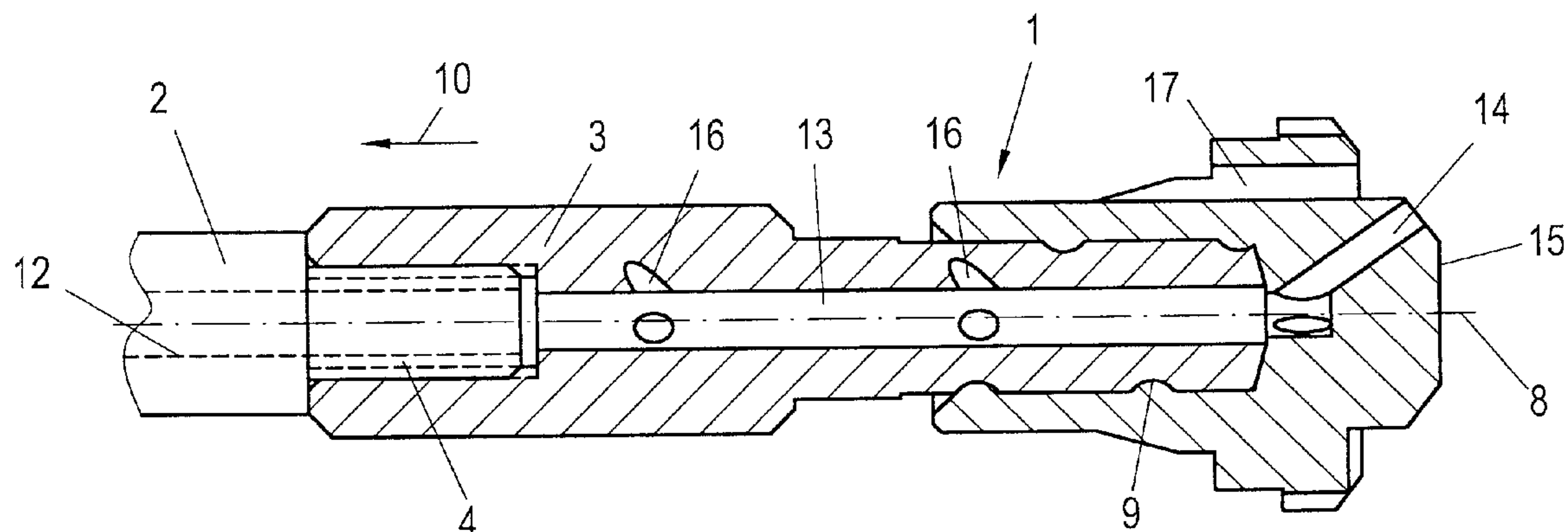




(86) Date de dépôt PCT/PCT Filing Date: 2006/08/11
(87) Date publication PCT/PCT Publication Date: 2007/02/22
(45) Date de délivrance/Issue Date: 2012/12/11
(85) Entrée phase nationale/National Entry: 2008/02/11
(86) N° demande PCT/PCT Application No.: AT 2006/000338
(87) N° publication PCT/PCT Publication No.: 2007/019594
(30) Priorité/Priority: 2005/08/19 (AT A 1386/2005)

(51) Cl.Int./Int.Cl. *E21B 17/07* (2006.01),
E21B 31/00 (2006.01)
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(54) Titre : PROCEDE ET DISPOSITIF D'ELIMINATION DU BLOCAGE D'UNE COURONNE LORS DU FORAGE
(54) Title: METHOD AND DEVICE FOR RELEASING A BLOCK ON A BORE-CROWN DURING A BORING PROCESS



(57) Abrégé/Abstract:

The invention relates to a method and a device for releasing a block on a bore-crown (1) during a boring process, especially percussion boring or rotary percussion boring, for boring holes in the ground or rock, whereby a borehole is formed by a bore-crown (1) mounted on a boring rod (2) and connected thereto and acted upon by the boring rod to generate a rotational movement and optionally a percussive movement. According to the invention, when the bore-crown (1) is blocked, preventing the continuation of the boring process and especially another rotational movement of the bore-crown (1), the bore-crown (1) is subjected to a linear movement in the opposite direction to the boring direction by means of the boring rod (2), and to a rotational movement in a direction opposing the direction of the rotational displacement during the boring process by means of a corresponding connection (7, 9) between the end of the boring rod (2) facing the bore-crown (1), and the bore-crown (1), independently of a rotary drive for carrying out the boring process. As a result the borehole can be bored in a simple manner after releasing the block on the bore-crown (1).



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Abstract

The invention relates to a method and a device for releasing a block or blockage on a bore-crown or drill bit (1) during a boring process, especially percussion boring or rotary percussion boring or drilling, for boring holes in the ground or rock, whereby a borehole is formed by a bore-crown (1) mounted on a boring rod or a drill rod assembly (2) and connected thereto and acted upon by the boring rod to generate a rotational movement and optionally a percussive movement. According to the invention, when the bore-crown (1) is blocked, preventing the continuation of the boring process and especially another rotational movement of the bore-crown (1), the bore-crown (1) is subjected to a linear movement in the opposite direction to the boring direction by means of the boring rod (2), and to a rotational movement in a direction opposing the direction of the rotational displacement during the boring process by means of a corresponding connection (7, 9) between the end of the boring rod (2) facing the bore-crown (1), and the bore-crown (1), independently of a rotary drive for carrying out the boring process. As a result the borehole can be bored in a simple manner after releasing the block on the bore-crown (1). (Fig. 3)

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METHOD AND DEVICE FOR RELEASING A BLOCK ON A BORE-CROWN
DURING A BORING PROCESS

The present invention relates to a method for releasing a
5 blockage of a drill bit or a bore-crown during the
drilling, particularly percussion or rotary percussion
drilling or boring, of holes in soil or rock material,
wherein a borehole is formed by a drill bit mounted on a
drill rod assembly or boring rod and connected thereto and
10 acted upon by the drill rod assembly to perform a
rotational movement and optionally a percussive movement.
The present invention further relates to a device for
releasing a blockage of a drill bit during the drilling,
particularly percussion or rotary percussion drilling, of
15 holes in soil or rock material, wherein a drill bit is
mounted on a drill rod assembly and acted upon by the drill
rod assembly to perform a rotational movement and
optionally a percussive movement for the formation of a
borehole.

