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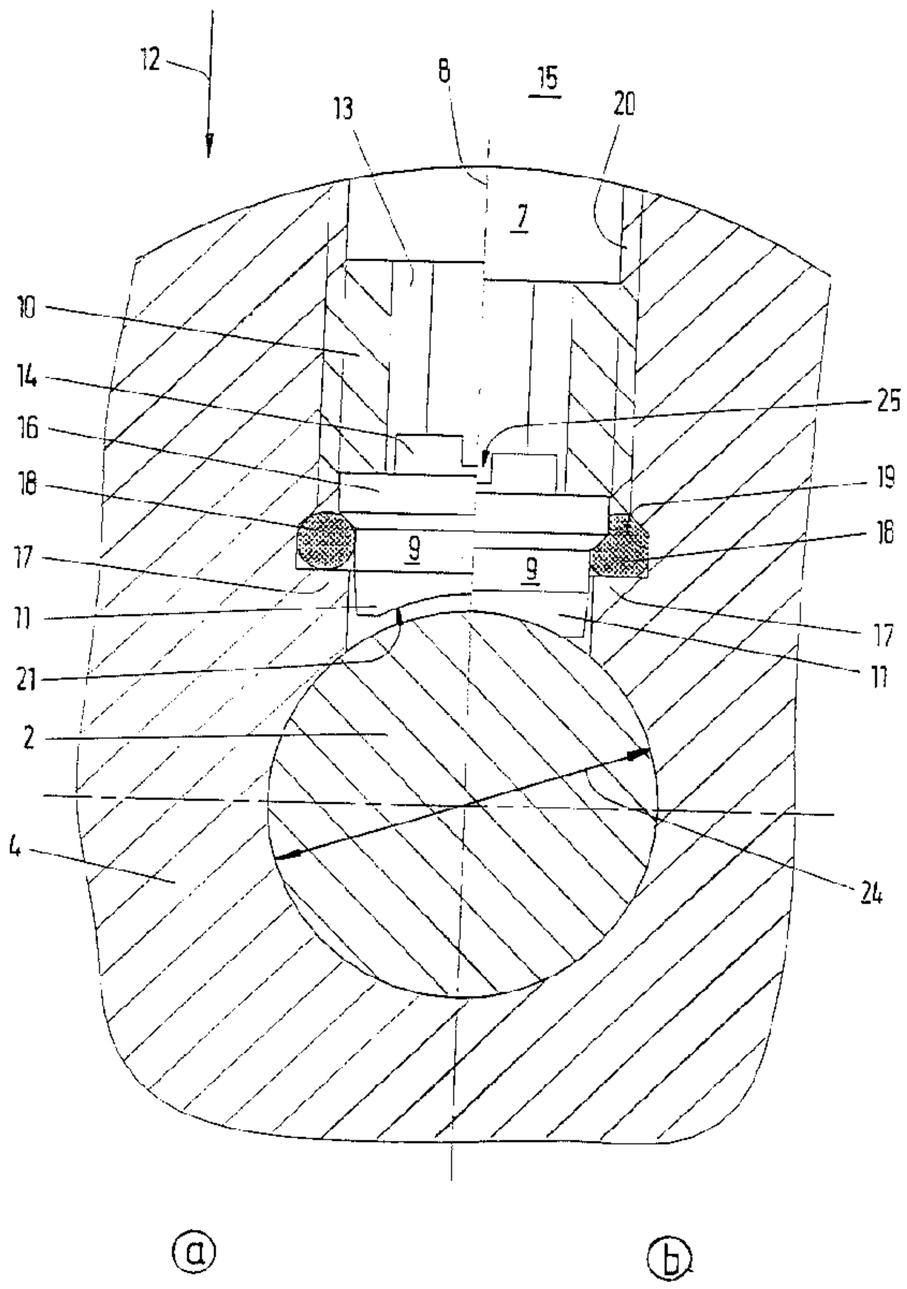


(57) Abrégé/Abstract:
A chuck for rotary tools with a cylindrical chucking shank (2) encloses such shank with a basic body (4). A radical through-hole (7) in basic body (4) serves to receive a clamping screw (10) which applies pressure to a clamping member (9) which is seated inside through-hole (7) between clamping screw (10) and chucking shank (2). Clamping member (9) is provided with a radial projection (16) and through-hole (7) with a cross-sectional narrowing (17) along its inner end. In between is an elastically compressible spring element (18) which, due to its return force, lifts clamping element (9) away from chucking shank (2) and pushes it back into through-hole (7) when it is not under tension from the clamping screw.

Abstract

A chuck for rotary tools with a cylindrical chucking shank (2) encloses such shank with a basic body (4). A radical through-hole (7) in basic body (4) serves to receive a clamping screw (10) which applies pressure to a clamping member (9) which is seated inside through-hole (7) between clamping screw (10) and chucking shank (2). Clamping member (9) is provided with a radial projection (16) and through-hole (7) with a cross-sectional narrowing (17) along its inner end. In between is an elastically compressible spring element (18) which, due to its return force, lifts clamping element (9) away from chucking shank (2) and pushes it back into through-hole (7) when it is not under tension from the clamping screw.

