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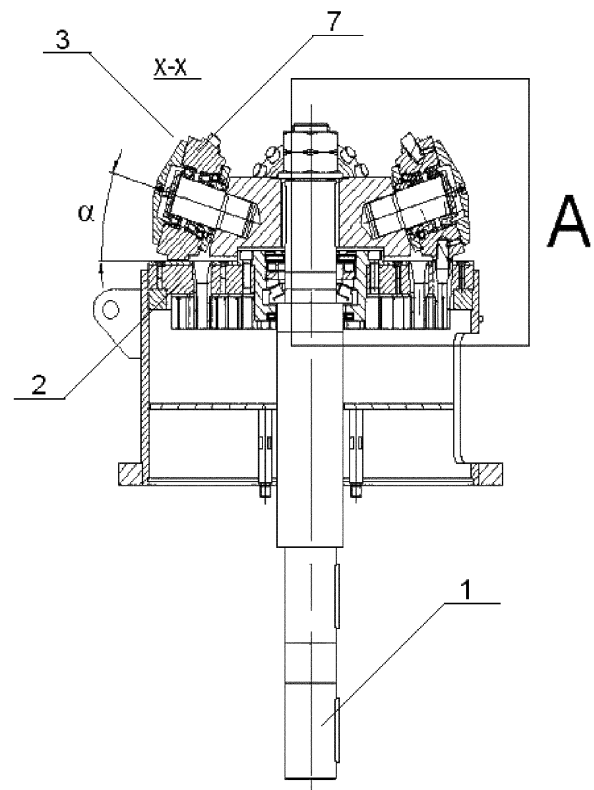
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(54) **Forming tool of the device for producing fuel or feed pellets.**

(57) The forming head of the machine producing fuel or feed pellets containing a matrix plate with numerous forming tubes arranged concentrically relative to the drive shaft, whereby the matrix plate cooperates with the mechanism mounted on the drive shaft with crushing rollers (7) on bearings and equipped around the periphery with forming punches (8) that enter on roller rotation into the appropriate forming tubes of the matrix plate, is characterized in that each of the crushing rollers (7) has a conically shaped lateral surface and is firmly connected to the rotating mechanism (3), whereas the angle α of inclination of each of the crushing rollers (7) in relation to the surface of the matrix plate (2) ranges from 2.5 to 25°. The forming punches (8) of the matrix plate have a shaped work surface. (9).

Fig. 2



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Description

[0001] This invention relates to the forming head of the equipment producing fuel or feed pellets, which is designed especially for devices operating on the basis of the compaction and compression of organic material, which, depending on the application, may take the form of agricultural or saw-milling biomass, straw, bran, sawdust and other waste materials or their mixtures originating from agriculture or industry. The material intended for the production of fuel pellets can also be enriched with additions raising the energy value of pellets, especially additions in the form of fine coal, and it may contain other additions in the form of various kinds of binders to improve the quality of pellets.

[0002] From the Polish description of invention no. P-390657, a device is known for the production of fuel and feed pellets, in which the head forming the pellets consists of a matrix plate with forming tubes, arranged concentrically relative to the drive shaft and a rotating mechanism, mounted on the drive shaft, with crushing rollers on bearings and equipped with forming punches which, at the rotation of crushing rollers, enter the forming tubes that are embedded in the matrix plate. The rotating mechanism has the form of a cross with arms and at the ends of these arms, the crushing rolls in their bearings are mounted. The lateral surface of the crushing rolls is in the form of a cylinder. Perpendicular to that surface, in each of the rollers, along the entire circumference, are mounted the forming punches with a flat working surface and a diversified cross-section matching the cross-section shape of the forming tubes. The punches and tubes have a cross-sectional shape of a circle, oval or square. The forming tubes embedded in the matrix plate are cylindrical with an external stopper ring in the upper part and a diversified shape of the internal channel. In the upper part, the internal channel of the tube has the shape of a convergent cone, which turns in the middle into a cylindrical shape and then goes into another cylindrical shape with a larger diameter.

[0003] In practice, the production of such a device presented many difficulties, because even small inaccuracies in the distribution of forming tubes in the matrix plate or in the distribution of forming punches in the rollers, as well as the wear of these parts resulted in inaccurate entrance of the forming punches into the forming tubes. Also, when feeding mixtures, in which hard contamination was present, or in the case of greater hardness of the material, from which pellets were formed, the tubes and forming punches wore out quickly. Simple, solid ends of forming tubes not susceptible to deformation were frequently jammed with formed pellets, and their cleaning was quite troublesome.

[0004] The aim of the present invention is to design a forming head devoid of existing deficiencies.

[0005] The forming head of the device for producing fuel or feed pellets containing a matrix plate with numerous forming tubes arranged concentrically relative to the

drive shaft, whereby the matrix plate cooperates with the mechanism mounted on the drive shaft with crushing rollers, on bearings, and equipped around the periphery with forming punches, entering, on the rotation of the rollers, into the appropriate forming tubes of the matrix plate, according to the invention, is **characterized in that** each of the crushing rollers has a conically shaped lateral surface and is firmly connected to the rotating mechanism, whereby the angle of inclination of each of the crushing rollers in relation to the surface of the matrix plate ranges from 2.5 to 25°.

[0006] The forming head is also **characterized in that** the crushing rollers of the rotating mechanism are mounted in the common holder, preferably by means of pins.

[0007] The forming head is also **characterized in that** the holder has a shape of a block mounted on the drive shaft, of which the oblique lateral surface is perpendicular to each of the axes of the crushing rollers.

[0008] The forming head is also **characterized in that** each of the forming punches of the arbitrary cross-section shape has a shaped work surface, preferably created by a shaped cutting.

[0009] The forming head is also characterized by the fact that the working surfaces of forming punches or the whole forming punches are made from materials of high hardness, preferably of sintered metals, sintered carbides, sintered ceramics or other materials with similar parameters.

