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(54) **Szerszámtartó és eljárás szerszám felvevő előállítására ilyen szerszámtartókhoz**

TOOL HOLDER AND METHOD FOR PRODUCING A TOOL RECEIVING PORTION FOR SUCH A TOOL HOLDER

This invention relates to a tool holder for clamping tools by friction. The invention also relates to a clamping system with a tool holder of this kind, and also to a method for producing a tool receiving portion for such a tool holder.

Already known from WO 2007/118626 A1 is a tool holder with an expansion sleeve deployed within a main part, the expansion sleeve being formed to receive a tool and capable of being compressed with hydraulic fluid to clamp the tool in place. The tool holder further includes a safety catch that contains multiple corresponding counter elements to engage with the locking elements deployed in the main part, in order to prevent the axial slippage of the tool during the processing. In this known tool holder, the blocking elements are realized as bolts or balls that can slide into corresponding drilled holes in the main part, and engage with corresponding clamping grooves on the shank of a tool to be clamped. In this tool holder, however, the main part must be handled in a time-consuming way to release the blocking elements.

EP 2749367 discloses a tool holder having a main part, a deformable receiving portion for clamping a tool and two blocking elements integrally formed within the receiving portion. The blocking elements are formed to prevent axial slippage of the tool from the receiving portion by engaging with corresponding counter elements on the tool and are set apart at equal angles in the peripheral direction in the receiving portion. Further tool holders with stable receiving portions are also known from EP 1029620, JP S4895278, EP 2001624 and JP 1430001.

The objective of the invention is to produce a tool holder of the above-described kind, as well as a clamping system with such a tool holder, that is simpler to produce and easy to assemble.

This objective is achieved by means of a tool holder with the characteristics of Claim 1 and a clamping system with the characteristics of Claim 13, as well as a method of production a tool receiving portion for such a tool holder having the characteristics of Claims 14 through 16. Preferred refinements and advantageous configurations of the invention are set forth in the

dependent claims.

In the tool holder of this invention, the blocking elements are formed integrally with the receiving portion and are helically running in the peripheral direction. As a result, the receiving portion can easily be fitted together with the blocking elements. In addition, the blocking element does not take any space away from the receiving portion. The entire available space can be used by the receiving portion, so that there is no loss of clamping force.

The clamping system of the invention comprises a tool holder and a tool, the tool holder comprising a main part, a deformable receiving portion for clamping a tool, and at least two blocking elements formed integrally with the receiving portion, which engage with corresponding counter elements to prevent the tool from slipping axially out of the tool holder.

In an especially preferred embodiment, the receiving portion is an expansion sleeve deployed in a receiving opening of the main part and subject to external pressure with hydraulic fluid, on the inner side of which are deployed the blocking elements.

The receiving portion can however also be a contracting chuck, a rolling power chuck, a reducing sleeve deployed within a clamping chuck, or a collet chuck that can be deformed by a clamping element and deployed within a receiving opening of the main part, on the inner side of which are deployed the at least two blocking elements; or another frictional clamping system.

In an embodiment that is both advantageous in production terms and easy to assemble, the at least two blocking elements can be formed directly on the receiving portion. The blocking elements can, however, in the case of an expansion sleeve, also be a separate component implemented as a ball, bolt, etc., fastened to the expansion sleeve.

The receiving portion can be produced from ceramic, metal, or a mixture of the two.

For direct forming of the blocking elements on the receiving portion, the receiving portion according to this invention is preferably produced from a metallic solid material by a

material-removal method by producing a recess; in the production of the recess to form the blocking elements that are formed integrally with the receiving portion, at least two protrusion projecting into the recess are left out. The blocking element is thus formed as one unit with the receiving portion. The spark erosion method, as well as the method known under the abbreviation EDM ("electrical discharge machining") and/or electrochemical removal methods like that known under the abbreviation ECM ("electrochemical machining"), or a combination thereof, such as ECDM ("electrochemical discharge machining"), have been found to be especially advantageous for producing the receiving portion from a metallic solid. With such metal-removing methods, the complex structures for forming projections that project inward within the receiving portion, and which form the blocking elements of the invention, can be produced. Thus, for the production of the recess in a solid block, machining methods can first be applied in a first processing step, and material-removing spark erosion methods, as are known under the abbreviation EDM ("electrical discharge machining"), and/or electrochemical removal methods, in a concluding processing step, whereby the fine structures can then be shaped for forming the projections in the recess that form the blocking elements. Obviously, the recess can also be produced entirely by means of machining methods.