20

In the context of the production of boreholes in soil or
rock material by percussion or rotary percussion drilling,
there are cases, in particular in soil our ground or rock
layers that are displaceable or shiftable relative to one
25 another, in which, due to the forces and vibrations
introduced during drilling, jamming or blocking or seizing
of the drill bit may occur by such a displacement or shift
of rock layers in the interior of a borehole. In such
cases, the rotary drive of the drilling or boring device
30 for the production of a bore, as a rule, is insufficiently
strongly dimensioned to overcome forces occurring at a
shift of rock layers and, hence, again release the blocked
state of the drill bit. In the most favorable case, it will

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be feasible at the occurrence of such a blockage of the drill bit to at least separate the drill rod assembly from the drill bit remaining in the incomplete borehole so as to at least enable the drill rod assembly to be reused when
5 carrying out a new drilling procedure. In the least favorable case, the drill rod assembly too will have to remain in the incomplete borehole such that, in addition to the fact that the production of a new bore, which will have to be located substantially immediately adjacent to the
10 incomplete borehole in order to achieve the required strength properties, will involve increased time expenditures, also accordingly increased amounts of money and material will be caused by the drill rod assembly remaining in the borehole and the drill bit having to be
15 left within the borehole in any event.

An embodiment of the present invention aims to provide a method and device for releasing a blockage of a drill bit during a drilling procedure so as to not only avoid any additional amounts of
20 time, money and material required for the production of a new bore, but also enable the simple continuation or completion of the bore in the incomplete borehole after the release of said blockage of the drill bit.

25 A method of the initially defined kind is essentially characterized in that, at a blockage of the drill bit or bore-crown preventing the continuation of a drilling procedure and, in particular, any further rotational movement of the drill
30 bit, the drill bit, via the drill rod assembly, is subjected to a linear movement opposite the drilling direction and, in addition, a rotational movement in a direction opposite the direction of the rotational movement

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during the drilling procedure via an appropriate connection between the end of the drill rod assembly facing the drill bit and the drill bit and independently of a rotary drive for carrying out the drilling procedure. Due to the fact that, in accordance with the invention, the drill bit, at a blockage of the drill bit, via the drill rod assembly, is subjected not only to a linear movement opposite the drilling direction, but also to a rotational movement in a direction opposite the direction of the rotational movement during the drilling procedure independently of a usually insufficiently strong rotary drive as mentioned above, it is feasible, by the at least partial retraction of the drill bit opposite the drilling direction and the simultaneous achievement of a rotational movement, to clear or release the jamming or seizure of the drill bit so as to subsequently enable the continuation or completion of the drilling procedure interrupted by the blockade, of the incomplete borehole after having released the blockade or jamming of the drill bit. In this context, it is to be anticipated that the linear drive is sufficiently strong to exert a sufficiently high extraction force on the drill rod assembly and, hence, on the drill bit opposite the drilling direction so as to cause a loosening of the drill bit in the linear direction of the borehole. By additionally providing the appropriate connection between the drill rod assembly and the drill bit, the drill bit will, moreover, be subjected to a rotational movement opposite the direction of rotation for carrying out the drilling procedure, thus enabling the drill bit to disengage from a jammed or blocked state caused, for instance, by slight shifts of adjacent rock layers. By providing said rotational movement opposite the direction of rotation for carrying out the drilling procedure, it is, moreover,

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ensured that no detachment of the drill bit from the drill rod assembly will occur and the drilling procedure will be immediately continuable upon release of the blockage of the drill bit.

5

In order to provide a particularly reliable connection simple to produce, for the simultaneously achievement of the rotational movement during the exertion of the extraction force on the drill rod assembly, it is proposed according to a preferred embodiment that the connection between the end of the drill rod assembly facing the drill bit and the drill bit is realized via an adapter comprising at least one helicoidal or spiral-shaped depression or flattening or elevation, and a complementary profiling provided on the drill bit, said helicoidal or spiral-shaped depression or flattening or elevation comprising a large inclination or pitch relative to the longitudinal axis of the drill rod assembly. By providing a large pitch or inclination relative to the longitudinal axis, of the at least one helicoidal or spiral-shaped connection or profiling, it will be feasible, when exerting an accordingly high extraction force on the drill rod assembly opposite the drilling direction, to also exert appropriate forces for obtaining the rotational movement opposite the direction of rotation during the drilling procedure.

In order to achieve accordingly high forces for obtaining the rotational movement for loosening or releasing the blockade of the drill bit and provide an appropriate distribution over the external periphery of the end facing the drill bit, of the drill rod assembly and/or adapter, which end is received in an accordingly complementary recess or pocket hole of the drill bit, it is proposed

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according to a further preferred embodiment that a plurality of helicoidal or spiral-shaped connections or profilings are provided, which are uniformly arranged about the periphery of the end facing the drill bit.

