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(54) WEAR ASSEMBLY FOR EARTH MOVING MACHINE

(57) Wear assembly (1) comprising a wear tooth (2) comprising a wall (4) that defines a pocket (6) and at least one through hole (8, 8') communicating with the pocket, an adapter (10) with a connection point (12) inserted into the pocket (6) in a removable manner and defining a pin cavity (14) aligned with the through hole (8, 8'), a blocking pin (16) between the tooth (2) and adapter (10), inserted in the through hole (8, 8') and in the pin cavity (14) rotatably and comprising at least a first blocking element (18), and a second blocking element (20, 20') associated to the wear tooth (2) or to the adapter (10).

The elements (18, 20, 20') are mutually arranged in such a way that, through rotation of the blocking pin (16) in a direction, the first blocking element (18) intercepts the second (20, 20') to block the pin in the pin cavity (14). In addition, one of said elements (20, 20') is deformable so that, through a further rotation in the same direction, this element disengages from the other element (18) allowing the extraction of the pin from the cavity.

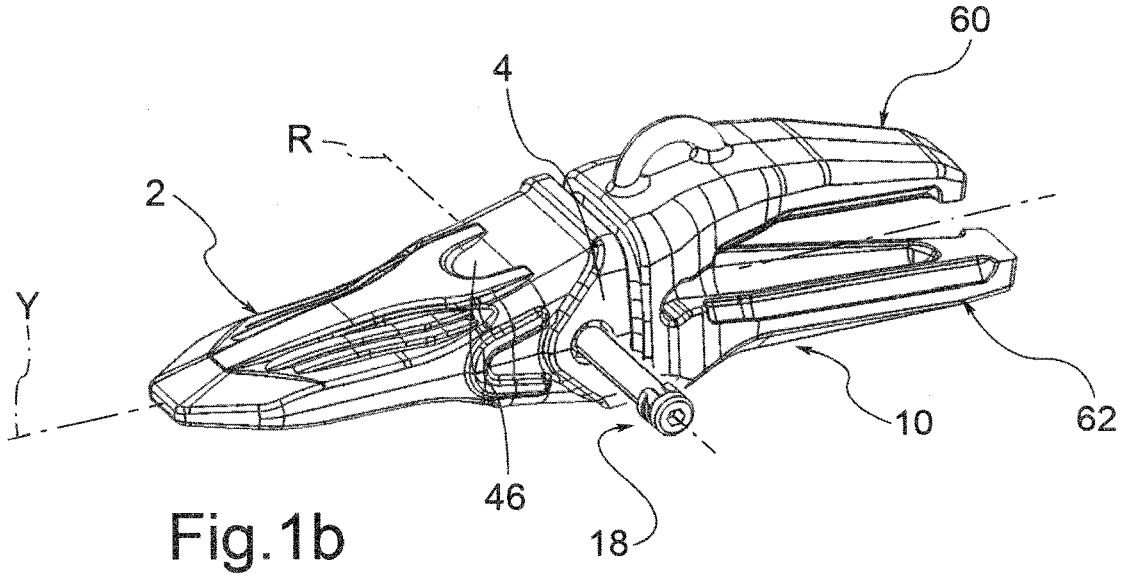

Fig.1b

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Description

[0001] This invention relates to a wear assembly for an earth moving machine.

[0002] In the earth moving and excavation industry, it is known to connect adapters provided with wear teeth to the buckets of the machinery: the adapters are internal components that are stably connected to the aforesaid machinery (for example by welding), and are covered and protected by the wear teeth that, on the contrary, are expendable components, intended to undergo a massive wear in place of the adapters and buckets.

[0003] The replacement of a wear tooth, or the accidental loss of a tooth of a set, are ordinary or exceptional events that directly affect the downtime of the machinery, and thus its productivity.

[0004] In recent years, there has been a gradual technical transition: the systems that could be defined as outgoing require that a fastening spline be hammered to be wedged firmly between the wear tooth and adapter. The next-generation systems, so-called hammerless, often make use of threading or rotational movements, so that a spline is interposed and fixed between the wear tooth and adapter.

[0005] This invention fits in the previous context, proposing to provide a wear assembly with faster fastening than traditional systems while suitable to be released with a few simple operations and designed to be mass-produced at low cost.

[0006] This purpose is achieved by means of a wear assembly according to claims 1 and 16. The claims dependent on these show variants of preferred embodiments.

[0007] The object of this invention will now be described in detail, with the help of the accompanying drawings, in which:

- figures 1a, 1b and 1c are perspective views of a wear assembly covered by this invention, according to a possible embodiment, wherein figures 1b and 1c are views of the assembly with the pin partially extracted and are different from each other in the rotation angle of the latter;
- figures 2 and 3 illustrate two side views of the assembly of figure 1a, from the right side and from the left side according to the orientation of the figure;
- figure 4 shows a view of the coupling of the pin with the respective wear tooth in the absence of the adapter, from the part of the pocket for housing the adapter formed in the tooth;
- figures 5 and 6 are a side view and a front view of the pin, without the wear tooth and without the adapter, wherein only the elastically deformable elements for retaining the pin in a predefined position are visible;
- figures 7 and 8 show details of the ends of the pin, in particular according to the visible ends respectively in figure 3 and figure 2;
- figure 9 is a pin-adapter coupling, in the absence of the wear tooth, with elastically deformable elements formed on the adapter;
- figures 10 and 11 show possible arrangements of the resilient member, respectively using a pair or a single element;
- figures 12a, 12b and 12c show a view similar to that shown in figure 4, but with the pin and the tooth in section, at different rotation angles (0°, 45°, 90°) of the pin relative to the tooth;
- figures 13a, 13b and 13c show cross sections of the pin and the tooth, transversely to the extension direction of the pin, respectively at the same rotation angles of the pin referred to in the above-mentioned figures 12 (0°, 45°, 90°).

[0008] With reference to the above tables, reference number 1 identifies, in its totality, a wear assembly comprising a wear tooth 2, an adapter 10 and a blocking pin 16 between the wear tooth 2 and the adapter 10.

