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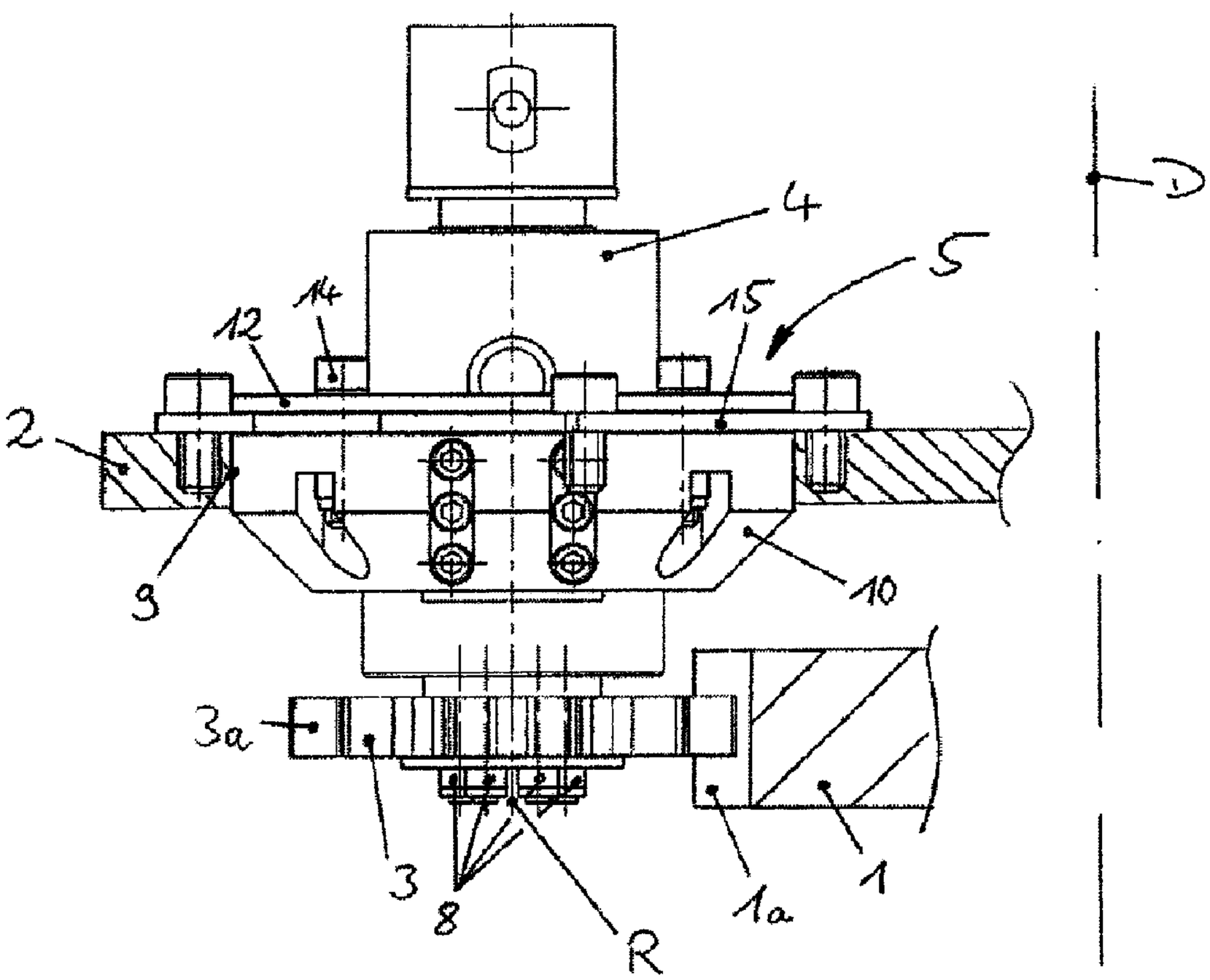
(54) Titre : RESEAU DE TRANSDUCTEURS DE POSITION ROTATIFS CONCU POUR COMPENSER LE JEU RADIAL
(54) Title: ROTARY POSITION TRANSDUCER ARRAY WHICH COMPENSATES FOR RADIAL PLAY



(57) Abrégé/Abstract:
Rotary position transducer array for a rotary connection on a work machine, in particular for a crane rotary connection, between two rotary elements (1, 2) comprising an elastic roll-off element (3) which, coupled to the rotary position transducer (4), rolls off on the first rotary element (1) via its circumferential area (3a), wherein the rotary position transducer (4) detects the rotational movement about the rotational axis (R) of the roll-off element (3), and the roll-off element (3) is held, such that it can be translationally and/or rotationally adjusted, by the second rotary element (2) by means of a bearing (5), so as to vary the distance between the roll-off element (3) and the first rotary element (1).

