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(54) SOCKET FOR FASTENING A WORKPIECE

(57) A socket for fastening a workpiece, the socket including a main body extending along a working axis, the main body including a working end and an opposite drive end, the working end having a workpiece hole adapted to receive a workpiece head, the drive end having a shaft holder hole adapted to receive an output shaft of an impact tool, and a damping component, which is axially elastically deformable along the working axis, being provided in the workpiece hole, wherein an axial distance from a front end surface of the damping component adjacent to the workpiece head to a front end edge of the working end is less than an axial length of the workpiece head. In this way, when the impact tool performs fastening application operations, the damping component can buffer the hard contact between the working end of the socket and an application base material to suppress the vibration of the socket caused thereby.

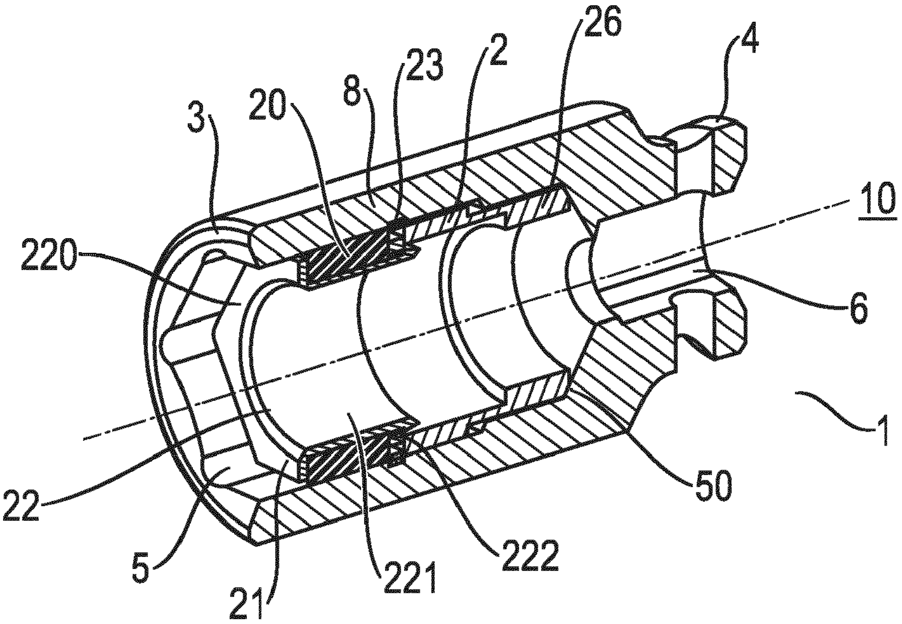

Fig. 3

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Description

TECHNICAL FIELD

[0001] The present invention relates to an accessory for an impact tool, and in particular to a socket that transfers an output torque of the impact tool to a workpiece so as to fasten the workpiece.

BACKGROUND ART

[0002] A socket is generally in a form that engages a workpiece and then applies torque to the workpiece (e.g., a bolt, a nut, a screw, or other fastener). The socket is typically an elongated cylindrical member that engages a workpiece head at a working end and is connected, at a drive end opposite the working end, to an impact tool having an output shaft. The torque applied by the impact tool is transferred by the socket to the workpiece, so that the workpiece is inserted into or removed from an application base material.

[0003] A tangential impact mechanism of the impact tool as well as a transmission gear and an electric motor will generate excitation in the form of vibration during operation. Most of the excitations occur on a rotating shaft of the tangential impact mechanism, and excitation forces are transferred to the socket connected to the output shaft of the impact tool. Referring to FIG. 1, the drive end of the socket adjacent to the output shaft is in undampened hard contact with a front end of the impact tool, and the working end of the socket is in unbuffered hard contact with the application base material (usually a stiff body, i.e. steel) where the operation is performed. Thus, the excitation transferred to the socket will be reflected back to the impact tool and a user, resulting in high hand-arm vibration (HAV) values.

SUMMARY OF THE INVENTION

[0004] An objective of the present invention is to provide a socket for fastening a workpiece, which can buffer the undampened hard contact between the socket, an impact tool and an application base material to suppress the reaction force of the vibration of the socket on the impact tool and a user, so that the impact tool is not easy to be damaged and meets the HAV value requirement of the user.

[0005] According to an embodiment of the present invention, a socket for fastening a workpiece is provided. The socket includes a main body extending along a working axis, the main body including a working end and an opposite drive end, the working end having a workpiece hole adapted to receive a workpiece head, the drive end having a shaft holder hole adapted to receive an output shaft of an impact tool, and a damping component, which is axially elastically deformable along the working axis, being provided in the workpiece hole, wherein an axial distance from a front end surface of the damping component adjacent to the workpiece head to a front end edge of the working end is less than an axial length of the workpiece head. In this way, when the impact tool performs tightening application operations, the damping component can buffer the hard contact between the working end of the socket and an application base material to suppress the vibration of the socket caused by the hard contact.

[0006] The damping component includes a first elastic element fixed into the workpiece hole by means of radial stretching and/or axial bonding. Here, the first elastic element is directly fixedly mounted into workpiece hole, and the hard contact between the socket and the application base material is buffered by means of the axial elastic deformation of the first elastic element.

[0007] Optionally, the damping component further includes a clamping ring and a protective cover, wherein the clamping ring is axially fixed in the workpiece hole along an outer peripheral edge thereof, the first elastic element is configured in a cylindrical shape having a centre hole, the protective cover includes an end cover that at least partially covers a radial cross-sectional profile of the workpiece head and a shaft portion that axially extends through the centre hole of the first elastic element, and one end of the shaft portion away from the end cover is axially flexibly connected to the clamping ring. Thus, the elastic element is indirectly axially fixed into the workpiece hole by means of the clamping ring and the protective cover, so that the damping component has prolonged service life and may be a part independent of the socket.

[0008] According to a preferred embodiment of the present invention, the clamping ring is radially elastically deformable, and the outer peripheral edge of the clamping ring has a slightly larger profile than an inner circumference of the workpiece hole, so that the clamping ring is radially elastically clamped in the workpiece hole. In this way, the fixed connection between the damping component and the workpiece hole is achieved by means of the radial elastic deformation of the clamping ring, so that the damping component is replaceable.

[0009] Alternatively, the clamping ring is rigid and is press-fitted into the workpiece hole. Here, the damping component is pre-mounted into the workpiece hole and forms an integral part with the socket, avoiding the risk of disengagement of the damping component from the socket.