5

In order to avoid excessive frictional forces in the region of the connection between the drill rod assembly and/or adapter and the drill bit, particularly during the moving procedure for releasing the blockage of the drill bit, it is proposed according to a further preferred embodiment that a merely pointwise engagement on several sites in the region of the profilings between the drill rod assembly or adapter and the drill bit is provided. Such a pointwise engagement on several sites will suffice to transmit the forces required for the simultaneous achievement of the linear extraction movement and the rotational movement opposite the direction of rotation during the drilling procedure and enable the desired simultaneous achievement of the linear extraction movement and rotational movement by excessive frictional forces, for instance in the region of the connection between the drill bit and the drill rod assembly.

25 A device of the initially defined kind is, moreover, essentially characterized in that at least one spiral-shaped or helicoidal connection is provided between the end of the drill rod assembly facing the drill bit and the drill bit, which, at a blockage of the drill bit upon retraction of the drill rod assembly opposite the drilling direction, in addition to a linear movement opposite the drilling direction, acts upon the drill bit to perform a rotational movement in a direction opposite the direction of rotation

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during the drilling procedure independently of a rotary drive for carrying out the drilling procedure. As already pointed out above, it will, thus, be feasible in a simple and reliable manner to provide appropriate elements for simultaneously exerting a linear extraction movement and a rotational movement opposite the direction of rotation when carrying out the drilling procedure, in order to release a blockage or jamming of the drill bit.

10 In order to obtain an exactly fitting embodiment that is simple to produce, it is preferably proposed that the at least one spiral-shaped or helicoidal connection is comprised of a depression or elevation or flattening provided on an adapter arranged between the drill rod
15 assembly and the drill bit, and a complementary profiling provided on the drill bit.

To ensure the uniform introduction of forces, optionally even large forces, it is proposed according to a preferred
20 embodiment that a plurality of spiral-shaped or helicoidal connections or profilings are provided between the drill rod assembly or adapter, respectively, and the drill bit, which are each equidistantly arranged.

25 In order to enable the reliable transmission of the simultaneously acting extraction forces and rotational movement from the drill rod assembly to the drill bit, it is, moreover, provided that the at least one helicoidal or spiral-shaped connection or profiling comprises a large
30 pitch or inclination relative to the longitudinal axis of the drill rod assembly, as in correspondence with a further preferred embodiment of the device according to the invention.

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As already indicated above, the introduction of excessive frictional forces between the drill rod assembly and/or adapter and the drill bit is to be avoided as far as possible. In this context, it is proposed according to a further preferred embodiment that a plurality of substantially point-shaped or semispherical elevations are provided in a pocket hole of the drill bit for cooperation with the spiral-shaped or helicoidal depression(s) or recess(es) on the end of the adapter facing the drill bit.

For the uniform distribution of forces over the entire periphery of both the adapter or drill rod assembly and the drill bit, it is proposed according to a further preferred embodiment that a plurality of adjacent, spiral-shaped flattenings are provided on the outer periphery of the adapter or drill rod assembly, respectively, and complementary flattenings are provided in a pocket hole of the drill bit, said flattenings having polygonal, for instance hexagonal, contours in terms of cross section. Such a helical polygon is easy to design and, at the same time, provides a reliable coupling.

For the reliable cooling and/or flushing of the drill bit and/or the adapter during a drilling procedure, it is, moreover, proposed that, in the interior of the drill rod assembly and/or the adapter, a passage channel for supplying a cooling or flushing fluid to the outlet channels or holes of the drill bit and/or the adapter is provided, which discharge on the working face of the drill bit and/or the peripheral surface of the adapter, as in correspondence with a further preferred embodiment of the device according to the invention.

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For the reliable haulage of excavated material during a drilling procedure, thus also further reducing the chance of a blockage or jamming of the drill bit during the realization of a drilling procedure, it is, moreover, preferably provided that, in a manner known per se, depressions or recesses and/or passage openings are
5 provided on the outer periphery of the drill bit for removing excavated material through an annular space between the outer periphery of the drill rod assembly and the inner wall of the produced borehole.

Some embodiments disclosed herein relate to a method for releasing a blockage of a drill bit during the percussion or rotary percussion drilling, of holes in soil or rock
10 material, wherein a borehole is formed by a drill bit mounted on a drill rod assembly and connected thereto and acted upon by the drill rod assembly to perform a rotational movement and a percussive movement, wherein, at a blockage of the drill bit preventing the continuation of a drilling procedure and any further rotational movement of the drill bit, the drill bit, via the drill rod assembly, is subjected to a linear
15 movement opposite the drilling direction and, in addition, a rotational movement in a direction opposite the direction of the rotational movement during the drilling procedure via an appropriate connection between the end of the drill rod assembly facing the drill bit and the drill bit and independently of a rotary drive for carrying out the drilling procedure.

20 Some embodiments disclosed herein relate to a device for releasing a blockage of a drill bit during the percussion or rotary percussion drilling, of holes in soil or rock material, wherein a drill bit is mounted on a drill rod assembly and acted upon by the drill rod assembly to perform a rotational movement and a percussive movement for the formation of a borehole, wherein the at least one spiral-shaped or helicoidal
25 connection is comprised of a depression or elevation or flattening provided on an adapter arranged between the drill rod assembly and the drill bit, and a complementary profiling provided on the drill bit, and wherein at least one spiral-shaped or helicoidal connection is provided between the end of the drill rod assembly facing the drill bit and the drill bit, which, at a blockage of the drill bit upon retraction

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of the drill rod assembly opposite the drilling direction, acts upon the drill bit to perform a rotational movement in a direction opposite the direction of rotation during the drilling procedure independently of a rotary drive for carrying out the drilling procedure.

