



(22) Date de dépôt/Filing Date: 2012/03/19

(41) Mise à la disp. pub./Open to Public Insp.: 2012/09/21

(30) Priorité/Priority: 2011/03/21 (DE102011005855.9)

(51) Cl.Int./Int.Cl. *E21D 21/00* (2006.01)

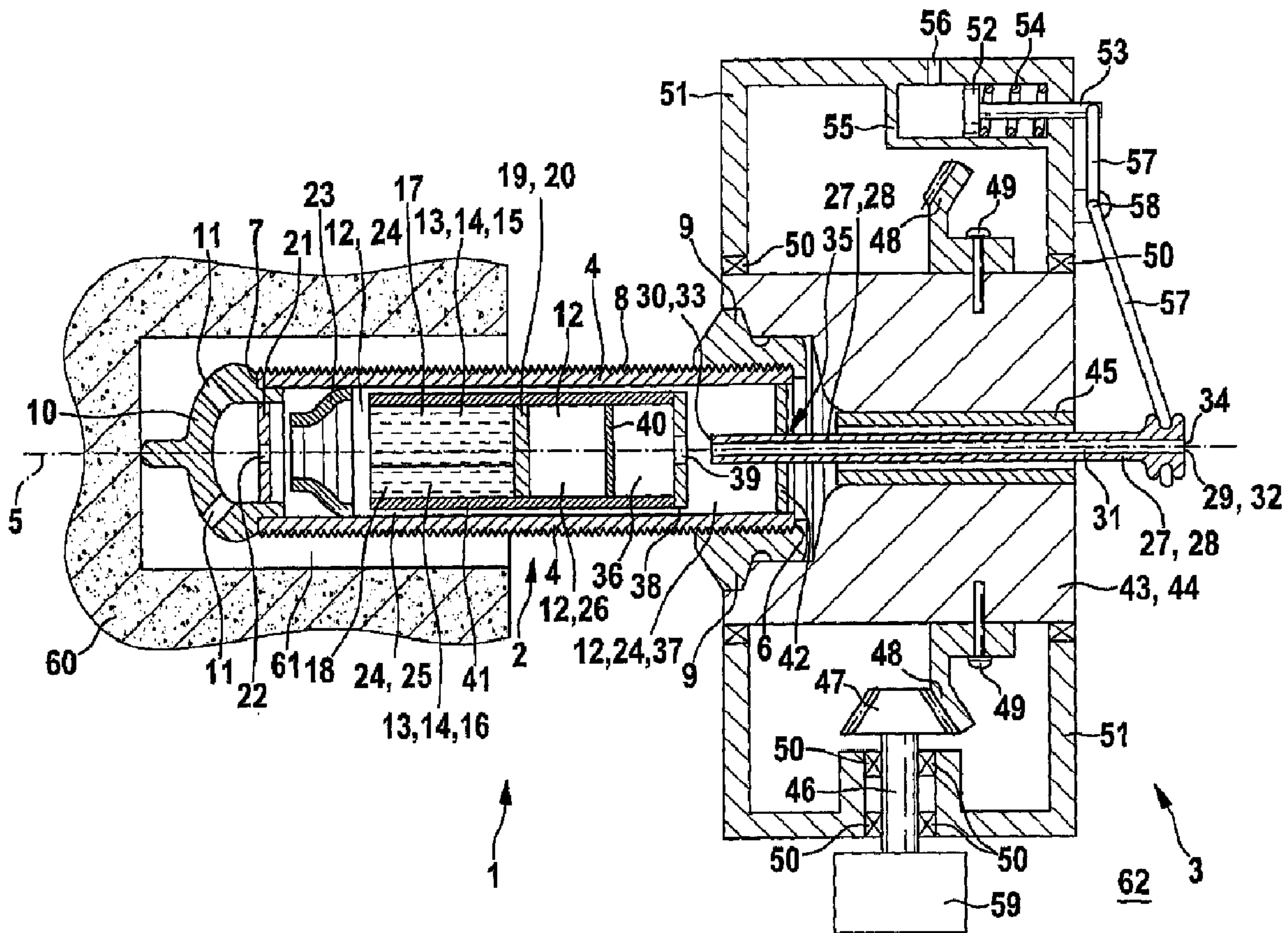
(71) Demandeur/Applicant:
HILTI AKTIENGESELLSCHAFT, LI

(72) Inventeur/Inventor:
GOETZFRIED, STEFAN, DE

(74) Agent: RICHES, MCKENZIE & HERBERT LLP

(54) Titre : BOULON D'ANCRAGE POUR LA ROCHE

(54) Title: ROCK ANCHOR BOLT



(57) Abrégé/Abstract:

The purpose of a system (1) with a self-drilling chemical rock anchor bolt (2), specifically for use in the mining industry and a device (3) for moving the rock anchor bolt (2), said rock anchor bolt (2) comprising an anchor tube (4) which encloses an interior (12), a



(57) **Abrégé(suite)/Abstract(continued):**

fixation substance (13) arranged within the interior (12) for bonding the anchor tube (4) on rock (60), a moveable piston (19) arranged inside the interior (12) for moving the fixation substance (13) outside the anchor tube (4) if the anchor tube (4) is arranged in a borehole (61) inside the rock (60), a boring head (10) at one back end (7) of the anchor tube (4), a rinsing channel (24) to supply rinsing fluid, in particular rinsing water to the boring head (10), an expression channel (26) to supply power fluid, in particular power water to the piston (19), is to be able to supply both rinsing water as well as power water into an interior (12) of the rock anchor bolt (2) with minor technical expenses. This object is solved in that the system (1), in particular the device (3) and/or the rock anchor bolt (2) comprises a moveable closing element (27) which is moveable between a rinsing position and a pressure position and the rinsing channel (24) is open and the expression channel (26) is closed in the rinsing position and the rinsing channel (24) is closed and the expression channel (26) is open in the pressure position.

