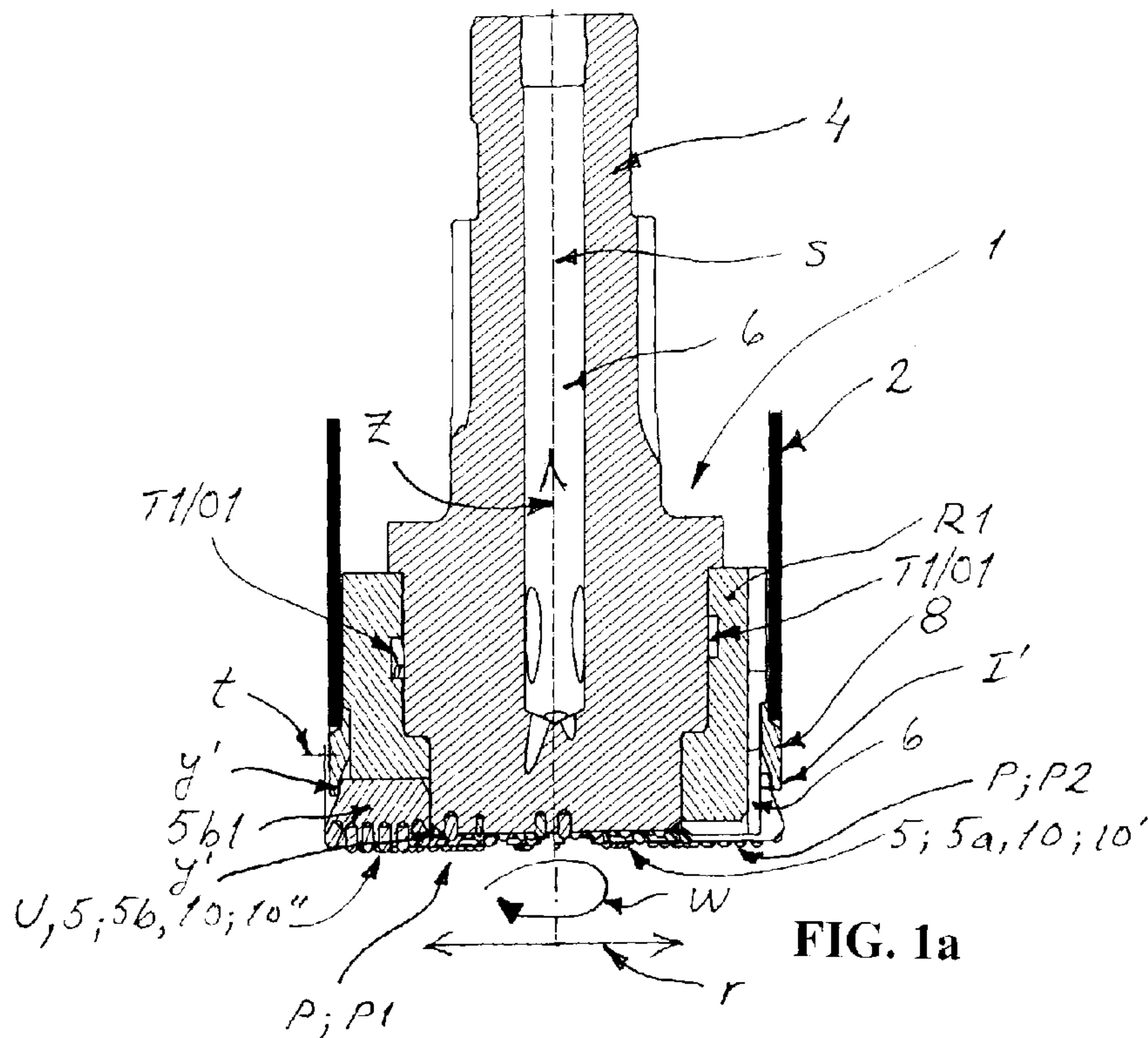




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(54) **Titre : DISPOSITIF DE FORAGE**
(54) **Title: DRILLING DEVICE**



(57) **Abrégé/Abstract:**

The invention relates to a drilling device that is meant to be used in a down-the-hole drilling apparatus for drilling a hole by using the drilling device (1) and a casing part (2) as well as a hammering device when needed. The drilling device (1) comprises in a drilling



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

head (I) thereof a guide (4), drilling means (5) and as well as advantageously flushing means for flushing of drilling waste being generated. The drilling means (4) comprise a first drill bit arrangement (5a) and a second drilling bit arrangement (5b) that is movable with respect to the above and that is arranged on the one hand to be expanded for drilling a greater (t) hole than the free cross-sectional surface area of an end (?) of the casing part (2) and on the other hand to be reduced to a smaller size than the free end (?) of the casing part. The bit pieces (5bl) of the second drill bit arrangement (5b) are arranged, for expanding/reducing of the second drill bit arrangement (5b) by means of the guide (4), movable in slide grooves (U) that pass wide open in the radial direction (r) on a drilling surface (P) of the drilling means (5) for expanding the second drill bit arrangement (5b) by moving its bit pieces (5bl) in the radial direction (r) outwards in the slide grooves (U), by rotating (w) the guide (4) in a drilling direction, and for reducing the second drill bit arrangement (5b) by moving its bit pieces (5bl) in the radial direction inwards in the slide grooves (U), by rotating the guide (4) in an opposite direction.