- 5 In the following, the invention will be explained in more detail by way of exemplary embodiments schematically illustrated in the accompanying drawings. Therein:

Fig. 1 is a top view on a drill bit of the device according to the invention for carrying out the method of the invention;

Fig. 2 is a rear view of the drill bit shown in Fig. 1;

- 10 Fig. 3 depicts a section along line III-III of Fig. 1;

Fig. 4 depicts a section along line IV-IV of Fig. 1 in an illustration similar to that of Fig. 3;

Fig. 5 is a side view of a first embodiment of an adapter used between the drill bit and the drill rod assembly according to Figs. 1 to 4;

- 15 Fig. 6, in an illustration similar to that of Fig. 5, depicts a side view of a modified embodiment of an adapter used between a drill bit and a drill rod assembly; and

Fig. 7 depicts a section along line VII-VII of Fig. 6 on an enlarged scale relative to Fig. 6.

From Figs. 1 to 4, it is apparent that an adapter 3 is provided between a drill bit or

- 20 bore-crown generally

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denoted by 1 and a drill rod assembly or boring rod generally denoted by 2, said drill rod assembly 2 being connected with the adapter 3 via a screw connection schematically indicated by 4, the adapter 3 being
5 separately illustrated in Fig. 5.

As is, in particular, apparent from Fig. 5, the adapter 3, on the outer periphery of its end 6 facing the drill bit 1, comprises a plurality of helicoidal or spiral-shaped
10 depressions 7 having large pitches or inclinations relative to the longitudinal axis schematically denoted by 8 in Fig. 3. The helicoidal or spiral-shaped depressions or connections or profilings 7 provided on the outer periphery of the end 6 of the adapter 3 cooperate with point-shaped
15 or semispherical elevations 9 of the drill bit, which are illustrated in more detail in Figs. 3 and 4 and which enable the reliable fixation of the drill bit 1 to the adapter 3 and, hence, to the drill rod assembly 2.

20 In the event of a blockage of the drill bit 1 during the drilling procedure caused, for instance, by a displacement or shift of rock layers in the region of the drill bit 1, thus preventing the subsequent continuation of the drilling procedure, the drill rod assembly 2 and, hence, the adapter
25 3 as well as the drill bit 1 are subjected to a linear extraction movement in the sense of arrow 10, with the direction of movement running counter to the usual drilling or mining direction.

30 By the cooperation of the spiral-shaped or helicoidal depressions 7 provided on the adapter 3 or its end 6 facing the drill bit, with the respective elevations 9 provided in the interior of the pocket hole 11 of the drill bit for the

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reception of the free end 6 of the adapter 3, a rotational movement of the drill bit 1 along the spiral-shaped or helicoidal connections or profilings 7 is, at the same time, caused by the provision of the extraction movement 10 so as to enable the loosening or release of the blockade of the drill bit 1 by the linear extraction movement and the simultaneous rotational movement of the drill bit 1. It is, thus, feasible, after having loosened the drill bit 1, to immediately continue the drilling procedure by appropriately acting upon the drill rod assembly 2 and, hence, on the drill bit 1 via the interposed adapter 3 by known driving means engaging in a known manner on an end of the drill rod assembly 2 projecting out of the borehole.

15 In order to provide an appropriate cooling or flushing effect, both the drill rod assembly 2 and the adapter 3 are, moreover, provided with a passage channel denoted by 12 and 13, respectively, which opens into respective outlet channels or holes 14 of the drill bit 1, which in turn discharge on the working face 15 of the drill bit 1. In addition, the adapter 3 too is provided with outlet channels 16 departing from the passage channel 13 to promote the haulage of excavated material.

25 For the removal of excavated material from the region of the working face 15 of the drill bit 1, passage openings 17 are, moreover, provided on the outer periphery of the drill bit 1. In addition, the drill bit 1, on its outer periphery, comprises suitable depressions 18 likewise enabling the reliable removal of material from the region of the working face 15 of the drill bit 1.

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Instead of the embodiment illustrated in Figs. 1 to 5, which comprises a plurality of peripherally distributed connection elements formed by depressions 7 and elevations 9, a single connection will also do, which will impart an appropriate rotational movement in a direction opposite the direction of the rotational movement during the drilling procedure, when exerting a linear extraction movement opposite the drilling direction of the drill bit 1.

10 Instead of providing an adapter 3, or its end 6, with the spiral-shaped or helicoidal depressions 7, the drill bit 1 or its pocket hole 11 may also be provided with appropriate depressions or grooves cooperating with corresponding profilings and, in particular, elevations provided on the
15 periphery of the end 6 of the adapter 3.

Instead of the adapter 3 illustrated in the drawing, the end of the drill rod assembly 2 facing the drill bit may be directly provided with the appropriate spiral-shaped or
20 helicoidal depressions or elevations cooperating with corresponding profilings of the drill bit 1, thus avoiding additional manufacturing expenses for the adapter 3.

When using an adapter 3, conventional designs, particularly
25 of the drill rod assembly 1, will, however, do such that no special embodiment of the drill rod assembly 2 need be provided to achieve the simple release of the blockage of a drill bit 1. In cases in which, due to the nature of the soil or rock material to be bored through, a blockage or
30 jamming of the drill bit will have to be feared on account of displacements or shifts, a drilling procedure may, thus, be immediately performed using a conventional drill rod assembly 2 by providing the adapter 3 as well as a drill

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bit 1 matching therewith, so that, in particular, the production of special drill rod assembly elements can be obviated and stock-keeping can, thus, be facilitated.

