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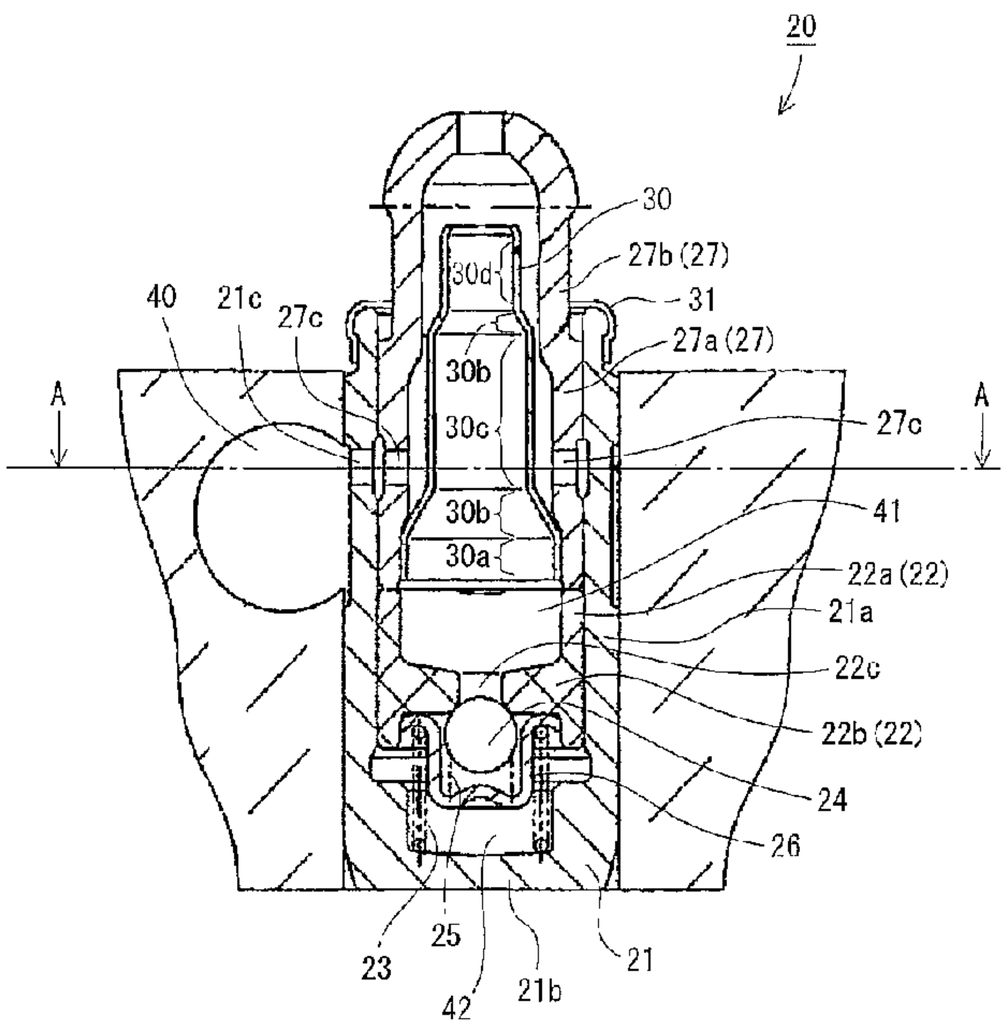
(54) Titre : RATTRAPEUR DE JEU HYDRAULIQUE
(54) Title: HYDRAULIC LASH ADJUSTER



(57) Abrégé/Abstract:
In a lash adjuster used for a valve train for internal combustion engines, a method for fitting a cylindrical sleeve into a plunger cap is disclosed as a configuration for preventing the mixing of air into a high-pressure chamber located in a lower portion thereof. However, in conventional lash adjusters, the plunger cap is provided with two side holes having a difference in axial height, and therefore the management of side surfaces as sliding surfaces has become complicated. Accordingly, the problem to be resolved by the present invention is to provide a lash adjuster which facilitates the management of the side surfaces and further reduces processing costs without interfering with the inflow/outflow of oil. The above-described problem has been addressed by a hydraulic lash adjuster which is characterized in that two or more cap side holes (27c) are provided, all these cap side holes (27c) being arranged in a plane perpendicular to the axis of a body (21).

ABSTRACT OF THE DISCLOSURE

In a lash adjuster used for a valve operating mechanism of an internal combustion engine, there is known a lash adjuster constituted by inserting a cylindrical sleeve into a plunger cap for preventing air from entering a high-pressure chamber located at a lower portion of the lash adjuster. However, in the conventional lash adjuster, since the plunger cap is formed with two side holes which are different in height in the axial direction of the plunger cap, it becomes complicated to regulate the side surface the plunger cap which corresponds to a sliding surface. Therefore, it is problems to be solved by the present invention to provide a lash adjuster in which the side surface of the plunger cap can be easily regulated without disturbing the inflow and outflow of oil and whose machining cost can be kept low.

The above problems can be solved by a hydraulic lash adjuster in which two or more cap side holes 27c are provided and all of them are disposed in a plane perpendicular to a shaft center of the body 21.

SPECIFICATION

[TITLE OF THE INVENTION]

HYDRAULIC LASH ADJUSTER

FIELD OF THE INVENTION

[0001]

The present invention relates to a hydraulic lash adjuster used for an internal combustion engine.

BACKGROUND ART OF THE INVENTION

[0002]

In a valve operating mechanism of the internal combustion engine, a lash adjuster is employed for correcting change in the gap between valves caused by abrasion, thermal expansion and the like. However, in the lash adjuster, if oil containing air is fed into a high-pressure chamber disposed at a lower portion of the lash adjuster, the lash adjuster cannot fulfil its function. In order to prevent air from being entrained into oil, each of a patent publication No. 1 and a patent publication No. 2 propose a method comprising the steps of inserting a cylindrical sleeve into a plunger cap and separating air contained in oil from the oil entering the high-pressure chamber.

