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(54) **DRILLING DEVICE**

BOHRVORRICHTUNG

DISPOSITIF DE FORAGE

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Description

[0001] The invention relates to a drilling device which comprises a pilot bit drilling a middle portion of a hole, to said bit detachable fastened ring bit said bit drilling outer circle of the hole, as well as an arrangement for pulling a casing tube into said hole during drilling, wherein in the drilling situation both the pilot bit and the ring bit are fitted to be rotated and the casing tube fitted to be unrotatable, and for removing drilling waste from drilled surface locating at front side of said bits, the drilling device comprises a flushing system, by means of which flushing medium is lead via the pilot bit to the drilling surface and returned therefrom into a flow space locating inside the casing tube.

[0002] Document WO 02/081856 A1 discloses a method for drilling and a drilling apparatus. Document DE 299 12 404 U1 discloses a drilling device. Document WO 00/11304 A1 discloses a reverse circulation drilling system with bit locked underreamer arms. Document FR 2 889 556 A1 discloses a well drilling device for measuring parameter e.g. pressure at ground level, has fluid injecting unit constituted of pipe mounted in cooperation with drilling tool so that pressurized fluid output openings are situated at level of tool. Document WO 95/34740 A1 discloses a drilling apparatus. Document WO 98/20229 A1 discloses a Method and apparatus for attaching a casing to a drill bit in overburden drilling equipment. Earlier is known drilling devices which drills a hole according to preamble above among others from publications WO 9813575 and WO 9618798. In these ones pressurized flushing medium flows direct or inclined towards drilled surface. When soft soil is drilled a high flushing flow removes soil possible from larger hole diameter area than the final drill hole has. This kind of extra hole enlargement is neither allowed in the pile drillings nor in many horizontal drilling cases. The pilot bits described in the above mentioned publications have flat drilling surfaces and they do not try in the earth drilling to loosen material from drilled surface, contrary even may tighten it.

[0003] For removing this disadvantage a new drilling device has been developed by means of which device the above described problem is avoided. Characteristics for the drilling device according to the invention is that the flushing medium flow has been by means of a channel system turned inside the pilot bit to a flow which is flowing in side direction, arranged to run a portion a inside the pilot bit in the said side direction before the flow will run in the groove on the surface of the pilot bit, which groove is open towards the drilled surface.

[0004] Characteristics for the pilot bit belonging to the drilling device according to the invention is that the pilot bit is designed to function by means of rotation motion and edges locating in the drilling surface and directed towards the rotation direction as a cutting edge which cuts the drilled surface during earth boring, wherein said edges are arranged to meet the drilled surface essentially first.

[0005] Advantageous for the invention is that pressurized flushing flow does not hit the drilled surface but flows in horizontal direction towards the inner surface of the ring bit, wherein its effect upon the drilled surface is essentially weakened. Drilling waste can, however, in same way as in known solutions flow with the flushing medium and together go away inside the casing tube. For improving soil drilling grooves have been formed in the pilot bit and cutting edges in their back portions seen in the rotation direction of the bit, wherein soil loosened by said edges moves into said groove and further therefrom into the flushing channels. Soil is not uncontrolled loosened from the area outside the hole.

[0006] In the following the invention is closer described by referring to accompanying drawings, where

Figure 1 shows a partial section view of a drilling device seen from side.

Figure 2 shows drilling device of the figure 1 seen from front.

Figure 3 shows another drilling device seen from front.

Figure 4 shows section A - A.

[0007] In the figure 1 there is as bits for the drilling device a pilot bit 1 which drills center part of a hole middle and a ring bit 2 which drills the outer circle of the hole and is detachable, like via bayonet coupling fastened to the pilot bit. Casing tube 4 is pulled into the hole during drilling by means of the pilot bit 1, which bit is hammering to a ring-like casing shoe 3. The casing shoe 3 has been welded to the casing tube 4 and therefore the casing shoe finally pulls the casing tube 4 into the hole.

[0008] Flushing medium, like pressurized air, is lead via center hole 8 in the pilot bit 1 towards the top of the pilot bit 1, but this channel ends a little before the front surface of the pilot bit 1. This solution has, however, very small hole 9 drilled through. The hole 9 is not necessary for the invention at all and can be left undrilled. The hole has for example thread, wherein a lift hook can be fastened to said hole, when the bit is handled. Nearly whole flushing flow is turned in the pilot bit 1 according to the invention to horizontal direction and continues in a round channel 6 in side direction. The channel 6 is opened after a distance being open of its upper portion, wherein drilling waste can move from the drilled surface and to join to flushing medium. The flushing medium jet is not in any stage directed towards the drilled surface towards the drilled soil.

