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(71) Applicant *(for all designated States except US)*: **BORGWARNER INC.** [US/US]; Patent Department, 3850 Hamlin Road, Auburn Hills, Michigan 48326 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **CVJETKOVIC, Tom** [DE/DE]; Kaiser-Wilhelm-Ring 32, 55118 Mainz (DE). **HAMBEL, Stefan** [DE/DE]; Buergermeister-Diehl-Strasse 9, 67304 Eisenberg (DE). **OSTERMEYER, Erich** [DE/DE]; Kupferbergstrasse 6, 67292 Kirchheimbolanden (DE). **EISINGER, Stefan** [DE/DE]; Am Kapellenberg 3, 55232 Alzey (DE).

(74) Agents: **PENDORF, Stephan A.** et al.; Patent Central LLC, 1401 Hollywood Boulevard, Hollywood, Florida 33020-5237 (US).

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(54) Title: METHOD AND DEVICE FOR MACHINING SHAFTS

(57) Abstract: The invention relates to a device (1) for machining a stepped shaft (2), having a workpiece rest (6); having a disk arrangement (3) which has a grinding disk (4) and a control disk (5); and having an axial stop arrangement (7), wherein the axial stop arrangement (7) has a contact adapter (8) which can be temporarily placed in contact with an end surface portion (9) of the shaft (2) and which has a punctiform contact surface (10) for contact against a stop part (11) of the stop arrangement (7). (Figure 3)

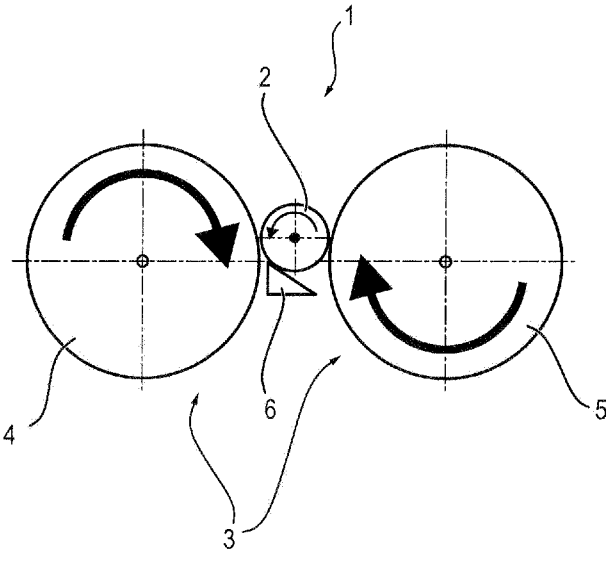


FIG. 1

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MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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METHOD AND DEVICE FOR MACHINING SHAFTS

Description

The invention relates to a method and to a device for machining stepped shafts according to claim 1 and claim 3 respectively.

Prior art for the machining of a stepped shaft is grinding using centering bores. However, this has the disadvantage that productivity is low and the production tolerances are relatively large on account of the bracing of the shaft and the associated deformations. It is likewise known to machine stepless shafts by means of so-called centerless grinding without the use of centering bores.

It is therefore an object of the present invention to create a method and a device for machining a shaft, in particular a stepped shaft, which enable increased productivity in relation to the prior art and permit an improvement in production accuracy.

Said object is achieved by means of the features of claim 1 and of claim 3.

The fact that, according to the invention, punctiform contact is used for the axial guidance of the shaft during the machining process yields the advantage that axial run-out of the shaft and angular errors of the stop do not result in axially oscillating shaft movements which increase the production tolerances of the axial shaft steps, and have only an extremely small effect, if any, on production accuracy.

In this connection, punctiform contact is to be understood as as small a (central punctiform) contact surface as possible with respect to the stop, which makes it possible to avoid the above-stated adverse effects on production accuracy.

The subclaims relate to advantageous refinements of the invention.

What is particularly advantageous is movable guidance of the shaft by means of the punctiform contact, since this permits a further increase in production accuracy.

Further details, advantages and features of the present invention can be gathered from the following description of an exemplary embodiment on the basis of the drawing, in which:

figure 1 shows a schematically highly simplified illustration of a device for machining a shaft,

figure 2 shows a perspective view of a shaft placed on a workpiece rest, with a stop device according to the invention,

figure 3 shows an enlarged detail illustration of the shaft according to figure 2, for the explanation of a stop arrangement of the device according to the invention,

figure 4 shows a diagrammatic illustration of the stop arrangement according to figure 3,

figure 5 shows a perspective illustration of the stop arrangement after the removal of the shaft, and

figure 6 shows a perspective illustration of a single-piece cage.

