close or open.
5. A guiding assembly according to any one of claims 1 to 4, wherein the receiver comprises an element that is pivotably coupled to one of the first portion (102) and the second portion (103) at a first pivot (109), and coupled to the other of the first portion (102) and the second portion (103) in such a way that the first portion (102) is operable to close or open the receiver; preferably the element is a jaw, more preferably the receiver comprises a pair of opposite jaws (107).
6. A guiding assembly according to claim 5, wherein the element of the receiver (106) is coupled to the first portion (102) or the second portion (103) via a linkage member (112).
7. A guiding assembly according to claim 6, wherein the linkage member (112) is coupled at its first end to the first portion (102) or the second portion (103) via a second pivot (110), and is coupled at its second end to the element of the receiver (106) at a third pivot (111) that is spaced apart from the first pivot (109).
8. A guiding assembly according to any one of claims 1 to 7, wherein the force means is an elastic means, abutting against or connecting to the first portion at the proximal end, and abutting against or connecting to the second portion at the distal end. Preferably the force means comprises at least one spring (113). Optionally, the force means is a second hydraulic or pneumatic actuator such as a hydraulic cylinder.

9. A guiding assembly according to any one of claims 1 to 8, wherein the force means comprises at least two springs arranged symmetrically on each side of the longitudinal axis (x). 5
10. A guiding assembly according to any one of claims 1 to 9, wherein the force means comprises a spring that is arranged in the center along the longitudinal axis (x). 10
11. A guiding assembly according to any one of claims 1 to 10, comprising a connector (104) connected to the first portion (102), the connector comprises a guide head configured to cooperate with a guide path (118) of the second portion (103) for slidable movement relating to each other. Preferably the guide path (118) is a sized sleeve, and the guide head is an elongate portion (116) that is arrangeable within the sleeve (118) of the second portion (103), more preferably the spring is fitted onto the elongate portion and abutting against the elongate portion at the proximal end. 15 20
12. A guiding assembly according to claim 11, wherein the connector includes at least a portion adapted to contact a transverse surface (119) of the second portion, so as to drive the second portion to move backward. 25
13. A guiding assembly according to any one of claims 1 to 12, wherein the actuator is a hydraulic or pneumatic actuator such as a hydraulic cylinder. Preferably the base portion is a cylinder body, the first portion includes a piston rod of the cylinder. Optionally the actuator comprises a motor to drive the linear movement of first portion (102). 30 35
14. A rock drilling apparatus (200) mountable at a mining machine (100), comprising: 40
- an elongate feed frame (206);
- a guiding assembly (100) according to any one of claims 1 to 13, mounted on the feed frame (206) for guiding a consumable. 45
15. A rock drilling apparatus (200) according to claim 14, further comprising: 50
- a drive unit (203) to provide rotational drive to the consumable used to create a bore hole in a mine roof or wall to receive the consumable;
- wherein a distance by which the guide means (106) projects laterally from the feed frame (206) is equal to or less than a distance by which the drive unit (203) projects laterally from the feed frame (206), such that when the actuator is in the extended state, the receiver does not obscure the drive unit (203) when the drive unit (203) 55

moves along the drilling axis. Preferably, the apparatus comprises a chain (205) to bring the drive unit (203) to move along the feed frame (206).

