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(54) Title: WEAR-RESISTANT ELEMENT FOR A COMMINUTING DEVICE

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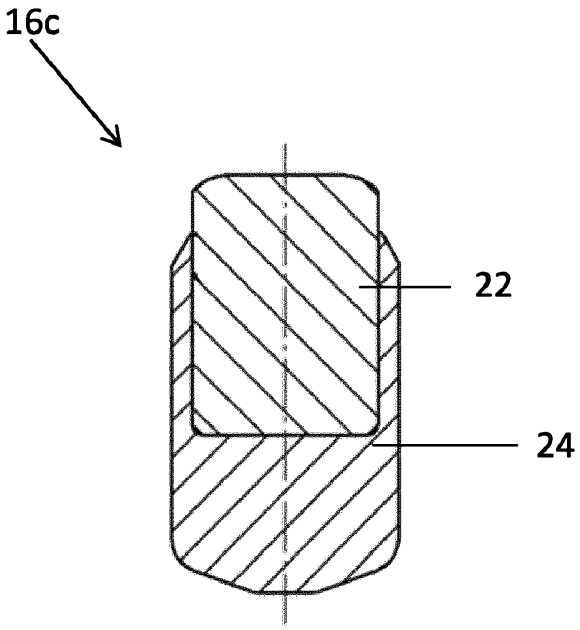

Fig.5

(57) Abstract: The invention relates to a wear-resistant element (16c) for partial insertion into a recess on a surface of a wear area of a comminuting device, the wear-resistant element (16c) comprising a fastening section (24) which can be connected to the recess on the surface of the wear area and has a wear portion (22) that protrudes at least in part from the surface of the wear area. According to the invention, the fastening section (24) comprises a material that has a lower wear resistance than the material of the wear portion (22), the wear portion (22) extends beyond the fastening section (24) in the vertical direction of the wear-resistant element (16c), and the fastening section (24) is in the form of a sleeve.

(57) Zusammenfassung: Die vorliegende Erfindung betrifft ein Verschleißschutzelement (16c) zum teilweisen Einsetzen in eine Ausnehmung in der Oberfläche einer Verschleißfläche einer Zerkleinerungseinrichtung, wobei das Verschleißschutzelement (16c) einen Befestigungsbereich (24), der mit der Ausnehmung in der Oberfläche der Verschleißfläche verbindbar ist und einen Verschleißbereich (22) aufweist, der

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zumindest teilweise aus der Oberfläche der Verschleißfläche hervorsteht. Erfindungsgemäß ist vorgesehen, dass der Befestigungsbereich (24) ein Material umfasst, das eine geringere Verschleißfestigkeit aufweist als das Material des Verschleißbereichs (22) und wobei sich der Verschleißbereich (22) in der Höhe des Verschleißschutzelements (16c) über den Befestigungsbereich (24) hinaus erstreckt und wobei der Befestigungsbereich (24) hülsenförmig ausgebildet ist.

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Wear-resistant element for a comminuting device

The invention relates to a wear-resistant element for partially inserting into a recess in the surface of a wear surface of a comminuting device, and to a comminuting device having such a wear-resistant element.

In comminuting devices, such as grinding rollers, which are used in particular in material bed comminution of for example hard ore, a high level of wear of the surface of a wear surface, for example the grinding roller surface, occurs during operation of the comminuting device. In order to counteract this wear, it is known, for example from DE 2006 010 042 A1, to mount additional wear-resistant elements on the surface of the grinding roller. At a particular degree of wear, it is necessary to replace the wear-resistant elements of the grinding roller in order to ensure efficient grinding. The replacement of the wear-resistant elements entails for example long downtimes of the roller mill and high maintenance costs.

It would be advantageous if embodiments of the present invention could provide a wear-resistant element which has a high level of wear resistance in order to increase the maintenance intervals for replacing the wear-resistant elements, wherein the wear-resistant element is at the same time cost-effective to produce.

