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(54) **BORE BITE AND METHOD FOR FORMING SUCH A BORE BITE**

(57) A tool (11) comprising a base element (2), which is a single-piece cast structure made of cast iron and comprising studs (3, 4) provided on the base element (2) by welding. The invention further relates to a method for forming such a tool and to the use of such a tool for forming secant walls.

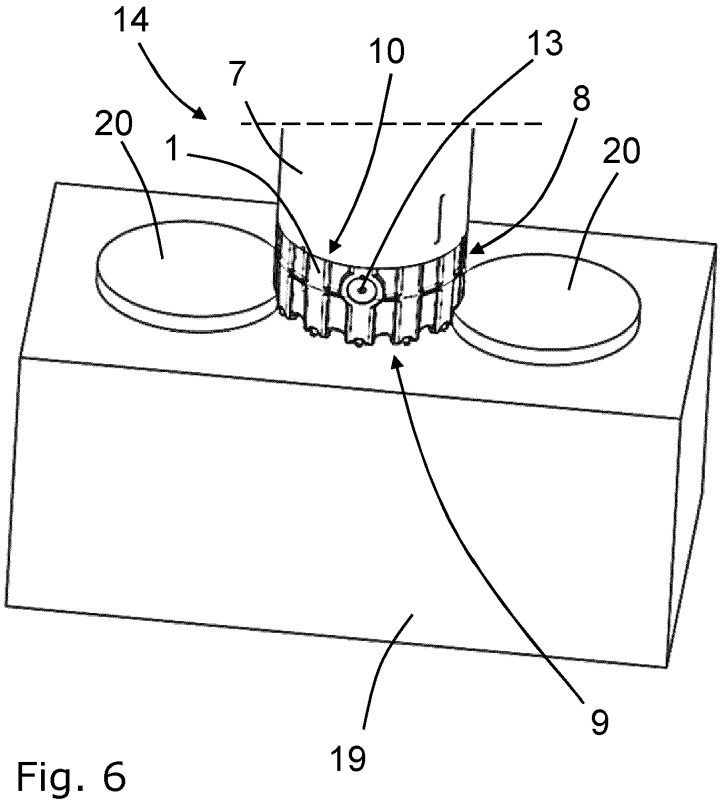

Fig. 6

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Description

[0001] The current invention relates to a tool comprising a base element and studs that are provided on the base element. The invention further relates to a method for forming such a tool and to a use of such a tool for forming secant walls.

[0002] US10683630 discloses such a tool, which is made of cast iron and which is provided with studs. The tool comprises a cast structure with a tip body and several spiral-shaped ribs protruding from the tip body. Several studs are arranged to the ribs. The tip body, the ribs and the protrusions are made as a single-piece cast structure.

[0003] For secant walls, one drills first (odd) bores into which one pours concrete for forming first piles. After the concrete of the first piles is formed, one drills second (even) bores between the first piles, this using a casing shoe as a tool, which casing shoe is made of steel and is provided with studs. Such a casing shoe is also known as a crown drill. In these second bores one then adds reinforcement elements and pours concrete for forming second piles that form together with the first piles the secant wall.

[0004] It is an object of the current invention to increase the lifespan of a tool according to the invention. Further objects are to provide an improved method for forming such a tool and to improve the forming of secant walls.

[0005] The object of increasing the lifespan of such a tool is achieved by providing a tool comprising a base element, which base element is a single-piece cast structure made of cast iron and comprising studs that are provided on the base element by welding.

[0006] The studs of such a tool are preferably made of a composition comprising tungsten and/or tungsten carbide.

[0007] Such studs are known and are used for being welded to steel. It also appears to be possible to weld such studs to cast structures made of cast iron. Surprisingly, those studs remain firmly attached to the cast structure, even in the case of e.g. drilling through concrete using such a tool, and this even through reinforced concrete.

[0008] The cast iron of which the base element is formed, is preferably ductile cast iron (GGG), which is also known as nodular cast iron. Instead, it is also possible to use grey cast iron (GG), which is also known as lamellar cast iron. Ductile cast iron is stronger than grey cast iron.

[0009] In a preferred embodiment, the studs are provided on the base element by spot welding.

[0010] Surprisingly, spot welding of studs and more specifically spot welding of studs made of a composition comprising tungsten and/or tungsten carbide on the cast iron base element allows to obtain a strong fixation of the studs to the cast iron base element. Such studs are preferably spot welded to the base element using known welding machines for welding such studs, by placing the studs with the spot welding machine on the base element and by applying a current with this spot welding machine.