Specification

Chuck for Rotary Tools

The invention relates to a chuck for rotary tools.

In metal working, rotary tools are clamped into the machine tool by means of a chuck. Preferred are rotary tools with standardized tool shanks. Conventionally, such tool shanks have a flattened area to provide positive locking for torque transmission. Particularly for the use in drilling tools, however, tool shanks are made fully cylindrical without this flattened area since they are cheaper to produce (DIN 1835 A and 6535 A). In such tools, torque is transmitted through an interference fit. The chuck according to the invention is intended for this latter type of rotary tools with a fully cylindrical chucking shank.

In prior art chucks for rotary tools which are equipped with fully cylindrical shanks, torque is transmitted by frictional locking in that a clamping screw applies direct radial pressure to the shank. Such chucks are suitable only for transmitting low torques which frequently are inadequate for drilling work. To increase the torque to be transmitted, it is known, in chucks for tools with fully cylindrical chucking shanks, to embed the shank in a slit sleeve within the basic body of the chuck. The clamping screw which is radially screwed into the basic body applies pressure on said sleeve from the outside, that is, it acts indirectly on the chucking shank. This solution presupposes that sufficient space is available for mounting the sleeve. Moreover, a sleeve means increased building costs.

To elmininate the need for such a sleeve between the clamping screw and the shank, and nevertheless to guarantee a good transmission of torque, it is known on chucks of the prior art that a clamping member can be positioned between the clamping screw and the shank in the radial through-hole, which clamping

member is mounted so that it cannot rotate around the axis of the hole, but can be displaced in the direction in which it was screwed in. The clamping member applies pressure to the chucking shank with its end, and is pressurized on its reverse side by the clamping screw (GB-29 908; 1913). As a result of the mounting of the clamping member in the through-hole so that it can be displaced axially but cannot rotate, it is possible to provide the end surface of the clamping piece that presses against the chucking shank with a surface contour that corresponds to the chucking shank, and thus to achieve a superficial application of pressure to the chucking shank.

On a similar chuck of the prior art, likewise with a clamping piece inserted between the clamping screw and the chucking shank of the tool, the clamping member is embedded in a captive manner in a receiving space on the end of the clamping screw, so that when it is loosened or when the clamping screw is unscrewed from the chucking shank of the tool, it can be extracted and removed along with it (US 4 511 960). This arrangement facilitates the insertion and removal of the chucking shank in the chuck. The captive embedding of the clamping member on the end of the fastening screw, however, requires a deformation of the compression screw, and thus requires considerable time, effort and expense in its fabrication. The clamping member also generally rotates along with the clamping screw when it is not in contact with the chucking shank of the tool. The rotational position of the clamping member is thereby undesirably modified.

An object of the invention, on a chuck of the type described above, is therefore to guarantee in a simple manner that when the clamping screw is loosened, the clamping piece can be removed from the shucking shank without any particular additional manufacturing effort or expense, and thus the chucking shank can be inserted into the chuck and removed from it without jamming.

The present invention provides a chuck for rotary tools having a basic body surrounding the tool's cylindrical chucking shank in the form of a sleeve, wherein the enclosure wall of such basic body surrounding a receiving space for the tool's chucking shank is penetrated by a substantially radial through-hole and having a clamping screw screwed into a through-hole, which applies pressure in screw-in direction to a chucking shank inserted in the receiving space having within the through-hole, between the clamping screw and the receiving space, a clamping member is adjustably inserted whose base facing the receiving space is adapted to the shape of a clamping shaft such as to apply two-dimensional pressure, characterized by the fact that the clamping member is provided with a radial projection forming an axial stop to ensure locating in relation to a cross-sectional narrowing on the inner end of the through-hole and that between the radial projection of the clamping member and the cross-sectional narrowing of the through-hole, an elastically compressible spring element is disposed, which, due to its return force, presses the clamping member, when not under tension from the clamping screw, outward against a screw-in direction.

The radial projection of clamping member can be formed by an annular flange. The cross-sectional narrowing can be a ring-shaped collar which comprises the hole exit toward the receiving space. The collar can be concentric with a hole axis of the through-hole.

The spring element can be a ring made of an elastic rubber material lying against the annular flange of the clamping member. The spring element can be an O-ring surrounding a cross-sectionally circular sheath portion of the clamping member. The spring element can be permanently inserted in an annular groove made in the through-hole. The spring element can apply radially inward initial tension to the clamping element.