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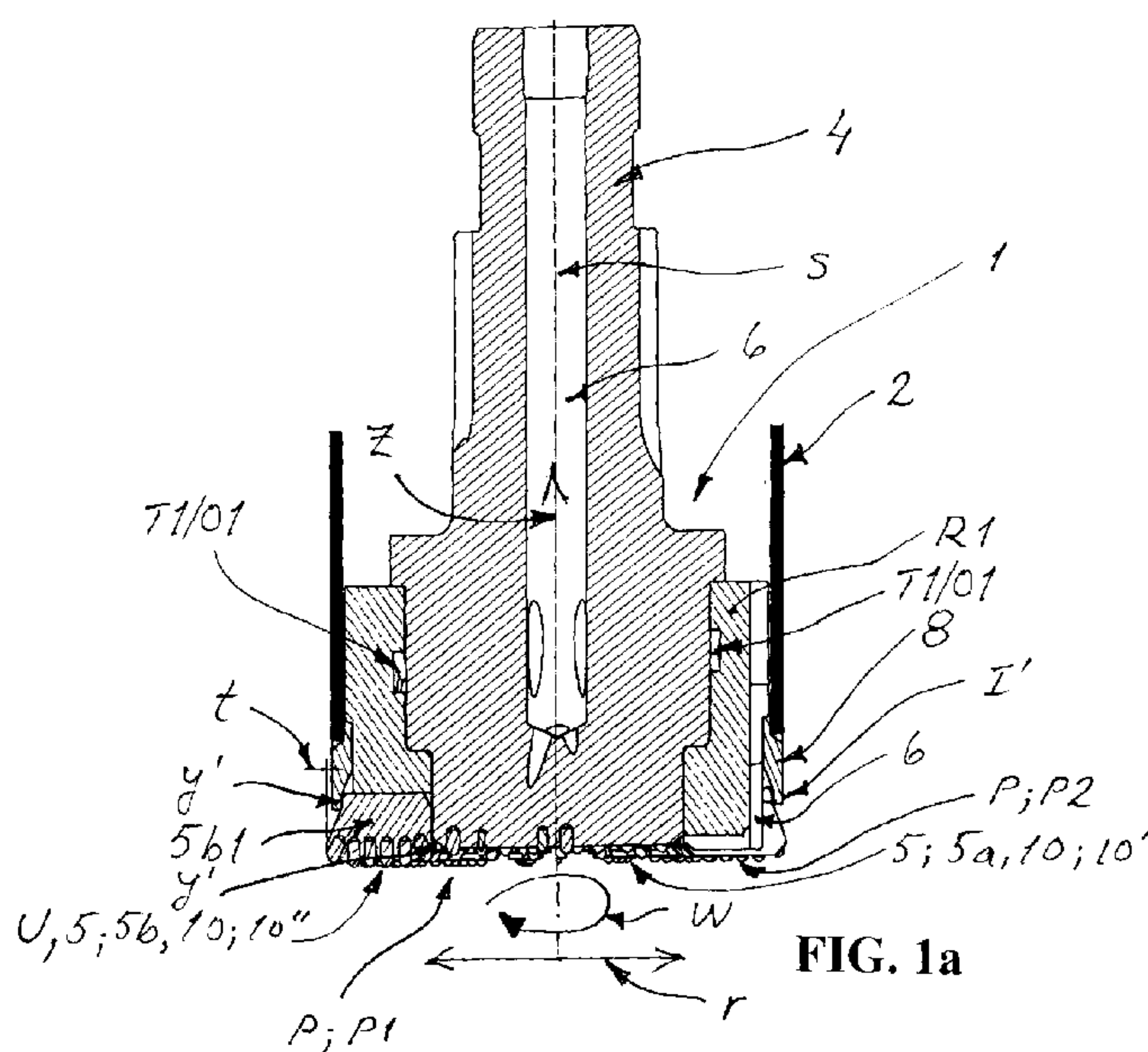
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(54) Title: DRILLING DEVICE

(57) Abstract: The invention relates to a drilling device that is meant to be used in a down-the-hole drilling apparatus for drilling a hole by using the drilling device (1) and a casing part (2) as well as a hammering device when needed. The drilling device (1) comprises in a drilling head (I) thereof a guide (4), drilling means (5) and as well as advantageously flushing means for flushing of drilling waste being generated. The drilling means (4) comprise a first drill bit arrangement (5a) and a second drilling bit arrangement (5b) that is movable with respect to the above and that is arranged on the one hand to be expanded for drilling a greater (t) hole than the free cross-sectional surface area of an end (I') of the casing part (2) and on the other hand to be reduced to a smaller size than the free end (I') of the casing part. The bit pieces (5bl) of the second drill bit arrangement (5b) are arranged, for expanding/reducing of the second drill bit arrangement (5b) by means of the guide (4), movable in slide grooves (U) that pass wide open in the radial direction (r) on a drilling surface (P) of the drilling means (5) for expanding the second drill bit arrangement (5b) by moving its bit pieces (5bl) in the radial direction (r) outwards in the slide grooves (U), by rotating (w) the guide (4) in a drilling direction, and for reducing the second drill bit arrangement (5b) by moving its bit pieces (5bl) in the radial direction in-

wards in the slide grooves (U), by rotating the guide (4) in an opposite direction.

Drilling device

The invention relates to a drilling device that is meant to be used in a down-the-hole drilling apparatus for drilling a hole by using the drilling device and a casing part as well as a hammering device when needed. The drilling device comprises in a drilling head thereof a guide, drilling means as well as advantageously flushing means for flushing of drilling waste being generated. The drilling means comprise a first drill bit arrangement and a second drill bit arrangement that is movable with respect to the above, whereby the drill bit arrangements are provided with drilling organs, such as an integrated drilling part, separate drilling pieces, bits or the like. The second drill bit arrangement is arranged on the one hand to be expanded for drilling a greater hole than a free cross-sectional surface area of an end of the casing part and on the other hand to be reduced to a smaller size than the free cross-sectional surface area of the end of the casing part in order to make possible removal of the drilling device from a hole that has been drilled and for leaving the casing part in the drilled hole by removing the drilling device through the casing part from above. The second drill bit arrangement is arranged by two or more bit pieces that are movable in radial direction on the drilling surface of the drilling means, and in which the drilling organs are arranged when viewed in longitudinal direction of the drilling device on the front surface thereof.