[0011] In a specific embodiment, the tool according to the invention is a drill tool. Such a drill tool can e.g. be a drill tip shaped similar to the ones as illustrated in US10683630, US D845737 and US10640946.

[0012] Preferably, such a drill tool can be a casing shoe. By welding studs to a cast iron base element of a casing shoe, it is now also possible to provide casing shoes with cast iron as material for the base element, which casing shoe can be used for forming secant walls.

[0013] In a further embodiment, it is e.g. also possible to provide studs on a tool comprising a cast iron drum for milling material from a surface.

[0014] A tool according to the invention is used to work a soil or a part, e.g. to drill into the soil or the part, or to remove material from the soil or the part. The studs of such a tool are preferably positioned so that they do not allow the cast iron to come into contact with the material of the soil or the part being worked with the tool.

[0015] When the tool is a drill tool, the studs are thus preferably provided at the end of the base element which in operation is in contact with the said material to be drilled or being drilled. The studs can more specifically be positioned both downward (axially) and sideways (outward) facing under an angle. Possibly, with e.g. casing shoes, studs can also be provided sideways (inwards) facing under an angle. The studs are positioned so that they do not allow the cast iron to come into contact with the said material in which one is drilling.

[0016] In a preferred embodiment, the base element is at a first end provided to be connected to a driver, such as a drill pipe and the studs are provided on a distal end of the base element, opposite the first end.

[0017] The object of the invention is further achieved by providing a drill assembly comprising:

- a drill pipe; and
- a drill tool according to the invention, which drill tool at a first end is provided to be connected to an end of the drill pipe and at a distal end, opposite to the first end is provided with studs.

[0018] The object of the invention is further achieved by providing a method for forming a tool comprising the following steps:

a. casting of a base element from cast iron as a single-piece cast structure; and
b. welding of studs to the base element.

[0019] Such a method results in an above described tool according to the invention, having the above described advantages.

[0020] In step a, the base element is preferably cast from ductile cast iron. In step b, studs are preferably chosen which are made of a composition comprising tungsten and/or tungsten carbide. Further in step b, the studs are preferably being welded using spot welding.

[0021] In a preferred method according to the invention, the base element is provided with application surfaces for welding the studs thereto and between steps a and b, these application surfaces are finished for facilitating welding the studs to the application surfaces.

[0022] Finally, the object of the invention is also achieved by using an above described drill tool and more specifically a casing shoe according to the invention for forming secant walls.

[0023] The present invention will now be explained in more detail by means of the following detailed description of a tool, a method for forming such a tool, a drill assembly comprising such a tool and a use of such a tool for forming a secant wall according to the invention. The sole aim of this description is to give explanatory examples and to indicate further advantages and particulars of the present invention, and can thus by no means be interpreted as a limitation of the area of application of the invention or of the patent rights defined in the claims.

[0024] In this detailed description, reference numerals are used to refer to the attached drawings, in which in:

- Fig. 1 shows a casing shoe according to the invention in perspective view;
- Fig. 2 shows a part of the casing shoe of figure 1 in more detail in perspective view at the height of some studs;
- Fig. 3 shows the casing shoe of figure 1 in view according to arrow F3 in figure 1;
- Fig. 4 shows the casing shoe of figure 1 in cross section, according to line AA in figure 3,
- Fig. 5 schematically shows in perspective view an intermediate step of a method for forming a secant wall using a casing shoe according to Fig. 1, wherein two first bores are filled with concrete to form two first piles;
- Fig. 6 schematically shows in perspective view how using a casing shoe according to Fig. 1, when a second bore is drilled, between and partially through the first piles;
- Fig. 7 schematically shows in cross section how using a casing shoe according to Fig. 1, when a second bore is drilled, between and partially through the first piles.

[0025] The illustrated tool 11 is a casing shoe 1 for forming secant walls. In order to form the illustrated casing shoe 1, a base element 2 is cast from cast iron as a single-piece cast structure, preferably from ductile cast iron. The base element 2 is mainly cylindrical and is provided with ribs 15 at its outer circumference.

[0026] As best seen in Figs. 4, 6 and 7, at a first end 8, the base element 2 is provided to be connected to an end 10 of a drill pipe 7. At this first end 8, an undercut 16 is therefore provided at the inner surface of the base element 2 via machining, e.g. via turning on a lathe. The drill pipe 7 is provided with a corresponding undercut 17 on its outer surface, for connecting the casing shoe 1 to the drill pipe 7.

[0027] Connection holes 12 are drilled along the contour of the base element 2 for inserting a coupling element 13 therein. The drill pipe 7 is provided with corresponding connection holes 18, for inserting the coupling element 13 therein, for connecting the casing shoe 1 to the drill pipe 7. Alternative coupling systems are also possible for connecting such a casing shoe 1 to such a drill pipe 7.