[0009] The wear tooth 2 comprises a body wall 4 that delimits at least part of a tip pocket 6, preferably open backwardly, and at least a through hole 8, 8' communicating with said pocket.

[0010] According to a variant, the wear tooth 2 comprises an upper wall 46 and a lower tooth wall 48 that converge frontally to form a working portion 72, for example an excavation tip or edge.

[0011] It is evident that, for the purposes of this invention, the working portion 72 could have any shape (for example bifurcated, pointed, flattened, etc.) depending on the purpose or use of the wear tooth.

[0012] Therefore, in this description the term "front" will indicate all those components facing or turned towards the working portion; on the contrary, the term "rear" will refer to a direction opposite the working portion, which is to say towards the adapter 10 or to a grab bucket 50 of the earth moving machine connected to the latter.

[0013] In the embodiment shown in figure 9, the connection point is generally or substantially truncated-pyramidal.

[0014] According to a particularly advantageous embodiment, the body wall 4 extends in tubular or conical manner around a longitudinal tooth axis Y.

[0015] According to a further variant, the body wall 4 delimits at least a pair of through holes 8, 8', for example aligned to each other.

[0016] The adapter 10 comprises a connection point 12, at least partially inserted in the tip pocket 6, in a removable manner, and that defines a pin cavity 14 at least partially aligned with the through hole 8, 8' or to the pair of such holes.

[0017] The pin cavity 14 thus constitutes the seat of the adapter in which the blocking pin 16 is at least partially received.

[0018] According to a particularly advantageous variant, the pin cavity 14 is at least partially aligned and communicating with the pair of through holes 8, 8', when pro-

vided.

[0019] The connection point 12 thus performs the adapter-tooth connection by geometrically coupling to the tip pocket 6.

[0020] More precisely, inner surfaces 52, 54 of the wear tooth 2 lie in abutment with the corresponding outer surfaces 56, 58 of the connection point 12.

[0021] Preferably, the connection point 12 is crossed (preferably from side to side) by the pin cavity 14.

[0022] Advantageously, the adapter 10 is associable to the grab bucket 50 of an earth moving machine (not shown) by means of fastening stems 60, 62 that define between them a space 64 for the rear insertion of the aforesaid bucket. In this way, the fastening stems are suitable to engage the grab bucket 50 to be subsequently secured to it, for example by welding.

[0023] The blocking pin 16 is inserted in the through hole 8, 8' and in the pin cavity 14 rotatably around a rotation axis R and comprises at least a first blocking element 18.

[0024] For example, the rotation axis R extends in a manner incident or orthogonal with respect to the longitudinal tooth axis Y.

[0025] According to a variant, the blocking pin 16 extends along a development direction X, specifically between a pin head 38 and an opposite pin tip 40.

[0026] In the embodiments shown, the development direction X is substantially parallel or coincident to the rotation axis R.

[0027] Optionally, for the variants that provide for a pair of through holes 8, 8', the pin head 38 and the opposite pin tip 40 are both accessible through the said holes.

[0028] According to preferred variants, the pin head 38 delimits a polygonal recess 42 (for example hexagonal) and/or the pin tip 40 is shaped externally 44 in a polygonal manner (for example hexagonal), to act in conjunction with one or more tools counter-shaped to said polygonal areas.

[0029] In other words, the pin head 38 and/or the pin tip 40 can be actuated by means of a tool to cause rotation of the blocking pin in the through hole and in the cavity pin as previously discussed.

[0030] According to a non-illustrated variant, the pin tip may define a polygonal recess and/or the pin head could be shaped externally in a polygonal manner, in an arrangement opposite to that mentioned above.

[0031] According to an advantageous variant, the pin head 38 could be inserted at least in part (for example completely) in the through hole 8, 8'.

[0032] According to this variant, the wear assembly 1 may comprise a protective hood (not shown) coupled with the pin head and/or with the surfaces delimiting the through hole 8, 8' to close at least partially the space surrounding the pin head 38.

[0033] For example, the protective hood may delimit a guide for the insertion of a tool (for example a screwdriver) to move it away from the pin head 38.

[0034] The wear assembly 1 comprises at least a second blocking element 20, 20' associated to the wear tooth 2 or to the adapter 10.

[0035] In the embodiment of figure 9, the second blocking element 20, 20' is connected to the adapter 10, for example in correspondence of an outer surface or side 66 of such adapter.

[0036] According to a further embodiment, the second blocking element 20, 20' is inserted in a seat 28 of the wear tooth 2, advantageously facing the tip pocket 6 (figure 12a).

[0037] The blocking elements 18, 20, 20' are mutually arranged in such a way that, through rotation of the blocking pin 16 in a certain direction (clockwise or counter-clockwise), the first blocking element 18 intercepts the second blocking element 20, 20' to block said pin in the pin cavity 14.

[0038] In other words, through this rotation, the first blocking element 18 arrives in abutment against the second blocking element 20, 20' to block the blocking pin 16 in the pin cavity 14.

[0039] In addition, one of the aforesaid elements 20, 20' is deformable so that, through a further rotation of the blocking pin 16 in the same direction (clockwise or counter-clockwise), this element disengages from the other element 18, thus allowing the extraction of the blocking pin from the pin cavity 14.

[0040] It follows that, through the aforesaid deformation, the engagement and disengagement of the blocking elements 18, 20, 20' takes place in such sequence by rotating the pin in the same direction.

[0041] Preferably, one of the aforesaid elements 20, 20' is compressible to accomplish the aforesaid disengagement. In this regard, please refer to the arrows 68, 68' of figures 12b and 13b, which schematically diagram this compression.

[0042] However, according to a preferred variant, this does not prevent that the disengagement of the blocking elements 18, 20, 20' could also take place by changing the direction of rotation of the blocking pin (for example from clockwise to counter-clockwise), by performing in reverse the rotation movement that led to the aforesaid engagement.

[0043] According to this variant, it follows that an operator no longer needs to pay attention to the rotation direction of the pin to block it in the pin cavity, since the disengagement of the blocking elements 18, 20, 20' may occur in any selected rotation direction.