PRIOR PUBLICATIONS

PATENT PUBLICATIONS

[0003]

Patent Publication No. 1: Japanese Patent Application Laid Open No. Sho 63-170509

Patent Publication No. 2: United States Patent No. 6,959,677 B2

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004]

In the lash adjuster disclosed in the patent publication No. 1, the plunger cap is formed with two side holes which are different in height in the axial direction of the plunger cap and in the lash adjuster disclosed in the patent publication No. 2, a side hole for discharging air is provided in addition to an oil feeding opening. However, since it is necessary to regulate the side surface of the plunger cap for keeping good slidable characteristic, in the case where a plurality of side holes are provided so as to be spaced vertically in the axial direction of the plunger cap, it becomes complicated to regulate the side surface the plunger cap and the machining cost of the plunger cap becomes high. Thus, it is problems to be solved by the present invention to provide a lash adjuster in which the side surface of the plunger cap can be easily regulated without disturbing the inflow and outflow of oil and whose machining cost can be kept low.

MEANS FOR SOLVING PROBLEMS

[0005]

The above problems can be solved by adopting the following technical means.

Specifically, an invention defined in Claim 1 is directed to a hydraulic lash adjuster comprising:

a bottomed cylindrical body 21 to be inserted into a fixing hole provided in an internal combustion engine,

a bottomed cylindrical plunger 22 slidably inserted into a

cylindrical portion 21a of the body 21,

a plunger cap 27 being in contact with an upper surface of the plunger 22 and slidably inserted into the body 21, and

a cylindrical sleeve 30 tightly inserted into the plunger cap 27, wherein

oil is led to an inside of the plunger 27 through a body side hole 21a provided on a side surface of the body 21 and cap side holes 27c communicating with the body side hole 21a and provided on a side surface of the plunger cap 27, and a high-pressure chamber 42 is formed between a bottom portion 21b of the body 21 and a plunger bottom portion 22b of the plunger 22 by a check valve mechanism provided at the plunger bottom portion 22b of the plunger 22,

the hydraulic lash adjuster being constituted so that two or more cap side holes 27c are provided and all of the cap side holes 27c are disposed in a plane perpendicular to a shaft center of the body 21.

[0006]

Further, an invention defined in Claim 2 is directed to the hydraulic lash adjuster in accordance with Claim 1, wherein an even number of the cap side holes 27c are provided.

[0007]

Moreover, an invention defined in Claim 3 is directed to the hydraulic lash adjuster in accordance with Claim 1 or 2, wherein oil passing resistance of a portion located above the cap side holes 27c and formed on an outer circumference of a large diameter portion 27a of the plunger cap 27 tightly inserted into the body 21 and slidable in an axial direction of the body 21 is lower than oil passing resistance of a portion located below the cap side holes 27c.

[0008]

Further, an invention defined in Claim 4 is directed to the hydraulic lash adjuster in accordance with Claim 3, wherein the portion of the large diameter portion 27a of the plunger cap 27 located above the cap side holes 27c is formed with an adjusting groove.

[0009]

In addition, an invention defined in Claim 5 is directed to the hydraulic lash adjuster in accordance with Claim 4, wherein the adjusting groove is not parallel with the axial direction of the plunger cap 27.

TECHNICAL EFFECTS OF THE INVENTION

[0010]

According to the invention defined in Claim 1, since two or more cap side holes 27c communicating with the body side hole 21c are provided, the oil passing resistance between the inside of the plunger cap 27 and an oil gallery 40 becomes low. As a result, low density oil containing air is easy of passing a gap between the inside of the plunger cap 27 and the oil gallery 40 and the amount of the low density oil containing air remaining in the plunger cap 27 is reduced. On the other hand, the amount of the low density oil containing air fed into the reserve chamber 41 is reduced.

[0011]

Further, since all of the cap side holes 21c are disposed in a plane perpendicular to the shaft center of the body 21, it is possible to perform the edge working of the cap side holes 21c in one operation. Thus, the side surface of the sliding portions can be readily controlled and the machining cost can be reduced.

[0012]

According to an invention defined in Claim 2, in addition to the

technical advantages obtained by the invention defined in Claim 1, since even number of the cap side holes 27c are provided, two holes can be processed at one time from the side portion of the plunger cap 27. Thus, the machining cost can be further reduced.

[0013]

According to the invention defined in Claim 3, in addition to the technical advantages obtained by the invention defined in Claim 1 or 2, since the oil passing resistance of the portion located above the cap side holes 27c and formed on the outer circumference of the large diameter portion 27a of the plunger cap 27 inserted into the body 21 and slidable in the axial direction is set to be lower than that of the portion below the cap side holes 27c, low density oil containing air passes through a space between the body 21 and the plunger cap 27 and therefore, the amount of the low density oil containing air fed into the reserve chamber 41 of the sleeve 30 can be reduced.

[0014]

According to the invention defined in Claim 4, in addition to the technical advantages obtained by the invention defined in Claim 3, since the portion located above the cap side holes 27c and formed at the outer circumference of the large diameter portion 27a of the plunger cap 27 is formed with a adjusting groove, it is possible to adjust the oil passing resistance by controlling the width of the groove and the depth of the groove and the oil passage resistance can be easily adjusted.

[0015]

According to the invention defined in Claim 5, in addition to the technical advantages obtained by the invention defined in Claim 4, since the adjusting groove is not parallel with the axial direction of the plunger cap 27, the oil passing resistance can be adjusted by controlling the length

of the adjusting groove and it is more easily to change the oil passage resistance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

[Figure 1]

Figure 1 is a schematic front cross-sectional view showing a lash adjuster which is a first preferred embodiment of the present invention.

[Figure 2]

Figure 2 is a schematic sectional plan view of the lash adjuster shown in Figure 1.

[Figure 3]

Figure 3 is a schematic front view of a plunger cap constituting a lash adjuster which is a second preferred embodiment of the present invention.

[Figure 4]

Figure 4 is a schematic front view of a plunger cap constituting a lash adjuster which is a third preferred embodiment of the present invention.

[Figure 5]

Figure 5 is a schematic front cross-sectional view showing a valve operating mechanism using a conventional lash adjuster.