The type of drilling apparatuses described above have been used for a long time and for example in patent publication FI 75650 there has been presented a boring tool, which is meant for boring and/or hammer drilling, to be used in connection with a drill rod unit placed inside a core pipe. The boring tool to be attached at the front end of the drill rod unit has a center drill,

being provided with a cutting unit, and an eccentric reaming drill, being placed behind the center drill, the reaming drill having also a cutting unit. The reaming drill moves with respect to the center drill between a drilling position, in which it is positioned to the side in front of the core pipe, and a return position, in which it is withdrawn in radial direction inside the core pipe. Deviating from earlier solutions, in which the center drill is in most cases provided with four cutting parts directed radially and being made of hard metal, the reamer for its part comprising either one or two radially directed cutting parts made of hard metal, in the solution according to the publication in question, the cutting parts are replaced by bit parts being arranged in a certain manner. With the solution presented in the publication in question such constructions of the center drill and the reaming drill have been desired that the operating time of the boring tool will be as long as possible.

It is thus characteristic for use of the type of drilling apparatuses described above that the hole to be drilled to the ground is reamed by an eccentrically operating reaming drill. This leads to most differing kinds of problems. First of all the drilling motion of the reaming drill taking place eccentrically causes high torsion stress to the drill rod unit. In this case it is not possible to take optimally advantage of the operating efficiency of the drilling device due to high breakage risk of the drill rod unit, particularly breaking off thereof. On the other hand, a problem in practice in a drilling situation is often the returning of the reaming drill to its return position, which is due to ground substance, being collected between the reaming drill and the center drill. In order to get the reaming drill back to its return position, usually a repeated back and forth movement of the drilling device is required. Naturally when e.g. a too high operating

power is being used or when the materials of the drilling device parts have a lowered fatigue resistance, there is a high risk for breakage of the drill rod unit.

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On the other hand e.g. in Finnish patent number 94891 there has been presented a boring tool, which has two or three blocks moving in respect with each other in the same plane, the blocks forming a drill bit of the boring tool. The boring tool in question is usable as described above in a way that in a drilling situation the bit blocks are in an ejected position, in which case the bit parts placed therein drill a hole that is essentially larger than the casing part. After a drilling situation the casing part may be left in the hole and the drill rod unit inside the same with its bit blocks can be removed as a whole from the hole by moving the bit blocks with respect to each other in a way that they get withdrawn to a form that is smaller than the free internal diameter of the casing part. In the solution in question, the bit blocks are arranged movable in respect with each other by coupling each one thereof by a single guiding pin with a guide part supporting the bit blocks, which pins depending on the rotation direction of the guide part bring about protrusion of the bit blocks or the same getting together in cooperation with guide grooves in the guide part.

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In the patent in question several differing solutions have been presented in order to couple these guiding pins with the bit blocks. The biggest problem in practice of these types of solutions is, however, the high stresses directed to the guiding pins, in which case particularly when drilling stony ground, the durability of the guide pins is put to a tough test, because very high torsion stresses as well as torque loads are directed to the guiding pins. This is why the

functionality of the guiding pins particularly in drilling to be performed under demanding circumstances is very unreliable, because when drilling e.g. rock a continuous fatigue load is directed to the pins, which furthermore weakens tensile properties thereof in longer lasting use.

Furthermore for example from patent documents CH 622312, US 5361859, US 3365010, GB 2310229 and GB 973790 it is known that the second drill bit arrangement is arranged by two or more bit pieces that are movable in radial direction in slide grooves that pass wide open on the drilling surface of the drilling means, and, in which the drilling organs are arranged when viewed in longitudinal direction of the drilling device on the front surface thereof. It is common to all of the solutions described above that the slide grooves therein, being inclined towards the drilling head of the drilling device when viewed in a longitudinal cross section, whereby the said bit pieces are arranged movable in the slide grooves e.g. by influence of a flushing medium being used in the drilling or by influence of a force directed thereto when the drilling head of the drilling device is being pushed against the ground. The return movement of the bit pieces in question for reducing the drilling head is carried out e.g. by spring force or by gravitation when the drilling head is being lifted upwards inside the casing part. With the type of solutions in question it is not in practice possible to e.g. lift the casing part upwards in a drilled hole, which is necessary in certain occasions.

A problem of the type of drilling heads described above is the very strongly conical drilling surfaces, which is why wearing out of the bits takes place unevenly, whereby a part of the drill bits wear out prematurely. On the other hand a further difficult problem in

practice related to the type of implementations in question is the fact that by the solutions utilized therein returning of the bit pieces to the reduced position of the drilling head is practically uncertain, and is not even possible under all circumstances, which is why the drilling head can necessarily not be removed from a drilled hole without getting broken. In addition, the type of drilling device in question may "get stuck", which requires reciprocating use in order to get the drill bit released, which causes the same problems that have been explained above about the use of eccentric drills. Due to the above, with the types of implementations in question, it is not possible to carry out drilling in practice in an adequately reliable and long-lasting manner.

