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(54) **ANCHORING BOLT HAVING AN EXTRUDING PISTON**

VERANKERUNGSBOLZEN MIT EXTRUSIONSKOLBEN

BOULON D'ANCRAGE COMPRENANT UN PISTON D'EXTRUSION

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Description

[0001] The invention relates to an anchoring bolt having an integrated anchoring compound and an extruding piston which acts on this anchoring compound and which, by way of a source of power, may be displaced along the inner wall of the bolt tube, starting from the bolt head and pressing the anchoring compound in the direction of a mixing head associated with the bolt tip.

[0002] Anchoring bolts are rock bolts which primarily serve to stabilise ground formations such as rock in the vicinity of ducts and passages and also tunnels. In the case of a rock bolt or anchoring bolt known from DE 100 17 750 A1, a borehole is bored into the ground (such as rock) in a first operating step so that, after the end length has been achieved, a bolt tube having a continuous bolt tube bore can then be introduced into the borehole produced. An anchoring compound, preferably in the form of a multi-chamber adhesive cartridge, is inserted into this bolt tube bore, whereupon the anchoring compound is then pressed into the borehole through a static mixer arranged at the opposite end of the bolt tube by way of an extruding piston. This static mixer is necessary to intensively mix the two components or multiple components of the anchoring compound together so that they then react with one another and harden and thus fix the bolt tube in the borehole so that the rock layers are thereby secured. Serving as the extruding piston in DE 100 17 750 A1 or B4 is a simple plate which is loaded from outside the bolt tube by way of a so-called extruding mechanism so that the plate, pushing the anchoring compound in front of it, is moved through the bolt tube bore. As the figures and the description relating to this known anchoring bolt show, it is assumed here that the bolt tube bore has a smooth wall. Otherwise, it would not be possible to displace the plate loading the anchoring compound without difficulty and, in particular, in sealing manner. However, even with this smooth wall, in the extruding mechanism illustrated therein there is a risk that the extruding piston constructed as a thin disc will cant slightly with the result that adhesive material then escapes past it into the cavity of the bolt tube bore - which cavity should actually be held open - and hinder further actuation of the extruding mechanism. It is moreover disadvantageous and problematic that it is then no longer possible to ensure that the quantity of adhesive mass required for the actual fixing and cementing of the bolt tube is available in the area of operation. However, this problem then becomes substantially greater if the inner wall of the bolt tube is not smooth, as in the construction shown in DE 100 17 750 B4, but instead profiled. However, this profiling occurs automatically when an outer profile is applied by rollers, as is conventional in bolt tubes of this type. This outer profile presses through onto the inner wall with the result that an extruding piston of this type is not able to carry out its work, or is only able to do so very inadequately.

[0003] US 2006/0153645 A1 discloses a bolt tube in

which an adhesive cartridge is arranged and is displaced inside the inner bore of the bolt tube by means of a piston. This piston or extruding mechanism has, on the side wall, bead-like parts for sealing purposes and, at the front, a type of strut by way of which the piston is fixed to the bolt tip so that, after the extrusion of the cartridge, it does not lose its position and, if necessary, continues to seal the bolt tube. This anchoring bolt is disadvantageous in that the extruding mechanism or the extruding piston can only function when the inner wall of the bolt tube bore is smooth. The figures show that the outer surface of the bolt rod or bolt tube is roughened or even provided with slight grooves, although it is clear from the figures, and particularly Figure 10, that the inner wall of the inner bore is completely smooth. In a bolt tube which is provided with groove-shaped indentations, an extruding piston of this type would not seal adequately and, in particular, it would not be guided but would either jam, tilt or present other problems.

[0004] In principle, the same problems are apparent in an anchoring bolt on the basis of the Provisional Patent Application ZA2004/10396 filed in South Africa. In the case of this bolt, in addition to the construction according to US 2006/0153645 A1, a piston has been used which has no beads or the like opposite the inner wall of the inner bore. Instead, according to Figure 4, it is provided at both ends with a cap which is arguably intended to assume this sealing function, which it is able to do when the wall is smooth, but not in the construction having the groove-shaped indentations. Even at first glance, it is clear that at least the rear cap will move out of position as soon as the wall is uneven. The front cap will then also lose its function, so that, as a whole, an extruding device of this type is no longer able to fulfill its function. With regard to these two documents relating to the prior art, it should also be noted that an extruding piston of this type is not able to carry out its work, or is only able to do so very inadequately, if the outer profile presses through to the inner wall and therefore even a virtually smooth inner wall is no longer present.

[0005] Amelioration of these problems has been sought.

[0006] According to the invention it has been found that where the inner wall of the bolt tube has groove-shaped indentations particularly as a result of the application of the strongly groove-shaped outer profile and where the extruding piston has a support body made of a hard material adapted to the source of power, it is advantageous to provide a sealing part, which is associated with the support body and designed to conform to the inner wall and to promote a "screwing in" of the extruding piston into the bolt tube with the groove-shaped indentations and thereby produce both a sealing and guide function.

[0007] By means of an anchoring bolt of this type, it is for the first time possible - even with a profiled inner wall of the bolt tube - to ensure that the extruding piston used actually presses all of the adhesive material reliably through the static mixer or other mixer into the borehole.

Thus, the precisely measured quantity of adhesive is available to fill the cavity between the bolt rod and the borehole wall and thus fix the anchoring bolt or bolt tube effectively in the rock. The extruding piston itself has a sufficiently stable support body, which either absorbs the force of a mechanical plunger and transmits it to the anchoring compound, or which is loaded by hydraulic fluid or compressed air so that it moves reliably along the inner wall of the bolt tube and pushes the anchoring compound in front of it, whereupon the sealing part having a large sealing face always ensures that adhesive does not push past the seal into the cavity located behind it. The large sealing face is produced in that the sealing part forms a sealing face which is sufficient to push all of the adhesive material in the direction of the mixing head by means of the extruding piston. The particular construction of the sealing part here ensures that, even with a pronounced inner profiling, the necessary sealing face by way of which the extruding piston has the continuously even contact pressure against the inner wall is always available. With a profiled inner wall, this sealing face, which is produced or provided by the sealing part, should be, for example, at least somewhat wider than the width of a profile thread. The particular construction of the sealing part results in a screwing-in procedure which ensures that the entire extruding piston is always reliably guided along this rippled inner wall and thereby has a perfect sealing action so that all the adhesive is also pressed effectively into the specified region on the rock or in the rock.

