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(54) Title: JOINT ARRANGEMENT FOR COUPLING OF A DRILL SHOE

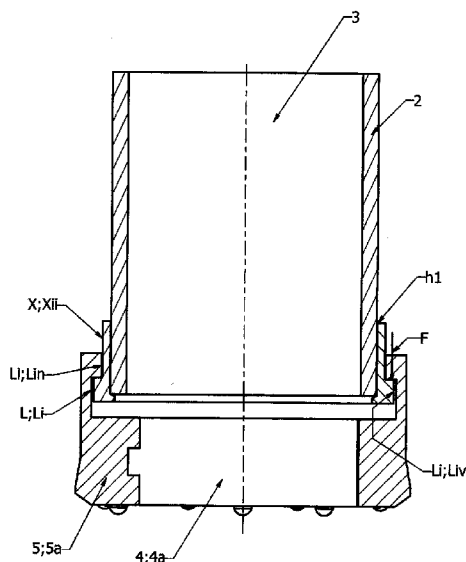


FIG 2

(57) Abstract: The invention relates to a joint arrangement for coupling of a drill shoe, the drill shoe being meant to be used when drilling a hole into the ground with a protective tube by means of a drilling device (1) that has a casing part (2) acting as the protective tube and a drilling unit (3), in a drilling head of which there are at least first drilling means (4), such as a pilot, for drilling a center hole and second drilling means (5), such as a reamer, for forming of an actual drilling hole for the casing part (2) by reaming the center hole, and whereby the casing part (2) is arranged to be pulled into the hole to be drilled by means of a joint arrangement (L), comprising a drill shoe (X) to be attached to the casing part (2) preferably by welding (h1) and being coupled with the drilling unit (3) by coupling means that enable rotative motion of the drilling unit (3) with respect to the drill shoe and that transmit power in a longitudinal direction (s). The joint arrangement comprises a drill shoe (X; Xii) that is to be coupled with respect to the second drilling means (5) essentially internally therewith. Furthermore the drill shoe pulls the casing part (2) into the hole by a power influence (F) transmitted to the drill shoe from the second drilling means (5).

Joint arrangement for coupling of a drill shoe

5 The invention relates to a joint arrangement for coupling of a drill shoe, the drill shoe being meant to be used when drilling a hole into the ground with a protective tube by means of a drilling device that has a casing part acting as the protective tube and a drilling unit, in a drilling head of which there are at
10 least first drilling means, such as a pilot, for drilling a center hole and second drilling means, such as a reamer, for forming of an actual drilling hole for the casing part by reaming the center hole, and whereby the casing part is arranged to be pulled into the hole
15 to be drilled by means of a joint arrangement, comprising a drill shoe to be attached to the casing part advantageously by welding and being coupled with the drilling unit by coupling means that enable rotative motion of the drilling unit with respect to
20 the drill shoe and that transmit power in a longitudinal direction.

The type of implementation described above has been presented in Finnish Patent number 95618, whereby the
25 protective tube is arranged to be pulled into the hole to be drilled by power influence transmitted from the first drilling means or the pilot. In this solution, the drill shoe is coupled usually in a machine workshop during a manufacturing phase of the drilling unit also
30 with the second drilling means that is the reamer by means of a coupling assembly that enables mutual rotative motion thereof and locking of the same with each other in the longitudinal direction. The drilling unit, being put together as described above, is then
35 brought to the operating site, where the drill shoe thereof is being welded to the protective tube, whereafter it is possible to initiate drilling after other necessary couplings are made.

When keeping in mind certain applications, there has been a need for development of the construction mentioned above so, that the protective tube is being pulled into the hole to be drilled by power influence being transmitted to the drill shoe from the reamer. One solution of this type has been presented in the enclosed figure 1, which solution is being put together typically in a way that an essentially elongated, so to say sleeve-like drill shoe is cut longitudinally at one point and spread open, whereby it is then afterwards in the machine workshop during an installation phase pressed back together around the reamer. After this, it is welded back together by its cutting point as a uniform ring. A disadvantage of this solution is that the drill shoe first of all needs to be pressed back together with the reamer and welded together at the machine workshop, whereafter it must be furthermore on the other hand welded into the end of the protective tube at the operating site.