Move specifically, the present invention provides a chuck for a rotary tool, the chuck comprising a receiving portion, the receiving portion being configured to receive and surround at least a portion of a chucking shank, a radial through-hole, the radial through-hole being disposed in the receiving portion configured to surround a chucking shank, a clamping arrangement, the clamping arrangement comprising a clamping screw, the clamping screw being configured to be screwed into the radial through-hole to apply pressure to a chucking shank, a clamping member, the clamping member being disposed in the radial through-hole, the clamping member comprising a base portion, which base portion is configured to be

disposed to face a chucking shank and is configured to a shape of a chucking shank to apply two-dimensional pressure, and the clamping member comprising a radial projection, the radial through-hole comprising an inner section and an outer section, the inner section of the radial through-hole being configured to be disposed between the outer section of the radial through-hole and a chucking shank, the inner section of the radial through-hole being narrower in diameter than the outer section of the radial through-hole, the radial projection being configured to form an axial stop, an elastically-compressible resilient element, the resilient element being disposed between the radial projection of the clamping member and the inner section of the radial through-hole, the resilient element being configured to be compressed upon screwing in of the clamping member by the clamping screw, and the resilient element being configured to apply a return force to the clamping member to move the clamping member in the direction opposite the screw-in direction upon a release of pressure on the resilient element from the clamping member.

The present invention also provides a chuck for a rotary tool, said chuck comprising a receiving portion, said receiving portion being configured to receive and surround at least a portion of a chucking shank, a radial through-hole, said radial through-hole being disposed in said receiving portion configured to surround a chucking shank, a clamping arrangement, said clamping arrangement comprising a clamping screw portion, said clamping screw portion being configured to be screwed into said radial through-hole to apply pressure to a chucking shank, a clamping member, said clamping member being disposed in said radial through-hole, and said clamping member comprising a radial projection, said radial through-hole comprising an inner section and an outer section, said inner section of said radial through-hole being configured to be disposed between said outer section of said radial through-hole and a chucking shank, said inner section of said radial through-hole being narrower in diameter than said outer section of said radial through-hole, said radial projection being configured to form an axial stop, an elastically-compressible resilient element, said resilient element being disposed between said radial projection of said clamping member and said inner section of said radial through-hole, said resilient element being configured to be compressed upon screwing in of said clamping member by said clamping screw portion, and said resilient element being configured to apply a return force to said clamping member to move said clamping member in the direction opposite the screw-in direction upon a release of pressure on said resilient element from said clamping member.

This solution does not require any additional radial space that might lead to an increase in the diameter of the main casting of the chuck. This solution also ensures that when the clamping screw is loosened, the clamping member is displaced radially outward far enough that its head end is out of the receiving space for the chucking shank. This solution also compensates easily for manufacturing tolerances of the chucking shank. Finally, this solution promotes a non-jamming extraction of the tool from the main casting. This design also facilitates the appropriate positioning of the clamping member, of which there are generally a plurality when high torques must be transmitted.

In one embodiment, the spring element is particularly preferably designed as a ring made of an elastic rubber material, particularly as an O-ring. This makes it suitable for securing the rotational position of the clamping member within the through-hole. The ring shape and the elastic rubber material as well as the selected initial stress conditions produce frictional locking which, if suitably dimensional, does not interfere with the return force acting axially on the clamping member but prevents any unwanted rotation of the clamping member within the through-hole. The fact that it prevents such rotation is particularly advantageous in view of the indentation in the face end of the clamping member that applies pressure to the chucking shank. The indentation requires the clamping member to be aligned, such that its indentation fits against the chucking shank to be inserted in the receiving space. Once this alignment has been achieved, it is to be maintained as far as possible so that the indentation of the clamping member does not need to be realigned with respect to the chucking shank with each new clamping procedure. The elastic ring shape of the spring element also acts as an O-ring when the clamping screw is tightened.

The indentation at the base of the clamping member is preferably dimensioned such that the shape of a hollow cylinder segment serving as contact surface, the diameter of curvature of which is slightly smaller than the nominal diameter of the associated chucking shank. During clamping, it permits on the one hand the partial clasping of the tool's shank by the clamping member, wherein the base of clamping member which applies pressure to chucking shank is provided with an indentation to form a contact surface adapted to the shape of the surface of the chucking shank. During clamping, dimensioning in causes a slight expansion of the clasping indentation which falls within the elasticity range of the material used for the

clamping member and thus ensures the elastic spring-back of the clamping member from the chucking shank after the clamping screw is loosened. As a result, when the clamping screw is loosened, the clamping member automatically detaches itself from its full-area rest against the chucking shank. The return force acting on the clamping member through the compression of the spring element in the direction away from the tool shank is then required merely to shift the clamping member.

In one embodiment, the clamping screw is penetrated in axial direction by a torque-receiving opening, particularly a hexagon socket and the face end of the clamping member is provided with an opening, particularly a slit, for torque engagement reaching through the clamping screw, which permits the adjustment from the outside through the clamping screw of the rotational position of the clamping member in relation to the chucking shank, e.g. by means of a screw driver.

The figures further illustrate the invention by way of example:

Fig. 1 is a longitudinal section through the chuck with a clamped drill bit.