ABSTRACT

The purpose of a system (1) with a self-drilling chemical rock anchor bolt (2), specifically for use in the mining industry and a device (3) for moving the rock anchor bolt (2), said rock anchor bolt (2) comprising an anchor tube (4) which encloses an interior (12), a fixation substance (13) arranged within the interior (12) for bonding the anchor tube (4) on rock (60), a moveable piston (19) arranged inside the interior (12) for moving the fixation substance (13) outside the anchor tube (4) if the anchor tube (4) is arranged in a borehole (61) inside the rock (60), a boring head (10) at one back end (7) of the anchor tube (4), a rinsing channel (24) to supply rinsing fluid, in particular rinsing water to the boring head (10), an expression channel (26) to supply power fluid, in particular power water to the piston (19), is to be able to supply both rinsing water as well as power water into an interior (12) of the rock anchor bolt (2) with minor technical expenses.

This object is solved in that the system (1), in particular the device (3) and/or the rock anchor bolt (2) comprises a moveable closing element (27) which is moveable between a rinsing position and a pressure position and the rinsing channel (24) is open and the expression channel (26) is closed in the rinsing position and the rinsing channel (24) is closed and the expression channel (26) is open in the pressure position.

(Fig. 1)

Rock Anchor Bolt

DESCRIPTION

The invention at hand relates to a system with a rock anchor bolt and a device for moving the rock anchor bolt according to the preamble of claim 1, a rock anchor bolt according to the preamble of claim 11 and a device for moving the rock anchor bolt according to the preamble of claim 14.

Rock anchor bolts are used in the mining industry and for tunnel construction to prevent or slow mountain movements of the bedrock or to secure major chipping of bedrock and hence allow a risk-free operation. Two principles have been disclosed for this purpose, which are in part also combined. With mechanical systems, the anchor is braced friction-tight, whereby mechanical rock or stone anchor bolts generally also comprise an expansion bolt. For chemical rock anchor bolts, anchor tubes are bonded with the subsoil or the bedrock by means of curing mortar or synthetic resin used as fixation substance. In doing so, the rock anchor bolts are installed in the bedrock with or without pre-stress. In contrast to tunnel construction, rock anchor bolts used in the mining industry, e.g. for underground coal mining, are only used to temporarily secure the rock, because the temporarily secured rock is generally extracted during a subsequent work step and hence the rock anchor bolts are removed from the rock again.

Self-drilling rock anchor bolts are equipped with a boring head at one back end of the rock anchor bolt. Said kinds of self-drilling rock anchor bolts can be drilled into the rock and then braced in a single step, without the need of an additional drilling step with a separate drilling tool. During the drilling procedure with the boring head on the rock anchor bolt, it is necessary to feed rinsing water at a low pressure through the rock anchor bolt to the boring head to rinse away the material or rock extracted with the boring head

and to cool the boring head. In the process, the rinsing water is fed to the boring head through an interior enclosed by an anchor tube and then the rinsing water together with the extracted rock flows outward to the opening of the drilled hole through an annulus between the rock and the anchor tube, where the rinsing water exits from the opening of the drilled hole.

At the end of the drilling procedure, it is necessary to feed power water under high pressure into the interior to press the fixation substance inside the anchor tube into the annulus between the anchor tube and the borehole or the rock. To ensure the supply of rinsing water and power water, rotary transmission lead-throughs, so-called dispensers are arranged between the anchor rock bolt and a rotary drill drive or a device for moving the rock anchor bolt. The technical design of said dispensers is very complex and hence their manufacture is expensive. The rinsing water which has to flow into an annulus between the fixation substance and the anchor tube originates from the rotary drill drive and flows through an opening on the inside of a reception coupling toward the dispenser and therefore initially lies in the drilling axis. In contrast, power water to be supplied to the fixation substance or to a plunger on the fixation substance is originally supplied radially from the outside. As a result, an expensive procedure is required in which the flows or channels used for feeding through the rinsing water and the power water intersect in the third dimension.

DE 10 2005 000 158 A1 discloses a drill and anchor placement device used in the mining industry, for tunnel construction or for underground mining to install anchors comprising a drill bit and equipped with a single or multi-component adhesive and having an expression device for expressing the adhesive from the anchor positioned in the borehole, wherein the expression device is integrated in a chamber provided inside the case of the drill and anchor placement device.

DE 10 2005 000 142 A1 discloses an expression device for expressing a mass from a self-drilling chemical rock anchor bolt used in the mining industry and for tunnel construction, having a case with a motor-driven sleeve, which is pivotably supported in the case and axially displaceable, wherein the sleeve comprises a first end with a plug-in opening on which a retainer is provided for rotational carrying means of the rock anchor bolt and a second end opposite the first end with a transmission lead-through as well as a sleeve axis and having a feeder lug through which media can be fed to the rock anchor bolt.

Therefore, the object of the invention at hand consists in providing a system with a rock anchor bolt and a device for moving the rock anchor bolt, a rock anchor bolt and a device for moving the rock anchor bolt in which both rinsing water as well as power water can be fed into an interior of the rock anchor bolt with minor technical expenditures.