Abstract

Rotary position transducer array for a rotary connection on a work machine, in particular for a crane rotary connection, between two rotary elements (1, 2) comprising an elastic roll-off element (3) which, coupled to the rotary position transducer (4), rolls off on the first rotary element (1) via its circumferential area (3a), wherein the rotary position transducer (4) detects the rotational movement about the rotational axis (R) of the roll-off element (3), and the roll-off element (3) is held, such that it can be translationally and/or rotationally adjusted, by the second rotary element (2) by means of a bearing (5), so as to vary the distance between the roll-off element (3) and the first rotary element (1).

Rotary position transducer array which compensates for radial play

Technical Field

The invention relates to a rotary position transducer array compensating for radial play for the crane rotary connection, especially for a rotary connection on work machines, in particular for a ball rotary connection or roller rotary connection between upper structure and undercarriage of a mobile crane.

Background of the Invention

In a mobile crane, the rotary table of an upper structure is usually rotatably connected to the undercarriage via a ball rotary connection or roller rotary connection. If the rotary connection is not exactly centered on the rotary table, a certain radial tolerance between rotary connection and rotary table can occur upon first assembly of the rotary connection to the rotary table. If a rotary position transducer is disposed on the rotary table of the upper structure, then, an undesired radial tolerance on engagement of the rotary position transducer with the circumferential ring gear of the rotary connection also occurs. In the prior art, therefore, one disposes the rotary position transducer at an end of a bendable arm, which is fixed to the rotary table of the upper structure with its other end and holds the rotary position transducer to the ring gear under preload. By the elastic deformation of the bendable arm, the radial tolerance is compensated for. Since the rotary connections have very large diameters, due to manufacturing tolerances, tolerances in the concentricity of the ring gearoften also occur, which are also compensated for by the bendable arm.

However, upon rotating the upper structure, the bendable arm protruding beyond the rotary table can easily be damaged together with the rotary position transducer, for example by lifting means placed on the undercarriage such as belts or chains, which get caught on the arm and bend it.

Summary of the Invention

Thus, the present invention is based on the object to provide a rotary position transducer array, which compensates for the occurring radial play on the rotary connection and avoids damages to the rotary position transducer at the same time.

In accordance with one aspect of the present invention, there is provided a rotary position transducer array for a rotary connection on a work machine between two rotary elements comprising an elastic roll-off element which, coupled to a rotary position transducer, rolls off on a first rotary element via its circumferential area, wherein the rotary position transducer detects the rotational movement about the rotational axis of the roll-off element, and the roll-off element is held, such that it can be translationally and/or rotationally adjusted, by a second rotary element by means of a bearing, so as to vary the distance between the roll-off element and the first rotary element.

The rotary position transducer array according to the invention is provided for a crane rotary connection, which allows rotation between two rotary elements, for example an upper structure and an undercarriage of a mobile crane. However, it would of course be possible to apply the basic idea according to the invention to other rotary connections, in particular also to rotary connections on any mobile work machines.

The rotary position transducer array according to the invention includes an elastic roll-off element, which, coupled to the rotary position transducer, rolls off on the first rotary element via its circumferential area, wherein the rotary position transducer detects the rotational movement about the rotational axis of the roll-off element and the roll-off element is held translationally and/or rotationally adjustable by the second rotary element by means of a bearing in order to thus vary the distance of the roll-off element to the first rotary element.

In other words, the rotary position transducer array includes a roll-off element deformable in the elastic range, which can for example have a smooth circumferential

roll-off surface like a friction wheel. In order to avoid slip between roll-off element and rotary element, however, it can also have a toothing or the like. This roll-off element rolls off on a corresponding area of a first rotary element via its circumferential area and is therein retained or supported by a second rotary element, which is rotationally movable relatively to the first rotary element. Therein, the rotational axis of the roll-off element is stationary with respect to the second rotary element and the rotational movement of the roll-off element is transferred to a rotary position transducer such that the roll-off path of the roll-off element can be determined.

According to the present invention, the roll-off element is not directly supported by the first rotary element, rather, a bearing is provided for this, which is interposed between roll-off element and rotary element and thus couples the roll-off element and second

rotary element to each other. This bearing allows rotation and/or translation of the roll-off element relatively to the first rotary element. In this manner, the distance of roll-off element and first rotary element can be varied.

However, preferably, the roll-off element is held by means of a bearing disposed substantially within the first rotary element and thus is kept protected from damages.

Further preferably, the bearing holds the roll-off element such that it can be rotated about a second rotational axis different from the rotational axis of the roll-off element. Since the second rotational axis is not different from the first rotational axis caused by the roll-off movement of the roll-off element, a distance variation between roll-off element and first rotary element, on which the roll-off element rolls off, arises upon rotation of the roll-off element about the second rotational axis.

By this distance variation, according to the present invention, the elastic roll-off element is preloaded with respect to the first rotary element or the ring gear. Subsequently, only possible manufacturing/assembly tolerances of the rotary connection or of the ring gear of the rotary connection have to be compensated for. According to the present invention, this is effected by the elastic roll-off element, which compensates for concentricity tolerances to a certain extent, while the rotational axis of the roll-off element does not vary its position and orientation relative to the rotary table/second rotary element. Thus, one can say that the present invention provides a dual radial tolerance compensation, wherein course adjustment is effected by rotating the roll-off element in the bearing about the second rotational axis and the tolerances induced by the manufacture of the rotary connection or of the ring gear of the rotary connection are compensated for by the elastic configuration of the roll-off element.