[0028] At a distal end 9 of the base element 2, opposite the first end 8, application surfaces 5, 6 are provided on the base element 2. After casting of the base element 2, these application surfaces 5, 6 are finished or machined, e.g. milled or grinded to finish these application surfaces 5, 6 for welding studs 3, 4 to the application surfaces 5, 6.

[0029] First application surfaces 5 are provided downward at the distal end 9 of the base element 2 and first studs 3 are welded to the first application surfaces 5, extending axially with respect to the base element 2. Second application surfaces 6 are provided sideways, facing under and angle with respect to the first application surfaces 5. Second studs 4 are welded to the second application surfaces 6, extending sideways (outward) facing under an angle with respect to the first studs 3. Possibly, further studs can be provided sideways (inwards) facing under an angle with respect to the first studs 3.

[0030] The studs 3, 4 of the illustrated casing shoe 1 are made of a composition comprising tungsten and/or tungsten carbide, but could also be made of any other suitable material. The studs 3, 4 are spot welded to base element 2 using a known welding machine for spot welding such studs 3, 4, by placing the studs 3, 4 with the welding machine on the corresponding application surfaces 5, 6 and applying a current with this welding machine. Alternative welding techniques are also possible to weld the studs 3, 4 to the cast iron base element 2.

[0031] With a diameter of approximately 430 mm, the illustrated casing shoe 1 can be loaded with a pushing force of approximately 20000 kg.

[0032] The illustrated casing shoe 1 is more specifically suitable for forming secant walls, as illustrated in figures 5 to 7. The casing shoe 1 forms part of a drill assembly 14 comprising the drill pipe 7 to which the casing shoe 1 is connected. At a first end 8 the casing shoe 1 is provided to be connected to an end 10 of the drill pipe 7 and at a distal end 9, opposite to the first end 8 the casing shoe 1 is provided with studs 3, 4, so that the casing shoe 1 can be used as a drill tool.

[0033] First (odd) bores are in this respect drilled into a soil 19, by using any suitable drill tool according to the invention, e.g. by using the illustrated casing shoe 1, and concrete is poured in these first bores for forming first piles 20, as illustrated in figure 5.

[0034] Preferably while the concrete of the first piles 20 is not fully cured, second (even) bores are drilled between the first piles 20, also using the casing shoe 1, as illustrated in figures 6 to 7. In these second bores reinforcement elements are then added and concrete is poured in these second bores for forming second piles

that form together with the first piles 20 a secant wall.

[0035] Similar to how the illustrated casing shoe 1 that comprises a base element 2 that is provided with studs 3, 4, one can also make a tool 11 such as a drill tool comprising a cast iron base element 2 such as a drill tip similar to the ones as illustrated in US10683630, US D845737 and US10640946 provided with studs 3, 4 for drilling holes, or make a tool 11 comprising a cast iron drum with studs 3, 4 for machining material from a surface.

[0036] The illustrated studs 3, 4 can be known studs, e.g. used for being welded to steel. Alternatively to the illustrated studs 3, 4, such studs can also take many other forms or shapes, such as e.g. a form or shape as the protrusions illustrated in US10683630.

Claims

1. Tool (11) comprising a base element (2) and studs (3, 4) provided on the base element (2), **characterised in that** the base element (2) is a single-piece cast structure made of cast iron, and **in that** the studs (3, 4) are provided on the base element (2) by welding.

2. Tool (11) according to claim 1, **characterised in that** the studs (3, 4) are made of a composition comprising tungsten and/or tungsten carbide.

3. Tool (11) according to claim 1 or 2, **characterised in that** the studs (3, 4) are provided on the base element (2) by spot welding.

4. Tool (11) according to any one of claims 1 to 3, **characterised in that** the tool (11) is a drill tool.

5. Tool (11) according to claim 4, **characterised in that** the drill tool is a casing shoe (1).

6. Drill assembly (14) comprising:

   - a drill pipe (7); and
   - a tool (11), which tool (11) at a first end (8) is provided to be connected to an end (10) of the drill pipe (7) and at a distal end (9), opposite to the first end (8) is provided with studs (3, 4);

   characterised in that the tool (11) is a drill tool according to claim 4 or 5.

7. Method for forming a tool (11) according to any one of claims 1 to 5, **characterised in that** the method comprises the following steps:

   a. casting of the base element (2) from cast iron as a single-piece cast structure; and
   b. welding of studs (3, 4) to the base element (2).