PREFERRED EMBODIMNT OF THE INVENTION

[0017]

Preferred embodiments of the present invention configured based on the above described technical ideas will be explained below in detail referring to accompanying drawings.

[0018]

Figure 5 is a schematic front cross-sectional view showing a valve operating mechanism using a conventional lash adjuster. A valve element 14 is disposed in an intake passage 12 formed in a cylinder head 10 constituting an internal combustion engine. The valve element 14 is biased by a return spring 15 toward a direction in which the intake passage 12 is closed and the upper end portion of the valve element 14 is in contact with a rocker arm 17 swingable in response to the rotation of a cam 16. A lash adjuster 20 is disposed adjacent to the valve element 10 and inserted into a fixing hole provided in the cylinder head 10 so as to open upwardly and fixed therein. The lash adjuster 20 is used for correcting change in the gap of the valves caused by the abrasion of the valve operating mechanism and thermal expansion thereof.

[0019]

Figure 1 is a schematic front cross-sectional view (in an axial direction) showing a lash adjuster which is a first preferred embodiment of the present invention and Figure 2 is a schematic sectional plan view of the lash adjuster taken along a line A-A in Figure 1. In this specification, the "top and bottom" of the lash adjuster 20 means the "top and bottom" thereof in Figure 2. The lash adjuster includes a bottomed cylindrical body 21, a bottomed cylindrical plunger 22, a plunger cap 27 in contact with the upper surface of the plunger 22 and a cylindrical sleeve 30 tightly inserted into the plunger cap 27.

[0020]

The lash adjuster 20 is fixed by inserting a body 21 thereof into a fixing hole formed in the cylinder head 10 of the internal combustion engine. The body 21 is provided with a cylindrical portion 21a and a bottom portion 21b and the plunger 22 and the plunger cap 27 are

slidably inserted into the cylindrical portion 21a of the body 21 from below. The cylindrical portion 21a of the body 21 is provided with a body side hole 21c through which oil is fed from an oil gallery 40. The body side hole 21c is perpendicular to the shaft center of the body 21 and is formed so as to penetrate through the cylindrical portion 21a. A groove whose width is larger than the diameter of the body side hole 21c is formed on the inner periphery of the cylindrical portion 21a so that the inflow and outflow of oil becomes smooth.

[0021]

The plunger 22 inserted into the lower portion of the body 21 includes a cylindrical portion 22a and a bottom portion 22b integrally formed therewith. The inside of the lash adjuster 20 is divided by a check valve mechanism provided at the bottom portion 22b into a reserve chamber 41 and a high-pressure chamber 42. The check valve mechanism includes a vertical communication hole 22c formed in substantially the center of the bottom portion 22b of the plunger 22, a check ball 24 located below the vertical communication hole 22c to be in contact with the lower portion of the vertical communication hole 22c, a ball cage 26 for holding the check ball 24 and a spring 25 disposed in the ball cage 26 and adapted for biasing the check ball 24 upwardly. The ball cage 26 is supported by a plunger spring 23 for biasing the plunger 27 upwardly.

[0022]

While the plunger cap 27 is subjected to a downward force by the check valve mechanism, oil in the high-pressure chamber 42 cannot pass through the vertical communication hole 22c, whereby the upper portion of the lash adjuster 20 serves as a pivot point of the rocker arm 17. On the other hand, when the plunger cap 27 is not subjected to the downward force, the plunger 22 and the plunger cap 27 are lifted, whereby oil

accommodated in the reserve chamber 41 passes through the vertical communication hole 22c and flows into the high-pressure chamber 41.

[0023]

Similarly to the plunger 22, the plunger cap 27 is slidably inserted in the body 21. The plunger cap 27 includes a large diameter portion 27a slidable on the body 21 and a small diameter portion 27b located above the large diameter portion 27a. The upper portion of the small diameter portion 27b has a hemispherical shape, which comes into contact with the rocker arm 17. The upper end portion of the small diameter portion 27b is formed with an oil passing hole in the vertical direction, thereby overflowing oil from the lash adjuster 20 and lubricating the valve operating mechanism. The lower surface of the plunger cap 27 is in contact with the upper surface of the plunger 22 and slides substantially integrally with the plunger 22 in the vertical direction.

[0024]

The plunger cap 27 is provided with two cap side holes 27c. The cap side holes 27c are disposed so as to communicate with the body side hole 21c, whereby oil is led from the oil gallery 40 provided in the cylinder head 10 to the inside of the plunger 22 and mobile oil containing air and having low density is led into the oil gallery 40. The two body side holes 27c are disposed in a plane perpendicular to the shaft center of the body 21. In the case where two or more cap side holes 27c are provided, they are disposed similarly to the case where the two cap side holes 27c are provided. Here, "what are disposed in a plane" includes the shaft center of the cap side holes 27c or a part of the cap side holes 27c.

[0025]

The cap side holes 27c of the plunger cap 27 is perpendicular to the shaft center of the body 21 and penetrate the large diameter portion 27a

of the plunger cap 27. On the outer periphery side of the large diameter portion 27a, a groove having a width larger than the diameter of the cap side holes 27c is formed in a circumferential direction, thereby facilitating the inflow of oil from the body side hole 21c and the outflow of oil from the cap side holes 27c. The diameter of the large diameter portion 27a of the plunger cap 27 which slides on the body 21 is different between a portion upper than the cap side holes 27c and a portion lower than the cap side holes 27c. Specifically, the portion upper than the groove and including the cap side holes 27c has a smaller diameter than that of the portion lower than the groove so that the passing resistance of oil becomes small through a space between the body 21 and the large dimeter portion 27a.

[0026]

The upper open end of the body 21 is formed with a cap retainer 31 for holding the plunger cap 27 so as to prevent the plunger 22 and the plunger cap 27 from falling off the body 21 when assembling the lash adjuster 20.