In certain drilling unit constructions, particularly when a wall thickness of a ring shaped reamer increases with respect to the diameter of the center hole, there has been found a further need for development of the construction particularly for the part of coupling of the drill shoe, since the type of solutions described above require either coupling of the drill shoe and the drilling unit during a preliminary stage at the machine workshop or rather demanding and laborious installation measures at the operating site, when keeping in mind particularly the difficulty of welding of the drill shoe, being usually manufactured of tempered steel. On the other hand, a drill shoe of the type described above, which is to be pulled into the hole by the reamer and to be coupled externally with the reamer, is rather oblong, whereby, when increasing the dimensions of the reamer with respect to the diameter of the center hole, an even sturdier wall thickness of the

drill shoe is required, which makes putting together thereof even more difficult at the operating site.

5 It is an aim of the joint arrangement according to the present invention, being meant for coupling of the drill shoe, to achieve a decisive improvement in the problems described above and thus to raise essentially the level of prior art. In order to bring about this aim, the joint arrangement according to the invention
10 is mainly characterized by that the joint arrangement comprises a drill shoe that is to be coupled with respect to the second drilling means essentially internally therewith and that the drill shoe pulls the casing part into the hole by a power influence
15 transmitted to the drill shoe from the second drilling means.

As the most important advantages of the joint arrangement according to the invention may be mentioned
20 simplicity and profitability of the structures belonging thereto, which first of all make installation of the drill shoe significantly easier. Thanks to the invention, it is thus possible to minimize measures in the manufacturing phase of the drilling unit at a machine workshop thanks to the fact that the drill shoe
25 needs not to be coupled with the drilling unit at the machine workshop in a preliminary stage, but instead all measures in order to couple the drill shoe with the drilling unit and the protective tube can be carried out e.g. by ordinary joint welds at an operating site.
30 When applying the joint arrangement according to the invention advantageously, the drill shoe can first of all be put together from two or more parts, which parts are slipped one at a time in place in a fixed fastening groove, existing at a rear part of the reamer,
35 whereafter the protective tube will be installed inside the assembled drill shoe and welded together therewith by an ordinary transverse joint weld. On the other

hand, as a further advantageous embodiment of the joint arrangement according to the invention, when exploiting a uniform drill shoe, it is possible to weld the drill shoe together with the protective tube in a usual manner at an operating site and after that to couple the protective tube, being equipped with the drill shoe, furthermore together with the reamer by means of a separate fastening flange that is to be coupled therewith by a transverse joint weld. The invention enables thus a remarkable cost saving when keeping in mind both manufacturing of the drilling unit at a machine workshop and introduction of the drill shoe at an operating site.

Advantageous embodiments of the joint arrangement according to the 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 an exemplary longitudinal cross section of a drilling shoe according to the prior art that pulls the protective tube into the ground by power influence transmitted from the reamer,

in figure 2

is shown as a longitudinal cross section an advantageous implementation of the joint arrangement according to the invention,

in figures 3a - 3c

is shown putting together of the embodiment shown in figure 2 step by step, and

in figure 4

is shown an alternative or complementary implementation of the joint arrangement according to the invention.

5

The invention relates to a joint arrangement for coupling of a drill shoe, the drill shoe being meant to be used when drilling a hole into the ground with a protective tube by means of a drilling device 1 that has a casing part 2 acting as the protective tube and a drilling unit 3, in a drilling head of which there are at least first drilling means 4, such as a pilot, for drilling a center hole and second drilling means 5, such as a reamer, for forming of an actual drilling hole for the casing part 2 by reaming the center hole, and whereby the casing part 2 is arranged to be pulled into the hole to be drilled by means of a joint arrangement L, comprising a drill shoe X to be attached to the casing part 2 advantageously by welding h1, and being coupled with the drilling unit 3 by coupling means that enable rotative motion of the drilling unit 3 with respect to the drill shoe and that transmit power in a longitudinal direction s. The joint arrangement comprises a drill shoe X; Xi, Xii that is to be coupled with respect to the second drilling means 5 essentially internally therewith. Furthermore the drill shoe pulls the casing part 2 into the hole by a power influence F transmitted to the drill shoe from the second drilling means 5.