[0010] The forming head is characterized in that each forming tube embedded in the matrix plate is a uniform part of diversified shape, whereas from the outside, it preferably has the form of a solid narrowing stepwise towards the bottom, while the inside of the forming tube assumes a chalice-like shape at the top where the shape of its cross section is adjusted to the cross-section of the forming punches, where the chalice-like shape in the forming middle section runs into a straight section, whereas the final section of the tube preferably has at least one longitudinal slit.

[0011] The forming head is also characterized in that the work surfaces of the forming tubes or the whole forming tubes are made of materials of high hardness, preferably of sintered metals, sintered carbides, sintered ceramics or other materials with similar parameters.

[0012] The conic lateral surface of the crushing rollers and the angular positioning of the axes of the rollers make it much easier to introduce the forming punch into the forming tube, even in the presence of small deviations in guiding the punches. Pin mounting of the rollers in the holder also reduces the risk of the rollers shifting in relation to the forming tubes. In addition, the longitudinal incision of the final part of the forming tube introduces the possibility of expanding the outlet in a resilient manner and thus prevent jamming with pellets. The application of shaped work surfaces of the punches introduces the possibility of better feeding of the material from which the pellets are made, into the forming tube, whereas the application of hard material for punches and forming tubes

improves their resistance to abrasion and extends their durability.

[0013] An embodiment of the invention is shown in the drawing, in which fig.1 presents a lateral view of the forming head, fig.2 presents the cross-section of the forming head, fig.3 presents the top view of the forming head, fig.4 presents an enlarged fragment of the roller cooperating with the matrix plate, fig.5 through fig.7 presents an example of the working surface of the punch with the relief in the shape of an inverted cone, fig.8 through.10 present another variant of the work surface of the punch with the cone-shaped relief, fig.11 through fig.13 present a sample forming tube with a cross-section shape of a circle in the version with four longitudinal grooves.

[0014] The forming head of the device producing fuel or feed pellets in this embodiment consists of a drive shaft 1, on which the matrix plate 2, as well as the rotating mechanism 3 are mounted. The forming tubes 4 are embedded in the matrix plate 2. The rotating mechanism 3 consists of the holder 5, in which crushing rollers on bearings 7 are mounted firmly, with the use of pins 6. The axis of rotation of each crushing roller 7 is inclined towards the matrix plate surface at an angle α of 20°, and in other embodiments, it can be positioned freely within an angle α range from 2.5 to 25° and is perpendicular to the lateral surface of the holder 5. Each of the crushing rollers 7 has a conical lateral surface, on which are embedded the forming punches 8. The forming tubes 4 are arranged in the matrix plate 2 in a circle, concentrically in relation to the drive shaft 1 and at equal distances from each other. To increase the efficiency of the forming head, the forming tubes 4 are also located on the second circle, concentrically in relation to the drive shaft 1 and at equal distances from each other. In the embodiment, the rotating mechanism 3 is equipped with four crushing rollers 7, which are evenly spaced around the circumference of the holder 5, with one pair of rollers 7 located on the opposite in the holder 5, has a suitable spacing and distribution of the forming punches 8 in relation to forming tubes 4 embedded on the external circle, whereas the second pair of crushing rollers 7 has a suitable spacing and distribution of forming punches 8 in relation to forming tubes 4 embedded on the internal circle. In addition, the cross-sectional shape of the forming punches 8 corresponds to the cross-sectional shape of the forming tubes 4, with which they cooperate. The cross-section in the embodiment is circular, while in other embodiments, it can be square, polygonal or oval. The work surface 9 of the forming punches 8 is shaped, for example, in the form of a sunken cone or in the form of a sunken inverted cone. The holder 5 of the rotating mechanism 3 has the shape of a truncated pyramid with a base of a regular octagon, but in other embodiments, it can have the shape of a truncated cone or some other shape. Each of the forming tubes 4, constitutes a uniform part of a diversified shape; from the outside, it preferably has a form of a solid that narrows stepwise to the bottom, whereas the inside of the forming tube 4 has a chalice-like with the shape of

its cross section adjusted to the cross-section shape of the forming punches 8 cooperating with it, where the chalice-like shape in the middle forming section runs into a straight section, whereas the end section of the forming tube 4 has four longitudinal slits 10 running in the final section into a technological hole 11. The slits 10 are arranged opposite to each other. In other embodiments, the number of slits can be optional. The forming punches 8 and the forming tubes 4 are made of sintered carbides. In other embodiments, the forming punches 8 and forming tubes 4 can be made of other materials of high hardness, such as sintered metals or sintered ceramics or other materials exhibiting the same or better durability properties. The forming punches 8 and the forming tubes 4 can also have only the work surfaces made of such materials.

Claims

1. The forming head of the device for producing fuel or feed pellets containing a matrix plate with numerous forming tubes, arranged concentrically relative to the drive shaft, whereby the matrix plate cooperates with the mechanism mounted on the drive shaft with crushing rollers, on bearings, and equipped around the periphery with forming punches, entering on roller rotation into the appropriate forming tubes of the matrix plate, is characterized in that each of the crushing rollers (7) has a conically shaped lateral surface and is firmly connected to the rotating mechanism (3), whereby the angle α of inclination of each crushing roller (7) in relation to the surface of the matrix plate (2) ranges from 2.5 to 25°.
2. The forming head, according to claim 1, is **characterized in that** the crushing rollers (7) of the rotating mechanism (3) are mounted in the common holder (5), preferably by means of pins (6).
3. The forming head, according to claim 1, is **characterized in that** the holder (5) has a shape of a block mounted on the drive shaft (1), of which the oblique lateral surface is perpendicular to each axis of the crushing rollers (7).
4. The forming head, according to claim 1, is **characterized in that** each of the forming punches (8) has a shaped work surface (9), preferably created by the shaped cutting.
5. The forming head, according to claim 1 or 4, is **characterized in that** the working surfaces (9) of the forming punches (8) or the whole forming punches (8) are made from a material of high hardness, preferably of sintered metals, sintered carbides, sintered ceramics or other materials with similar or better parameters.

