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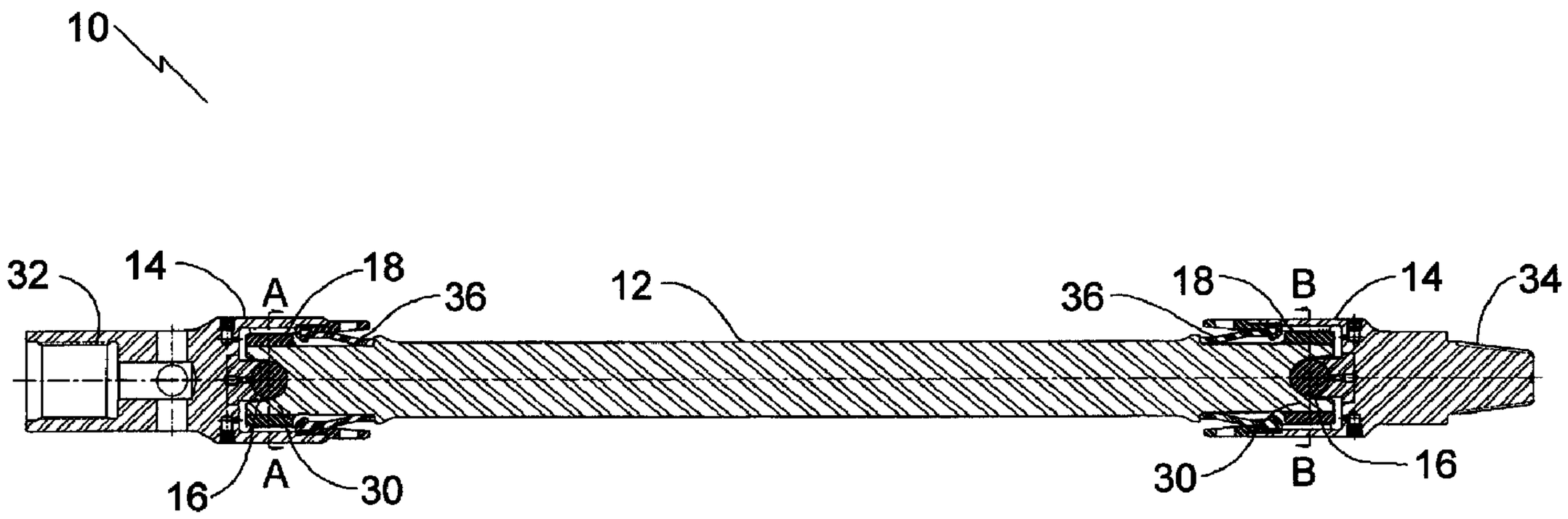
(71) Demandeurs/Applicants:
JOHNSON, ORREN S., CA;
WHYTE, ALEXANDER, CA

(72) Inventeurs/Inventors:
JOHNSON, ORREN S., CA;
WHYTE, ALEXANDER, CA

(74) Agent: THOMPSON, DOUGLAS B.

(54) Titre : ARBRE D'ENTRAINEMENT POUR MOTEUR
(54) Title: DRIVE SHAFT FOR MOTOR



(57) Abrégé/Abstract:
An improved drive shaft for a motor having a central shaft, end housings, a ball and socket engagement to facilitate omni-directional movement between the central shaft and the end housings and drive keys to transmit torque between the central shaft and end housings with each end housing having planar drive key contact faces. The improvement lies in the drive keys, each of the drive keys having a shaft contact surface formed as a radius from a centre point and a planar housing contact surface longer than the drive key contact face of the end housing that the housing contact surface engages.

ABSTRACT OF THE DISCLOSURE

An improved drive shaft for a motor having a central shaft, end housings, a ball and socket engagement to facilitate omni-directional movement between the central shaft and the end housings and drive keys to transmit torque between the central shaft and end housings with each end housing having planar drive key contact faces. The improvement lies in the drive keys, each of the drive keys having a shaft contact surface formed as a radius from a centre point and a planar housing contact surface longer than the drive key contact face of the end housing that the housing contact surface engages.