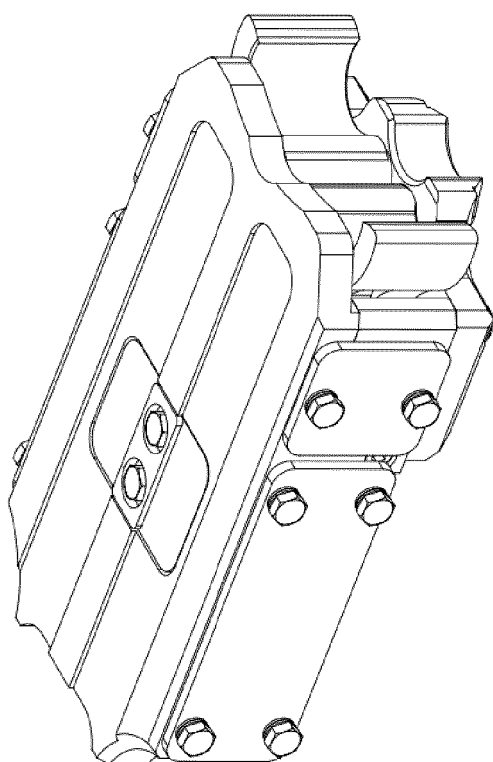


Figure 1

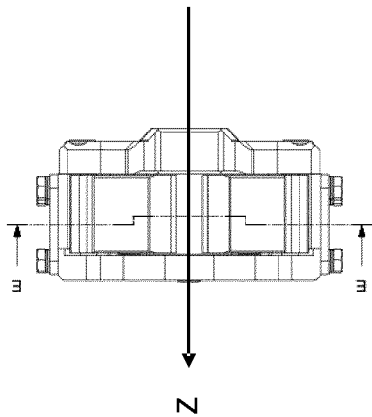


Figure 3

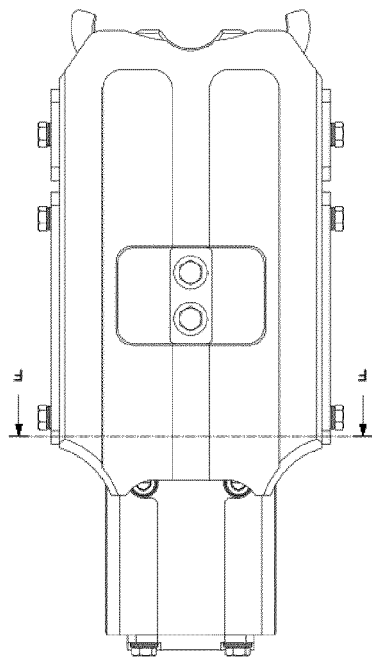


Figure 2

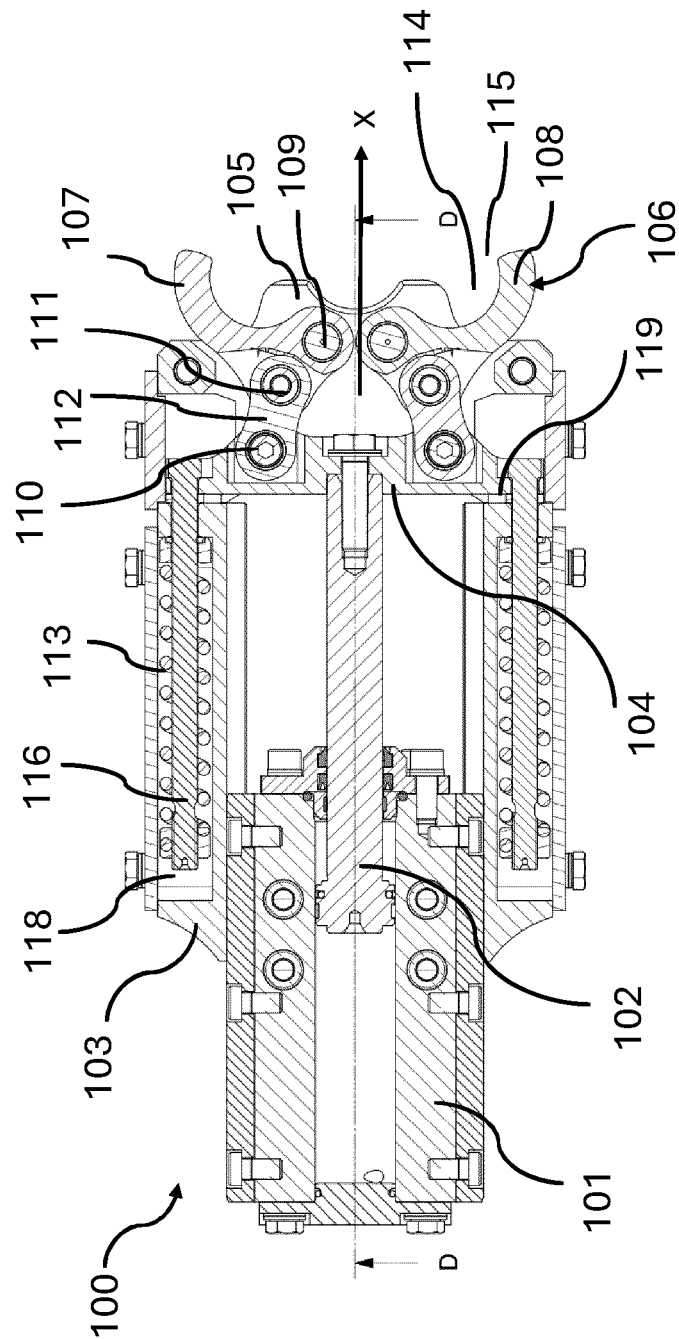


Figure 4

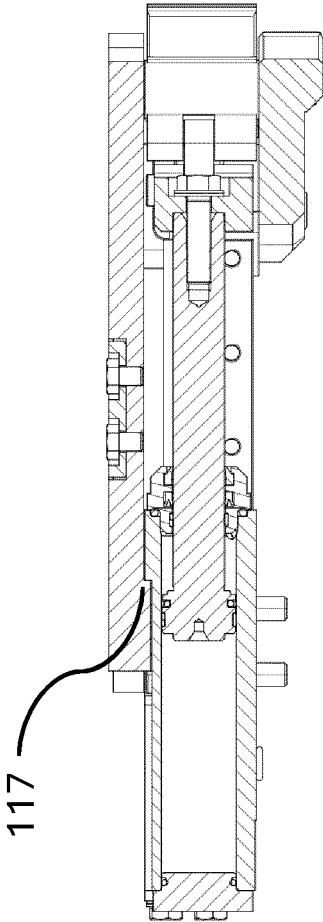


Figure 5

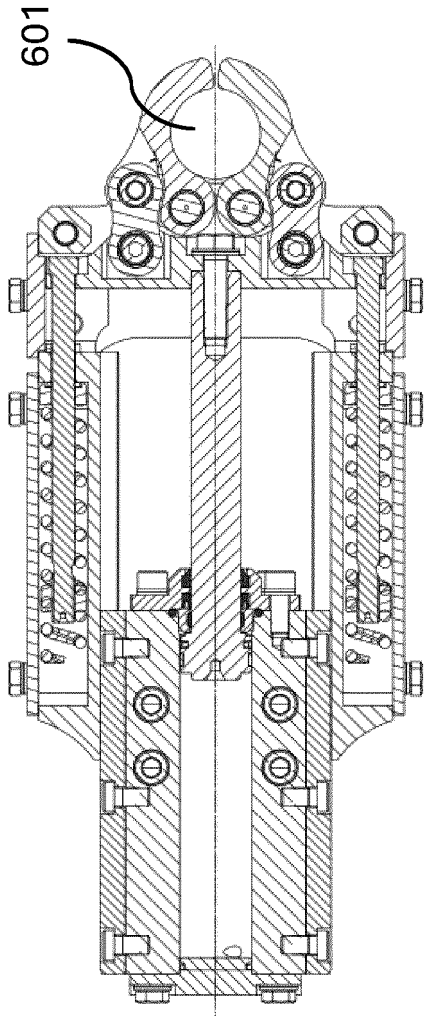


Figure 6

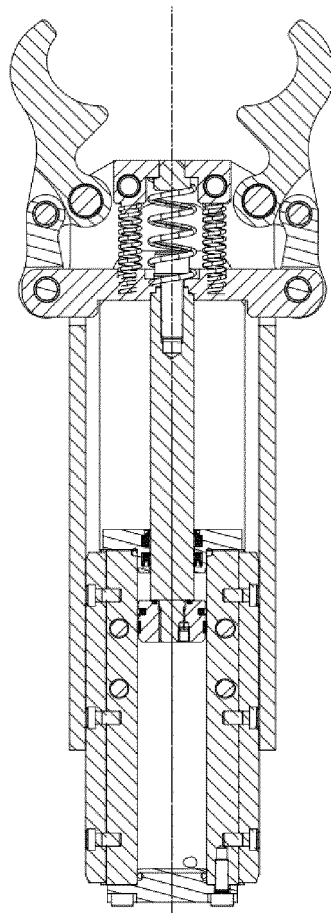


Figure 7

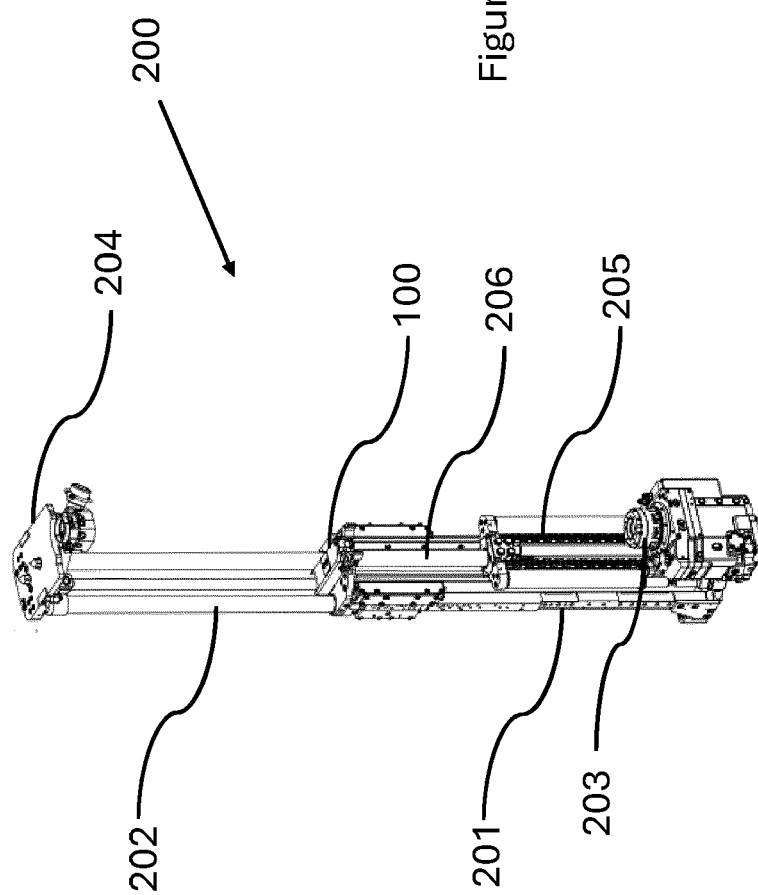


Figure 8



EUROPEAN SEARCH REPORT

Application Number

EP 25 16 7977

DOCUMENTS CONSIDERED TO BE RELEVANT

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			TECHNICAL FIELDS SEARCHED (IPC)
			E21B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 August 2025	Examiner Pieper, Fabian
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
AU 2016213888	B2	20-07-2017	NONE

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

REFERENCES CITED IN THE DESCRIPTION

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