[0008] According to an expedient construction of the invention, it is provided for the extruding piston to be constructed as a tubular piston designed in the shape of a hat, to be introduced into the bolt tube with its piston base pointing towards the adhesive cartridge or anchoring compound and to be formed with its guide and sealing rim, which serves as a sealing part, abutting tightly against the inner wall of the bolt tube with the groove-shaped indentations, sealing against them and guiding the extruding piston. The particular form of the extruding piston ensures that the pressure exerted on it also actually results in the piston moving smoothly along the inner wall of the bolt tube, thereby pressing, as it were, into the groove-shaped indentations and thereby guiding itself and thereby pushing all of the adhesive material in front of it. With this, it exerts such a pressure that the adhesive cartridge opens or is split open on the opposite side so that the adhesive material can exit and move into the static mixer. The description shows that the hat-shaped tubular piston also moves smoothly past the inner wall of the bolt tube because the seal or sealing rim at the same time acts as a guide ring.

[0009] Particularly favourable guidance along the inner wall of the bolt tube is ensured if the extruding piston is constructed in one or more parts. Here, the extruding piston has a length which already substantially prevents canting, wherein this canting is further prevented in that this extruding piston is equipped with the guide means

described, relating to the sealing rim.

[0010] The necessary sealing and, at the same time, guidance is then particularly advantageously ensured if the extruding piston has one, two or more guide and sealing rims which are arranged at a spacing from one another and are capable of a limited flexibility. The result of this is that the extruding piston is not only sealed and, at the same time, guided at one point, but instead at several points, wherein it is advantageous if a further guide and sealing rim is present at least at the head of the extruding piston and at the end facing the bolt head. One or more such rims are again advantageously present between these so that an even sealing and guidance is produced overall.

[0011] It was explained above that the extruding piston is pushed or pressed against the adhesive cartridge so that this latter tears open or opens at the end associated with the static mixer in order to release the adhesive in the cartridge. Both to ensure the smooth guidance of the extruding piston and, at the same time, also reliably hold the adhesive cartridge, the invention provides for a guide element with finger-like, resilient side elements to be associated with the extruding piston or multiple piston arrangement and to be integrally formed with its base on the side of the piston base, to be detachably connected thereto or to be present as a single part. This guide element therefore runs in front of the actual extruding piston, receives the end of the adhesive cartridge and thus ensures that the job allocated to it is also carried out optimally. It should be noted here that, at the same time, the sealing effect is thereby also made constant because this guide element ensures that the extruding piston is centred centrally in the bolt tube.

[0012] Since the guide element is intended to have guiding properties, as already shown in the text, it is advantageous if the guide element is designed like a basket and is constructed with resilient side elements which are fixed to its base and have an end-face, outwardly pointing turned-up edge forming a scraper ring. The resilient side elements ensure that the guide element lies practically around the end of the adhesive cartridge and is thereby also centred at the same time, whilst the side elements having the turned-up edge not only ensure this centring but at the same time also ensure that the guide element is also supported on the inner wall of the bolt tube and therefore slides along the inner wall.

[0013] The adhesive material or the anchoring compound comprises a single-chamber or multi-chamber cartridge or else a direct column, so that it is very advantageous if the extruding piston may be adapted to this particular construction of the anchoring compound. This is effected in that the support body is constructed such that it may be equipped with sealing parts of different materials, in particular with regard to their hardness. Here, the sealing part is then virtually pulled over the support body and can therefore be readily exchanged if the conditions of use with regard to the anchoring compound were to change.

[0014] In order to facilitate putting on the sealing part, the invention provides for the support body to be designed like a thimble with an approximately perpendicular annular wall, onto the closed piston base of which a sealing part designed like a hat can be pushed or slipped. This embodiment has the advantage that the sealing part, when pushed through the bolt tube, also deforms automatically so that it can adapt particularly well to the inner wall of the bolt tube. Part of the sealing material can be pushed somewhat away from the piston base, namely as a result of a corresponding load, so that additional sealing beads are produced.

[0015] The multiple support, described above, of the extruding piston against the inner wall can also be achieved in that the sealing part has an outer surface in the region of the annular wall, which outer surface is equipped with lamellas arranged at a spacing. This is advantageous in that, even with short lengths of an extruding piston of this type, it is already possible to achieve even sealing and guidance.

[0016] With relatively coarse threads, it is advantageous if the sealing part has a balloon-like outer surface and/or a deformable coating. Thus, a relatively large mass can push along the inner wall and move into the thread so that, even with complicated inner walls of this type, the necessary sealing action can always be ensured.

[0017] To distribute the adhesive material evenly in the annular channel about the bolt tube, it is advantageous if the support body with its sealing part is constructed such that it may be combined with a seating adapter for a bolt-rotating and extruding device, which seating adapter may be fixed to the bolt head of the bolt tube and projects into the bolt tube, and is preferably detachably connected by way of a predetermined breaking point. This seating adapter enables the necessary connection with the bolt-rotating and extruding device, wherein this should be expediently constructed so that there are no leaks and instead the corresponding pressure force is reliably effected right into the support body of the extruding piston. Whilst the seating adapter then remains on the bolt tube head, the extruding piston moves through the bolt tube in the direction of the mixing head or static mixer. To facilitate assembly, the said predetermined breaking point is advantageous. Thus, both the extruding piston and, at the same time, the seating adapter can be brought into the starting position, wherein the predetermined breaking point yields under an appropriately high pressure so that the seating adapter is then fixed and the support body or the extruding piston can move along the inner wall as described above.

[0018] Irrespective of whether the seating adapter is inserted into the bolt tube with the extruding piston or alone, it is advantageous if it has an outer wall with longitudinal grooves and spacer webs or with an external thread corresponding to the internal thread of the bolt tube. In the latter construction, the seating adapter is rotated practically into the bolt tube, which results in it hav-

ing a secure seat and, also with the extruding piston arranged in front, ensures that the necessary pressure builds up in the bolt tube for the extruding piston to be pressed against the adhesive cartridge.

[0019] To connect the bolt-rotating and extruding device effectively and tightly to the seating adapter, it is provided for the seating adapter equipped with a square or polygonal socket, an oval or a circular socket to have, at the end facing the bolt head, a support ring which may be combined with a sealing ring and which is dimensioned such that it is supported on the bolt tube wall, wherein the sealing ring is designed such that it may be pushed or clamped onto the support ring. By means of the bolt-rotating and extruding device, the support ring is thus pressed onto the bolt tube wall so that a first sealing action is ensured here. The polygonal or square socket in the seating adapter then acts as a guide and, at the same time, also ensures that the support ring combined with the sealing ring can ensure that the pressure medium, preferably the hydraulic fluid, acts effectively on the extruding piston and ensures that this moves smoothly along the inner wall towards the adhesive cartridge and influences this accordingly. The seating adapter is generally already delivered with a sealing ring pushed onto the support ring, so that it is then ensured that, upon further assembly, this sealing ring also results in the desired successful sealing action. It can also be pushed or clamped on for the first time during the final assembly procedure.

[0020] It is further advantageous if the single- or multi-part extruding piston is designed to form a structural unit with one or more sealing parts and, to this end, is preferably made from elastomers or a resiliently acting material. The extruding piston can then be made available to the respective workman in a complete construction so that it is also ensured that, upon assembly, both parts are then in effective and full working order. This structural unit is then pushed into the bolt tube and acted upon accordingly with pressure or the like so that the extrusion of the adhesive can be carried out evenly and reliably.

