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(54) Benævnelse: **Slidbeskyttelseselement til en fragmenteringsmaskine**

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Description

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.

WO 2012/092427 A1 discloses roller mills or roller crushers for comminuting materials for cement production, which have a wear-resistant element that is fitted in a recess in the surface of the roller mill or of the roller crusher. WO 2016/150719 A1 likewise discloses wear-resistant elements for a mill or a crusher, which are formed for example in a sleeve-like manner.

WO 2016/150719 A1 discloses a wear-resistant element for a mill or a crusher, wherein a fastening region of the wear-resistant element extends in a sleeve-like manner around a wearing region of the wear-resistant element.

US 3 805 364 A discloses a drill bit of a rock drill. The drill bit has wear-resistant elements that are inserted into a recess in the surface of the wear surface. US 2008/142272 A1 likewise relates to a wear-resistant assembly for comminuting devices, for example crushers, grinding rollers and drills, wherein the wear-resistant element is arranged in a cutout in a wear surface.

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.

Therefore, it is an object of the present invention to 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.

This object is achieved by a wear-resistant element having the features of independent device Claim 1. Advantageous developments will become apparent from the dependent claims.

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 furthermore has a lower cylindrical region, on which the wearing region bears, and an upper sleeve-like region, which circumferentially surrounds the wearing region at least partially. 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, wherein 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. 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 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 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.

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.

For example, 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. 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.

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

The invention is explained in more detail in the following text on the basis of a number of exemplary embodiments 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 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 the 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 an exemplary embodiment according to the invention 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, not encompassed by the invention, 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 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, not encompassed by the invention, 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 the 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.

List of reference signs

	10	Comminuting device/roller mill
	12	Wear surface/grinding roller
5	14	Wear surface/grinding roller
	16a-e	Wear-resistant element
	17	Wear-resistant corner element
	18	Receiving region
	20	Cutout
10	22	Wearing region
	24	Fastening region
	26	Recess

PATENTKRAV

1. Slidbeskyttelseselement (16b) for delvis indsætning i en udsparing (26) i overfladen af en slidflade (12, 14) i en fragmenteringsindretning (10), hvorved slidbeskyttelseselementet (16b) omfatter et fastgørelsesområde (24), som kan forbindes med udsparingen (26) i overfladen (12, 14) af slidfladen (12, 14) og omfatter et slidområde (22), som mindst delvist rager frem fra overfladen af slidfladen (12, 14), hvorved fastgørelsesområdet (24) omfatter et materiale, der har en ringere slidbeskyttelse end materialet i slidområdet (22), og hvorved slidområdet (22) strækker sig ud over fastgørelsesområdet (24) på højde med slidbeskyttelseselementet (16b), og, hvorved fastgørelsesområdet (24) omfatter et modtageområde (18) til modtagelse af slidområdet (22), og som er således udformet, at det centrerer slidområdet (22) i forhold til fastgørelsesområdet (24) og

kendetegnet ved, at

fastgørelsesområdet (24) omfatter et nedre cylinderformet område, mod hvilket slidområdet (22) hviler, samt et øvre muffeformet område, som mindst delvist, periferisk omslutter slidområdet 22, og at modtageområdet (18) i det mindste delvist omfatter en udsparing og slidområdet (22) et fremspring, der virker sammen med udsparingen, eller hvorved modtageområdet (18) omfatter et fremspring og slidområdet (22) en udsparing, som virker sammen med fremspringet.

2. Slidbeskyttelseselement (16b) ifølge krav 1,
hvorved materialet i slidområdet (22) omfatter et keramisk materiale.

3. Slidbeskyttelseselement (16b) ifølge krav 1 eller 2,
hvorved materialet i fastgørelsesområdet (24) omfatter et stål.

4. Slidbeskyttelseselement (16b) ifølge et af de foregående krav,
hvorved slidbeskyttelseselementet omfatter en ende-side udsparing (20), navnlig en boring, som vender mod slidfladen (12, 14) for fragmenteringsindretningen (10).

5. Slidbeskyttelseselement (16b) ifølge et af de foregående krav,

hvorved slidområdet (22) i det mindste delvist er arrangeret inden i fastgørelsesområdets (24) muffeformede område.

6. Slidbeskyttelseselement (16b) ifølge et af de foregående krav,
hvorved fastgørelsesområdet (24) og slidområdet (22) stoffølgende er forbundet med hinanden, navnlig klæbet eller loddet.

