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(71) Applicant: **OY ATLAS COPCO ROTEX AB** [FI/FI]; Pihtisulunkatu 1 A, FI-33330 Tampere (FI).

(72) Inventor: **GYLLING, Kai**; Ylimännynkatu 36, FI-33580 Tampere (FI).

(74) Agent: **KANGASMÄKI, Reijo**; Finnish Patent Consulting FPC, PL 25, FI-33401 Tampere (FI).

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(54) Title: METHOD IN PUTTING TOGETHER OF A DOWN-THE-HOLE DRILLING APPARATUS AND A DOWN-THE-HOLE DRILLING APPARATUS

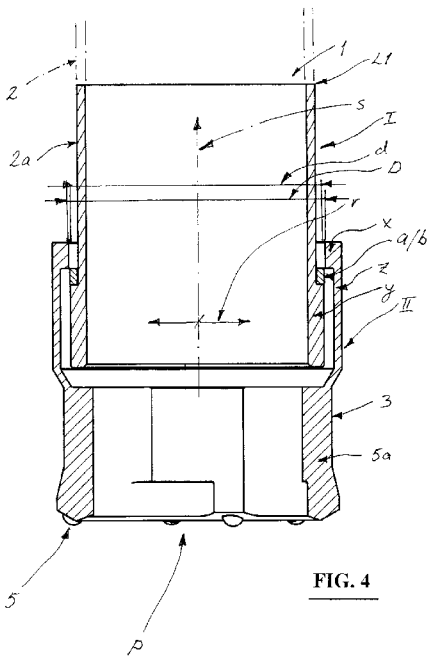

FIG. 4

(57) Abstract: The invention relates to a method in putting together of a down-the-hole drilling apparatus and a down-the-hole drilling apparatus, which apparatus has a drilling device (1) that consists of a casing part (2) and a drilling unit (3) existing at least during a drilling situation in connection with the above, which drilling unit includes in its drilling head a drilling arrangement, such as first drilling means (4) for drilling a center hole and second drilling means (5) for reaming the center hole for the casing part (2), the drilling means (4, 5) being coupled on the first hand at least during a drilling situation mutually in a power transmitting manner in order to carry out co-operation thereof for a rotational motion, a feeding motion and/or a hammering motion, and on the other hand removably in connection with the casing part (2) in order to enable at least remo¬ val of the first drilling means (4) from a drilled hole. The casing part (2) is arranged to be pulled into the hole to be drilled through a shoulder arrangement being arranged at an end thereof by a power influence directed thereto from the drilling unit (3). At an opposite end (II) of the drilling arrangement, such as the second drilling means (5), with respect to a drilling surface (P) of the drilling unit (3), is being arranged a built-in skirt part (z), which has in radial direction (r) an internal shoulder arrangement (x) for pulling the casing part (2) into the hole to be drilled by co-operation of the said internal shoulder arrangement (x) and the external shoulder arrangement (y) arranged at the end (I) of the casing part.

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Method in putting together of a down-the-hole drilling apparatus and a down-the-hole drilling apparatus

The invention relates to a method in putting together of a down-the-hole drilling apparatus and a down-the-hole drilling apparatus according to the preambles of the independent claims related thereto.

A way to carry out down-the-hole drilling in ordinary metal pipe drilling in a deviant manner from traditional asymmetric wing drilling technique is known e.g. from Finnish Patent No. 95618. A drilling head in a drilling unit of the drilling apparatus presented in this patent, existing inside a casing part or in other words a so called earth pipe or casing pipe, is formed of a first frame part and an annular second frame part, the drilling surfaces of which being provided with drilling organs, such as drill bits or like, of the first and second drilling means or in other words of a center drill or a pilot and a reaming drill or a reamer. In this solution the first frame part comprising the first drilling means, is being released from the second frame part comprising the reamer, in order to pull the same alone off from a drilled hole after the drilling situation.

In the solution in question, the second organs of the flushing means for removal of drilling waste being generated are arranged to lead drilling waste by means of an assembly, which locks the said drilling means together for a drilling situation unrotatively in respect with each other and in both directions longitudinally, which is in other words carried out as an advantageous embodiment by loosening grooves of a bayonet coupling, being placed longitudinally on a side surface of the first frame part.

In connection with a drilling device of the type described above, typically a casing shoe is being used at the end of the casing part, by means of which the casing part is pulled into the hole to be drilled by a power influence (F) that is directed to the casing shoe either from the pilot or the reamer. E.g. in figure 3 presenting prior art, the power influence pulling the casing part into the hole is transmitted by counterparts in the casing shoe (8) and the pilot. In the implementation in question, there has been exploited furthermore screw joint principle in the binding means (L) connecting the casing shoe and the reamer in a way that the parts in question can be coupled with each other in a lockable manner in the longitudinal direction by a screw joint, whereby the parts in question stay axially together though the mutual bayonet locking between the pilot and the reamer is opened. Respectively in figures 1 and 2 presenting prior art there has been presented for their part structures, in which the casing part is being pulled through binding means between the casing shoe and the reamer that is by one or in the longitudinal direction two pulling shoulder assemblies one after the other in the parts in question.

Furthermore e.g. from patent EP 1144797 it is known to exploit a so called shrinking method in forming of the binding means between a casing shoe and a rotationally symmetrical drill, in which case the casing shoe is being pressed radially in a way that a locking projection therein gets coupled with a corresponding locking recess in the drill. This kind of a mounting requires high power in order to carry out the press binding, which is why the method in question is applicable usually for coupling of structures, having a maximum outer diameter of 300 mm.

Putting together of a drilling head according to figure 1 takes place typically so that an essentially elongated, in a manner of speaking sleeve-like, casing shoe is being cut during a mounting phase in a machine shop longitudinally at one point and spread open, whereafter it is being pressed together over the reamer. After this, it is being welded by its cutting point back to form once again as a uniform ring. The most remarkable disadvantage of this kind of a structure, being welded together, is the weak point due to the welding seam in the casing shoe, which gets very easily broken under difficult circumstances. A further disadvantage of this solution are thus those "extra" working phases related thereto, because the casing shoe must first of all be cut longitudinally, pressed onto the reamer and finally once again welded together. The drilling device according to figure 2 is being put together by the shrinking method explained above that is by pressing and the one shown in figure 3 by using a screw joint, in which case the screw joint does not, however, carry load during drilling.

Furthermore particularly applications for use of so called plastic pipe drilling typically e.g. well drilling or e.g. forepoling come into question. An advantage of use of a plastic pipe in drilling is first of all the fact that plastic pipes are very light compared to steel pipes, thanks to which they also have more profitable transport costs and they are easier to handle at a construction site. Furthermore a plastic pipe is significantly cheaper than a corresponding steel pipe. A plastic pipe does not rust for that matter and when being mounted into the ground, it does not break the bits of crushers or drills, when the soil is later on being e.g. worked or drilled. Furthermore in caves or quarries, metal may not blend with broken rocks, which is why use of plastic pipes in drilling has a very remarkable meaning in that context as well.

