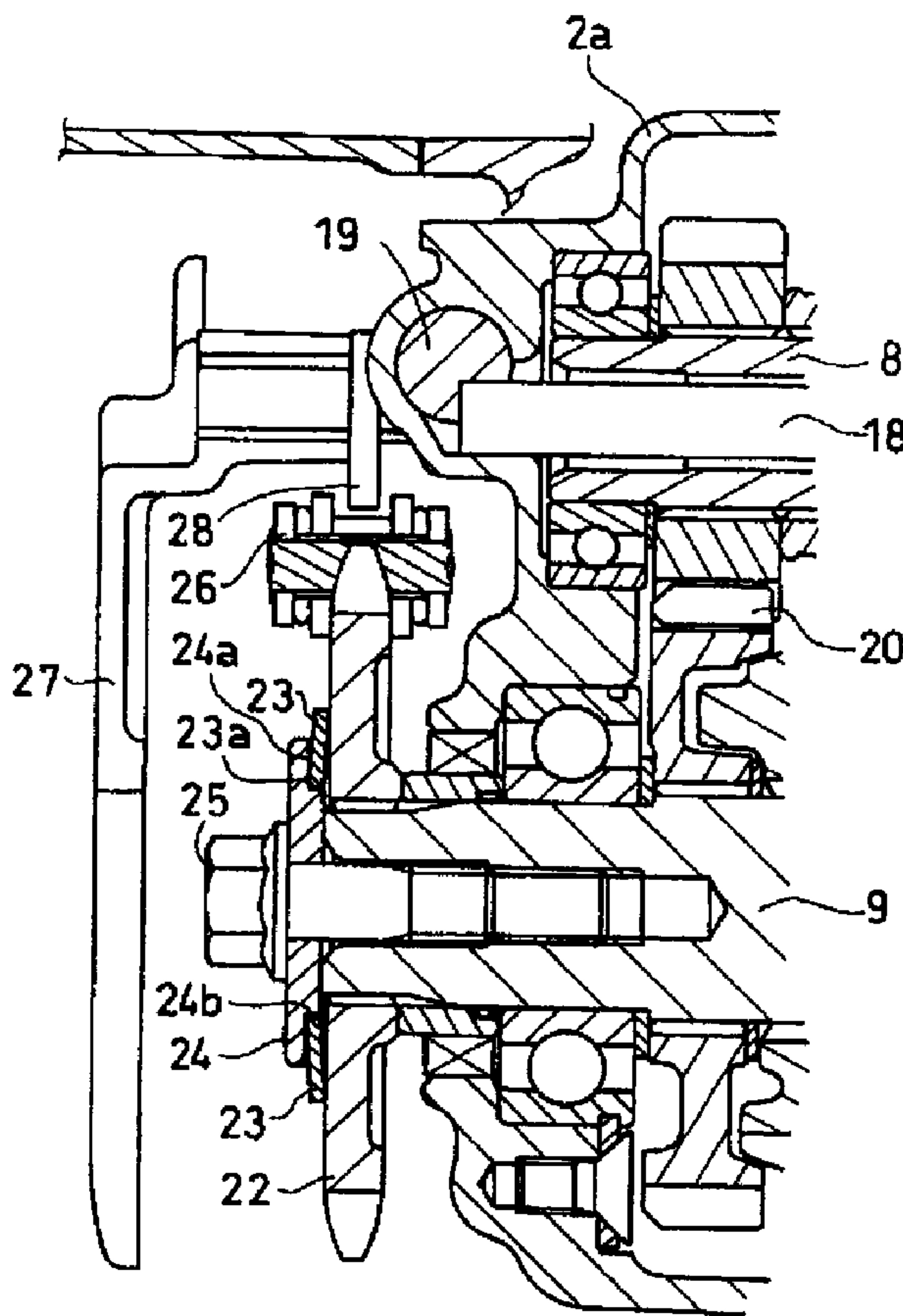




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(54) Titre : STRUCTURE DE FIXATION D'ELEMENT DE TRANSMISSION DE FORCE DE ROTATION
 (54) Title: ROTATIONAL FORCE TRANSMISSION MEMBER MOUNTING STRUCTURE



(57) Abrégé/Abstract:

The present invention relates to a mounting structure for mounting firmly onto a rotating shaft a rotational force transmission member such as a chain sprocket, a gear, a belt pulley and the like. A drive sprocket as a rotational force transmission member is

(57) **Abrégé(suite)/Abstract(continued):**

fitted into an end of the rotating shaft in a splined manner; a coned disc spring and a washer are stuck in sequence onto a face at the outer end of the rotational force transmission member; and the coned disc spring and the washer are supported and sandwiched by the screw fastening member to be screwed to an end of the rotating shaft and the rotational force transmission member.