According to a first aspect, the present invention relates to a wear-resistant element for partially inserting into a recess in the surface of a wear surface of a comminuting device, wherein the wear-resistant element has a fastening region, which is connectable to the recess in the surface of the wear surface, and a wearing region, which protrudes at least partially from the surface of the wear surface. The fastening region comprises a material that is less wear-resistant than the material of the wearing region, wherein the wearing region extends beyond the fastening region at the level of the wear-resistant element. The fastening region is furthermore formed in a sleeve-like manner.

The comminuting device is for example a roller mill, a roller crusher, a hammer mill or a vertical roller mill, wherein the wear surface is in particular the surface of a grinding roller, the hammer tools and the surface of the grinding track of a hammer mill, or the surface

of the rollers and of the grinding table of a vertical roller mill, which are subject to a high level of wear during operation of the comminuting device.

The wear-resistant element is formed for example in a cylindrical manner or has a square cross section. In particular, one end of the wear-resistant element is configured such that it is fastenable to the surface of the wear surface, in particular in a recess in the surface of the wear surface. In particular, the wear-resistant element is formed in a plate-shaped manner. This is advantageous in particular when such a wear-resistant element is used on for example a grinding track of a hammer mill or a vertical roller mill.

The fastening region is preferably arranged such that, during operation of the comminuting device, it is not subject to any wear or is subject to only very little wear. In particular, the fastening region serves for fastening the wear-resistant element to the surface of the wear surface. The wearing region is arranged in the fastening region and extends beyond the fastening region at the level of the wear-resistant element, such that the wearing region is subject to the majority of the wear acting on the wear-resistant element. Such a wear-resistant element is much more cost-effective to produce, since it is possible to dispense with forming the entire wear-resistant element from the expensive more wear-resistant material. The region of the wear-resistant element which is subject to no wear or only to very little wear, has a less wear-resistant material, resulting in lower material costs. A sleeve-like fastening region affords the advantage of particularly easy producibility. The term sleeve-like should be understood as meaning in particular that the fastening region is formed in a cylindrical manner with a central, coaxial cutout facing the wearing region. The fastening region has preferably a lower cylindrical region, on which the wearing region bears, and an upper, for example thin-walled sleeve-like region, which circumferentially encloses the wearing region at least partially. The sleeve-like region has in particular at least the same longitudinal extent as or a greater longitudinal extent than the cylindrical region. The wearing region has preferably a cylindrical region, which is configured such that it cooperates with the sleeve-like region of the fastening region with a precise fit. In particular, the wearing region is configured entirely as a cylinder.

According to a first embodiment, the material of the wearing region comprises a ceramic material, for example tungsten carbide WC, titanium carbide TiC, titanium carbonitride TiCN, vanadium carbide VC, chromium carbide CrC, tantalum carbide TaC, boron carbide

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BC, niobium carbide NbC, molybdenum carbide Mo2C, aluminum oxide Al2O3, zirconium oxide ZrO2, or silicon carbide SiC. Furthermore, preferably particles of industrial diamonds, in particular high-strength ceramics, are embedded in a ceramic or metallic matrix in the wearing region.

The material of the fastening region comprises, according to a further embodiment, a steel, for example a quenched and tempered structural steel.

According to a further embodiment, the fastening region has a receiving region for receiving the wearing region, which is configured such that it centers the wearing region relative to the fastening region. The receiving region is preferably formed on that side face of the fastening region that faces the wearing region. In particular, that face of the wearing region that faces the fastening region is configured such that it cooperates with the receiving region.

According to a further embodiment, the receiving region has at least one cutout and the wearing region has a protrusion which cooperates with the cutout. In particular, the receiving region has a protrusion and the wearing region has a corresponding cutout.

According to a further embodiment, the wear-resistant element has an end-side cutout, in particular a bore, which faces in the direction of the wear surface of the comminuting device. Preferably, the fastening region has the end-side cutout. The cutout is formed in particular coaxially with the wear-resistant element. Such a cutout brings about a saving of material of the fastening region and thus a reduction in cost of the wear-resistant element.