[0021] The invention is particularly notable in that, first of all, an extruding piston is produced which is also really worthy of this name. The extruding piston, as a result of the thimble-like construction of the support body or as a result of some other design thereof, is optimally suitable to absorb the applied compressed air or compressed fluid applied and thereby to ensure that it moves smoothly along the inner wall. Moreover, a correspondingly formed support body with a pushed-on sealing part or integrally formed sealing part provides a very advantageously large sealing face, thus ensuring that, upon displacement of the extruding piston along the inner wall of the bolt tube, the adhesive is also effectively and completely pressed out of the bolt tube without the adhesive being able to move along the seal or along the sealing part. This extrusion then proceeds optimally if the inner wall of the bolt tube is profiled, which is almost always the case in today's bolt tubes. It is particularly advantageous here

that the extruding piston can be provided with a sealing part constructed according to the conditions, so that an optimally constructed extruding piston can be provided in each case. An extruding piston of this type can be employed both when using adhesive cartridges, preferably multi-chamber cartridges, and with other anchoring compounds, so that, already owing to the versatility of such an extruding piston, considerable advantages over the prior art are evident. In addition to a single extruding piston, it is further advantageous to use a double piston or multiple piston arrangement, especially when each of these individual pistons is provided with a sealing part. These sealing parts, arranged one after another, here ensure both the necessary sealing action and also a smooth guidance of the extruding piston, so that this also moves smoothly when there are corresponding irregularities and when there is an internal thread, and ensures that the adhesive is also actually and exclusively pressed in the direction of the static mixer. For smooth guidance and uniform holding of the adhesive cartridge, a guide element is arranged in front of the actual extruding piston, which guide element has resilient side elements and a turned-up edge so that precise mounting and holding of the adhesive cartridge and smooth guidance along the inner wall of the bolt tube is produced. Together with the extruding piston, a seating adapter is expediently associated with the bolt head or is pushed into the end of the inner bore, wherein this seating adapter ensures an even and secure connection of the bolt-rotating and extruding device and, at the same time, a sealing action in this connecting region.

[0022] Further details and advantages of the inventive subject matter are revealed in the description below of the associated drawing, in which a preferred exemplary embodiment having the details and individual parts necessary for this is illustrated. The drawings show in:

Figure 1 shows an anchoring bolt in section, inserted into a borehole with a profiled inner wall;

Figure 2 shows a multiple piston arrangement, composed of a plurality of individual pistons, in a side view;

Figure 3 shows a seating adapter with a thread;

Figure 4 shows a guide element of an extruding piston in a side view with flexible side elements;

Figure 4a shows a single-part construction of such a guide element;

Figure 5 shows a section through a bolt tube in the region of the bolt head with a profiled inner wall;

Figure 5a shows an enlargement in the region of the inserted extruding piston;

Figure 6 shows a schematic illustration of a support body with a balloon-like sealing part;

Figure 7 shows a schematic illustration of a support body with a yielding sealing part;

Figure 8 shows a schematic illustration of a support body with a plurality of lamella-like sealing parts;

Figure 9 shows a combined seating adapter/extruding piston; and

Figure 10 shows a seating adapter, reproduced in perspective, with axial longitudinal grooves.

[0023] Figure 1 shows an anchoring bolt 1 in section. The anchoring bolt 1 has a bolt tube 2 with its inner-lying bolt tube bore 3. The anchoring bolt 1 has a proximal end at which there is a bolt head 28 and a distal end at which there is a bolt tip 27 are shown. It is made clear that the bolt tube 2 is profiled on the outside. This profile 7 is provided to improve the adhesion of the adhesive on the steel wall. It is moreover clearly shown that the inner wall 4 of the bolt tube 2 is not smooth but, as is conventional today, instead has an internal thread 22 which, when the profile 7 is produced on the outer wall, is practically automatically generated with it. This internal thread 22 produces indentations 79,80 which render the previously-known extruding pistons unusable. The anchoring compound 5, here in the form of a multiple adhesive cartridge arrangement 6, should be squeezed or pressed out effectively from the bolt head 28 in the direction of the deepest part of the borehole by way of this extruding piston 8. Part 5a in Figure 5 denotes a second component in an adhesive cartridge 6, which is mixed intensively in the static mixer 61 when the adhesive material is pushed out.

[0024] In Figure 1, the extruding piston 8 is reproduced in simplified form, wherein only the insertion end 42 forms a type of hat here. A construction of the extruding piston 8 is reproduced more clearly in Figure 2, wherein a plurality of extruding pistons 8, 8', 8'' are pushed inside one another here for the sake of simplicity. Thus, a multiple piston arrangement 70 of this type has a plurality of guide and sealing rims 77,77a,77b.

[0025] In the illustration according to Figure 1, the extruding piston 8 (only schematically reproduced here) also has a plurality of such guide and sealing rims 77,77a,77b. The extruding piston 8 is pressed through along the inner wall 4 of the bolt tube 2 by way of a source of power (not illustrated here), wherein it moves into the bolt tube 2, rotating in some respect and aided by the specially designed guide and sealing rims 77, 77a, 77b.

[0026] In addition, it is advantageous if a guide element 71 is arranged in front of the extruding piston 8, as shown in Figure 1. This guide element 71 (illustrated in Figure 4) is placed with its base 72 on the piston base 12 of the extruding piston 8 and can also expediently be detachably connected thereto. This guide element 71 has a plu-

ality of side elements 73, 74 which form a turned-up edge 75 at the end face for scraping inner wall 4 and in order to thus improve the guidance of this guide element 71 for the extruding piston 8. At the same time, as shown in Figure 1, the adhesive cartridge 6 with its anchoring compound 5 is held reliably and it is ensured that the adhesive cartridge 6 is moved in the direction of the static mixer 61. By way of a screen 62 arranged there, it is ensured that, when the adhesive cartridge 6 is opened, no parts can slip into the static mixer 61. A plain washer (not shown further here) holds the casing of the adhesive cartridge 6 securely and ensures reliable opening of the entire adhesive cartridge 6, because the washer is pressed down from the lower end of the adhesive cartridge 6. The borehole-side end of the bolt tube 2 is denoted by 14 and shows the mixing head constructed there, which ensures that the exiting material of the anchoring compound 5 is pressed reliably into the borehole 44.

[0027] It is shown at the bolt head 28 that the bolt tube wall 69 does not end with the rock 47 but projects beyond it to then enable the connection of the source of power. The rock 47 is secured by the sheathing 46 (which is merely indicated).

[0028] It is furthermore shown in Figure 1 that the indentations 79, 80, i.e. the so-called internal thread 22, extend over the entire length of the inner wall 4. This means that the seating adapter 29 which is to be seated at the top of the outer edge of the bolt tube wall 69 is advantageously equipped with an external thread 68 to seat it securely on the bolt head 28. This external thread 68 advantageously extends over the entire guide part 59 of the seating adaptor 29, wherein the upper edge with the polygonal socket 32 is formed by a support ring 35 onto which a sealing ring 34 is pushed.