In an especially advantageous embodiment, the at least two blocking elements are realized in the receiving portion as projections that stretch inward to engage with the corresponding recess on the shank of a tool to be clamped; this projections being preferably formed integrally with the receiving portion, and, as described above, produced in a recess of a solid block via a material-removing spark erosion method and/or an electrochemical removal method. Likewise, the block elements furnished in the receiving portion could, however, also be realized as recesses, the corresponding counter elements on the tool could be realized as projections. The blocking elements can have a semi- or partially-circular-shaped cross section for more straightforward engagement with the corresponding counter elements.

In a preferred manner, the at least two blocking elements can extend over at least a partial circumference of the receiving portion on the inner side thereof, in the manner of a female thread. A more even mounting along the circumference can be achieved by deploying multiple blocking elements along at least a partial circumference of the receiving portion, in the manner of a female thread. In the case of multiple blocking elements, the blocking

elements are preferably set apart at equal angles in the peripheral direction within the receiving portion.

In an alternative method of production, the receiving portion can also be produced from ceramic or metal powder by compression molding or laser sintering.

Additional distinguishing characteristics and advantages of the invention will be apparent from the following description of a preferred embodiment with reference to the drawings. The drawings are as follows:

Figure 1 a tool holder with an expansion sleeve for hydraulic clamping of a tool, in a longitudinal section view;

Figure 2 enlarged partial view of the expansion sleeve of Figure 1;

Figure 3 perspective view of the expansion sleeve;

Figure 4 view of the expansion sleeve from behind;

Figure 5 detail view of the expansion sleeve in a partial cutaway view;

Figure 6 detail A of Figure 2;

Figure 7 partial perspective view of a first embodiment of a clamping system with tool holder, expansion sleeve and tool;

Figure 8 partial perspective view of a second embodiment of a clamping system with tool holder and tool;

Figure 9 partial perspective view of a third embodiment of a clamping system with tool holder, reducing sleeve and tool;

Figure 10 partial perspective view of a fourth embodiment of a clamping system with tool holder, collet chuck, and tool; and

Figure 11 partial perspective view of a fifth embodiment of a clamping system with tool holder, rolling power chuck, and tool.

Figure 1 shows a longitudinal section of a tool receiving portion 1, shown here as a hollow-taper10 shank (HSK) tool receiving portion, with a rotationally symmetric main part 2 and an expansion sleeve 3 deployed within the main part 2 to receive the cylindrical shank of a tool, not shown here. The main part 2 has a cylindrical front part 4 with a receiving opening 5 for the expansion sleeve 3 and a conical rear part 6 for accommodating the work spindle of a machine tool.Between the cylindrical front part 4 and the conical rear part 6 is furnished a gripper groove 7 on the outer side of the main part 2.

The expansion sleeve 3 shown separately in Figure 2 has on its exterior two circumferential recesses 8 set apart from one another, and a coil 9 on its front end. Between the recesses 8 and the interior wall of the main part 2 in the vicinity of the receiving opening 5, the pressure chambers 10 shown in Figure 1 are delimited to receive hydraulic fluid. The expansion sleeve 3 is preferably fastened to the main part 2 at the front and back ends of the sleeve. It can be soldered thereto or fastened to the main part 2 in another way. The pressure chambers 10 are e.g. connected to a pressure space deployed within the main part 2 via channels not shown here, also within the main part 2, the volume of the pressure space being adjustable e.g. by a partition that can be moved by a screw. By moving the partition by means of the screw, the pressure of the hydraulic fluid in the pressure space and pressure chambers 10 can be elevated, thereby pushing the expansion sleeve 3 inward radially. Through this arrangement, which is well-known and therefore not shown, the expansion sleeve 3 is uniformly pressed against the cylindrical shank introduced into the expansion sleeve 3, thus enabling a centric clamping over the full surface, with a high level of clamping force.

On the interior side of the expansion sleeve 3 are furnished inward-projecting blocking elements 12 in a back region 11 with an expanded inner diameter, which run in the manner of a female thread and arrive at a cylindrical shank 14 of a tool 15, shown in Figure 7, to engage with a corresponding counter element 13. The counter elements 13 are realized in the manner of a male thread. By means of the blocking elements 12 that engage with the corresponding counter element 13 on the tool 15, a safety catch is formed that prevents e.g. axial slippage of the tool 15 due to e.g. vibration during processing.