According to a further embodiment, the wearing region is arranged at least partially within the sleeve-like region of the fastening region. The sleeve-like fastening region arranged at least partially around the wearing region affords the advantage of a simple arrangement of the wearing region on the fastening region and easy finish-machining of the casing of the wear-resistant element.

According to a further embodiment, the fastening region and the wearing region are bonded together substance-to-substance, in particular adhesively bonded or soldered.

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Screwing the wearing region and the fastening region together is likewise conceivable. Substance-to-substance bonding affords a simple possibility of fastening the wearing region to the fastening region, wherein the wearing region is mounted on the fastening region preferably releasably, such that the wearing region is easy to replace when it becomes worn. Therefore, it is not necessary to replace the fastening region in the event of the wearing region becoming worn.

According to a further embodiment, the fastening region comprises less than 45%, preferably less than 30%, most preferably less than 20% of the wear-resistant element.

According to a second aspect, the invention furthermore relates to a comminuting device having a wear surface and a wear-resistant element as described above, wherein the wear-resistant element is mounted at least partially in a recess in the surface of the wear surface, in particular of a grinding roller.

The advantages described with regard to the wear-resistant element also apply to the comminuting device having such a wear-resistant element.

According to a further embodiment, the fastening region of the wear-resistant element is bonded substance-to-substance to the grinding roller, in particular, welded, adhesively bonded or soldered. Preferably, the fastening region is soldered, adhesively bonded or welded to the recess in the wear surface.

The comminuting device is for example a grinding roller for material bed comminution or a vertical roller mill.

Description of the drawings

Exemplary embodiments of the present invention will now be explained in more detail in the following text with reference to the attached figures.

Figure 1 shows a schematic illustration of a comminuting device in a front view according to one exemplary embodiment.

Figure 2 shows a schematic illustration of a grinding roller of the comminuting device according to Figure 1.

Figures 3-7 show schematic illustrations of various exemplary embodiments of wear-resistant elements in a cross-sectional view.

Figure 1 schematically illustrates a comminuting device 10, in particular a roller mill. The comminuting device 10 comprises two grinding rollers, illustrated schematically as circles, having wear surfaces 12, 14 which have the same diameter and are arranged alongside one another. Formed between the wear surfaces 12, 14 of the grinding rollers is a grinding gap, the size of which is settable, for example.

During operation of the comminuting device 10, the grinding rollers rotate in opposite directions to one another in directions of rotation illustrated by the arrows, wherein grinding stock passes through the grinding gap in the falling direction and is ground.

Figure 2 shows an end region of a grinding roller which has a wear surface 12, on which wear-resistant elements 16 are mounted. The wear-resistant elements 16 are mounted in the outer circumference of the surface of the grinding roller. For example, the mutually spaced-apart wear-resistant elements 16, arranged alongside one another, in figure 2 have a circular cross section. It is likewise conceivable for the wear-resistant elements 16 to vary in terms of size, number, cross-sectional shape and arrangement with respect to one another over the surface of the grinding roller, in order for example to compensate for local differences in wearing during operation of the comminuting device 10.

Furthermore, the grinding roller has wear-resistant corner elements 17, mounted on its end, which have for example a rectangular cross section and are arranged in a row alongside one another such that they form a ring around the circumference of the grinding roller. Further cross-sectional shapes of the wear-resistant corner elements 17, which differ from the cross-sectional shape shown in figure 2, are furthermore conceivable. A mutually spaced-apart arrangement of the wear-resistant corner elements 17 is also possible. In figure 2, by way of example, only the left-hand end of the grinding roller having

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the wear surface 12 is shown, wherein the right-hand end, which is not shown, is advantageously of identical construction.