[0029] Reference has already been made to Figure 4. Figure 4a shows a further embodiment of guide element 71, which is likewise possible when using a material which is capable of a limited flexibility. The guide element 71 formed as shown in Figure 4a also has the outer edge denoted as turned-up edge 75 here. As in the embodiment according to Figure 4 with the guide element 71 having the side elements 73, 74, it can likewise guide the discharge piston 8 along the inner wall 4 without the risk of tilting or the like, even with the indentations 79, 80. One reason for this is that turned-up edge 75 engages indentations 79,80.

[0030] In the embodiment according to Figure 5, it is likewise shown that the extruding piston 8 can comprise a support body 9 and a sealing part 10 pushed onto support body 9. The support body 9 is made of a material which enables compressed air or an alternative pressure fluid to be applied from the bolt head 28, such that the support body 9 preferably has a thimble-like form, as shown in Figure 5. Accordingly as shown in Figure 5a, the support body 9 has an approximately perpendicular annular wall 11 which ends in a piston base 12, which has a projecting edge 15. The sealing part 10 is made of

a yielding material, particularly rubber, and has a corresponding annular groove 16 such that when the sealing part 10 is pushed onto support body 9 (or vice versa), projecting edge 15 latches into annular groove 16 to fix sealing part 10 on the support body 9.

[0031] The perpendicular annular wall 11 of support body 9 of piston 8 merges into a guide and support edge 18 at its open end 17. Guide and support edge 18 produces a sealing face 13 which ensures effective sealing of the extruding piston 8 against the inner wall 4 of the bolt tube 2. The guide and support edge 18 prevents the sealing part 10 from becoming thinner or being pulled correspondingly long, as it were, upon insertion. Instead, a compression is effected here at the guide and support edge 18 so that this still ensures the optimisation of the sealing face 13 which lies tightly against the inner wall 4 of the bolt tube 2. Figure 5a shows that the outer surface 23 of the sealing part 10 is deformed such that it moves fully into the indentation and thus ensures a reliable and trouble-free pressing out of the anchoring compound 5.

[0032] Figures 6 to 8 show different embodiments of the sealing part 10, wherein a type of annular bead 19, 20, which is optimally integrated in the respective indentation, is shown in Figures 6 and 7. According to Figure 8, a plurality of lamellas or flaps 24, 25 are provided, which, as mentioned, serve as guide and support rims 18.

[0033] Whilst Figure 10 shows a single-part embodiment of the seating adapter 29, Figure 9 shows a combined embodiment, wherein the seating adapter 29 is connected to the extruding piston 8 (indicated as 9,10) by way of a predetermined breaking point 31. Therefore, both form a type of tube piece 30, which can be divided by way of the predetermined breaking point 31. A sealing ring 34 is pushed onto the support ring 35, whilst, Figure 10 only shows the support ring 35 which has the polygonal socket 32 which here forms a funnel 36. According to Figure 10, the outer wall of the seating adapter 29 has a plurality of longitudinal grooves 37, 38 and spacer webs 39, 40 around it so that a correspondingly formed outer wall 41 is produced. The seating adapter 29 shown in Figure 10 is particularly suitable for a smooth inner wall 4, but can also be used with an internal thread 22 under certain circumstances, although the embodiment according to Figure 3 is clearly better for this.

[0034] All the said features, including those which are revealed in the drawings alone, are to be seen as inventive in their own right and in combination.

Claims

1. An anchoring bolt (1) comprising:

a bolt tube (2) having an inner wall (4) which forms one or more indentations (79,80); and
characterised in that the anchoring bolt (1) further comprises:

an extruding piston (8) which has a sealing part (10) to engage the one or more indentations (79,80) to:

- seal the extruding piston (8) against the inner wall (4); or to
- seal the extruding piston (8) against the inner wall (4) and to guide movement of the extruding piston (8) through the bolt tube (2).

2. An anchoring bolt (1) comprising:

a bolt tube (2) having an inner wall (4) which forms more than one indentation (79,80); and **characterised by:**

an extruding piston (8) which has a sealing part (10) to engage the more than one indentation (79,80) to guide movement of the extruding piston (8) through the bolt tube (2).

3. An anchoring bolt as defined in any one of the preceding claims wherein the extruding piston (8) has a tubular shape in the form of a receptacle, preferably the extruding piston (8) is formed a receptacle shaped sealing part which receives a receptacle shaped support body, preferably the support body resiliently engages the sealing part (10)
4. An anchoring bolt (1) as defined in any one of the preceding claims wherein the extruding piston (8) has one or more guide and/or sealing rims for engaging the one or more indentations (79,80), preferably the one or more guide and/or sealing rims are spaced from one another and are capable of a limited flexibility.
5. An anchoring bolt (1) as defined in any one of the preceding claims wherein the extruding piston (8) has a guide element (71) for engaging the adhesive compound, preferably the guide element (71) is detachably connected or is fixed to the extruding piston (8).
6. An anchoring bolt (1) as defined in claim 5 wherein the guide element (71) has one or more resilient elements for scraping adhesive compound from the inner wall (4).
7. An anchoring bolt (1) as defined in any one of the preceding claims wherein the sealing part has a balloon-like outer surface and/or a deformable coating.
8. An anchoring bolt (1) as defined in any one of the preceding claims which comprises a seating adaptor (29) for engagement with a bolt-rotation device

wherein the extruding piston (8) is detachably combined with the seating adapter (29), preferably the extruding piston (8) is detachably connected by a link that breaks at a predetermined pressure.

9. An anchoring bolt (1) as defined in claim 8 wherein the seating adapter (29) has an outer wall with one or more formations for engaging with the one or more indentations (79, 80).
10. An anchoring (1) bolt as defined in claim 8 or claim 9 wherein the seating adapter (29) equipped with a square or polygonal socket (32), an oval or a circular socket has, at the end (33) facing the bolt head (28), a support ring (35) which may be combined with a sealing ring (34) and which is dimensioned such that it is supported on the bolt tube wall (69), wherein the sealing ring (34) is designed such that it may be pushed or clamped onto the support ring (35).
11. An anchoring bolt (1) as defined in any one of the preceding claims wherein the extruding piston (8) is formed from a resilient material, preferably the extruding piston (8) is formed from an elastomer.
12. An anchoring bolt (1) as defined in any one of the preceding claims which has a distal end which, in use, is anchored in a borehole wherein from the distal end of the bolt tube, there is placed the anchoring compound, the guide element, and the extruding piston and wherein the seating adaptor is placed on a proximal end of the anchoring bolt.
13. A method of anchoring an anchoring bolt (1) in a borehole which method comprises the steps of:

forming an anchoring bolt (1) with a bolt tube (2) having an inner wall (4);
forming one or more indentations (79,80) on the inner wall (4);
placing in the bolt tube (2) an adhesive compound suitable for anchoring the bolt (1) in the borehole;
arranging an extruding piston (8) in the bolt tube (2) adjacent the adhesive compound wherein the extruding piston (8) has a sealing part (10) to engage the one or more indentations (79, 80) to:

- seal the extruding piston (8) against the inner wall (4); or to
- seal the extruding piston (8) against the inner wall (4) and to guide movement of the extruding piston (8) through the bolt tube (2);

placing the anchoring bolt (1) in a borehole;
applying pressure to the extruding piston (8)

such that the extruding piston (8) forces the adhesive compound out of the bolt tube (2) to anchor the anchoring bolt (1) in the borehole.