8. Method according to claim 7, **characterised in that** the base element (2) is provided with application surfaces (5, 6) for welding the studs (3, 4) to the application surfaces (5, 6) and **in that** between steps a and b, these application surfaces (5, 6) are finished for welding the studs (3, 4) to the application surfaces (5, 6).

9. Use of a tool in a drilling assembly according to claim 6, **characterized in that** a tool (11) according to claim 4 or 5 is used for forming secant walls.

10. Use of a tool according to claim 9, **characterized in that** the tool (11) is a casing shoe (1).

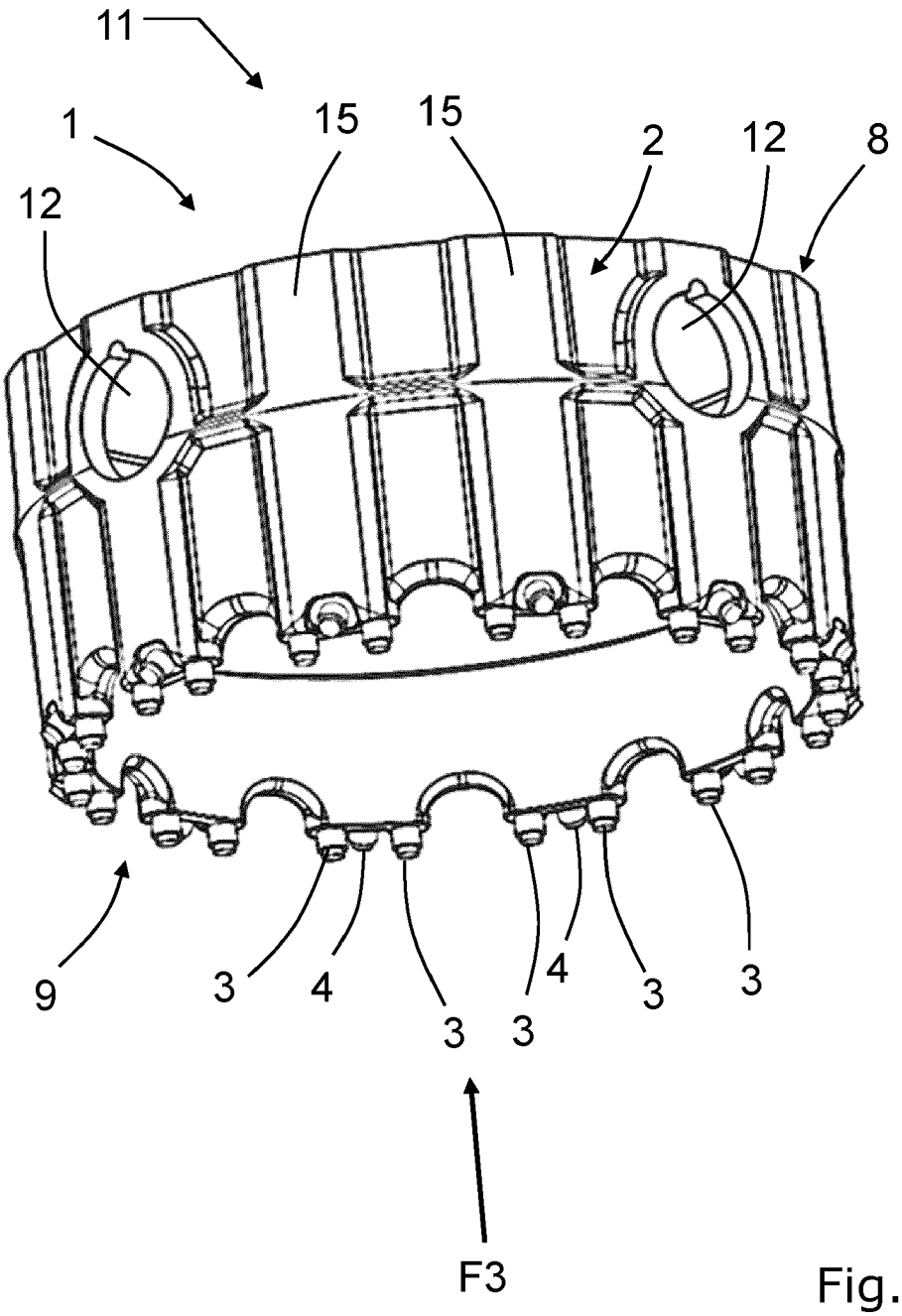

Fig. 1

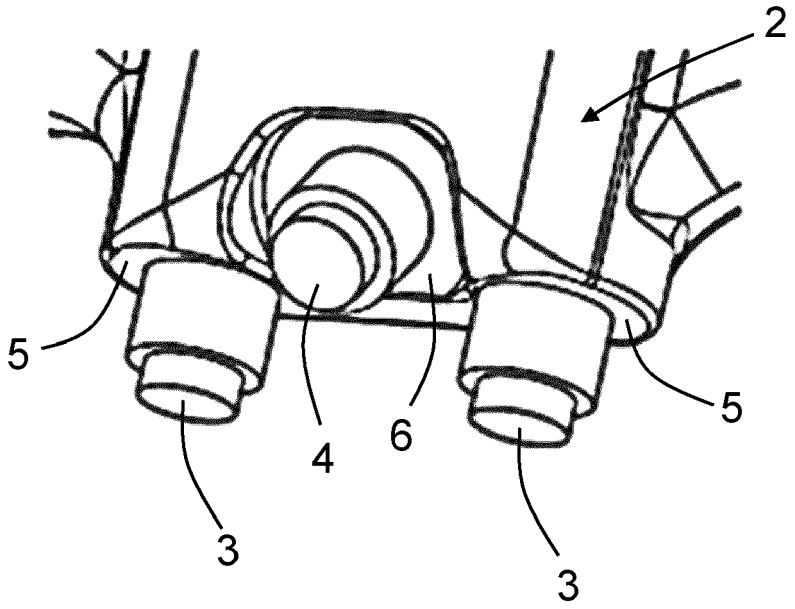

Fig. 2

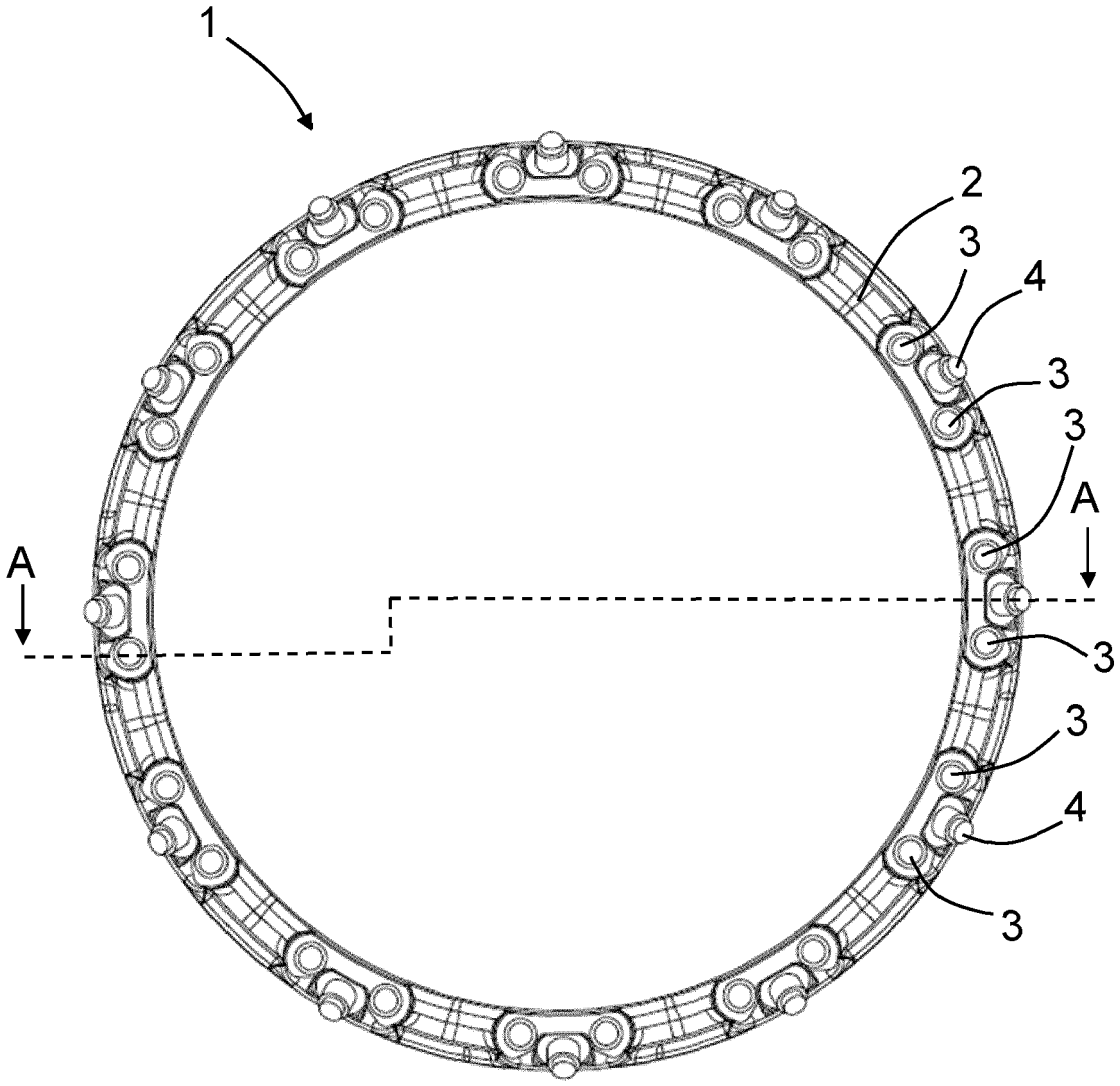

Fig. 3

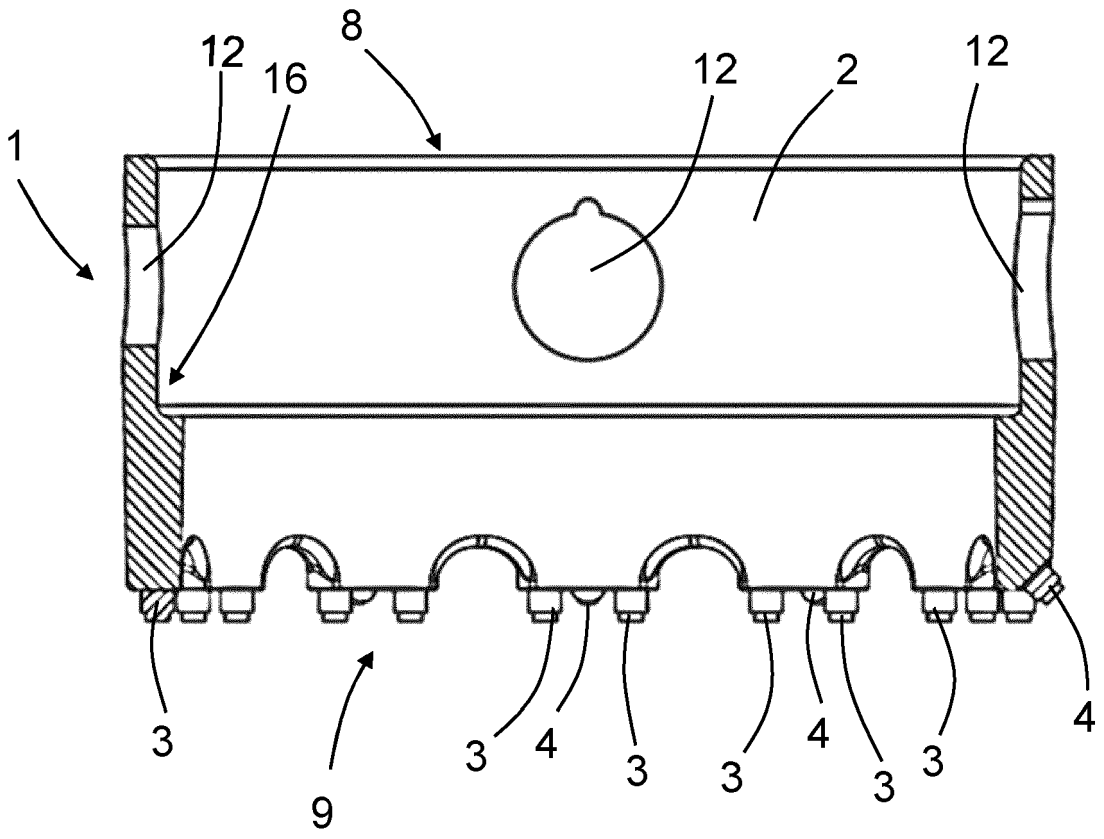

Fig. 4

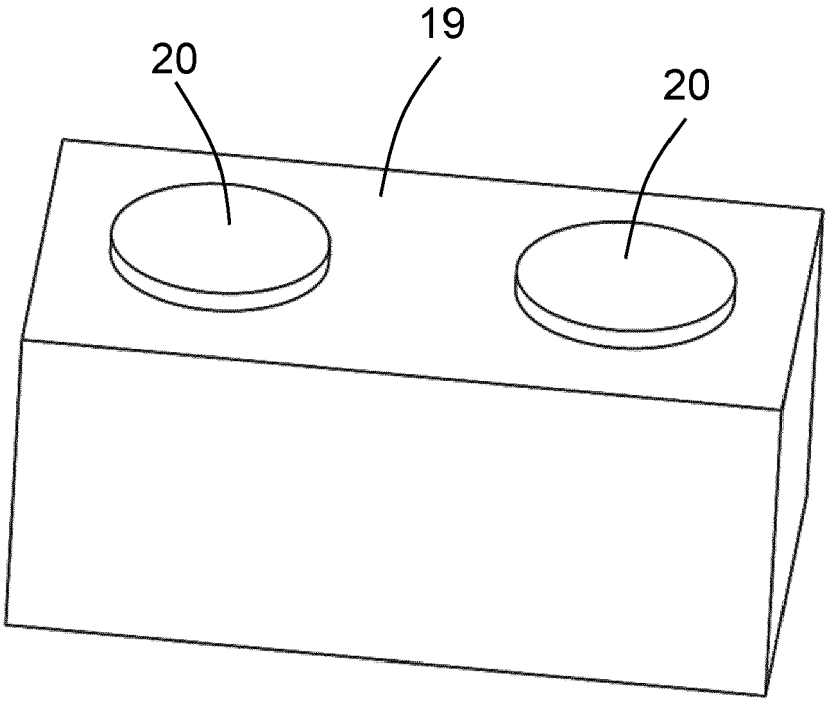

Fig. 5

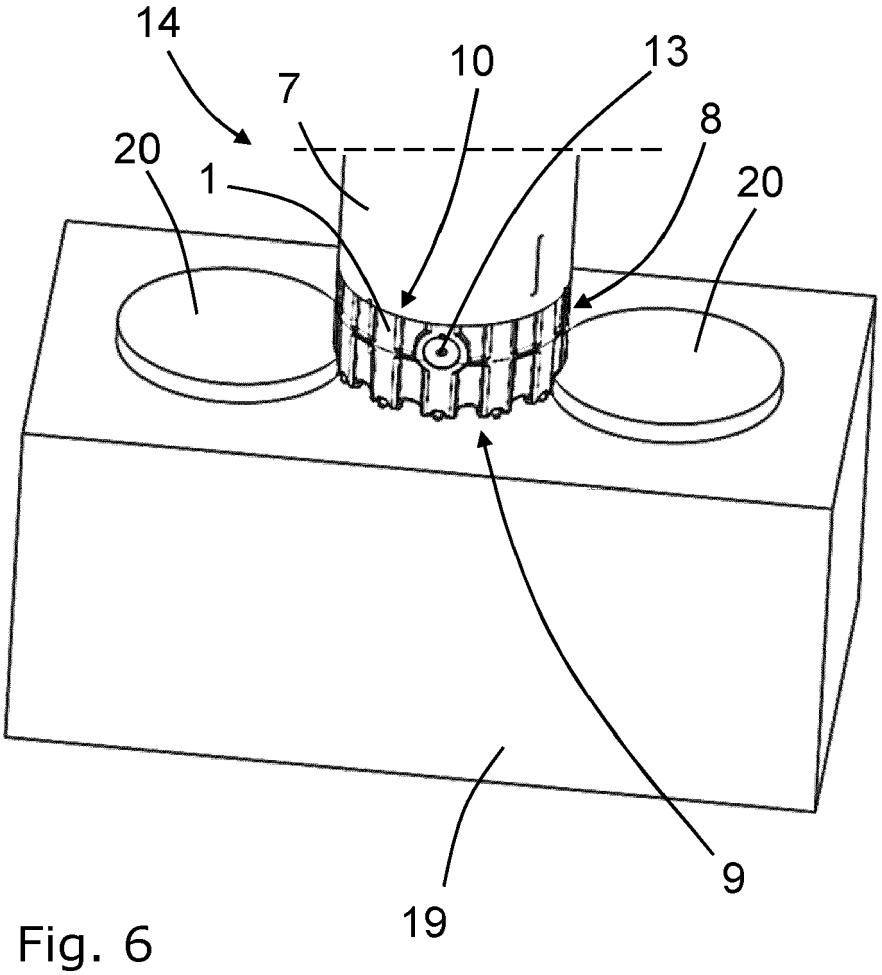

Fig. 6

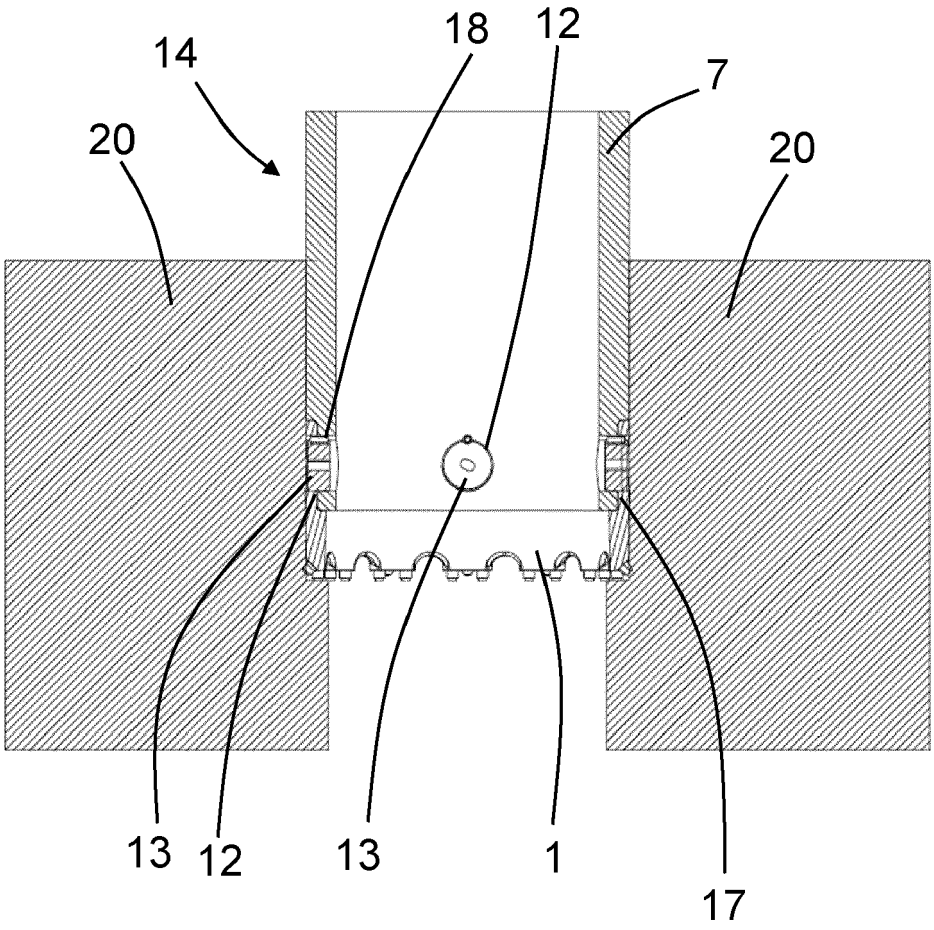

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 21 19 3475