30

A joint arrangement according to the invention is advantageously utilized in connection with a drilling device 1, the drilling head of the drilling unit 3 thereof being formed from a first and a second frame part 4a, 5a that are to be coupled with each other and drilling surfaces of which are provided with drilling organs 10a, 10b of the first and second drilling means 4, 5, such as a uniform cutting part, separate drill

35

bits or parts or like; wherein the first frame part 4a thereof is arranged separable from the second frame part 5a in order to enable its removal from a drilled hole; wherein a radial outer surface of the first frame part 4a is provided with an essentially longitudinal s groove assembly particularly for leading of drilling waste or flushing medium internally within the protective tube 2 and/or in order to enable a mutual longitudinal motion of the first and second frame parts 4a, 5a; wherein during a drilling situation a rotative motion w4 of the first drilling means 4 around a longitudinal axis and, when needed, a hammering motion t4 in the longitudinal direction is transmitted to the second drilling means 5, being in a power transmitting connection with the first drilling means 4 by means of a counterpart surface assembly essentially by the drilling head of the drilling unit 3, the second drilling means 5 being arranged to rotate by an end of the casing part 2 centrically around the longitudinal axis s by means of the joint arrangement L, such as by the coupling means operating on male-female principle or correspondingly; and/or wherein the casing part 2 is arranged to be pulled into the hole to be drilled by influence of a feed motion z4 of the drilling device 1. With reference e.g. to advantageous embodiments shown in figures 2, 3a - 3c and 4, the joint arrangement according to the invention comprises a drill shoe X; Xi, Xii that is to be coupled with the casing part 2 in one or several parts as an advantageous embodiment by welding h1 and/or coupling means L; Li that are to be coupled with the second drilling means 5, such as the second frame part 5a preferably by welding h2.

With reference to an implementation of the joint arrangement according to the invention shown particularly in figures 2 and 3a - 3c, the drill shoe X consists of two or more parts Xii, which are provided with a male surface Li; Liu of the joint arrangement's

coupling organs, such as an external end flange or like. In this case correspondingly a female surface of the joint arrangement's coupling organs, such as an internal counterpart groove Li; Liv and an internal counterpart flange Li; Lin or like, are arranged as an advantageous embodiment in a built-in manner in connection with the second drilling means 5, such as at a rear edge of the second frame part 5a.

In the implementation described above, the parts Xii of the drill shoe are arranged furthermore to be welded together to each other and/or to the casing part 2 by an essentially longitudinal s weld h3, which for its part strengthens significantly the drill shoe.

Putting together of the embodiment described above at an operating site takes place e.g. as shown in figures 3a - 3c in a way that the parts of the drill shoe Xii are slipped one at the time into the counterpart groove Liv, existing at a back surface of the reamer and ending to a counterpart flange Lin. When the parts Xii, forming advantageously e.g. according to figure 3c an essentially uniform circle, are in place in the reamer, the protective tube 2 is then pushed inside the assembled drill shoe, whereafter it can be welded together by joint welds h1 and h3, which results to a composition as shown in the longitudinal cross section in figure 2.

The drill shoe X of the implementation shown in figure 4 comprises for its part a uniform ring structure Xi, which has a male surface Li; Liu of the joint arrangement's coupling organs, such as an external end flange or like. As a further advantageous embodiment of the joint arrangement according to the invention, the female surface of the joint arrangement's coupling organs, such as an internal counterpart groove Li; Liv and/or an internal counterpart flange Li; Lin or like,

are arranged to be coupled preferably by welding h2 in connection with the second drilling means 5, such as on a back surface of the second frame part 5a. This enables connecting of the protective tube equipped with the drill shoe to the drilling unit at the operating site by customary joint welds h1, h2 and h3.

Furthermore as an advantageous embodiment, joint surfaces of the drill shoe parts Xii particularly in the embodiment shown in figure 2 and/or between the female surfaces of the coupling means and the second drilling means 5, such as the second frame part 5a, in the embodiment according to figure 4, are provided with guides in order to make easier mutual placement thereof for the welding.