[0009] In side direction locating groove 5, 6 in the pilot bit 1 is a hole 6 from its first portion as long as the flushing medium jet will get motion in horizontal direction. The distance is for example about 2 - 3 times the diameter of the hole 6. If it is drilled soft soil, at least the flushing medium jet does not loosen too much soil with it, because the jet hits mainly to the inner surface of the ring bit 2, from where the jet continues via the channel 7 back inside the casing tube 4.

[0010] Figure 2 shows a drilling device seen from front and section view of the flushing groove 5, 6 from line A - A. The flushing groove which comes via center hole 8 in the pilot bit 1 is divided in this drilling device into five horizontal directed holes 6 and grooves 5, 6 which are following said holes. The hole 6 is forming the bottom part of the groove along the whole portion in the pilot bit 1, but the hole changes to a groove which is open upwards due to another groove 5 which has been machined above it. The groove 5 has been made widening when it continues towards the outer edge of the pilot bit 1. This helps access of the flushing medium into the groove 5, 6 because there is also more produced waste in front of the pilot bit 1 when going towards its outer edge.

[0011] In the figure 3 there is shown a pilot bit 1, whose drilling surface comprises only two grooves 5 and two into horizontal direction turned flushing groove 6. The grooves 5 are wide and especially in soil drilling they receive soil which has loosened from the drilled surface. Soil can be loosened from the drilled surface when cutting edges 11 have been formed in the pilot bit 1 in the rear edge of the grooves 5. The edges 11 are cutting the drilled surface when the pilot bit 1 rotates though they locates in the same level with the drilling surface in the pilot bit 1, because there is also advance motion for the bits 1, 2 towards the drilled surface.

[0012] The cutting edges 11 can be in the drilling surface a little lifted up, as section A - A shows, when the drilling surface has been made slanted surface in angle α so, that edge 11 cuts the drilled surface also with a little advance motion. Angle α is advantageous little for example 5 - 15°. Thus it is secured that soil is loosened from the drilled surface. The ring bit 2 pushes soil a little outside the hole and this soil at least partly flows with the flushing air into the channel 7. The flushing air cannot flow to space outside the hole as well as does not loose soil from said space.

[0013] There is also a cutting edge 11 in the pilot bit 1 in the figure 2, which edge is cutting soil from the drilled surface, said soil then moves into the groove 5 and further into the channel 7. Also in this pilot bit 1 the cutting edge 11 can be a little lifted up compared with the other drilling surface.

Claims

1. Drilling device which comprises a pilot bit (1) drilling a middle portion of a hole, to said bit (1) detachable fastened ring bit (2) said ring bit drilling the outer circle of the hole, as well as an arrangement for pulling a casing tube (4) into said hole during drilling, wherein in the drilling situation both the pilot bit (1) and the ring bit (2) are fitted to be rotated and the casing tube (4) fitted to be unrotatable, and for removing drilling waste from a drilled surface located at front side of said bits (1,2) the drilling device comprises a flushing system, by means of which a flush-

ing medium is lead via the pilot bit (1) to the drilling surface and returned therefrom into a flow space (7) located inside the casing tube (4), **characterized in that** the flushing system comprises a channel system comprising an axial channel (8) and, in a radial outward direction, a hole (6) having a length providing for the flushing medium a motion in the radial outward direction and after the length having an open side towards the drilled surface thereby forming a groove (5,6), whereby the flushing medium flow has been by means of the channel system (8, 6) turned inside the pilot bit (1) to a flow which is flowing in the radial outward direction, arranged to run a portion (a) inside the pilot bit (1) in the radial and outward direction before the flow will run in the groove (5, 6) on the surface of the pilot bit (1), which groove is open towards the drilled surface.

2. Drilling device according to claim 1, **characterized in that** the groove (5, 6) located on the surface of the pilot bit (1) is directed towards the ring bit (2) to a channel (7) leading rearwards from the drilling surface.

3. Drilling device according to claim 1, **characterized in that** at least bottom of the groove (5, 6) is of a round cross section.

4. Drilling device according to claim 1, **characterized in that** the hole (6) in the pilot bit (1) is of a round cross section.