[0044] Preferably, the deformable blocking element (first 18 or second 20, 20') has a shape memory.

[0045] In the variant shown, the deformable blocking element 20, 20' is associated to the wear tooth 2 or to the adapter 10.

[0046] In particular, figures 10 and 11 illustrate second, non-deformed blocking elements, while figure 8 shows these elements in contact with the first blocking element 18.

[0047] According to a preferred embodiment, the second blocking element 20, 20' is at least partially (or com-

pletely) made of a first resilient material 24, configured to deform as a result of said rotation of the blocking pin 16.

[0048] Preferably, a plurality of first blocking elements 18 is provided, angularly staggered around the blocking pin 16, interacting with one or more second blocking elements 20, 20'.

[0049] Merely by way of example, for small or lightweight wear teeth, the wear assembly could comprise a single second blocking element 20 (figure 11). Alternatively, for larger or heavier wear teeth, the wear assembly could comprise a plurality of second blocking elements 20, 20' (figure 10), for example acting along incident or (diametrically) opposite directions.

[0050] According to an advantageous variant, the first blocking elements 18 and the at least one second blocking element 20, 20' extend for a portion parallel to the rotation axis R. Preferably, these first elements are alongside the second element so as to guide the blocking pin 16 into or out of the pin cavity 14.

[0051] In other words, the first blocking elements 18 delimit between them a sliding passage 70 along which, at least during insertion of the blocking pin in the pin cavity, the second blocking element 20 is slidably received at least in part.

[0052] According to a not shown variant, a pair of second blocking elements could extend for a portion parallel to the rotation axis R and such pair could accompany the first blocking element so as to guide the blocking pin 16 into or out of the pin cavity 14.

[0053] According to a particularly advantageous variant, the second blocking element 20, 20' comprises at least one element end 22, 22' projecting into the lumen of the through hole 8, 8' and/or of the pin cavity 14 to intercept the blocking pin 16 and, in particular, the first blocking element 18.

[0054] According to a further variant, the second blocking element 20, 20' could comprise an attachment portion 26 to a seat 28 of the wear tooth 2 or adapter 10. Preferably, this portion 26 could comprise a second resilient material 30 configured to block itself by force and, optionally also by shape, in said seat.

[0055] Preferably, the second resilient material 30 is a material different from the first resilient material 24, at least for the related mechanical behaviour (for example, the related modulus of elasticity).

[0056] Advantageously, the first resilient material 24 and the second resilient material 30 are co- or overmoulded.

[0057] Optionally, the first blocking element 18 could comprise at least one lateral protrusion 32, which extends radially with respect to the direction of extension X of the blocking pin 16, to stop the rotation of the latter around the rotation axis R and to block the translation of said pin parallel to said axis R.

[0058] In the variant shown in figures 13, the first blocking element 18 comprises at least one pair of lateral protrusions 32 separated from each other.

[0059] According to a preferred embodiment, the first blocking element 18 further comprises at least one projection or annular lip 34 that, with the aforesaid protrusions 32 defines a recess 36 for receiving at least part of the second blocking element 20, 20'.

[0060] In this way, the projection or annular lip 34 improves the resistance to the extraction of the blocking pin from the pin cavity of the adapter 10.

[0061] Preferably, when the first blocking element 18 is in abutment against the second blocking element 20, 20' to block the blocking pin 16 in the pin cavity 14, this second blocking element is enclosed (axially) between the pin head 38 and the projection or annular lip 34.

[0062] This invention further relates to a wear assembly 1, comprising:

- a wear tooth 2 which comprises a body wall 4 which delimits at least part of a tip pocket 6, open backwardly, and at least a pair of through holes 8, 8' communicating with said pocket;
- an adapter 10 comprising a connection point 12, at least partially inserted in the tip pocket 6, in a removable manner, and crossed by a pin cavity 14;
- a blocking pin 16 between wear tooth 2 and the adapter 10, inserted in at least one through hole 8, 8' - preferably in both such holes - and in the pin cavity 14 rotatably around a rotation axis R and comprising a pin head 38 and an opposite pin tip 40;
- wherein the pin cavity 14 is at least partially aligned with the through holes 8, 8', so as to make the pin head 38 and the pin tip 40 accessible through the aforesaid holes.

[0063] With regard to the preferred features of such assembly with the blocking pin accessible from both sides, please refer to the preceding description.

[0064] Finally, this invention relates to an earth moving machine comprising at least one wear assembly 1, according to any of the preceding embodiments, connected to a grab bucket 50 by means of the respective adapter 10.

[0065] Innovatively, the assembly covered by this invention brilliantly achieves the purposes mentioned in the introduction.

[0066] More precisely, the aforesaid assembly is simple to construct and allows a very rapid assembly and disassembly compared to traditional systems.

[0067] Advantageously, the assembly covered by this invention allows optimising the use of the mechanical components and facilitating their renewal or replacement.

[0068] Advantageously, the assembly covered by this invention allows giving up the use of hammers for blocking of the tooth, and in this way, risks for the operator who must perform the aforesaid assembly are minimised.

[0069] In fact, the hammering of the traditional splines is an objective risk for the operator who inserts it and for those who are within range of that operator.

[0070] Advantageously, the useful life of the assembly

described is dramatically longer than the devices of the prior art, particularly by virtue of the reduced play between the components.

[0071] Advantageously, the blocking pins described are suitable to eliminate any play in the receiving pocket, so as to give a sense of stability when assembly is concluded.

[0072] Advantageously, the assembly covered by this invention ensures a complete, safe and efficient coupling between tooth and adapter.

[0073] Advantageously, the operator actuating the blocking pin does not need to remember the direction of rotation for blocking or unblocking said pin since, preferably, the blocking and unblocking of the pin are repeated cyclically in any chosen direction of rotation.

[0074] Advantageously, in the assembly covered by this invention, it is also possible to understand the exact moment of the pin blocking/release, since the operator feels a latch at the moment in which the lobes of the pin overcome the resistance opposed by the retention member.