14. A method of anchoring an anchoring bolt (1) in a borehole which method comprises the steps of:

forming an anchoring bolt (1) with a bolt tube (2) having an inner wall (4);
forming more than one indentation (79, 80) on the inner wall (4);
placing in the bolt tube (2) an adhesive compound suitable for anchoring the bolt (1) in the borehole;
arranging an extruding piston (8) in the bolt tube (2) adjacent the adhesive compound wherein the extruding piston (8) has a sealing part to engage the more than one indentation (79, 80) to guide movement of the extruding piston (8) through the bolt tube (2);
placing the anchoring bolt (1) in a borehole;
applying pressure to the extruding piston (8) such that the extruding piston (8) forces the adhesive compound out of the bolt tube (2) to anchor the anchoring bolt (1) in the borehole.

15. A method as defined in claims 13 or 14 wherein the step of forming the one or more indentations (79, 80) comprises applying an outer profile on the anchoring bolt (1).

Patentansprüche

1. Verankerungsbolzen (1), aufweisend:

ein Bolzenrohr (2) mit einer Innenwand (4), die mindestens eine Einkerbung (79, 80) bildet; und **dadurch gekennzeichnet, dass** der Verankerungsbolzen (1) ferner aufweist:
einen Strangpresskolben (8), der ein Dichtungsteil (10) aufweist, das an der mindestens einen Einkerbung (79, 80) angreift, um

- den Strangpresskolben (8) gegen die Innenwand (4) abzudichten; oder um
- den Strangpresskolben (8) gegen die Innenwand (4) abzudichten und die Bewegung des Strangpresskolbens (8) durch das Bolzenrohr (2) zu lenken.

2. Verankerungsbolzen (1), aufweisend:

ein Bolzenrohr (2) mit einer Innenwand (4), die mehr als eine Einkerbung (79, 80) bildet; und **gekennzeichnet durch:**
einen Strangpresskolben (8), der ein Dichtungsteil (10) aufweist, das an der mehr als einen Ein-

kerbung (79, 80) angreift, um die Bewegung des Strangpresskolbens (8) **durch** das Bolzenrohr (2) zu lenken.

3. Verankerungsbolzen nach einem der vorangehenden Ansprüche, wobei der Strangpresskolben (8) eine Rohrform aufweist, die ein Behältnis bildet, wobei am Strangpresskolben (8) vorzugsweise ein Dichtungsteil in Form eines Behältnisses ausgebildet ist, das einen behälterförmigen Trägerkörper aufnimmt, wobei der Trägerkörper vorzugsweise federelastisch am Dichtungsteil (10) angreift.

4. Verankerungsbolzen (1) nach einem der vorangehenden Ansprüche, wobei der Strangpresskolben (8) eine oder mehrere Führungs- und/oder Dichtungskrempen aufweist, um an der mindestens einen Einkerbung (79, 80) anzugreifen, wobei die eine oder die mehreren Führungs- und/oder Dichtungskrempen vorzugsweise voneinander beabstandet und in begrenztem Umfang flexibel sind.

5. Verankerungsbolzen (1) nach einem der vorangehenden Ansprüche, wobei der Strangpresskolben (8) ein Führungselement (71) aufweist, um an der Haftmittelmasse anzugreifen, wobei das Führungselement (71) vorzugsweise lösbar mit dem Strangpresskolben (8) verbunden oder an diesem fixiert ist.

6. Verankerungsbolzen (1) nach Anspruch 5, wobei das Führungselement (71) eines oder mehrere federelastische Elemente aufweist, um Haftmittelmasse von der Innenwand (4) abzuschaben.

7. Verankerungsbolzen (1) nach einem der vorangehenden Ansprüche, wobei der Dichtungsteil eine ballonartige Außenfläche und/oder eine verformbare Beschichtung aufweist.

8. Verankerungsbolzen (1) nach einem der vorangehenden Ansprüche, der einen Auflageflächenadapter (29) zum Angreifen an einer Bolzendrehvorrichtung aufweist, wobei der Strangpresskolben (8) lösbar mit dem Auflageflächenadapter (29) kombiniert ist, wobei der Strangpresskolben (8) vorzugsweise durch ein Verbindungsglied, das bei einem vorgegebenen Druck bricht, lösbar verbunden ist.

9. Verankerungsbolzen (1) nach Anspruch 8, wobei der Auflageflächenadapter (29) eine Außenwand mit mindestens einer Formation aufweist, um in die mindestens eine Einkerbung (79, 80) einzugreifen.

10. Verankerungsbolzen (1) nach Anspruch 8 oder Anspruch 9, wobei der Auflageflächenadapter (29), der mit einer quadratischen oder mehrreckigen Ausnehmung (32), einer ovalen oder kreisförmigen Ausnehmung versehen ist, an dem Ende (33), das dem Bol-

zenkopf (28) zugewandt ist, einen Trägerring (35) aufweist, der mit einem Dichtring (34) kombiniert sein kann und der so bemessen ist, dass er auf der Bolzenrohrwand (69) aufliegt, wobei der Dichtring (34) so ausgelegt ist, dass er auf den Trägerring (35) geschoben oder auf diesem festgespannt werden kann.

11. Verankerungsbolzen (1) nach einem der vorangehenden Ansprüche, wobei der Strangpresskolben (8) aus einem federelastischen Material gebildet ist, wobei der Strangpresskolben (8) vorzugsweise aus einem Elastomer gebildet ist.

12. Verankerungsbolzen (1) nach einem der vorangehenden Ansprüche, der ein distales Ende aufweist, das im Gebrauch in einem Bolzenloch verankert wird, wobei vom distalen Ende des Bolzenrohrs aus die Verankerungsmasse, das Führungselement und der Strangpresskolben angeordnet sind, und wobei der Auflageflächenadapter an einem proximalen Ende des Verankerungsbolzens angeordnet ist.