ABSTRACT OF THE DISCLOSURE

The present invention relates to a mounting structure for mounting firmly onto a rotating shaft a rotational force transmission member such as a chain sprocket, a gear, a belt pulley and the like. A drive sprocket as a rotational force transmission member is fitted into an end of the rotating shaft in a splined manner; a coned disc spring and a washer are stuck in sequence onto a face at the outer end of the rotational force transmission member; and the coned disc spring and the washer are supported and sandwiched by the screw fastening member to be screwed to an end of the rotating shaft and the rotational force transmission member.

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ROTATIONAL FORCE TRANSMISSION MEMBER MOUNTING STRUCTURE

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FIELD OF THE INVENTION

The present invention relates to a mounting structure for rigidly mounting onto a rotating shaft a rotational force transmission member such as a chain sprocket, a gear, a belt pulley and the like.

10

BACKGROUND OF THE INVENTION

In the Japanese Patent Laid-Open No. Hei. 7-259577, a gear is fitted into an end of a crankshaft in an internal combustion engine in a splined manner. A washer is placed next to the gear and a bolt passes through
15 the washer and is screwed into the crankshaft at one end thereof.

With this arrangement the gear is fitted into an end of the crankshaft in a splined manner so that torque is transmitted from the crankshaft to the gear. However, since there exists a small amount of backlash along the
20 circumferential direction between the crankshaft and the gear, fluctuations in torque and loading of the crankshaft and gear can occur. These fluctuations can influence the bolt and it would be desirable to have a structure that reduces the influence caused by the fluctuations in the torque and the loading. One suggested solution includes using a
25 coned disc spring washer, however this modification does not overcome the problem.

Accordingly, the present invention relates to improvement of the gear mounting structure, i.e., the rotational force transmission member mounting structure as described above. An object of the present invention is to provide a structure that, even though the fluctuation in the torque for the crankshaft is generated, is capable of further reducing transmission to the bolt of the influence caused by the fluctuation in the torque.

SUMMARY OF THE INVENTION

10 The present invention is characterized in that a rotational force transmission member is fitted into an end of a rotating shaft in a splined manner; a coned disc spring and a washer are stacked in sequence onto a face at an outer end of the rotational force transmission member; and the coned disc spring and the washer are supported by, and interposed
15 between, a screw fastening member to be screwed into an end of the rotating shaft and the rotational force transmission member.

An aspect of the invention is characterized in that an outer circumferential edge of the coned disc spring is in line contact with an
20 outer face of the rotational force transmission member and an inner circumferential edge of the coned disc spring is in line contact with a face at an inner side of the washer.

Another aspect of the invention is characterized in that an outer
25 circumferential portion at an inner side of the washer is notched off in a ring shape and the coned disc spring is disposed in the portion notched off in the ring shape.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Preferred embodiments of the invention are shown in the drawings, wherein:

Fig. 1 illustrates a side view of an internal combustion engine having an embodiment of a rotational force transmission member mounting
35 structure according to the present invention.

Fig. 2 illustrates a section view taken along the line II-II in Fig. 1.

Fig. 3 illustrates an enlarged section view of a chief portion in Fig. 2.

Fig. 4 illustrates a further enlarged section view of a chief portion in Fig. 3.

5

Fig. 5 illustrates a section view of the other embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

10 According to the present invention, the rotational force transmission member is fitted into the rotating shaft at the end thereof in a splined manner; the coned disc spring and the washer are stacked in sequence on the face at the end of the rotational force transmission member; and the coned disc spring and the washer are supported by, and interposed between the screw fastening member to be screwed into the end of the
15 rotating shaft and the rotational force transmission member. Therefore, even though a relatively minute vibration in the circumferential direction between the end of the rotating shaft and the rotational force transmission member is generated in the portion where both are fitted into each other in a splined manner due to the backlash in the
20 circumferential direction, it is made possible to further reduce an influence of the relatively minute vibration on the screw fastening member, by a relative slip between the outer end of the rotational force transmission member and the inner end of the coned disc spring as well as a relative slip between the outer end of the coned disc spring and the inner
25 end of the washer.

