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(54) **A system of heads for a fuel or feed pellet machine.**

(57) This invention relates to a system comprising of forming slots and pressing stamps of the heads of the machine for forming fuel or feed pellets, characterized by the fact that it comprises of two heads attached at shafts (6), so that the heads operate with each other,

whereas such heads are fitted with cone-like working surfaces (5), and are positioned towards each other by such surfaces (5), and either each of the adjacent heads is fitted with stamps (1) and slots (2), or one of the heads is fitted with stamps (1), while the other head is fitted with slots (2).

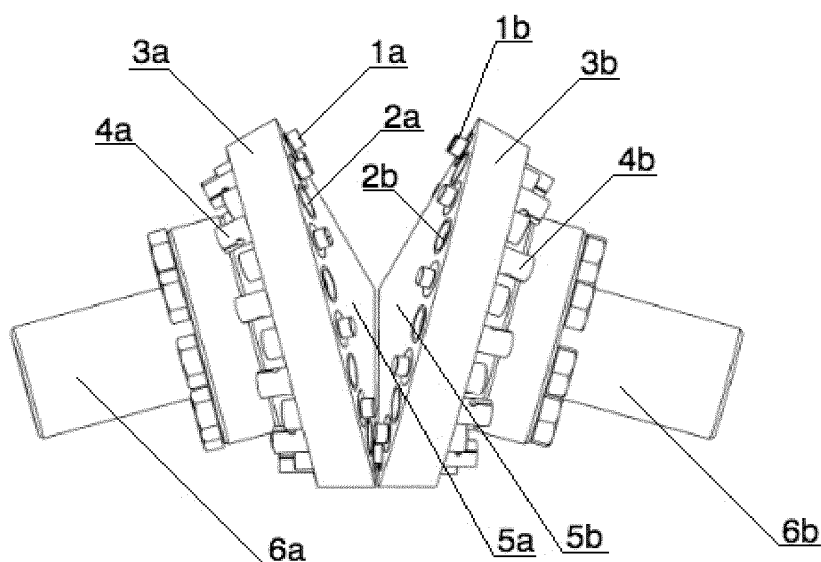


Fig. 1

Description

[0001] The invention relates to a system of heads for a fuel or feed pellet machine. The invention concerns the design of the main chamber of such a machine, which forms fuel or feed pellets. The principle of operation of such machines consists in thickening and pressing organic material through dies, whereas depending on the intended use of such a material, this can be in the form of agro or sawmill biomass, straw, rape, corn, plant cake or bran, sawdust or other waste materials, or their mixtures rejected from farming or industrial processing. The material intended for fuel pellets can be mixed with additives in the form of coal dust, and can include other additives such as fillers and bonding agents.

[0002] Polish patent description no. PL201369 discloses a method of forming solid fuel by homogenizing and briquetting components, whereas the basic stage of the formation takes place in a wheel crusher.

[0003] Polish patent application no. P.390657 discloses a method of forming fuel or feed pellets, where such a process consists of shaped vertical slot openings in a stationary horizontal die, which are arranged at the same distance from one another, within the same planes along the wheel perimeter, whereas protruding shaped pressing components are positioned perpendicularly to the stationary horizontal die. The protruding shaped pressing components are attached in a radial manner to wheel rim, so that they go into the vertical slot openings and operate one by one with further slot openings in the stationary horizontal die, while at the same time the entire surface of the stationary die is being supplied with appropriately size-reduced organic waste material. A machine for performing the said method is described as well.

[0004] Practically, such a machine caused some problems associated with the use of a flat die with forming openings, because even small imperfections in the arrangement of the forming slots in the die or the arrangement of stamps in the rollers, as well as such parts being worn out, caused imprecise overlapping of the stamps on the forming slots. For the disclosed machine, there were also problems associated with uneven distribution of the raw material. It could have been observed that the raw material mixture accumulated in some places of the die, whereas in other places the coverage was insufficient, and as such efficiency of the process was decreased. In addition, sections of compacted raw material on the horizontal die were created, and as such it was not possible to evenly feed the die openings.