[0075] Advantageously, the assembly covered by this invention is, above all, a highly reliable system since the contact surfaces between the parts are large and allow a better distribution of the stresses.

[0076] Advantageously, the solution with a reduced number of blocking organs, while maintaining all the advantages discussed, will also have a further advantage in terms of costs to be incurred by the user as there is one mechanical part less for the completion of the coupling.

[0077] To the embodiments of the aforesaid wear assembly and machine, one skilled in the art, in order to meet specific needs, may make variants or substitutions of elements with others functionally equivalent.

[0078] Even these variants are contained within the scope of protection, as defined by the following claims.

[0079] Moreover, each of the variants described as belonging to a possible embodiment can be performed independently of the other variants described.

Claims

1. Wear assembly (1) comprising:

- a wear tooth (2) which comprises a body wall (4) which delimits at least part of a tip pocket (6), open backwardly, and at least one through hole (8, 8') communicating with said pocket;
- an adapter (10) comprising a connection point (12), at least partially inserted in the tip pocket (6), in a removable manner, and defining a pin cavity (14) aligned at least partially with the through hole (8, 8');
- a blocking pin (16) between wear tooth (2) and adapter (10), inserted in the through hole (8, 8') and in the pin cavity (14) rotatably around a rotation axis (R) and comprising at least a first blocking element (18);
- at least a second blocking element (20, 20') associated to the wear tooth (2) or to the adapter (10);

said blocking elements (18, 20, 20') being mutually arranged in such a way that, by rotation of the blocking pin (16) in a given direction, the first blocking element (18) intercepts the second blocking element (20, 20') to block said pin (16) in the pin cavity (14), and wherein one of said first (18) or second (20, 20') element is deformable in such a way that, through a further rotation of said pin (16) in the same direction, said element disengages from the other element (18), thereby allowing the extraction of said pin from said pin cavity (14).

2. Assembly according to claim 1, comprising a plurality of first blocking elements (18), angularly staggered around the blocking pin (16), interacting with one or more second blocking elements (20, 20').

3. Assembly according to the previous claim, wherein the first blocking elements (18) and the at least one second blocking element (20, 20') extend for a length parallel to said rotation axis (R), and wherein said first elements are placed alongside said second element so as to guide the blocking pin (16) inside or outside the pin cavity (14).

4. Assembly according to any one of the previous claims, wherein the second blocking element (20, 20') comprises at least one element end (22, 22') projecting into the lumen of the through hole (8, 8') and/or of the pin cavity (14) to intercept the blocking pin (16).

5. Assembly according to any of the previous claims, wherein the second blocking element (20, 20') comprises an attachment portion (26) to a seat (28) of the wear tooth (2) or of the adapter (10), said portion comprising a second resilient material (30) configured to block itself by force, and optionally by shape, in said seat.

6. Assembly according to the preceding claim, wherein the second blocking element (20, 20') is at least partially made of a first resilient material (24), configured to deform as a result of said rotation of the blocking pin (16), and wherein the first resilient material (24) and the second resilient material (30) are co- or over-moulded.

7. Assembly according to any one of the previous claims, wherein the first blocking element (18) comprises at least one lateral protrusion (32), which extends radially to an extension direction (X) of the

blocking pin (16), to stop the rotation of the latter around the rotation axis (R) and to block the translation of said pin parallel to said axis (R).

8. Assembly according to the previous claim, comprising a pair of lateral protrusions (32) separated from each other, and wherein the first blocking element (18) further comprises at least one projection or annular lip (34) which defines a recess (36) with said protrusions to house at least part of the second blocking element (20, 20'), and wherein, when the first blocking element (18) is in abutment with the second blocking element (20, 20') to block the blocking pin (16) in the pin cavity (14), said second blocking element is enclosed between a pin head (38) and said protrusion or annular lip (34).

9. Assembly according to any of the previous claims, wherein the second blocking element (20, 20') is inserted in a seat (28) of the wear tooth (2), facing the tip pocket (6).

10. Assembly according to claim 1, wherein the deformable blocking element, first (18) or second (20, 20'), has a shape memory.

11. Assembly according to any of the previous claims, wherein the connection tip (12) is crossed by the pin cavity (14), the latter being at least partially aligned and communicating with a pair of through holes (8, 8') delimited by the body wall (4), wherein the blocking pin (16) comprises a pin head (38) and an opposite pin tip (40) accessible through said holes.

12. Assembly according to the previous claim, wherein the pin head (38) delimits a polygonal recess (42) and /or wherein the pin tip (40) is shaped externally (44) in a polygonal manner, or vice versa, to act in conjunction with one or more tools counter-shaped to said polygonal areas.

13. Assembly according to any of the previous claims, wherein the blocking pin (16) comprises a pin head (38) inserted at least partially in the through hole (8, 8'), and wherein said assembly (1) comprises a protective hood coupled with said head and/or with the surfaces delimiting said hole to close at least partially the space around the pin head (38).

14. Wear assembly (1) comprising:

- a wear tooth (2) which comprises a body wall (4) which delimits at least part of a tip pocket (6), open backwardly, and at least a pair of through holes (8, 8') communicating with said pocket;
- an adapter (10) comprising a connection point (12), inserted at least partially in the tip pocket (6), in a removable manner, and crossed by a pin cavity (14);
- a blocking pin (16) between wear tooth (2) and adapter (10), inserted in at least one through hole (8, 8') and in the pin cavity (14) rotatably around a rotation axis (R) and comprising a pin head (38) and an opposite pin tip (40);

wherein the pin cavity (14) is at least partially aligned with the through holes (8, 8'), so as to make the pin head (38) and the pin tip (40) accessible through said holes.

15. Earth moving machine comprising at least one wear assembly according to the previous claims, connected to a grab bucket (50) by means of the respective adapter (10).