13. Verfahren zum Verankern eines Verankerungsbolzens (1) in einem Bohrloch, wobei das Verfahren die folgenden Schritte umfasst:

Ausbilden eines Verankerungsbolzens (1) mit einem Bolzenrohr (2), das eine Innenwand (4) aufweist;
Ausbilden mindestens einer Einkerbung (79, 80) an der Innenwand (4);
Einbringen einer Haftmittelmasse, die geeignet ist, den Bolzen (1) im Bolzenloch zu verankern, in das Bolzenloch (2);
Anordnen eines Strangpresskolbens (8) im Bolzenrohr (2) angrenzend an die Haftmittelmasse, wobei der Strangpresskolben (8) ein Dichtungsteil (10) aufweist, das an der mindestens einen Einkerbung (79, 80) angreift, um

- den Strangpresskolben (8) gegen die Innenwand (4) abzudichten; oder um
- den Strangpresskolben (8) gegen die Innenwand (4) abzudichten und die Bewegung des Strangpresskolbens (8) durch das Bolzenrohr (2) zu lenken;

Anordnen des Verankerungsbolzens (1) in einem Bohrloch;
Anlegen von Druck an den Strangpresskolben (8), so dass der Strangpresskolben (8) die Haftmittelmasse aus dem Bolzenrohr (2) treibt, um den Verankerungsbolzen (1) im Bolzenloch zu verankern.

14. Verfahren zum Verankern eines Verankerungsbolzens (1) in einem Bohrloch, wobei das Verfahren die

folgenden Schritte umfasst:

Ausbilden eines Verankerungsbolzens (1) mit einem Bolzenrohr (2), das eine Innenwand (4) aufweist;
Ausbilden mindestens einer Einkerbung (79, 80) an der Innenwand (4);
Einbringen einer Haftmittelmasse, die geeignet ist, den Bolzen (1) im Bolzenloch zu verankern, in das Bolzenloch (2);
Anordnen eines Strangpresskolbens (8) im Bolzenrohr (2) angrenzend an die Haftmittelmasse, wobei der Strangpresskolben (8) ein Dichtungsteil aufweist, das an der mindestens einen Einkerbung (79, 80) angreift, um die Bewegung des Strangpresskolbens (8) durch das Bolzenrohr (2) zu lenken;
Anordnen des Verankerungsbolzens (1) in einem Bohrloch;
Anlegen von Druck an den Strangpresskolben (8), so dass der Strangpresskolben (8) die Haftmittelverbindung aus dem Bolzenrohr (2) treibt, um den Verankerungsbolzen (1) im Bolzenloch zu verankern.

15. Verfahren nach Anspruch 13 oder 14, wobei der Schritt des Ausbildens der einen oder der mehreren Einkerbungen (79, 80) das Anlegen eines Außenprofils an den Verankerungsbolzen (1) beinhaltet.

Revendications

1. Un boulon d'ancrage (1) comprenant :

un tube de boulon (2) possédant une paroi intérieure (4) qui forme une ou plusieurs indentations (79, 80), et **caractérisé en ce que** le boulon d'ancrage (1) comprend en outre :

un piston d'extrusion (8) qui possède une partie de scellement (10) destinée à venir en prise avec les une ou plusieurs indentations (79, 80) de façon à :

- sceller le piston d'extrusion (8) contre la paroi intérieure (4), ou de façon à
- sceller le piston d'extrusion (8) contre la paroi intérieure (4) et guider le déplacement du piston d'extrusion (8) au travers du tube de boulon (2).

2. Un boulon d'ancrage (1) comprenant :

un tube de boulon (2) possédant une paroi intérieure (4) qui forme plus d'une indentation (79, 80), et **caractérisé par** :

- un piston d'extrusion (8) qui possède une partie de scellement (10) destinée à venir en prise avec la plus d'une indentation (79, 80) de façon à guider le déplacement du piston d'extrusion (8) au travers du tube de boulon (2).
3. Un boulon d'ancrage selon l'une quelconque des Revendications précédentes où le piston d'extrusion (8) possède une forme tubulaire de la forme d'un réceptacle, de préférence le piston d'extrusion (8) est formé en une partie de scellement en forme de réceptacle qui reçoit un corps de support en forme de réceptacle, de préférence le corps de support vient en prise de manière élastique avec la partie de scellement (10).
 4. Un boulon d'ancrage (1) selon l'une quelconque des Revendications précédentes où le piston d'extrusion (8) possède un ou plusieurs rebords de scellement et/ou de guidage destinés à venir en prise avec les un ou plusieurs indentations (79, 80), de préférence les un ou plusieurs rebords de scellement et/ou de guidage sont espacés les uns des autres et sont capables d'une flexibilité limitée.
 5. Un boulon d'ancrage (1) selon l'une quelconque des Revendications précédentes où le piston d'extrusion (8) possède un élément de guidage (71) destiné à venir en prise avec le composé adhésif, de préférence l'élément de guidage (71) est raccordé de manière détachable ou est fixé au piston d'extrusion (8).
 6. Un boulon d'ancrage (1) selon la Revendication 5 où l'élément de guidage (71) possède un ou plusieurs éléments élastiques destinés à racler le composé adhésif de la paroi intérieure (4).
 7. Un boulon d'ancrage (1) selon l'une quelconque des Revendications précédentes où la partie de scellement possède une surface extérieure comparable à un ballon et/ou un revêtement déformable.
 8. Un boulon d'ancrage (1) selon l'une quelconque des Revendications précédentes qui comprend un adaptateur d'assise (29) pour une mise en prise avec un dispositif de rotation de boulon où le piston d'extrusion (8) est combiné de manière détachable avec l'adaptateur d'assise (29), de préférence le piston d'extrusion (8) est raccordé de manière détachable par un raccord qui se casse à une pression prédéterminée.
 9. Un boulon d'ancrage (1) selon la Revendication 8 où l'adaptateur d'assise (29) possède une paroi extérieure avec une ou plusieurs formations destinées à venir en prise avec les une ou plusieurs indentations (79, 80).
 10. Un boulon d'ancrage (1) selon la Revendication 8 ou 9 où l'adaptateur d'assise (29) équipé d'une douille carrée ou polygonale (32), d'une douille circulaire ou ovale possède, à l'extrémité (33) faisant face à la tête de boulon (28), une bague de support (35) qui peut être combinée avec une bague de scellement (34) et qui est dimensionnée de sorte qu'elle soit soutenue sur la paroi du tube de boulon (69), où la bague de scellement (34) est conçue de sorte qu'elle puisse être poussée ou fixée par serrage sur la bague de support (35).
 11. Un boulon d'ancrage (1) selon l'une quelconque des Revendications précédentes où le piston d'extrusion (8) est formé à partir d'un matériau élastique, de préférence le piston d'extrusion (8) est formé à partir d'un élastomère.
 12. Un boulon d'ancrage (1) selon l'une quelconque des Revendications précédentes qui possède une extrémité distale qui, en utilisation, est ancrée dans un trou de forage dans lequel, à partir de l'extrémité distale du tube de boulon, sont placés le composé d'ancrage, l'élément de guidage et le piston d'extrusion et où l'adaptateur d'assise est placé sur une extrémité proximale du boulon d'ancrage.
 13. Un procédé d'ancrage d'un boulon d'ancrage (1) dans un trou de forage, ledit procédé comprenant les opérations suivantes :
 - la formation d'un boulon d'ancrage (1) avec un tube de boulon (2) possédant une paroi intérieure (4),
 - la formation d'une ou de plusieurs indentations (79, 80) sur la paroi intérieure (4),
 - le placement dans le tube de boulon (2) d'un composé adhésif conçu pour un ancrage du boulon (1) dans le trou de forage,
 - l'agencement d'un piston d'extrusion (8) dans le tube de boulon (2) de manière adjacente au composé adhésif où le piston d'extrusion (8) possède une partie de scellement (10) destinée à venir en prise avec les une ou plusieurs indentations (79, 80) de façon à :
 - sceller le piston d'extrusion (8) contre la paroi intérieure (4), ou de façon à
 - sceller le piston d'extrusion (8) contre la paroi intérieure (4) et guider le déplacement du piston d'extrusion (8) au travers du tube de boulon (2),
 - le placement du boulon d'ancrage (1) dans un trou de forage,
 - l'application d'une pression au piston d'extrusion (8) de sorte que le piston d'extrusion (8) force le composé adhésif en dehors du tube de