TITLE OF THE INVENTION:

Drive shaft for motor

FIELD OF THE INVENTION

The present invention relates to a drive shaft for a motor and, in particular, a downhole drilling motor.

BACKGROUND OF THE INVENTION

A known configuration of drive shaft used with down hole drilling motors has a ball and socket arrangement to allow omni-directional pivotal movement between a central shaft and end housings and drive keys to transmit torque between the central shaft and end housings. Problems of wear are being experienced where the drive keys engage the end housings.

SUMMARY OF THE INVENTION

According to the present invention there is provided an improved drive shaft for a motor having a central shaft, end housings, a ball and socket engagement to facilitate omni-directional movement between the central shaft and the end housings and drive keys to transmit torque between the central shaft and end housings with each end housing having planar drive key contact faces, The improvement lies in the drive keys, each of the drive keys having a shaft contact surface formed as a radius from a centre point and a planar housing contact surface longer than the drive key contact face of the end housing that the housing contact surface engages.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to in any way limit the scope of the invention to the particular embodiment or embodiments shown, wherein:

FIG. 1 is a side elevation view, in section, of a drive shaft constructed in accordance with the teachings of the present invention.

FIG. 2 is a transverse section view taken along section lines A-A and B-B of the drive

shaft illustrated in **FIG. 1.**

FIG. 3 is a detailed side elevation view, in section, of the drive shaft illustrated in **FIG. 1.**

FIG. 4 is a detailed side elevation view, in section, of an end housing from the drive shaft illustrated in **FIG. 1.**

FIG. 3 is a detailed side elevation view, in section, of an end housing from the drive shaft illustrated in **FIG. 1.**

FIG. 4 is a detailed side elevation view, in section, of an end portion of a central shaft from the drive shaft illustrated in **FIG. 1.**

FIG. 5A is a side elevation view of a drive key from the drive shaft illustrated in **FIG. 1.**

FIG. 5B is a top plan view of the drive key illustrated in **FIG. 5A.**

FIG. 5C is an end elevation view of the drive key illustrated in **FIG. 5A.**

FIG. 6 is a detailed side elevation view, in section, of an end portion of a central shaft from the drive shaft illustrated in **FIG. 1.**

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment, a drive shaft generally identified by reference numeral 10, will now be described with reference to **FIG. 1** through **6**.

Structure and Relationship of Parts:

Referring to **FIG. 1,** there is shown drive shaft 10 intended for use with a downhole motor (not shown) but is not exclusively restricted to use with a downhole motor. Drive shaft 10 has a central shaft 12, end housings 14, a ball and socket engagement 16 and drive keys 18 to transmit torque between central shaft 12 and end housings 14. Ball and socket engagement 16 facilitates omni-directional movement between central shaft 12 and end housings 14. Referring to **FIG. 2,** each end housing 14 has planar drive key contact faces 20. Referring to **FIG. 5A – 5C,** each drive key 18 has a shaft contact surface 22 formed as a radius R from a centre point 26, and a planar housing contact surface 28 with a length K. Referring to **FIG. 3,** length K of housing contact surface 28 is longer than the length J of drive key contact face 20 of end housing 14 that housing contact surface 28 engages. This is important for maximizing the total contact area, thus improving the wear life and capacity of drive shaft 10. It is also

important for economic reasons, as it is preferable for drive keys 18 to wear out quicker than end housing 14 since they are less expensive to replace. Referring to **FIG. 5A-5C,** centre point 26 for the radius R of shaft contact surface 22 is positioned past housing contact surface 28 (or in other words, centre point 26 is not coincident to housing contact surface 28), such that the radius R is greater than the depth Y of drive key 18. In addition, the length A of housing contact surface 28 is approximately 2 times the depth Y of drive key 18 between shaft contact surface 22 and housing contact surface 28. This improves the longevity of housing contact surface 28 while keeping the length Y of drive key 18 to a minimum. Referring to **FIG. 3** and **6,** shaft contact surface 22 contacts a web 30 on central shaft 12. Referring to **FIG. 2,** the depth X of web 30 is greater than two thirds the depth Y of drive key 18, which allows for improved torsional capacity of drive shaft 10 and minimizes the likelihood of a crack occurring near the minimum depth X of web 30. It will be noted that keeping the depth Y to a minimum is important to maximize the minimum depth X of web 30 and thus improve the torsional capacity of drive shaft 10.