The drilling device according the present invention is aimed to achieve a decisive improvement in the problems described above and thus to raise substantially the level of prior art. To bring about this aim, the drilling device according to the invention is primarily characterized by that, the bit pieces of the second drill bit arrangement are arranged, for expanding/reducing of the second drill bit arrangement by means of the guide, movable in slide grooves that pass wide open in the radial direction on the drilling surface of the drilling means for expanding the second drill bit arrangement by moving its bit pieces in the radial direction outwards in the slide grooves, by rotating the guide in one direction in a drilling direction, and for reducing the second drill bit arrangement by moving its bit pieces in the radial direction inwards in the slide grooves, by rotating the guide in an opposite direction.

As the most important advantages of the drilling device, simplicity and operating reliability of its functioning and construction may be mentioned. Thanks

to the invention both in drilling and in all operations related thereto it is possible to utilize the operating efficiency of a drilling apparatus optimally, because the bit pieces of the second drill bit arrangement of the drilling means are arranged movable from an expanded drilling position to a reduced position and vice versa in radially directed slide grooves on the drilling surface first of all by influence of the rotation movement of the guide and on the other hand by a "forced control" achieved by a movement mechanism controlling the movement of the bit pieces. The slide grooves mentioned above are carried out furthermore advantageously e.g. by a so called dovetail or t-groove in a way that movement of the drill pieces in other directions is totally prevented.

Furthermore when using advantageously several bit pieces moving in slide grooves that are in radial direction symmetrically on the outer surface of the drilling unit, the risk for breakage of the drilling device is low also thanks to the fact that a significantly lower fatigue stress is directed thereto due to drilling when compared to utilization of solutions based on one single drill bit or in other ways asymmetrical solutions. In this case, there is neither a need to support the back part of the drilling device the way that is required in present solutions by a disproportionately long support surface inside the casing part, in which case also a slide surface arrangement between the back part of the drilling device and the internal surface of the casing part can be made as short as possible. Thus, the overall cost effectiveness of the drilling device according to the invention is based also on the fact that the structure of the drilling device's back part may be carried out clearly lighter than the same of the corresponding present solutions. What is the most important, is the fact that the drilling device according to the

invention also makes possible removal of the drilling device from inside the casing part as a whole with its movable parts as one single piece from above, in which case there is no need to leave anything extra in addition to the casing part or the core pipe in the hole that has been drilled. The above has naturally a remarkable cost savings effect.

Advantageous embodiments of the drilling device according to the invention have been presented in the dependent claims related thereto.

In the following description the invention is being described in detail with reference to the appended drawings, in which

in figures 1a and 1b

is shown an advantageous drilling device according to the invention in its drilling position as a longitudinal cross section and as an end view,

in figures 2a and 2b

is shown as perspective views an auxiliary frame and a drill bit of a drilling device according to figures 1a, 1b,

in figures 3a and 3b

is shown an advantageous alternative implementation of the drilling device according to the invention in its drilling position as a longitudinal cross section and as an end view,

in figures 4a and 4b

is shown as perspective views an intermediate frame as seen from opposite directions

belonging to a drilling device as shown in figures 3a and 3b, and

in figures 5a and 5b

5 are shown as advantageous embodiments perspective views of an end surface of the guide and a drill bit belonging to the drilling device according to figures 3a and 3b.

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The invention relates to a drilling device that is meant to be used in a down-the-hole drilling apparatus for drilling a hole by using the drilling device 1 and a casing part 2 as well as a hammering device when
15 needed. The drilling device 1 comprises in the drilling head I thereof a guide 4, drilling means 5 as well as advantageously flushing means for flushing of drilling waste being generated. The drilling means 5 comprise a first drill bit arrangement 5a and a second drill bit
20 arrangement 5b that is movable with respect to the above, whereby the drill bit arrangements are provided with drilling organs 10, such as an integrated drilling part, separate drilling pieces, bits or the like. The second drill bit arrangement is arranged on the one
25 hand to be expanded for drilling a greater hole than a free cross-sectional surface area of an end I' of the casing part 2 and on the other hand to be reduced to a smaller size than the free cross-sectional surface area of the end I' of the casing part in order to make
30 possible removal of the drilling device from a hole that has been drilled and for leaving the casing part 2 in the drilled hole by removing the drilling device 1 through the casing part 2 from above. The second drill bit arrangement 5b is arranged by two or more bit
35 pieces that are movable in radial direction r on a drilling surface P of the drilling means, and in which the drilling organs 10; 10" are arranged when viewed in

a longitudinal direction s of the drilling device on the front surface thereof.

5 The bit pieces 5b1, being advantageously essentially elongated that is essentially longer than the width of the slide grooves U and belonging to the second drill bit arrangement 5b, are arranged, for expanding/reducing of the second drill bit arrangement 5b by means of the guide 4, movable in slide grooves U
10 that pass wide open in the radial direction r on the drilling surface P of the drilling means 5 for expanding the second drill bit arrangement 5b by moving its bit pieces 5b1 in the radial direction r outwards in the slide grooves U, by rotating the guide 4 in one
15 direction w in a drilling direction, and for reducing the second drill bit arrangement 5b by moving its bit pieces 5b1 in the radial direction inwards in the slide grooves U, by rotating the guide 4 in an opposite direction.

20 As an advantageous embodiment of the drilling device according to the invention particularly with reference to figures 1a, 1b, the first drill bit arrangement 5a is arranged in an immovable manner in connection with the guide 4, whereby as a furthermore advantageous
25 embodiment, the drilling organs 10' of the first drill bit arrangement 5a, being arranged in a built-in manner in the guide 4, are arranged at an outer end of the guide 4 operating as the drilling surface P1.