Said object is solved with a system having a self-drilling chemical rock anchor bolt, in particular for use in the mining industry, and a device for moving the rock anchor bolt, said rock anchor bolt comprising an anchor tube which comprises an interior, a fixation substance for bonding the anchor tube on rock arranged within the interior, a moveable plunger arranged within the interior for transporting the fixation substance outside the anchor tube if the anchor tube is arranged in a borehole in the rock, a boring head on one back end of the anchor tube, a rinsing channel for supplying rinsing fluid, in particular rinsing water to the drilling head, an expression channel for supplying power fluid, in particular power water to the plunger, wherein the system, in particular the device and/or the rock anchor bolt, comprises a moveable closing element which is moveable between a rinsing position and a pressure position and where the rinsing channel is open and the expression channel is closed in the rinsing position and the rinsing channel is closed and the expression channel is open in the pressure position.

Consequently, the moveable closing element makes it possible in an advantageous way to supply either rinsing water to the boring head with a low pressure or expression water to the plunger or the fixation substance with a high pressure. Advantageously, no technically complex dispenser is necessary anymore, because the closing element, in particular integrated into the device can assume the function of separating the rinsing fluid and the power fluid.

In particular, the system, in particular the rock anchor bolt and/or the device comprises one, in particular only one, fluid opening for supplying both rinsing fluid as well as power fluid and preferably a fluid connection between the fluid opening and the rinsing channel and no fluid connection between the fluid opening and the expression channel exists in the rinsing position of the closing element and no fluid connection between the fluid opening and the rinsing channel and a fluid connection between the fluid opening and the expression channel exists in the pressure position of the closing element.

Conveniently, both rinsing fluid as well as power water can be supplied axially through a fluid opening on the rock anchor bolt and/or on the system, in particular the device, into the rock anchor bolt and the separation can be achieved by moving the closing element between the rinsing position and the pressure position.

In another arrangement, the closing element is pivotable and/or supported in the direction of a longitudinal axis of the rock anchor bolt.

In a supplementary embodiment, the closing element is designed as a pipe socket with an axial fluid channel and the fluid opening leads into a back end of the fluid channel so that both rinsing fluid as well as power fluid can be supplied through the axial fluid channel of the pipe socket.

The interior of the rock anchor bolt is preferably divided into a backpressure space, in particular within a channel sleeve and a front rinsing space by means of a separating ring with a connecting opening in front of the fixation substance and/or the plunger. In the process, the backpressure space also represents an expression channel and the rinsing space also represents a rinsing channel.

In one variant, the rinsing channel leads into the front rinsing space and the expression channel, in particular within the channel sleeve is separated fluid-tight from the back pressure space on the plunger by a separating membrane. As a result, the separating membrane, e.g. made of plastic or a thin sheet metal, can keep the rinsing water away from the plunger during the drilling procedure and the separating membrane is preferably arranged within the channel sleeve.

Conveniently, the separating membrane separates the expression channel on the plunger fluid-tight from the back pressure space when the pipe socket is in rinsing position and a fluid-conducting connection exists between the back end of the axial fluid channel of the pipe socket and the front rinsing space and/or the rinsing channel.

In another embodiment, the pipe socket is arranged outside the connecting opening of the separating ring if the pipe socket is in rinsing position. In the rinsing position, the pipe socket can also be arranged within the connecting opening of the separating ring, but an annulus between the pipe socket and the separating ring is provided so that the rinsing water exiting the pipe socket at the back end can flow back into the front rinsing space through the connecting opening on the separating ring.

The separating membrane is split in particular if the pipe socket is in pressure position, so that a fluid-conducting connection between the expression channel on the plunger and the back pressure space exists and the front rinsing space and/or the rinsing channel is separated fluid-tight from the back end of the axial fluid channel of the pipe socket.

In another arrangement, the pipe socket is arranged in the connecting opening of the separating ring if the pipe socket is in pressure position and the radial exterior of the pipe socket fits fluid-tight on the separating ring on the connecting opening of the separating ring so that no fluid-conducting connection exists between the back pressure space and the rinsing space and/or the rinsing channel and the back end of the pipe socket preferably ends on the expression channel on the plunger so that the axial fluid channel of the pipe socket leads into the expression channel on the plunger and/or the rinsing channel is created as an annulus between the fixation substance and the anchor tube and/or the rock anchor bolt is designed as a rock anchor bolt described in this patent application and/or the device is designed as a device described in this patent application.

Self-drilling chemical rock anchor bolt according to the invention, in particular for use in the mining industry, comprising an anchor tube which includes an interior, a fixation substance for bonding the anchor tube on rock arranged within the interior, a moveable plunger arranged within the interior for transporting the fixation substance outside the anchor tube if the anchor tube is arranged in a borehole in the rock, a boring head on the back end of the anchor tube, a rinsing channel for supplying rinsing fluid, in particular water to the boring head, an expression channel for supplying power fluid, in particular water to the plunger, wherein the rock anchor bolt comprises one, in particular only one, fluid opening for supplying both rinsing fluid as well as power fluid.

In a supplementary variant, the interior is divided into a backpressure space and a front rinsing space by a separating ring with a connecting opening in front of the fixation substance and/or the plunger.

In another variant, the rinsing channel leads into the front rinsing space and the expression channel is separated fluid-tight from the pressure space on the plunger by means of a penetrable separating membrane, e.g. made of plastic or metal and/or the rock

anchor bolt comprises an anchor nut and preferably an anchor plate supported by the anchor nut for putting it on the rock.