Operation:

Drive shaft 10 is provided as described above. Referring to **FIG. 1**, drive shaft 10 has connections 32 and 34 to be connected into a downhole drill string. As required, ball and socket engagement 16 allows omni-directional movement between central shaft 12 and end housings 14. For example, this may be required to smooth out the eccentric movement induced by a power section (not shown) in order to drive a bit section (not shown). An elastomeric seal 36 prevents mud from entering end housings 14. Referring to **FIG. 5A,** shaft contact surface 22 is curved and thus permits a rocking movement between shaft contact surface 22 and web 30, as can be seen in **FIG. 2** and **6**, while planar housing contact surface 28 rests against drive key contact surface 20, as can be seen in **FIG. 2** and **4**. The particular design and dimensions of drive key 18 with respect to central shaft 12 and end housing 14 allows for advantageous results during use, such as improved torsional capacity of shaft 10, economic benefits, and minimizing the likelihood of a crack occurring, as described previously.

In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not

excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as hereinafter defined in the Claims.

What is Claimed is:

1. A drive shaft for a motor having a central shaft, end housings, a ball and socket engagement to facilitate omni-directional movement between the central shaft and the end housings and drive keys to transmit torque between the central shaft and end housings, each end housing having planar drive key contact faces, the improvement comprising:

each of the drive keys having

a shaft contact surface formed as a radius from a centre point;

a planar housing contact surface longer than the drive key contact face of the end housing that the housing contact surface engages.

2. The drive shaft as defined in Claim 1, wherein the centre point for the radius of the shaft contact surface is positioned past the housing contact surface, such that the radius is greater than a depth of the drive key.

3. The drive shaft as defined in Claim 2, wherein the length of the housing contact surface exceeds 2 times the depth of the drive key between the shaft contact surface and the housing contact surface.

4. The drive shaft as defined in Claim 2, wherein the shaft contact surface contacts a web on the central shaft, the depth of the web being greater than two thirds the depth of the drive key.