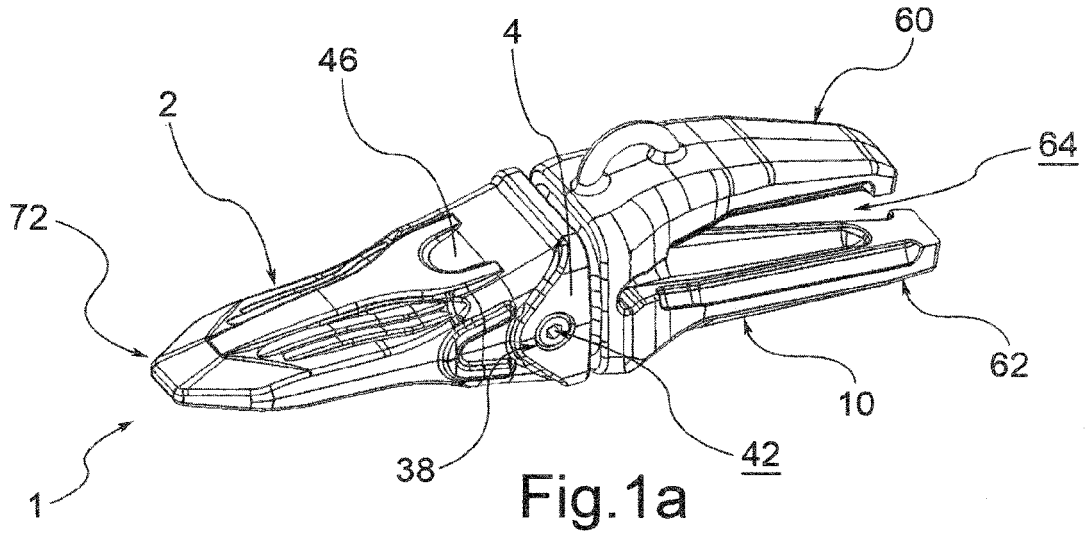

Fig.1a

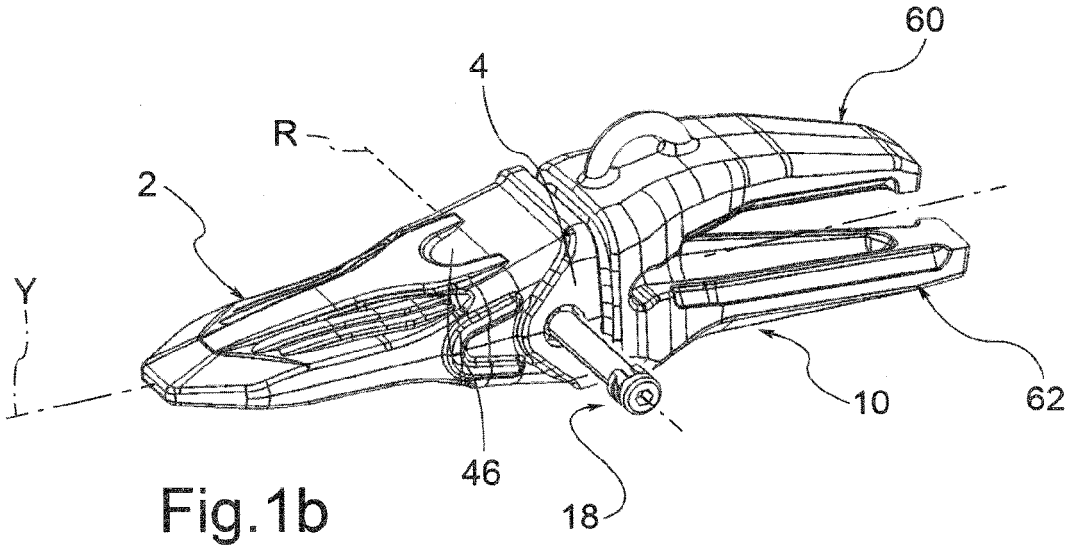

Fig.1b

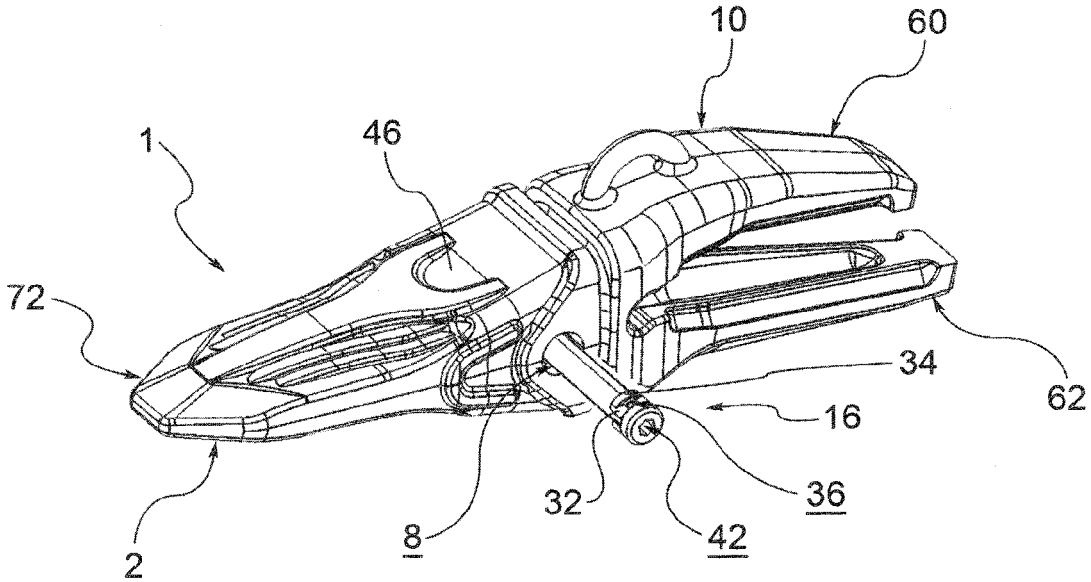

Fig.1c

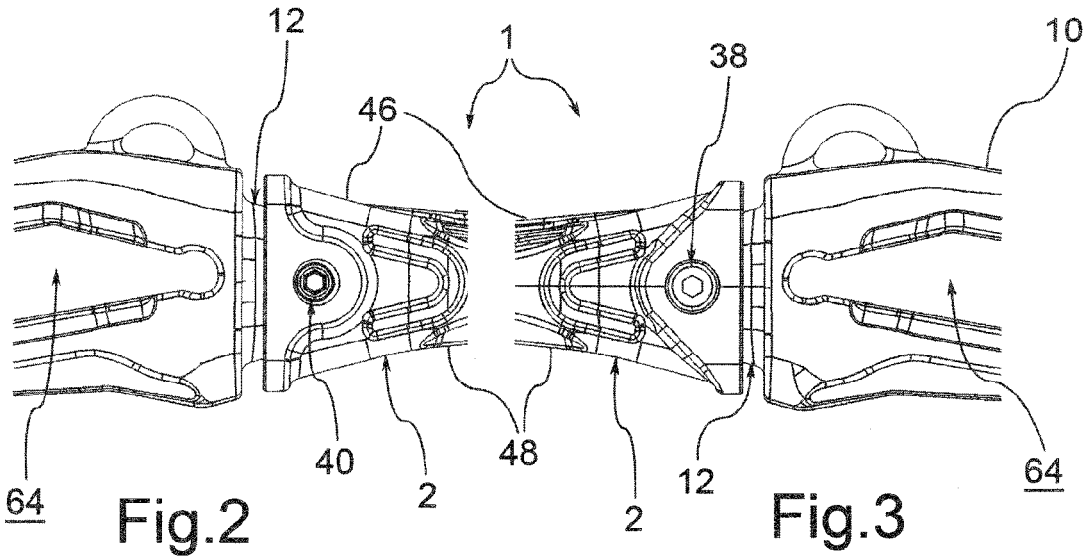

Fig.2

Fig.3