7. Slidbeskyttelseselement (16b) ifølge et af de foregående krav,
hvorved fastgørelsesområdet (24) er mindre end 45%, fortrinsvis mindre end 30%, mest foretrukket mindre end 20% af slidbeskyttelseselementet (16a-e).

8. Fragmenteringsindretning (10), omfattende en slidflade (12, 14) og et slidbeskyttelseselement (16b) ifølge et af kravene 1 til 7,
hvorved slidbeskyttelseselementet (16b) mindst delvist er arrangeret i en udsparing (26) i slidfladens (12, 14) overflade.

9. Fragmenteringsindretning (10) ifølge krav 8,
hvorved fastgørelsesområdet (24) for slidbeskyttelseselementet (16b) stoffølgende er forbundet med en formalingsvalse (12, 14), navnlig svejset, klæbet eller loddet.

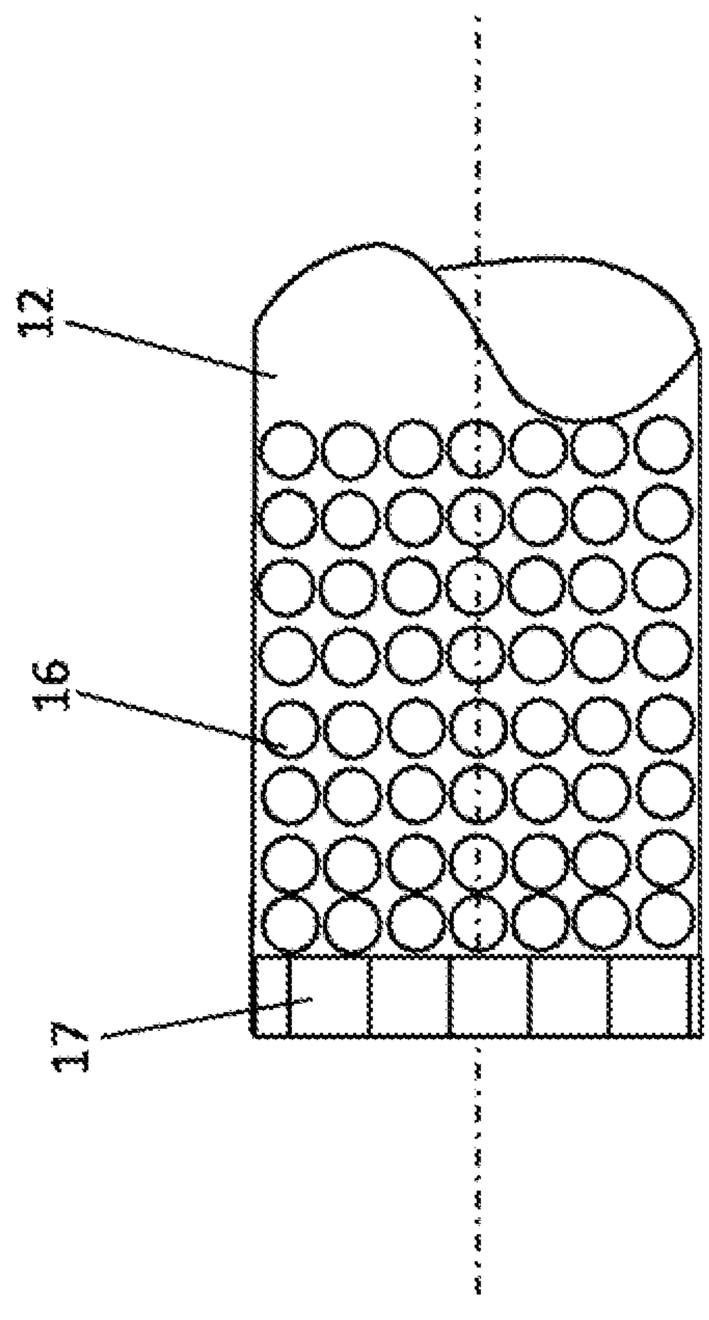


Fig.2

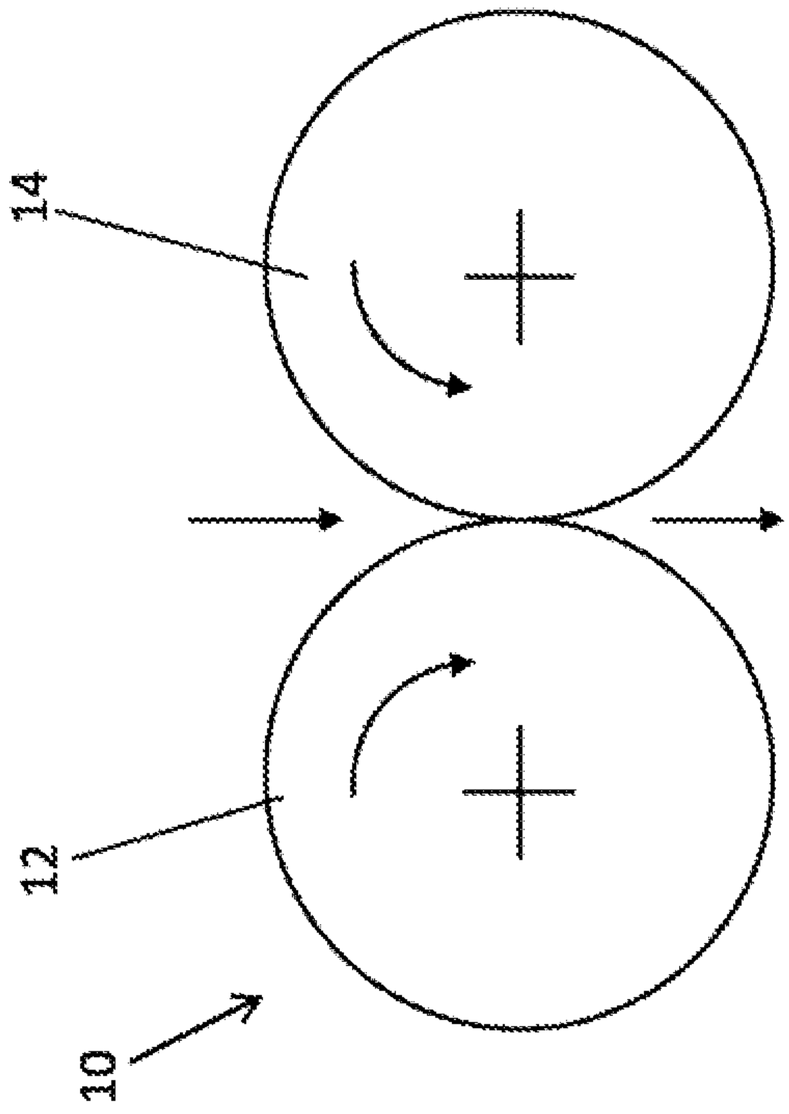