Today significant problems are, however, related to plastic pipe drilling, which is why it is not possible to exploit the same to the extent that there is a need for or that there are possibilities in practice. This is among other things due to the fact that the present arrangements require first of all use of a steel pipe in the beginning of drilling, whereby it is only after that possible to start using in the drilling a plastic pipe to be coupled with the steel pipe e.g. by a screw joint and after that further plastic pipes to be coupled with each other one after the other. On the other hand solutions are being used, which are based on a screw joint coupling between a plastic pipe with a readymade threading and a casing shoe.

The former solution is not satisfactory first of all due to the fact that there is still a need for use of a steel pipe in the starting phase, whereby it is possible to exploit plastic pipes with preworked threadings only after the above phase. On the other hand use of plastic pipes with readymade threadings has, however, found out to be also very difficult in practice, because a threaded part of a plastic pipe being coupled with a casing shoe made of steel easily gets cut due to differences in shapes of mutual threadings in the parts in question. The problems related to preworked threadings in plastic pipes are probably due to the differences of steel and plastic e.g. because of strength and thermal expansion characteristics thereof and the like reasons.

There have been efforts for further development of joint arrangements in plastic pipes with readymade threadings e.g. by using first of all a coupling part coupled with the plastic pipe with a screw joint and on the other hand a very long coupling stem in the casing shoe with necessary elasticity means, such as damping O-rings, despite of which a screw joint between a ca-

sing shoe and a plastic pipe to be carried out with reasonable costs has not been managed to reliably accomplish so far. All the types of arrangements described above require unnecessarily massive arrangements in carrying out a screw joint between the casing shoe and the plastic pipe, which is why they increase the manufacturing costs disproportionately and make use of the solutions in question significantly more difficult in practical installation work.

Particularly for the part of a drilling apparatus comprising a rotationally symmetrical pilot and a reamer, there has been found a further need for development of its construction particularly due to the problems related to use of a traditional casing shoe with a view both to metal and plastic pipe drilling, because the type of solutions described above for the mutual coupling of a drilling unit and a casing part by using a casing shoe have been found unsatisfactory.

It is an aim of the present method and the down-the-hole drilling apparatus to achieve a decisive improvement particularly for the putting together of the type of down-the-hole drilling apparatus described above and thus to raise essentially the level of prior art. In order to carry out this aim, the method and the down-the-hole drilling apparatus according to the invention are mainly characterized by what has been presented in the characterizing parts of the independent claims related thereto.

As the most important advantages of the method and the down-the-hole drilling apparatus according to the invention may be mentioned simplicity of constructions and operating principles enabled by the same first of all thanks to the fact that the functionality of the rotationally symmetrical drilling apparatus, being found profitable in practice as such, can be further

improved, because thanks to the invention it is possible to make particularly the mounting phases related to the putting together of a drilling unit more efficient and to significantly decrease material consumption. The above is particularly thanks to the fact that there is no more need for use a traditional casing shoe, but instead the drilling unit can be coupled in a machine shop in a preliminary working phase to be coupled, as an advantageous embodiment as a separate part, with the end of the casing part, which for its part can be coupled with traditional arrangements as such furthermore in connection with the end of the casing part endways or e.g. partly in an overlapping manner e.g. by flash welding, spot welding, glueing, or by mechanical arrangements, such as by a screw, cotter pin, snap lock joint or correspondingly etc.

A further crucial advantage of the invention is furthermore the fact that it enables increasing the efficiency of production with a view to both traditional metal pipe drilling and plastic pipe drilling. A coupling between the reamer and the casing part, being produced according to the invention, can be carried out by exploiting shrinking technique more efficiently than before and when needed even with bigger dimensions than the solutions described in the beginning, particularly thanks to the simple structure of the reamer's skirt part, in which case the wall thicknesses thereof can be minimized when compared to traditional casing shoe constructions. By virtue of the invention, in the coupling between the drilling unit and the casing part, disproportionately high use of power is thus not required, thanks to the invention enabling on the first hand savings in materials thanks to the functioning of the casing shoe being integrated in the reamer and on the other hand the putting together getting more efficient thanks to avoiding the mounting phases due to the longitudinal cutting of the casing shoe.

Other advantageous embodiments of the method and the down-the-hole drilling apparatus according to the present invention have been presented in the dependent claims related thereto.

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

in figure 1

is shown as a longitudinal cross-sectional view an implication according to prior art related to metal pipe drilling, in which the mutual jointing means of the casing shoe and the reamer are arranged by two successive pulling shoulders in the longitudinal direction in the parts in question,

in figure 2

is shown as a longitudinal cross-sectional view an implication according to prior art related to metal pipe drilling, in which the jointing means between the casing shoe and the reamer are carried out by one pulling shoulder in each,

in figure 3

is shown as a longitudinal cross-sectional view an implication according to prior art related to metal pipe drilling, in which the jointing means between the casing shoe and the reamer are carried out by a screw joint and, in which pulling of the casing part into the hole takes place by shoulders between the pilot and the casing shoe,

in figure 4

is shown as a longitudinal cross-sectional view an advantageous reamer manufactured according to the invention after manufacturing thereof prior to pressing thereof and mounting of the pilot in its place,

in figure 5

is shown as a longitudinal cross-sectional view the coupling of the reamer according to figure 4 as a further advantageous embodiment with an extension part to be coupled with the end of the casing part,

in figure 6

is shown as a longitudinal cross-sectional view a composition according to figure 4, being pressed together, in which the pilot has been placed in its place,

in figure 7

is shown a longitudinal cross-sectional view a further advantageous composition, being carried out according to the invention, of an external shoulder arrangement in connection with the reamer and the end of the casing part, and

in figure 8

is shown furthermore as a longitudinal cross-sectional view an advantageous composition according to the invention of the reamer and the end of the casing part.

The invention relates first of all to a method in putting together of a down-the-hole drilling apparatus, which apparatus has a drilling device 1 that consists of a casing part 2 and a drilling unit 3 existing at

least during a drilling situation in connection with the above, which drilling unit includes in its drilling head a drilling arrangement, such as first drilling means 4 for drilling a center hole and second drilling means 5 for reaming the center hole for the casing part 2, the drilling means 4, 5 being coupled on the first hand at least during a drilling situation mutually in a power transmitting manner in order to carry out co-operation thereof for a rotational motion, a feeding motion and/or a hammering motion, and on the other hand removably in connection with the casing part 2 in order to enable at least removal of the first drilling means 4 from a drilled hole. The casing part 2 is arranged to be pulled into the hole to be drilled by a power influence directed thereto from the drilling unit 3 through a shoulder arrangement being arranged at an end of the casing part. At an opposite end II of the drilling arrangement, such as the second drilling means 5, with respect to a drilling surface P of the drilling unit 3, there has been arranged e.g. as shown in figure 4 a built-in skirt part z, which has in radial direction r an internal shoulder arrangement x for pulling the casing part 2 into the hole to be drilled by co-operation of the said internal shoulder arrangement x and the external shoulder arrangement y being arranged at the end I of the casing part.