According to an embodiment of the invention, the outer and inner circumferential edges of the coned disc spring are respectively in line contact with the outer face of the rotational force transmission member and the inner side of the washer along the circumferential direction.
30 Therefore, even though there are a large number of asperities over these contacted portions therebetween hence creating a large frictional coefficient, the inner and outer circumferential edges of the coned disc spring are locally pressed in a large magnitude onto the outer face of the rotational force transmission member and the inner side of the washer
35 along the circumferential direction, thereby causing the asperities of both

contacted portions to be flattened and smoothed, accordingly leading the frictional coefficients thereof to be greatly reduced.

5 According to another embodiment of the invention, since a portion notched off in a ring shape is formed in the outer circumferential edge at the inner side of the washer and the coned disc spring is then disposed in the portion notched off in a ring shape in the washer, the coned disc spring is securely put against the washer in a concentric position. Therefore, aligning the center of the coned disc spring with each center of
10 the rotational force transmission member and the washer is maintained with high accuracy.

An embodiment for the rotational force transmission member mounting structure with respect to the inventions according to claims 1 to 3 in the
15 present application will be described hereinafter with reference to Figs. 1 to 4.

In Fig. 1, an internal combustion engine 1 mounted on a motorcycle, which is not illustrated, is of a four-stroke single-cylinder internal
20 combustion engine. In the main body of the internal combustion engine 1, a cylinder block 3, a cylinder head 4 and a cylinder head cover 5 are stacked in sequence on a crankcase 2 made of aluminum alloy all of which are joined together in one unit.

25 As illustrated in Fig. 2, the crankcase 2 is separated into two parts, a left one and a right one, along a plane which passes through a cylinder hole center line 6, the plane being formed directed to the front and back of the vehicle. A crankshaft 7, a main shaft 8, a countershaft 9 and a balancer shaft 10, each directed in the width direction of the vehicle perpendicular
30 to the above separation plane, are pivotably supported on the left and right half bodies 2a and 2b of the crankcase.

In the cylinder block 3, a cylinder hole, which is not illustrated, having the cylinder hole center line 6 as a center therein is formed, and a piston (not
35 shown) is fitted into the cylinder hole freely slidably in the up-and-down direction. An upper end and a lower end of a connecting rod 12 are pivotably fitted into a piston pin, which is not illustrated, being inserted

into the piston in parallel to the crankshaft 7; and a crank pin 11 being inserted into a crank web 7a of the crankshaft 7 in parallel to the crankshaft 7. The piston is pushed downward due to the combustion of gaseous mixture in a combustion chamber located above the cylinder hole so that the crankshaft 7 is driven in rotation in the clockwise direction as shown Fig. 1.

As shown in Fig. 2, the drive gear 13 is fitted into the right end of the crankshaft 7 in a splined manner and combined therewith by use of a bolt 14. The rotational force transmission member mounting structure which will be described hereinafter can also be applied to the connection portion formed between the crankshaft 7 and the drive gear 13.

Likewise, a multi-plate clutch 15 is disposed at the right end of the main shaft 8; a driven gear 16 located at an input side of the multi-plate clutch 15 is pivotably fitted into the main shaft 8 of the multi-plate clutch 15. The main shaft 8 is formed as a hollow shaft, and a push rod 18 is inserted into the center hole 8a of the main shaft freely slidably in the right-and-left direction. A clutch cam 19 being adjacent to the left end of the push rod 18 is pivotably fitted into the left crankcase 2a in the direction perpendicular to the driven gear 16. A notch 19a being a quarter of a circle in shape is formed in the cylindrical-shaped clutch cam 19, and the push rod is pushed into the right direction through a rotation of the clutch cam 19 in a counterclockwise direction, thus causing the multi-plate clutch 15 to be interrupted from being connected.

Furthermore, a large number of transmission gears 20 are provided to the main shaft 8 and the countershaft 9 so as to constitute a gearbox 21. An engagement of the transmission gear 20 is selected through movement of the transmission gear 20 in the axial direction by means of a shifter, which is not illustrated, so that the gearbox 21 can be switched to a required gear ratio.