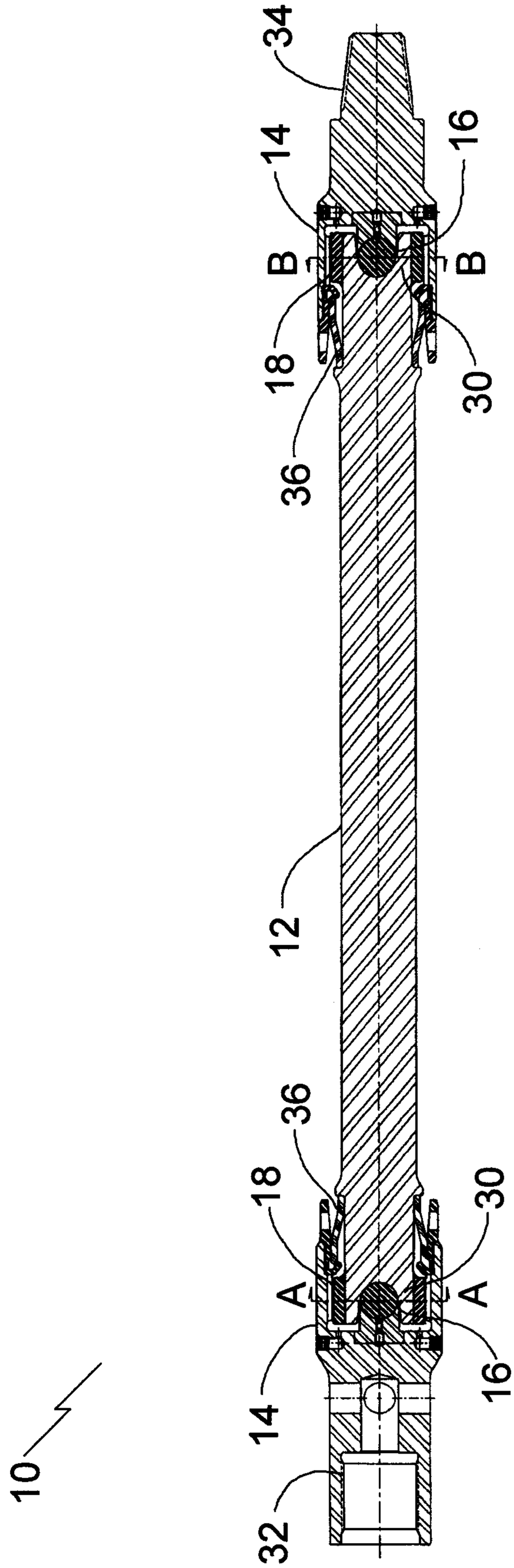
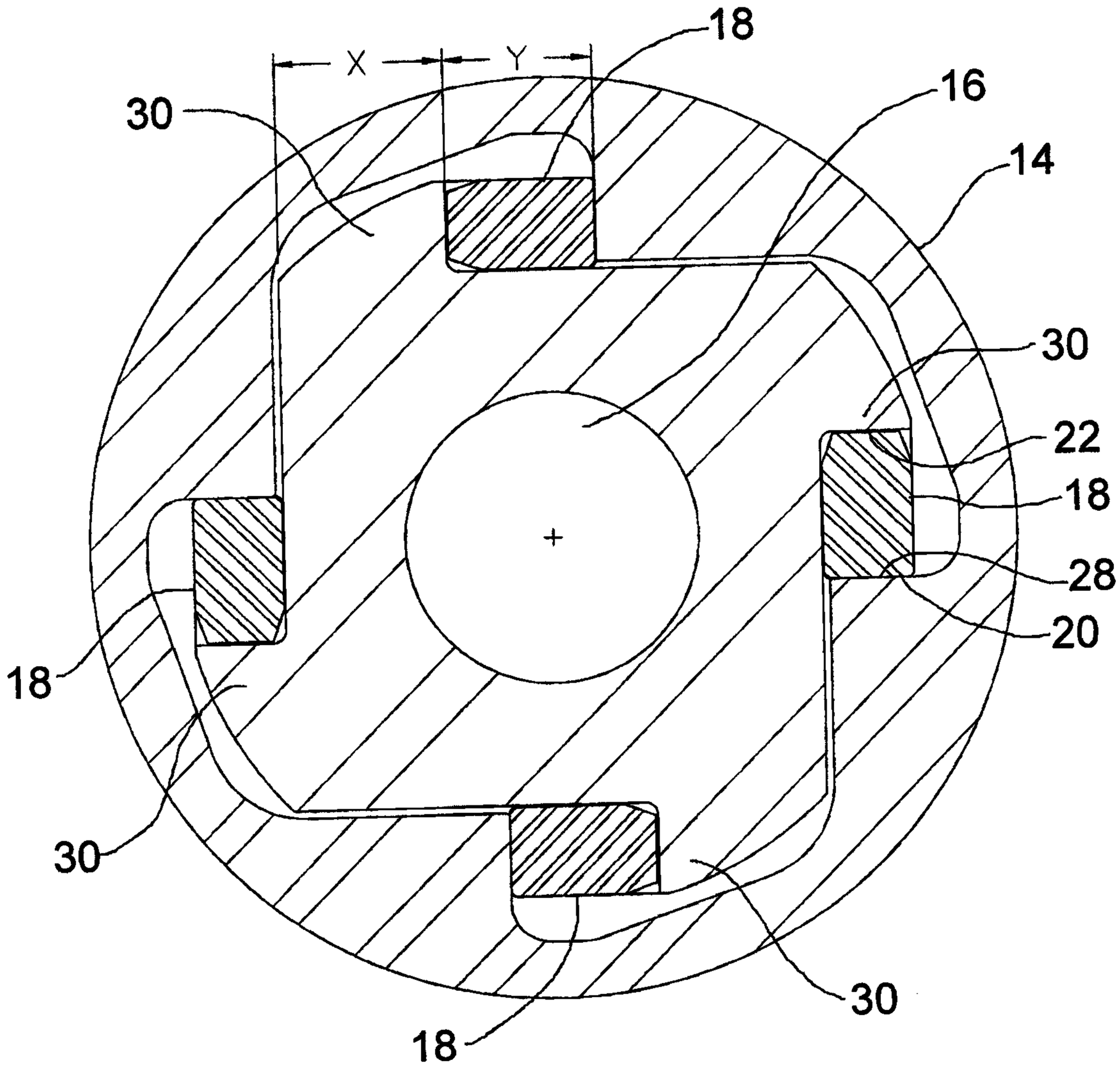