30 As a furthermore advantageous embodiment of this drilling device, the slide grooves U of the bit pieces 5b1 of the second drill bit arrangement 5b are arranged in an auxiliary frame R1 according to figure 2a, which
35 is coupled with the guide 4 on the principle that manifests itself in figure 1a to rotate in a restricted manner in a crosswise plane x, such as by a pin/guide groove arrangement T1/O1 or a like.

Furthermore as an advantageous embodiment of the drilling device according to figures 1a, 1b, a movement mechanism of the bit pieces 5b; 5b1 of the second drill bit arrangement, moving in the radial direction r in a crosswise plane x that is essentially perpendicular to the longitudinal direction s of the drilling device, is arranged depending on the rotation direction of the guide 4 to push the guide in the longitudinal direction s out from the casing part 2 or to pull the same inside the casing part 2, whereby the movements of the bit pieces in the radial direction r are arranged by influence of a guide surface arrangement y' , being in connection with the bit pieces and both the casing part 2 and an end of the guide 4.

The guide surface arrangement y' mentioned above comprises for example in the embodiment according to figure 1a an edge gasket at the outer edge of the guide 4 as well as e.g. according to figure 2b inclined guide surfaces at the opposite ends of the bit pieces 5b1, which glide against an internal guide surface of the casing shoe 8 existing at the end of the casing part 2, when the guide 4 moves in the longitudinal direction s inside the casing part 2 as explained in the following.

The embodiment according to figures 1a, 1b is carried out furthermore advantageously in a way that the bits 10' at the end of the guide 4 are positioned in the longitudinal direction s to some extent deeper than the bits 10" of the second drill bit arrangement 5, which has been found in practice to operate more profitably in drilling in some occasions than by placing the bits in totally the same plane. According to figures 1a and 2b, the bits 10" at opposite ends of the bit pieces 5b1 are placed advantageously on inclined surfaces and so that the bits at the "reaming end" of the bit pieces are arranged to ream the drill being drilled according to figure 1 with an adequate clearance t with respect

to the outer diameter of the casing shoe 8 at the end of the casing part 8.

5 As a furthermore advantageous embodiment of the drilling device according to the invention, movement z of the guide 4 in the longitudinal direction s while the same is being rotated in an opposite direction with respect to the drilling rotation direction w, is arranged by a thread coupling carried out by a
10 pin/guide groove arrangement T1/O1 or a like between the guide 4 and the auxiliary frame R1, in which case the auxiliary frame has one or more thread grooves and the guide 4 has respectively one or more draw pins. The thread coupling in question, which is carried out
15 advantageously by using draw pins to be installed in holes H in the auxiliary frame R1 after installation of the guide 4 and the auxiliary frame R1 on top of each other, works in practice in a drilling situation also as a power transmission arrangement transmitting the
20 guide's 4 rotational motion to the auxiliary frame R1.

As an alternative embodiment with respect to the one explained above with reference to the advantageous embodiment shown particularly in figures 3a, 3b, the
25 first drill bit arrangement 5a is arranged in an intermediate frame R2, which is coupled with the guide 4 to be movable with a restricted rotational movement in a crosswise plane x, such as by a pin/guide groove arrangement T2/O2 or a like that manifests itself in
30 figures 3a and 4b. The above manifests itself in figure 4b, in which the intermediate frame R2 is shown from behind, according to which in the hole H in the intermediate frame R2 is fitted a pin T2 that moves in an elongated guide groove O2 in the guide 4.

35 In this embodiment, the bit pieces 5b; 5b1 of the second drill bit arrangement that are movable in the crosswise plane x, as shown in figure 3b that is

essentially perpendicular to the longitudinal directions of the drilling device, are further advantageously coupled with slide grooves U, such as so called dovetail or T-grooves, in the intermediate frame R2 that comprises the drilling organs 10' of the first drill bit arrangement 5a, which grooves hold the bit pieces also axially (which principle applies naturally also to the bit pieces of the embodiment according to figures 1a, 1b).

As a further advantageous embodiment of the drilling device according to figures 3a, 3b, the movement of the drill bits 5b; 5b1 of the second drill bit arrangement in the radial direction r are arranged by a movement mechanism between the guide 4 and the bit pieces 5b1.

The movement mechanism in question is arranged by a mutual pin/glide groove arrangement T3/O3 between an end surface 4a of the guide 4 and back surfaces of the bit pieces 5b1 or in a corresponding manner, wherein with reference particularly to figures 5a and 5b, the movement mechanism has been carried out in this case by guide grooves O3 at the end surface of the guide 4, which depending on the rotating direction of the guide 4 transmit the bit pieces' 5b1 movement in radial direction in the slide grooves U in co-operation with pins T3 in the bit pieces. On the end surface 4a of the guide there has also been arranged flow ways 6 for leading of the flushing medium, being brought centrically, to the drilling device's drilling surface P in radial direction, on the outer surface of the guide guided by the end surfaces of the bit pieces and through the slide grooves U in the intermediate frame R2.

It is clear that the invention is not limited to those embodiments, being presented or described above, but instead it can be modified significantly within the

basic idea. It is thus possible e.g. to use on the drilling surfaces of the drilling device more frame parts than shown in the drawings or to exploit the embodiments shown in figures 1a, 1b and 3a, 3b in a "mixed" manner one way or another e.g. by using wider or narrower bit pieces. Correspondingly in connection with the end of the casing part there is not necessarily a need to use a separate casing shoe, but instead the corresponding arrangements can be formed e.g. with arrangements fixed on the outer and/or internal surfaces of the end of the casing part. By arranging the flushing flows according to the principles shown in the drawings an efficient flow of the flushing medium into the spaces that will be left open between the drilling parts has been tried to achieve, so that material may not get collected therein. This influence may be made more efficient by using a more abundant flushing flow channel system than presented above or by carrying out the flushing flow channel system to operate by so called reverse flow. In the drilling device according to the invention it is possible to exploit parts manufactured by utilizing most heterogeneous manufacturing techniques by using customary used materials.