Figure 1 shows a device 1 for machining a shaft 2 in a schematically highly simplified illustration. The shaft 2 is a stepped shaft, as can be seen from figure 2, in which can be seen shaft steps 2A, 2B and 2C which each have different diameters.

Figure 1 shows that, for machining the shaft 2, the device 1 has a disk arrangement 3 which has at least one grinding disk 4 and one control disk 5. Here, the disks 4 and 5 are arranged at both sides of the shaft 2 and both rotate in the same direction. The shaft 2 rotates in the opposite direction, and during the machining process, rests on a workpiece rest 6, which is also referred to as a grinding rule.

Figure 2 illustrates the shaft 2 on the workpiece rest 6, with the disk arrangement 3 not being shown in order to simplify the illustration. Figure 2 shows that the shaft 2 is fixed in its position on the workpiece rest 6 by an axial stop arrangement 7 which is fastened to the workpiece rest 6, as can also be seen for example from figure 5. The axial stop arrangement 7 will be explained in more detail below, in particular with reference to figures 3 to 6.

Accordingly, the stop arrangement 7 has a contact adapter 8 which, in the example, can be temporarily plugged into an end surface portion 9 of the shaft 2, for which purpose the shaft 2 has a recess (not illustrated in any more detail in the figures) in the end surface portion 9. For this purpose, the contact adapter 8 has a journal 21 which can be seen in figure 5, after the removal of the shaft 2. It is likewise possible for the shaft 2 to be plugged into a bore of the contact adapter 8 or for the contact between the shaft 2 and the contact adapter 8 to be realized by means of frictional engagement in the end surfaces.

Figures 3 and 4 also show that the contact adapter 8 has a punctiform contact surface 10 which is arranged between an end surface 20 of the shaft 2 and the stop part 11. As has already been explained in the introduction, the term "punctiform" is to be

understood according to the invention to mean a contact surface 10 which enables an increase in the production accuracy of the shaft 2. In figure 4, said punctiform contact surface 10 is formed, in the schematic illustration of figure 4, in the manner of a point, though this is not imperative. In fact, it can be seen from figure 3 that a punctiform contact surface 10 may also be understood to mean an areal configuration of said contact surface 10.

Figure 4 in particular shows that the contact adapter 8 is guided in a movable fashion in the stop arrangement 7. In the embodiment illustrated in figures 3 to 6, the stop arrangement 7 has, for this purpose, for example a cage 12 in which a stop part 11 is fixed, which stop part 11 has a counterpart surface 13 on which the punctiform contact surface 10 rests during the production of the shaft 2.

In the embodiment illustrated in figures 3 to 5, the stop arrangement 7 has two cage parts 12A and 12B which, in figures 3 and 5, are connected to one another by means of a screw connection 12, with the stop element 11 which is arranged between the cage parts 12A and 12B functioning as a spacer.

The cage parts 12A and 12B each have retaining claws 14 and 15 which engage around a connecting region 17 of the contact adapter 8 and engage behind a retaining collar 18 so as to retain the contact adapter 8 within the cage in a movable fashion, as can be seen in particular from the schematic illustration of figure 4. Here, the punctiform contact surface 10 is formed on a point region 19 of the contact adapter 8.

It can be seen from the illustration of figure 5 that, in said embodiment, the retaining claws 14 and 15 are integral parts of the cage parts 12A and 12B and are of approximately semi-circular design, so as to provide the movable guidance of the contact adapter 8 as is desired in particular from figure 4 on account of the clearances shown therein between the cage 12 and the contact adapter 8. By means of said guidance, it is possible in particular for axial run-out of the end surface 20 and unevenness and angular errors of the counterpart surface 13 to be compensated in conjunction with the punctiform contact surface 10.

As illustrated in figure 6, the cage may also be formed in one piece. For this purpose, the retaining claws 14 and 15 are replaced by a U-shaped bracket 25 with an opening 26 for holding a contact adapter 8.

In addition to the above written disclosure, reference is hereby explicitly made to the diagrammatic illustration thereof in figures 1 to 6.