[0010] According to another preferred embodiment of the present invention, the damping component further includes a spacer, which is disposed between the clamping ring and a bottom surface of the workpiece hole and is configured to define an axial position of the damping component in the workpiece hole. The spacer abuts against the clamping ring on one side of the clamping ring facing the bottom surface of the workpiece hole, so as to define the axial position of the clamping ring in the workpiece hole. In this way, a suitable damping component can be selected according to different applications and workpieces.

[0011] According to yet another preferred embodiment of the present invention, the clamping ring further includes an axially extending spacing portion, and one end of the spacing portion away from clamping ring abuts the bottom surface of the workpiece hole. Here, the clamping ring itself includes the spacing portion that defines the axial position of the damping component in the workpiece hole, so that the damping component is simply and conveniently positioned and mounted in the workpiece hole.

[0012] According to another embodiment of the present invention, a socket for fastening a workpiece is provided. The socket includes a main body extending along a working axis, the main body having a working end and an opposite drive end, the working end having a workpiece hole adapted to receive a workpiece head, the drive end having a shaft holder hole adapted to receive an output shaft of an impact tool, a second elastic element is axially fixedly disposed in the shaft holder hole, and the second elastic element abuts a front end of an output shaft. In this way, the second elastic element can buffer the hard contact between the front end of the impact tool and the socket during working of the impact tool to reduce the axial vibration transferred by the socket to the impact tool.

[0013] The second elastic element is fixed to an axial notch of the shaft holder hole by means of radial supporting and/or bonding and/or an elastic element. The second elastic element is axially fixed to the shaft holder hole, so that the hard contact between the socket and the impact tool is buffered by means of the axial deformation of the second elastic element.

[0014] According to yet another embodiment of the present invention, a socket for fastening a workpiece is provided. The socket includes a main body extending along a working axis, the main body having a working end and an opposite drive end, the working end having a workpiece hole adapted to receive a workpiece head, the drive end having a shaft holder hole adapted to receive an output shaft of an impact tool, and a damping component, which is axially elastically deformable along a working axis, being provided in the workpiece hole, wherein an axial distance from a front end surface of the damping component adjacent to the workpiece head to a front end edge of the working end is less than an axial length of the workpiece head, a second elastic element is axially fixed in the shaft holder hole, and the second elastic element abuts a front end of an output shaft. In this embodiment, the socket is provided with elastic damping components on both the working end and the drive end to respectively buffer the hard contacts between the working end of the socket and the application base material and between the drive end of the socket and the impact tool, so as to minimize the vibration transferred by the socket to the impact tool.

[0015] The first elastic element and/or the second elastic element are/is formed of an elastic material (e.g., plastic, rubber, foam, or elastomer), or an elastic geometric shape (e.g., a helical spring, a disk spring(s), or a honeycomb structure), or an elastic component (e.g., a hydraulic device, or an air spring), or a combination thereof. Thus, the rigidity of the first elastic element and/or the second elastic element can be adjusted by means of material selection and/or geometric shapes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] A better understanding of the embodiments mentioned can be gained from the following detailed description with reference to the drawings. It is emphasised that various components are not necessarily drawn to scale. In fact, dimensions may be increased or decreased at will for the purpose of clear description. In the drawings, the same reference signs refer to the same elements.

FIG. 1 is a schematic diagram of a socket in the prior art in a working state;

FIG. 2 is a schematic cross-sectional view of a socket for fastening a workpiece according to a first embodiment of the present invention;

FIG. 3 is a schematic cross-sectional view of a variant of the socket shown in FIG. 2;

FIG. 4 is a schematic exploded view of a variant of the socket shown in FIG. 3;

FIG. 5 is a schematic exploded view of another variant of the socket shown in FIG. 2;

FIG. 6 is a schematic cross-sectional view of yet another variant of the socket shown in FIG. 2;

FIG. 7 is a schematic cross-sectional view of a socket according to a second embodiment of the present invention;

FIG. 8 is a schematic cross-sectional view with enlarged detail of the socket according to the embodiment shown in FIG. 7; and

FIG. 9 is a schematic cross-sectional view of a socket according to a third embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0017] A socket for an impact tool of the present invention will be described below with reference to FIGS. 2 to 9. The following description is merely exemplary and does not limit the disclosed content of the present application or the applications or uses of the present invention. In the description of the present invention, it should be understood that orientations or positional relationships indicated by terms such as "centre", "longitudinal", "transverse", "length", "width", "thickness", "upper", "lower", "front", "rear", "left", "right", "vertical", "horizontal", "top", "bottom", "inside", "outside", "axial", "radial", and "circumferential" are based on orientations or positional relationships shown in the drawings, which are only for facilitating the description of the present invention and simplifying the description, rather than indicating or implying that devices or elements referred to must have a specific orientation or be constructed and operated in the specific orientation, and therefore cannot be construed as limiting the present invention.

[0018] Referring to FIGS. 2 to 9, a socket 1 includes a main body 8 extending along a working axis, and the main body 8 is generally in a hollow elongated cylindrical shape. The main body 8 includes a working end 3 and an opposite drive end 4. The drive end 4 is adapted to be releasably coupled to a torque application tool such as an electric drill, a ratchet wheel, a torque or impact spanner, a screwdriver, or a recessing machine. In an embodiment of the present invention, the torque application tool is an impact tool. An output shaft 9 of the impact tool extends from the front of a housing of the impact tool, and generally has a square cross-sectional profile. The drive end 4 has a shaft holder hole 6 adapted to engage the output shaft 9 of the impact tool, such as a square drill hole, adapted to be releasably coupled to a front end of the output shaft 9 of the impact tool. The shaft holder hole 6 may further include an engagement portion provided on an inner surface thereof, and the engagement portion is adapted to engage, in a retained manner, with an outwardly offset retaining ring or retaining ball provided on the output shaft 9 of the tool.

[0019] The working end 3 has a workpiece hole 5 axially extending along a working axis 10 from a front end edge 31 of the working end, and the workpiece hole 5 is adapted to accommodate a workpiece head 7 that fastens a workpiece, so as to transfer torque from the torque application tool to the workpiece. The workpiece hole 5 may have different radial cross-sectional profiles and/or dimensions, for example, the workpiece hole 5 has a radial profile and dimension depending on the profile and dimension of the workpiece head 7, to which the workpiece hole is adapted, at a portion close to the front end edge 31, and may have a smaller inside diameter profile or dimension at a portion close to the shaft holder hole 6. Although the workpiece hole 5 and the shaft holder hole 6 of the socket 1 are different in shape and dimension, the workpiece hole 5 is usually in communication, preferably coaxial, with the shaft holder hole 6, and thus the portion where the workpiece hole 5 joins with the shaft holder hole 6 includes a transition portion where a bottom surface 50 of the workpiece hole 5 tapers toward the shaft holder hole 6.