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/183892 A1 (OLDHAM JACK T [US] ET AL) 25 August 2005 (2005-08-25) * figures 1c, 7a * * paragraph [0133] *	1-6,9,10	INV. E21B10/02 E21B10/48
X	US 2007/079995 A1 (MCCLAIN ERIC E [US] ET AL) 12 April 2007 (2007-04-12) * paragraph [0044] *	1-6,9,10	
X	US 4 499 795 A (RADTKE ROBERT P [US]) 19 February 1985 (1985-02-19)	1-6,9	
Y	* column 5, line 50 - column 6, line 48; claim 1; figure 1 *	7,8	
X	US 2015/007505 A1 (MOLLER KARL H [US] ET AL) 8 January 2015 (2015-01-08)	1-6,9	
Y	* paragraph [0032] * * paragraph [0047] * * paragraph [0069] * * paragraph [0093] *	7,8	
			TECHNICAL FIELDS SEARCHED (IPC) E21B

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 January 2022	Valenta, Ivar

CATEGORY OF CITED DOCUMENTS

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27-01-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005183892 A1	25-08-2005	US 2005183892 A1	25-08-2005
		US 2008223575 A1	18-09-2008
		US 2011259604 A1	27-10-2011
		US 2011259605 A1	27-10-2011
		US 2011259606 A1	27-10-2011
		US 2011259608 A1	27-10-2011
		US 2011259643 A1	27-10-2011
		US 2011266069 A1	03-11-2011
		WO 2005080742 A1	01-09-2005
US 2007079995 A1	12-04-2007	US 2007079995 A1	12-04-2007
		US 2011203850 A1	25-08-2011
US 4499795 A	19-02-1985	NONE	
US 2015007505 A1	08-01-2015	AU 2014203371 A1	22-01-2015
		CA 2854691 A1	03-01-2015
		US 2015007505 A1	08-01-2015
		ZA 201404647 B	29-07-2015

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 10683630 B **[0002] [0011] [0035] [0036]**
- US D845737 S **[0011] [0035]**
- US 10640946 B **[0011] [0035]**