Device for moving a rock anchor bolt according to the invention, in particular a rock anchor bolt described in this patent application, comprising a driving element, in particular a driving ring for transmitting a torque to the rock anchor bolt, a drive shaft for connection with the drive motor, preferably a mechanism for transmitting a torque from the drive shaft to the driving element, wherein the device comprises one, in particular only one fluid opening for supplying both rinsing fluid as well as power fluid.

In yet another variant, the device comprises a moveable pipe socket with an axial fluid channel which is moveable between a rinsing position and a pressure position and the fluid opening leads into a front end of the axial fluid channel and the device preferably comprises an apparatus, e.g. a jig plunger and a lever coupled to the jig plunger for moving the pipe socket and the driving element comprises an axial borehole and the pipe socket is arranged within the axial borehole of the driving element as well as the pipe socket is preferably axially moveably supported in the borehole.

Conveniently, the device comprises a drive motor, e.g. an internal combustion engine or electric motor for driving the drive shaft.

Furthermore, the rock anchor bolt is also designed as a sliding anchor. The sliding anchor has a sliding function in so far as the length of the rock anchor bolt expands starting from a defined tensile force absorbed by the rock anchor bolt, i.e. the compressive force acting on the anchor plate or the anchor nut which is caused by the rock, thus allowing a movement of the rock which reduces the tensile force to be absorbed by the rock anchor bolt (to below the defined tensile force as threshold value, to prevent sliding), thus ensuring better securing of the rock.

In an additional arrangement a back end of the anchor tube is covered with a cap and the anchor tube and/or the cap comprise at least one opening for transporting the fixation substance out of the interior enclosed by the anchor tube. On the one hand, the cap can be a separate component or it can be designed as one piece together with the anchor tube.

In a supplementary arrangement, the fixation substance, in particular a synthetic resin or mortar comprises two components, e.g. an adhesive component and a curing component.

The two components are preferably arranged separately in a pouch. Any device for storing the two separate components is considered a pouch, for instance also a cartouche or a different container.

In a supplementary arrangement, a mixer is arranged between the fixation substance at the at least one opening for mixing the fixation substance, in particular the two components, before the fixation substance exits the at least one opening.

In a supplementary arrangement, the components of the system, for example the anchor tube, the plunger, the anchor nut, the anchor plate, the cap, the closing element, the separating ring, the channel sleeve, the closing and supporting ring, the driving element, the driving ring, the bearing bush, the drive shaft, the first and second gearwheel, the case and/or the jig plunger and/or the lever are made at least partly, in particular completely of metal, for example steel or steel alloy or fiberglass-reinforced plastic.

Below is a detailed description of an embodiment of the invention with reference to the enclosed drawings. In the figures:

Fig. 1 shows a longitudinal section of a system with a rock anchor bolt and a device for moving the rock anchor bolt with a closing element in a rinsing position and

Fig. 2 shows a longitudinal section of the system according to Fig. 1 with the closing element in pressure position.

A rock anchor bolt 2 designed as a sliding bolt is used e.g. in the mining industry for temporarily securing rock 60 on galleries. The rock anchor bolt 2 comprises an anchor tube 4, which encloses an interior 12. The rock anchor bolt 2 is a chemical rock anchor bolt 2, meaning that the anchor tube 4 can be bonded to a rock 60 by means of a fixation substance 13 arranged in the interior 12. For this purpose, a borehole 61 needs to be created in the rock 60 with a boring head 10 on a back end 7 of the anchor tube 4. For drilling with the boring head 10, the anchor tube 4 needs to be set in a rotating motion around a longitudinal axis 5 of the anchor tube on a front end 6 on a work space 62 by means of a device 3 for moving the rock anchor bolt 4. The rock anchor bolt 2 and the device 3 create a system 1.

Fig. 1 and 2 illustrate a condition before the fixation substance 13 is expressed into a space between the anchor tube 4 and the rock 60. The fixation substance 13 is a synthetic resin 14, comprising an adhesive component 15 and a curing component 16. The adhesive component 15 is stored in a first pouch 17 and the curing component 16 is stored in a second pouch 18. The two pouches 17, 18 are stored in the interior 12.

A plunger 19 as means 20 for expressing the fixation substance 13 is arranged on the front end of the two pouches 17, 18. The back end 7 of the anchor tube 4 is closed with a cap 21 having an opening 22 for squeezing out the fixation substance 13. The fixation substance 13 can flow out of the interior 12 of the anchor tube 4 through the opening 22 into the space, in particular the annulus between the anchor tube 4 and the rock 60, whereby the fixation substance 13 is lead into said annulus through rinsing and expression openings 11 on the boring head 10. In the process, a mixer 23 is arranged on the opening 22, through which the fixation substance 13 is forced as a result of the

geometrical arrangement of the mixer 23 in the interior 12 to flow from the two pouches 17, 18 first through the mixer 23 before it exists from the opening 22 and the rinsing and expression openings 11. The mixer 23 comprises devices, for instance a corresponding geometry in so far that the fixation substance 13 flows in a meandering or hose-like shape through the mixer 23 and as a result the adhesive component 14 is mixed with the curing component 15 of the synthetic resin 14 before it exists from the opening 22.

To bring the fixation substance 13 into the space between the anchor tube 4 and the rock 60, the plunger 19 is moved inward by the power water, i.e. to the left according to the illustration in Fig. 1 and 2. As a result, the first and second pouch 17, 18 are destroyed by the plunger 19 so that the adhesive component 15 and the curing component 16 move and as a result of the shrinking volume of the interior 12 between the plunger 19 and the cap 21, the fixation substance 13 is pushed through the mixer 23 and the opening 22 or the rinsing and expression openings 11 respectively into the space between the anchor tube 4 and the rock 60 and subsequently cures.