According to a preferred embodiment of the present invention, the roll-off element is a pinion engaging with and rolling off on the circumferential toothing of a rotary connection ring gear on the first rotary element. The advantage of a corresponding

toothing of pinion and ring gear is in that slip between roll-off element and the first rotary element with the ring gear and measuring inaccuracies associated therewith will not have to be feared.

According to a further preferred embodiment of the present invention, the second rotational axis runs parallel to the rotational axis of the roll-off element, about which the rotation caused by rolling off is effected. Accordingly, the movement that the roll-off element performs by rotating about the second rotational axis is oriented perpendicularly to the first rotational axis and, if the circumferential area of the roll-off element is oriented parallel to the first rotational axis, also perpendicularly to this circumferential area. Furthermore, it is possible that the second rotational axis is oriented parallel to the rotational axis between first and second rotary element such that the movement that the roll-off element performs upon rotation about the second rotational axis is oriented perpendicularly to the rotational axis between the rotary elements and, if the corresponding roll-off area or toothing on the second rotary element/undercarriage runs parallel to the rotational axis between the rotary elements, also perpendicularly to this roll-off area or ring gear toothing of the undercarriage. If all of the three rotational axes run parallel, thus, the roll-off element is inserted or extended perpendicularly to the rotational axes into the outer toothing of the ring gear upon rotation about the second rotational axis, such that in this manner a possible radial play can be compensated for in simple manner. According to the present invention, this will be effected after assembly of the rotary connection to the rotary table, wherein the desired position of the rotary position transducer is subsequently fixed such that the rotary position transducer is positionally properly adjusted to the rotary connection from this point in time. Therefore, in the present invention, for compensating for large tolerances, the rotary position transducer does no longer have to be attached to a bendable arm prone to failure.

For compensating for further small tolerances, according to a further preferred embodiment, the elastic roll-off element can include an elastic material. For instance, it can be an elastic plastic, in particular rubber. Herein, the roll-off element can be

totally manufactured from elastic material such that a kind of rubber gear results. On the other hand, it would also be possible to form the roll-off and circumferential area or the roll-off toothing on an inelastic element, which circumferentially surrounds an elastic element. In this manner, the roll-off area or toothing of the roll-off element can be formed hard, pressure and wear resistant without losing the elastic properties of the roll-off element as a whole. This is in particular advantageous if the risk of icing on tooth profile surfaces are to be feared. Therein, the inelastic element can be configured as a ring, in which a toothing is machined and which surrounds a rubber element as an insert. The interior elastic element then couples the inelastic ring portion to a drive element of the rotary position transducer in order to pass the rotation of the roll-off element to the rotary position transducer.

Preferably, the bearing includes a receptacle for a cam, wherein the bearing itself can be formed on or in the second rotary element. The received cam then supports the roll-off element such that the rotational axis of the roll-off element in the cam is different from the rotational axis of the cam in the receptacle of the rotary element.

In particular, the receptacle can be a through-bore in the second rotary element or in the rotary table of a mobile crane. In this form of configuration, the bearing and thus also the roll-off element are seated more or less in the solidly constructed rotary table and are advantageously no longer attached to a bendable armoutside of the rotary table prone to damage.

According to a further preferred embodiment of the present invention, the cam supports the roll-off element coupled to the rotary position transducer together with the rotary position transducer itself such that the cam circumferentially encompasses and retains the rotary position transducer.

However, in principle, it would also be conceivable that the rotary position transducer is disposed at another location than on or in the bearing and gets transferred the

rotary movement of the roll-off element via a drive element, for example via a rigid or flexible shaft.

In order to fix the desired position of the roll-off element and optionally of the rotary position transducer relative to the first rotary element or ring gear of the undercarriage after assembly and subsequent positioning of the rotary position transducer array, the rotary position transducer array according to the invention can have a fixing means, by which the adjustable retainer of the roll-off element and optionally of the rotary position transducer can be locked such that further rotation of the roll-off element and optionally of the rotary position transducer about the second rotational axis is not possible. Hereby, the roll-off element can also be preloaded against the ring gear with a certain force in play compensating manner, which is allowed by employment of an elastic roll-off element.

It is also conceivable that the fixing means includes a clamping ring, which is screwed to the cam and thereby clamps a base disposed between clamping ring and cam, having longitudinal holes for the screw connection and fixed to the second rotary element. As soon as the desired position of the roll-off element relative to the first rotary element has been adjusted, the screw connection of clamping ring to cam is tightened and herein clamps a base between clamping ring and cam, wherein the base itself can be fixedly connected, for example screwed, to the rotary table. By the screw connection between clamping ring and cam being guided in longitudinal holes of the base, a simple adjustment of the rotary position transducer array is possible.