5 From the embodiment represented in Figs. 6 and 7, of an adapter again denoted by 3, it is again apparent that the latter is provided with a plurality of helicoidal or spiral-shaped flattenings 19 on its end again denoted by 6 and facing the drill bit not illustrated in detail, said
10 flattenings forming polygonal and, in particular, hexagonal contours in terms of cross section, as is particularly apparent from Fig. 7. By providing said helicoidal or spiral-shaped flattenings 19 on the end 6 of the adapter 3 as well as designing a pocket hole 11 of a drill bit not
15 illustrated in detail with the respective, complementary flattenings forming a polygonal contour, a rotational movement in a direction opposite the drilling direction may again be imparted to the drill bit not illustrated in detail in Figs. 6 and 7 upon extraction of the drill rod
20 assembly and the adapter 3, in order to loosen a stuck drill bit 1 so as to enable the subsequent completion of a borehole.

Instead of the substantially hexagonal contour of the
25 helical polygon illustrated in Figs. 6 and 7, accordingly modified polygonal contours comprising, for instance, four, five, seven or more elevations, may, of course, be employed.

30 Furthermore, it is indicated in Figs. 6 and 7 that the adjacent flattenings 19 are each connected by rounded zones 20 which are defined by the outer periphery of the cylindrical end 6 of the adapter 3.

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CLAIMS:

1. A method for releasing a blockage of a drill bit during the percussion or rotary percussion drilling, of holes in soil or rock material, wherein a borehole is formed by a drill bit mounted on a drill rod assembly and connected thereto and acted
5 upon by the drill rod assembly to perform a rotational movement and a percussive movement, wherein, at a blockage of the drill bit preventing the continuation of a drilling procedure and any further rotational movement of the drill bit, the drill bit, via the drill rod assembly, is subjected to a linear movement opposite the drilling direction and, in addition, a rotational movement in a direction opposite the direction of the
10 rotational movement during the drilling procedure via an appropriate connection between the end of the drill rod assembly facing the drill bit and the drill bit and independently of a rotary drive for carrying out the drilling procedure.
2. A method according to claim 1, wherein the connection between the end of the drill rod assembly facing the drill bit and the drill bit is realized via an
15 adapter comprising at least one helicoidal or spiral-shaped depression or flattening or elevation, and a complementary profiling provided on the drill bit, said helicoidal or spiral-shaped depression or flattening or elevation comprising a large inclination or pitch relative to the longitudinal axis of the drill rod assembly.
3. A method according to claim 2, wherein a plurality of helicoidal or spiral-
20 shaped profilings are provided, which are uniformly arranged about the periphery of the end facing the drill bit.
4. A method according to claim 2 or 3, wherein a merely pointwise engagement on several sites in the region of the profilings between the drill rod assembly or the adapter and the drill bit is provided.
- 25 5. A device for releasing a blockage of a drill bit during the percussion or rotary percussion drilling, of holes in soil or rock material, wherein a drill bit is mounted on a drill rod assembly and acted upon by the drill rod assembly to perform

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a rotational movement and a percussive movement for the formation of a borehole, wherein the at least one spiral-shaped or helicoidal connection is comprised of a depression or elevation or flattening provided on an adapter arranged between the drill rod assembly and the drill bit, and a complementary profiling provided on the drill
5 bit, and wherein at least one spiral-shaped or helicoidal connection is provided between the end of the drill rod assembly facing the drill bit and the drill bit, which, at a blockage of the drill bit upon retraction of the drill rod assembly opposite the drilling direction, acts upon the drill bit to perform a rotational movement in a direction opposite the direction of rotation during the drilling procedure independently of a
10 rotary drive for carrying out the drilling procedure.

6. A device according to claim 5, wherein a plurality of helicoidal or spiral-shaped profilings are provided between the drill rod assembly or the adapter, respectively, and the drill bit, which are each equidistantly arranged.

7. A device according to claim 5 or 6, wherein the at least one helicoidal or
15 spiral-shaped connection or profiling comprises a large pitch or inclination relative to the longitudinal axis of the drill rod assembly.

8. A device according to claim 5, 6 or 7, wherein a plurality of substantially point-shaped or semispherical elevations are provided in a pocket hole of the drill bit for cooperation with the spiral-shaped or helicoidal depression(s) or recess(es) on the
20 end of the adapter facing the drill bit.

9. A device according to any one of claims 5 to 7, wherein a plurality of adjacent, spiral-shaped flattenings are provided on the outer periphery of the adapter or drill rod assembly, respectively, and complementary flattenings are provided in a pocket hole of the drill bit, said flattenings having polygonal contour in terms of cross
25 section.

10. A device according to any one of claims 5 to 9, wherein, in the interior of at least one of the drill rod assembly and the adapter, a passage channel for

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supplying a cooling or flushing fluid to outlet channels or holes of at least one of the drill bit and the adapter is provided, which discharge on the working face of the drill bit or the peripheral surface of the adapter.

11. A device according to any one of claims 5 to 10, wherein depressions or
5 recesses or passage openings are provided on the outer periphery of the drill bit for removing excavated material through an annular space between the outer periphery of the drill rod assembly and the inner wall of the produced borehole.