The anchor tube 4 has an external thread 8 on the outside and an anchor nut 9 with an internal thread is screwed onto the external thread 8 of the anchor tube 4. The internal thread of the anchor nut 9 engages into the external thread 8 of the anchor tube 4 and because of the geometry of the anchor nut 9, the anchor nut 9 can only be screwed onto the anchor tube 4 up to the position illustrated in Fig. 1 and 2. The anchor nut 9 comprises a polygon (not illustrated) on the exterior. Based on said polygon arranged radially on the exterior of the anchor nut 9, a torque can be transmitted to the anchor nut 9 and hence also to the anchor tube 4 by a driving element 43, namely a driving ring 44 of the device 3 for moving the rock anchor bolt 2, because the anchor nut 9 can only be screwed onto the anchor tube 4 up to the position illustrated in Fig. 1 and 2 based on a limit stop in the region of the front end 6 of the anchor tube 4.

In addition to the driving element 43, the device 3 comprises a case 51. A drive shaft 46 is mounted on the case 51 with a bearing 50, e.g. a rolling bearing and a drive motor 59 designed as internal combustion engine is arranged on an exterior end of the drive shaft 46 outside the case 51. A first gearwheel 47 is provided on the other inside end of the drive shaft 46, whose not illustrated cogs comb the not illustrated cogs of a second gearwheel 48. In the process, the rotational axes of the first and second gearwheel 47, 48 are perpendicular to each other. The second gearwheel 48 is fastened on the driving ring 44 by means of fastening bolts 49. Furthermore, the driving ring 44 is mounted on the case 51 with the bearing 50. The driving ring 44 comprises an axial borehole with respect to the longitudinal axis 5 of the anchor tube 4 and a closing element 27 designed as a pipe socket 28 is arranged in said borehole. The pipe socket 28 comprises an axial fluid channel 31. A front end 29 of the pipe socket 28 and a front end 32 of the axial fluid channel 31 is or ends on the work space 62 outside the case 51 and a back end 30 of the pipe socket 28 as well as a back end 33 of the axial fluid channel 33 ends within the interior 12 enclosed by the anchor tube 4. A bearing bush 45 is arranged between the pipe socket 28 and the driving ring 44. As a result, the drive motor 59 can bring the driving ring 44 into a rotational movement around the longitudinal axis 5 of the anchor tube 4 by means of the drive shaft 46 and the first and second gearwheel 47, 48. In the process, the pipe socket 28 is not conducting a rotational movement and the bearing bush 45 is used for supporting the rotating driving ring 44 on the non-rotating pipe socket 28. Based on the polygon on the anchor nut 9 as well as a corresponding complementary polygon (not illustrated) on the driving ring 44, the driving ring 44 can transmit a torque to the anchor nut 9 and hence also to the anchor tube 4. The boring head 10 is rigidly connected with the anchor tube 4, so that the boring head 10 also performs a rotational movement around anchor tube 4, due to the torque applied from the drive motor 59 to the anchor tube 4 and as a result the borehole 61 can be driven into the rock 60 with the self-drilling rock anchor bolt 2.

Fig. 1 illustrates the system 1 during the drilling procedure and the pipe socket 28 is in a rinsing position. In Fig. 2, the system 1 is illustrated during the expression of the fixation substance 13 from the anchor tube 4 and the pipe socket 28 is in a pressure position. To move the pipe socket 28 from the rinsing position according to Fig. 1 into the pressure position according to Fig. 2, the pipe socket 28 needs to be moved in an axial direction toward the back end 7 of the anchor tube 4. For this purpose, the device 3 must be equipped with an apparatus for moving the pipe socket 28. A jig cylinder 55 is created within the case 51 which a jig piston 52 with a piston rod 53 is arranged in. A spring 54 is arranged between the jig piston 52 and the case 51 or the jig cylinder 55, respectively. A lever 57 is non-rigidly connected with the piston rod 53 on the outer end of the piston rod 53 and the lever 57 is supported on a lever bearing 58 rotating around a rotational axis perpendicular to the plane of projection of Fig. 1 and 2 on the case 51. A lower end of the lever 57 is non-rigidly fastened on the pipe socket 28. In the rinsing position according to Fig. 1, the spring 54 applies a torque in counter clockwise direction around the lever bearing 58 onto the jig piston 52 and hence also onto the lever 57, so that the pipe socket 28 is in rinsing position. To move the pipe socket 28 from the rinsing position into pressure position, a hydraulic fluid needs to be fed in through a cylindrical opening 56, so that the pressure of the hydraulic fluid in the space between the jig cylinder 55 and the jig piston 52 exerts a force aimed against the force of the spring 54 directed at the jig piston 52, so that the jig piston 52 moves from left to right as illustrated in Fig. 1 and 2 and therefore applies a torque to the lever 57 around the lever bearing 58 in clockwise direction and the lever 57 moves in clockwise direction as a result. Consequently, the lever 57 moves the axially supported pipe socket 28 from the rinsing position into the pressure position. On the device 3, the second gearwheel 48, the driving ring 44 and in part also the bearing bush 45 perform a rotational movement around the longitudinal axis 5 of the anchor tube 4. The other components of the device 3, e.g. the case 51, the first gearwheel 47, the drive motor 59 and the apparatus for moving the pipe socket 28 are not performing a rotational movement around the longitudinal axis 5 of the anchor tube 4 during the drilling procedure.