Figure 3 shows a wear-resistant element 16a that is not encompassed by embodiments of the present invention, said wear-resistant element 16a being arranged in a recess 26 in the wear surface 12 of the grinding roller according to figures 1 and 2. The wear-resistant element 16a has a fastening region 24 and a wearing region 22, wherein the fastening region is arranged in the recess 26 in the surface of the wear surface 12 of the grinding roller and is connected to the wear surface 12 of the grinding roller. For example, in the fastening region 24, the wear-resistant element 16a is bonded substance-to-substance to the recess in the surface of the wear surface 12 of the grinding roller, in particular welded, soldered or adhesively bonded or connected in a form-fitting manner, in particular screwed or wedged. The wearing region 22 of the wear-resistant element 16a is arranged at least partially outside the recess 26 in the wear surface 12, such that said wearing region protrudes from the surface of the wear surface 12 in a radial direction of the grinding roller (not illustrated). The fastening region 24 comprises, in the exemplary embodiment illustrated, about one third of the entire wear-resistant element 16a, wherein the wearing region 22 comprises approximately the further two thirds. The fastening region 24 has a receiving region 18, which comprises that face of the fastening region that faces the wearing region 22. The receiving region 18 is arranged between the wearing region 22 and the fastening region 24 and configured in particular in a bulging manner such that the fastening region 24 of the wear-resistant element 16a has an inwardly directed bulge at the end facing the wearing region 22. This bulge serves for positioning the wearing region 22 on the fastening region 24.

The wearing region 22 of the wear-resistant element 16a has a material having a higher level of wear resistance than the material of the fastening region 24. For example, the wearing region 22 has a ceramic material, for example tungsten carbide, titanium carbide, titanium carbonitride, vanadium carbide, chromium carbide, tantalum carbide, boron carbide, niobium carbide, molybdenum carbide, aluminum oxide, zirconium oxide, or silicon carbide. Furthermore, it is also possible for particles of industrial diamonds or high-strength ceramics to be embedded in a ceramic or metallic matrix in the wearing region. For example, the wearing region has a matrix material in which a majority of particles are arranged. The particles in question are in particular a highly wear-resistant material which

comprises for example diamond, ceramic or titanium. The matrix material comprises for example tungsten carbide. The particles are bonded in particular substance-to-substance, for example by sintering with the matrix material.

During operation of the comminuting device 10, the wear-resistant elements 16a are subject to a high level of wear, wherein in particular the wearing region 22, protruding from the surface of the wear surfaces 12, 14 of the grinding rollers, of the wear-resistant elements 16a becomes worn. The wear-resistant material of the wearing region 22 reduces the wear of the wear-resistant elements 16a considerably. Furthermore, it is possible to dispense with forming the fastening region, which is not subject to any wear or only to very little wear, from the expensive, more wear-resistant material.

Figure 4 shows a further exemplary embodiment of a wear-resistant element 16b, wherein the wear surface having the recess 26, in which the wear-resistant element 16b is arranged, is not illustrated. Figure 4 shows a wear-resistant element 16b which corresponds substantially to the wear-resistant element 16a in figure 1, wherein the receiving region, in particular that region of the fastening region 24 of the wear-resistant element 16b that faces the wearing region 22 has a cutout which cooperates with a protrusion in that region of the wear-resistant region 22 that faces the fastening region 24. Such a cutout in the fastening region 24 serves in particular for positioning the wearing region 22 on the fastening region 24, wherein the wearing region is centered relative to the fastening region 24. The cutout is formed for example in a cylindrical and centered manner.

Figure 5 shows a wear-resistant element 16c, which has a substantially sleeve-like fastening region 24, wherein the latter extends along the lateral face of the wearing region 22 and the wearing region 22 is arranged at least partially within the sleeve-like fastening region 24. The sleeve-like fastening region 24 is formed from a softer, less wear-resistant material than the wearing region 22. The wearing region 22 of the wear-resistant element 16c extends beyond the sleeve-like fastening region 24 in the longitudinal direction of the wear-resistant element 16c, such that the wearing region 22 protrudes from the sleeve-like fastening region 24. The wearing region 22 extends in particular beyond the fastening region 24 in the radial direction of the grinding roller. The fastening region 24 in figure 5 has a lower, radially inwardly directed, fully cylindrical region, on which the wearing region

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22 bears, and a radially outwardly directed, for example thin-walled sleeve-like region, which circumferentially surrounds the wearing region 22 at least partially.