Fig. 1

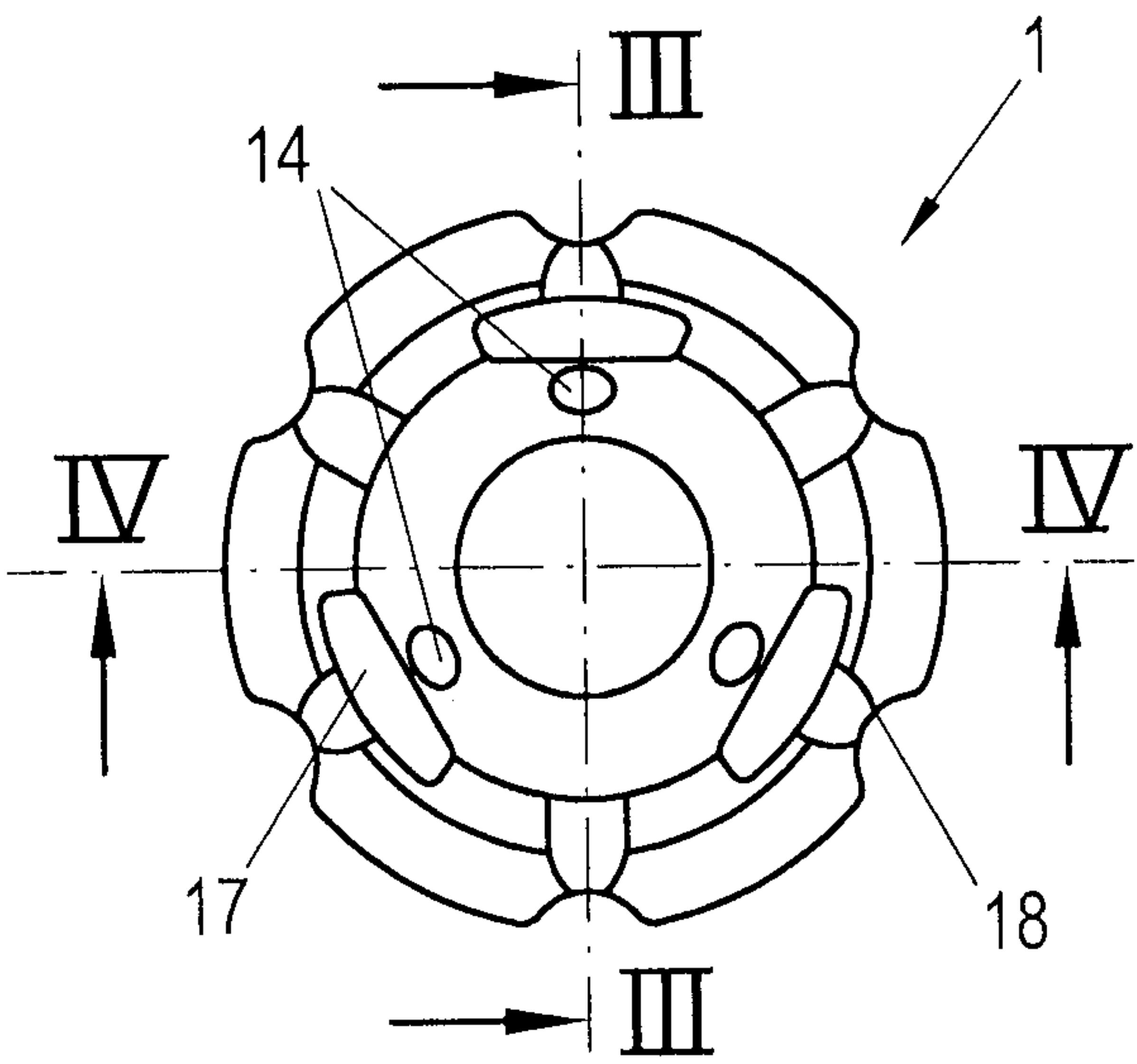


Fig. 2