List of reference symbols

1	Device
2	Shaft
2A-2C	Shaft steps
3	Disk arrangement
4	Grinding disk
5	Control disk
6	Workpiece rest / grinding rule
7	Stop arrangement
8	Contact adapter
9	End surface portion of the shaft
10	Contact surface / punctiform contact
11	Stop part
12	Cage
12A,B	Cage parts
13	Counterpart surface for stop
14, 15	Holding claws
16	Screw connection
17	Connecting region
18	Retaining collar
19	Point region
20	End surface of the shaft
21	Journal
25	Single-part cage
26	Opening

CLAIMS

1. A method for machining a stepped shaft (2), having the following method steps:

- placing the shaft (2) on a workpiece rest (6);
- placing an end surface (20) of the shaft (2) in contact with an axial stop part (11) of the workpiece receptacle (6), and
- grinding that region (2A, 2B, 2C) of the shaft (2) which is to be machined,

wherein

- the end surface (20) of the shaft (2) is placed in contact with the stop part (11) by means of punctiform contact (10).

2. The method as claimed in claim 1, wherein the punctiform contact (10) is movable.

3. A device (1) for machining a stepped shaft (2),

- having a workpiece rest (6);
- having a disk arrangement (3) which has a grinding disk (4) and a control disk (5); and
- having an axial stop arrangement (7),

wherein

- the axial stop arrangement (7) has a contact adapter (8)
  - which can be temporarily placed in contact with an end surface portion (9) of the shaft (2) and
  - which has a punctiform contact surface (10) for contact against a stop part (11) of the stop arrangement (7).

4. The device as claimed in claim 3, wherein the stop arrangement (7) has a cage (12) in which the stop part (11) is fixed.

5. The device as claimed in claim 3 or 4, wherein the contact adapter (8) is guided in a movable fashion.

6. The device as claimed in one of claims 3 to 5, wherein the stop arrangement (7) is fixed to the workpiece rest (6).

7. The device as claimed in one of claims 3 to 6, wherein the contact adapter (8) is releasably plugged into the end surface portion (9) of the shaft.

8. A stop arrangement (7) of a device for machining a shaft,

- having a contact adapter (8) which has a punctiform contact surface (10); and
- having a stop part (11) which has a counterpart surface (13) for the punctiform contact surface (10).

9. The stop arrangement as claimed in claim 8, wherein the contact adapter (8) is guided in a movable fashion.

10. The stop arrangement as claimed in claim 9, characterized by a cage (12) in which the contact adapter (8) is guided in a movable fashion.

11. The stop arrangement as claimed in claim 10, wherein the stop part (11) is fixed in the cage (12).

12. The stop arrangement as claimed in claim 10 or 11, wherein the cage (12) has two cage parts (12A, 12B) which can be connected to one another by means of the stop part (11) which serves as a spacer, and said cage parts (12A, 12B) have retaining claws (14, 15) for movably guiding the contact adapter (8).

13. The stop arrangement as claimed in claim 10 or 11, wherein the cage (25) is formed in one piece and has an opening (26) through which the stop part (11) can be placed in contact with the shaft (2).

14. The stop arrangement as claimed in claim 12, wherein, to connect the cage parts (12A, 12B), a screw connection (16) is provided which extends through said

cage parts (12A, 12B) and the stop part (11).