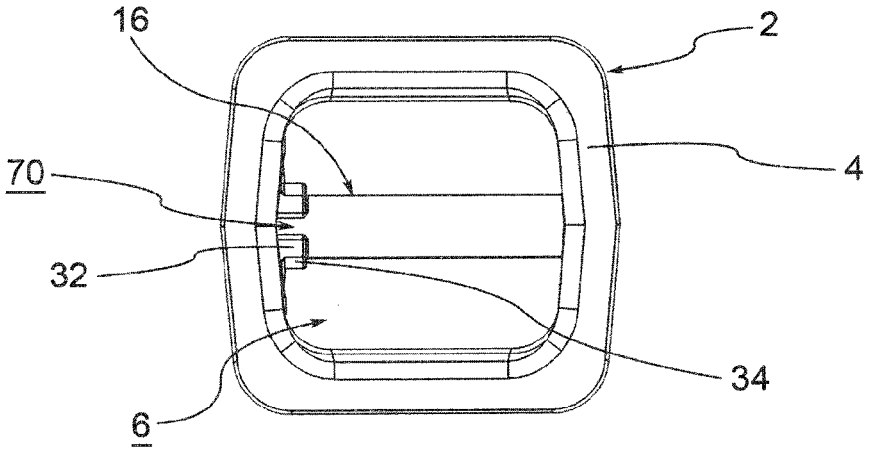

Fig.4

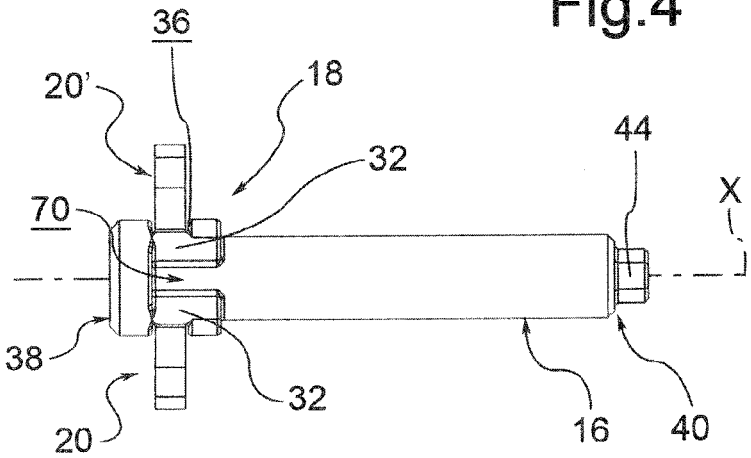

Fig.5

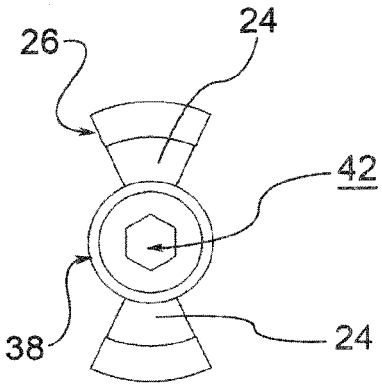

Fig.6

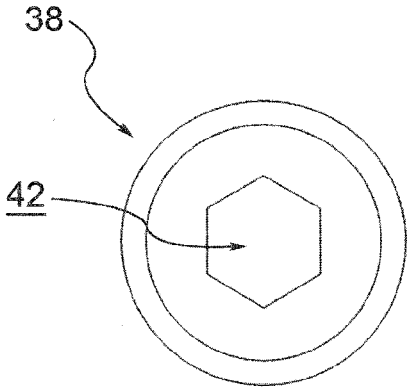

Fig.7