In the embodiment shown, the blocking elements 12 are realized as projections running helically in the peripheral direction, with a semicircular cross section. As evident from Figure 4, in the embodiment, there are furnished three projections set apart at equal angles in the peripheral direction, in the form of female threads as blocking elements 12 that run in the manner of a triple inner female thread with a pitch angle on the inner wall of the expansion sleeve 3. The counter elements that fit into the blocking elements 12 are formed as clamping grooves that run helically, in the manner of a triple male thread on the exterior of the cylindrical shank 14 of a tool 15, along the circumferential surface starting on the rear face.

The expansion sleeve 3 is preferably produced from a solid metallic block (e.g. a solid cylinder) by producing a recess by means of a materialremoving spark erosion process (like e.g. EDM or ECDM); the blocking elements 12, as projections extending inward in the cylindrical recess, are omitted in forming the recess.

To grip a tool in the tool holder 1, the tool must first be turned upon introduction into the tool holder 1 in such a way that the blocking elements 12 on the expansion sleeve 3 are able to engage with the corresponding counter elements 13 on the tool 15. The expansion sleeve 3 can then be compressed from outside with hydraulic fluid. By means of this pressure, the expansion sleeve 3 is pressed inward, clamping the tool 15. Axial slippage of the tool 15 out of the tool holder 1 can be prevented via the positive-fit engagement of the blocking elements 12 in the corresponding counter elements 13.

Figure 7 shows a clamping system with a tool holder 1, an expansion sleeve 3, and a tool 15 formed e.g. as a cutter or drill. In distinction from the embodiment of Figures 1-6, the expansion sleeve 3 has on its exterior only a recess 8 for forming a pressure chamber 10. Also furnished in this embodiment are inward-extending blocking elements 12 on the interior of the expansion sleeve 3, in the form of helically running projections for engaging with the counter elements 13 on the shank 14 of a tool 15, which are realized as clamping grooves.

Figure 8 shows a clamping system with a tool holder 1, and a tool 15 formed as a cutter or drill. In this embodiment, the receiving portion is formed as a contracting chuck 16 realized integrally with the main part 2. In such a tool holder 1, the contracting chuck 16 is heated by inductive heating, whereby the interior diameter of the contracting chuck 16 is expanded.

While it is in a heated state, a tool 15 is inserted into the contracting chuck 16; the relationship of the inner diameter of the contracting chuck 16 to the outer diameter of the tool shank 14 is designed so that the tool 15 is held firmly in the contracting chuck 16 when the contracting chuck 16 is subsequently cooled. Furnished in this embodiment are inward-extending blocking elements 12 on the interior of the contracting chuck 16, in the form of helically running projections for engaging with the counter elements 13 on the shank 14 of a tool 15, which are realized as clamping grooves.

In a further embodiment shown in Figure 9, the receiving portion is likewise realized as a contracting chuck 16, realized integrally with the main part 2. Here, the tool 15 is however clamped within the contracting chuck 16 via a reducing sleeve 17. The reducing sleeve 17 is formed in a known way as a slotted sleeve with multiple axial slots and an inner diameter adapted to the outer diameter of a tool shank 14. On its interior, the reducing sleeve 17 likewise has inward-extending blocking elements 12, in the form of helically running projections that engage with the counter elements 13 on the shank 14 of a tool 15, which are realized as clamping grooves. The reducing sleeve 17 further includes on its exterior clamping grooves 18 that run helically to engage with blocking elements 19 that are formed as projections projecting inward and running helically on the interior of the contracting chuck 16. By this means, a safety catch is realized for preventing the axial slippage of the reducing sleeve 17.

Figure 10 shows a further embodiment wherein the receiving portion is formed as a collet chuck 22 that can be deformed by a clamping element 21 and is deployed within a receiving opening 20 of the main part 2. The collet chuck 22 has an outer conical surface 23 for contacting an inner conical surface 24 of the receiving opening 20. The conical surfaces 23 and 24 are coordinated with one another in such a way that the collet chuck 22 can be compressed inward by axial displacement, and thereby grips the shank 14 of a tool 15. On its interior, the collet chuck 22 likewise has inward-extending blocking elements 12, in the form of helically running projections that engage with the counter elements 13 on the shank 14 of a tool 15, which are realized as clamping grooves. Axial displacement of the collet chuck 22 is achieved by means of the clamping element 21, that here is realized as a ring nut screwed onto an outside thread on the front end of the main part 2.