FIG. 1



SECTIONS A-A & B-B

FIG. 2

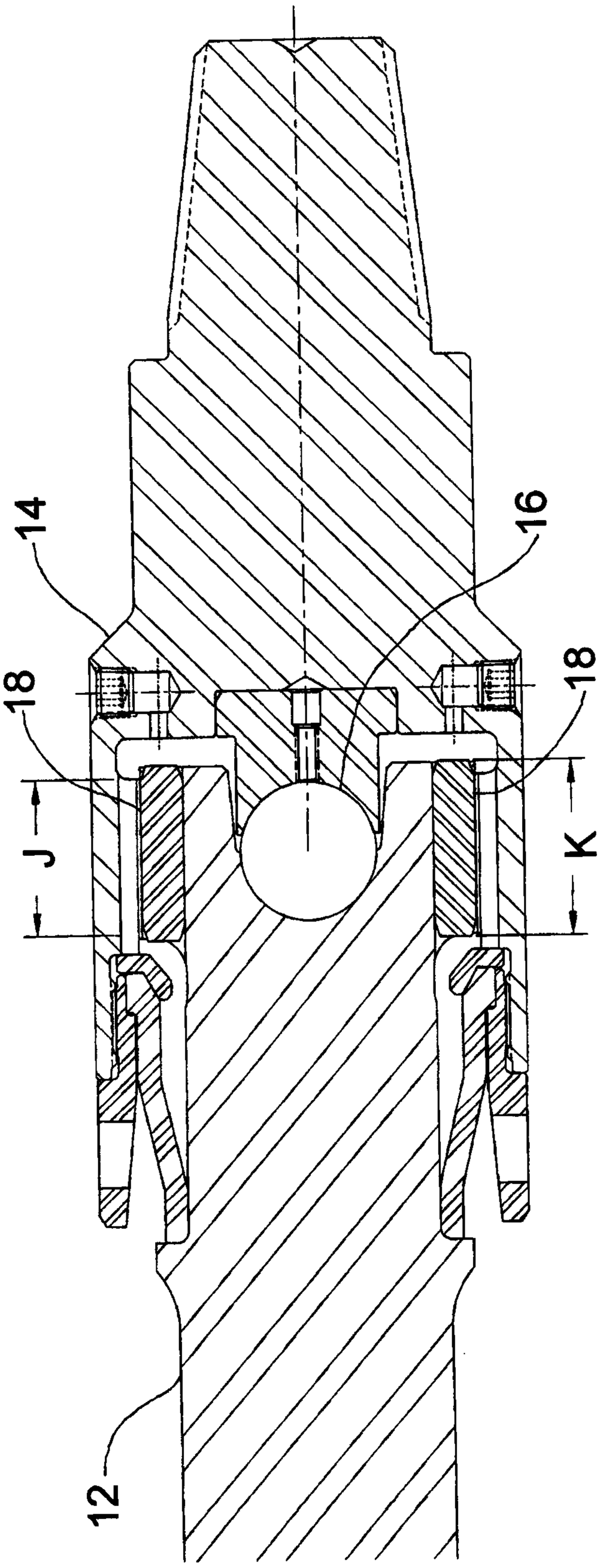


FIG. 3