Fig. 2 is a section through the chuck along Line II-II of Fig. 1 in its loosened position with the drill bit removed.

Fig. 3 is an enlarged side view of the clamping member.

Fig. 4 is a section through the chuck analogous to Fig. 2 with the clamping member or the clamping screw next to the center axis of the through-hole shown in loosened position on the left side, identified as a), and in clamped position on the right side, identified as b).

Chuck 3 serves to clamp a drill bit 1, whose chucking shank 2 is fully cylindrical in accordance with DIN 1835 A and 6535 A. Chuck 3 surrounds chucking shank 2 with basic body 4 in the manner of a sleeve. Basic body 4 receives chucking shank 2 with its receiving space 5 which accordingly has the shape of a hollow cylinder. Enclosure wall 6 of basic body 4 surrounding receiving space 5 is penetrated by a plurality of axially offset through-holes 7. Hole axes 8 of through-holes 7 extend

radially. The inner end of each through-hole 7 facing receiving space 5 serves to receive a clamping member 9 and, on the outside, a clamping screw 10 applying radially inward pressure to clamping member 9. Clamping member 9 is provided with a base 11 which is adapted to the cylindrical shape of chucking shank 2 of drill bit 1.

From the outside, clamping screw 10 can be screwed radially inward in screwing direction 12. Clamping screw 10 is provided with a continuous hexagon socket 13 extending in the direction of the hole axis 8 to receive the torque. The fact that hexagon socket 13 extends through clamping screw 10 makes it possible at all times to reach face end 14 of clamping member 9 from the outside 15 of basic body 4.

Clamping member 9 is provided with an annular flange 16 which is a radial projection forming an axial stop with respect to ring-shaped collar 17 acting as a cross sectional narrowing along the inner end of through-hole 7. Disposed between annular flange 16 and collar 17 is a ring-shaped spring element 18 made of compressible elastic rubber material. Such spring element 18 is an O-ring which, due to its elastic return force, pushes clamping member 9 outward against screwing direction 12 as long as no force is applied to clamping member 9 by clamping screw 10. The O-ring is also effective as a seal. Spring element 18 surrounds the cross-sectionally cylindrical sheath portion of clamping member 9 with a certain initial stress that acts radially inward and generates frictional locking to secure the rotational position, once adjusted, of clamping member 9 within through-hole 7 even if clamping screw 10 is loosened. Spring element 18 is permanently inserted in an annular groove 19 made in through-hole 7. Annular groove 19 is located between collar 17 at the inner hole exit and internal thread 20 which extends from the outside 15 of through-hole 7 inward up to annular groove 19 and serves to receive hexagon socket screw 10.

At its base 11, clamping member 9 has an indention to form a contact surface 21 which is adapted to the surface of chucking shank 2. Indentation 22 has the shape of a hollow cylinder segment with a diameter of curvature 23 which is slightly smaller than the nominal diameter 24 of chucking shank 2.

The face end 14 of clamping member 9 is provided with a slit 25 for torque engagement through clamping screw 10, e.g. by means of a screw driver blade. This permits the rotational position of clamping member 9 to be adjusted in relation to clamping shank 2 to align its indentation 22.

In the initial clamping position, base 11 of clamping member 9 is lifted away from chucking shank 2 and retracted into through-hole 7 (Fig. 4 a) - left). In this initial position, retracted within through-hole 7, drill bit 1 with its chucking shank 2 is unobstructed and can be inserted into receiving space 5 of basic body 4. To align indentation 22 of contact surface 21 of base 11 in relation to chucking shank 2, such that base 11 is not misaligned with respect to chucking shank 2, the rotational position of clamping member 9 can be corrected by means of a screwdriver that is applied from the outside 15 and engages with slit 25 on face end 14 of clamping member 9. Clamping member 9 is frictionally engaged in this rotational position by spring element 18, i.e. an O-ring, which is permanently inserted in annular groove 19. Clamping screw 11 is then screwed in by a torque engaging with its hexagonal socket 13. This causes clamping member 9 to be brought into its clamped position as may be seen in Fig. 4 b) - right side - in which spring element 18 is compressed. During clamping, indentation 22 on base 11 of clamping member 9 is slightly expanded in its elastic material area with the result that indentation 22 has a slightly larger diameter of curvature 23.

To release the tension, clamping screw 10 is moved back against screwing direction 12. The expansion of indentation 22 of face end 11 of clamping member9 springs back elastically such that indentation 22 detaches itself from its surface contact along the circumference of chucking shank 2. Furthermore, spring

element 18 is decompressed from its compressed clamping position into its relaxed initial position (Fig. 4 a) - left side). This causes clamping member 9 to be pressed into through-hole 7. Its face end 11 loses all contact with chucking shank 2. It is lifted away from chucking shank 2 and pushed back from receiving space 5 so that it does not interfere with the insertion of a new drill bit 1 (Fig. 2).