boulon (2) de façon à ancrer le boulon d'ancrage (1) dans le trou de forage.

- 14.** Un procédé d'ancrage d'un boulon d'ancrage (1) dans un trou de forage, ledit procédé comprenant les opérations suivantes :

la formation d'un boulon d'ancrage (1) avec un tube de boulon (2) possédant une paroi intérieure (4),
la formation de plus d'une indentation (79, 80) sur la paroi intérieure (4),
le placement dans le tube de boulon (2) d'un composé adhésif conçu pour un ancrage du boulon (1) dans le trou de forage,
l'agencement d'un piston d'extrusion (8) dans le tube de boulon (2) de manière adjacente au composé adhésif où le piston d'extrusion (8) possède une partie de scellement destinée à venir en prise avec la plus d'une indentation (79, 80) de façon à guider le déplacement du piston d'extrusion (8) au travers du tube de boulon (2),
le placement du boulon d'ancrage (1) dans un trou de forage,
l'application d'une pression au piston d'extrusion (8) de sorte que le piston d'extrusion (8) force le composé adhésif en dehors du tube de boulon (2) de façon à ancrer le boulon d'ancrage (1) dans le trou de forage.

- 15.** Un procédé selon la Revendication 13 ou 14 où l'opération de formation des une ou plusieurs indentations (79, 80) comprend l'application d'un profil extérieur sur le boulon d'ancrage (1).

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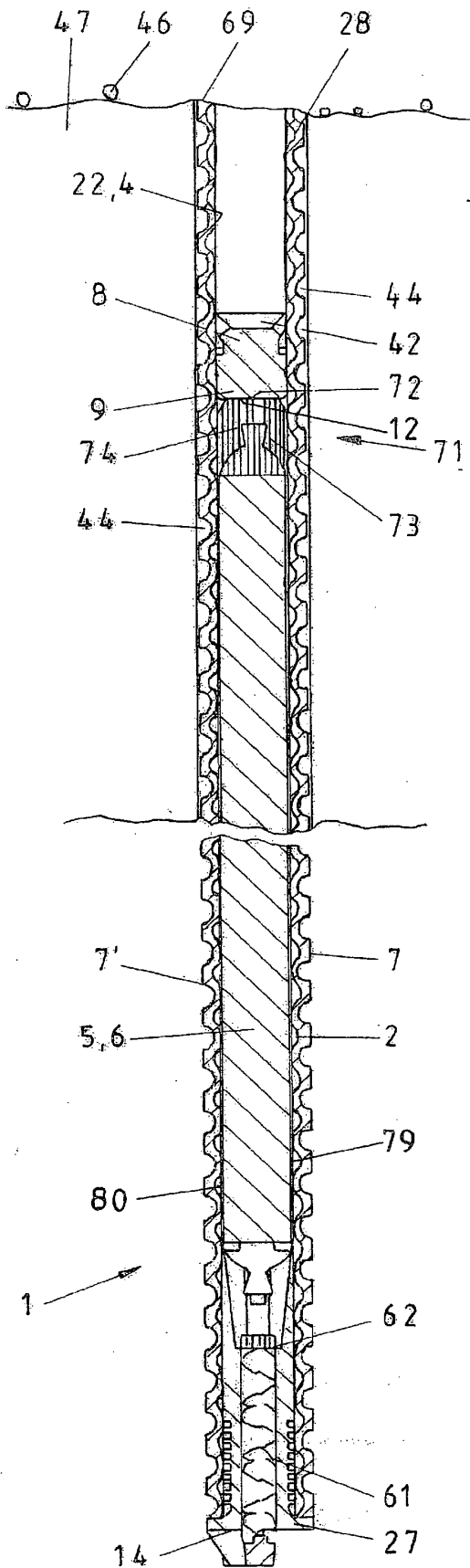