During the drilling procedure with the system 1, rinsing water needs to be fed to the boring head 10 to cool the boring head 10 and to transport extracted rock 60 from the borehole 61 to the working space 62. Power water needs to be fed to the piston 19 for expressing the fixation substance into the space between the anchor tube 4 and the rock 60, to move the piston 19 toward the left with the power water under high pressure as illustrated in Fig. 1 and 2 and to direct the fixation substance 13 into the space between the anchor tube 4 and the rock 60 for the chemical fastening of the rock anchor bolt 2 on the rock 60. For this purpose, a rinsing channel 24 for feeding through rinsing water with a low pressure, e.g. in the range between 1 and 10 bar and an expression channel 26 for feeding through power water with a high pressure, e.g. in the range between 100 and 500 bar is created inside the interior 12 of the anchor tube 4. The system 1 only contains one fluid opening 34 on the device 3 for feeding through both rinsing water as well as power water. The fluid opening 34 is created at the front end 32 of the fluid channel 31. As well, the rock anchor bolt 2 also only comprises one fluid opening 35, namely on a closing and bearing ring 42. As a result, both rinsing water as well as power water is fed through the fluid opening 34 and 35. The closing and bearing ring 42 seals the front rinsing space 37.

A channel sleeve 41 encloses the fixation substance 13 and is additionally guided in the direction toward the front end 6 of the anchor tube 4. In addition to the fixation substance 13, the piston 19 resting on the fixation substance 13 as well as a separating membrane 40 made of plastic are arranged inside the channel sleeve 41. A separating ring 38 with a connecting opening 39 is arranged on the front end of the channel sleeve 41. The space within the channel sleeve 41 between the piston 19 and the separating ring 38 is divided into the expression channel 26 and the back pressure space 36 by the separating membrane 40 within the channel sleeve 41 when the pipe socket 28 is in rinsing position or during the drilling procedure as illustrated in Fig. 1. The channel sleeve 41 comprises a separating ring 38 on the front end and the rinsing channel 24 or the front rinsing space 37 is formed between the separating ring 38 and the closing and bearing ring 42 on the

front end 6 of the anchor tube 4. The rinsing channel 24 between the separating ring 38 and the closing and bearing ring 42 leads into an annulus 25 between the channel sleeve 41 and the anchor tube 4. The rinsing water can be supplied to the boring head 10 through said annulus 25 acting as a rinsing channel 24.

As a result, rinsing water can be fed through the fluid opening 34 on the pipe socket 28 through the axial fluid channel 31 of the pipe socket 28 with low pressure during the drilling procedure when the pipe socket 28 is in rinsing position according to Fig. 1. Consequently, the fluid channel 31 also represents a rinsing channel 24 for feeding through rinsing water. At the back end 30 of the pipe socket 28, the rinsing water flows into the rinsing channel 24 between the separating ring 38 and the closing and bearing ring 42 and then flows through the annulus 25 to the boring head 10. Indeed, the rinsing water can flow through the connecting opening 39 into the back pressure space 36, but the flow of rinsing water to the expression channel 26 and hence to the piston 19 is impossible due to the fluid-tight seal with the separating membrane 26. As a result, the rinsing water is unable to apply any force onto the piston 19 and the rinsing water is exclusively used to rinse the boring head 10 and to transport rock 60 outward. As a result, the expression of fixation substance 13 with rinsing water is impossible. Moreover, the boring head 10 is set into a rotating movement around the longitudinal axis as described above with the drive motor 59, so that the borehole 61 can be drilled into the rock 60 with the self-drilling rock anchor bolt 2.

At the end of the drilling procedure, the drive motor 59 is turned off and the feeding of rinsing water through the axial fluid channel of the pipe socket 28 is stopped. Next, the apparatus for moving the pipe socket 28 described above is used to move the pipe socket to the left from the rinsing position according to Fig. 1 into the pressure position according to Fig. 2. In the process, the back end 30 of the pipe socket 28 penetrates the separating membrane 40 (Fig. 2), so that a fluid-conducting connection between the expression channel 26 and the backpressure space 36 exists. The pipe socket 28 rests

fluid-tight on the exterior of the connecting opening 39 of the separating ring 28, so that power water fed through the axial fluid channel 31 of the pipe socket 28 will not reach the front rinsing space 37 to the right of the separating ring 38. The power water fed through the fluid opening 34 under high pressure therefore exclusively reaches the backpressure space 36 and the expression channel 26. As a result, the power water can apply a compression force onto the piston 19 and the piston 19 moves to the left as illustrated in Fig. 2, so that the fixation substance 13 reaches the space between the anchor tube 4 and the rock 60 through the opening 22 and the rinsing and expression openings 11 on the boring head 10.

After the fixation substance 13 has been expressed, the device 3 is removed from the rock anchor bolt 2. Consequently, the rock anchor bolt 2 with the anchor nut 9 remains in the borehole 61 as a one-way part. The device 3, e.g. with the driving ring 44, the apparatus for moving the pipe socket 28 and the case 51 represents a re-usable part. This means that after the drilling and expression procedure, the device 3 can be used to drill another rock anchor bolt 2 into the rock 60 and the fixation substance 13 can subsequently be expressed.

All in all, the system 1 according to the invention is associated with considerable advantages. Both rinsing water as well as power water can be fed into the interior 12 of the anchor tube 4 through a single fluid opening 34 on the device 3. No technically complex dispenser is required and rinsing water as well as power water can be fed in axial direction through the axial fluid channel 31 of the pipe socket 28.