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A chuck for a rotary tool, said chuck comprising:

a receiving portion;

said receiving portion being configured to receive and surround at least a portion of a chucking shank;

a radial through-hole;

said radial through-hole being disposed in said receiving portion configured to surround a chucking shank;

a clamping arrangement;

said clamping arrangement comprising:

a clamping screw;

said clamping screw being configured to be screwed into said radial through-hole to apply pressure to a chucking shank;

a clamping member;

said clamping member being disposed in said radial through-hole;

said clamping member comprising a base portion, which base portion is configured to be disposed to face a chucking shank and is configured to a shape of a chucking shank to apply two-dimensional pressure; and

said clamping member comprising a radial projection;

said radial through-hole comprising an inner section and an outer section;

said inner section of said radial through-hole being configured to be disposed between said outer section of said radial through-hole and a chucking shank;

said inner section of said radial through-hole being narrower in diameter than said outer section of said radial through-hole;

said radial projection being configured to form an axial stop;

an elastically-compressible resilient element;

said resilient element being disposed between said radial projection of said clamping member and said inner section of said radial through-hole;

said resilient element being configured to be compressed upon screwing in of said clamping member by said clamping screw; and

said resilient element being configured to apply a return force to said clamping member to move said clamping member in the direction opposite the screw-in direction upon a release of pressure on said resilient element from said clamping member.

2. The chuck according to claim 1, wherein said radial projection of said clamping member is formed by an annular flange.

3. The chuck according to claim 1 or 2, wherein:
said inner section comprises a ring-shaped collar;
said ring-shaped collar comprises an opening; and
said opening is disposed to open toward the interior of said chuck.

4. The chuck according to claim 3, wherein said ring-shaped collar is substantially concentric with respect to the axis of said radial through-hole.

5. The chuck according to any one of claims 1 to 4, wherein:
said resilient element is substantially ring-shaped;
said resilient element comprises an elastic rubber material; and
said resilient element is configured and disposed to lie against said radial projection of said clamping member.

6. The chuck according to claim 5, wherein:
said resilient element is an O-ring;
said clamping member comprises a cross-sectionally circular sheath portion; and
said O-ring is configured and disposed to surround said sheath portion of said clamping member.

7. The chuck according to any one of claims 1 to 6, wherein:
said radial through-hole comprises an annular groove; and
said resilient element is inserted in said annular groove.

8. The chuck according to claim 6 or 7, wherein said resilient element applies radially inward initial tension to said clamping member.

9. The chuck according to any one of claims 1 to 8, wherein said base portion of said clamping member which applies pressure to a chucking shank is provided with an indentation to form a contact surface adapted to the shape of the surface of a chucking shank.

10. The chuck according to claim 9, wherein the diameter of curvature of said base portion of said clamping member is slightly smaller than the nominal diameter of a corresponding chucking shank.

11. The chuck according to any one of claims 1 to 10, wherein:

said clamping screw comprises an axial opening;

said axial opening forms a hexagon socket;

said clamping member comprises an end face disposed on an end opposite said base portion; and

said end face comprises a slit-like opening.

12. A chuck for a rotary tool, said chuck comprising:

a receiving portion;

said receiving portion being configured to receive and surround at least a portion of a chucking shank;

a radial through-hole;

said radial through-hole being disposed in said receiving portion configured to surround a chucking shank;

a clamping arrangement;

said clamping arrangement comprising:

a clamping screw portion;

said clamping screw portion being configured to be screwed into said radial through-hole to apply pressure to a chucking shank;

a clamping member;

said clamping member being disposed in said radial through-hole; and

said clamping member comprising a radial projection;

said radial through-hole comprising an inner section and an outer section;

said inner section of said radial through-hole being configured to be disposed between said outer section of said radial through-hole and a chucking shank;

said inner section of said radial through-hole being narrower in diameter than said outer section of said radial through-hole;

said radial projection being configured to form an axial stop;

an elastically-compressible resilient element;

said resilient element being disposed between said radial projection of said clamping member and said inner section of said radial through-hole;

said resilient element being configured to be compressed upon screwing in of said clamping member by said clamping screw portion; and

said resilient element being configured to apply a return force to said clamping member to move said clamping member in the direction opposite the screw-in direction upon a release of pressure on said resilient element from said clamping member.