A drive sprocket 22 is fitted into the left end of the countershaft 9 in a splined manner; a ring-shaped coned disk spring 23 is put on the outer face of the drive sprocket 22; a washer 24 is further put on the outer face of the coned disk spring 23; a bolt 25 is then passed through the washer 24

and is rigidly screwed into the center portion at the left end of the countershaft 9; and a seamless chain 26 is bridged between the drive sprocket 22 and a driven sprocket connected to a rear axle, which is not illustrated.

5

The rotational force transmission member, the screw fastening member, the coned disc spring and the washer according to the claims herein respectively correspond to the drive sprocket 22, the bolt 25, the coned disc spring 23 and the washer 24.

10

As shown in Fig. 3, the coned disc spring 23 is formed along a surface of a cone having the vertex angle slightly less than 180 degree. With regard to the washer 24, a ring-shaped notch 24a is formed along the outer circumferential edge at the inner face of a thick circular plate in such a manner that an inner circumferential edge 23a at the outer face of the coned disc spring 23 can be gently fitted into an inner circumferential corner portion 24b of the ring-shaped notch 24a. Such a washer 24 is generally referred to as a stepped washer.

15

20 A chain dropping-off prevention section 28 is joined in advance with a sprocket protection cover 27, and this sprocket protection cover 27 is so provided that it is removably attachable to the left crankcase 2a.

The embodiment as shown in Figs. 1 to 4 is so arranged as described above that, when the internal combustion engine 1 is actuated and is in a driving mode, the crankshaft 7 is rotated in a clockwise direction in Fig. 1. When the multi-plate clutch 15 is set in a connecting mode, a driving force produced by the internal combustion engine 1 is transmitted to the drive sprocket 22 from the crankshaft 7 via the drive gear 13, the driven gear 16, 25 the multi-plate clutch 15, the main shaft 8, the transmission gear 20 and the countershaft 9, and is further transmitted to the rear wheel, which is not illustrated, via the seamless chain 26 being engaged with the drive sprocket 22.

30

35 In the driving mode of the internal combustion engine 1, the mixed gases in the combustion chamber, which is not illustrated, combusts every two rotations of the crankshaft 7 and a torque applied on the crankshaft 7

intermittently and considerably fluctuates. Therefore, even though a dumping means incorporated in the multi-plate clutch 15, a friction plate of the multi-plate clutch 15 and the like absorb in part the fluctuation in the torque, the fluctuation in the torque is still transmitted to the countershaft 9. There further exists a backlash in the portion at which the countershaft 9 and the drive sprocket 22 are fitted into each other in a splined manner, hence creating a small relative vibration along the circumferential direction between the countershaft 9 and the drive sprocket 22.

10

However, as shown in Fig. 4 in the present embodiment, the outer circumferential edge 23b at the inner side of the coned disc spring 23 is in line contact with the outer face 22a of the drive sprocket 22 and the inner circumferential edge 23a at the outer side of the coned disc spring 23 is also in line contact with the inner face 24c along the ring-shaped notch 24a of the washer 24. Therefore, a load per unit area in a large magnitude is applied over these line contact portions under which load a small relative vibration along the circumferential direction between the drive sprocket 22 and the washer 24 brings a surface of each line contact portion to a flat and smooth surface, thus causing the frictional coefficient thereof to be reduced. In consequence, the reduction of the frictional coefficient lowers the influence of the small vibration along the circumferential direction to the bolt 25.

15

Moreover, the inner circumferential edge 23c at the inner side of the coned disc spring 23 is positioned with a face 24d along a circumferential direction for the ring-shaped notch 24a of the washer 24 such that the center of the coned disc spring 23 aligns with each center of the washer 24 and the drive sprocket 22, thus enabling to maintain with the coned disc spring 23 a high absorbing effect for absorbing the small relative vibration along the circumferential direction.

20

Furthermore, as the washer 24 is thick, there is no possibility to cause the washer 24 to be deformed due to a spring reaction force generated by the coned disc spring 23, so that the washer 24 can rigidly be fitted to the countershaft 9 with the bolt 25.

25

It is particularly effective when a mounting structure for the sprocket as a rotation force transmission member is adapted to the drive sprocket 22 at an input side of which sprocket an internal combustion engine 1 in which irregular rotations is apt to occur is provided and to an output side of which sprocket an axle for which running resistance fluctuates by the irregularity of a road surface is connected, as in the case of this embodiment.