[0020] The socket 1 of the present invention is suitable for a threaded fastening workpiece having a workpiece head 7, for example, a bolt having a head, or a thread-fitting stud nut. Threaded fastening workpieces are the most commonly used standard components in various mechanical equipment, and should be selected according to usage occasions and functions of the fastening workpieces. Sockets suitable for the threaded fastening workpieces are also standard components. The specification and dimension of the socket depend on those of the fastening workpiece to which the socket is adapted. For example, the profile of the workpiece hole of the working end of the socket is approximately the same as the profile of the workpiece head, most commonly hexagonal. In addition to common standard sockets, there are many special sockets, such as hexagonal long sockets, hexagonal or dodecagonal spline sockets, and screwdriver sockets. If the head is made into a special-shaped bolt or nut, it is necessary to use a special socket for mounting or removal. The radial dimension of the workpiece hole is approximately equal to or slightly larger than that of the workpiece head to which the workpiece hole is adapted. The axial length of the workpiece hole usually depends on the length of a rod portion of the stud or the bolt that protrudes from the application base material. That is to say, the axial length of the workpiece hole is at least longer than the longest distance of the rod portion of the stud or the bolt that may extend into the socket.

[0021] According to a first embodiment of the present invention, referring to FIG. 2, a buffer mechanism 2, which is axially elastically deformable along the working axis 10, is provided in the workpiece hole 5, wherein the buffer mechanism 2 includes a first elastic element 20. The first elastic element 20 may be formed of an elastic material such as plastic, rubber, foam (e.g., polyurethane) or elastomer (e.g., NBR, HNBR, EPDM, or AEM), or an elastic geometric shape (e.g., a helical spring, a disk spring(s), or a honeycomb structure), or an elastic component (e.g., a hydraulic device, or an air spring), or a combination thereof. In the embodiment shown in FIG. 2, the first elastic element 20 is an elastic body formed of an elastic material, and is in the shape of a hollow cylinder axially extending along the working axis 10, and the outer peripheral surface thereof has approximately the same profile, for example, a hexagonal shape, as the workpiece hole 5.

[0022] The first elastic element 20 is fixed into the workpiece hole 5 by means of axial fixed connection (e.g., axial bonding). Alternatively, the first elastic element 20 is fixed into the workpiece hole 5 by means of radial stretching. For example, the outside diameter dimension of the first elastic element 20 is larger than the inside diameter dimension of the workpiece hole. During mounting of the elastic element, the first elastic element 20 is radially compressed and then placed in the workpiece hole 5. Since the first elastic element 20 is an elastic body formed of an elastic material, the first elastic element 20 is naturally, radially, elastically stretched after the radial pressure is released, and then abuts against the inner wall of the workpiece hole 5.

[0023] Optionally, a positioning mechanism may be provided on the inner wall of the workpiece hole 5, so that the first elastic element 20 can be axially fixed in the workpiece hole 5, without the risk of axial displacement or disengagement. For example, the workpiece hole 5 has a positioning surface 51 extending at least partially radially inwardly and substantially perpendicular to the working axis. The positioning surface 51 is not completely closed, but is an annular surface slightly protruding from the inner wall of the workpiece hole 5. The rear end of the first elastic element 20 abuts the positioning surface 51, and then the bottom surface can define the axial position of the elastic element 20 in the workpiece hole.

[0024] The axial distance from the front end surface 21 of the first elastic element 20 adjacent to the workpiece head 7 of the fastening workpiece to the front end edge 31 of the working end 3 should be less than the axial length of the workpiece head 7. As shown in FIG. 2, in this way, when a fastening application operation is started, the workpiece head 7 is received in the workpiece hole 5, the front end edge 31 of the first elastic element 20 is adjacent to the end surface of the workpiece head 7, and since the axial distance from the front end surface 21 of the first elastic element 20 to the front end edge 31 of the working end 3 should be less than the axial length of the workpiece head 7, the workpiece head 7 has not been completely accommodated in the workpiece hole 5, that is to say, the front end edge 31 of the working end is not in contact with, but is slightly separated from, the surface of the application base material. As the fastening application operation processes, when the workpiece head 7 gradually approaches the application base material until it can no longer approach, the first elastic element 20 begins to axially elastically deform, which avoids the hard contact between the front end edge 31 of the socket and the surface of the application base material to reduce the vibration caused by the reaction force transferred by the fastening workpiece to the socket.

[0025] FIGS. 3 and 6 show variant embodiments of the socket shown in FIG. 2. Different from the embodiment shown in FIG. 2, the buffer mechanism 2 not only includes the first elastic element 20, but also includes a clamping ring 23 and a protective cover 22. Here, the first elastic element 20 is indirectly axially fixed into the workpiece hole 5 by means of the clamping ring 23 and the protective cover 22, so that the damping component 2 has prolonged service life, and the damping component 2 may be a part independent of the socket 1.

[0026] The first elastic element 20 may still be formed of an elastic material (e.g., plastic, rubber, foam, or elastomer), or an elastic geometric shape (e.g., a helical spring, a disk spring(s), or a honeycomb structure), or an elastic component (e.g., a hydraulic device, or an air spring), or a combination thereof. The shape and material of the first elastic element 20 can be selected or combined according to the difference in elasticity and rigidity required by the damping component of different sockets. In the embodiment as shown in FIGS. 3 to 5, the first elastic element 20 may be an elastic body formed of an elastic material, is in the shape of a cylinder having a centre hole 25 and axially extending along the working axis 10, and the outer peripheral surface thereof has approximately the same profile, for example, a hexagonal shape, as the workpiece hole 5. In the embodiment as shown in FIG. 6, the first elastic element 20 is a helical spring, and the spring wire is circumferentially helically wound along the working axis to form the cylinder having the centre hole 25.

[0027] Specifically, the protective cover 22 includes an end cover 220 that at least partially covers the radial cross-sectional profile of the workpiece head 7 and a shaft portion 221 that axially extends through the centre hole 25 of the first elastic element 20, and one end of the shaft portion away from end cover is axially flexibly connected to the clamping ring 23. Thus, one side of the end cover 220 of the protective cover 22 facing the workpiece head serves as the front end surface 21 of the buffer mechanism 2 adjacent to the workpiece head, and at least partially covers the radial cross-sectional profile of the workpiece head 7, and the axial distance from the front end surface 21 to the front end edge 31 of the working end 3 is less than the axial length of the workpiece head 7. The other side of the end cover 220 is configured to support the first elastic element 20, so as to protect the first elastic element 20 to reduce wear or damage of the first elastic element 20.