Fig.1

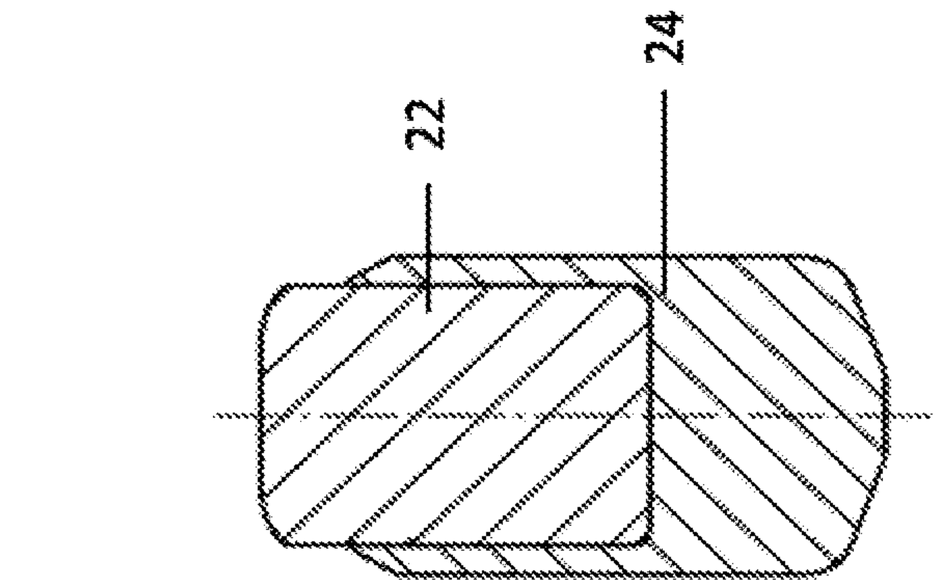


Fig.5

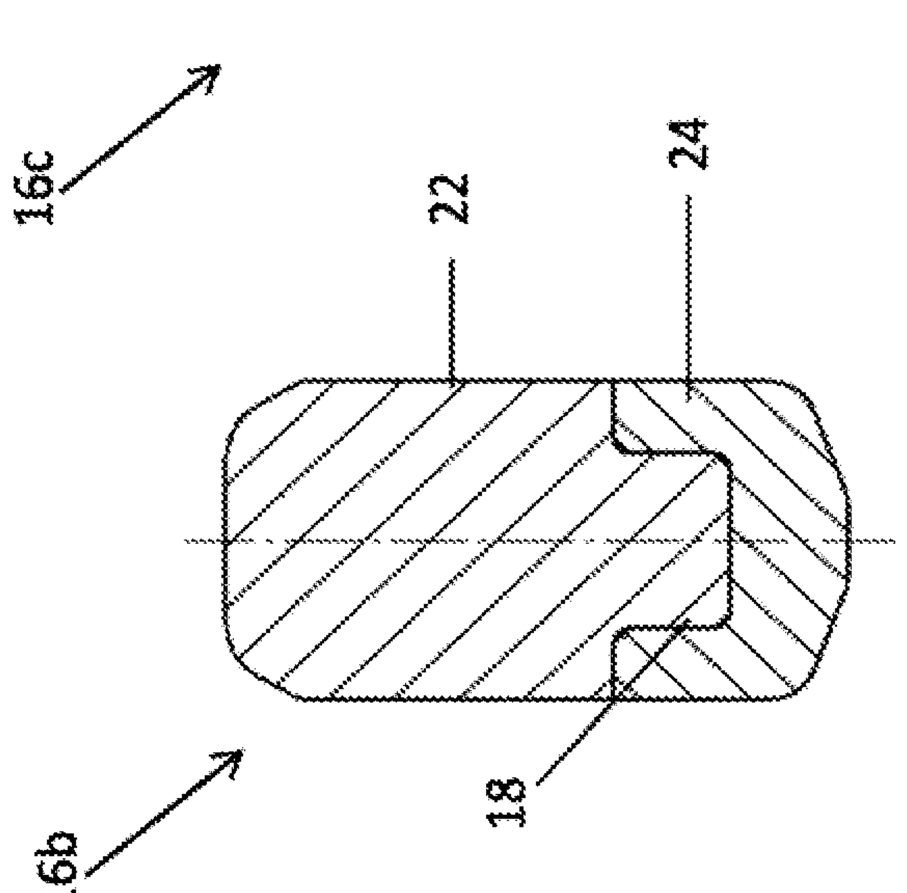


Fig.4

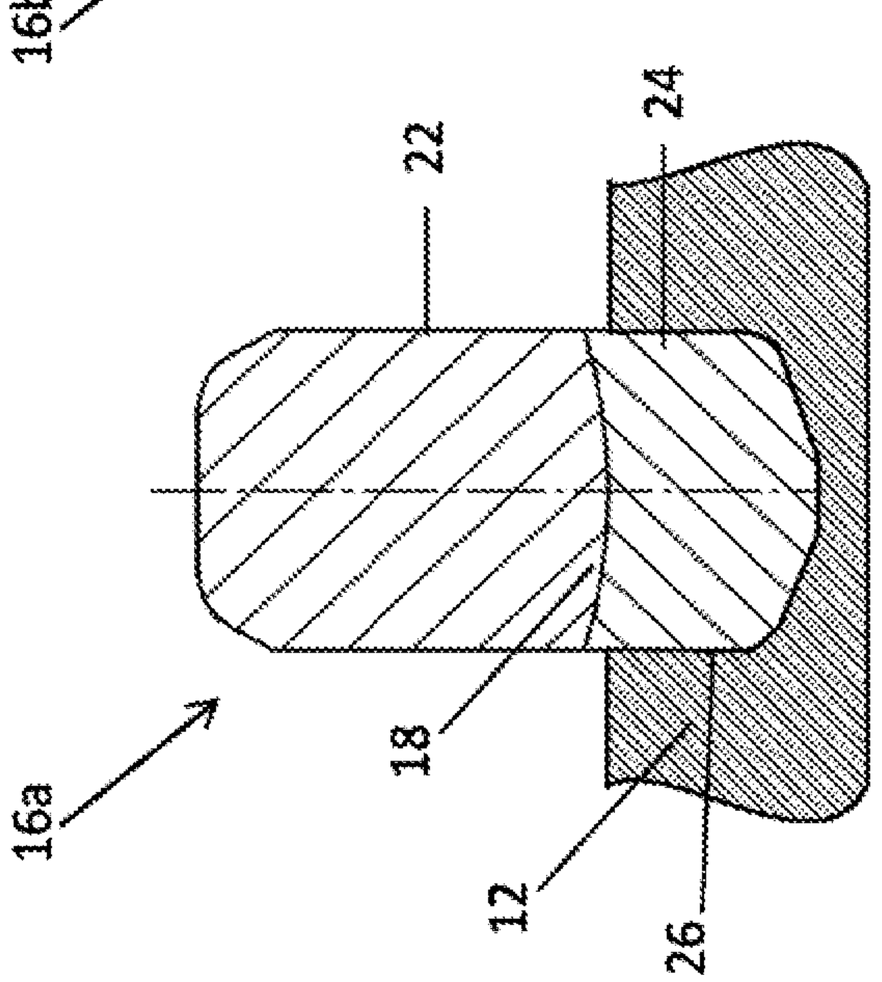


Fig.3

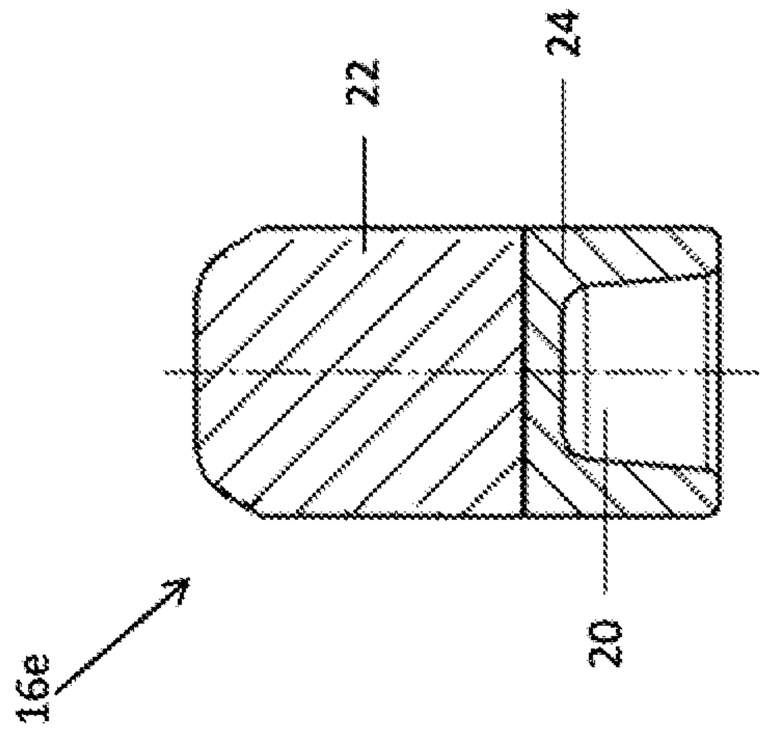


Fig.7

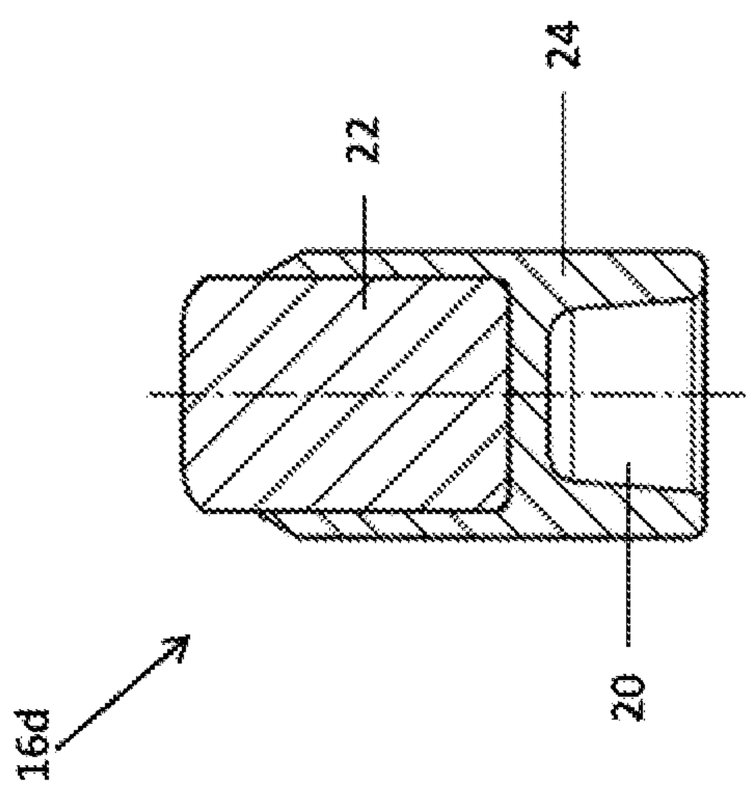


Fig.6