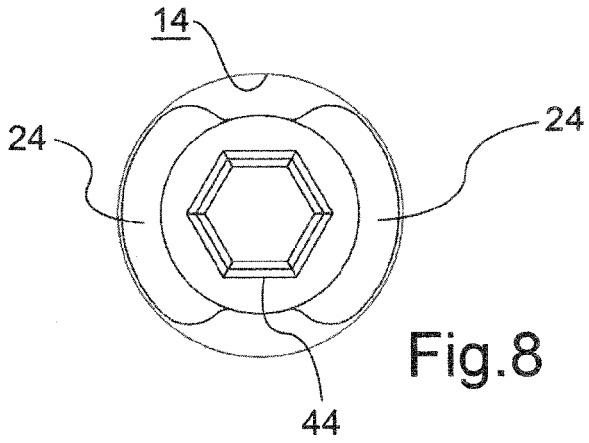

Fig.8

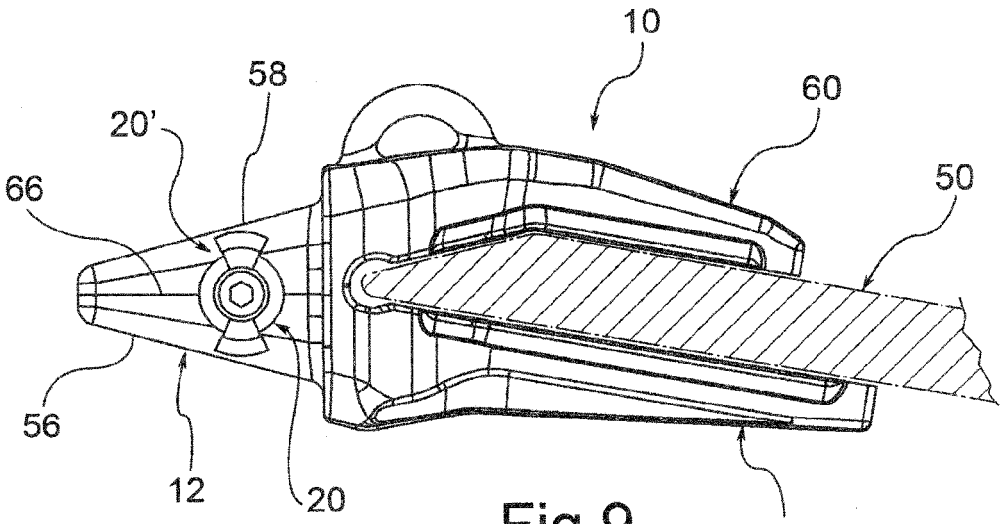

Fig.9

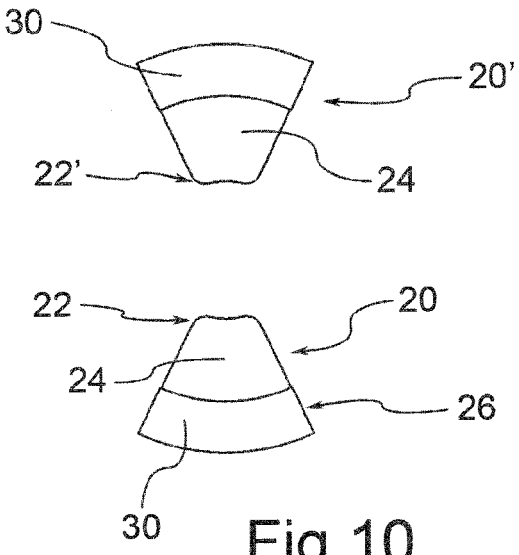

Fig.10

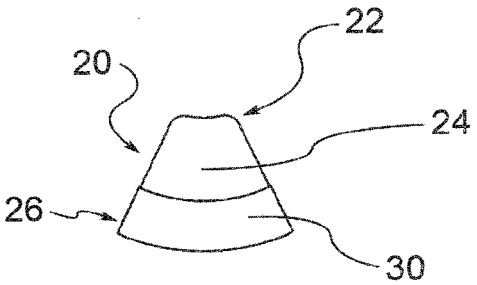

Fig.11