In the embodiment as shown in Figs. 1 to 4, the coned disc spring 23 and the washer 24 are mounted on the countershaft 9 by rigidly screwing the bolt 25 into the end of the countershaft 9. It is however also possible to realize the arrangement as disclosed in the present invention in such a way that as shown in Fig. 5, a male screw 30 is provided at the left end of the countershaft 9 in a protruding manner and a nut 31 is then screwed to the male screw 30.

Incidentally, an element in Fig. 5 is indicated by a reference numeral same as that indicating an element in Figs. 1 to 4 when both elements in the respective figures are identical.

In the embodiment as shown in Fig. 5, it is made possible to obtain a similar effect as that obtained by the embodiment as shown in Figs. 1 to 4 and to securely align the washer 24 with the male screw 30 integral with the countershaft 9.

While the drive sprocket 22 is adapted as a rotational force transmission member in the present embodiment, a pulley and a gear are also adaptable. In the above embodiment, although the four-stroke engine is illustrated, a two-stroke engine is also applicable.

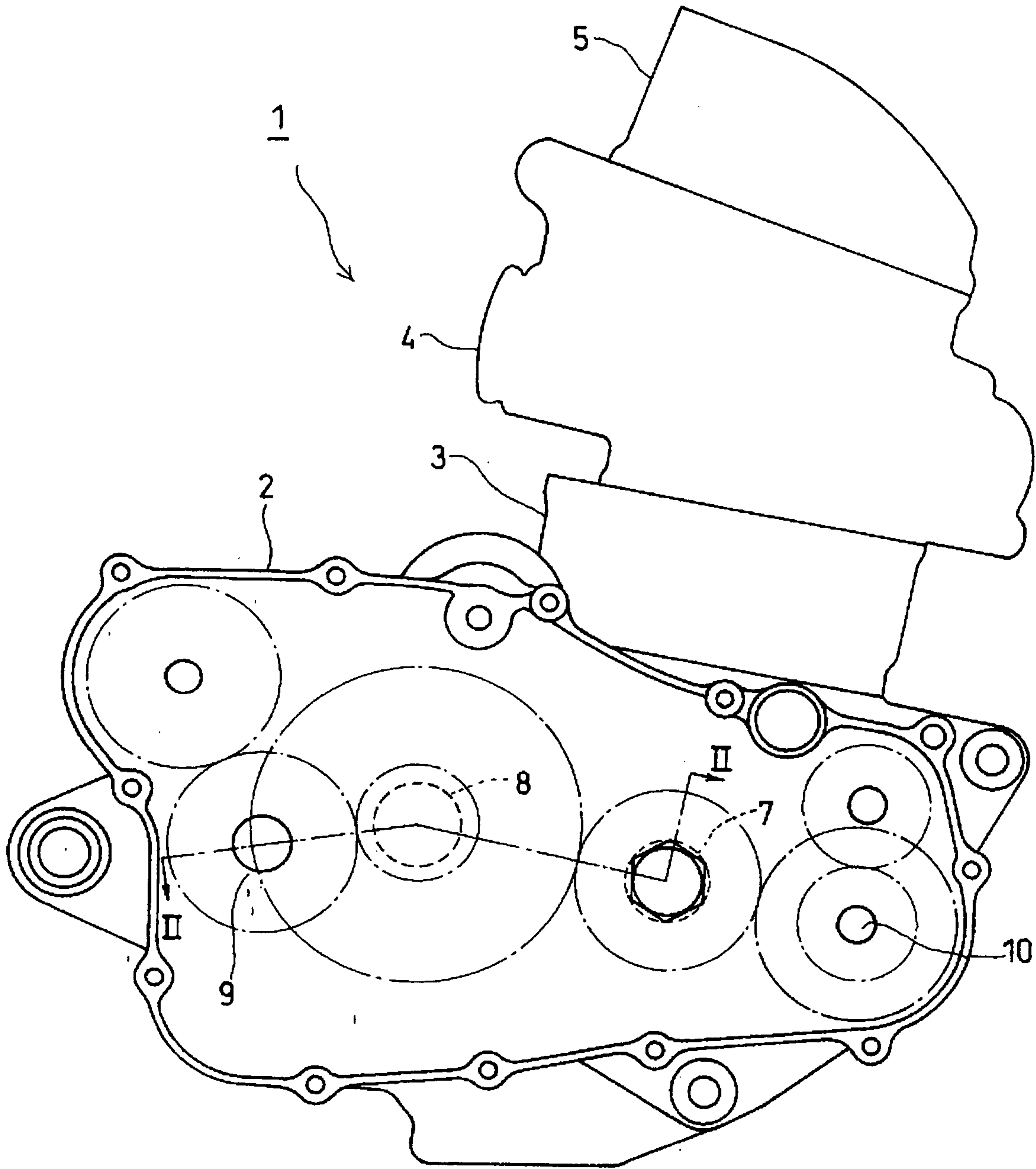
Although various preferred embodiments of the present invention have been described herein in detail, it will be appreciated by those skilled in the art, that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