6. The forming head, according to claim 1, is **characterized in that** each of the forming tubes (4) embedded in the matrix plate (2) constitutes a single part of diversified shape, whereas from the outside, it preferably has the form of a solid that narrows stepwise to the bottom, while the inside of the forming tube (4) assumes, from the top, a chalice-like shape with the shape of its cross-section adjusted to the cross-section of the forming punches (8), where the chalice-like shape in the middle forming section runs into a straight section, whereas the final section of the tube preferably has at least one longitudinal slit (10).
7. The forming head, according to claim 1 or 6, is **characterized in that** the working surfaces of the forming tubes (4) or the whole forming tubes (4) are made from a material of high hardness, preferably of sintered metals, sintered carbides, sintered ceramics or other materials with similar or better parameters.

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Fig. 1

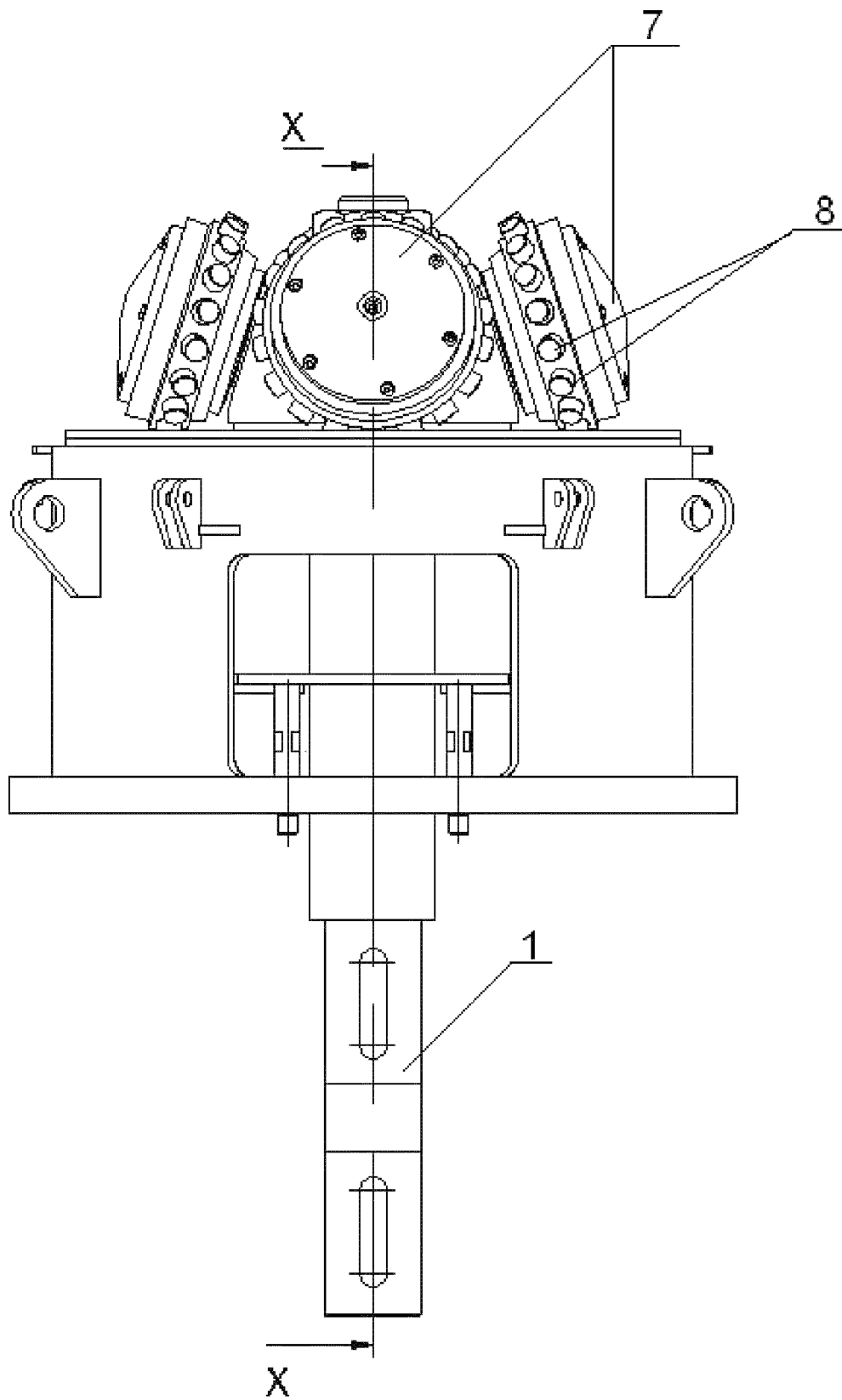


Fig. 2

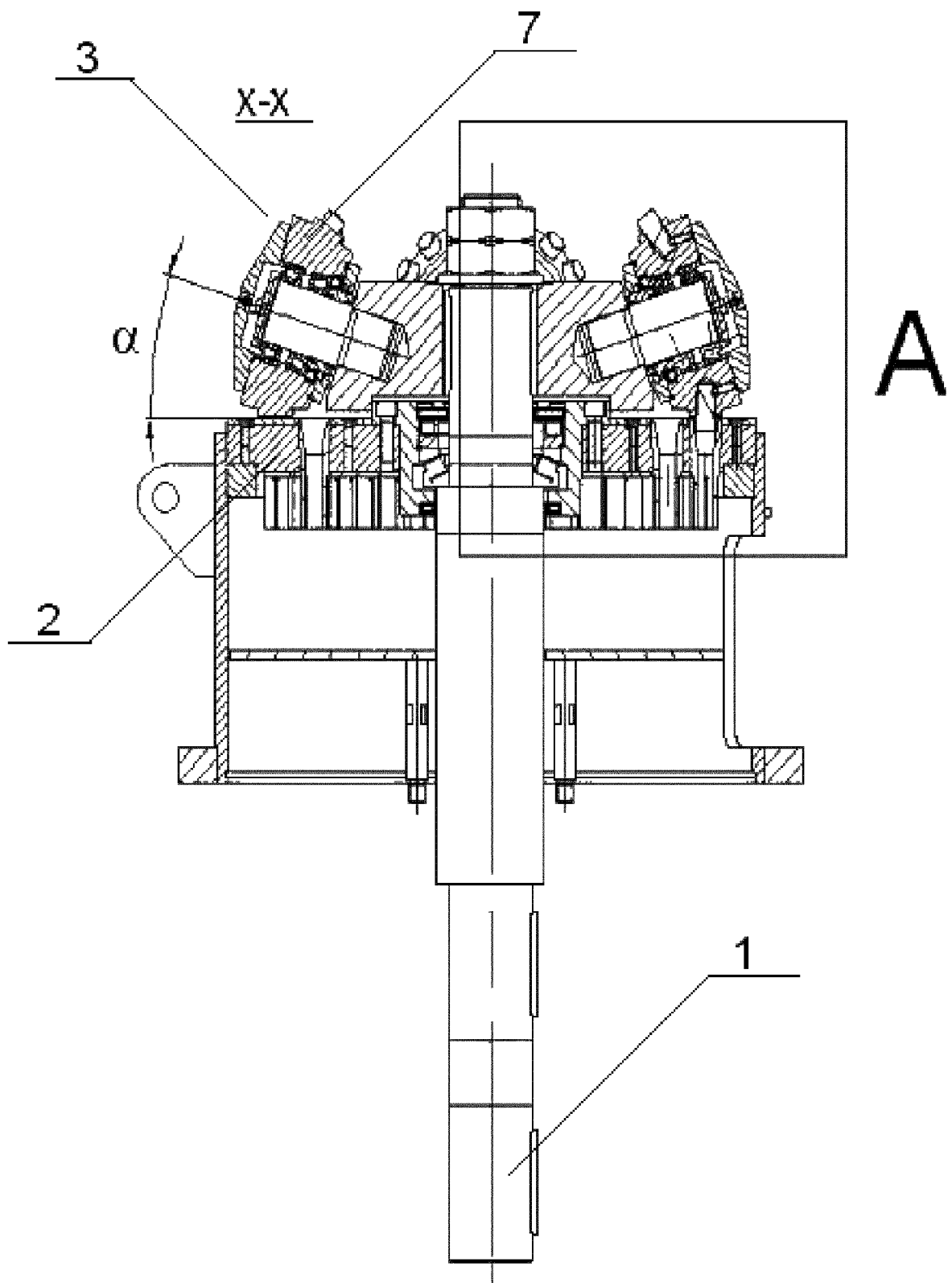


Fig. 3

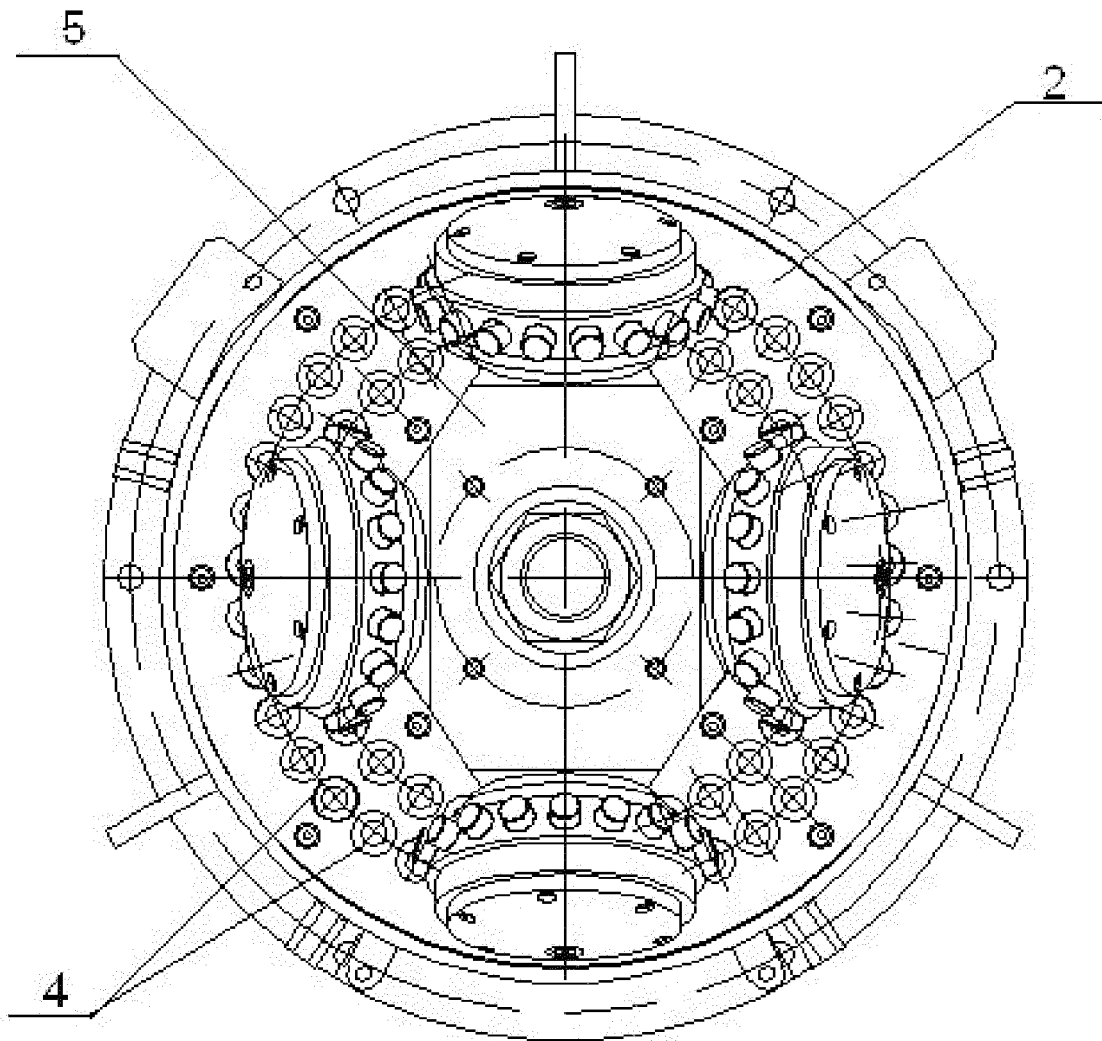


Fig. 4

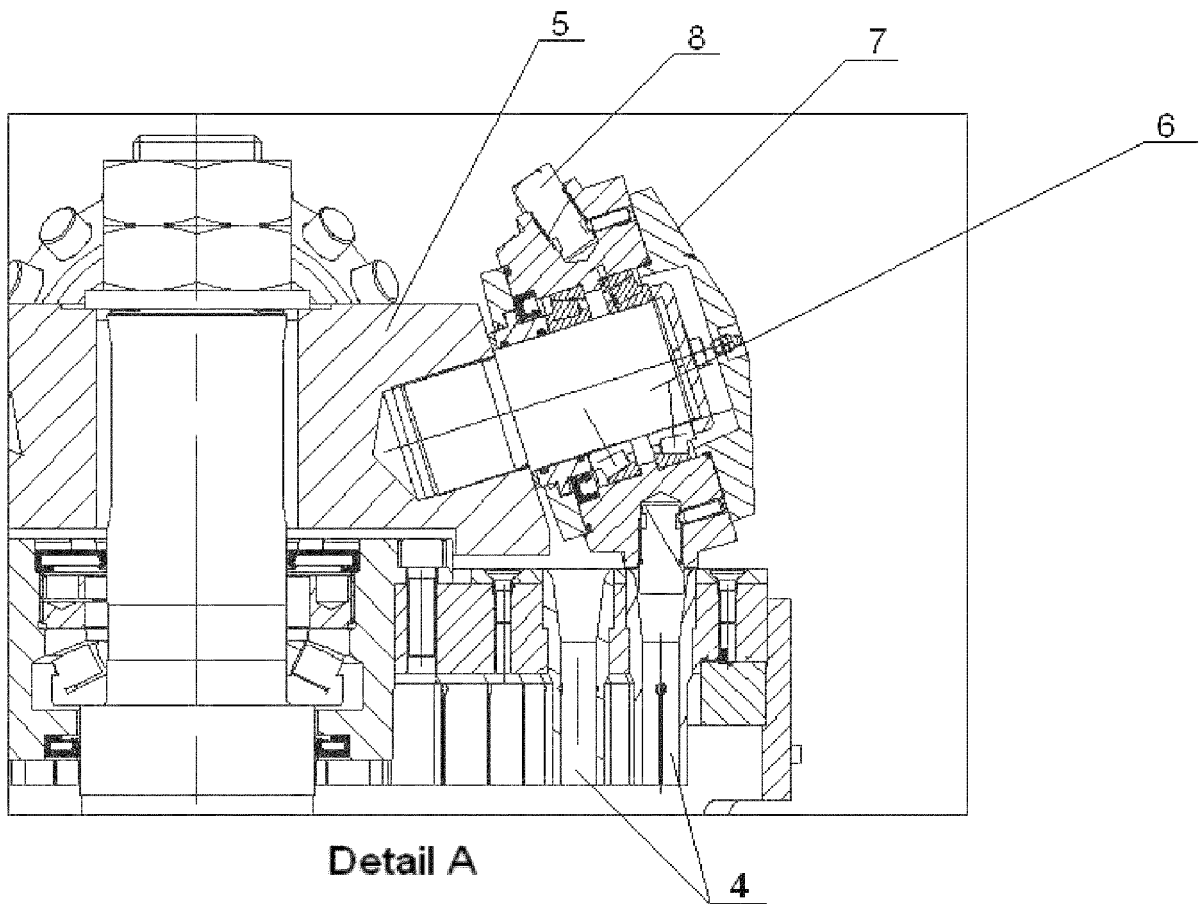


Fig. 5

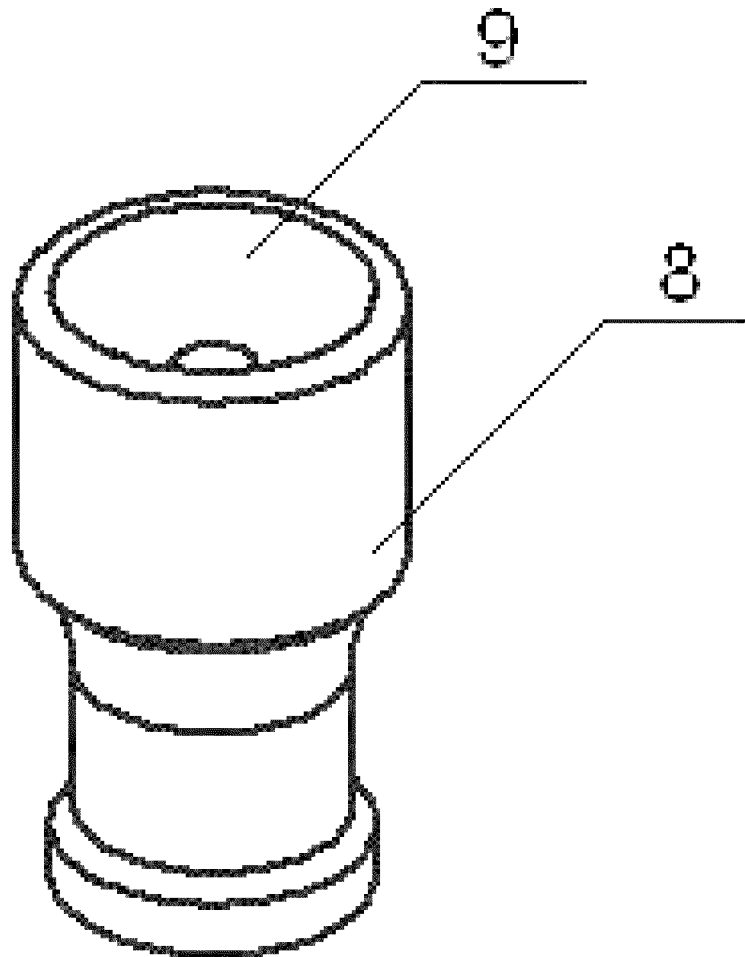


Fig. 6

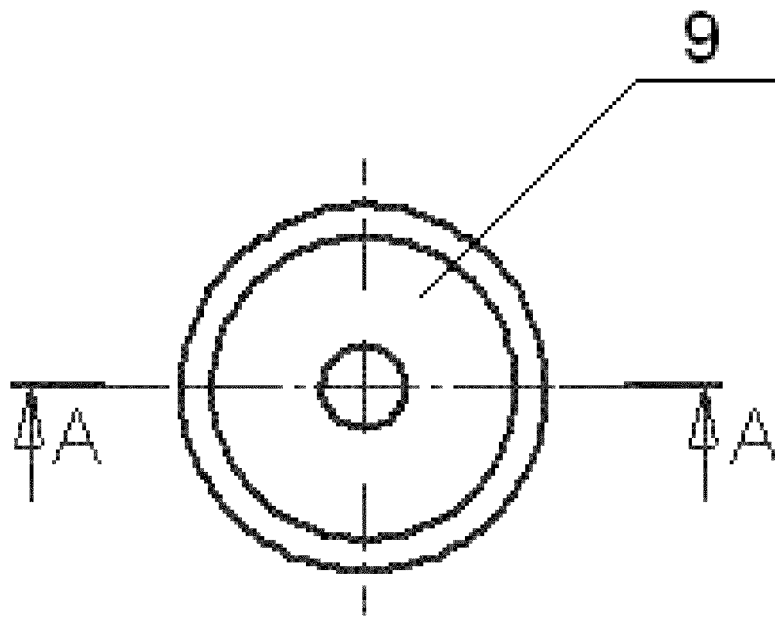
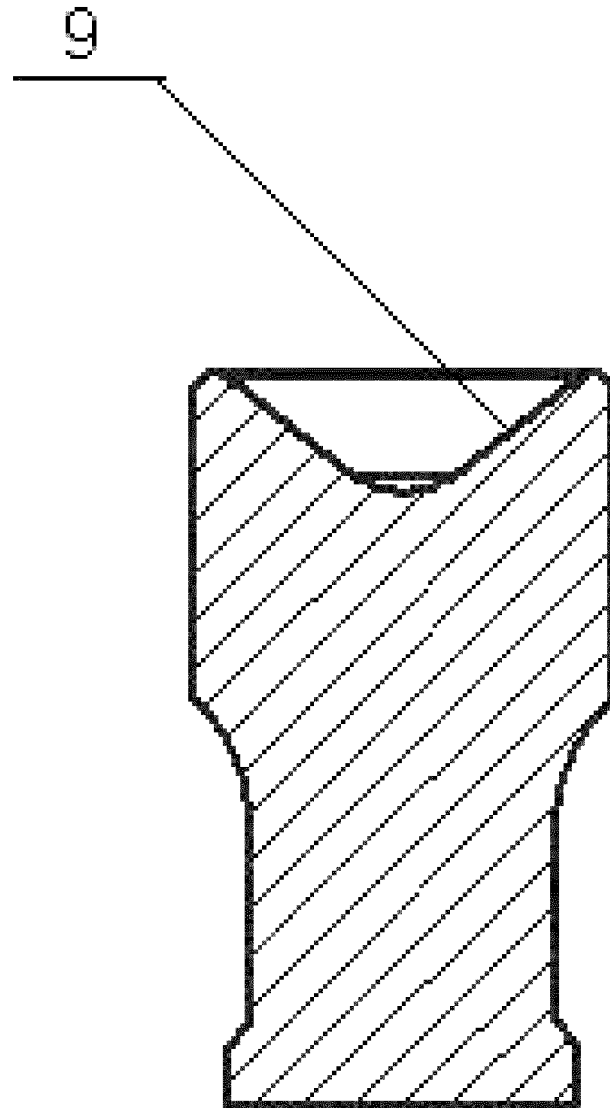