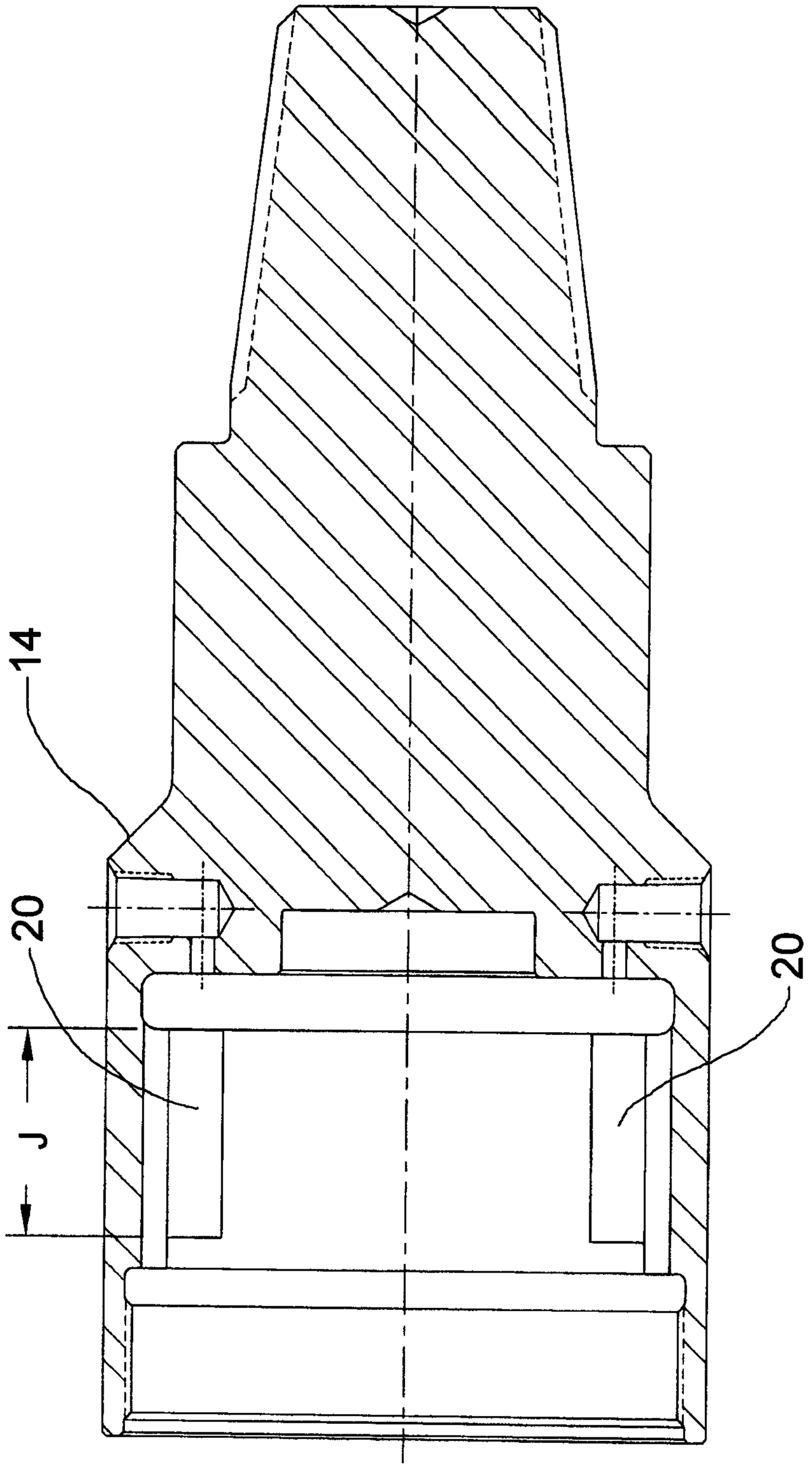


FIG. 4

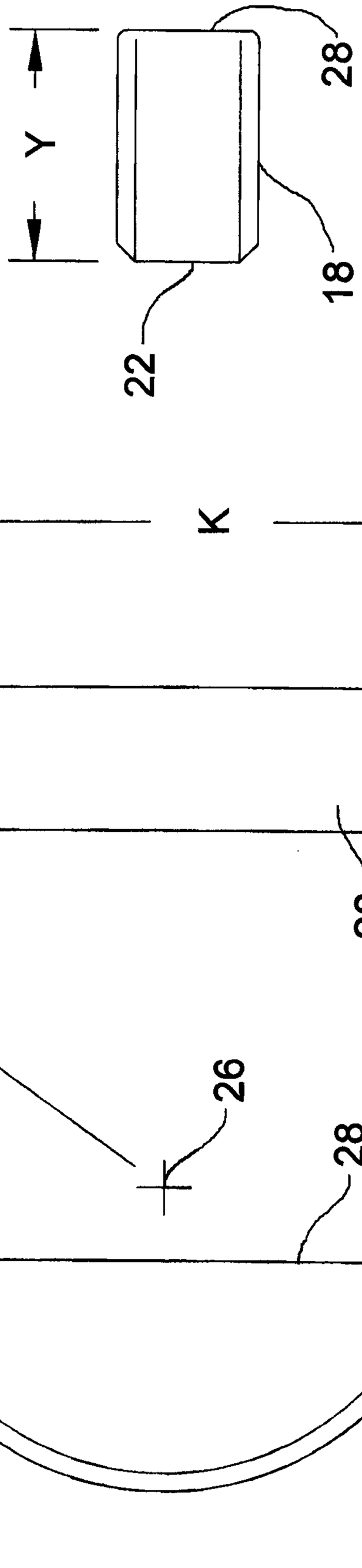