[0028] The clamping ring 23 is axially fixed in the workpiece hole 5 along the outer peripheral edge thereof. As shown in FIGS. 3 and 4, the clamping ring 23 is formed of POM plastic, and is slightly radially deformable, and the outer peripheral edge of the clamping ring 23 has a slightly larger profile dimension than the inner circumference of the workpiece hole 5, and the clamping ring 23 is radially elastically clamped in the workpiece hole. In this way, the fixed connection between the damping component and the workpiece hole is achieved by means of the radial elastic deformation of the clamping ring, so that the damping component is replaceable. Optionally, the outer peripheral edge of the clamping ring 23 is provided with several positioning structures, such as protrusions, and accordingly, the inner peripheral surface of the workpiece hole 5 is provided with several corresponding recesses. The protrusions of the clamping ring can be engaged in the recesses of the workpiece hole, so that the clamping ring 23 is axially positioned in the workpiece hole 5 more stably.

[0029] Alternatively, as shown in FIG. 5, the clamping ring 23 is rigid, for example, is made of metal. The rigid clamping ring 23 is press-fitted into the workpiece hole 5. Here, the damping component 2 is pre-mounted into the workpiece hole and forms an integral part with the socket 1, avoiding the risk of disengagement of the damping component 2 from the socket. It can be understood that the rigid clamping ring 23 may also include axial positioning structures to achieve better axial fixed positioning effect, which will not be described herein again.

[0030] The damping component 2 includes a first elastic element 20, a protective cover 22 and a clamping ring 23, and the vibration caused by the hard contact between the front end edge 31 and the surface of the application base material is buffered by the damping component 2 by means of the axial elastic deformation of the first elastic element 20. The first elastic element 20 has a front end abutting the end cover 220 and a rear end abutting the clamping ring 23, and the clamping ring 23 is axially fixed in the workpiece hole 5. One end of the shaft portion 221 of the protective cover 22 away from the end cover is axially flexibly connected to the clamping ring 23, and the first elastic element 20 can be elastically deformed when the front end surface 21 of the protective cover 22 is under pressure, achieving a buffering function. Preferably, one end of the shaft portion 221 of the protective cover 22 away from the end cover is connected to the clamping ring 23 by means of an annular snap-fit fastener.

[0031] Referring to FIGS. 3 to 5, preferably, the damping component 2 further includes a spacer 26, which is disposed between the clamping ring 23 and the bottom surface 50 of the workpiece hole 5 and is configured to adjust the initial axial position of the damping component 2 in the workpiece hole 5. As shown in the figures, the spacer 26 may be in the shape of a cylinder axially extending along the working axis, and has the front end thereof abutting the clamping ring on the side of the clamping ring 23 facing the bottom surface 50 of the workpiece hole, so as to define the axial position of the clamping ring in the workpiece hole. Preferably, the spacer 26 is in the shape of a hollow ring, the axial length of the spacer 26 may be selected according to the different sockets and the axial length of the damping component 2, which can select a suitable socket according to different applications and workpieces, and also will not affect the performance of the socket due to the adding of the damping component.

[0032] Further referring to FIG. 6, in this embodiment, the clamping ring 23 further includes an axially extending spacing portion 24, and one end of the spacing portion 24 away from the clamping ring abuts the bottom surface 50 of the workpiece hole. Here, there is no need to provide a separate spacer 26, but a spacing portion 24 is integrated on the clamping ring 23, and the clamping ring 23 includes the spacing portion configured to define the axial position of the damping component in the workpiece hole. In this way, the clamping ring 23 does not need an additional axial positioning structure, so that the damping component 2 is simply and conveniently positioned and mounted in the workpiece hole 5.

[0033] Next, referring to FIGS. 7 and 8, according to a second embodiment of the present invention, a second elastic element 40 is axially fixed in the shaft holder hole 6, and the second elastic element 40 abuts the front end of the output shaft 9. As described in the Background Art, the vibration of the socket 1 during a fastening operation mainly comes from the undampened hard contact between the drive end of the socket and the front end of the impact tool, and the working end of the socket is in unbuffered hard contact with the application base material (usually a stiff body i.e. steel) on which the operation is performed. In the forgoing embodiments shown in FIGS. 2 to 6, the main purpose is to buffer the hard contact between the working end of the socket and the surface of the application base material. In the embodiment shown in FIGS. 7 and 8, the socket is mainly used to buffer the hard contact between the front end of the impact tool and the socket during operation of the impact tool to reduce the axial vibration transferred by the socket to the impact tool.

[0034] Similarly, the rigidity of the second elastic element 40 can be adjusted by means of material selection and/or geometric shapes. For example, the second elastic element 40 is formed of an elastic material (e.g., plastic, rubber, foam, or elastomer), or an elastic geometric shape (e.g., a helical spring, a disk spring, or a honeycomb structure), or an elastic component (e.g., a hydraulic device, or an air spring), or a combination thereof. As shown in FIGS. 7 and 8, as an example, the second elastic element 40 is an elastic plug formed of an elastic material.

[0035] The second elastic element 40 is axially fixed to the shaft holder hole 6. Referring to FIG. 8, the second elastic element 40 includes an end surface 41 that can abut the front end of the output shaft 9 and an axially extending shaft portion 42 that has one end adjacent to the end surface 41 and the opposite end provided with a hook 43. The shaft portion has a slightly smaller profile than the end surface. A radially inwardly extending protrusion 60 is provided in the shaft holder hole 6. When the second elastic element 40 is mounted to the shaft holder hole 6, the end surface 41 and the hook 43 respectively abut against front and rear ends of the protrusion 60, so that the second elastic element 40 is axially fixedly mounted into the shaft holder hole 6. It can be understood that the manner in which the second elastic element 40 is axially fixed into the shaft holder hole 6 is not limited thereto. For example, the second elastic element 40 is mounted into the shaft holder hole 6 by means of radial supporting and/or bonding and/or press-fitting.