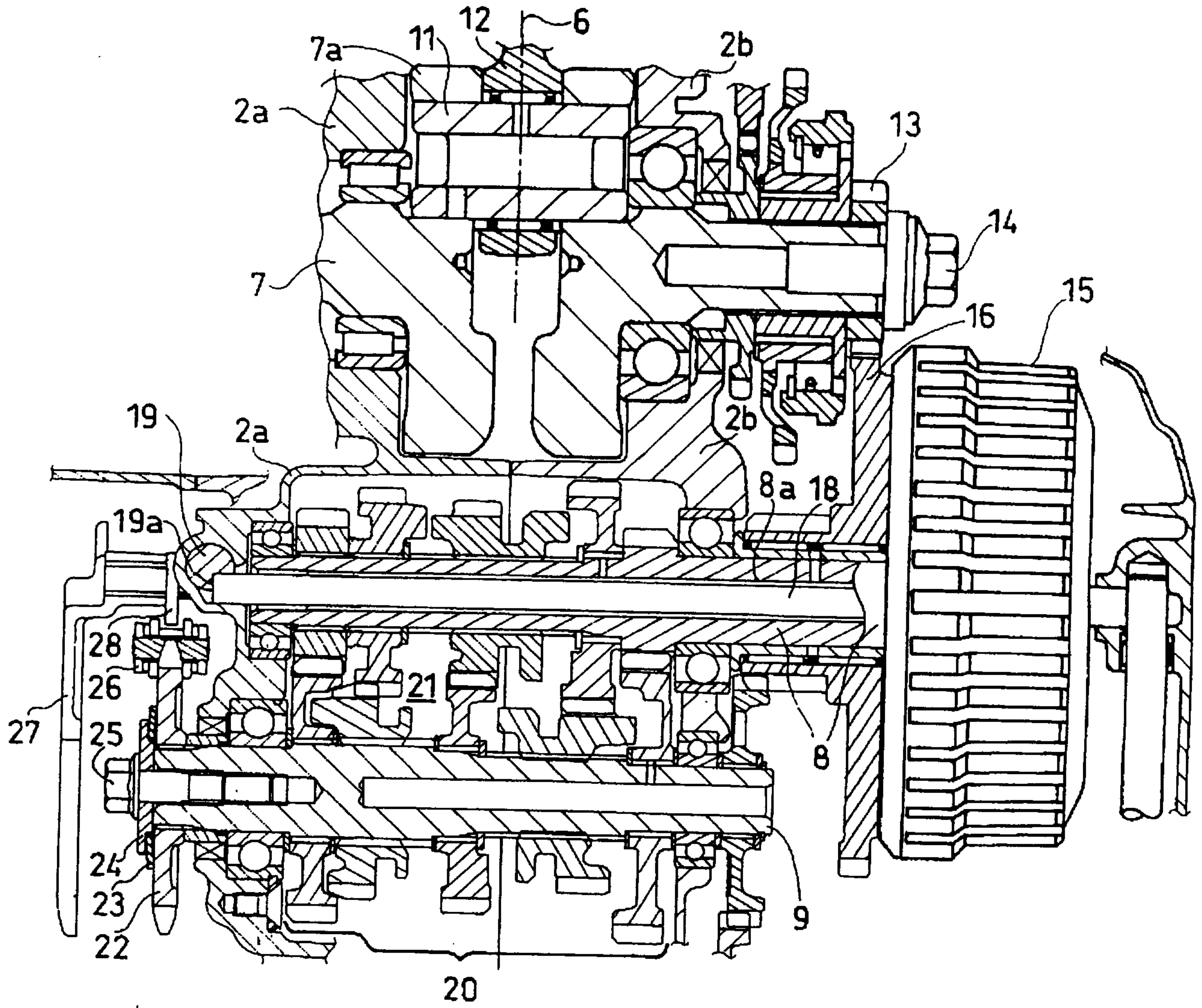
1. A rotational force transmission member mounting structure,
5 characterized in that a rotational force transmission member is fitted into an end of a rotating shaft in a splined manner; a coned disc spring and a washer are stacked in sequence onto a face at an outer end of the rotational force transmission member; and the coned disc spring and the washer are supported by, and interposed between, a screw fastening member to be
10 screwed into an end of the rotating shaft and the rotational force transmission member.
2. A rotational force transmission member mounting structure according to claim 1, characterized in that an outer circumferential edge of
15 the coned disc spring is in line contact with an outer face of the rotational force transmission member and an inner circumferential edge of the coned disc spring is in line contact with a face at an inner side of the washer.
- 20 3. A rotational force transmission member mounting structure according to any one of claims 1 and 2, characterized in that an outer circumferential portion at an inner side of the washer is notched off in a ring shape and the coned disc spring is disposed in the portion notched off in the ring-shape.