The tool holder 1, in a further embodiment shown in Figure 11, may also be realized as a rolling power chuck. The main part 2 has, in a front part, a clamping region 25 furnished with lengthwise slots, as a receiving portion for the shank 14 of the tool 15. In the deformable clamping region 25 is deployed a clamping nut 27 that is rotatably seated, usually by means of a needle bearing 26 or another ball bearing, by the rotation of which a clamping pressure can be brought to bear on the deformable clamping region 25. The needle bearings 28 seated within a bearing cage shift, when the clamping nut 27 is turned on the tapering inner surface of the clamping nut 27 and a narrowing outer surface of the deformable clamping region 25, in such a way that when the clamping nut 27 is tightened, the clamping nut 27 presses against the deformable clamping zone 25 via the needle bearings 28 to press the deformable clamping zone 25 against the shank 14 of the tool 15. In the embodiment shown, the inward-extending blocking elements 12 are likewise formed as helically-running projections for engaging with the counter elements 13 on the shank 14 of a tool 15, which are realized as clamping grooves. The clamping elements 12 are here deployed on the interior of the deformable clamping region 25. It is, however, also possible to deploy the blocking elements 12 further within the main part 2. In addition, a reducing sleeve, as shown in Figure 9, could be deployed between the deformable clamping region 25 and the tool shank 14.

The invention is, of course, not limited to HSK tool holders. SK-, JIS-, BT-, ABS-, or Capto-interfaces, and the like, can similarly be furnished on the main part 2.

The clamping elements do not necessarily have to be deployed in the deformable region of the receiving portion. They can also be in a non-deformable region or in the region of the base holder.

SZERSZÁMTARTÓ ÉS ELJÁRÁS SZERSZÁM FELVEVŐ ELŐÁLLÍTÁSÁRA ILYEN SZERSZÁMTARTÓKHOZ

SZABADALMI IGÉNYPONTOK

1. Szerszámtartó (1) egy alaptesttel (2), egy alakítható felvevővel (3, 16, 17, 22, 25) egy szerszám (15) rögzítésére és legalább két retesz elemmel (12), amik megakadályozzák a szerszámnak (15) a felvevőből axiális irányban történő kimozdulását és összekapcsolódnak a szerszámon (15) kialakított ellen elemekkel (13), ahol a retesz elemek (12) a felvevőben a kerület mentén vannak elrendezve egymástól azonos szögtávolságban, **azzal jellemezve**, hogy a retesz elemek (12) a kerület mentén vannak elrendezve, és a felvevővel (3, 16, 17, 22, 25) egy darabból vannak kialakítva.
2. Az 1. igénypont szerinti szerszámtartó, azzal jellemezve, hogy a felvevő egy, az alaptest (2) befogadó nyílásában (5) elrendezett és kívülről nyomás alatti folyadékkal működtetett táguló persely (3), aminek belső oldalán van a legalább két retesz elem (12) kialakítva.
3. Az 1. igénypont szerinti szerszámtartó, azzal jellemezve, hogy a felvevő egy, az alaptesttel (2) egy darabból kialakított zsugortokmány (16), aminek belső oldalán van a legalább két retesz elem (12) kialakítva.
4. Az 1. igénypont szerinti szerszámtartó, azzal jellemezve, hogy a felvevő egy, a zsugortokmány (16) belsejében elrendezett redukciós hüvely (17), aminek belső oldalán van a legalább két retesz elem (12) kialakítva.
5. Az 1. igénypont szerinti szerszámtartó, azzal jellemezve, hogy a felvevő az alaptest (2) egy befogadó nyílásában (20) elrendezett és egy feszítőelemmel (21) deformálható feszítőbefogó (22), aminek belső oldalán van a legalább két retesz elem (12) kialakítva.
6. Az 1. igénypont szerinti szerszámtartó, azzal jellemezve, hogy a felvevő az alaptest (2) egy elülső részén elrendezett feszítőtartomány (25), ami egy hengeres csapággyal (28) forgathatóan az alaptestben (2) ágyazott feszítőanyával (27) deformálható.
7. Az 1 – 6. igénypontok bármelyike szerinti szerszámtartó, azzal jellemezve, hogy a legalább egy retesz elem (12) befelé nyúló kiugrásként van kialakítva.
8. Az 1 – 7. igénypontok bármelyike szerinti szerszámtartó, azzal jellemezve, hogy a retesz elem félkör vagy részkör keresztmetszetű.
9. Az 1 – 8. igénypontok bármelyike szerinti szerszámtartó, azzal jellemezve, hogy a legalább egy retesz elem (12) anyamenet szerűen van a felvevő (3, 16, 17, 22, 25) kerületének legalább egy részén belül kialakítva.
10. Az 1 – 9. igénypontok bármelyike szerinti szerszámtartó, azzal jellemezve, hogy a felvevő (3, 16, 17, 22, 25) belső oldalán több, a táguló persely (3) kerületének legalább egy részén anyamenet szerűen futó retesz elem (12) van.
11. A 10. igénypont szerinti szerszámtartó, azzal jellemezve, hogy a felvevőn (3, 16, 17, 22, 25) a retesz elemek (12) a kerület mentén vannak elrendezve egymástól azonos szögtávolságban.
12. Az előző igénypontok bármelyike szerinti szerszámtartó, azzal jellemezve, hogy a felvevő (3, 16, 17, 22, 25) kerámia, fém, vagy ezek keveréke.