FIG. 5C

FIG. 5B

FIG. 5A

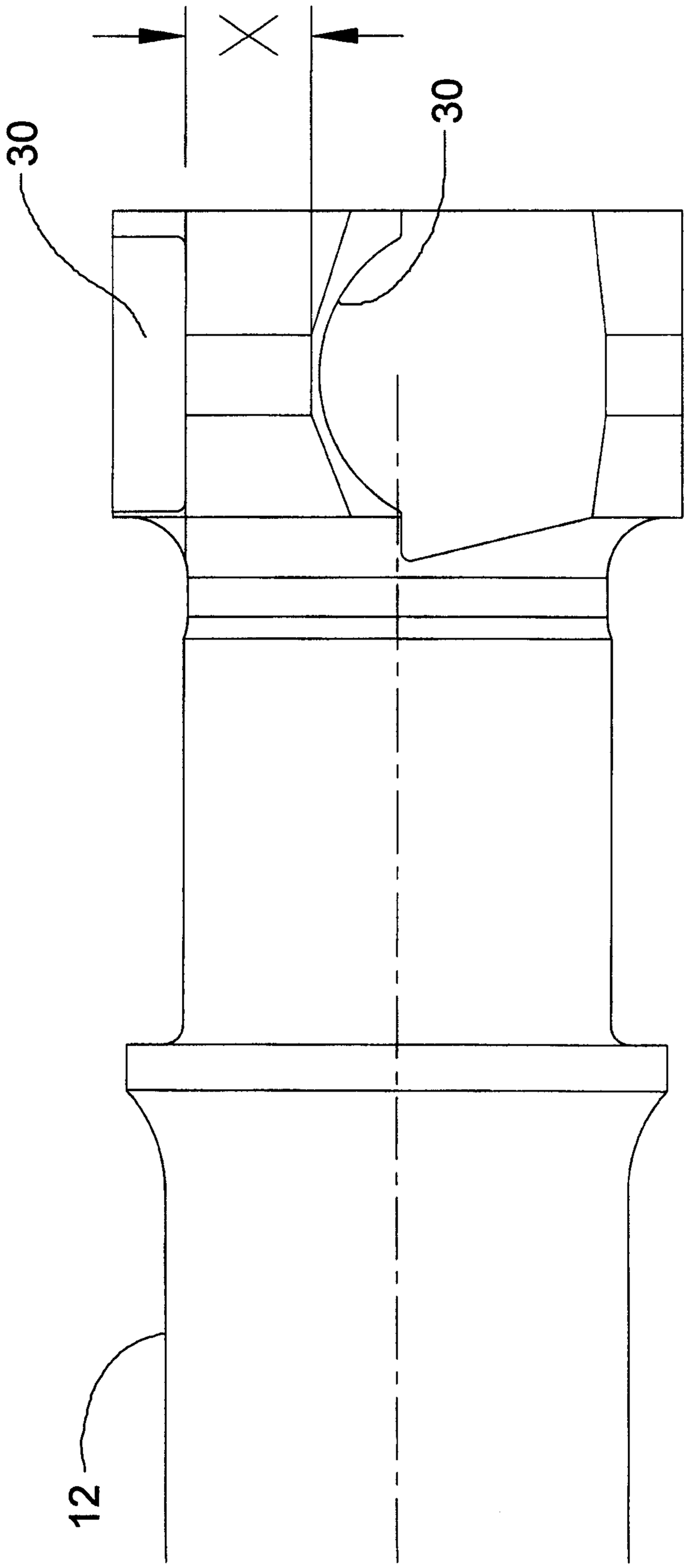