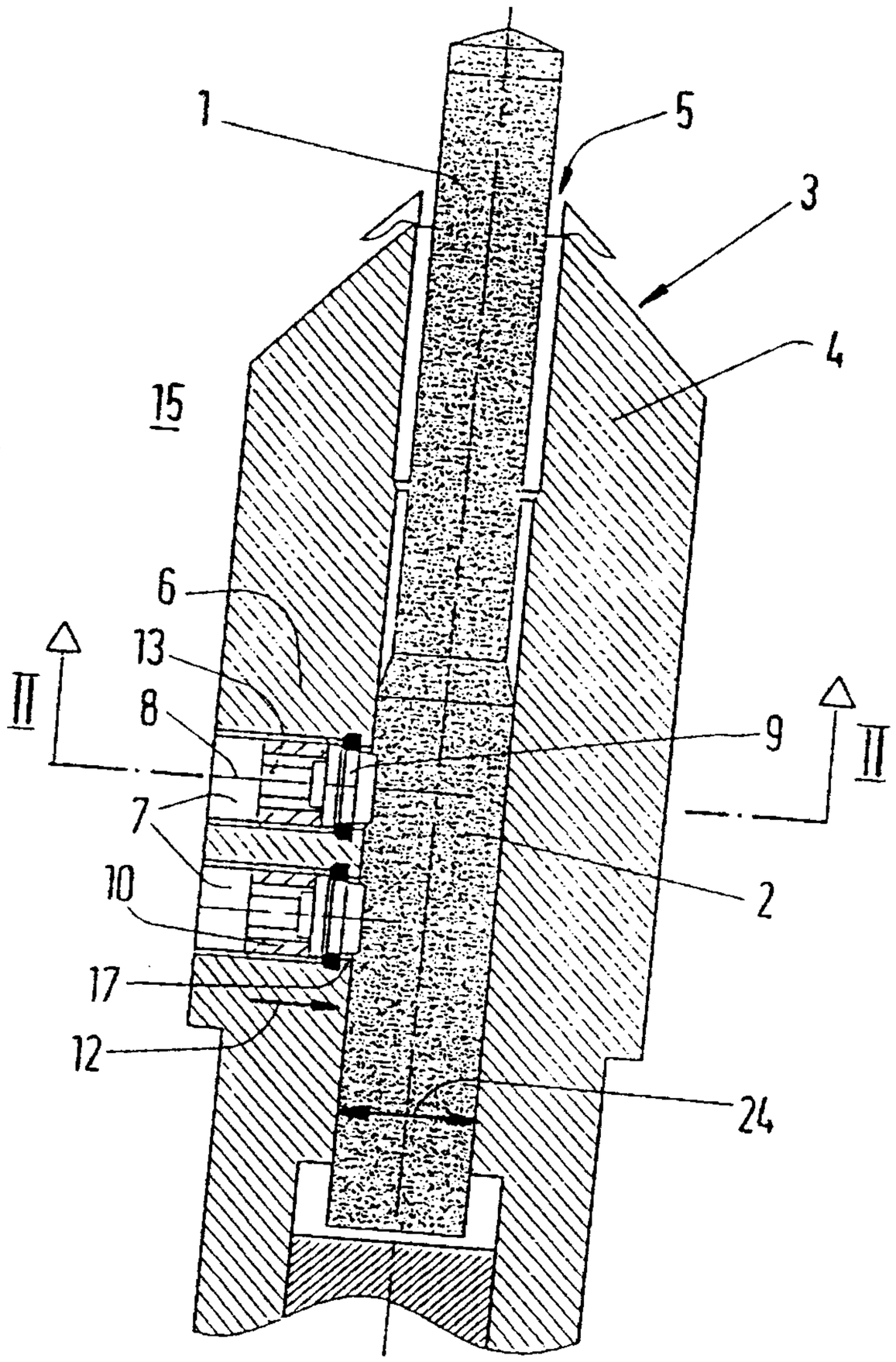


FIG.1

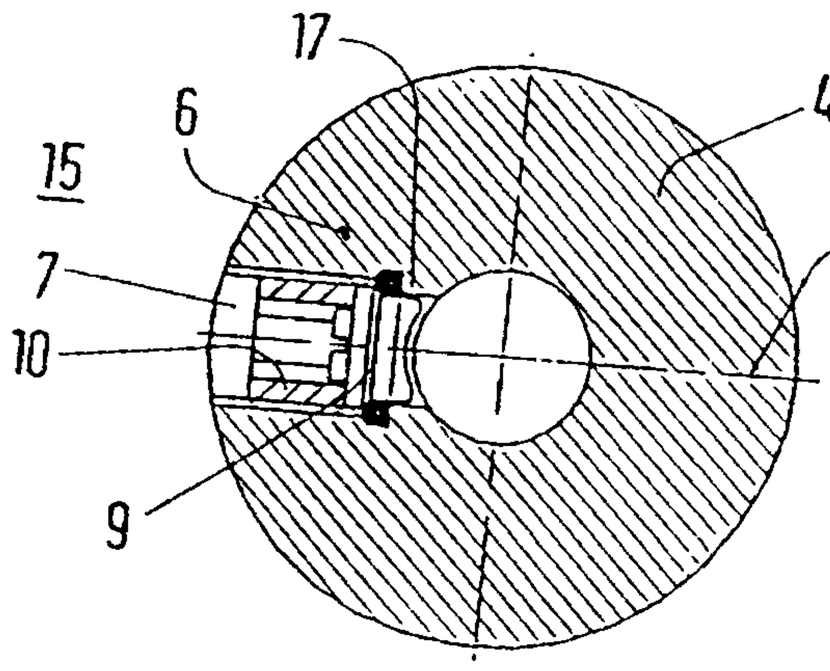