[0005] Therefore, there is a need for improvement of the granulation process, in particular eliminating problems associated with manufacturing pellets with the use of a horizontal forming die. The invention has developed an improved efficient and versatile machine for manufacturing formed solid fuel and feed.

[0006] According to the invention the system comprising the forming slots and pressing stamps of the heads of the machine for manufacturing fuel or feed pellets comprises

two heads affixed on shafts, so that the heads operate with each other, whereas such heads are fitted with cone-like working surfaces and are positioned towards each other with such surfaces being in contact, and either each of the adjacent heads is equipped with stamps and slots located within the working surface, or one of the heads is fitted with stamps, while the other one is fitted with slots. The arrangement of the stamps and/or slots within the cone-like working surface of the first head is a reflection of the arrangement of the stamps and/or slots on the opposite head which operates with the first head. At least one head operating in the system of two heads is coupled, by means of a shaft to the drive unit.

[0007] A system of heads according to the invention ensures an even course of the process and its high output. In the machine, the heads operate in pairs so that their working surfaces, i.e. surfaces fitted with the slots and stamps, move continuously. Due to this solution the raw material mixture can be mixed well, and moves downwards by gravity from one side, whereas it is reclaimed by moving heads from the other side.

[0008] The subject of the invention is presented as an example embodiment in the drawing in which Fig. 1 and Fig. 2 illustrate the two heads which operate with each other, whereas each head is fitted in forming slots and pressing stamps arranged by turns, Fig. 3 illustrates a single head from Fig. 1 and Fig. 2, Fig. 4 illustrates a head fitted only with stamps, Fig. 5 illustrates a head fitted only with openings, Fig. 6 illustrates two heads which operate with each other in a cross-section view, whereas the angle of the cone-like working surface with respect to the shaft is 50°, Fig. 7 illustrates a side view of the heads from Fig. 6, Fig. 8 illustrates two heads which operate with each other in a cross-section view, whereas the angle of the cone-like working surface with respect to the shaft is 30°, Fig. 9 illustrates a side view of the heads from Fig. 8.

[0009] Fig. 1 and Fig. 2 illustrate a system of two heads as the first example of embodiment in which the first head operates with the analogously shaped second head (a system of heads). Both heads comprise the same cone-like side surfaces. According to the invention the system is comprised of two heads, whereas the first one is fitted with cone-like working surface 5a and is equipped with pressing stamps 1a on the surface, and forming slots 2a whose extension in the die consists of grooves 4a. The slots 2a and stamps 1a are arranged on the working surface 5a of the body 3a of the head, by turns in rows around the perimeter of the cone-like working surface 5a. The head is seated at the drive shaft 6a, through which it is coupled with the drive means. Such a head may comprise of one, two, three or more concentrically arranged rows of slots and/or stamps. On the second head, which operates in tandem with the first one, the arrangement of the stamps 1b and the slots 2b (with the grooves 4b) on the cone-like working surface 5b of the body 2b reflects the arrangement of the stamps and slots

on the first head. The second head is also seated at the drive shaft 6b by which it is coupled with the drive means. When in operation, the heads are positioned so that every stamp on 1a and 1b meets the slot on 2a and 2b. The easiest manner to achieve this effect is to arrange the slots and stamps at strictly specified repeatable distances, so that those components which operate with one another in head pairs would constitute their mirror reflection, when in operation, so that stamps 1 and slots 2 are positioned facing each other.

[0010] Fig. 3 illustrates a single head of the system of heads, which operate with one another, as described above. The head's cone-like working surface 5 of the body 3 is fitted with stamps 1 and slots 2.