[0027]

A sleeve 30 having a cylindrical shape is tightly inserted into an inner circumferential portion of the large diameter portion 27a of the plunger cap 27. The sleeve 30 has an open opposite end portions and is constituted by three cylindrical portions having different diameters from each other and disposed along the axial direction. What is tightly inserted into the plunger cap 27 is a larger diameter portion 30a having a largest diameter. The sleeve 30 has a first small diameter portion 30c having a smaller diameter than that of the larger diameter portion 30a above the larger diameter portion 30a and a second small diameter portion 30d having a smaller diameter than that of the first small diameter portion 30c above the first small diameter portion 30c. A taper portion 30b is

formed between the larger diameter portion 30a and the first small diameter portion 30c and a taper portion 30b is also formed between the first small diameter portion 30c and the second small diameter portion 30d, whereby the sleeve 30 can be integrally formed. In addition, a gap between the inner surface of the small diameter portion 27b of the plunger cap 27 and the outer surface of the first small diameter portion 30c of the sleeve 30 is constituted small. According to such configuration, since the resistance of oil passing through the gap between the small diameter portion 27b and the first small diameter portion 30c becomes high, much oil passes through the body side hole 21c and the cap side holes 27c so that low density oil containing air is prevented from being stored in the reserve chamber 41.

[0028]

Since two or more cap side holes 27c communicating with the body side hole 21c are provided, the resistance of oil passing through a space between the inside of the plunger cap 27 and the oil gallery 40 becomes low. As a result, low density oil containing air is easy of passing through a gap between the inside of the plunger cap 27 and the oil gallery 40 and the amount of the low density oil containing air remaining in the plunger cap 27 is reduced. In addition, the amount of the low density oil containing air fed into the reserve chamber 41 is reduced.

[0029]

Further, since all of the cap side holes 21c are disposed in a plane perpendicular to the shaft center of the body 21, it is possible to perform the edge working of the cap side holes 21c in one operation. Thus, the side surface of the sliding portions can be readily regulated and the machining cost can be reduced.

[0030]

Since an even number of the cap side holes 27c are provided, two holes 27c can be processed at one time from the side portion of the plunger cap 27. Thus, the machining cost can be further reduced.

[0031]

Since the passing resistance of oil in the portion located above the cap side holes 27c and formed on the outer circumference of the large diameter portion 27a of the plunger cap 27 inserted into the body 21 and slidable in the axial direction is lower than that of the portion below the cap side holes 27c, low density oil containing air passes through a space between the body 21 and the plunger cap 27 and, therefore, the amount of the low density oil containing air fed into the reserve chamber 41 in the sleeve 30 can be reduced.

[0032]

Figure 3 is a schematic front view of a plunger cap 27 constituting a lash adjuster 20 that is a second preferred embodiment of the present invention and Figure 4 is a schematic front view of a plunger cap 27 constituting a lash adjuster 20 that is a third preferred embodiment of the present invention.

[0033]

In the second preferred embodiment of the present invention, a portion above the cap side hole 27c formed at the outer circumference of the large diameter portion 27a of the plunger cap 27 is formed with parallel adjusting groove 28 through which oil can pass. Figure 3 (a) shows parallel adjusting groove 28a which communicates an upper portion and a lower portion and Figure 3 (b) shows parallel adjusting groove 28b which does not communicate the upper portion and the lower portion.

[0034]

Since the portion above the cap side hole 27c formed at the outer circumference of the large diameter portion 27a of the plunger cap 27 is formed with parallel adjusting groove 28a or 28b through which oil can pass, it is possible to adjust the oil passing resistance by controlling the width of the groove and the depth of the groove and, therefore, the oil passage resistance can be easily adjusted.

[0035]

In the third preferred embodiment of the present invention, a portion above the cap side hole 27c formed on the outer circumference of the large diameter portion 27a of the plunger cap 27 is formed with non-parallel adjusting groove 29 through which oil can pass. Figure 4 (a) shows the non-parallel adjusting groove 29 which communicates an upper portion and a lower portion and Figure 4(b) shows non-parallel adjusting groove 29b which does not communicate the upper portion and the lower portion. The non-parallel adjusting groove 29 is formed at an angle of 45 degrees or more (75 degree in this embodiment) to the shaft center of the plunger cap 27, thereby lengthening the adjusting groove.

[0036]

Since the adjusting groove is not parallel with the axial direction of the plunger cap 27, the oil passing resistance can be adjusted by controlling the length of the adjusting groove and it is easier to adjust the oil passage resistance.

EXPLANATION OF REFERENCE NUMERALS

[0037]

10 a cylinder head

12 an intake passage

14 a valve element

15 a return spring

16 a cam

17 a rocker arm

20 a lash adjuster

21 a body

21a a cylindrical portion

21b a bottom portion

21c a body side hole

22 a plunger

22a a cylindrical portion of a plunger

22b a bottom portion of a plunger

22c a vertical communication hole

23 a plunger spring

24 a check ball

25 a spring

26 a ball cage

27 a plunger cap

27a a large diameter portion

27b a small diameter portion

27c a cap side hole

28a, 28b a parallel adjusting groove

29a, 29b a non-parallel adjusting groove

30 a sleeve

30a a large diameter portion

30b a taper portion

30c a first small diameter portion

30d a second small diameter portion

31 a cap retainer

40 an oil gallery

41 a reserve chamber

42 a high-pressure chamber

5

15

CLAIMS:

[Claim 1]

A hydraulic lash adjuster comprising;

a bottomed cylindrical body to be inserted into a fixing hole provided in an internal combustion engine,

a bottomed cylindrical plunger slidably inserted into a cylindrical portion of the body,

a plunger cap being in contact with an upper surface of the plunger and slidably inserted into the body, and

a cylindrical sleeve tightly inserted into the plunger cap,

wherein

oil is led to an inside of the plunger through a body side hole provided on a side surface of the body and cap side holes communicating with the body side hole and provided on a side surface of the plunger cap, and a high-pressure chamber is formed between a bottom portion of the body and a plunger bottom portion of the plunger by a check valve mechanism provided at the plunger bottom portion of the plunger,

the hydraulic lash adjuster being constituted so that two or more cap side holes 27c are provided and all of the cap side holes 27c are disposed in a plane perpendicular to a shaft center of the body.