Brief Description of the Drawings

The present invention is explained in more detail by way of an embodiment from figures 1 to 4. Herein, the invention can include shown features individually as well as in any reasonable combination.

Fig. 1 shows a side view of the rotary position transducer array according to the invention in the installed state

Fig. 2 shows the embodiment of figure 1 in a perspective view

Fig. 3 shows the embodiment of figure 1 in a plan view

Fig. 4 shows the embodiment of figure 1 in the section apparent from figure 3

Detailed Description of the Preferred Embodiments

In figure 1, a rotary table 2 of an upper structure and a ring gear 1 of an undercarriage are shown, wherein the rotary table 2 is rotationally movable relatively to the ring gear 1 about the rotational axis D. If such a rotation occurs, the rotary position transducer array fixedly screwed to the rotary table 2 is moved in its bearing 5 about the rotational axis D, wherein the roll-off element 3 rolls off on a corresponding circumferential area 1a of the ring gear 1 with its circumferential area 3a. Herein, the circumferential areas 1a and 3a are corresponding spur gear toothings.

The roll-off element 3 rotates about the rotational axis R and is screwed to the rotary position transducer 4 such that only a rotational movement about the axis R is possible. Therein, the housing of the rotary position transducer 4 is fixedly retained by the cam 10. Further, it is seen that the rotary table 2 also has a through-bore 9, in which the cam 10 is inserted. By means of the screw connection 14, the base 15 is clamped by the clamping ring 12 and the cam 10 such that the cam together with the clamping ring 12 cannot be rotated relatively to the base 10. Since the base 15 is screwed to the rotary table 2, the cam is also fixedly retained in the rotary table 2.

Figure 2 shows a perspective view of the rotary position transducer array with the cam 10, the base 15, the roll-off element 3 rotationally movable about the rotational axis R with the circumferential toothing 3A. Further, the screw connection 8 of the elastic roll-off element 3 is seen, wherein an inelastic disk not further denoted allows the screw connection of the elastic roll-off element 3 to the input shaft of the rotary position transducer.

In figure 3, a plan view of the rotary position transducer array according to the invention, the eccentricity e between the first rotational axis, about which the roll-off element 3 rotates upon rolling-off via its toothing 3A, and the second rotational axis E, about which the cam 10 can be rotated in the bore 9, if it is not fixedly clamped rotationally secure with the clamping ring 12 and the screw connection 14 on the base 15, is shown. Further, the longitudinal holes 13 can be seen, which allow rotation of the cam together with the clamping ring 12 and the screw connection 14, if the screw connection 14 has been released.

In figure 4, a sectional view along A-A of figure 3 is seen. In particular, it is also seen that the roll-off element 3 here has not an inelastic circumferential ring, but the elastic portion 7 extends up to the roll-off toothing 3A and directly contacts the toothing 1A of the ring gear. Further, it is seen that the housing of the rotary position transducer has a kind of key surface, which engages with a corresponding retaining surface of the cam 10 not further denoted and prevents rotation of the rotary position transducer 4 relatively to the cam 10. This is supported by a screw connection not further denoted.

What is claimed is:

1. Rotary position transducer array for a rotary connection on a work machine between two rotary elements (1, 2) comprising an elastic roll-off element (3) which, coupled to a rotary position transducer (4), rolls off on a first rotary element (1) via its circumferential area (3a), wherein the rotary position transducer (4) detects the rotational movement about the rotational axis (R) of the roll-off element (3), and the roll-off element (3) is held, such that it can be translationally and/or rotationally adjusted, by a second rotary element (2) by means of a bearing (5), so as to vary the distance between the roll-off element (3) and the first rotary element (1).

2. The rotary position transducer array according to claim 1, wherein the roll-off element (3) is retained adjustable about a second rotational axis (E) different from the rotational axis (R) by means of the bearing (5).

3. The rotary position transducer array according to claim 1 or 2, wherein the roll-off element (3) is a pinion (3), which engages with and rolls off on a circumferential toothing (1a) of a rotary connection ring gear on the first rotary element (1).

4. The rotary position transducer array according to claim 2 or 3, wherein the second rotational axis (E) is oriented parallel to the rotational axis (R) of the roll-off element (3) and/or parallel to the rotational axis (D) between first and second rotary element (1, 2).

5. The rotary position transducer array according to any one of claims 1 to 4, wherein the roll-off element (3) includes an elastic material.

6. The rotary position transducer array according to claim 5, wherein the circumferential area (3a) of the roll-off element (3), is coupled to a drive element (8),

by means of an elastic element (6), which transfers the rotational movement of the roll-off element (3) to the rotary position transducer (4).

7. The rotary position transducer array according to any one of claims 2 to 6, wherein the bearing (5) includes a receptacle (9) for a cam (10) on or in the second rotary element (2), which supports the cam (10) about the second rotational axis (E), and wherein the cam (10) supports the roll-off element (3) about the rotational axis (R) of the roll-off element (3).

8. The rotary position transducer array according to claim 7, wherein the receptacle (9) is a through-bore in the second rotary element (2).