Claims:

1. Drilling device that is meant to be used in a down-the-hole drilling apparatus for drilling a hole by using the drilling device (1) and a casing part (2) as well as a hammering device when needed, whereby the drilling device (1) comprises in a drilling head (I) thereof a guide (4), drilling means (5) as well as preferably flushing means for flushing of drilling waste being generated, whereby the said drilling means (5) comprise a first drill bit arrangement (5a) and a second drill bit arrangement (5b) that is movable with respect to the above, whereby the drill bit arrangements are provided with drilling organs (10), such as an integrated drilling part, separate drilling pieces, bits or the like, wherein the second drill bit arrangement is arranged on the one hand to be expanded for drilling a greater (t) hole than a free cross-sectional surface area of an end (I') of the casing part (2) and on the other hand to be reduced to a smaller size than the free cross-sectional surface area of the end (I') of the casing part in order to make possible removal of the drilling device from a hole that has been drilled and for leaving the casing part (2) in the drilled hole by removing the drilling device (1) through the casing part (2) from above, whereby the second drill bit arrangement (5b) is arranged by two or more bit pieces that are movable in radial direction (r) on a drilling surface (P) of the drilling means, and in which the drilling organs (10; 10") are arranged when viewed in longitudinal direction (s) of the drilling device on the front surface thereof, **characterized** in that, the bit pieces (5b1) of the second drill bit arrangement (5b) are arranged, for expanding/reducing of the second drill bit arrangement (5b) by means of the guide (4), movable in slide grooves (U) that pass wide open in the radial direction (r) on the drilling surface (P) of the drilling means

(5) for expanding the second drill bit arrangement (5b) by moving its bit pieces (5b1) in the radial direction (r) outwards in the slide grooves (U), by rotating the guide (4) in one direction (w) in a drilling direction, and for reducing the second drill bit arrangement (5b) by moving its bit pieces (5b1) in the radial direction inwards in the slide grooves (U), by rotating the guide (4) in an opposite direction.

2. Drilling device according to claim 1, **characterized** in that, the first drill bit arrangement (5a) is arranged in an immovable manner in connection with the guide (4).

3. Drilling device according to claim 2, **characterized** in that, the drilling organs (10') of the first drill bit arrangement (5a), being arranged in a built-in manner in the guide (4), are arranged at an outer end of the guide (4) operating as the drilling surface (P1).

4. Drilling device according to claim 2 or 3, **characterized** in that, the slide grooves (U) of the bit pieces (5b1) of the second drill bit arrangement (5b) are arranged in an auxiliary frame (R1), which is coupled with the guide (4) to rotate in a restricted manner in a crosswise plane (x), such as by a pin/guide groove arrangement (T1/O1) or a like.

5. Drilling device according to any of the preceding claims 2-4, **characterized** in that, a movement mechanism of the bit pieces (5b; 5b1) of the second drill bit arrangement, moving in the radial direction (r) in a crosswise plane (x) that is essentially perpendicular to the longitudinal direction (s) of the drilling device, is arranged depending on the rotation direction of the guide (4) to push the guide in the longitudinal direction (s) out from the casing part (2)

or to pull the same inside the casing part (2), whereby the movements of the bit pieces in the radial direction (r) are arranged by influence of a guide surface arrangement (y'), being in connection with the bit
5 pieces and both the casing part (2) and an end of the guide (4).

6. Drilling device according to any of the preceding claims 2-5, **characterized** in that, movement
10 (z) of the guide (4) in the longitudinal direction (s) while the same is being rotated in an opposite direction with respect to the drilling rotation direction (w), is arranged by a thread coupling carried out by a pin/guide groove arrangement (T1/O1) or a like
15 between the guide (4) and the auxiliary frame (R1), such as by one or more thread grooves in the auxiliary frame and one or more draw pins in the guide (4).

7. Drilling device according to claim 1,
20 **characterized** in that, the first drill bit arrangement (5a) is arranged in an intermediate frame (R2), which is coupled with the guide (4) to be movable with a restricted rotational movement in a crosswise plane (x), such as by a pin/guide groove arrangement (T2/O2)
25 or a like.