It is clear that the invention is not limited to the embodiments shown or described above, but instead it can be modified considerably within the basic idea of the invention. It is thus possible to couple e.g. a uniform drill shoe with the casing part or a separate counterpart flange with the reamer instead of a weld joint or in addition thereto e.g. with a thread joint (in which case the welding may comprise merely spot-like locking welds). Furthermore e.g. with reference to figure 1, it is possible to carry out the coupling means of the joint arrangement with two or more power transmission surface assemblies placed on after the other in the longitudinal direction. Furthermore e.g. the mutual counterpart surface assemblies of the drilling means as well as those between the same and the casing part can be carried out in most heterogeneous ways. In this case the first frame part and the second frame part may be connected to each other by e.g. a thread joint, wherein the locking between the same is achieved by mechanical, pressurized fluid and/or electrical assemblies. Naturally the parts may be connected to each other only by a thread joint,

which solution, however, may cause problems in separating the parts from each other, because the parts will probably jam against each other too tightly during drilling. The frame parts may be connected on a quick-release principle, for example by a bayonet coupling or like or for example in a way that there are teeth in both parts which fit to each other in the longitudinal direction. In such a case it is, however, not possible with simple arrangements to achieve the actual longitudinal locking between the frame parts. Then there is e.g. a risk that in certain operational situations the frame parts get separated unintentionally, whereby additional installation measures are needed to couple them again. With the solution in question, there is not a full certainty in every operational situation about the frame parts being tightened to each other long enough, in which case on the other hand the drilling result suffers because the center drill does not reach far enough to drill, and on the other hand the toothing between the frame parts may get out of order by breakage. Naturally the second drilling means may be connected only to the first drilling means, in which case there is a risk that the second drilling means turns into an unsuitable position at the bottom of the hole, when the first drilling means is removed from the hole, and thus possibly even prevent exploitation of the hole being drilled. In the drilling apparatus according to the invention, parts made of customary materials may be used that are produced applying most differing manufacturing methods. In addition e.g. an oscillating movement may be applied as the drilling movement of the drilling apparatus.

Claims:

1. Joint arrangement for coupling of a drill shoe, the drill shoe being meant to be used when
5 drilling a hole into the ground with a protective tube by means of a drilling device (1) that has a casing part (2) acting as the protective tube and a drilling unit (3), in a drilling head of which there are at least first drilling means (4), such as a pilot, for
10 drilling a center hole and second drilling means (5), such as a reamer, for forming of an actual drilling hole for the casing part (2) by reaming the center hole, and whereby the casing part (2) is arranged to be pulled into the hole to be drilled by means of a joint
15 arrangement (L), comprising a drill shoe (X) to be attached to the casing part (2), preferably by welding (h1), and being coupled with the drilling unit (3) by coupling means that enable rotative motion of the drilling unit (3) with respect to the drill shoe and
20 that transmit power in a longitudinal direction (s), **characterized** by that the joint arrangement comprises a drill shoe (X; Xi, Xii) that is to be coupled with respect to the second drilling means (5) essentially internally therewith and that the drill shoe pulls the
25 casing part (2) into the hole by a power influence (F) transmitted to the drill shoe from the second drilling means (5).

2. Joint arrangement according to claim 1 in
30 connection with a drilling device (1), the drilling head of the drilling unit (3) thereof being formed from a first and a second frame part (4a, 5a) that are to be coupled with each other and drilling surfaces of which are provided with drilling organs (10a, 10b) of the
35 first and second drilling means (4, 5), such as a uniform cutting part, separate drill bits or parts or like; wherein the first frame part (4a) thereof is arranged separable from the second frame part (5a) in

order to enable its removal from a drilled hole (R); wherein a radial outer surface of the first frame part (4a) is provided with an essentially longitudinal (s) groove assembly particularly for leading of drilling waste or flushing medium internally within the protective tube (2) and/or in order to enable a mutual longitudinal motion of the first and second frame parts (4a, 5a); wherein during a drilling situation a rotative motion (w4) of the first drilling means (4) around a longitudinal axis and, when needed, a hammering motion (t4) in the longitudinal direction is transmitted to the second drilling means (5), being in a power transmitting connection with the first drilling means (4) by means of a counterpart surface assembly essentially by the drilling head of the drilling unit (3), the second drilling means (5) being arranged to rotate by an end of the casing part (2) centrically around the longitudinal axis (s) by means of the joint arrangement (L), such as by the coupling means operating on male-female principle or correspondingly; and/or wherein the casing part (2) is arranged to be pulled into the hole to be drilled by influence of a feed motion (z4) of the drilling device (1), **characterized** in that the joint arrangement comprises a drill shoe (X; Xi, Xii) that is to be coupled with the casing part (2) in one or several parts preferably by welding (h1) and/or coupling means (L; Li) to be coupled with the second frame part (5a) preferably by welding (h2).