9. The rotary position transducer array according to claim 7 or 8, wherein the cam (10) supports the roll-off element (3) coupled to the rotary position transducer (4) by means of the rotary position transducer (4).

10. The rotary position transducer array according to any one of claims 1 to 6, wherein the bearing (5) has a fixing means (11), by which the adjustable mounting of the roll-off element (3) can be locked.

11. The rotary position transducer array according to any one of claims 7 to 9, wherein the bearing (5) has a fixing means (11), by which the adjustable mounting of the roll-off element (3) can be locked.

12. The rotary position transducer array according to claim 11, wherein the fixing means (11) includes a clamping ring (12), which is screwed to the cam (10), and thereby clamps a base (15) disposed between clamping ring (12) and cam (10), having longitudinal holes (13) for a screw connection (14) and fixed to the second rotary element (2).

13. The rotary position transducer array according to claim 1, wherein the rotary connection is a crane rotary connection.

14. The rotary position transducer array according to claim 2, wherein the bearing (5) is disposed substantially within the first rotary element (1).

15. The rotary position transducer array according to claim 5, wherein the roll-off element (3) includes a plastic material or rubber.

16. The rotary position transducer array according to claim 6, wherein the circumferential area (3a) is part of an inelastic ring portion and/or is coupled to the drive element (8) by means of an insert (6).

17. The rotary position transducer array according to claim 8, wherein the receptacle (9) is a through-bore in the rotary table (2).

18. The rotary position transducer array according to claim 9, wherein the cam (10) circumferentially encompasses the rotary position transducer (4).