[0036] It should be noted that for the sockets adapted to different impact tools, the profile and dimension of the shaft holder hole are determined according to the output shaft of the impact tool to which the shaft holder hole is adapted, in which the distance the output shaft extends into the shaft holder hole is also specific. Therefore, the axial length of the second elastic element 40 is selected according to the output shaft to which the socket is adapted, so that after the socket is attached to the output shaft, the second elastic element 40 abuts the front end of the output shaft 9, so that the second elastic element 40 can be elastically deformed to absorb the vibration caused thereby when axial movement occurs between the socket and the output shaft.

[0037] FIG. 9 shows a socket for fastening a workpiece according to a third embodiment of the present invention, in which elastic damping components are respectively provided on the drive end and the working end to buffer both the hard contacts between the working end of the socket and the application base material and between the drive end of the socket and the impact tool, so as to minimize the vibration transferred by the socket to the impact tool. As shown in FIG. 9, the socket 1 includes a main body 8 extending along a working axis 10, the main body 8 having a working end 3 and an opposite drive end 4, the working end 3 having a workpiece hole 5 adapted to receive a workpiece head 7, the drive end 4 having a shaft holder hole 6 adapted to engage an output shaft 9 of the impact tool, and a damping component 2, which is axially elastically deformable along the working axis 10, being provided in the workpiece hole 5, wherein an axial distance from a front end surface 21 of the damping component 2 adjacent to the workpiece head to a front end edge 31 of the working end 3 is less that an axial length of the workpiece head 7, a second elastic element 40 is axially disposed at one end of the shaft holder hole 6 away from output shaft, and the second elastic element 40 is adjacent to a front end of the output shaft 9.

[0038] It should be understood that the number, structure and other technical features of the damping component and/or the elastic elements disclosed in the first embodiment and its variants and the second embodiment disclosed above can be combined and configured according to the requirements of different sockets and applied in this embodiment, so as to achieve corresponding effects, which will not be described herein again.

[0039] Many variants and other embodiments of the present invention described herein will readily occur to those skilled in the pertinent art of the present invention having the benefit of the teachings set forth in the foregoing specification and associated drawings.

[0040] Therefore, it should be understood that the present invention is not limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Furthermore, while the foregoing specification and related drawings describe exemplary embodiments of certain exemplary combinations of elements and/or functions, it should be understood that different combinations of elements and/or functions may be provided by alternative embodiments, without departing from the scope of the appended claims.

Claims

1. Socket (1) for fastening a workpiece, the socket comprising a main body (8) extending along a working axis (10), the main body (8) having a working end (3) and an opposite drive end (4), the working end (3) having a workpiece hole (5) adapted to receive a workpiece head (7), and the drive end (4) having a shaft holder hole (6) adapted to receive an output shaft (9) of an impact tool, **characterized in that**
a damping component (2), which is axially elastically deformable along the working axis (10), is provided in the workpiece hole (5), and an axial distance from a front end surface (21) of the damping component (2) adjacent to the workpiece head (7) to a front end edge (31) of the working end (3) is less than an axial length of the workpiece head (7).

2. Socket (1) according to Claim 1, **characterized in that**
the damping component (2) comprises a first elastic element (20), the first elastic element (20) being fixed into the workpiece hole (5) by means of radial stretching and/or axial bonding.

3. Socket (1) according to Claim 1, **characterized in that**
the damping component (2) further comprises a clamping ring (23) and a protective cover (22), wherein the clamping ring (23) is axially fixed in the workpiece hole (5) along an outer peripheral edge thereof, the first elastic element (20) is configured in a cylindrical shape having a centre hole (25), the protective cover (22) comprises an end cover (220) that at least partially covers a radial cross-sectional profile of the workpiece head (7) and a shaft portion (221) that axially extends through the centre hole (25) of the first elastic element, and one end of the shaft portion (221) away from the end cover is axially flexibly connected to the clamping ring (23).

4. Socket (1) according to Claim 3, **characterized in that**
the clamping ring (23) is radially elastically deformable, and the outer peripheral edge of the clamping ring (23) has a slightly larger profile than an inner peripheral surface of the workpiece hole (5) so that the clamping ring is radially elastically clamped in the workpiece hole (5).

5. Socket (1) according to Claim 3, **characterized in that**
the clamping ring (23) is rigid and is press-fitted into the workpiece hole (5).

6. Socket (1) according to Claim 3, 4 or 5, **characterized in that**
the damping component (2) further comprises a spacer (26), which is disposed between the clamping ring (23) and a bottom surface (50) of the workpiece hole (5) and is configured to define an axial position of the damping component in the workpiece hole (5).

7. Socket (1) according to Claim 3, 4 or 5, **characterized in that**
the clamping ring (23) further comprises an axially extending spacing portion (24), and one end of the

spacing portion (24) away from the clamping ring (23) abuts the bottom surface (50) of the workpiece hole (5).

8. Socket (1) according to any one of Claims 2-7, **characterized in that**
the first elastic element (20) is formed of plastic, rubber, foam, elastomer or other elastic material, or a helical spring, a disc spring, a honeycomb structure or other elastic geometric shape, or a hydraulic device, an air spring or other elastic component, or a combination thereof.

9. Socket (1) for fastening a workpiece, the socket comprising a main body (8) extending along a working axis (10), the main body (8) having a working end (3) and an opposite drive end (4), the working end (3) having a workpiece hole (5) adapted to receive a workpiece head (7), and the drive end (4) having a shaft holder hole (6) adapted to receive an output shaft (9) of an impact tool, **characterized in that**
a second elastic element (40) is axially fixedly disposed in the shaft holder hole (6), and the second elastic element (40) abuts a front end of an output shaft (9).

10. Socket (1) according to Claim 9, **characterized in that**
the second elastic element (40) is formed of plastic, rubber, foam, elastomer or other elastic material, or a helical spring, a disc spring, a honeycomb structure or other elastic geometric shape, or a hydraulic device, an air spring or other elastic components, or a combination thereof.

11. Socket (1) according to Claim 10, **characterized in that**
the second elastic element (40) is fixed to an axial notch of the shaft holder hole (6) by means of radial supporting and/or bonding and/or an elastic element.

12. Socket (1) for fastening a workpiece, the socket comprising a main body (8) extending along a working axis (10), the main body (8) having a working end (3) and an opposite drive end (4), the working end (3) having a workpiece hole (5) adapted to receive a workpiece head (7), and the drive end (4) having a shaft holder hole (6) adapted to receive an output shaft (9) of an impact tool, **characterized in that**
a damping component (2), which is axially elastically deformable along the working axis (10), is provided in the workpiece hole (5), an axial distance from a front end surface (21) of the damping component (2) adjacent to the workpiece head (7) to a front end edge (31) of the working end (3) is less than an axial length of the workpiece head (7), a second elastic element (40) is axially fixedly disposed in the shaft holder hole (6), and the second elastic element (40) abuts a front end of the output shaft (9).