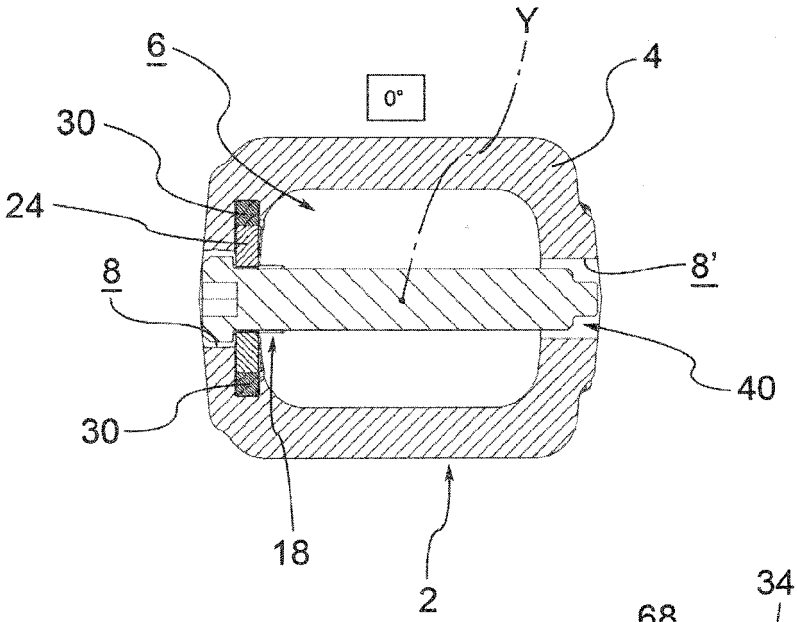

Fig.12a

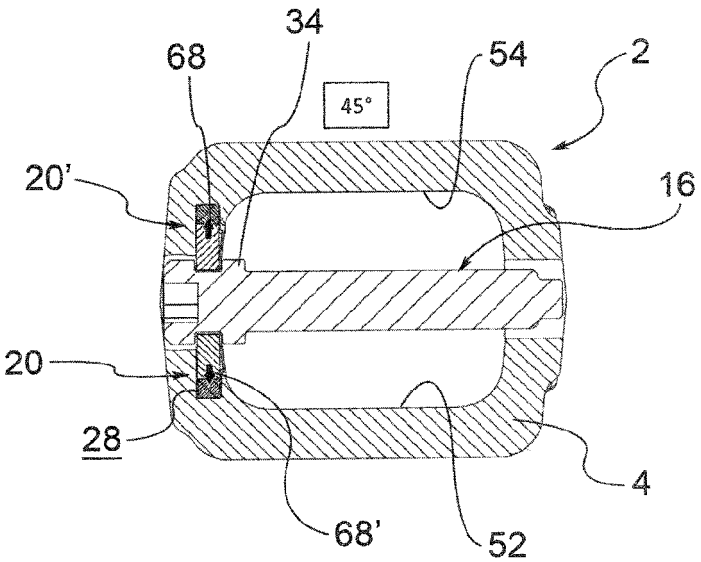

Fig.12b

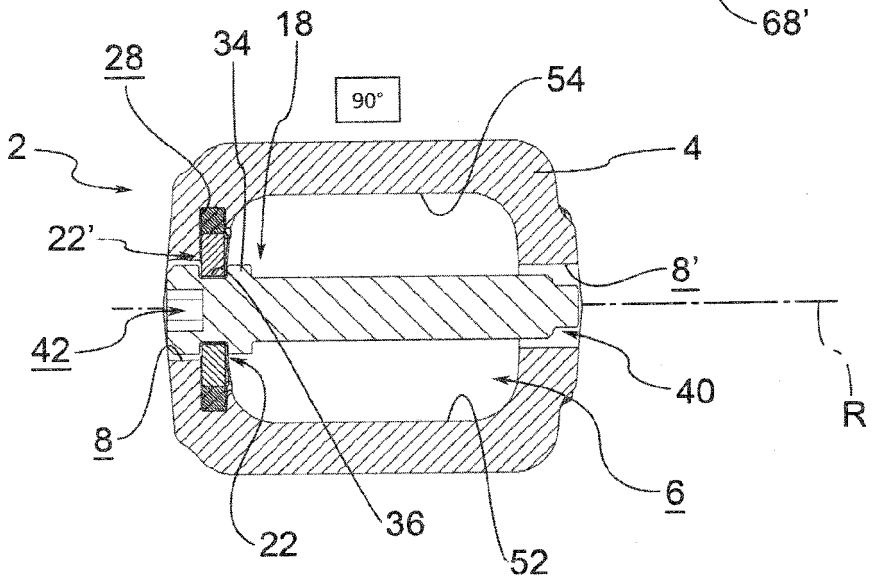

Fig.12c

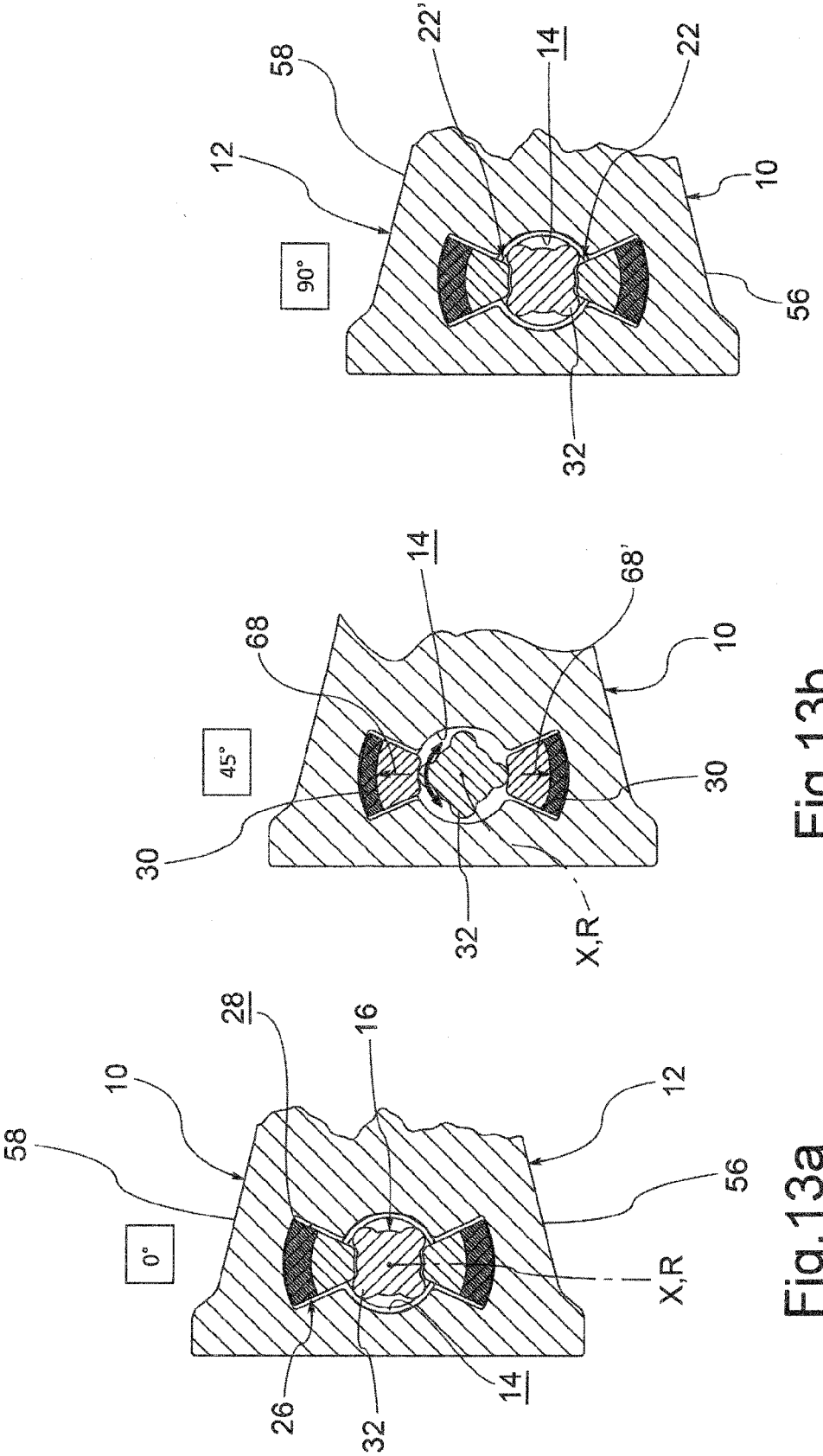

Fig.13c

Fig.13b

Fig.13a