CLAIMS

1. System (1) with a self-drilling chemical rock anchor bolt (2), specifically for use in the mining industry and a device (3) for moving the rock anchor bolt (2), said rock anchor bolt (2) comprising
 - an anchor tube (4) which encloses an interior (12),
 - a fixation substance (13) arranged within the interior (12) for bonding the anchor tube (4) on rock (60),
 - a moveable piston (19) arranged inside the interior (12) for moving the fixation substance (13) outside the anchor tube (4) if the anchor tube (4) is arranged in a borehole (61) the rock (60),
 - a boring head (10) at one back end (7) of the anchor tube (4),
 - a rinsing channel (24) to supply rinsing fluid, in particular rinsing water to the boring head (10),
 - an expression channel (26) to supply power fluid, in particular power water to the piston (19),

characterized in that

the system (1), in particular the device (3) and/or the rock anchor bolt (2) comprises a moveable closing element (27) which is moveable between a rinsing position and an pressure position and the rinsing channel (24) is open and the expression channel is closed (26) in the rinsing position and the rinsing channel (24) is closed and the expression channel (26) is open in the pressure position.

2. System according to claim 1,

characterized in that

the system (1), in particular the rock anchor bolt (2) and/or the device (3) comprises one, in particular only one fluid opening (34, 35) for supplying both rinsing fluid as well as power fluid and preferably a fluid connection between the fluid opening (34, 35) and the rinsing channel (24) and no fluid connection between the fluid opening (34, 35) and the expression channel (26) exists when the closing element (27) is in rinsing position and no fluid connection between the fluid opening (34) and the rinsing channel (24) and a fluid connection between the fluid opening (34) and the expression channel (26) exists when the closing element (27) is in pressure position.

3. System according to claim 1 or 2,

characterized in that

the closing element (27) is moveable and/or supported in the direction of a longitudinal axis (5) of the rock anchor bolt (2).

4. System according to any one or a plurality of the preceding claims,

characterized in that

the closing element (27) is designed as a pipe socket (28) with an axial fluid channel (31) and the fluid opening (34) leads into a front end (29) of the axial fluid channel (31) so that both rinsing fluid as well as

power fluid can be fed through the axial fluid channel (31) of the pipe socket (28).

5. System according to claim 4,

characterized in that

the interior (12) of the rock anchor bolt (2) is divided into a back pressure space (36), in particular within a channel sleeve (41) and a front rinsing space (37) in front of the fixation substance (13) and/or the piston (19) by means of a separating ring (38) with a connecting opening (39).

6. System according to claim 5,

characterized in that

the rinsing channel (24) leads into the front rinsing space (37) and the expression channel (26), in particular within a channel sleeve (41) is separated fluid-tight from the back pressure space (36) on the piston (19) by means of a separating membrane (40).

7. System according to claim 5 or 6,

characterized in that

the separating membrane (40) separates the expression channel (26) on the piston (19) fluid-tight from the back pressure space (36) and a fluid-conducting connection exists between the back end (33) of the

axial fluid channel (31) of the pipe socket (28) and the front rinsing space (37) and/or the rinsing channel (24) when the pipe socket (28) is in rinsing position.

8. System according to any one or a plurality of claims 5 to 7,

characterized in that

the pipe socket (28) is arranged outside the connecting opening (39) of the separating ring (38) when the pipe socket (28) is in rinsing position.

9. System according to any one or a plurality of claims 5 to 8,

characterized in that

the separating membrane (40) is split when the pipe socket (28) is in pressure position, so that a fluid-conducting connection exists between the expression channel (26) on the piston (19) and the back pressure space (36) and the front rinsing space (37) and/or the rinsing channel (24) is separated fluid-tight from the back end (33) of the axial fluid channel (31) of the pipe socket (28).

10. System according to claim 9,

characterized in that

the pipe socket (28) is arranged in the connecting opening (39) of the separating ring (38) and the radial exterior of the pipe socket (28) rests fluid-tight on the connecting opening (39) of the separating ring (38)

on the separating ring (38) when the pipe socket (28) is in pressure position, so that no fluid-conducting connection between the back pressure space (36) and the rinsing space (37) and/or the rinsing channel (24) exists and preferably the back end (33) of the pipe socket (28) ends on the expression channel (26) on the piston (19), so that the axial fluid channel (31) of the pipe socket (28) leads into the expression channel (26) on the piston (19)

and/or

the rinsing channel (24) is designed as an annulus (25) between the fixation substance (13) and the anchor tube (4)

and/or

the rock anchor bolt (2) is designed according to any one or a plurality of claims 11 to 13

and/or

the device (1) is designed according to claim 14 or 15.

11. Self-drilling chemical rock anchor bolt (2), in particular for use in the mining industry, comprising

- an anchor tube (4) which encloses an interior (12),
- a fixation substance (13) arranged inside the interior (12) for bonding the anchor tube (4) to rock (60)
- a moveable piston (19) arranged inside the interior (12) for transporting the fixation substance (13) outside the anchor tube (4) when the anchor tube (4) is arranged in a borehole (61) inside the rock (60),
- a boring head (10) on a back end (7) of the anchor tube (4),

- a rinsing channel (24) for supplying rinsing fluid, in particular water to the boring head (10),
- an expression channel (26) for supplying power fluid, in particular water to the piston (19),

characterized in that

the rock anchor bolt (2) comprises one, in particular only one fluid opening (35) for supplying both rinsing fluid as well as power fluid.