[Claim 2]

A hydraulic lash adjuster in accordance with Claim 1, wherein an even number of the cap side holes are provided.

[Claim 3]

A hydraulic lash adjuster in accordance with Claim 1 or 2, wherein oil passing resistance in a portion formed on an outer circumference of a

large diameter portion of the plunger cap inserted into the body and slidable in an axial direction of the body and located above the cap side holes is lower than oil passing resistance of a portion below the cap side holes.

[Claim 4]

A hydraulic lash adjuster in accordance with Claim 3, wherein the portion of the large diameter portion of the plunger cap located above the cap side holes is formed with an adjusting groove.

[Claim 5]

A hydraulic lash adjuster in accordance with Claim 4, wherein the adjusting groove is not parallel with an axial direction of the plunger cap.

FIG. 1

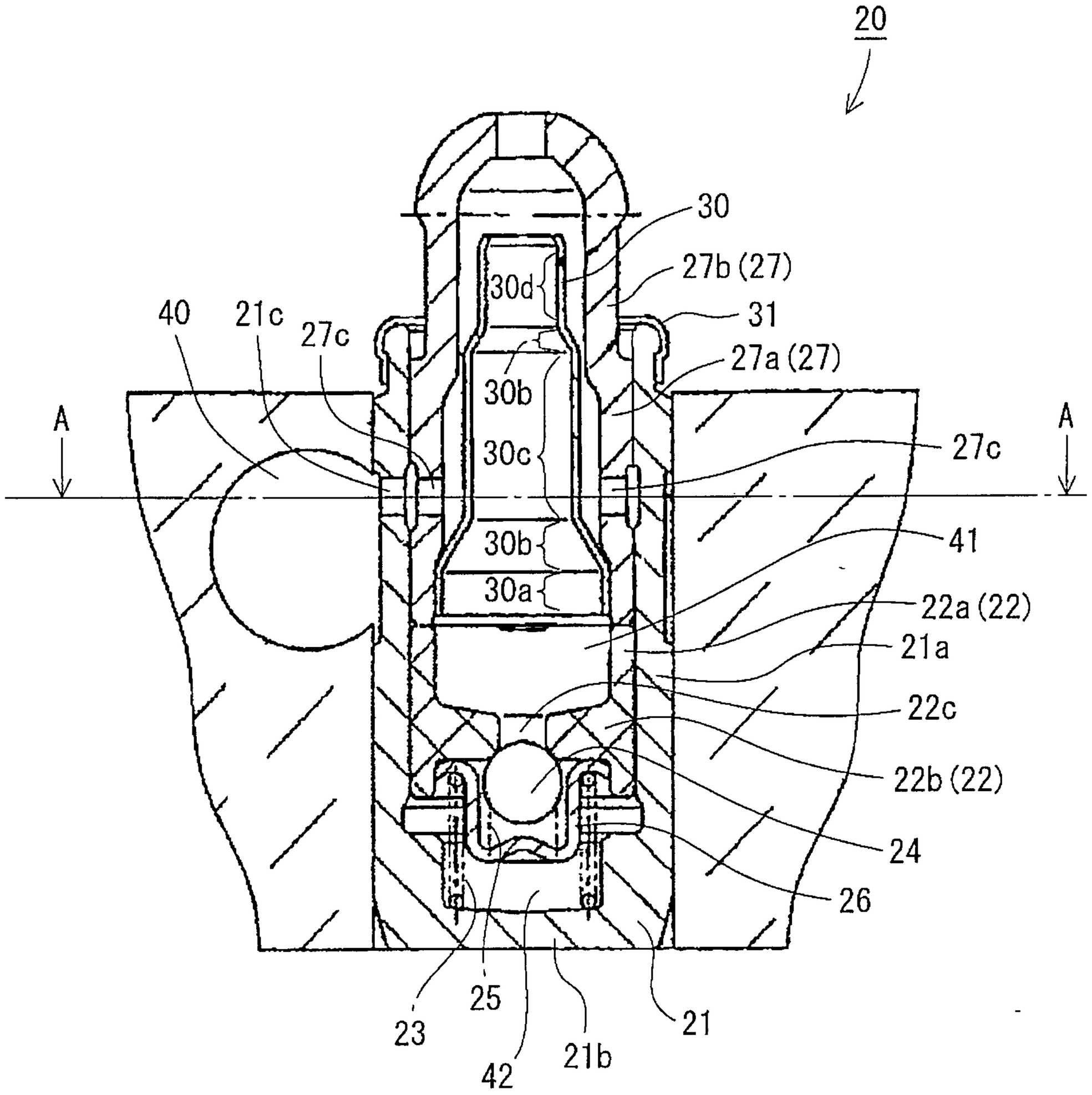

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FIG. 2