3. Joint arrangement according to claim 1 or 2, **characterized** in that the drill shoe (X) consists of two or more parts (Xii), which are provided with a male surface (Li; Liu) of the joint arrangement's coupling organs, such as an external end flange or like.

4. Joint arrangement according to claim 3, **characterized** in that a female surface of the joint

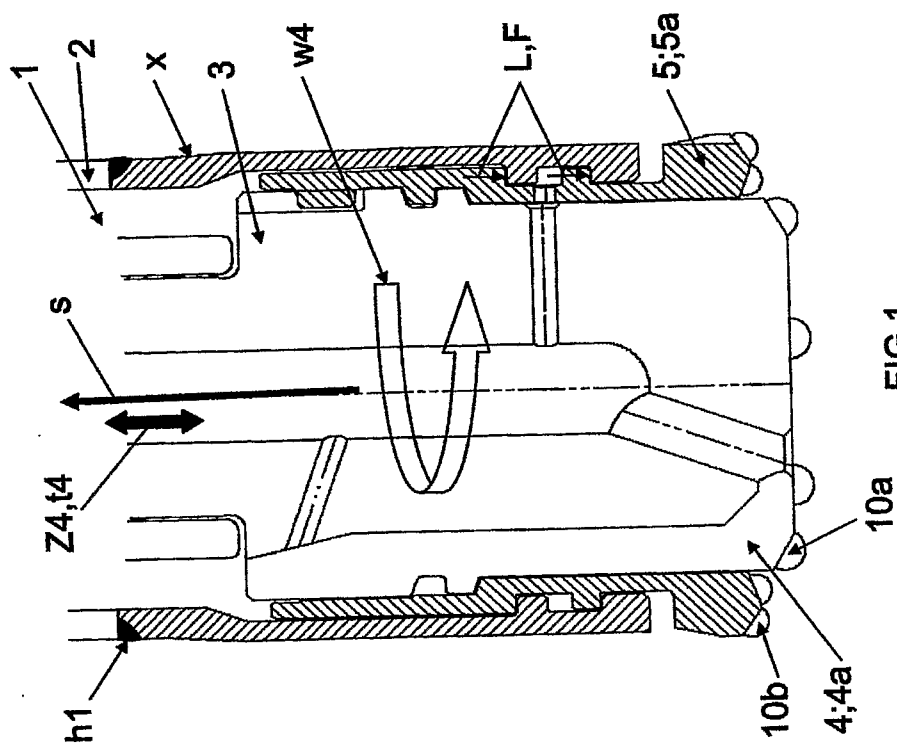
arrangement's coupling organs, such as an internal counterpart groove (Li; Liv) and an internal counterpart flange (Li; Lin) or like, are arranged in a built-in manner in connection with the second drilling means (5), such as at a rear edge of the second frame part (5a).

5. Joint arrangement according to claim 3 or 4, **characterized** in that the parts (Xii) of the drill shoe are arranged to be welded together to each other and/or to the casing part (2) by an essentially longitudinal (s) weld (h3).

6. Joint arrangement according to claim 1 or 2, **characterized** in that the drill shoe (X) comprises a uniform ring structure (Xi), which has a male surface (Li; Liu) of the joint arrangement's coupling organs, such as an external end flange or like.

7. Joint arrangement according to any of the preceding claims 1-6, **characterized** in that the female surface of the joint arrangement's coupling organs, such as an internal counterpart groove (Li; Liv) and/or an internal counterpart flange (Li; Lin) or like, are arranged to be coupled, preferably by welding (h2), in connection with the second drilling means (5), such as on a back surface of the second frame part (5a).

8. Joint arrangement according to claim 3 or 7, **characterized** in that joint surfaces of the drill shoe parts (Xii) and/or between the female surfaces of the coupling means and the second drilling means (5), such as the second frame part (5a), are provided with guides in order to make easier mutual placement thereof for the welding.