13. Feszítő rendszer szerszámtartóval (1) és egy szerszámmal (15), ahol legalább két retesz elemmel (12) van ellátva, amik megakadályozzák a szerszámnak (15) a felvevőből axiális irányban történő kimozdulását és összekapcsolódnak a szerszám (15) megfelelő ellen elemeivel (13), azzal jellemezve, hogy a szerszámtartó (1) az 1 – 12. igénypontok bármelyike szerint van kialakítva.

14. Eljárás olyan alakítható felvevő (3, 16, 17, 22, 25) előállítására, ami egy szerszám (15) befogására szolgál, amely szerszám egy szerszámtartó alaptestébe (2) beilleszthető, vagy azzal egy darabból van kialakítva, ahol a felvevő (3, 16, 17, 22, 25) legalább két retesz elemmel (12) van ellátva, amik megakadályozzák a szerszámnak (15) a felvevőből (3, 16, 17, 22, 25) axiális irányban történő kimozdulását és összekapcsolódnak a szerszámon (15) kialakított ellen elemekkel (13), ahol a retesz elemek (12) a felvevőben a kerület mentén vannak elrendezve egymástól azonos szögtávolságban, **azzal jellemezve**, hogy a felvevőt (3, 16, 17, 22, 25) anyagleválasztó eljárással állítjuk elő egy tömör fém anyagból, amelybe üreget készítünk, ahol az üreg kialakítása során a kerület mentén spirálisan futó és a felvevővel (3, 16, 17, 22, 25) egy darabból kialakított retesz elemek (12) elkészítéséhez legalább két, az üregbe kinyúló kiugrást hagyunk, vagy két bemélyedést készítünk az üregbe.

15. A 14. igénypont szerinti eljárás, azzal jellemezve, hogy anyagleválasztó eljárásként szikraforgácsolást és/vagy elektrokémiai leválasztást végzünk.

16. Eljárás olyan alakítható felvevő (3, 16, 17, 22, 25) előállítására, ami egy szerszám (15) befogására szolgál, amely szerszám egy szerszámtartó alaptestébe (2) beilleszthető, vagy azzal egy darabból van kialakítva, ahol a felvevő (3, 16, 17, 22, 25) legalább két retesz elemmel (12) van ellátva, amik megakadályozzák a szerszámnak (15) a felvevőből (3, 16, 17, 22, 25) axiális irányban történő kimozdulását és összekapcsolódnak a szerszámon (15) kialakított ellen elemekkel (13), ahol a retesz elemek (12) a felvevőben a kerület mentén vannak elrendezve egymástól azonos szögtávolságban, **azzal jellemezve**, hogy a felvevőt (3, 16, 17, 22, 25) kerámiából és/vagy fémporból sajtolásos vagy lézeres szinterezéssel előállított anyagból készítjük, ahol az üreg kialakítása során a kerület mentén spirálisan futó és a felvevővel (3, 16, 17, 22, 25) egy darabból kialakított retesz elemek (12) elkészítéséhez legalább két, az üregbe kinyúló kiugrást hagyunk, vagy két bemélyedést készítünk az üregbe.