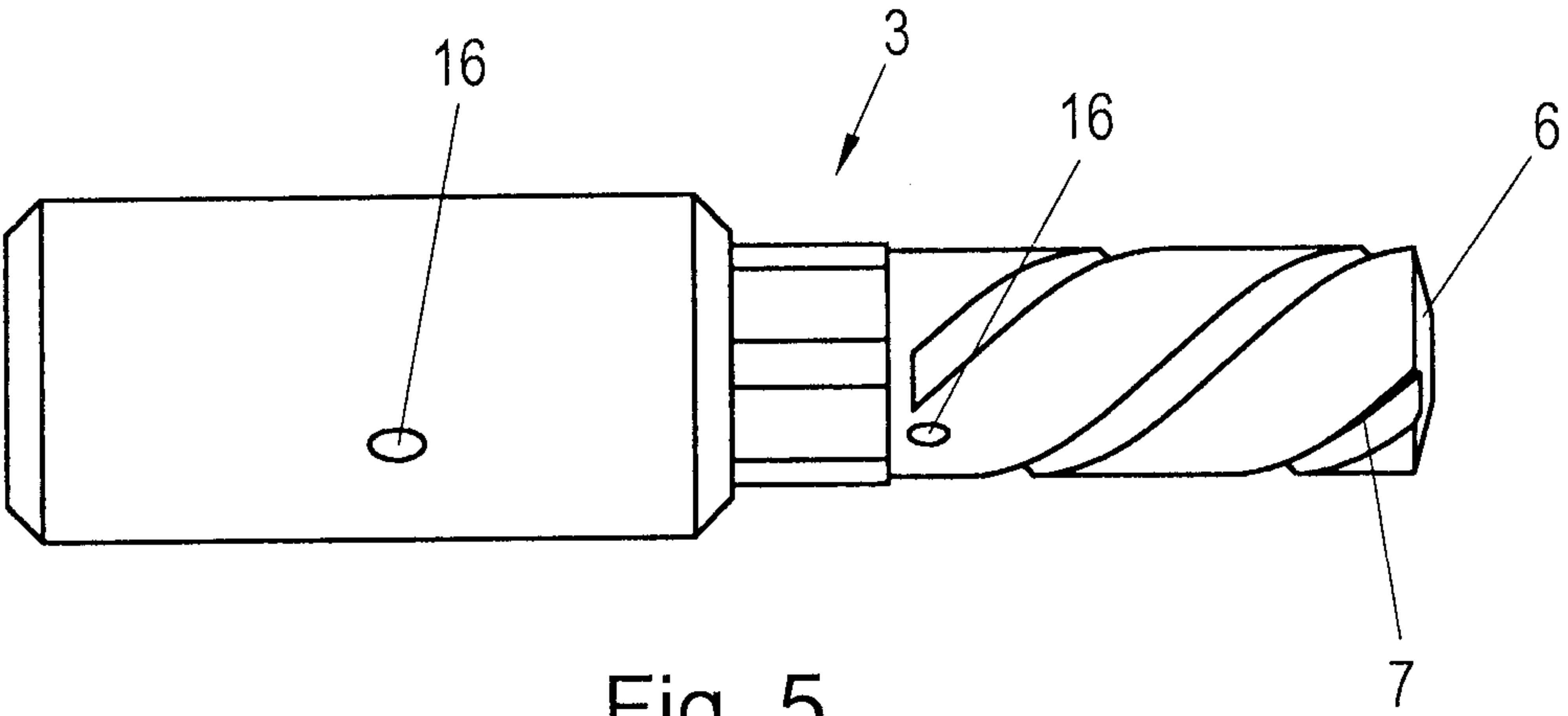
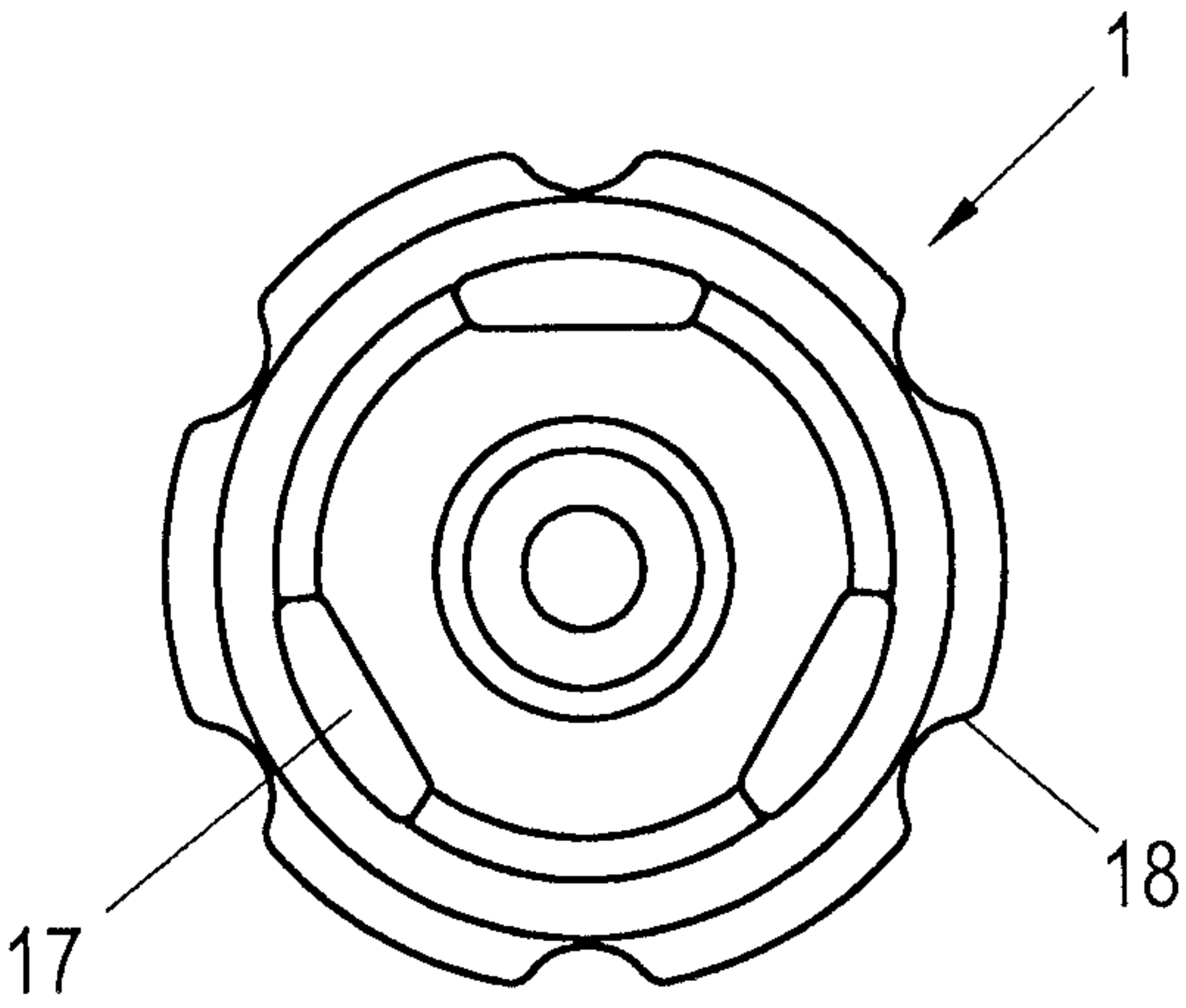