13. Socket (1) according to Claim 12, **characterized in that**
the damping component comprises a first elastic element (20), wherein the first elastic element (20) is fixed into the workpiece hole (5) by means of radial stretching and/or axial bonding, and the second elastic element (40) is fixed to an axial notch of the shaft holder hole (6) by means of radial supporting and/or bonding and/or an elastic element.

14. Socket (1) according to Claim 12, **characterized in that**
the damping component (2) further comprises a clamping ring (23) and a protective cover (22), wherein the clamping ring (23) is axially fixed in the workpiece hole (5) along an outer peripheral edge thereof, the first elastic element (20) is configured in a cylindrical shape having a centre hole (25), the protective cover (22) comprises an end cover (220) that at least partially covers a radial cross-sectional profile of the workpiece head (7) and a shaft portion (221) that axially extends through the centre hole (25) of the first elastic element, one end of the shaft portion (221) away from the end cover is axially flexibly connected to the clamping ring (23), and the second elastic element (40) is fixed to the axial notch of the shaft holder hole (6) by means of radial supporting and/or bonding and/or an elastic element.

15. Socket (1) according to Claim 13 or 14, **characterized in that**
the first elastic element (20) and the second elastic element (40) are each formed of plastic, rubber, foam, elastomer or other elastic material, or a helical spring, a disc spring, a honeycomb structure or other elastic geometric shape, or a hydraulic device, an air spring or other elastic component, or a combination thereof.