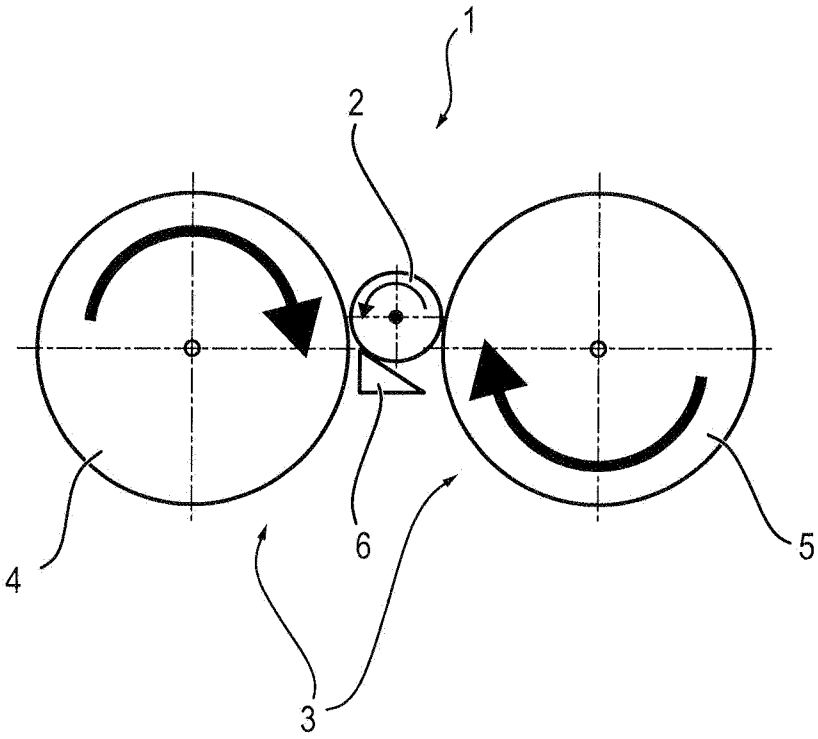


FIG. 1

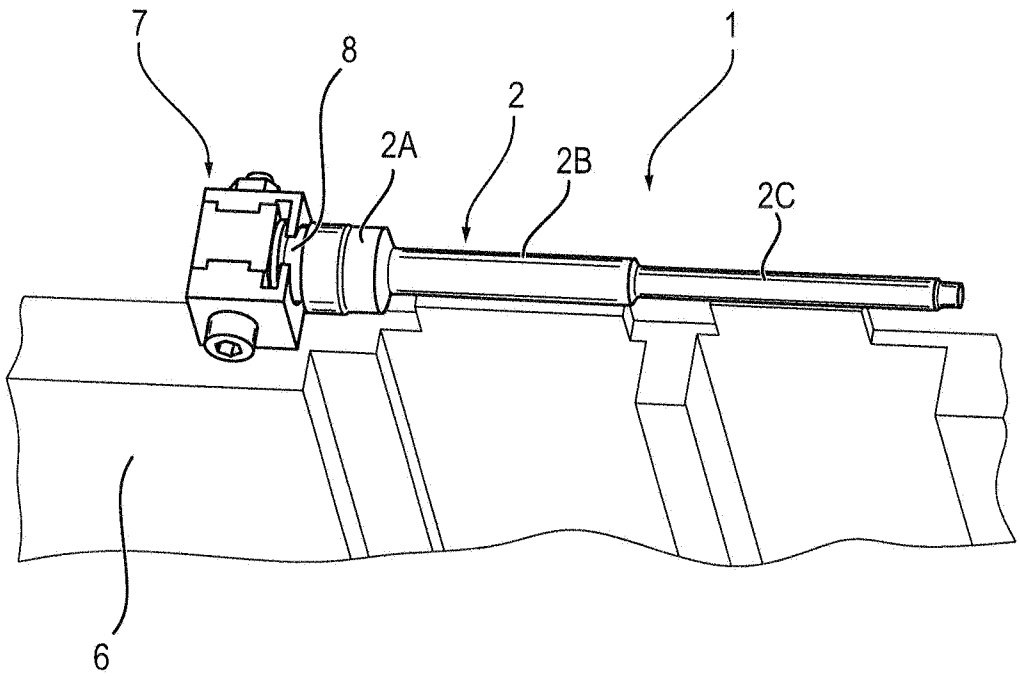


FIG. 2

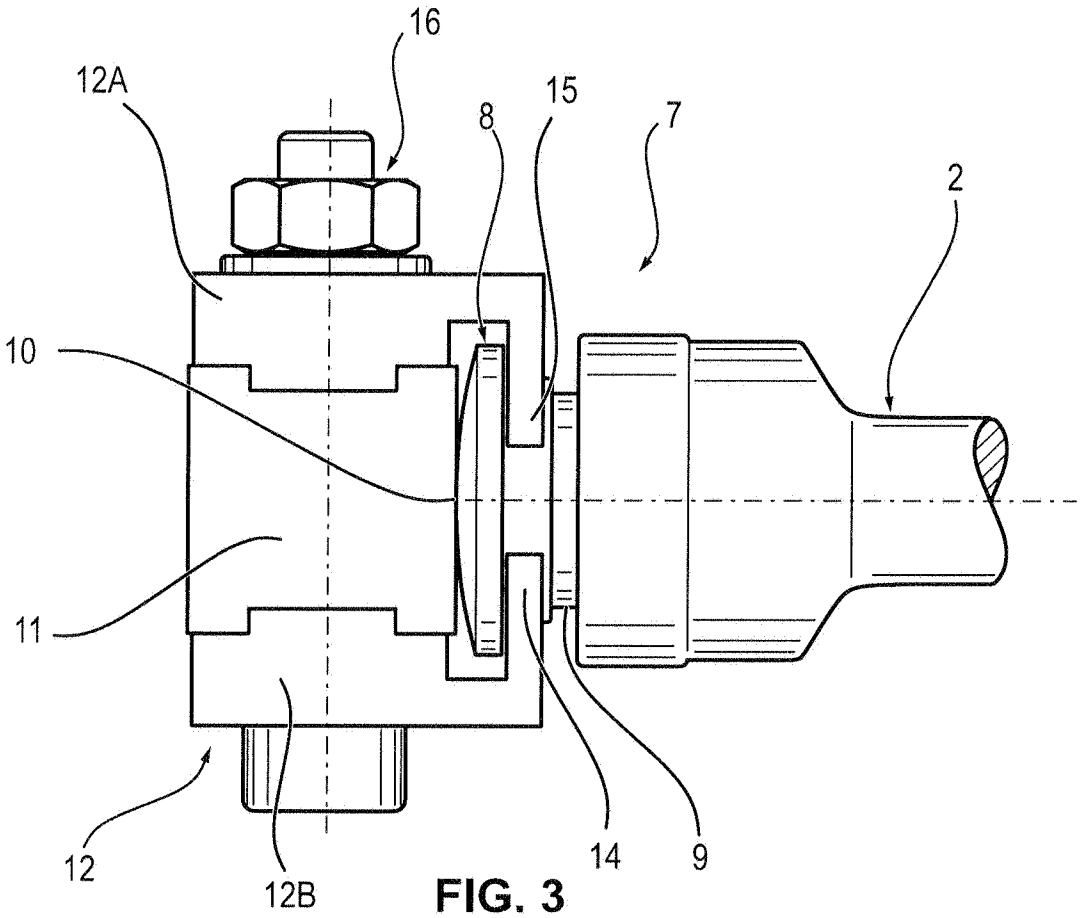