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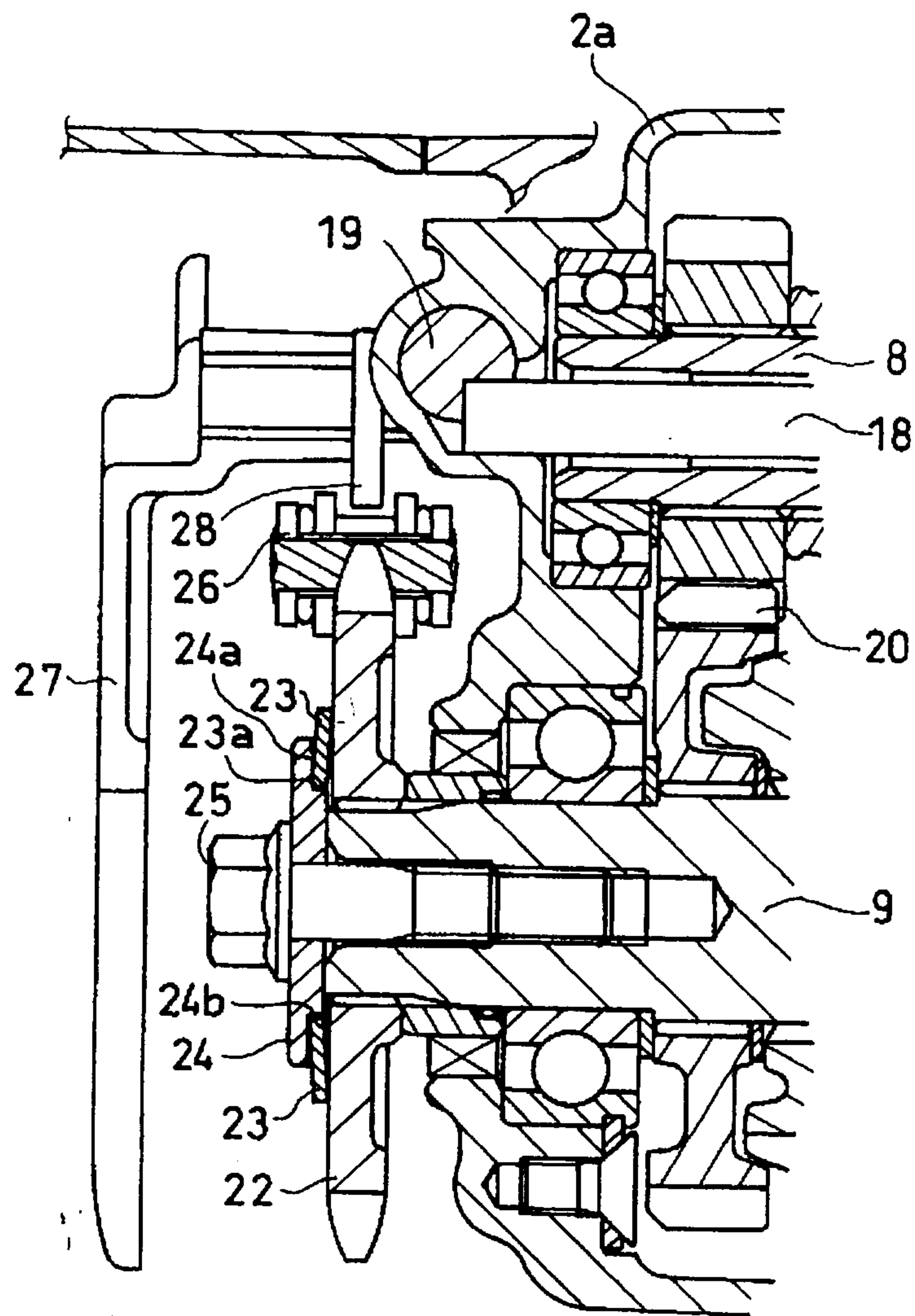
[FIG. 1]