5. Drilling device according to claim 1, **characterized in that** the groove (5, 6) located on the surface of the pilot bit (1) is designed to function by means of rotation motion and edges (11) located in the drilling surface and directed towards the rotation direction as a cutting edge which cuts the drilled surface during earth boring, wherein said edges (11) are arranged to meet the drilled surface essentially first.

6. Drilling device according to claim 5, **characterized in that** the drilling surface of the pilot bit (1) comprises the grooves (5) in front of the cutting edges (11) seen in the rotation direction, said grooves (5) are receiving loosened material and being part of an arrangement, via which cut, loosened from drilled surface or by cutting loosened material is lead back via flushing channels (7).

7. Drilling device according to claim 5, **characterized in that** the drilling surface of the pilot bit (1) is arranged to be a slanted surface in angle (α) so that edge (11) in the drilling situation located as the foremost in the drilling surface.

8. Drilling device according to claim 5, **characterized in that** in the drilling surface of the pilot bit (1) is

arranged the groove (5) before the cutting edge (11), wherein the advance motion given to the pilot bit (1) and rotation of the bit move the edge (11) to cut the drilled surface.

Patentansprüche

1. Bohrvorrichtung, die einen Pilotbohrer (1) zum Bohren eines mittleren Abschnitts eines Lochs und, an diesem Bohrer (1) lösbar befestigt, einen Ringbohrer (2) umfasst, wobei der Ringbohrer den äußeren Kreis des Lochs bohrt, sowie eine Anordnung zum Ziehen eines Mantelrohres in das Loch während des Bohrens, wobei in der Bohrsituation sowohl der Pilotbohrer (1) als auch der Ringbohrer (2) dazu eingerichtet sind, gedreht zu werden, und das Mantelrohr (4) dazu eingerichtet ist, undrehbar zu sein, und zum Entfernen von Bohrabfall von einer Bohrfläche, die sich an einer Vorderseite der Bohrer (1, 2) befindet, wobei die Bohrvorrichtung ein Spülsystem umfasst, mithilfe dessen ein Spülmedium über den Pilotbohrer (1) zu der Bohrfläche geleitet und von dort in einen Durchflussraum (7) zurückgeführt wird, der sich in dem Mantelrohr (4) befindet, **dadurch gekennzeichnet, dass** das Spülsystem ein Kanalsystem umfassend einen axialen Kanal (8) und, in einer radial äußeren Richtung, ein Loch (6) mit einer Länge umfasst, um für das Spülmedium eine Bewegung in der radial äußeren Richtung zu ermöglichen und das der Länge nach eine offene Seite in Richtung der Bohrfläche aufweist, so dass eine Nut (5, 6) entsteht, wodurch der Strom des Spülmediums mithilfe des Kanalsystems (8, 6) in dem Pilotbohrer (1) zu einer Strömung geführt wird, die in der radial äußeren Richtung fließt, und dazu eingerichtet ist, einen Abschnitt (a) in dem Pilotbohrer (1) in der radialen und äußeren Richtung zu entlang fließen, bevor die Strömung in der Nut (5, 6) auf der Oberfläche des Pilotbohrers (1) fließt, wobei diese Nut in Richtung der Bohrfläche offen ist.
2. Bohrvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Nut (5, 6), die sich auf der Oberfläche des Pilotbohrers (1) befindet, in Richtung des Ringbohrers (2) zu einem Kanal (7) gerichtet ist, der von der Bohrfläche nach hinten führt.
3. Bohrvorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** zumindest ein Boden der Nut (5, 6) einen runden Querschnitt aufweist.
4. Bohrvorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** das Loch (6) in dem Pilotbohrer (1) einen runden Querschnitt aufweist.
5. Bohrvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Nut (5, 6), die sich auf der

Oberfläche des Pilotbohrers (1) befindet, dazu ausgelegt ist, mithilfe einer Drehbewegung zu funktionieren und Kanten (11), die sich in der Bohrfläche befinden und in Richtung der Drehrichtung ausgerichtet sind, als Schneidkante dienen, welche die Bohrfläche während der Erdbohrung schneiden, wobei die Kanten (11) dazu ausgelegt sind, im Wesentlichen zuerst auf die Bohrfläche zu treffen.