16
12A
8
15
7
2
10
11
12
12B
14
9

FIG. 3

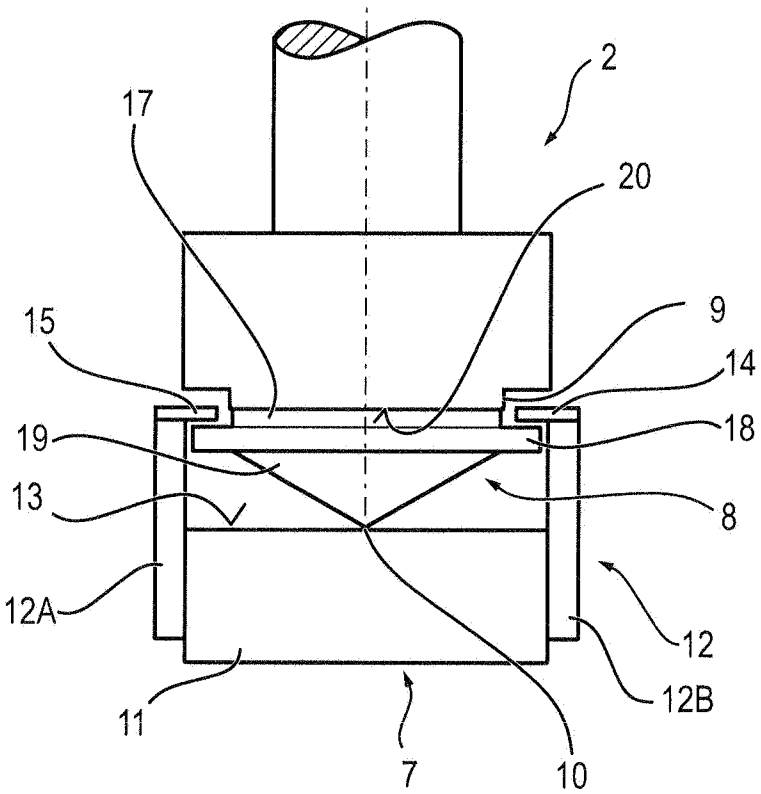

2
17
20
15
9
14
19
18
13
8