Fig. 7



Section A-A

Fig. 8

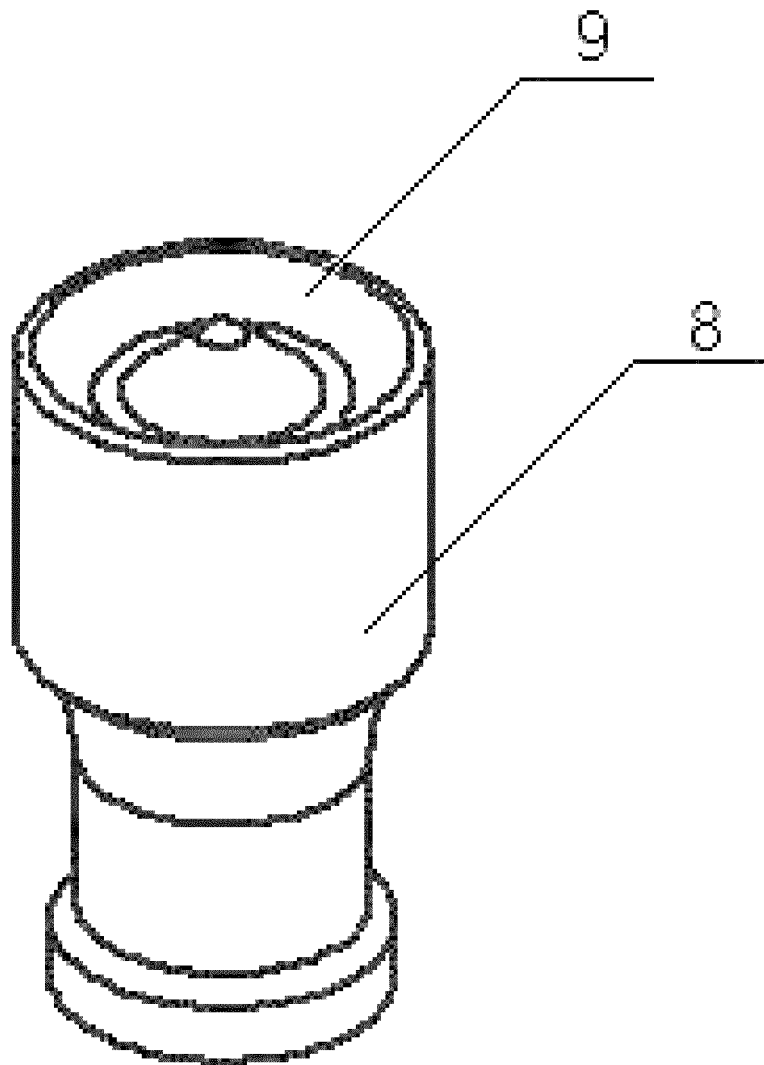


Fig. 9

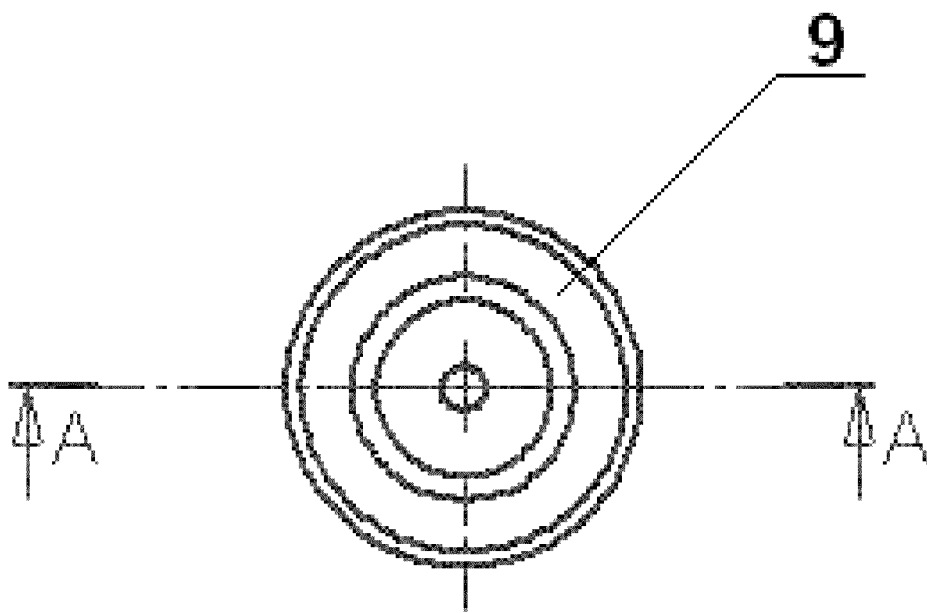
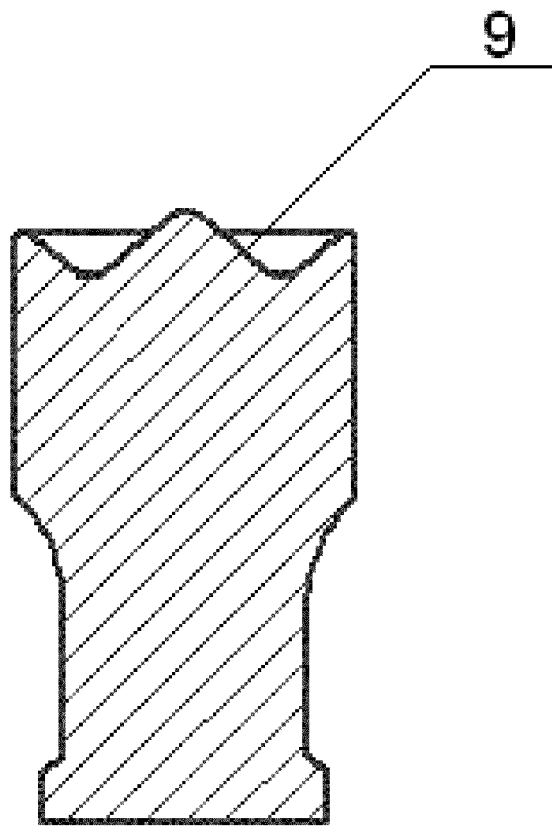