[0011] However, a different embodiment is possible, in which the head from this invention whose cone-like working surface 5 of the body 3 is fitted only with stamps 1 or only with slots 2. Such an example of the heads is illustrated in Fig. 4 and Fig. 5. For such a design of the heads, the head fitted with slots operates with the head fitted with stamps.

[0012] The stamps provided for the heads as elements whose task is to press the raw material effectively, are always adjusted by their shape to the shape of the sleeve. Fig. 2 illustrates an example of arranging the system of heads in the pellet or briquette forming machine and marked by an arrow S to indicate the direction of raw material falling down, which takes place by gravity from the top.

[0013] The cone-like working surface 5 of a single head in the system of heads can be positioned at various angles with respect to the shaft axis; both at a small angle as presented in Fig. 1, as well as tilted at greater angles with respect to the shaft axis. Fig. 6 illustrates an example of embodiment of the system of heads in accordance with the invention, where the surface 5 angle of the head with reference to its shaft 6 axis is 50°, whereas Fig. 8 illustrates an example of embodiment in which the angle is 30°. This angle can have such a value that the shape of the working surface 5 of the head becomes similar to the form of a cylinder. In addition to the various values of angles shaft 6 of two heads which operate with each other are arranged with each other at an altered suitable angle. The examples of head embodiments presented in Fig. 6 and Fig. 8, can optionally require a connection of the working surface 5 with additional spacing surface 7, but this does not alter the operation of the heads and beneficial effects achieved.

[0014] The machine for producing fuel or feed pellets can in principle comprise any quantity of two-head systems combined into sections operating together, i.e. any quantity of two-head systems. At least one head in the two-headed system is connected by means of a drive shaft to the drive means.

[0015] Movement of two heads operating together ensures collection of the raw material, as well as its pressing through the openings and squeezing. If only one head is coupled with the drive unit, such as in situations which

necessitate mutual transmission by engagement of stamps in one head with the openings of the opposite head, which is equipped with bearing so that it can move freely. Being an invention variant, if both heads operating with one other are coupled with drive units and are driven independently, their rotational speed values are selected so that there is no friction between the working components due to the application of a suitable gear ratio. Such a solution significantly improves the lifetime of the machine by eliminating metal-to-metal friction.

[0016] It is preferable that the tubular slots and stamps designed for the head have a cylindrical shape, but their cross-section can be oval, square or triangular as well. Cylindrical shapes are, however, a matter of choice, but are still the preferred shape for many reasons. The diameter of the fuel forming openings, and that is the diameter of formed fuel shaped items (briquettes, pellets) can be selected rather freely; from a few millimetres to a few centimetres, e.g. from 6 to 25 mm.

[0017] The heads can be arranged so that the raw material below their surfaces is returned directly or indirectly into the machine.

Claims

1. A system comprising forming slots and pressing stamps, machine heads for forming fuel or feed pellets, **characterized in that** it comprises of two heads attached to shafts (6) so that the heads operate with each other, whereas such heads are fitted with cone-like working surfaces (5), and are positioned towards each other by such surfaces (5), and either each of the adjacent heads is equipped with stamps (1) and slots (2) located within the working surface (5), or one of the heads is fitted with stamps (1), while the other surface (5) is fitted with slots (2).
2. A system of heads according to Claim 1 is **characterized in that** the arrangement of stamps (1) and/or slots (2) within the cone-like working surface (5) of the first head is a reflection of the arrangement of stamps (1) and/or slots (2) on the opposite head which operates with the first head.
3. A system of heads according to Claim 1 or 2 **characterized in that** at least one head operating in the system of two heads is coupled by means of a shaft (6) to the drive unit.