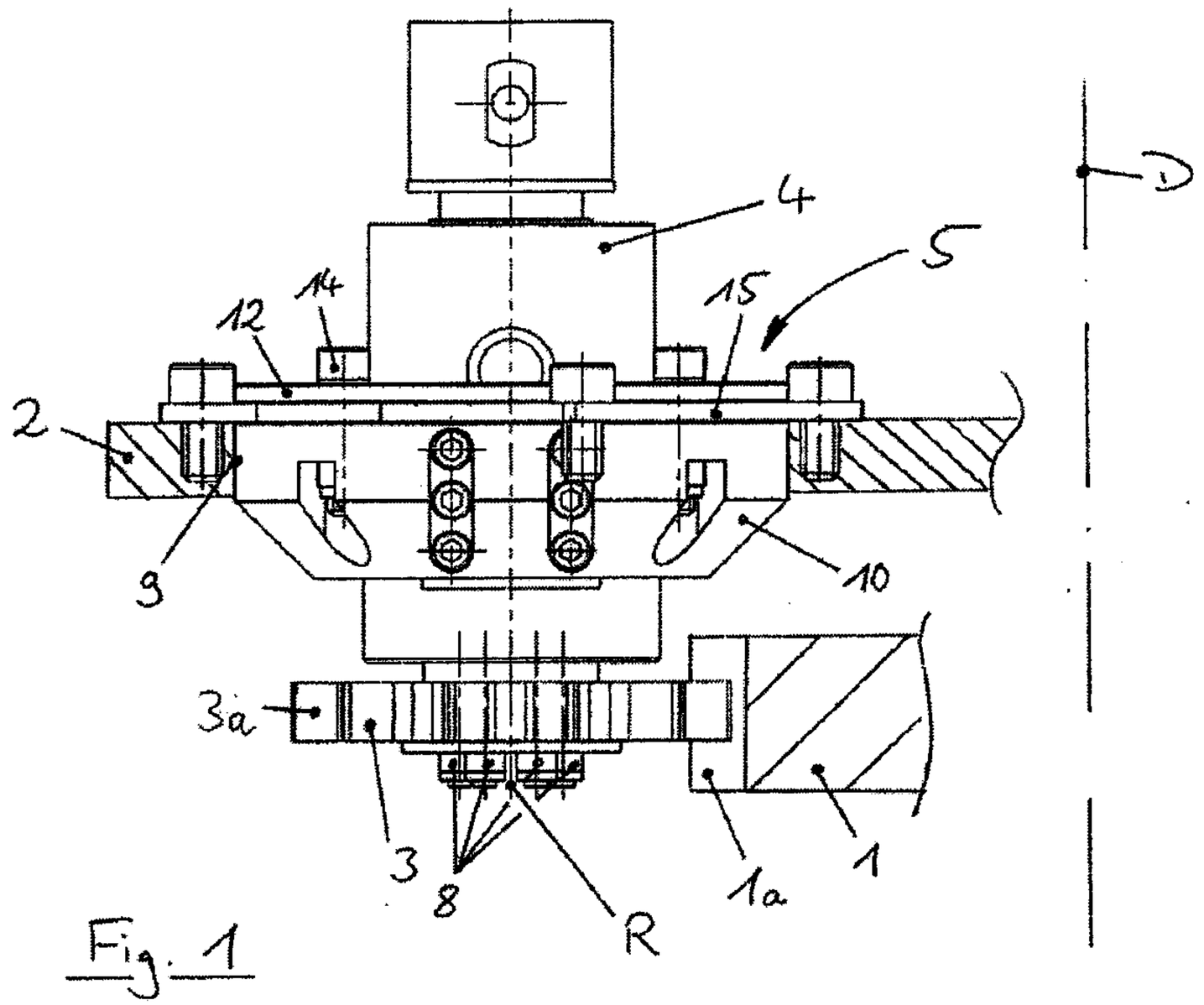


Fig. 1

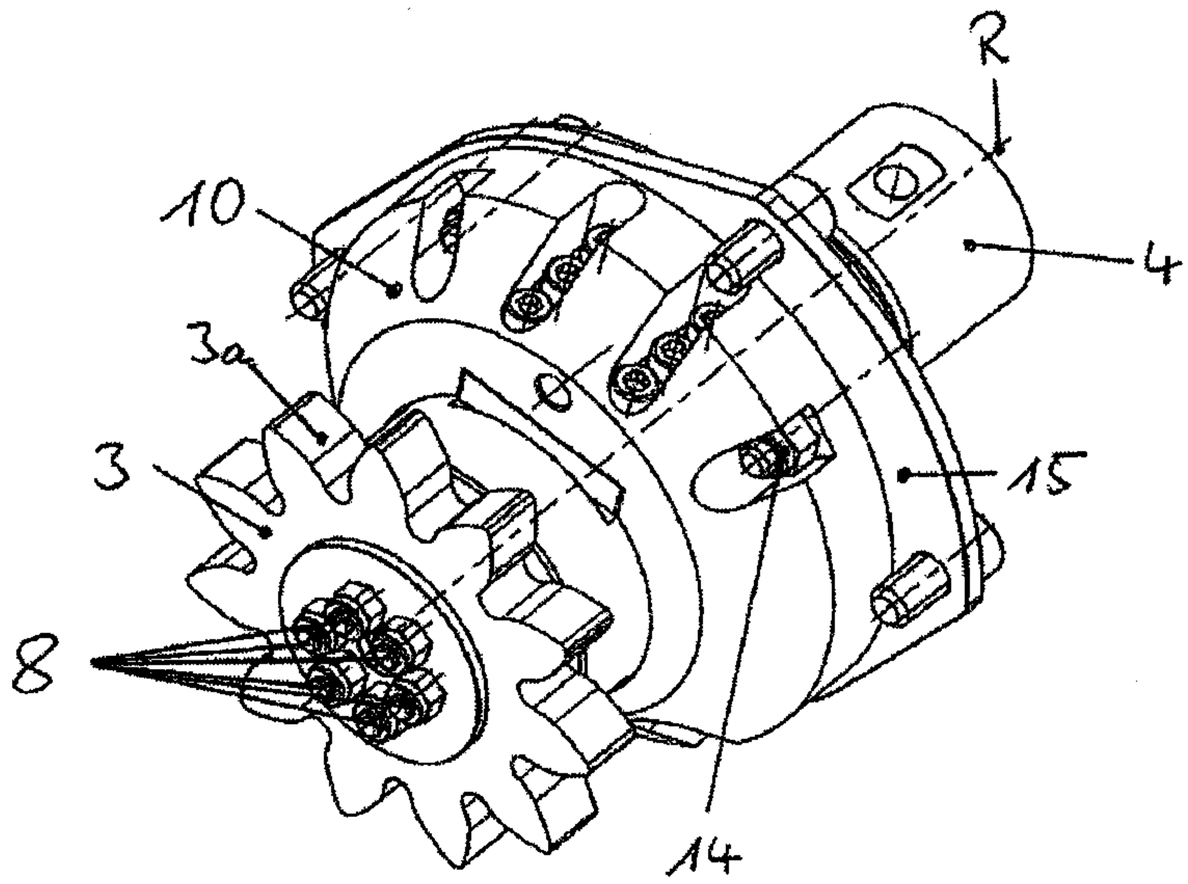


Fig. 2