Fig. 10



Section A-A

Fig. 11

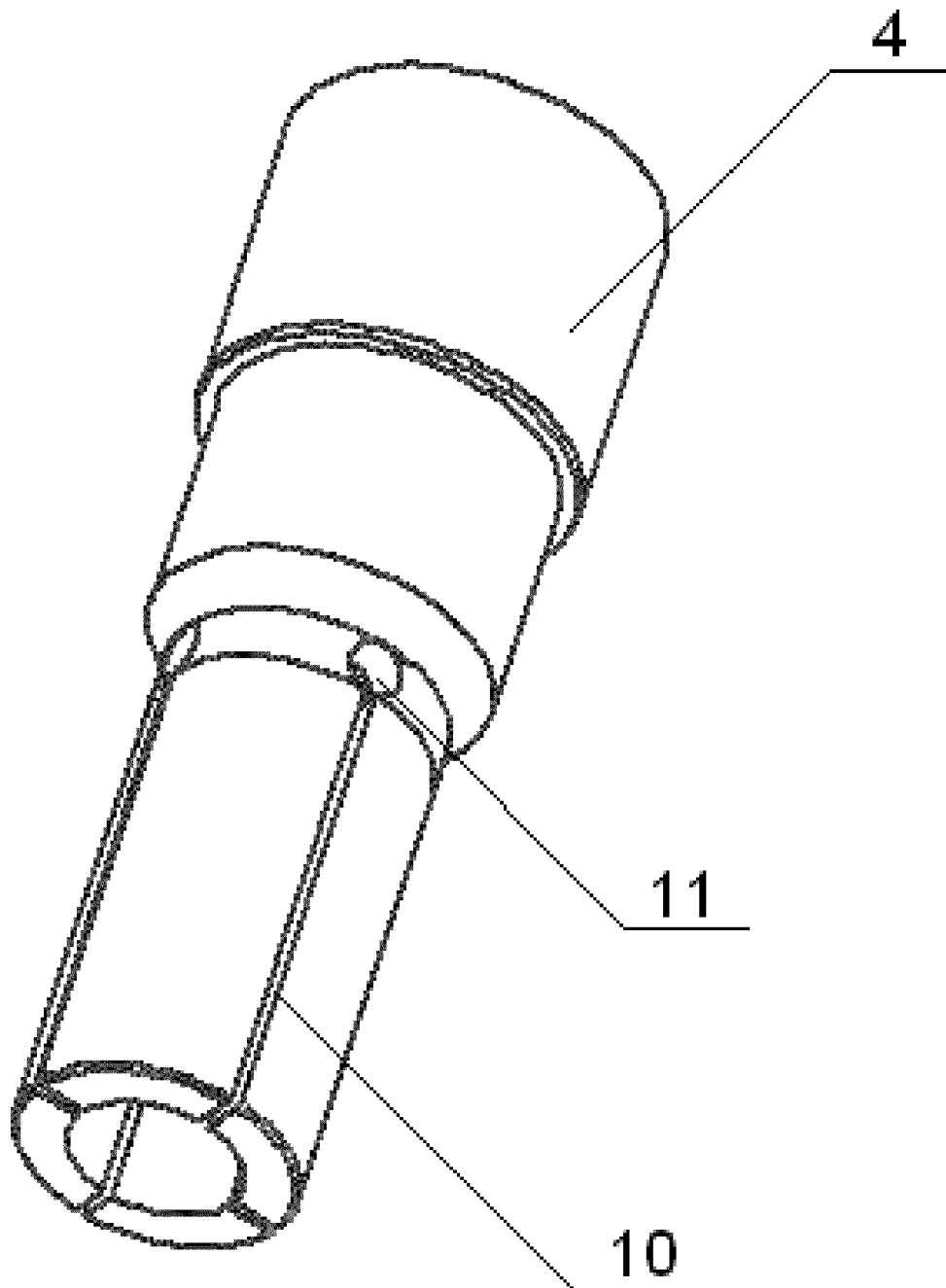


Fig. 12

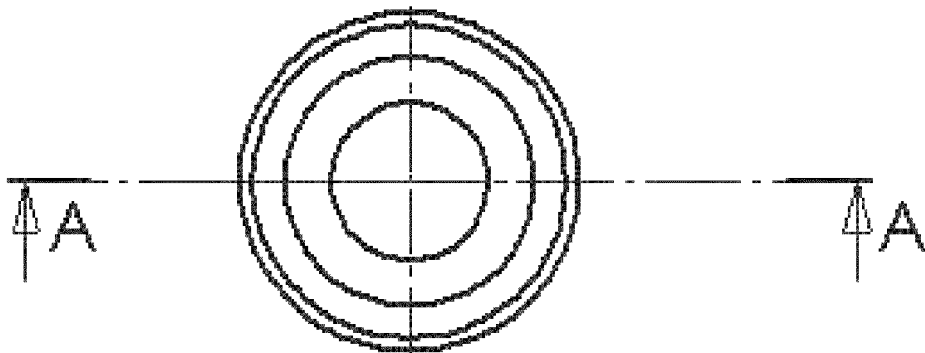
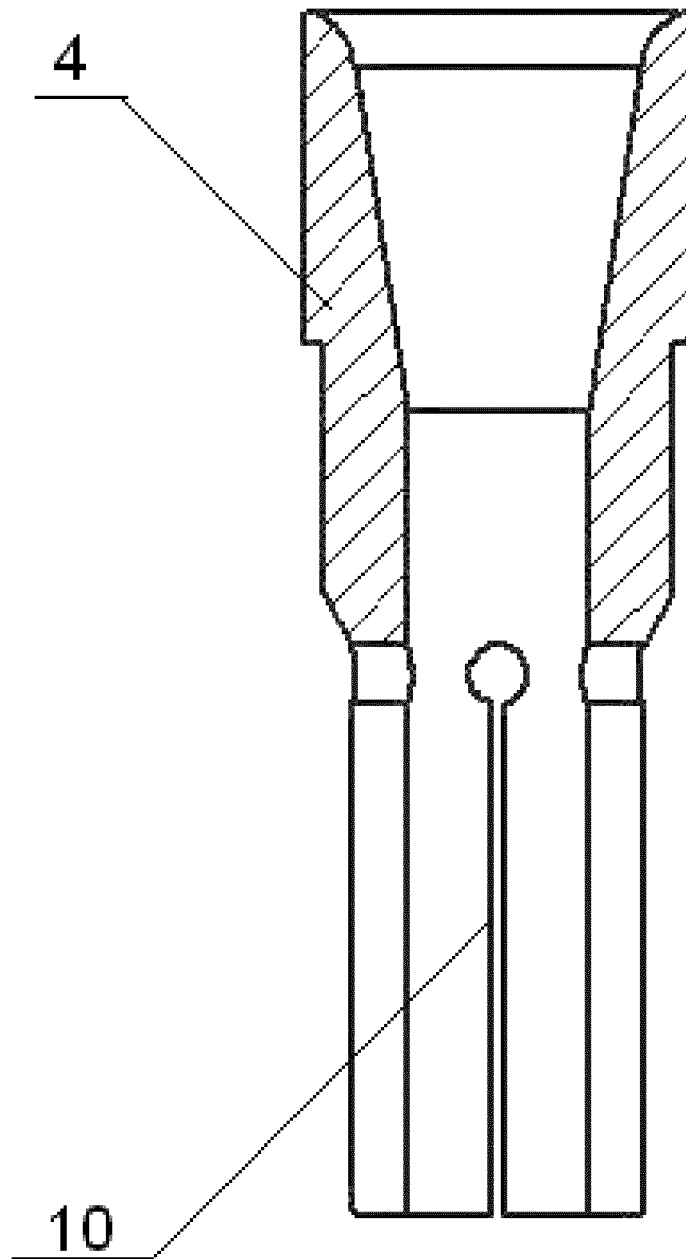


Fig. 13





EUROPEAN SEARCH REPORT

Application Number
EP 12 17 8483

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ANNEX TO THE EUROPEAN SEARCH REPORT
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