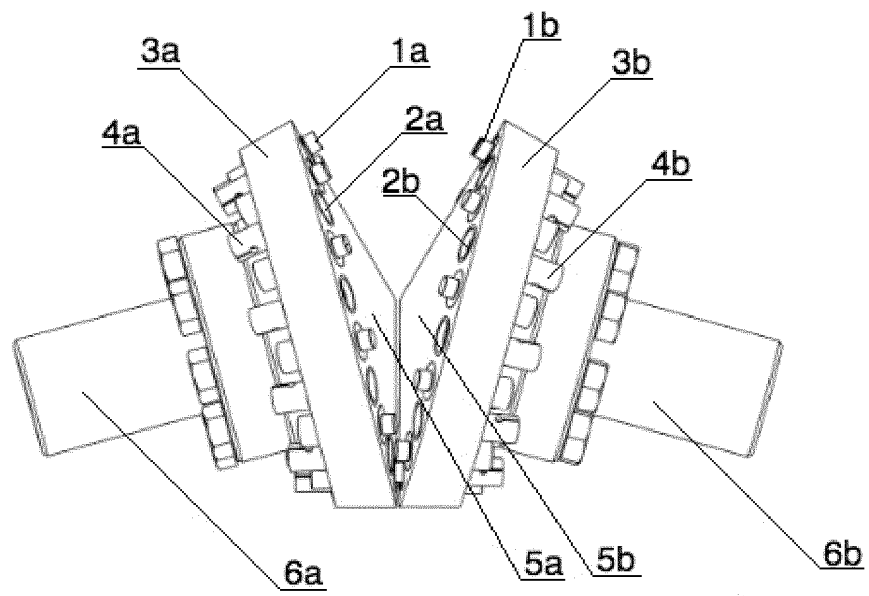


Fig. 1

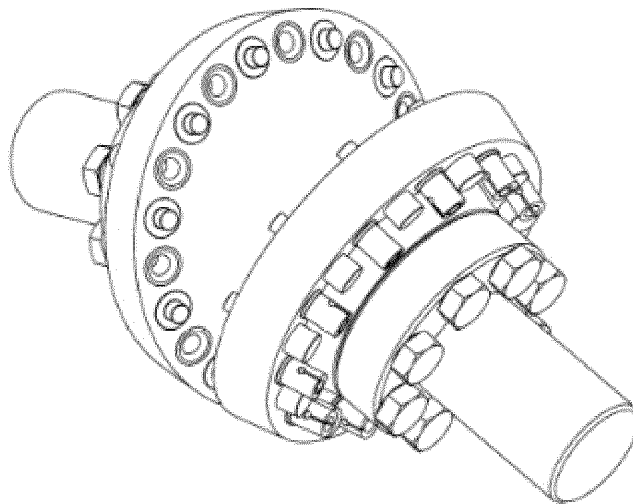


Fig. 2

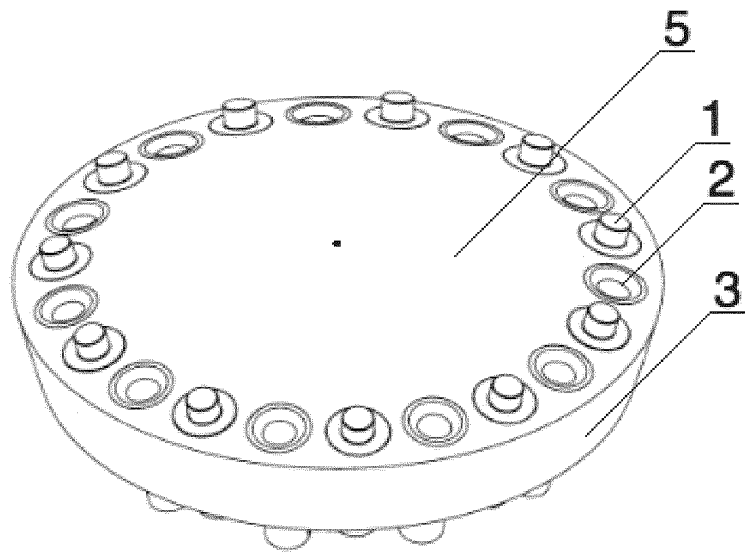


Fig. 3