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6. Bohrvorrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** die Bohrfläche des Pilotbohrers (1) die Nuten (5) vor den Schneidkanten (11) umfasst, betrachtet in der Drehrichtung, wobei die Nuten (5) gelöstes Material aufnehmen und Teil einer Anordnung sind, durch welche geschnittenes, von der Bohrfläche gelöstes oder durch Schneiden gelöstes Material durch die Spülkanäle (7) nach hinten geleitet wird.
7. Bohrvorrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** die Bohrfläche des Pilotbohrers (1) dazu eingerichtet ist, eine winklig geneigte (α) Fläche zu sein, so dass sich eine Kante (11) in der Bohrsituation ganz vorne an der Bohrfläche befindet.
8. Bohrvorrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** in der Bohrfläche des Pilotbohrers (1) die Nut (5) vor der Schneidkante (11) angeordnet ist, wobei die Vorschubbewegung, die auf den Pilotbohrer (1) übertragen wird, und die Drehung des Bohrers die Kante (11) zu der Oberfläche bewegen.

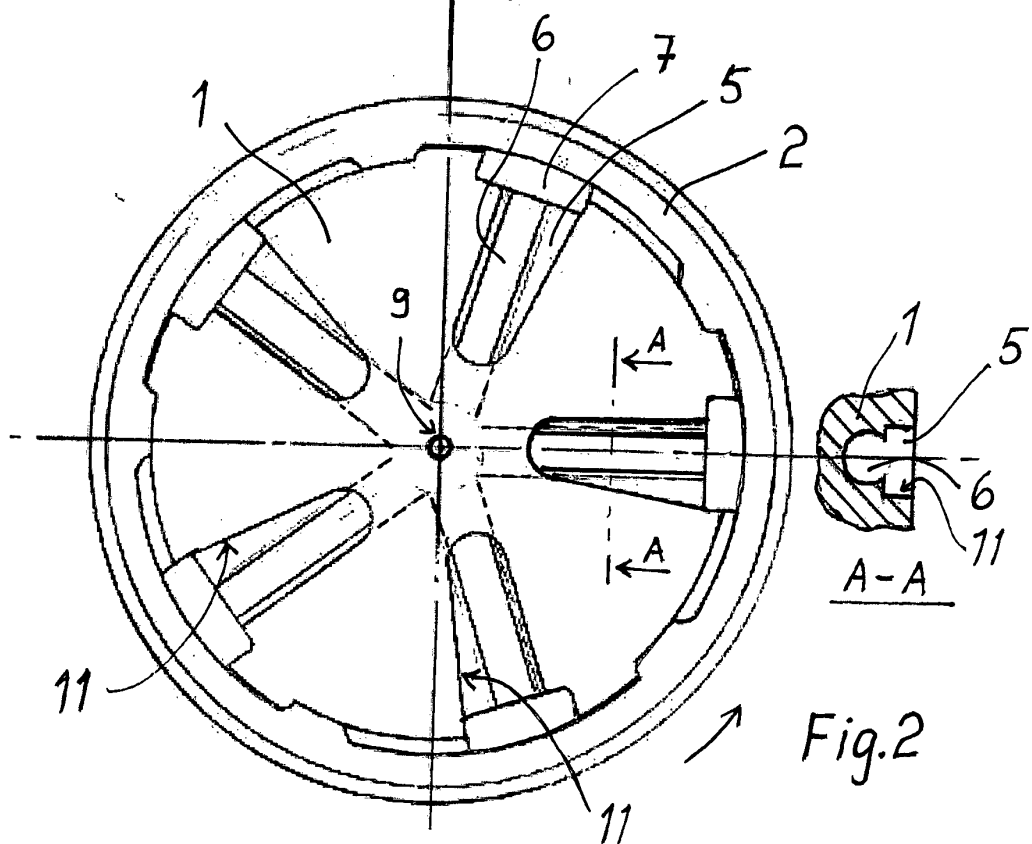
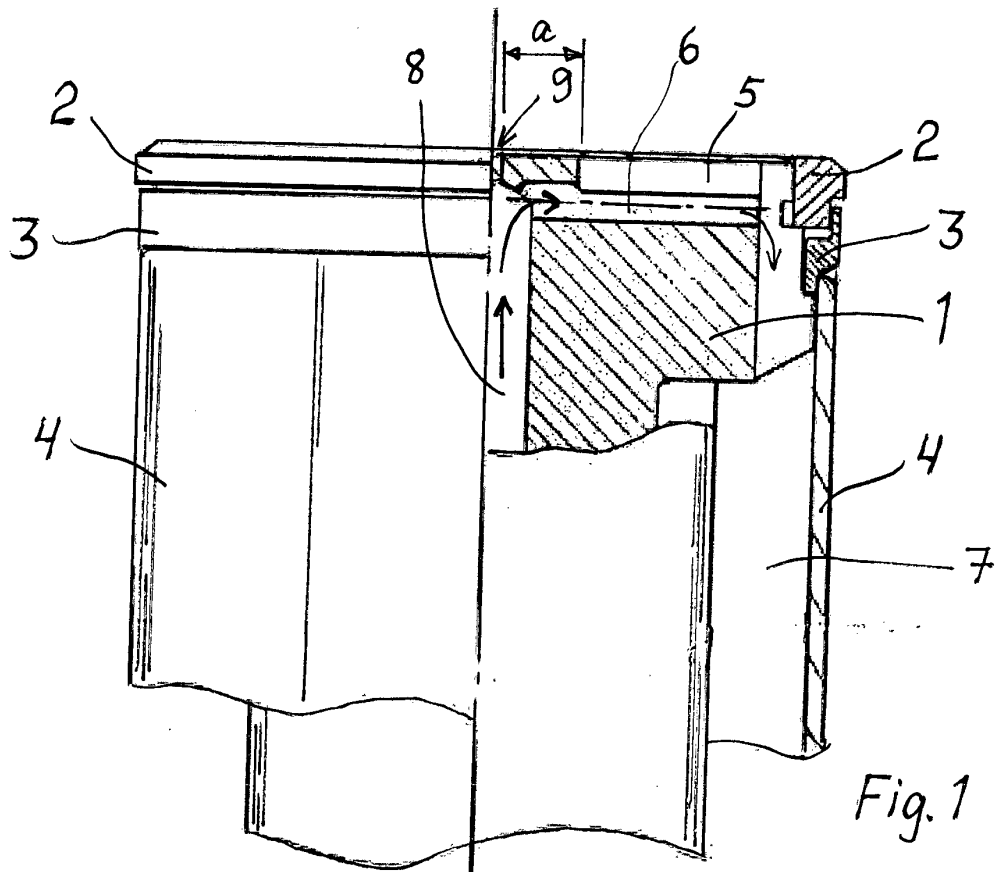
Revendications