Figure 6 shows a wear-resistant element 16d which corresponds substantially to the wear-resistant element 16c in figure 5 except that the wear-resistant element 16d has a cutout 20 in its fastening region 24. The cutout 20 is provided in the end face of the fastening region 24 and formed for example in a cylindrical or conical manner. The cutout is formed in particular coaxially with the wear-resistant element 16d and serves for example for fastening the wear-resistant element 16d in the recess 26 in the wear surface of the comminuting device 10. Furthermore, the cutout 20 results in a considerable material saving of the fastening region 24.

Figure 7 shows a wear-resistant element 16e, not encompassed by embodiments of the present invention, which corresponds substantially to the wear-resistant element 16a in figure 3 except that the wear-resistant element 16e has a cutout 20 in the fastening region 24 as in figure 6. The receiving region 18 of the wear-resistant element 16e is formed in a substantially planar manner. A bulging configuration is likewise conceivable.

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word “comprise” or variations such as “comprises” or “comprising” is used in an inclusive sense, i.e. to specify the presence of the stated features in various embodiments of the invention.

Modifications and variations as would be apparent to a skilled addressee are determined to be within the scope of the present invention.

It is also to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or any other country.

List of reference signs

10	Comminuting device/roller mill
12	Wear surface/grinding roller
14	Wear surface/grinding roller
16a-e	Wear-resistant element
17	Wear-resistant corner element
18	Receiving region
20	Cutout
22	Wearing region
24	Fastening region
26	Recess

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Patent claims

1. A wear-resistant element for partially inserting into a recess in the surface of a wear surface of a comminuting device,
wherein the wear-resistant element has a fastening region, which is connectable to the recess in the surface of the wear surface, and a wearing region, which protrudes at least partially from the surface of the wear surface,
wherein the fastening region comprises a material that is less wear-resistant than the material of the wearing region, wherein the wearing region extends beyond the fastening region at the level of the wear-resistant element and wherein the fastening region is formed in a sleeve-like manner, wherein the fastening region has a receiving region for receiving the wearing region, which is configured such that it centers the wearing region relative to the fastening region, and the receiving region has at least one cutout and the wearing region has a protrusion which cooperates with the cutout,
or wherein the receiving region has a protrusion and the wearing region has a cutout which cooperates with the protrusion.

2. The wear-resistant element as claimed in claim 1, wherein the material of the wearing region comprises a ceramic material.

3. The wear-resistant element as claimed in claim 1 or 2, wherein the material of the fastening region comprises a steel.

4. The wear-resistant element as claimed in any one of the preceding claims, wherein the wear-resistant element has an end-side cutout, in particular a bore, which faces in the direction of the wear surface of the comminuting device.

5. The wear-resistant element as claimed in any one of the preceding claims, wherein the wearing region is arranged at least partially within the sleeve-like region of the fastening region.

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6. The wear-resistant element as claimed in any one of the preceding claims, wherein the fastening region and the wearing region are bonded together substance-to-substance, in particular adhesively bonded or soldered.

7. The wear-resistant element as claimed in any one of the preceding claims, wherein the fastening region comprises less than 45%, preferably less than 30%, most preferably less than 20% of the wear-resistant element.

8. A comminuting device having a wear surface and a wear-resistant element as claimed in one of the preceding claims, wherein the wear-resistant element is mounted at least partially in a recess in the surface of the wear surface.

9. The comminuting device as claimed in claim 8, wherein the wear surface is the surface of a grinding roller and wherein the fastening region of the wear-resistant element is bonded substance-to-substance to the grinding roller, in particular, welded, adhesively bonded or soldered.