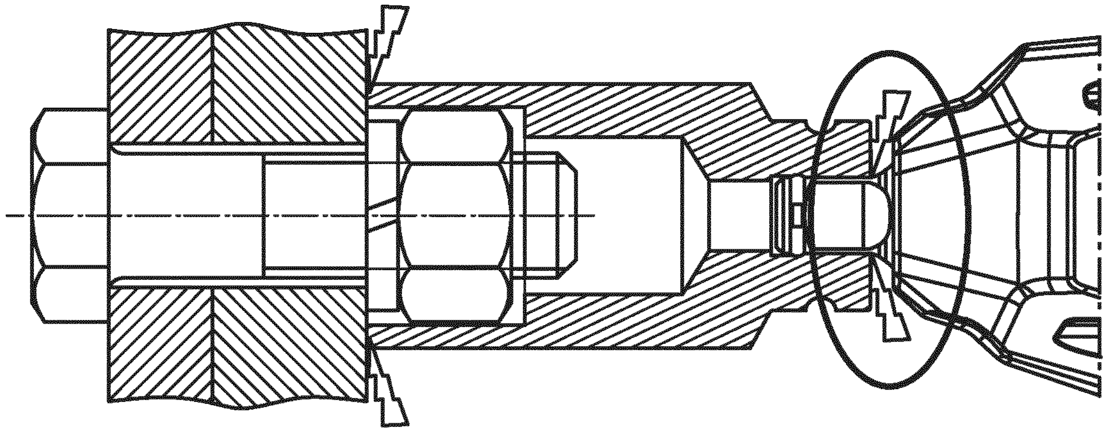

Fig. 1

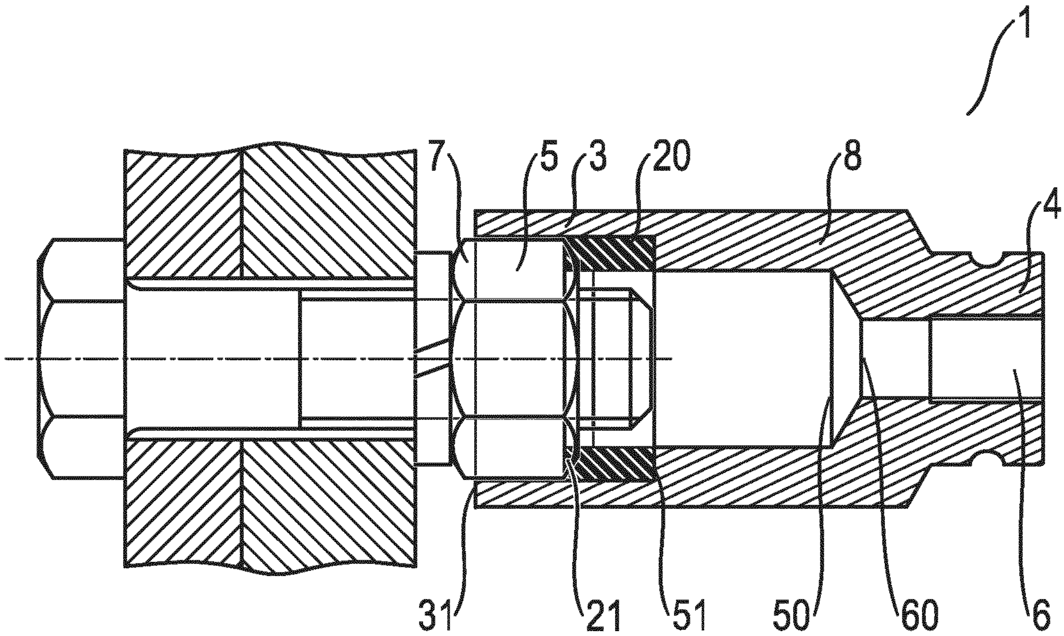

Fig. 2

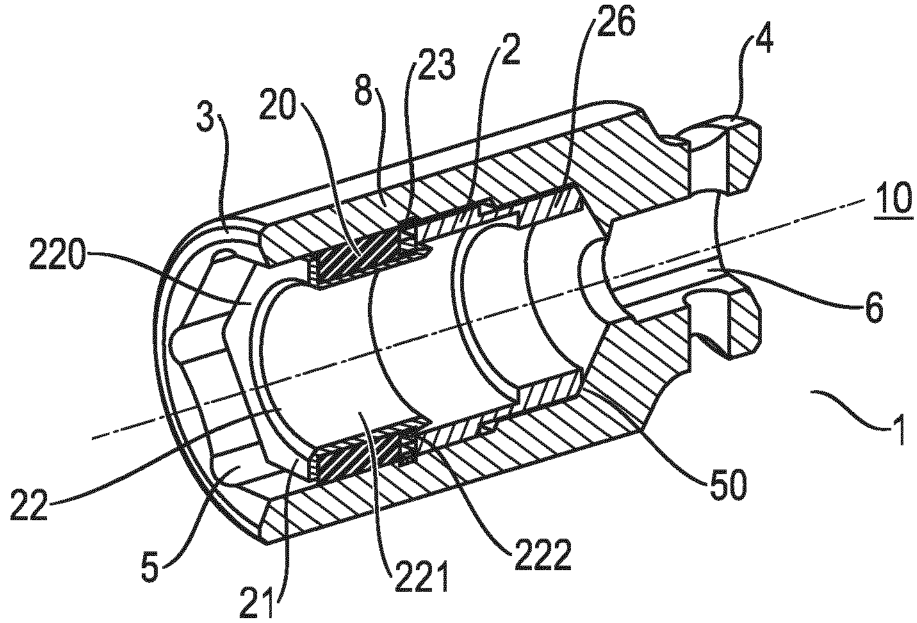

Fig. 3

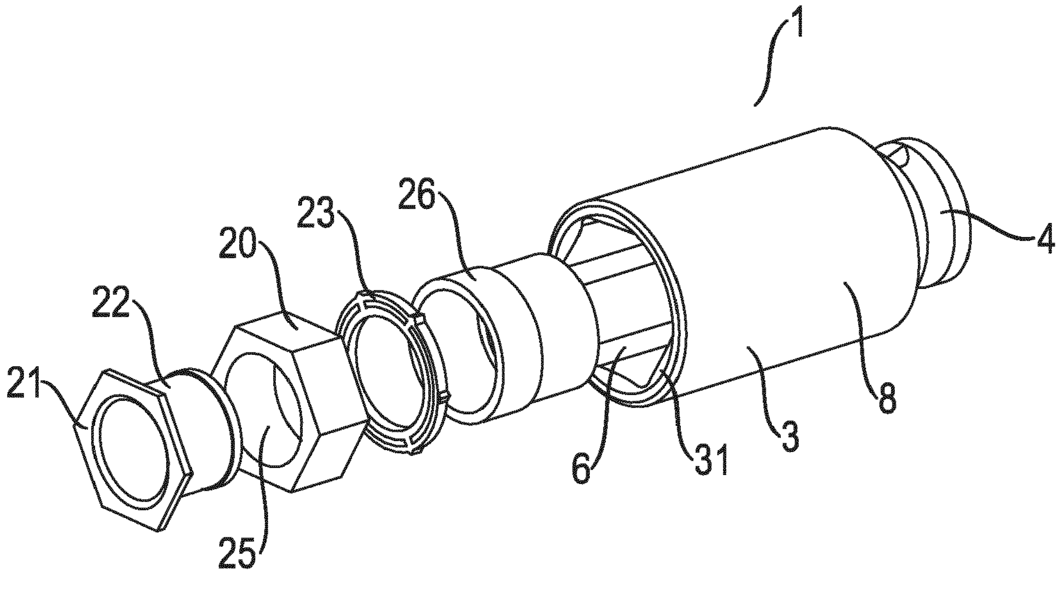

Fig. 4

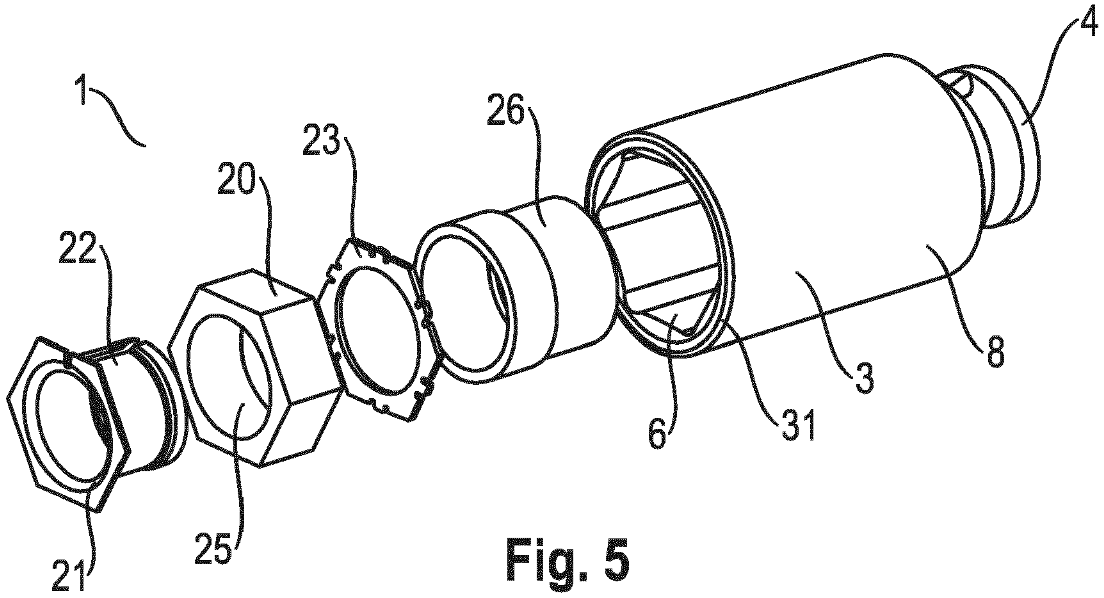

Fig. 5

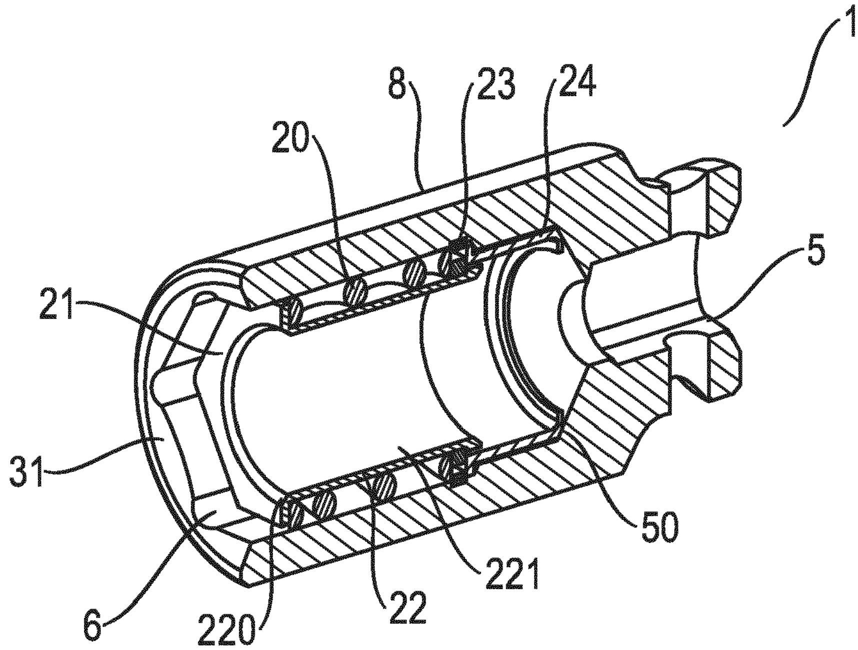

Fig. 6

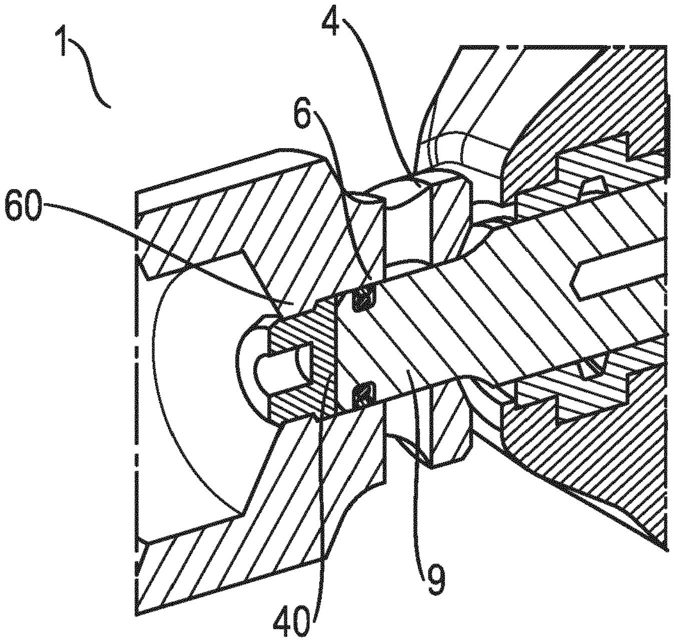

Fig. 7

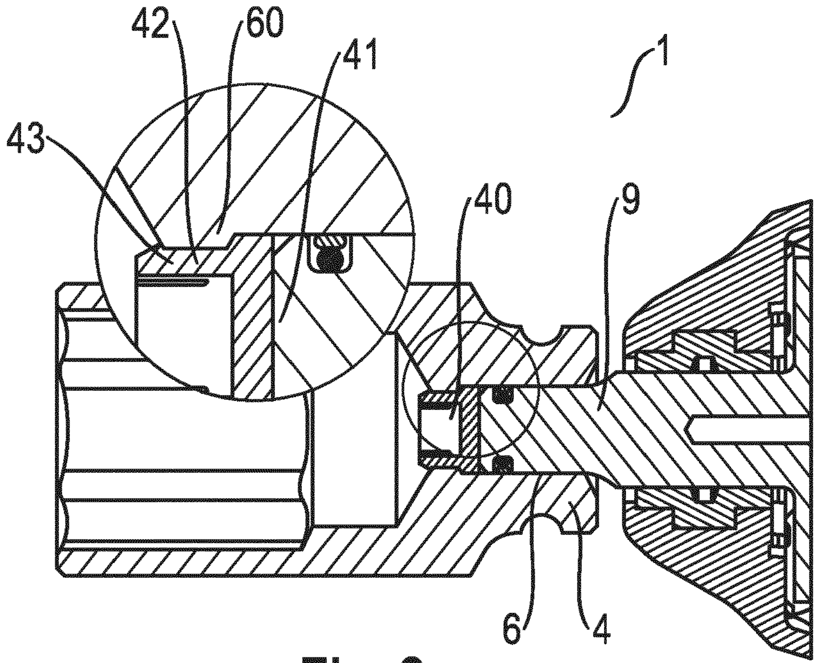

Fig. 8

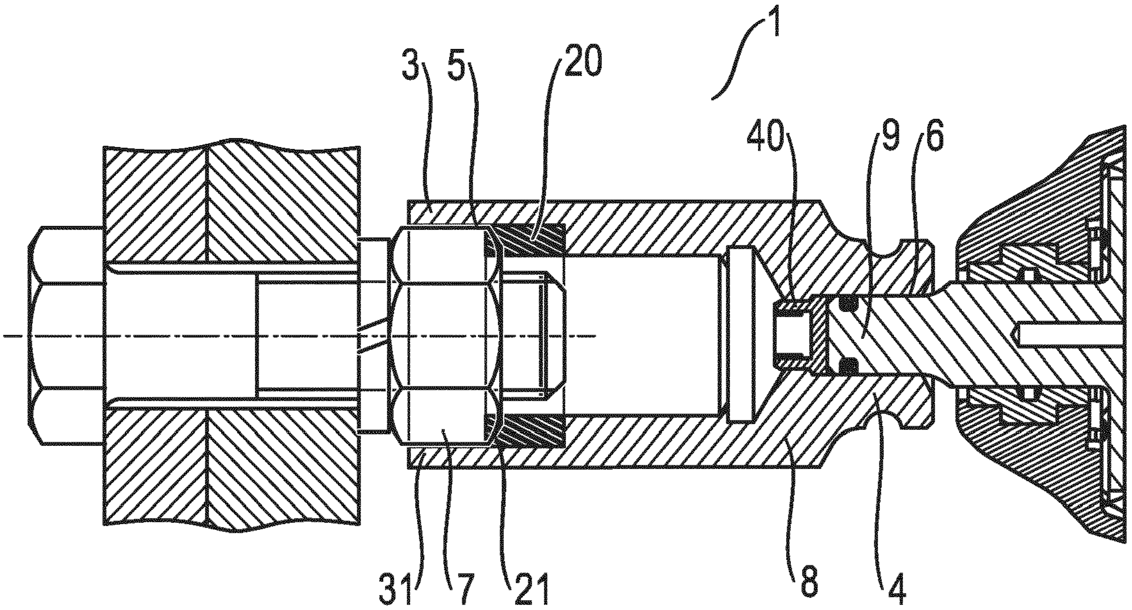

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 23 20 3964

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 407 526 A (COPAGE MICHAEL [GB]) 4 May 2005 (2005-05-04) * the whole document * -----	9-11	INV. B25B13/06 B25B23/00
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TECHNICAL FIELDS SEARCHED (IPC)
B25B

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	12 March 2024	Pothmann, Johannes

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12-03-2024

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