Fig.1

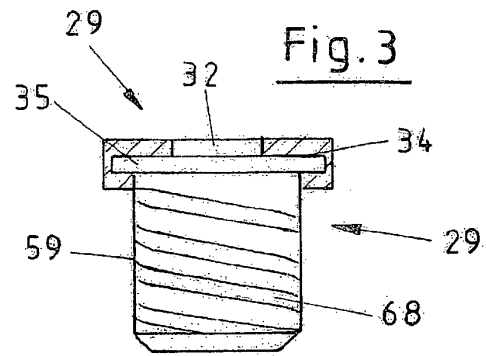


Fig.3

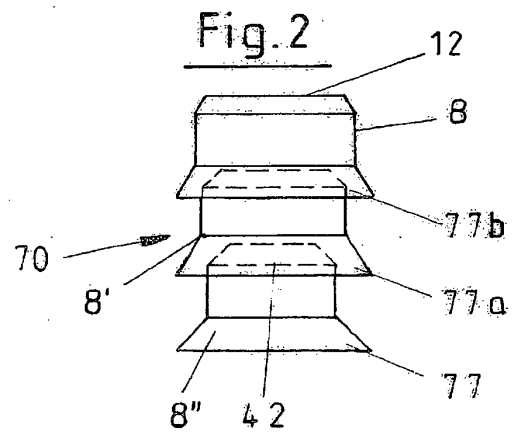


Fig.2

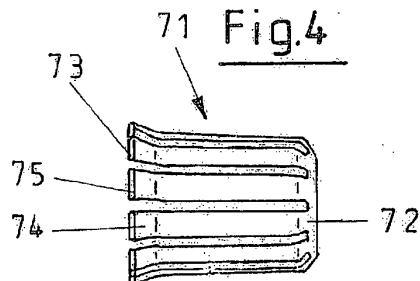


Fig.4

Fig.4a



Fig.5

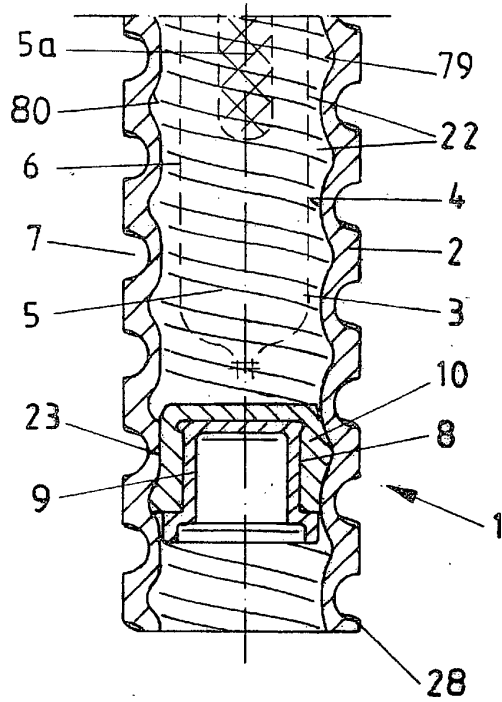


Fig.5a

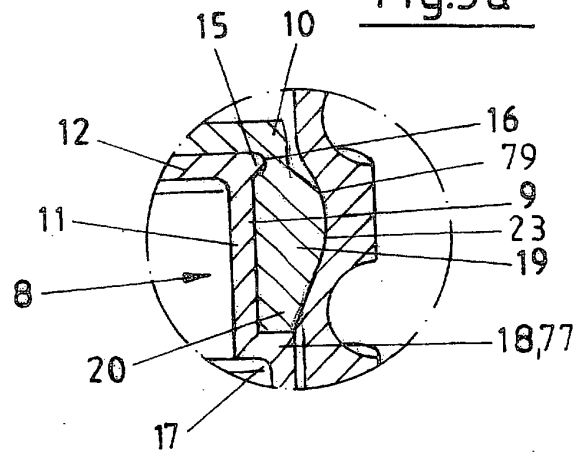


Fig.6

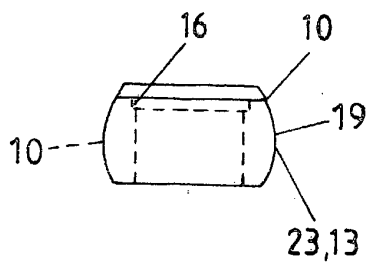


Fig.7

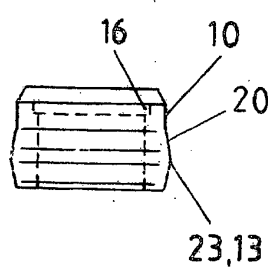


Fig.8

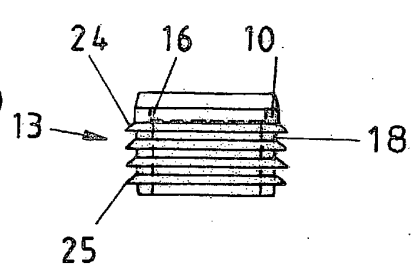


Fig.9

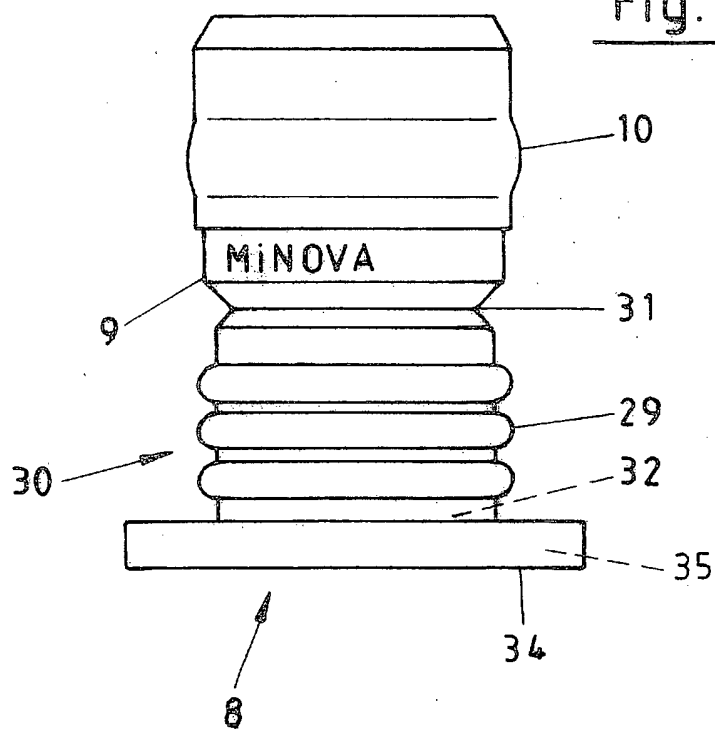
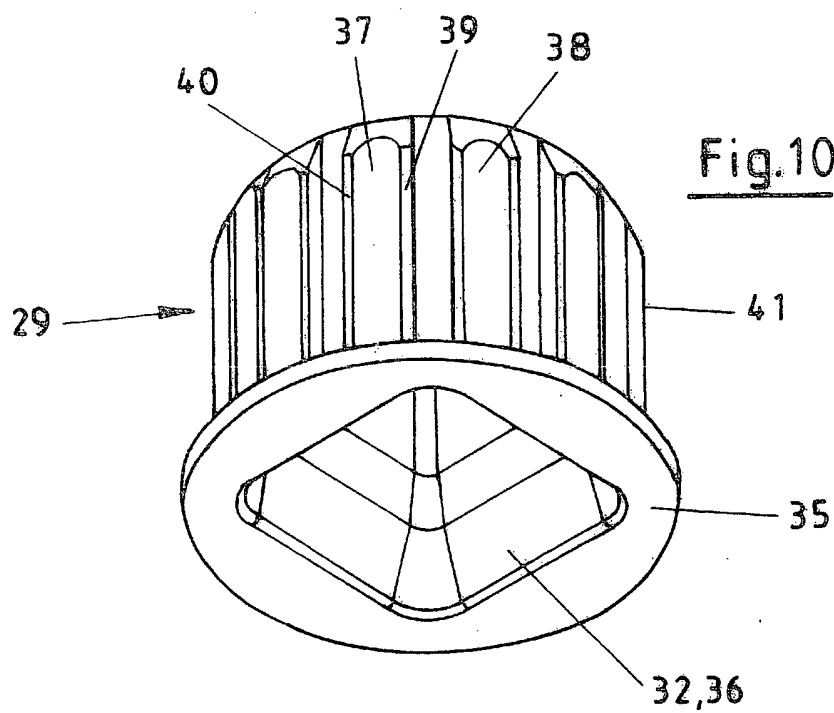


Fig.10



REFERENCES CITED IN THE DESCRIPTION

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