1. Dispositif de forage qui comprend un trépan pilote (1) forant la partie centrale d'un trou, vers ledit trépan (1), trépan annulaire fixé amovible (2) ledit trépan annulaire perçant le cercle extérieur du trou, ainsi qu'un agencement pour tirer un tube de gainage (4) dans ledit trou pendant le forage, dans lequel dans la situation de forage, le trépan pilote (1) et le trépan annulaire (2) doivent être montés pour pouvoir tourner et le tube de gainage (4) est ajusté pour ne pas pouvoir tourner, et pour éliminer les déchets de forage d'une surface percée située à l'avant desdits trépons (1, 2), le dispositif de forage comprend un système de rinçage au moyen duquel un agent de rinçage est acheminé à la surface de forage par l'intermédiaire du trépan pilote (1) et renvoyée depuis cet endroit dans un espace d'écoulement (7) situé à l'intérieur du tube de gainage (4), **caractérisé en ce que** le système de rinçage comprend un système de canaux englobant un canal axial (8) et, dans une direction radiale extérieure, un trou (6) ayant une longueur assurant au fluide de

rinçage un mouvement dans le sens radial extérieur et après la longueur ayant un côté ouvert vers la surface forée, formant ainsi une gorge (5, 6), de sorte que l'écoulement du fluide de rinçage a été effectué au moyen du système de canaux (8, 6) tournés à l'intérieur du trépan pilote (1) vers un écoulement qui s'écoule dans la direction radiale vers l'extérieur, agencé pour faire passer une partie (a) à l'intérieur du trépan pilote (1) dans la direction radiale et vers l'extérieur avant l'écoulement dans la gorge (5, 6) à la surface du trépan pilote (1), laquelle gorge étant ouverte vers la surface forée.

trépan déplacent le bord (11) pour couper la surface forée.