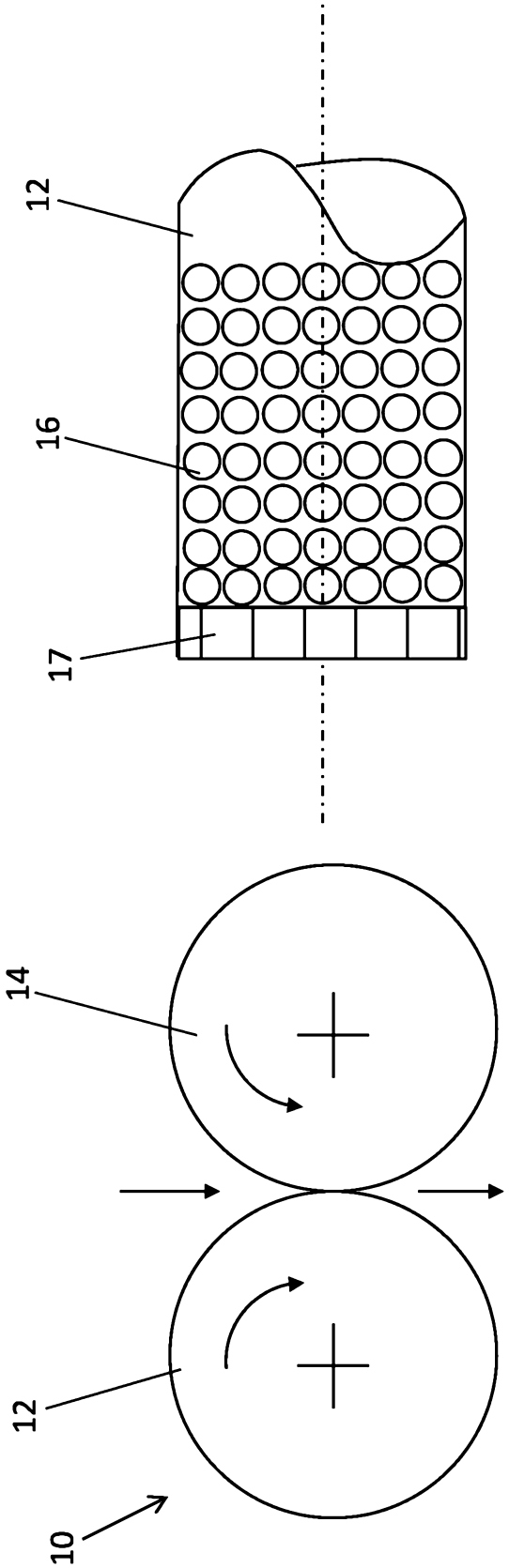

Fig.1

Fig.2

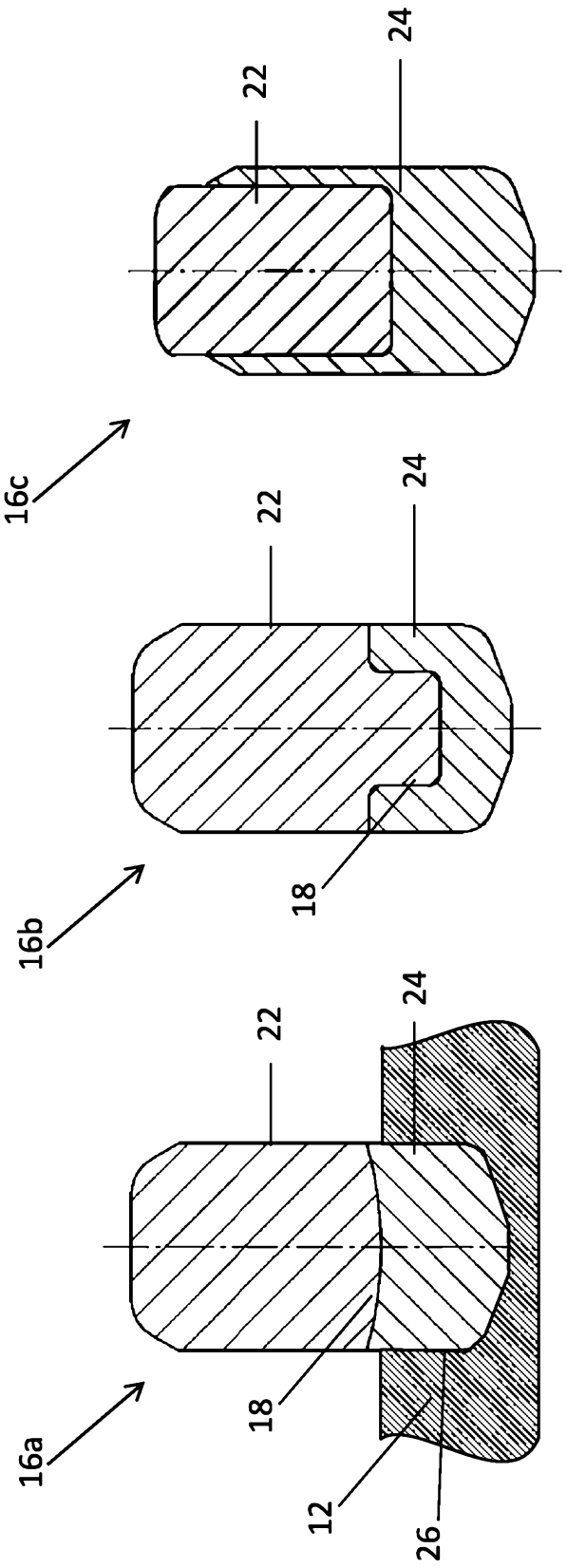

Fig.3