Fig. 5

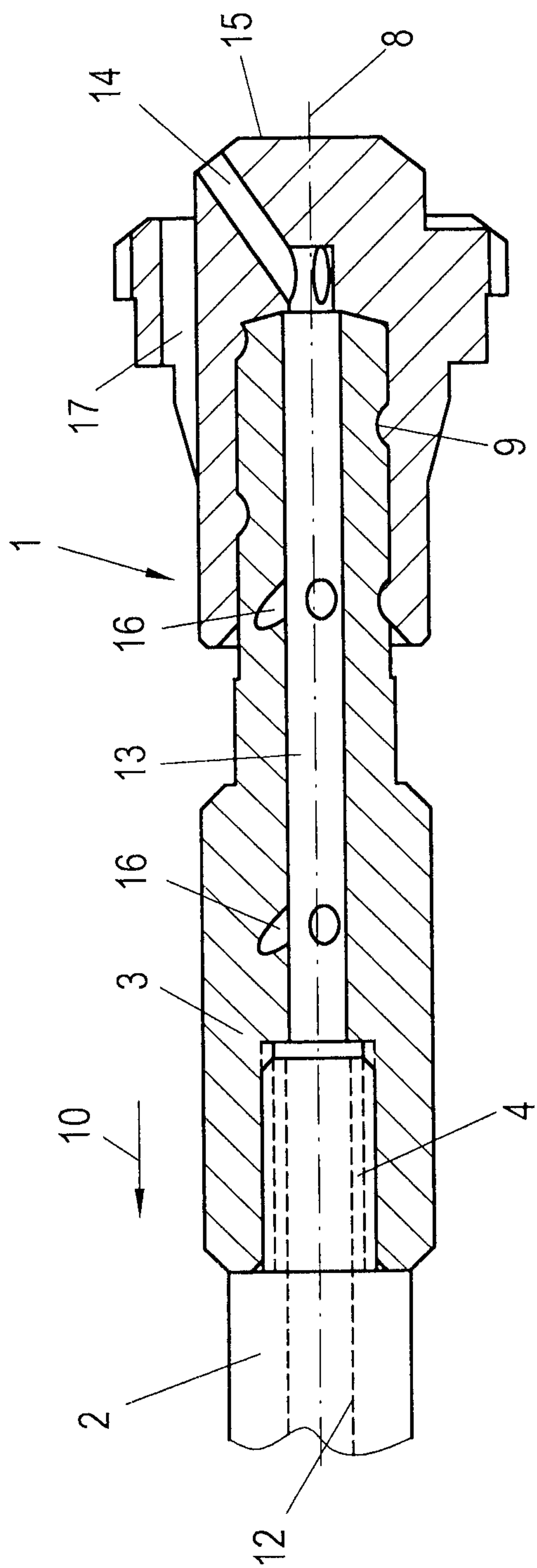


Fig. 3

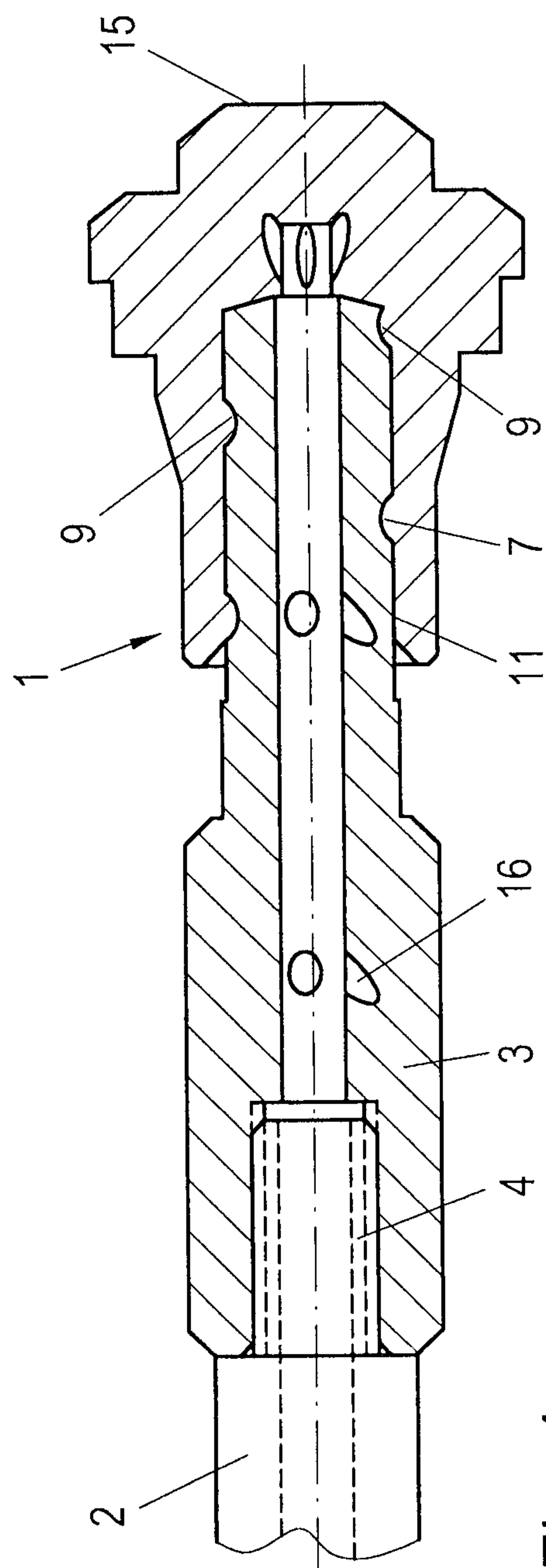


Fig. 4

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