Fig. 1

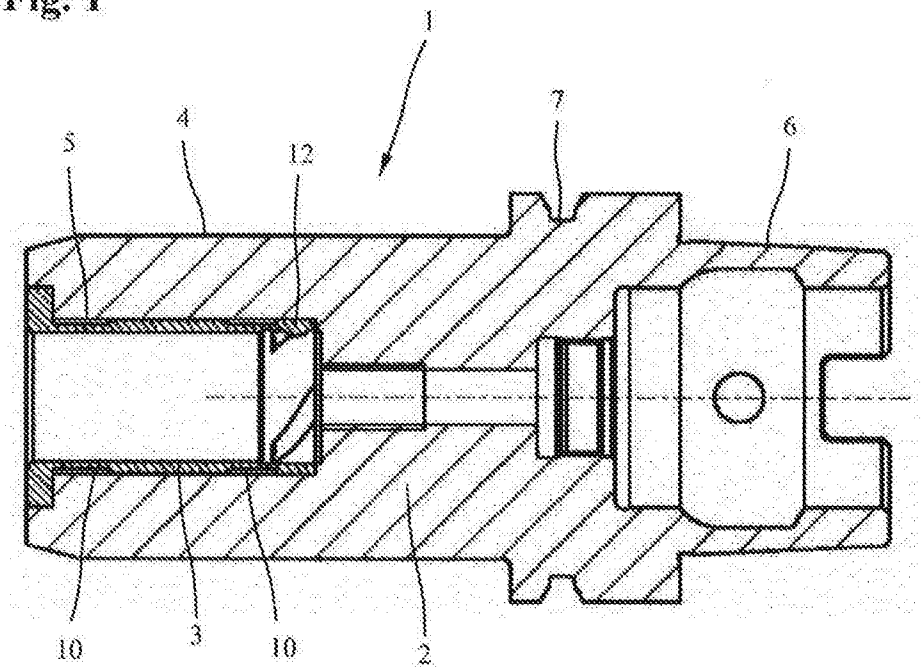

Fig. 2

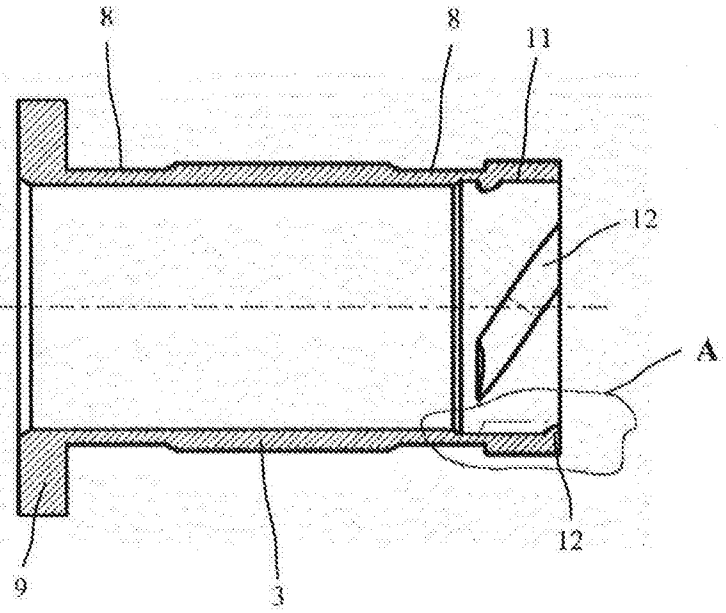

Fig. 3

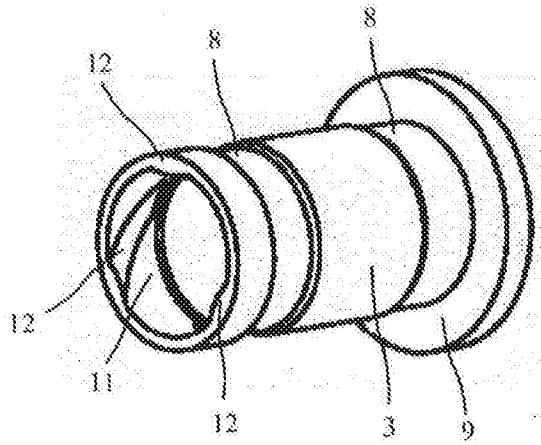

Fig. 4