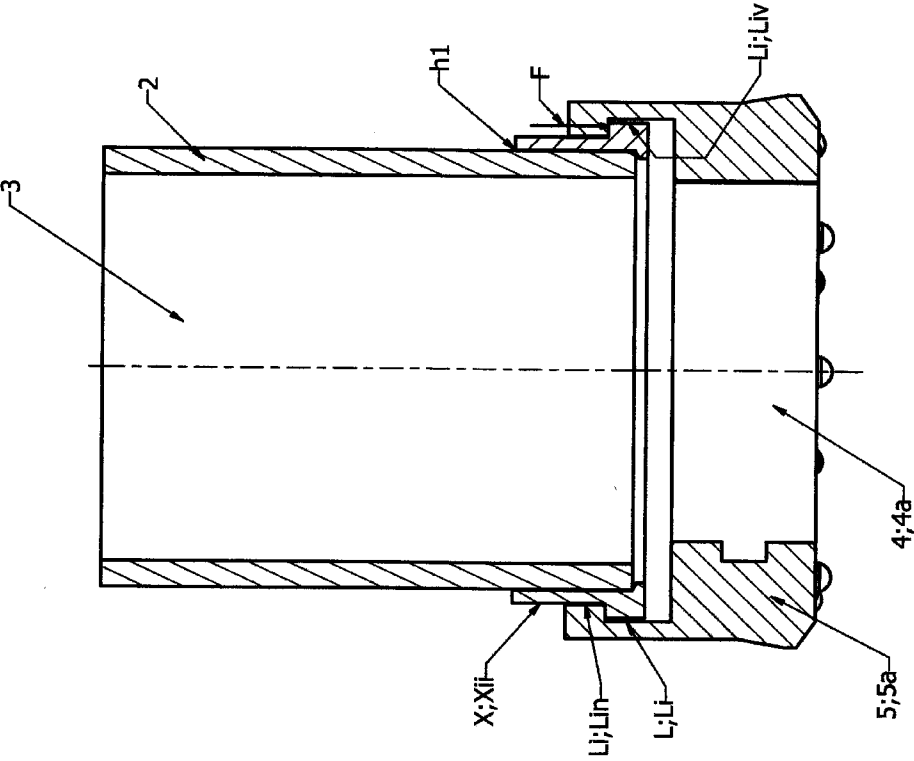


FIG 2

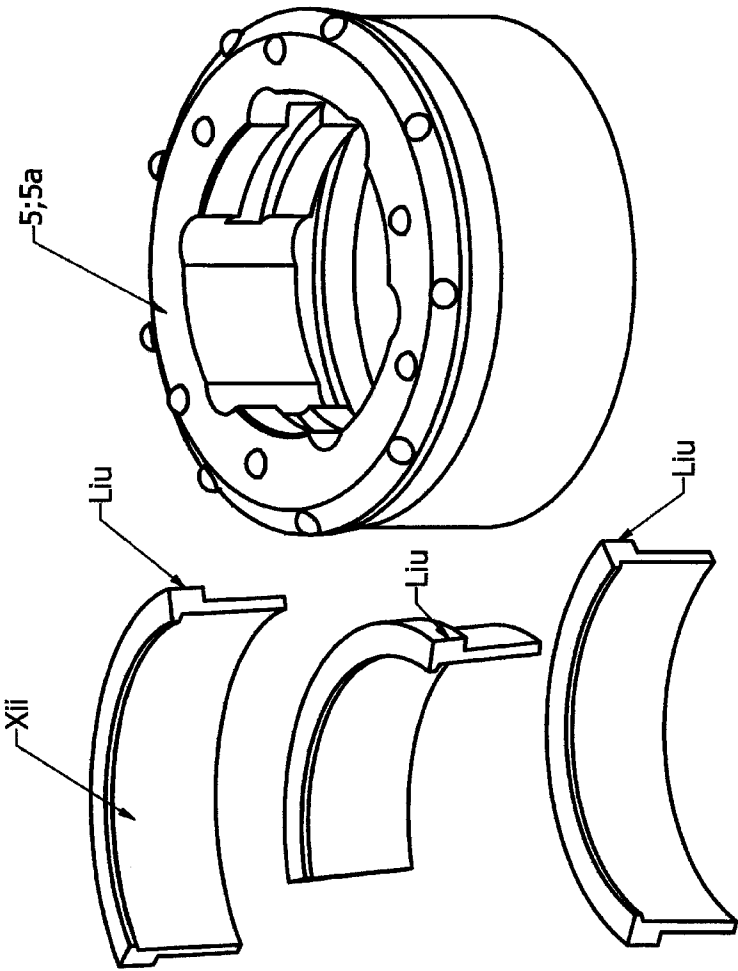


FIG 3a