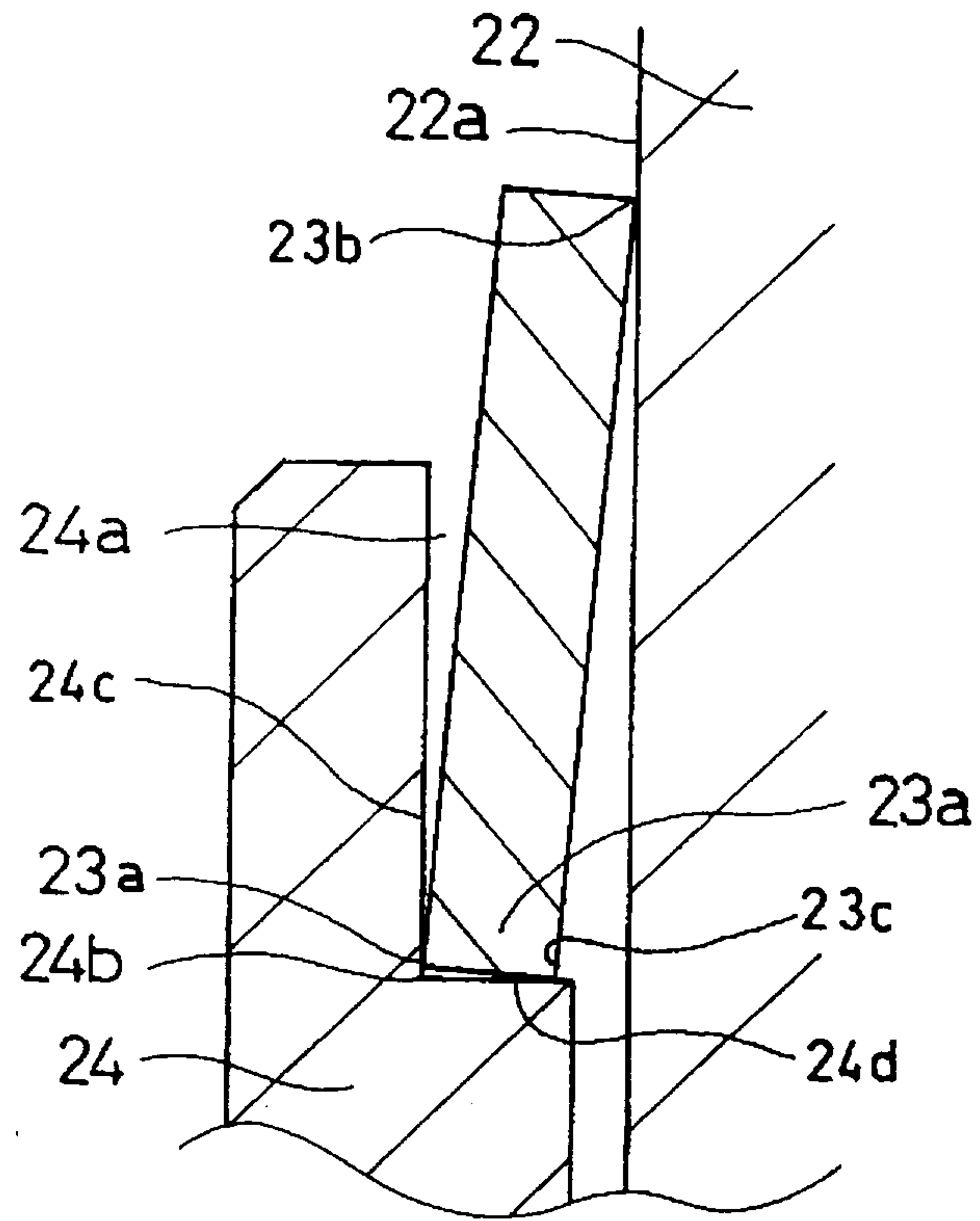
[FIG. 1]



[FIG. 3]



[FIG. 4]



[FIG. 5]