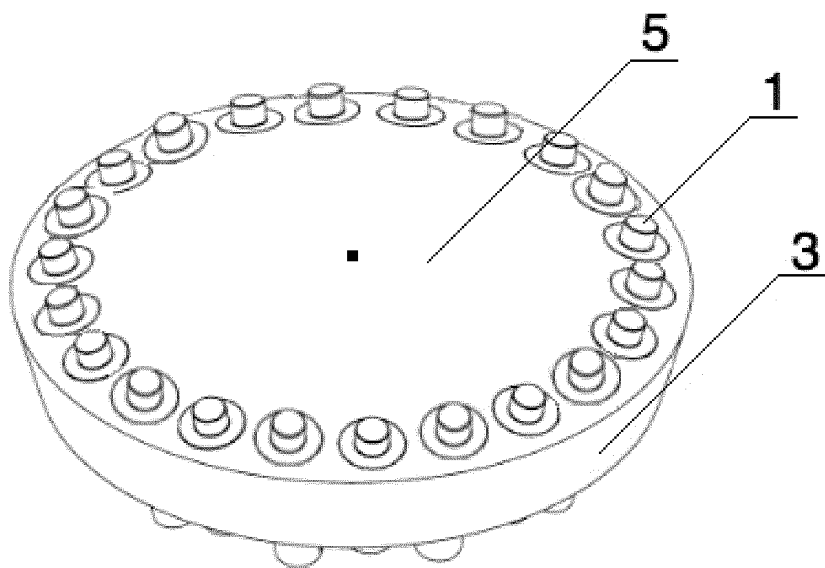


Fig. 4

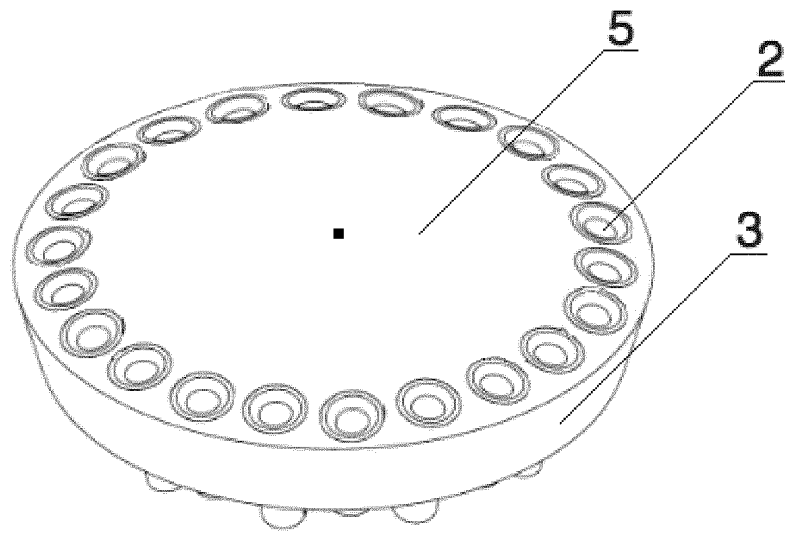


Fig. 5

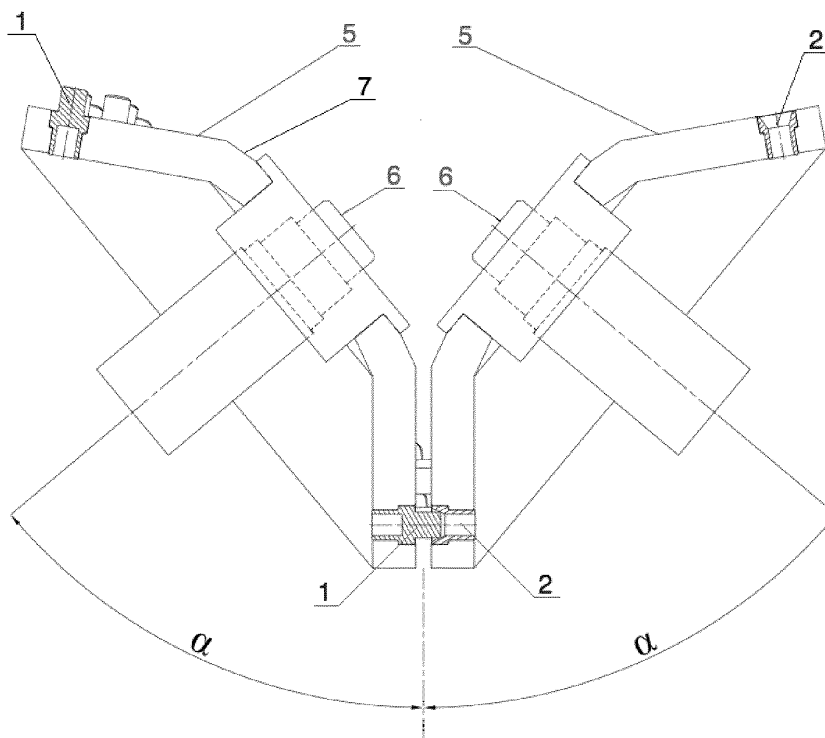


Fig. 6

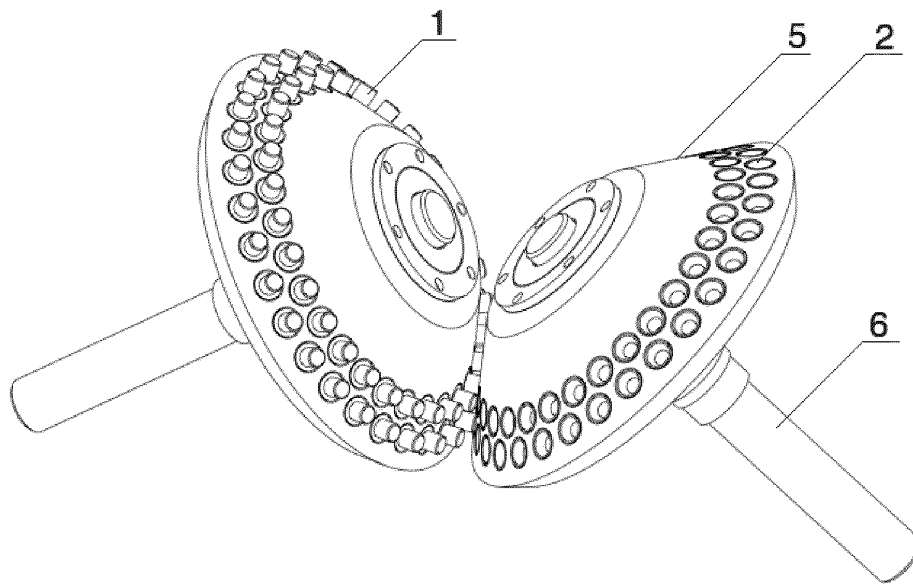