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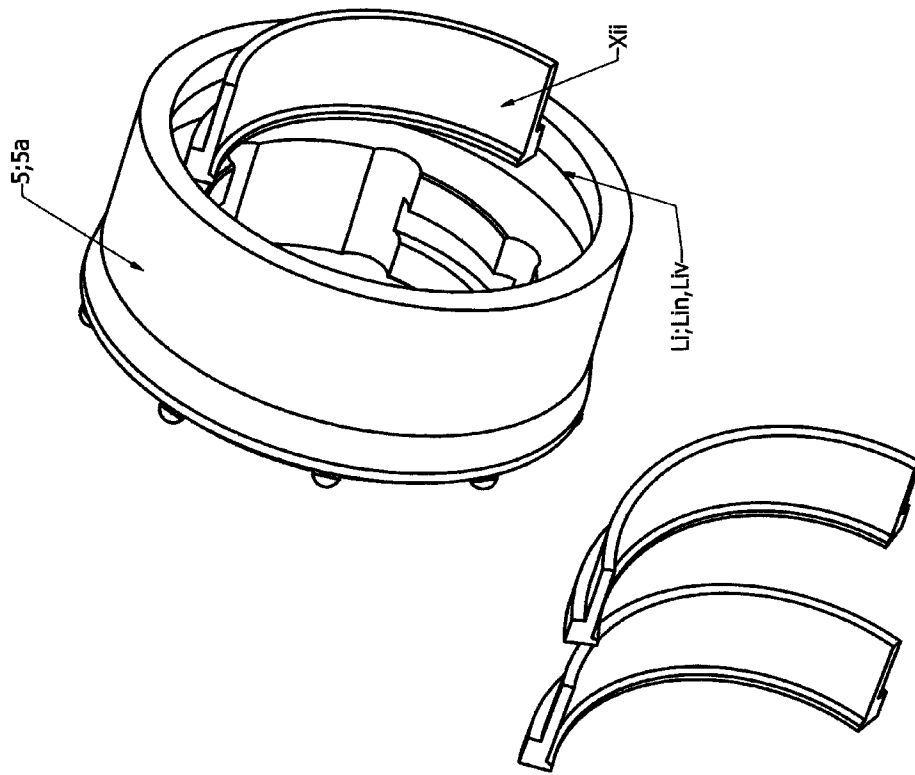