In the method according to the invention the internal shoulder arrangement x in connection with the second drilling means 5, such as an internal flange at an end of the skirt part z, is being manufactured e.g. on the principle that manifests itself in figure 4 by its inner diameter D essentially larger than the outer diameter d of the corresponding external shoulder arrangement y of the casing part 2, such as a cantilever flange at an end thereof, whereby a mutual joint L2 between the parts in question that transmits pulling in longitudinal direction s is being formed on the princi-

ple that manifests itself in figure 5 by placing the shoulder arrangements x, y, being put on top of each other, to overlap one another and by shrinking F1 the internal shoulder arrangement x in the longitudinal direction s behind the external shoulder arrangement y.

As an advantageous embodiment of the method according to the invention particularly with reference to figure 6 the drilling head of the drilling unit 3 is formed of a first frame part 4a and a second frame part 5a, wherein drilling surfaces P; P1, P2 formed of end surfaces of the above frame parts are provided with drilling organs of the first and the second drilling means 4, 5, such as an integrated drilling part, separate drilling pieces, bits or like. Furthermore particularly with reference to figure 4 at the end of the casing part 2 is being arranged an extension part to be fastened thereto separately and that is equipped with a shoulder arrangement. The extension part 2a is being coupled with the end of the casing part 2 by what ever suitable e.g. mechanical joint arrangement L1, chemical joint arrangement L1 and/or joint arrangement L1 based on melting.

As a further advantageous embodiment of the method according to the invention, in plastic pipe drilling, as the casing part 2 an essentially unpreworked raw pipe preform is being used, which is manufactured particularly for food stuff utilization preferably from PEH-, PVC-plastic or the like and/or from reinforced plastic, such as fibre-reinforced plastic or the like.

Furthermore as an advantageous embodiment of the method according to the invention particularly with reference to figures 4 and 6 in the longitudinal direction s between the shoulder arrangements x, y is being placed (e.g. by pushing in its place from behind prior to radial pressing together of the skirt part z) at least

one wear/slide ring a particularly in order to minimize thermal influence directed to the external shoulder arrangement y. What is meant by the above in practise is that e.g. a wear/slide ring a made of e.g. plastic, metal, composite and/or ceramic material acts as a slide surface for the internal shoulder arrangement x, in which case heat or wear is not directed to the external shoulder arrangement y.

Depending on e.g. drilling circumstances at any given time, with reference particularly to figure 7 as a further advantageous embodiment as an alternative to the above mentioned or as an advantageous complementary embodiment, in the longitudinal direction s between the shoulder arrangements x, y is being placed at least one elastic/friction ring b particularly in order to minimize impact and thermal influence directed to the external shoulder arrangement y. What is meant by the above in practise is that the elastic/friction ring above e.g. made of elastic plastic, rubber, silicon and/or the like material and that is placed advantageously directly against the external shoulder arrangement y absorbs e.g. vibration directed to the external shoulder arrangement from a hammering motion and eliminates rotative motion taking place against it, in which case excessive heating thereof can be avoided.

The invention relates on the other hand to a down-the-hole drilling apparatus, which has a drilling device 1 that consists of a casing part 2 and a drilling unit 3 existing at least during a drilling situation in connection with the above, which drilling unit includes in its drilling head a drilling arrangement, such as first drilling means 4 for drilling a center hole and second drilling means 5 for reaming the center hole for the casing part 2, the drilling means 4, 5 being coupled on the first hand at least during a drilling situation mutually in a power transmitting manner in order to

carry out co-operation thereof for a rotational motion, a feeding motion and/or a hammering motion, and on the other hand removably in connection with the casing part 2 in order to enable at least removal of the first drilling means 4 from a drilled hole. The casing part 2 is arranged to be pulled into the hole to be drilled by a power influence directed thereto from the drilling unit 3 through a shoulder arrangement being arranged at an end of the casing part. At an opposite end II of the drilling arrangement, such as the second drilling means 5, with respect to a drilling surface P of the drilling unit 3, there has been arranged e.g. on the principle shown in figure 4 a built-in skirt part z, which has in radial direction r an internal shoulder arrangement x for pulling the casing part 2 into the hole to be drilled by co-operation of the said internal shoulder arrangement x and the external shoulder arrangement y being arranged at the end I of the casing part.

In the down-the-hole drilling apparatus according to the invention, an inner diameter D of the internal shoulder arrangement x in connection with the second drilling means 5, such as an internal flange at an end of the skirt part z, is essentially larger than the outer diameter d of the corresponding external shoulder arrangement y of the casing part 2, such as a cantilever flange at an end thereof, in order to form a mutual joint L2 between the parts in question that transmits pulling in longitudinal direction s on the principle shown in figure 5 by placing the shoulder arrangements x, y, being put on top of each other, to overlap one another and by shrinking F1 the internal shoulder arrangement x in the longitudinal direction s behind the external shoulder arrangement y.

As an advantageous embodiment of the down-the-hole drilling apparatus according to the invention, the drilling head of the drilling unit 3 is formed of a

first frame part 4a and a second frame part 5a, wherein drilling surfaces P; P1, P2 formed of end surfaces of the above frame parts are provided with drilling organs of the first and the second drilling means 4, 5, such as an integrated drilling part, separate drilling pieces, bits or like, and, whereby at the end of the casing part 2 is arranged an extension part to be fastened thereto separately and that is equipped with a shoulder arrangement. The extension part 2a provided with an external shoulder arrangement y is coupled with the end of the casing part 2 e.g. by a mechanical joint arrangement L1, chemical joint arrangement L1 and/or a joint arrangement L1 based on melting.

As a further advantageous embodiment of the down-the-hole drilling apparatus according to the invention, in plastic pipe drilling the casing part 2 is an essentially unpreworked raw pipe preform, which is manufactured particularly for food stuff utilization preferably from PEH-, PVC-plastic or the like and/or from reinforced plastic, such as fibre-reinforced plastic or the like. Furthermore, in the longitudinal direction s between the shoulder arrangements x, y, is arranged with reference to the advantageous embodiment shown in figures 4, 6 and 7 at least one:

- wear/slide ring a particularly in order to minimize thermal influence directed to the external shoulder arrangement y, and/or
- elastic/friction ring b particularly in order to minimize impact and thermal influence directed to the external shoulder arrangement y.

It is clear that the invention is not limited to the embodiments shown or described above, but instead it can be modified within limits of the basic idea of the invention according to the needs and circumstances, such as the drilling site, at any given time. It is thus clear, that the constructions of the drilling

devices being illustrated in the appended drawings may vary in practice very much merely when being carried out with differing diameters. Instead of the type of embodiments shown e.g. in the appended drawings, it is naturally possible to use as the drilling device also other drilling devices that are applicable for the same purpose, in which a casing part is being exploited in connection with the drilling that is being drawn into the ground most profitably unrotatively. It is not that significant for the method and the apparatus according to the invention, either, how the first and second drilling means are coupled to work, so that most heterogeneous solutions can be exploited as the power transmission assemblies between the same particularly thanks to the "external" functioning of the flushing flow with respect to the fastening arrangement starting from a screw joint locking. The invention is naturally applicable for use of a single part drilling device, which in that case does not have a separate reamer and pilot.