FIG.2

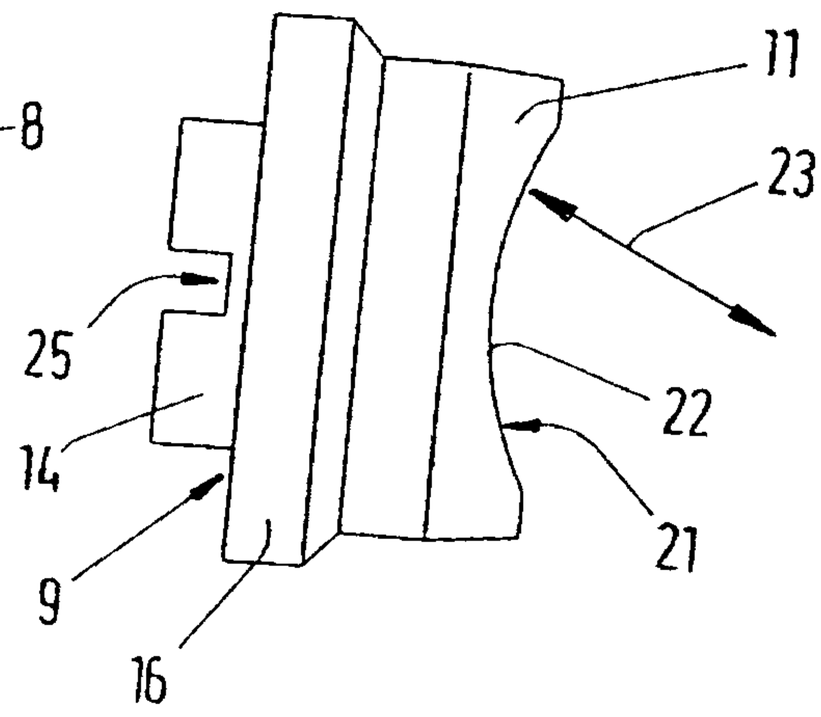


FIG.3