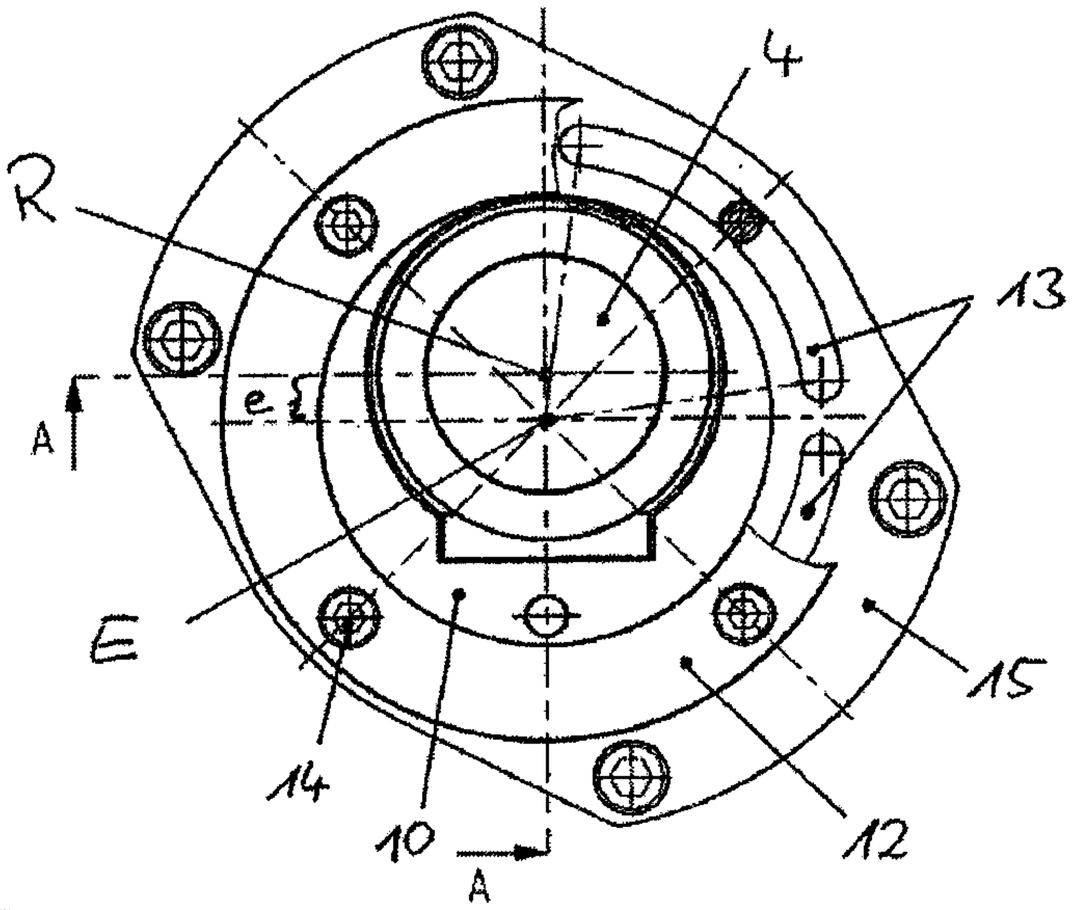


Fig. 3

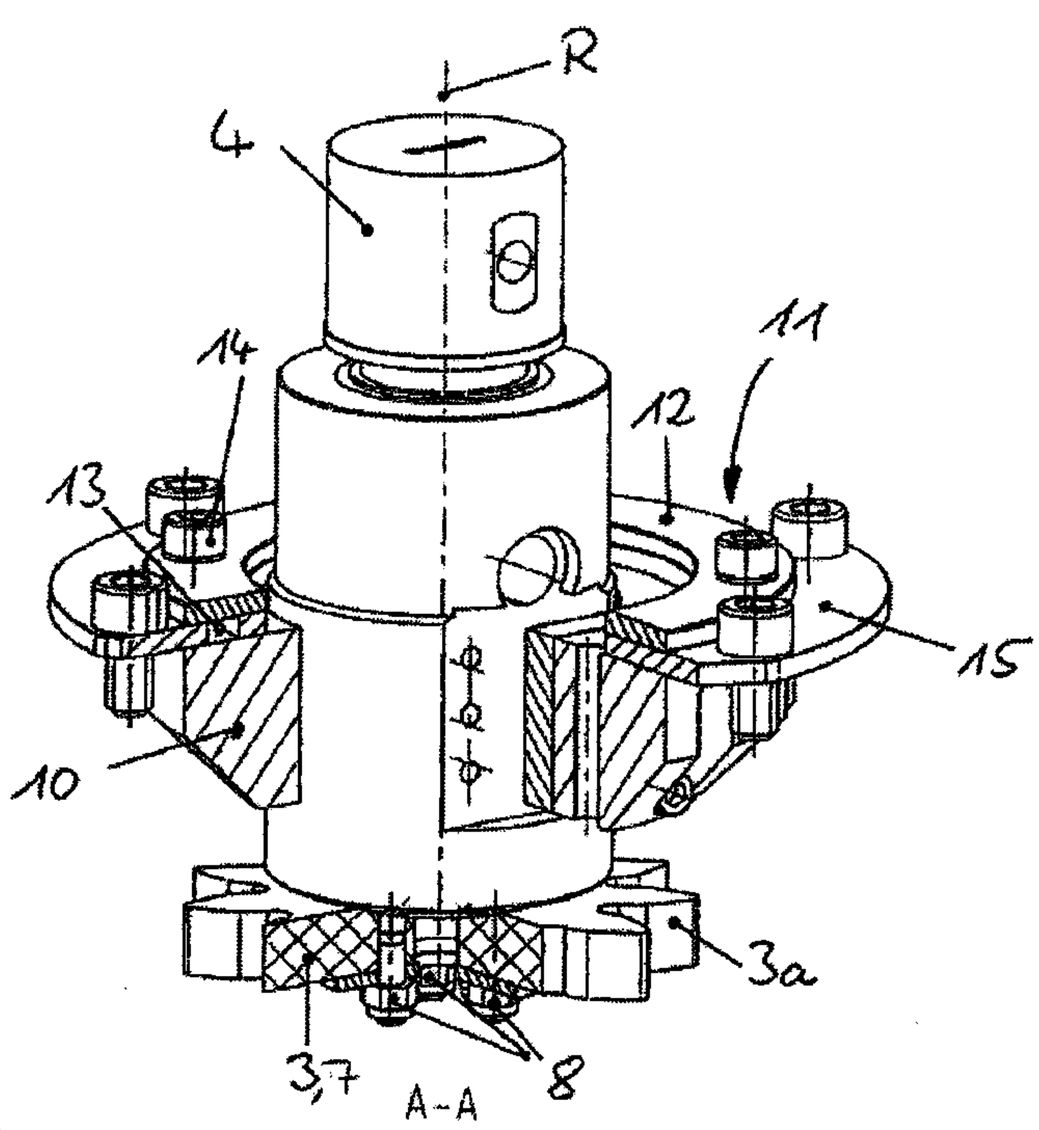