Claims:

1. Method in putting together of a down-the-hole drilling apparatus, which apparatus has a drilling device (1) that consists of a casing part (2) and a drilling unit (3) existing at least during a drilling situation in connection with the above, which drilling unit includes in its drilling head a drilling arrangement, such as first drilling means (4) for drilling a center hole and second drilling means (5) for reaming the center hole for the casing part (2), the drilling means (4, 5) being coupled on the first hand at least during a drilling situation mutually in a power transmitting manner in order to carry out co-operation thereof for a rotational motion, a feeding motion and/or a hammering motion, and on the other hand removably in connection with the casing part (2) in order to enable at least removal of the first drilling means (4) from a drilled hole, whereby the casing part (2) is arranged to be pulled into the hole to be drilled by a power influence directed thereto from the drilling unit (3) through a shoulder arrangement being arranged at an end of the casing part, and, whereby at an opposite end (II) of the drilling arrangement, such as the second drilling means (5), with respect to a drilling surface (P) of the drilling unit (3), there has been arranged a built-in skirt part (z), which has in radial direction (r) an internal shoulder arrangement (x) for pulling the casing part (2) into the hole to be drilled by co-operation of the said internal shoulder arrangement (x) and the external shoulder arrangement (y) being arranged at the end (I) of the casing part, **characterized** in that, the internal shoulder arrangement (x) in connection with the second drilling means (5), such as an internal flange at an end of the skirt part (z), is being manufactured by its inner diameter (D) essentially larger than the outer diameter (d) of the corresponding external shoulder arrangement (y) of the casing

part (2), such as a cantilever flange at an end thereof, whereby a mutual joint (L2) between the parts in question that transmits pulling in longitudinal direction (s) is being formed by placing the shoulder arrangements (x, y), being put on top of each other, to overlap one another and by shrinking (F1) the internal shoulder arrangement (x) in the longitudinal direction (s) behind the external shoulder arrangement (y).

2. Method according to claim 1 when using an apparatus, in which the drilling head of the drilling unit (3) is formed of a first frame part (4a) and a second frame part (5a), wherein drilling surfaces (P; P1, P2) formed of end surfaces of the above frame parts are provided with drilling organs of the first and the second drilling means (4, 5), such as an integrated drilling part, separate drilling pieces, bits or like, and, whereby at the end of the casing part (2) is being arranged an extension part to be fastened thereto separately and that is equipped with a shoulder arrangement, **characterized** in that, the extension part (2a) provided with an external shoulder arrangement (y) is being coupled with the end of the casing part (2) by a mechanical joint arrangement (L1), chemical joint arrangement (L1) and/or a joint arrangement (L1) based on melting.

3. Method according to claim 1 or 2 **characterized** in that, in plastic pipe drilling, as the casing part (2) an essentially unpreworked raw pipe preform is being used, which is manufactured particularly for food stuff utilization preferably from PEH-, PVC-plastic or the like and/or from reinforced plastic, such as fibre-reinforced plastic or the like.

4. Method according to claim 3 **characterized** in that, in the longitudinal direction (s) between the shoulder arrangements (x, y) is being placed at least

one wear/slide ring (a) particularly in order to minimize thermal influence directed to the external shoulder arrangement (y).

5. Method according to claim 3 or 4 **characterized** in that, in the longitudinal direction (s) between the shoulder arrangements (x, y) is being placed at least one elastic/friction ring (b) particularly in order to minimize impact and thermal influence directed to the external shoulder arrangement (y).

6. Down-the-hole drilling apparatus, which has a drilling device (1) that consists of a casing part (2) and a drilling unit (3) existing at least during a drilling situation in connection with the above, which drilling unit includes in its drilling head a drilling arrangement, such as first drilling means (4) for drilling a center hole and second drilling means (5) for reaming the center hole for the casing part (2), the drilling means (4, 5) being coupled on the first hand at least during a drilling situation mutually in a power transmitting manner in order to carry out co-operation thereof for a rotational motion, a feeding motion and/or a hammering motion, and on the other hand removably in connection with the casing part (2) in order to enable at least removal of the first drilling means (4) from a drilled hole, whereby the casing part (2) is arranged to be pulled into the hole to be drilled by a power influence directed thereto from the drilling unit (3) through a shoulder arrangement being arranged at an end of the casing part, and, whereby at an opposite end (II) of the drilling arrangement, such as the second drilling means (5), with respect to a drilling surface (P) of the drilling unit (3), there has been arranged a built-in skirt part (z), which has in radial direction (r) an internal shoulder arrangement (x) for pulling the casing part (2) into the hole to be drilled by co-operation of the said internal

shoulder arrangement (x) and the external shoulder arrangement (y) being arranged at the end (I) of the casing part, **characterized** in that, an inner diameter (D) of the internal shoulder arrangement (x) in connection with the second drilling means (5), such as an internal flange at an end of the skirt part (z), is essentially larger than the outer diameter (d) of the corresponding external shoulder arrangement (y) of the casing part (2), such as a cantilever flange at an end thereof, in order to form a mutual joint (L2) between the parts in question that transmits pulling in longitudinal direction (s) by placing the shoulder arrangements (x, y), being put on top of each other, to overlap one another and by shrinking (F1) the internal shoulder arrangement (x) in the longitudinal direction (s) behind the external shoulder arrangement (y).

7. Apparatus according to claim 6, in which the drilling head of the drilling unit (3) is formed of a first frame part (4a) and a second frame part (5a), wherein drilling surfaces (P; P1, P2) formed of end surfaces of the above frame parts are provided with drilling organs of the first and the second drilling means (4, 5), such as an integrated drilling part, separate drilling pieces, bits or like, and, whereby at the end of the casing part (2) is arranged an extension part to be fastened thereto separately and that is equipped with a shoulder arrangement, **characterized** in that, the extension part (2a) provided with an external shoulder arrangement (y) is coupled with the end of the casing part (2) by a mechanical joint arrangement (L1), chemical joint arrangement (L1) and/or a joint arrangement (L1) based on melting.

8. Apparatus according to claim 6 or 7 **characterized** in that, in plastic pipe drilling the casing part (2) is an essentially unpreworked raw pipe preform, which is manufactured particularly for food stuff uti-

lization preferably from PEH-, PVC-plastic or the like and/or from reinforced plastic, such as fibre-reinforced plastic or the like.

9. Apparatus according to claim 8 **characterized** in that, in the longitudinal direction (s) between the shoulder arrangements (x, y) is arranged at least one wear/slide ring (a) particularly in order to minimize thermal influence directed to the external shoulder arrangement (y).

10. Apparatus according to claim 8 or 9 **characterized** in that, in the longitudinal direction (s) between the shoulder arrangements (x, y) is arranged at least one elastic/friction ring (b) particularly in order to minimize impact and thermal influence directed to the external shoulder arrangement (y).