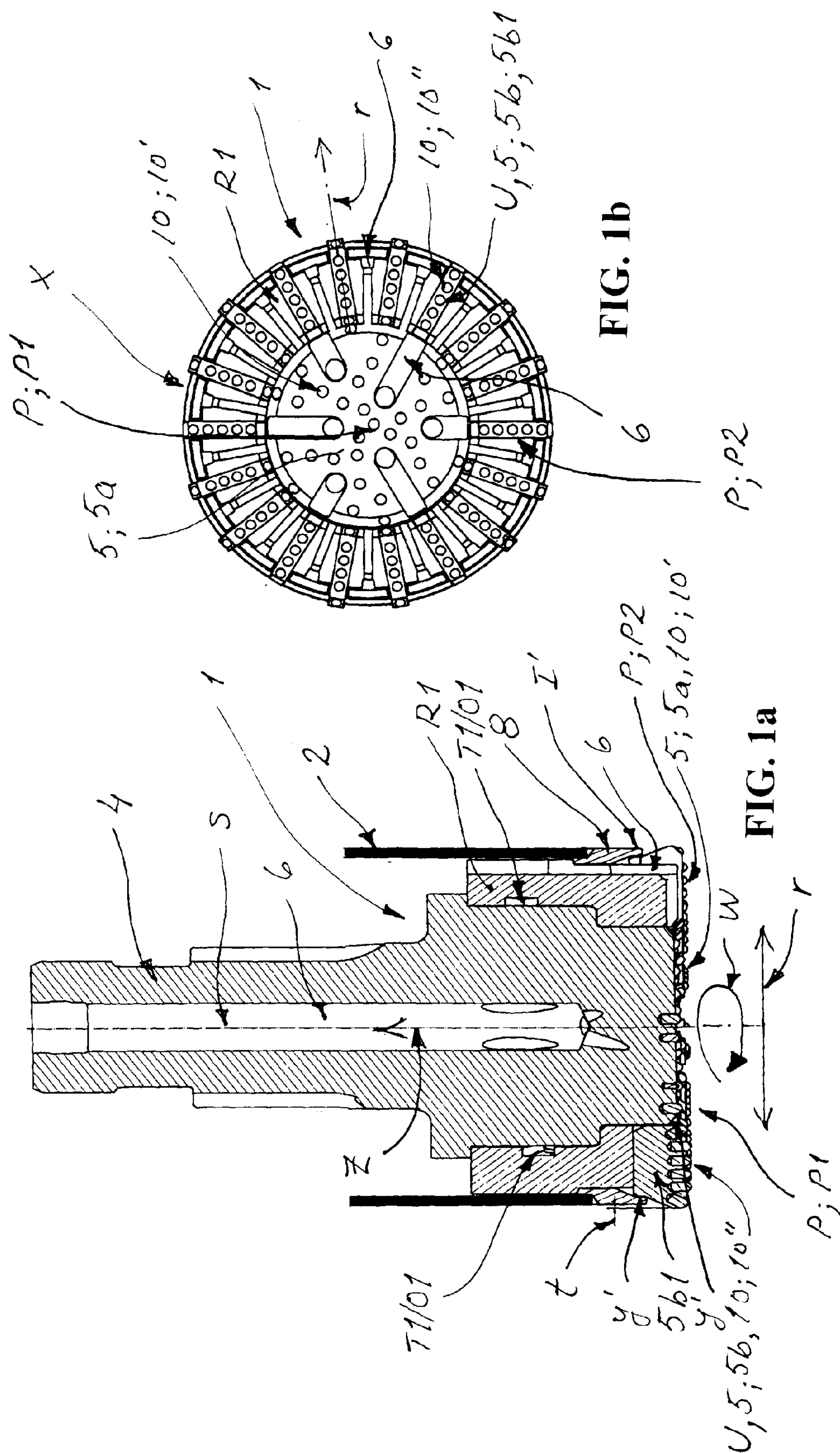
8. Drilling device according to claim 7,
characterized in that, the bit pieces (5b; 5b1) of the second drill bit arrangement that are movable in the
30 crosswise plane (x), being essentially perpendicular to the longitudinal direction (s) of the drilling device, are coupled with slide grooves (U) in the intermediate frame (R2) that comprises the drilling organs (10') of the first drill bit arrangement (5a).

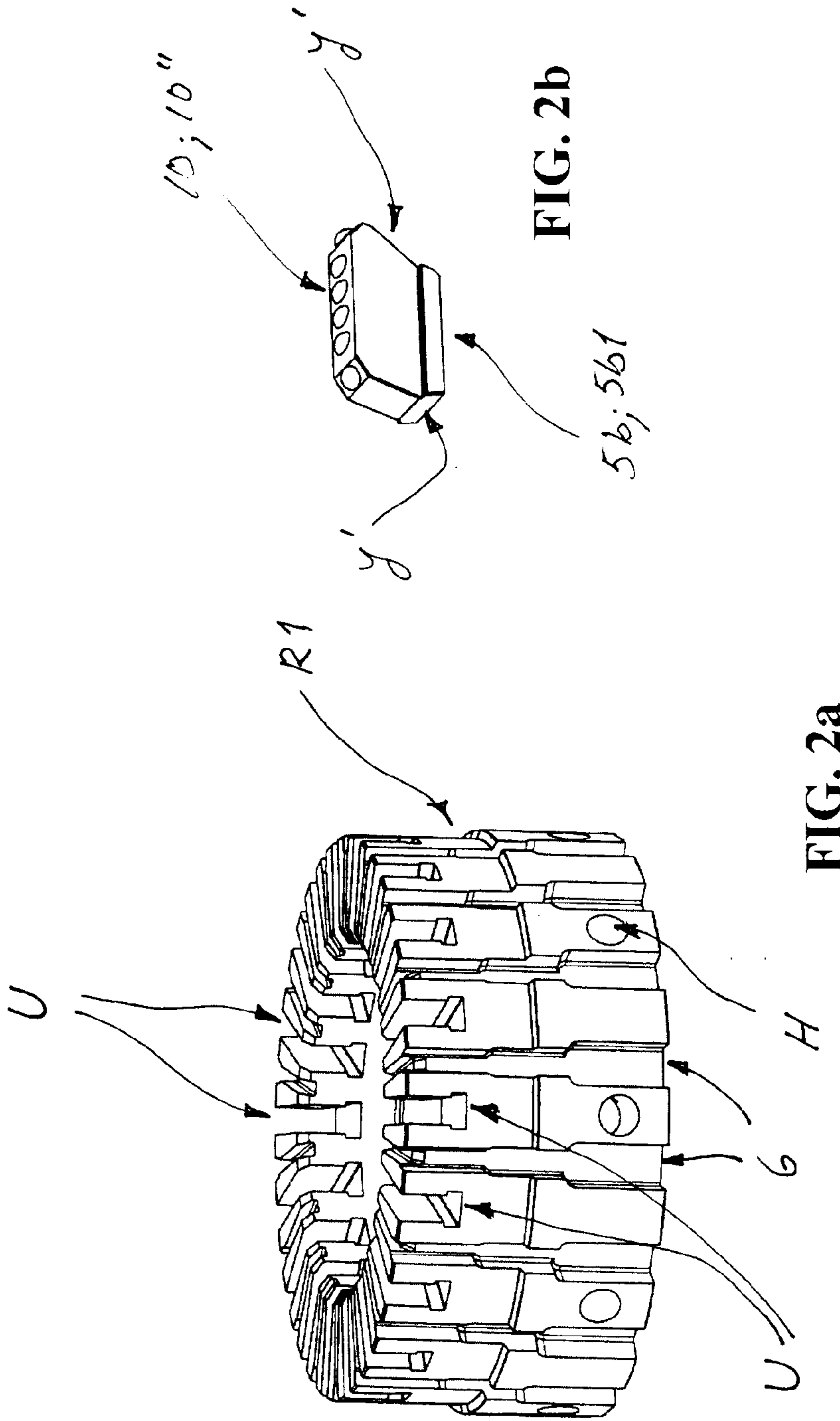
35 9. Drilling device according to claim 7 or 8, **characterized** in that, the movement of the drill bits (5b; 5b1) of the second drill bit arrangement in the