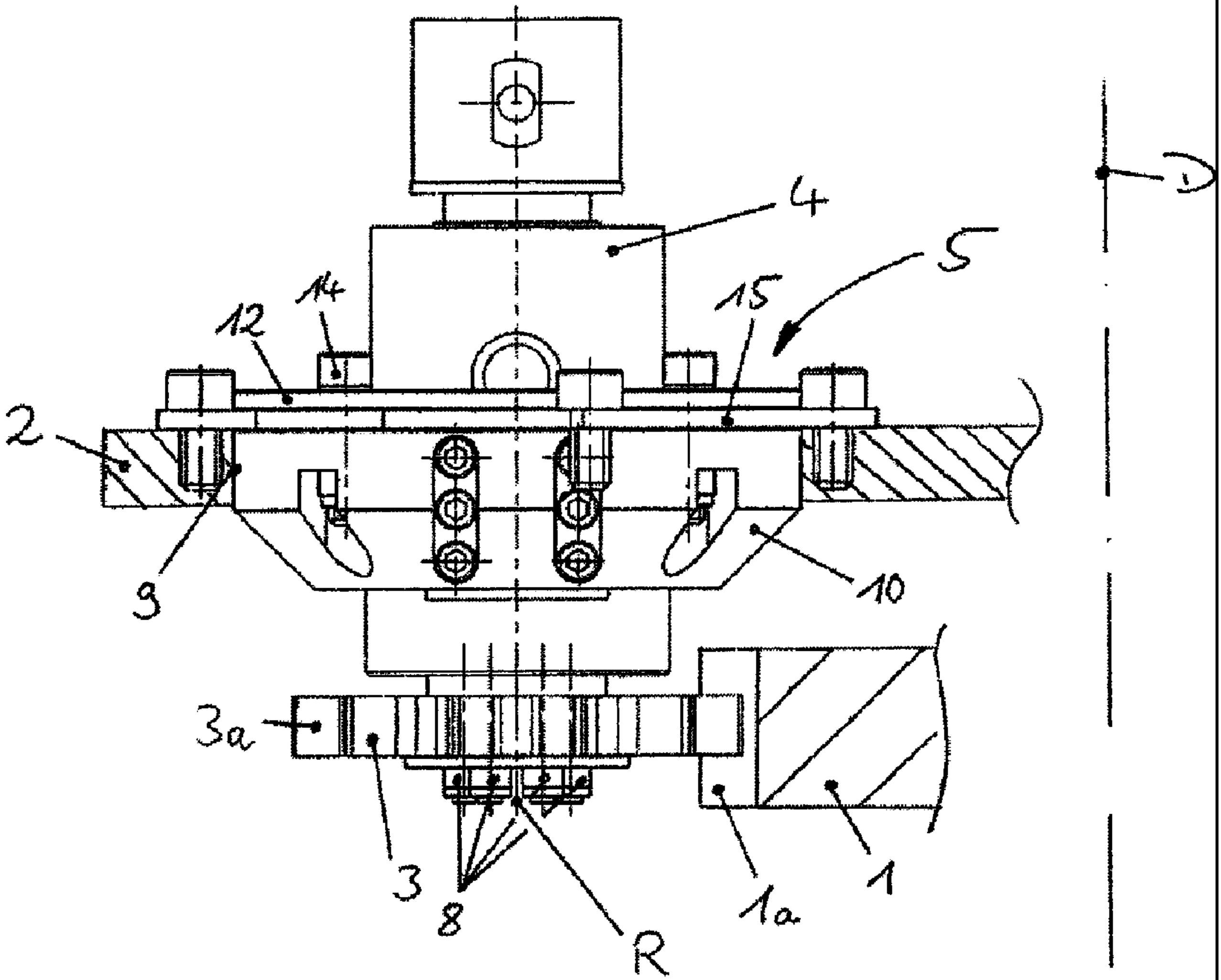


Fig. 4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