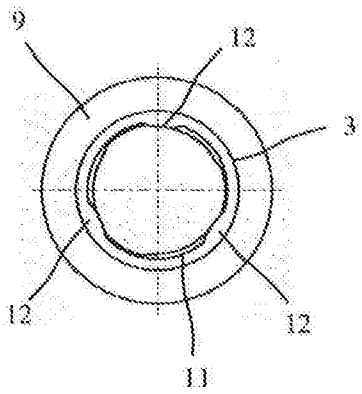

Fig. 5

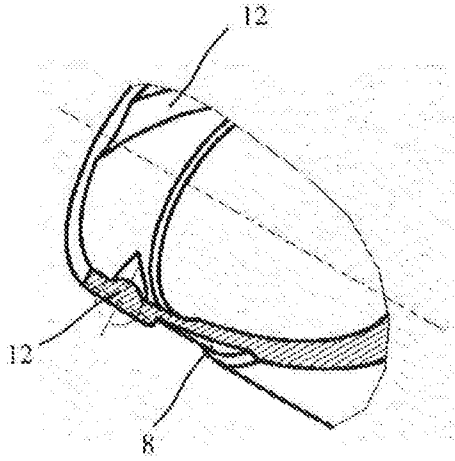

Fig. 6

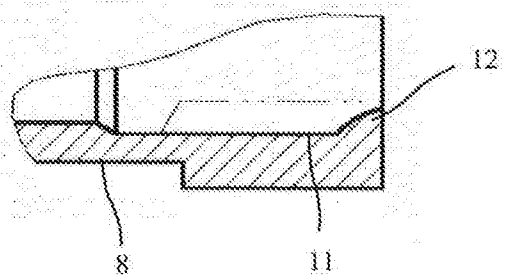

Fig. 7

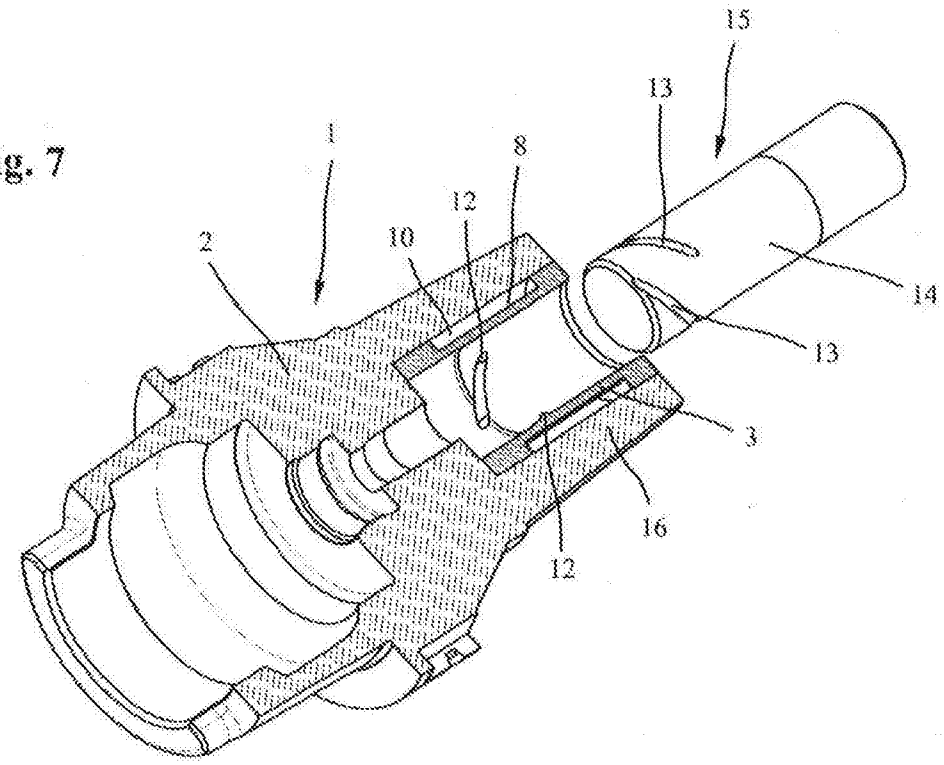