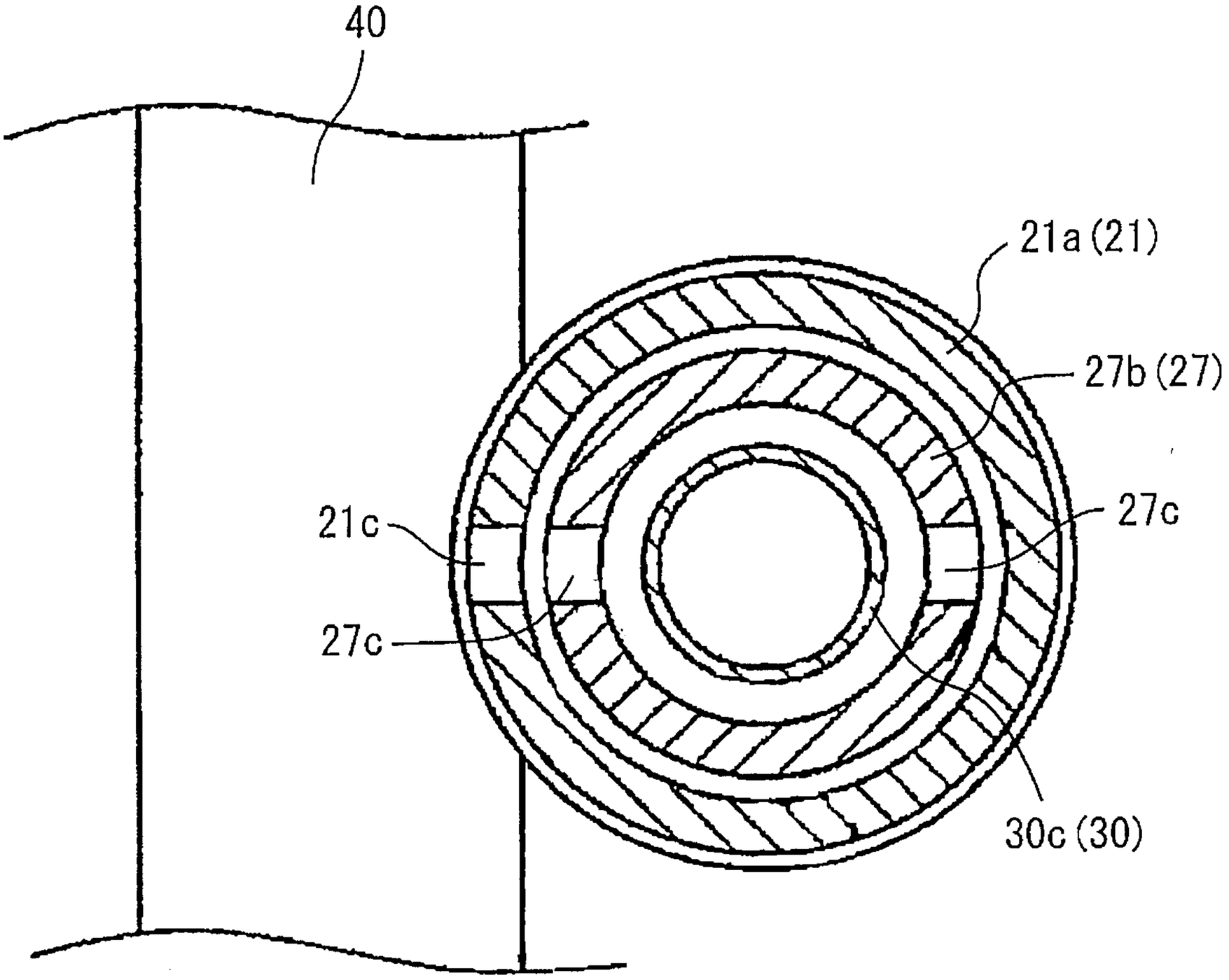


FIG. 3

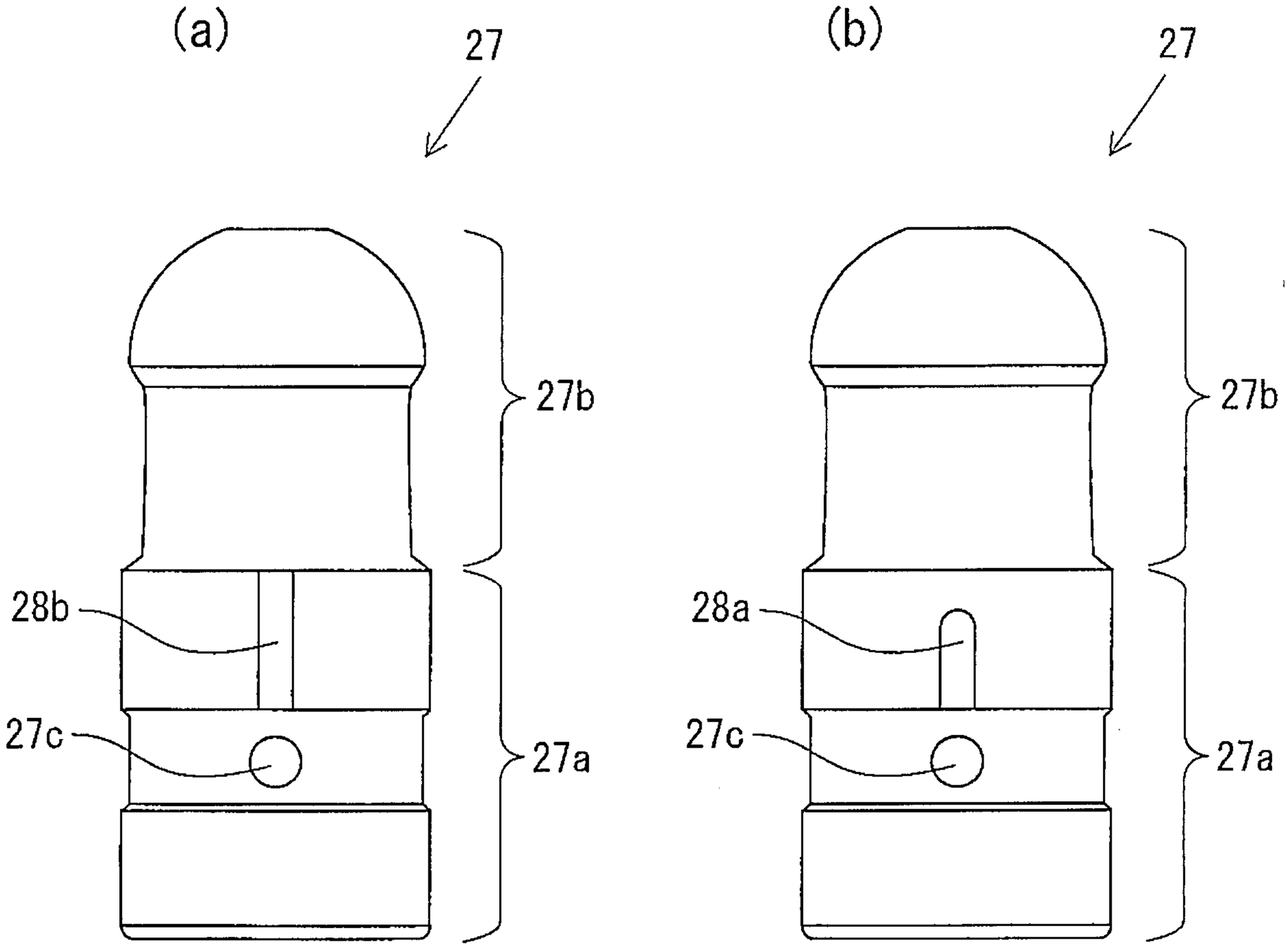


FIG. 4

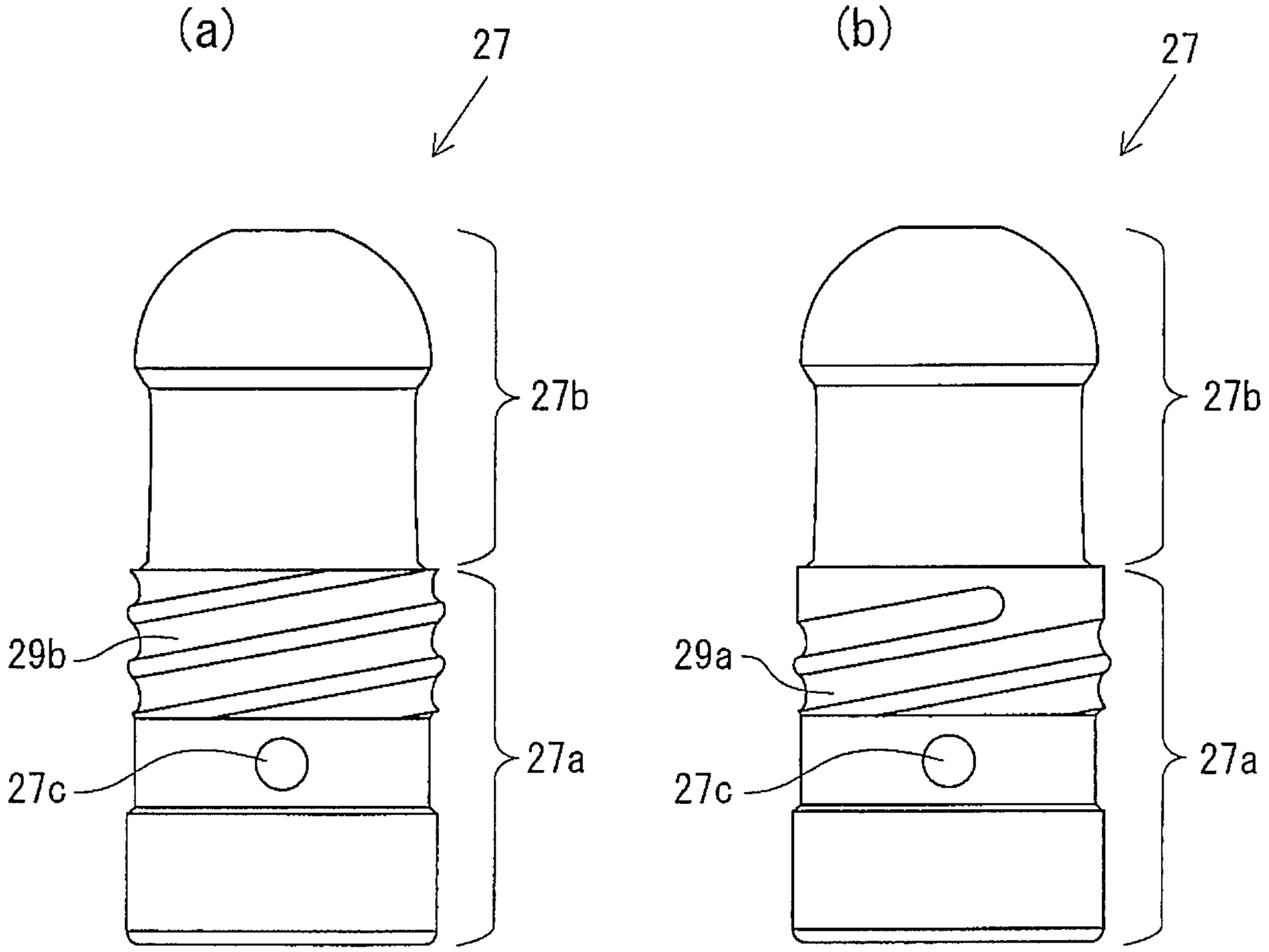
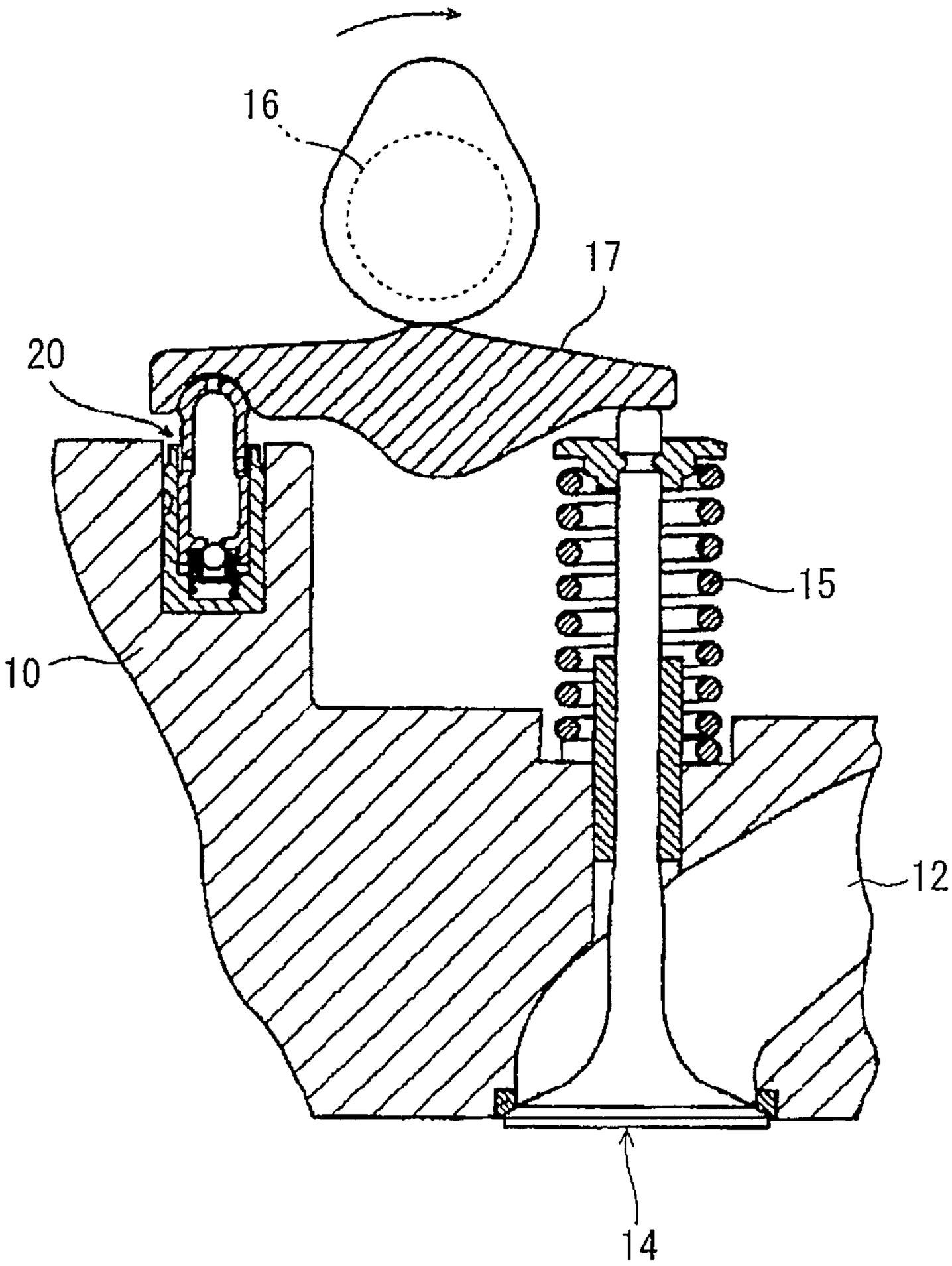
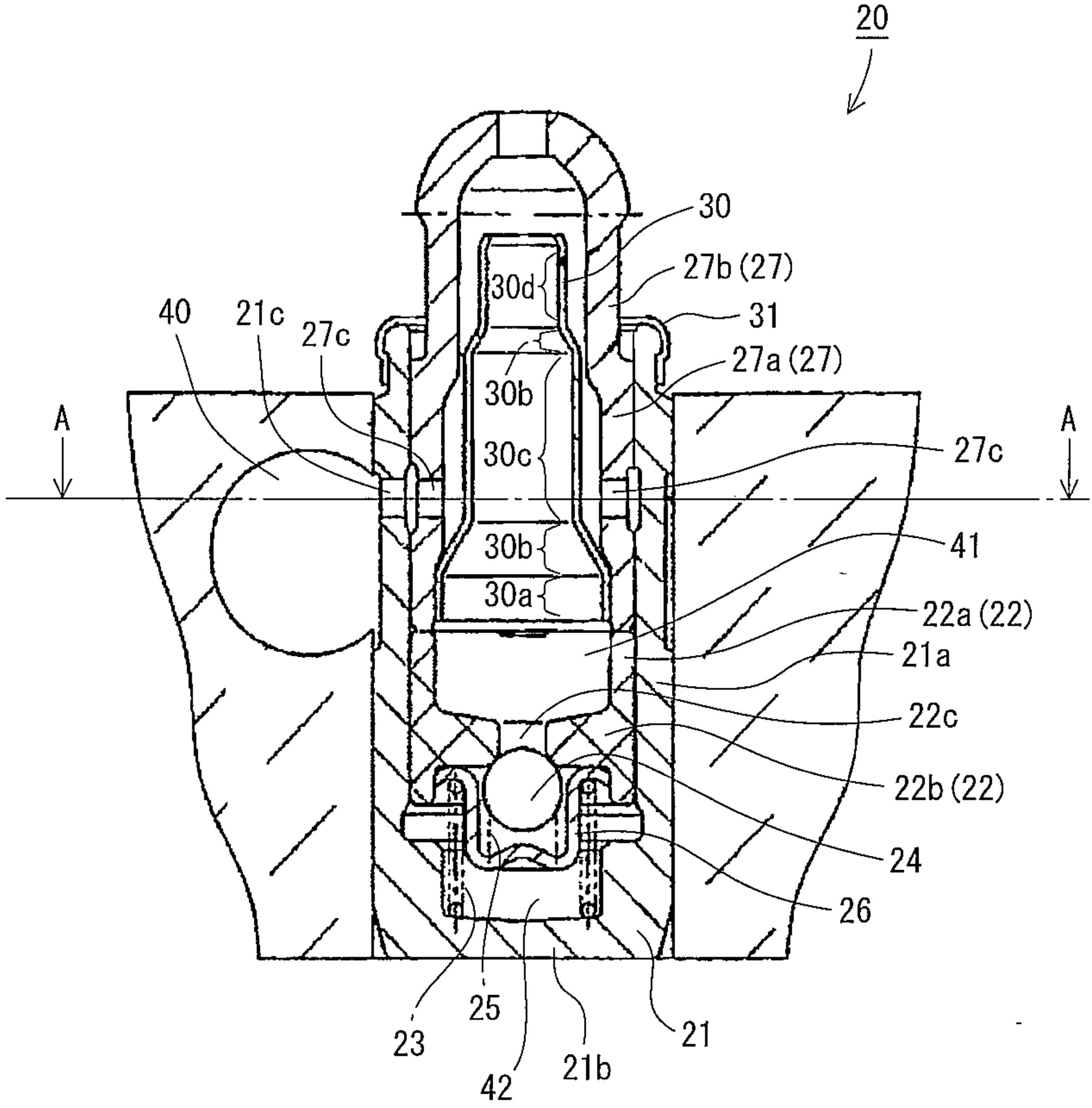


FIG. 5

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