radial direction (r) are arranged by a movement mechanism between the guide (4) and the bit pieces (5b1).

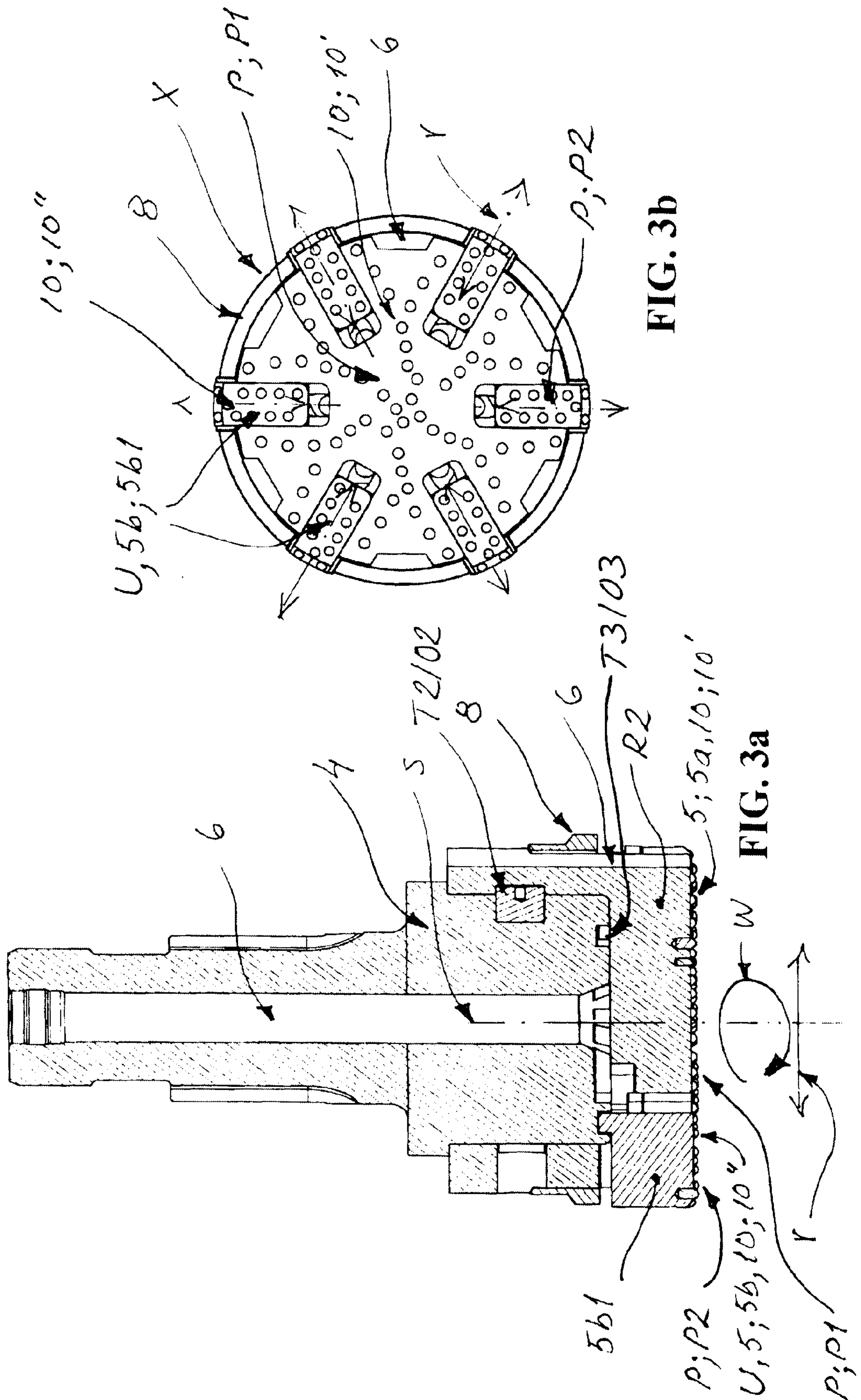
- 5 10. Drilling device according to claim 9,
characterized in that, the movement mechanism is
arranged by a mutual pin/glide groove arrangement
(T3/O3) between an end surface (4a) of the guide (4)
and back surfaces of the bit pieces (5b1) or in a
10 corresponding manner.

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