Fig. 8

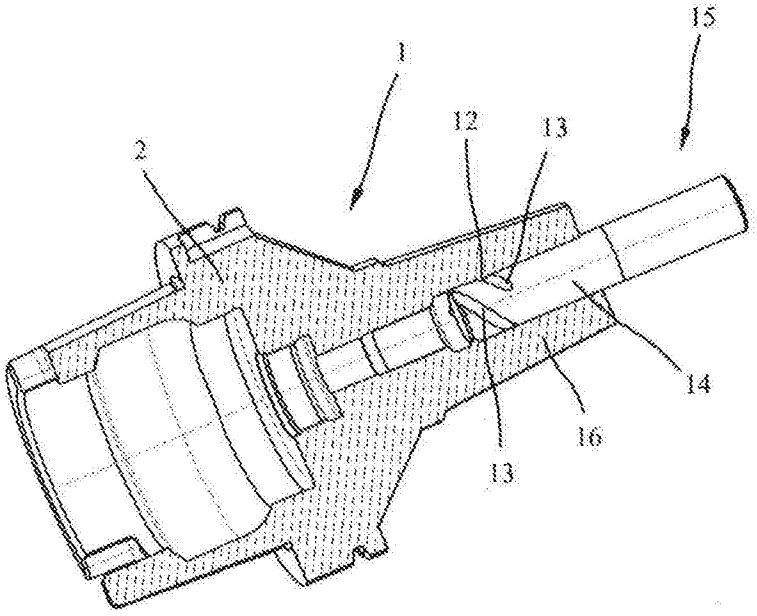

Fig. 9

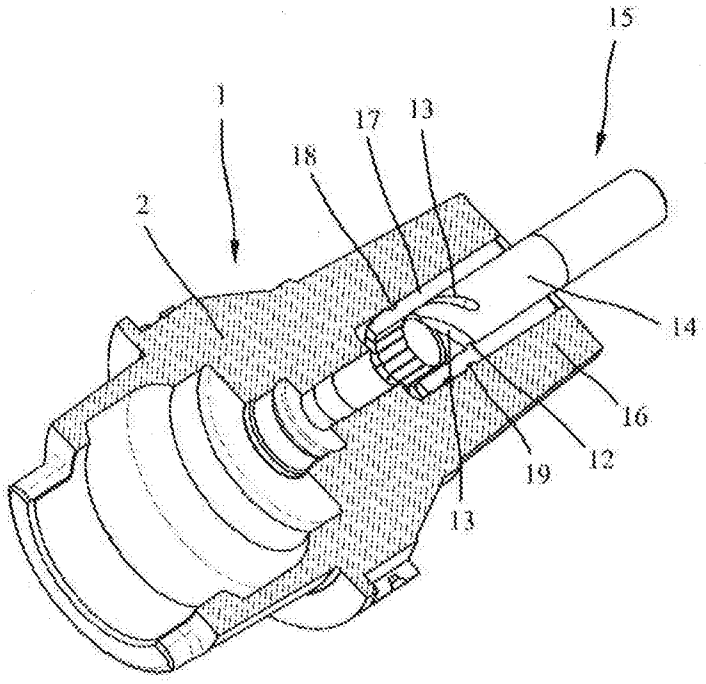

Fig. 10

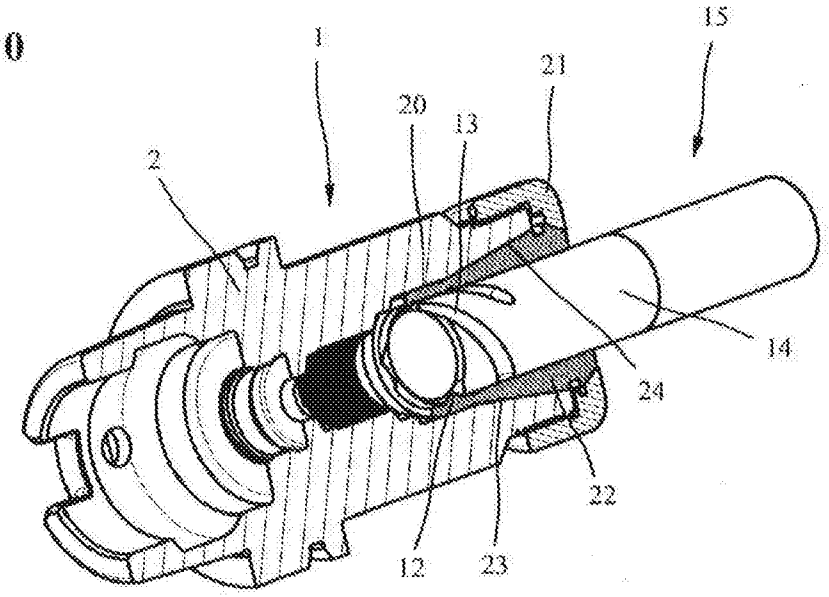

Fig. 11