Fig.4

Fig.5

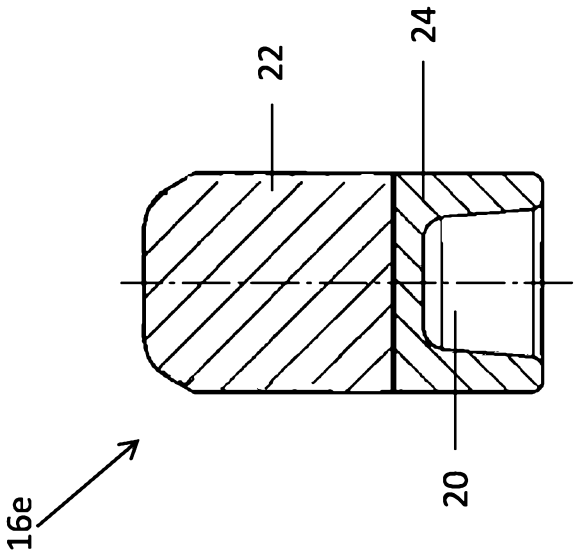

Fig.7

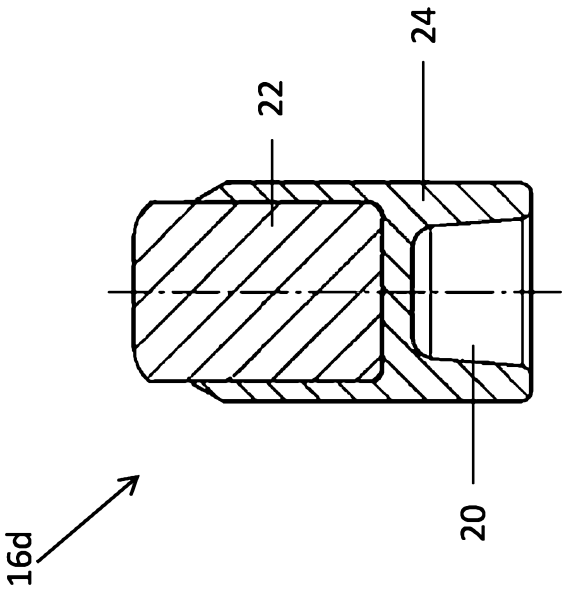

Fig.6