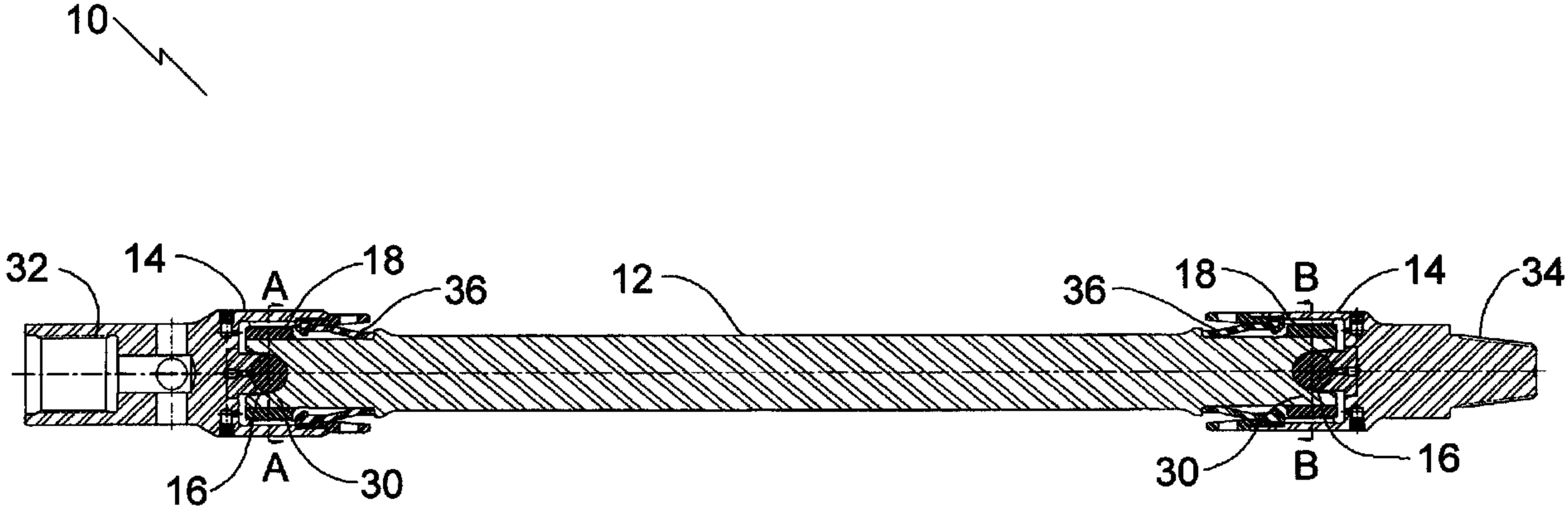


FIG. 6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