FIG 3b

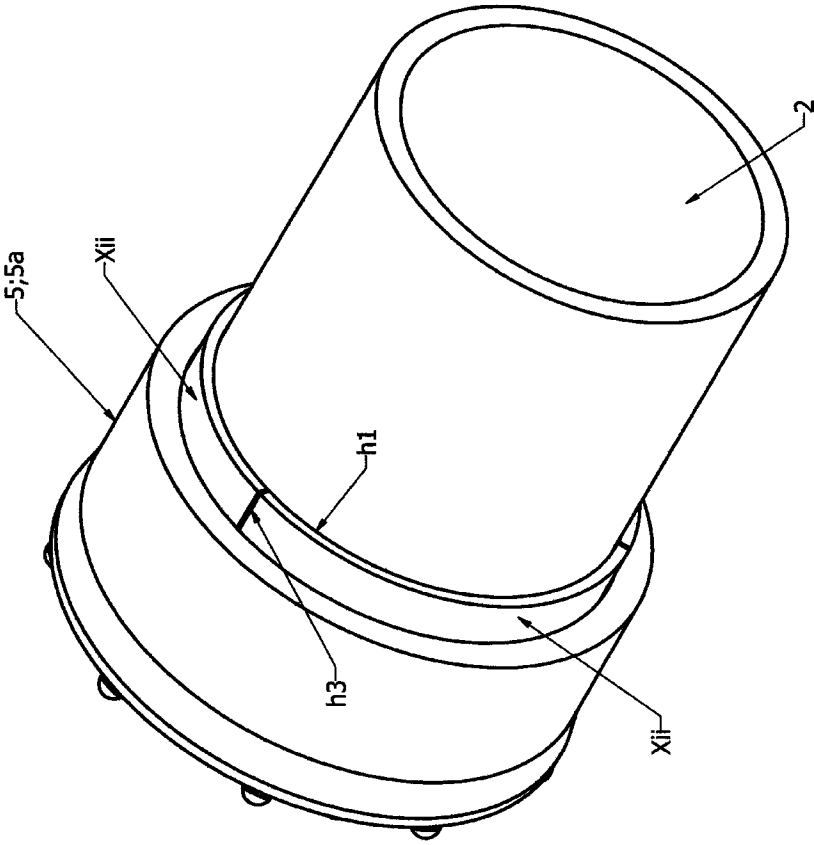


FIG 3c

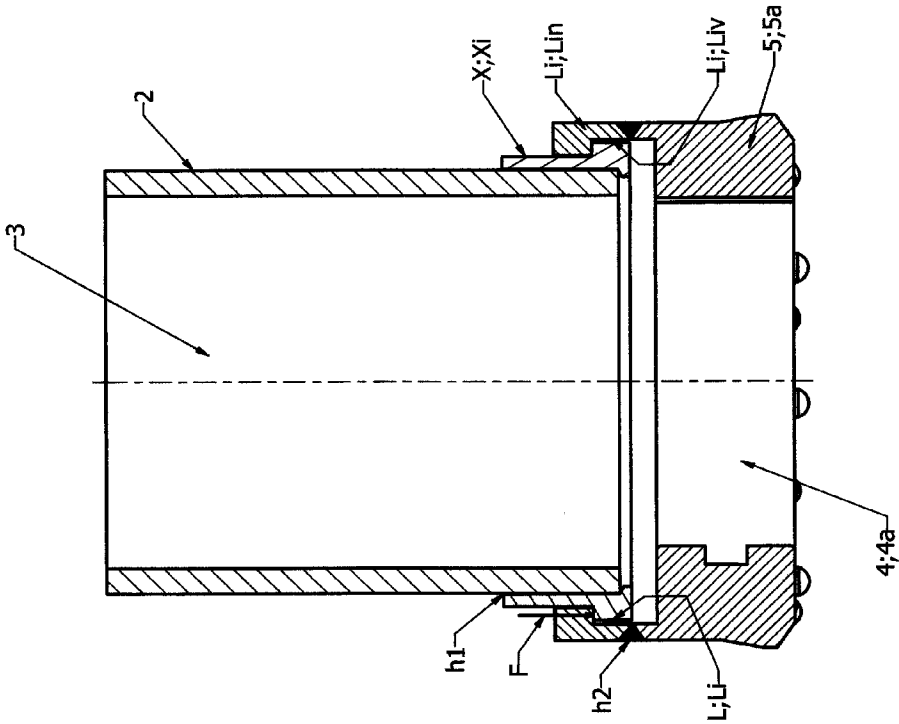


FIG 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2009/050123

A. CLASSIFICATION OF SUBJECT MATTER

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
FI, SE, NO, DKElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-INTERNAL, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FI 109143 B (JÄRVELÄ JORMA et al.) 31 May 2002 (31.05.2002) figure 3; page 7, lines 16-18	1, 2, 6, 7
Y	figure 3; page 7, lines 16-18	3, 4, 5, 8
X	CN 1766277 A (CHENGDU HYDROELECTRIC INVEST &) 03 May 2006 (03.05.2006) figures 1, 2, 3 and 10; EPOQUENET EPODOC -abstract; machine translation into English	1, 2, 6, 7
Y	figures 1, 2, 3 and 10; EPOQUENET EPODOC -abstract; machine translation into English	3, 4, 5, 8
X	FI 20060401 A (PIRKAN LAATUPALVELU OY) 28 October 2007 (28.10.2007) figure 1; page 2, second paragraph, last sentence	1, 2, 6, 7
Y	figure 1; page 2, second paragraph, last sentence	3, 4, 5, 8
Y	WO 03001022 A1 (SANDVIK AB et al.) 03 January 2003 (03.01.2003), page 5, lines 24-25; figures 1A, 1B, 1C, 2A, 2B and 2C	3, 4, 5, 8

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

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INTERNATIONAL SEARCH REPORT

International application No.
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CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

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