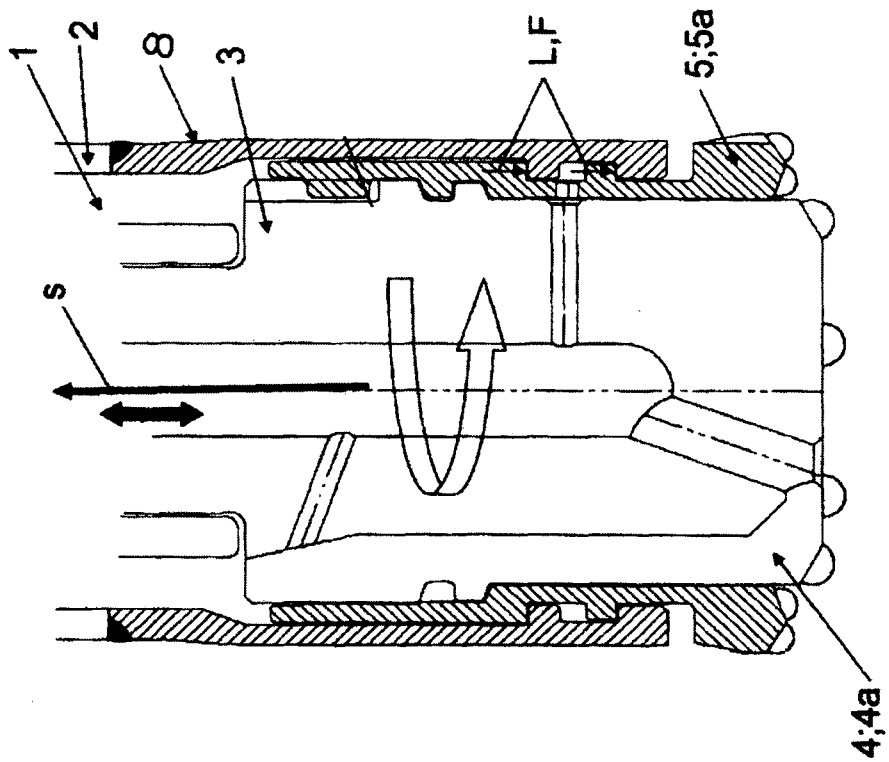

FIG 1.
PRIOR ART

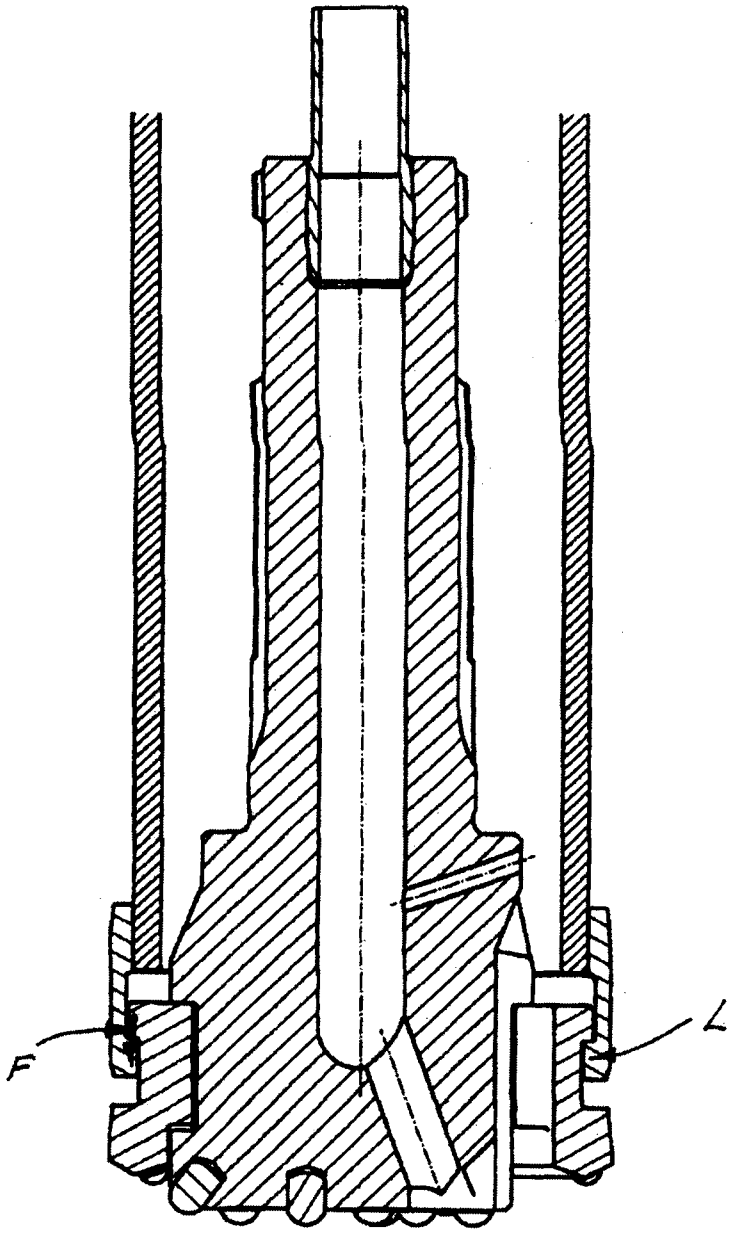

FIG. 2
PRIOR ART

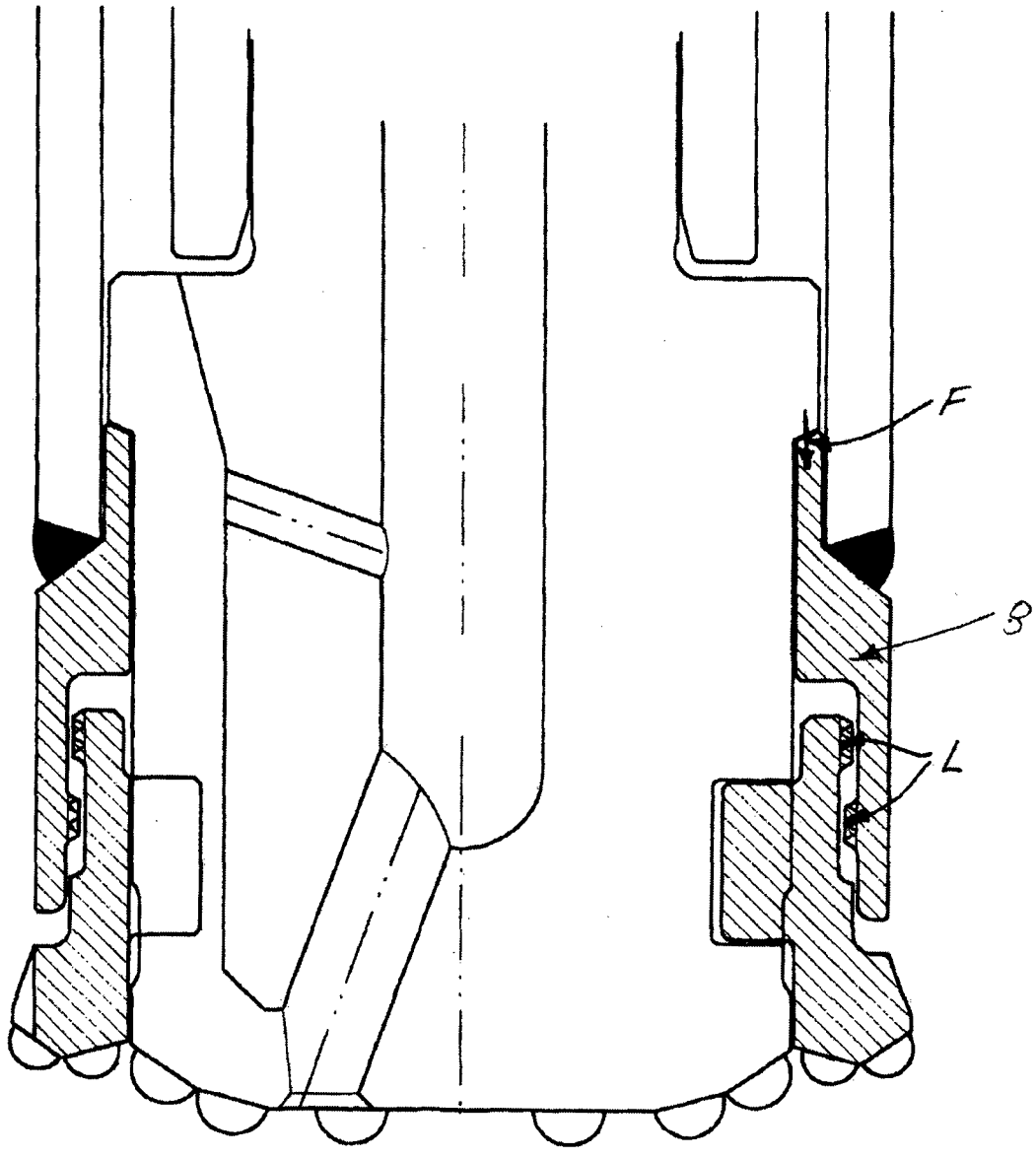

Fig. 3
PRIOR ART

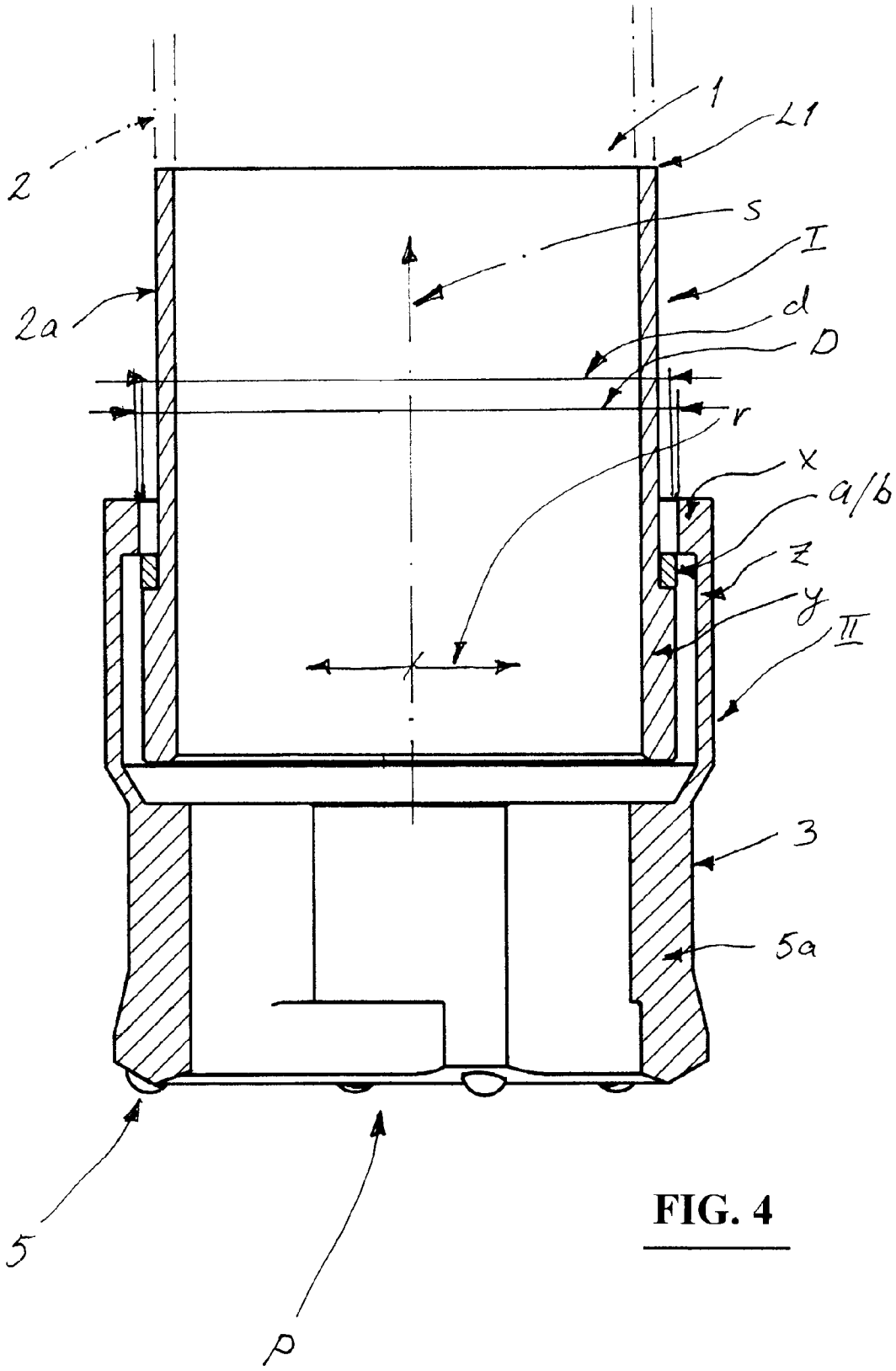

FIG. 4

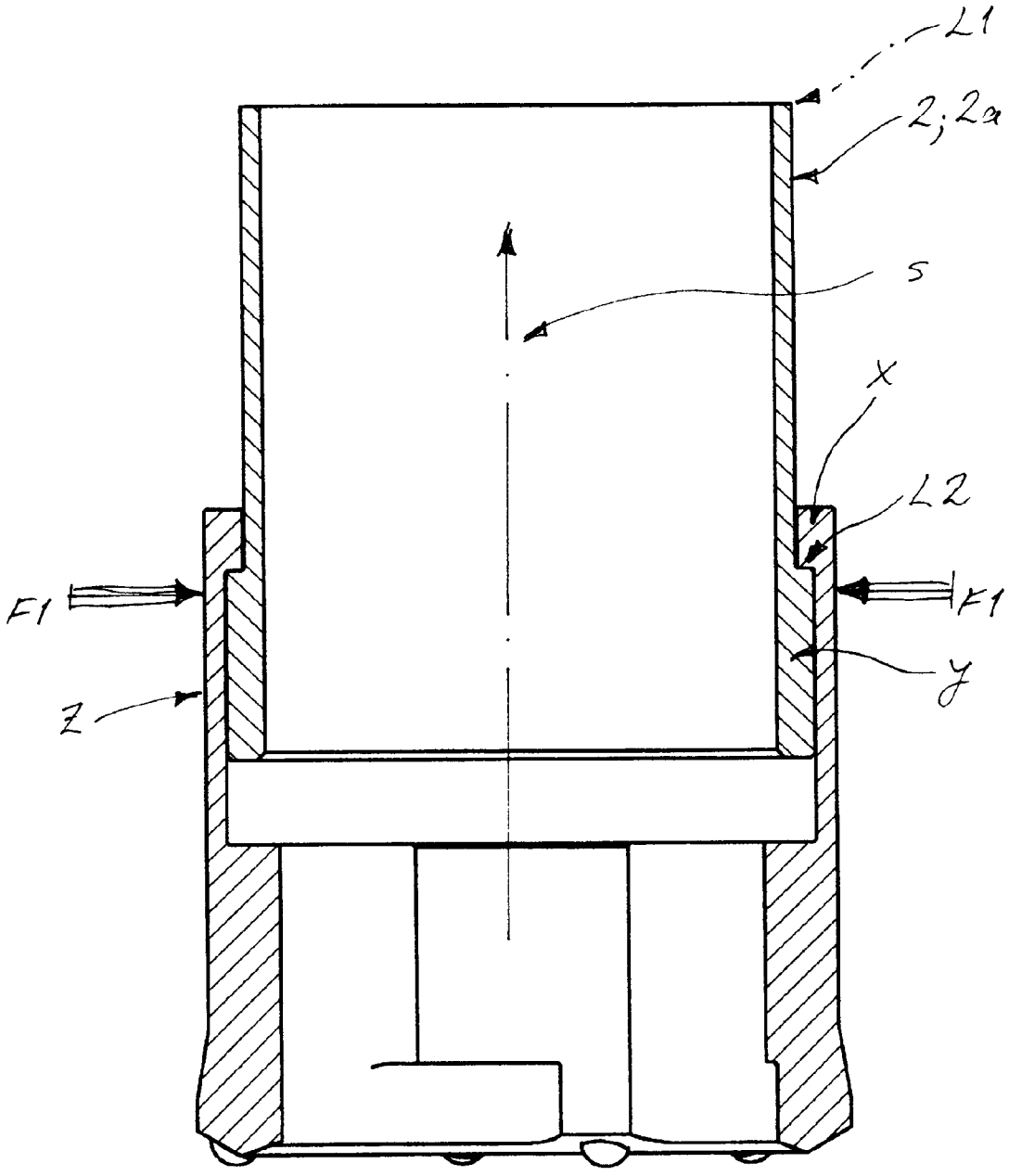

FIG. 5

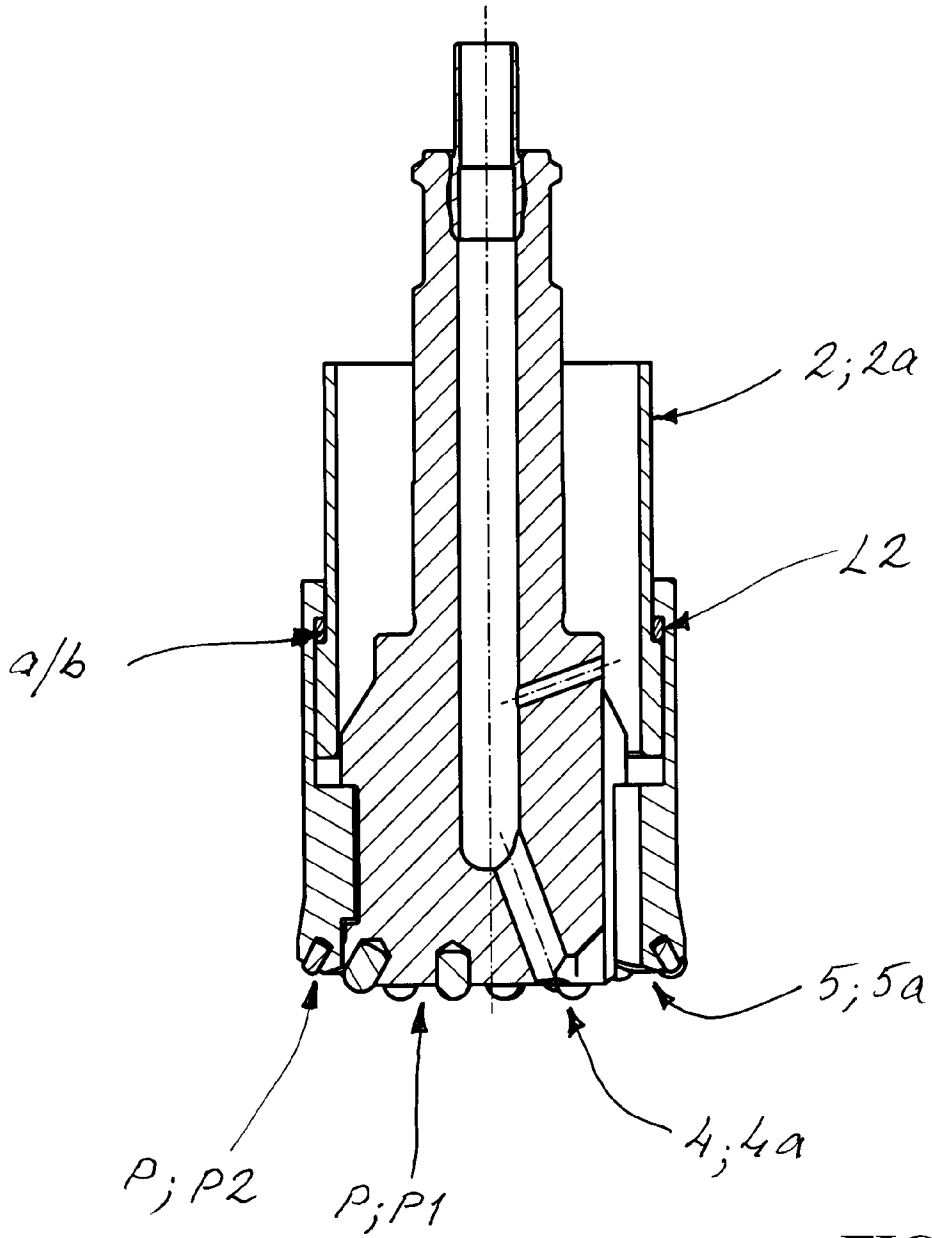

FIG. 6

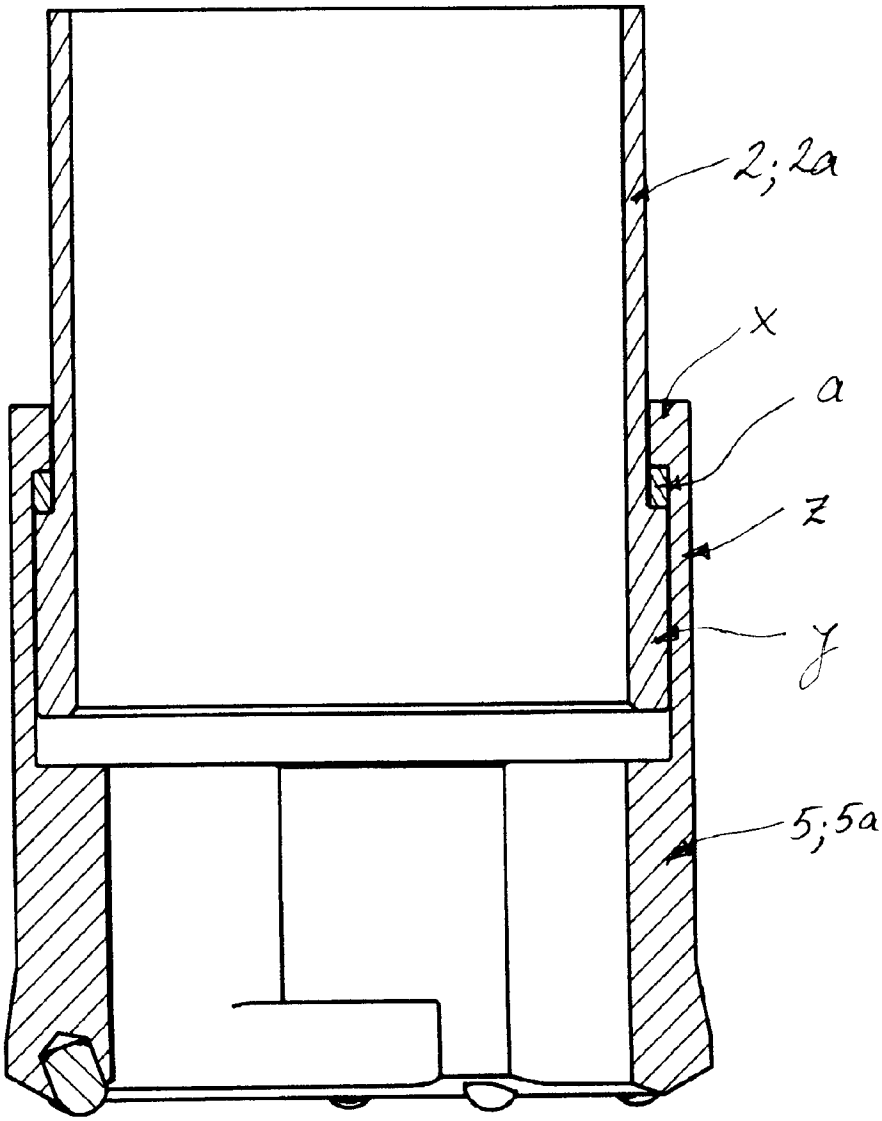

FIG. 7

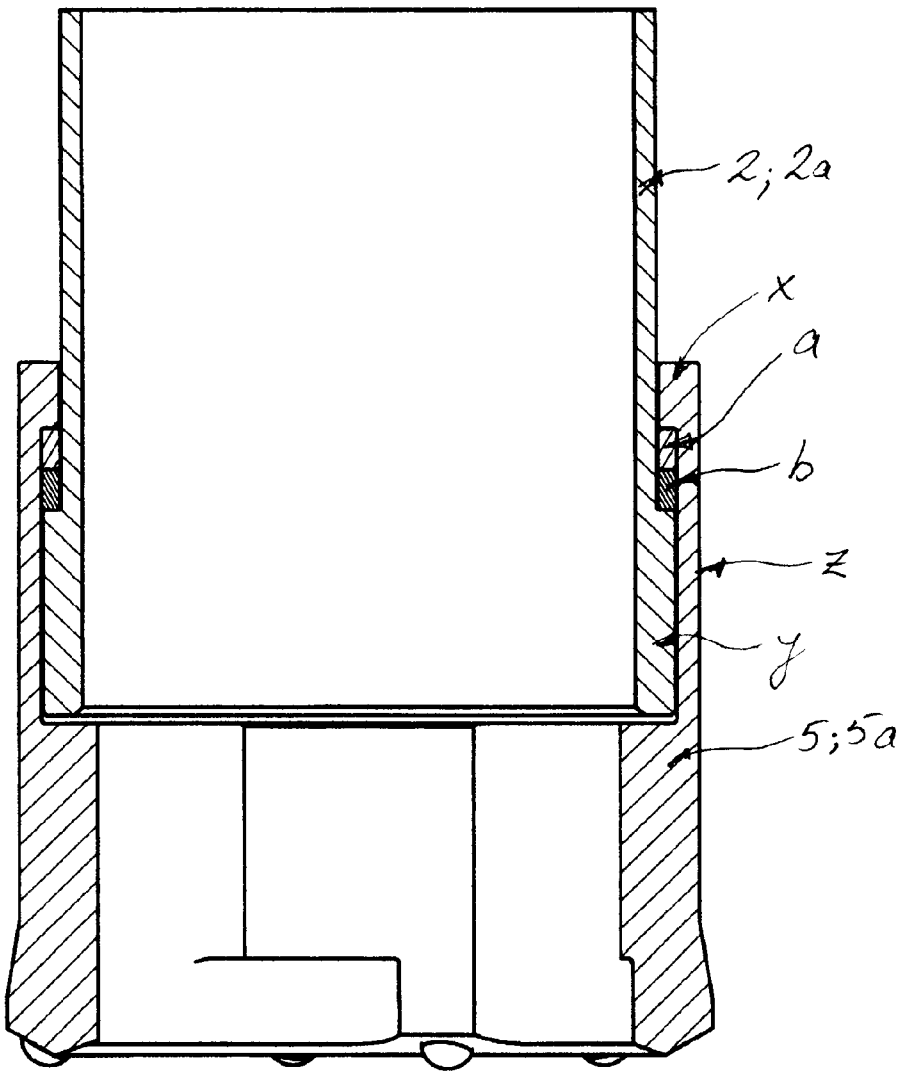

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2014/050366

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2009007494 A1 (ROBIT ROCKTOOLS LTD ET AL), 15 January 2009 (2009-01-15); whole document --	1-10
A	WO 9529321 A1 (ATLAS COPCO ROCKTECH AB ET AL), 2 November 1995 (1995-11-02); whole document --	1-10
A	CN 201083085 Y (BIN LI), 9 July 2008 (2008-07-09); whole document --	1-10
A	US 20030038476 A1 (GALLE EDWARD M -(B2) GALLE JR EDWARD M [US] ET AL), 27 February 2003 (2003-02-27); whole document --	1-10

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30-10-2014	03-11-2014
Name and mailing address of the ISA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Christer Bäcknert Telephone No. + 46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2014/050366

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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International application No.
PCT/FI2014/050366

Continuation of: second sheet

International Patent Classification (IPC)

E21B 17/14 (2006.01)
E21B 17/04 (2006.01)
E21B 7/20 (2006.01)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2014/050366

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