Fig. 7

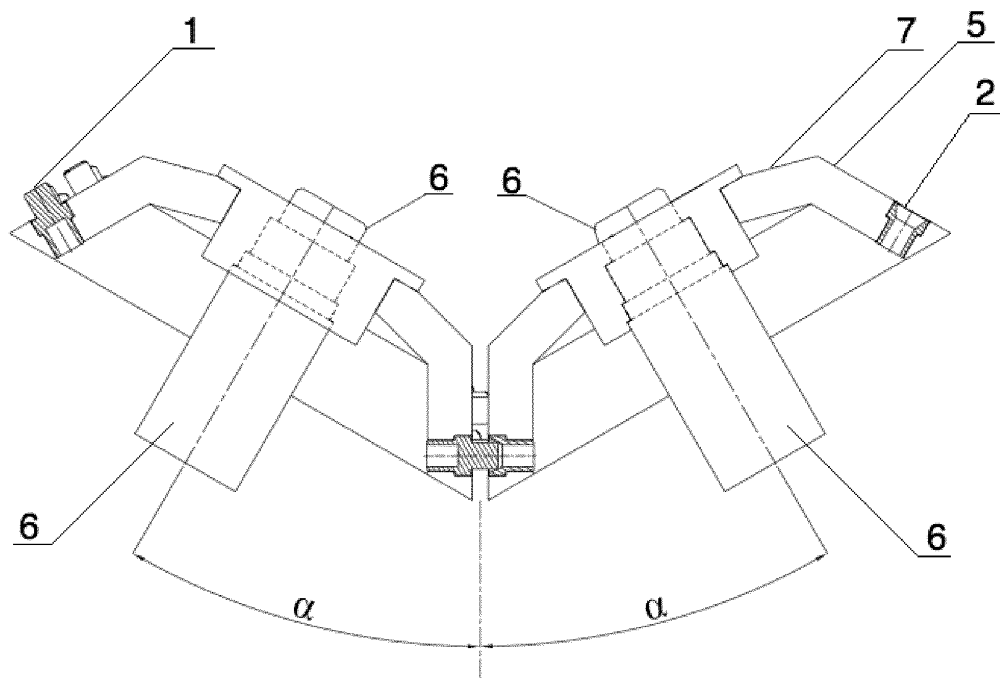


Fig. 8

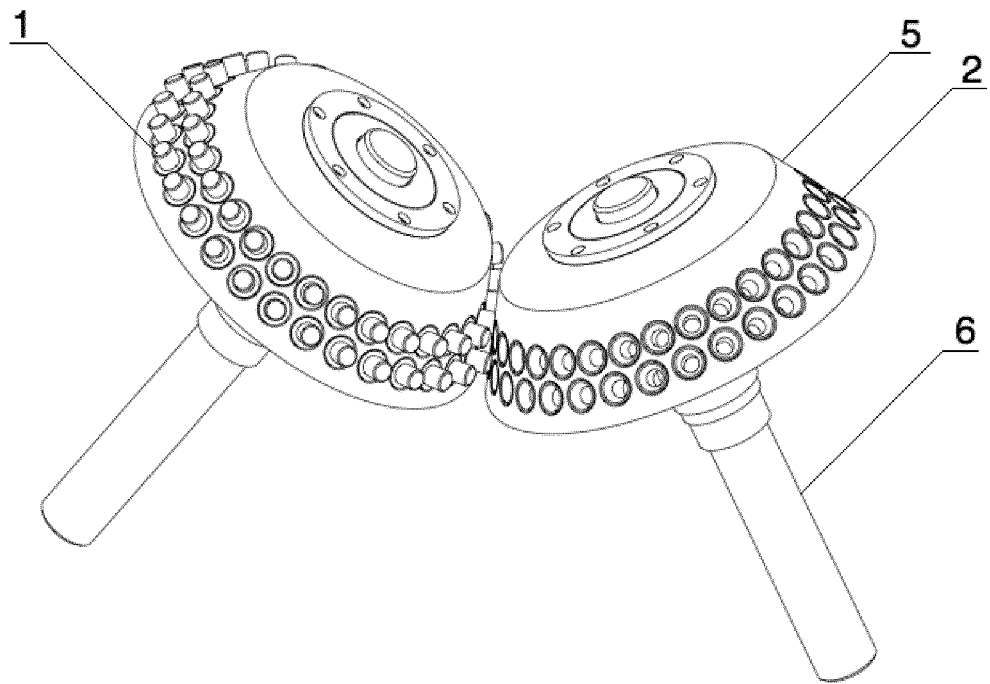


Fig. 9



EUROPEAN SEARCH REPORT

Application Number
EP 13 15 4118

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 9 April 2013	Examiner Bélibel, Chérif
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