12. Rock anchor bolt according to claim 11,

characterized in that

the interior (12) is divided into a back pressure space (36) and a front rinsing space (37) in front of the fixation substance (13) and/or the piston (19) by a separating ring (38) with a connecting opening (39).

13. Rock anchor bolt according to claim 12,

characterized in that

the rinsing channel (24) leads into the front rinsing space (37) and the expression channel (26) is separated fluid-tight from the back pressure space (36) on the piston (19) by means of a penetrable separating membrane (40), e.g. made of plastic or metal
and/or

the rock anchor bolt (2) comprises an anchor nut (19) and preferably an anchor plate supported by the anchor nut (9) for placing on the rock (60).

14. Device (3) for moving a rock anchor bolt (2), in particular a rock anchor bolt (2) according to claim 12 or 13, comprising
- a driving element (43), in particular a driving ring (44) for transmitting a torque to the rock anchor bolt (2),
 - a drive shaft (46) for connection with a drive motor (59),
 - preferably a mechanism for transmitting a torque from the drive shaft (46) to the driving element (43),

characterized in that

the device (3) comprises one, in particular only one fluid opening (34) for supplying both rinsing fluid as well as power fluid.

15. Device according to claim 14,

characterized in that

the device (3) comprises a moveable pipe socket (28) with an axial fluid channel (31) which is moveable between a rinsing position and a pressure position and the fluid opening (34) leads into a front end (29) of the axial fluid channel (31)

and preferably the device (3) comprises an apparatus, e.g. a jig piston (52) and a lever (57) coupled with the jig piston (52) for moving the pipe socket (28)

and the driving element (43) comprises an axial borehole and the pipe socket (28) is arranged within the axial borehole of the driving element (43) as well as the pipe socket (28) is preferably axially moveably mounted.

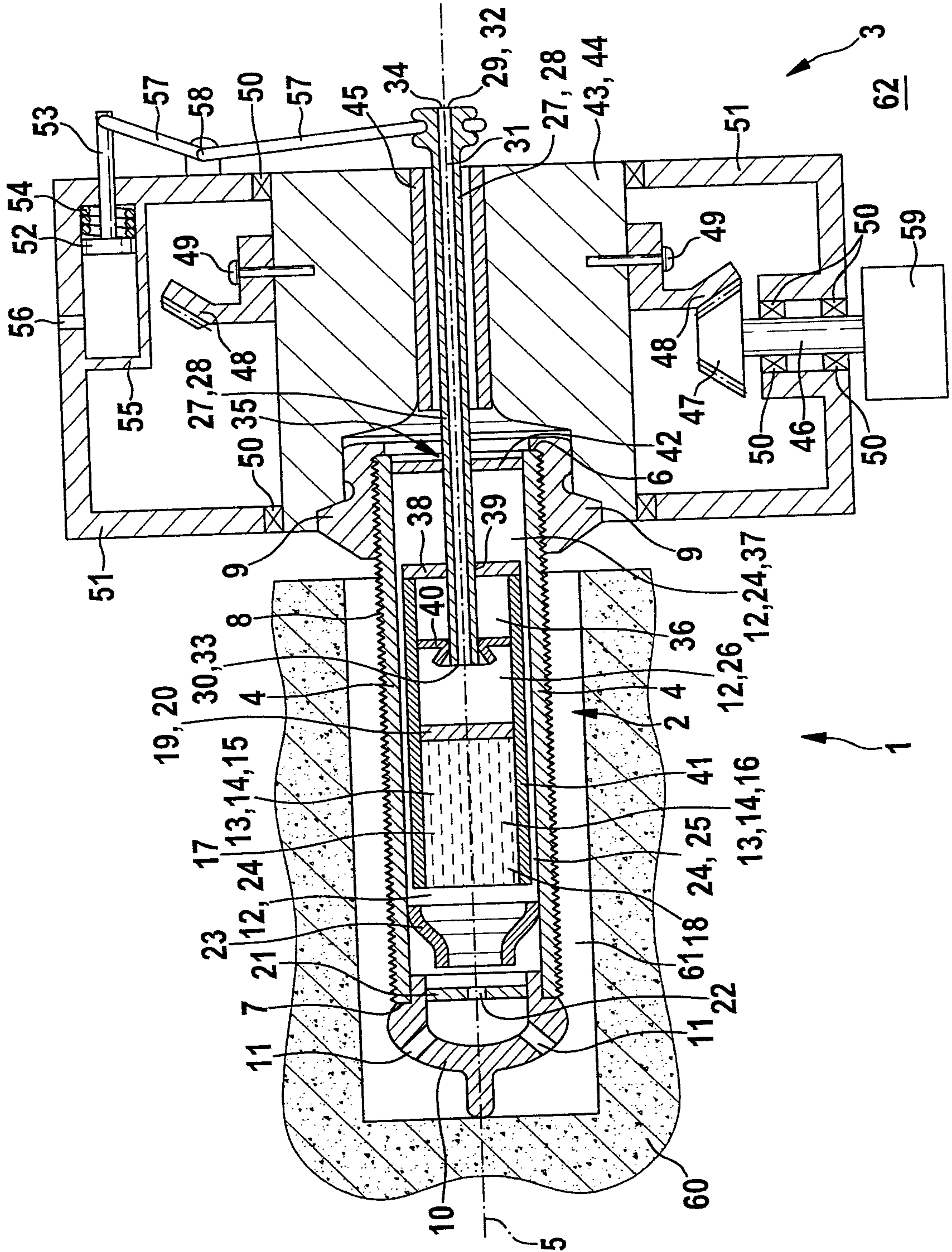


Fig. 2