12A
12
12B
11
7
10

FIG. 4

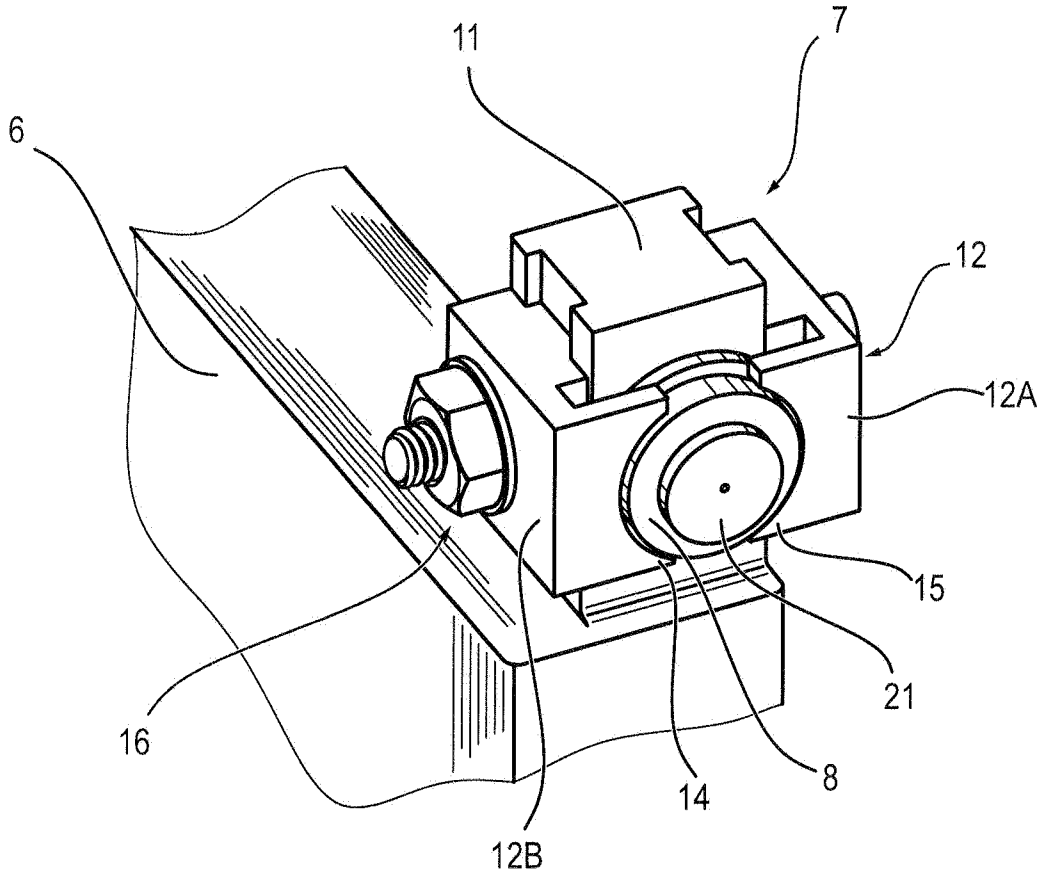


FIG. 5

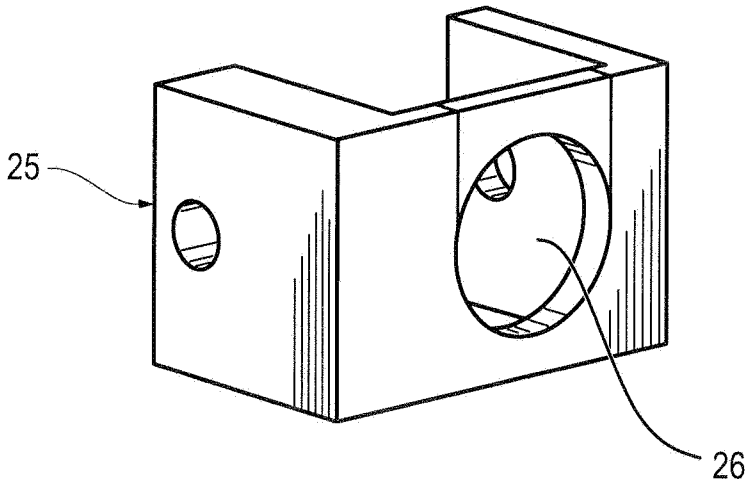


FIG. 6