2. Dispositif de forage selon la revendication 1, **caractérisé en ce que** la gorge (5, 6) située à la surface du trépan pilote (1) est dirigée vers le trépan annulaire (2) vers un canal (7) menant vers l'arrière par rapport à la surface de forage. 5 10
3. Dispositif de forage selon la revendication 1, **caractérisé en ce qu'**au moins le fond de la gorge (5, 6) présente une section transversale ronde. 20
4. Dispositif de forage selon la revendication 1, **caractérisé en ce que** le trou (6) dans le trépan pilote (1) est de section transversale arrondie. 25
5. Dispositif de forage selon la revendication 1, **caractérisé en ce que** la gorge (5, 6) située à la surface du trépan pilote (1) est conçue pour fonctionner au moyen d'un mouvement de rotation et des arêtes (11) situées dans la surface de forage et dirigées vers le sens de rotation comme bord tranchant qui coupe la surface forée pendant le forage du sol, dans lequel lesdits bords (11) sont agencés pour rencontrer la surface forée essentiellement en premier lieu. 30 35
6. Dispositif de forage selon la revendication 5, **caractérisé en ce que** la surface de forage du trépan pilote (1) comprend les gorges (5) situées devant les bords tranchants (11) visibles dans le sens de rotation, lesdites gorges (5) reçoivent du matériau en vrac et font partie d'un agencement, par lequel ledit matériau découpé, détaché de la surface percée ou le matériau en vrac sont ramené par le biais des canaux de rinçage (7). 40 45
7. Dispositif de forage selon la revendication 5, **caractérisé en ce que** la surface de forage du trépan pilote (1) est agencée pour former une surface inclinée en angle (a) de sorte que le bord (11) avec le forage situé le plus possible en tête de la surface de forage. 50
8. Dispositif de forage selon la revendication 5, **caractérisé en ce que** dans la surface de forage du trépan pilote (1) est aménagé dans la gorge (5) avant le bord tranchant (11), dans lequel le mouvement d'avance donné au trépan pilote (1) et la rotation du 55



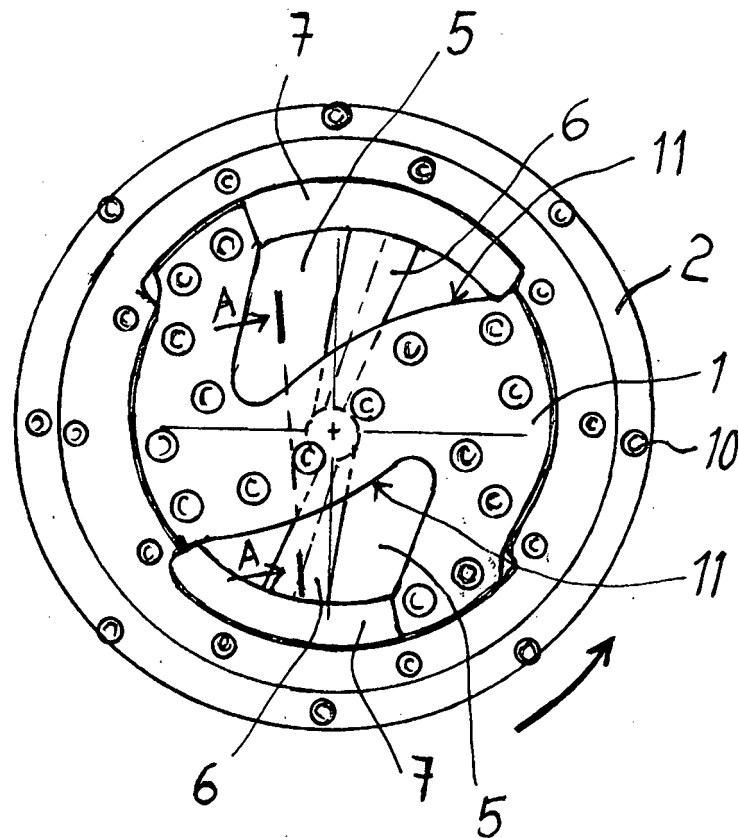


Fig. 3

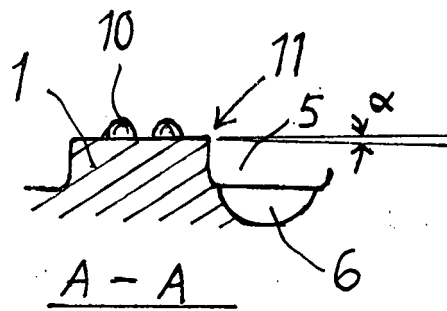


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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