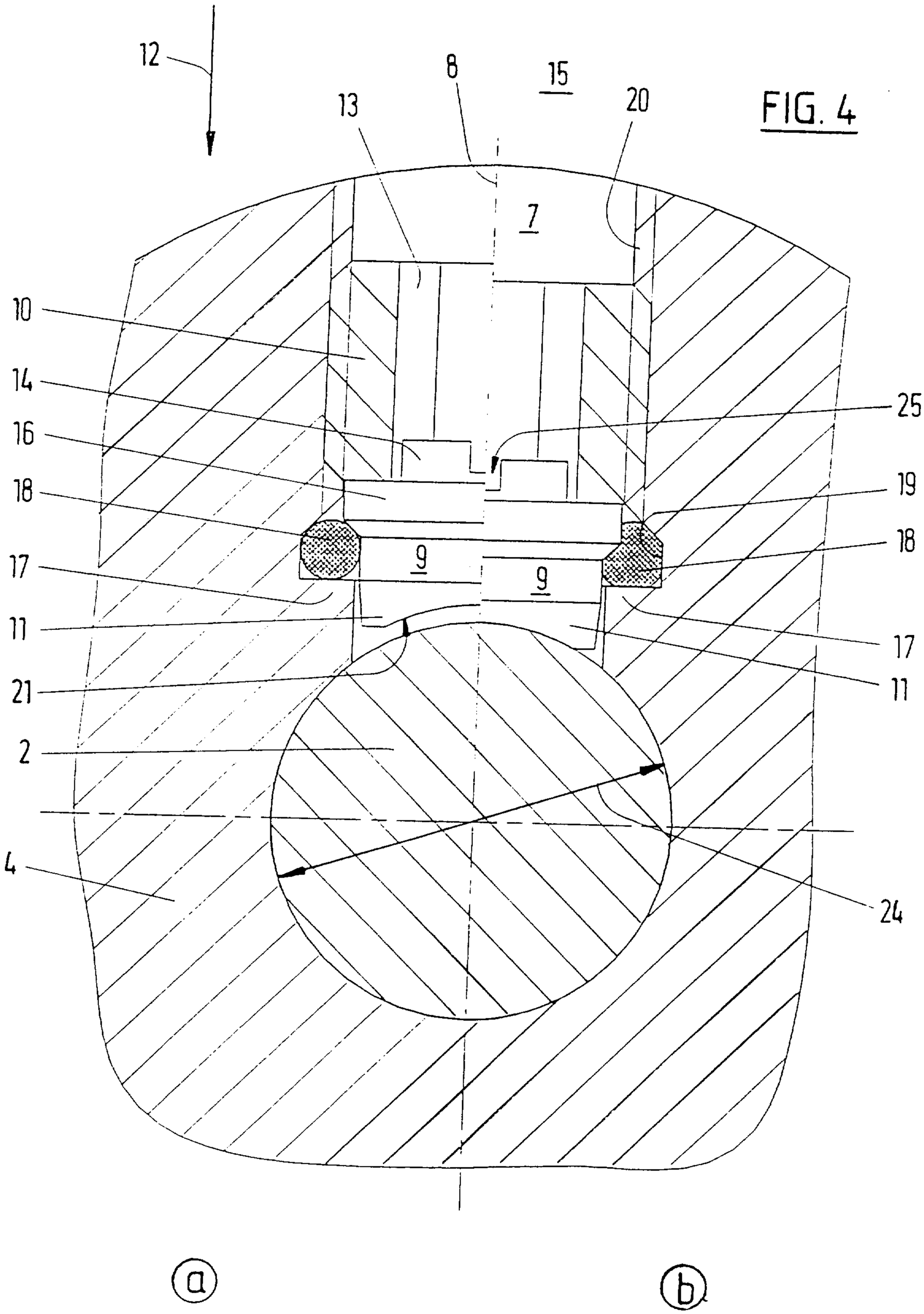
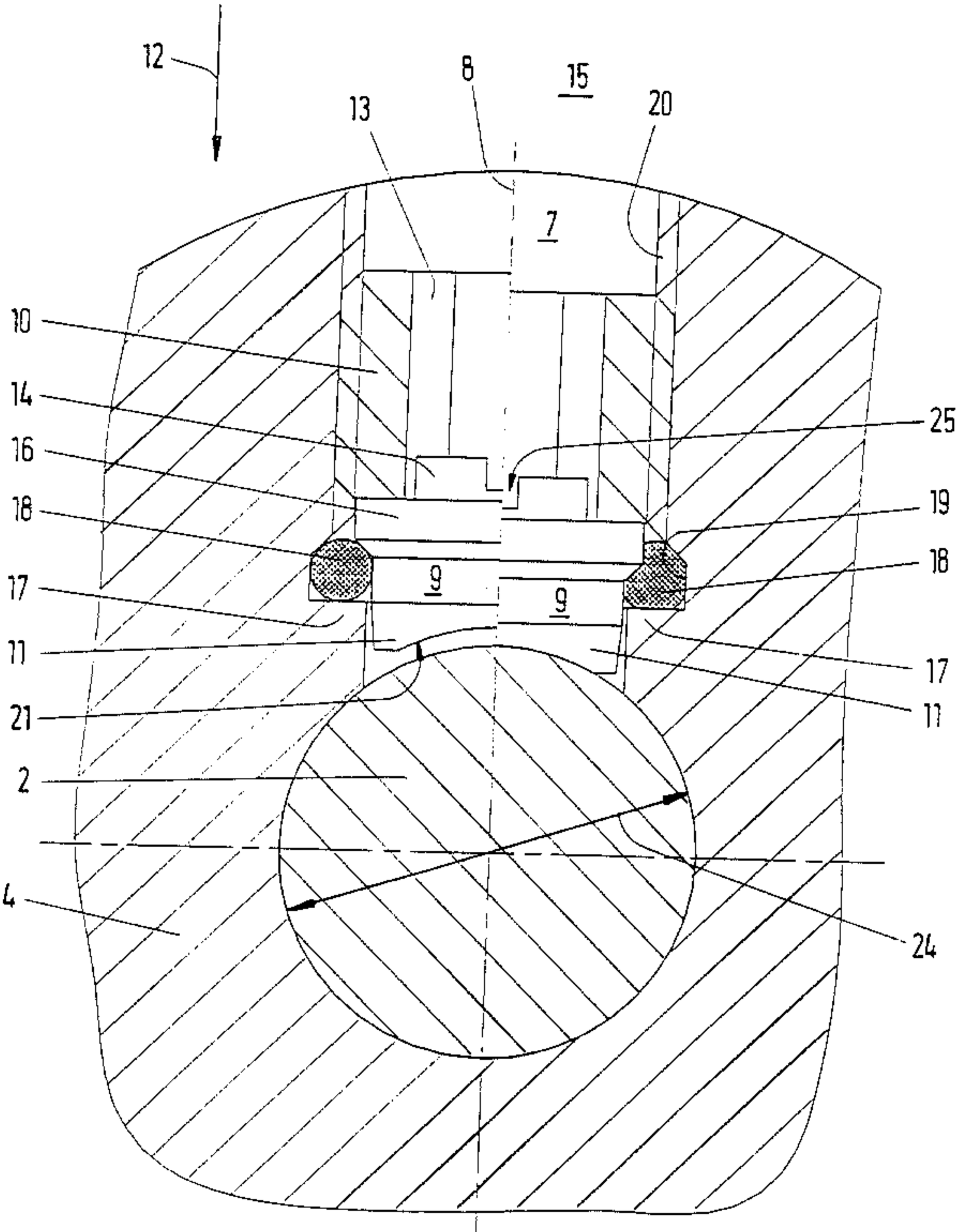


FIG. 4



a

b