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(54) **POWER TRANSMISSION DEVICE**
LEISTUNGSÜBERTRAGUNGSVORRICHTUNG
DISPOSITIF DE TRANSMISSION DE PUISSANCE

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Description

Technical Field

[0001] The present invention relates to a power transmission device that can transmit rotational force of an input member to an output member or interrupt the rotational force as desired.

Background Art

[0002] In general, a power transmission device mounted on a motorcycle is intended to transmit the driving power of an engine to a transmission and a driving wheel or interrupt the driving power as desired and includes an input member, which is coupled toward the engine, an output member, which is coupled toward the transmission and the driving wheel, and a clutch member, which is coupled to the output member. Power is transmitted by bringing a plurality of driving-side clutch discs and driven-side clutch discs provided into press-contact and the transmission of the power is interrupted by releasing the press-contact force thereof.

[0003] More specifically, as disclosed in e.g. Patent Literature (PTL) 1, a prior-art power transmission device includes a clutch housing, which rotates with an input member and on which a plurality of driving-side clutch discs are mounted, a plurality of driven-side clutch discs, which are arranged alternately with the driving-side clutch discs of the clutch housing, a clutch member, which is coupled to an output member, and a pressure member, which is attached to the clutch member while being allowed to move in an axial direction of the clutch member and can bring the driving-side clutch discs and the driven-side clutch discs into press-contact or release the press-contact force with the axial movement relative to the clutch member. The prior-art power transmission device is structured to be capable of transmitting the rotational force input to the input member to the output member or interrupting the rotational force by bringing the driving-side clutch discs and the driven-side clutch discs into press-contact or releasing the press-contact force thereof.

[0004] Further, a press-contact assisting cam and a back-torque limiting cam are provided in the prior-art power transmission device. The press-contact assisting cam can increase the press-contact force of the driving-side clutch discs and the driven-side clutch discs when the pressure member and the clutch member relatively rotate to move closer to each other if a state in which the rotational force input to the input member can be transmitted to the output member is established. The back-torque limiting cam releases the press-contact force of the driving-side clutch discs and the driven-side clutch discs when the pressure member and the clutch member relatively rotate to move away from each other if the rotational speed of the output member exceeds the rotational speed of the input member.

[0005] Further, the prior-art power transmission device includes a resistant member made of a rubber material or the like, which is for generating sliding resistance against the pressure member when the pressure member rotates relative to the clutch member. Accordingly, the resistant member can generate rotational resistance when the pressure member and the clutch member relatively rotate owing to clearance caused between cam surfaces of the press-contact assisting cam or the back-torque limiting cam. Thus, impact or hitting noise accompanied when the cam surfaces abut on each other can be suppressed.

Citation List

Patent Literature

[0006] PTL 1: Japanese Unexamined Patent Application Publication No. 2013-137039 Further, in US 2017/0159725 A1, EP 2 781 781 A1, EP 2 530 348 A1 and JP H05 71554 A clutch devices for motorcycles are disclosed which include a clutch housing, a clutch member, a pressure member, a restricting member, a clutch spring and a press-contact assisting cam or a back-torque limiting cam.

Summary of Invention

Technical Problem

[0007] However, the prior-art power transmission device includes a resistant member made of a rubber material or the like, which is for generating sliding resistance against the pressure member when the pressure member rotates relative to the clutch member. This involves problems of increase in the number of components and need for frequent maintenance, which is caused if the rubber material is worn considerably.

[0008] Therefore, the present applicant has focused attention on a clutch spring for adding urging force in an axial direction to a pressure member and reached a review of utilizing the clutch spring to generate rotational resistance when the pressure member rotates relative to the clutch member. That is, utilization of a clutch spring that adds urging force in an axial direction to a pressure member can generate sliding resistance in a rotational direction suitable for the axial urging force and can generate rotational resistance in the rotational direction accurately and easily without employing any other dedicated component of a rubber material or the like.

[0009] The present invention has been made in view of such circumstances to provide a power transmission device that can add rotational resistance to the rotation of a pressure member relative to a clutch member by using a clutch spring and can suppress impact or hitting noise accompanied when cam surfaces of a press-contact assisting cam or a back torque limiting cam abut on each other without employing any other dedicated mem-

ber.

Solution to Problem

[0010] According to the invention of Claim 1, a power transmission device includes: a clutch housing that rotates with an input member and to which a plurality of driving-side clutch discs are attached; a clutch member to which a plurality of driven-side clutch discs are attached and that is coupled to an output member, the driven-side clutch discs being arranged alternately with the driving-side clutch discs of the clutch housing; a pressure member that is attached to the clutch member while being allowed to move in an axial direction of the clutch member and is capable of bringing the driving-side clutch discs and the driven-side clutch discs into press-contact with movement in the axial direction relative to the clutch member or releasing press-contact force thereof; a restricting member that is attached to the clutch member and is capable of restricting movement of the pressure member away from the clutch member by a predetermined dimension; a clutch spring that is attached by one end of the clutch spring abutting on a surface of the restricting member and adds urging force to the pressure member in a direction in which the driving-side clutch discs and the driven-side clutch discs are brought into the press-contact; and a press-contact assisting cam or a back-torque limiting cam, the press-contact assisting cam being capable of increasing the press-contact force of the driving-side clutch discs and the driven-side clutch discs when the pressure member and the clutch member relatively rotate to move closer to each other if a state in which rotational force input to the input member is transmittable to the output member is established, the back-torque limiting cam releasing the press-contact force of the driving-side clutch discs and the driven-side clutch discs when the pressure member and the clutch member relatively rotate to move away from each other if a rotational speed of the output member exceeds a rotational speed of the input member. The power transmission device is capable of transmitting the rotational force input to the input member to the output member or interrupting the rotational force through the press-contact of the driving-side clutch discs and the driven-side clutch discs or the releasing of the press-contact force thereof. In the power transmission device, the clutch spring is accommodated and attached in a depressed portion provided in the pressure member and when the pressure member rotates relative to the clutch member owing to clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring is capable of generating rotational resistance by the one end being allowed to slide on a surface of the restricting member while an outer circumferential side surface in the longitudinal direction abuts and is held on an inner circumferential wall surface of the depressed portion. The dimension of the clearance between cam surfaces of the press-contact assisting cam or the back torque limiting

cam is set so as to be larger than the value obtained by subtracting the dimension of the outside diameter of the clutch spring from the dimension of the opening diameter of the depressed portion..

[0011] According to the invention of Claim 2, a power transmission device includes: a clutch housing that rotates with an input member and to which a plurality of driving-side clutch discs are attached; a clutch member to which a plurality of driven-side clutch discs are attached and that is coupled to an output member, the driven-side clutch discs being arranged alternately with the driving-side clutch discs of the clutch housing; a pressure member that is attached to the clutch member while being allowed to move in an axial direction of the clutch member and is capable of bringing the driving-side clutch discs and the driven-side clutch discs into press-contact with movement in the axial direction relative to the clutch member or releasing press-contact force thereof; a restricting member that is attached to the clutch member and is capable of restricting movement of the pressure member away from the clutch member by a predetermined dimension; a clutch spring that is attached by one end of the clutch spring abutting on a surface of the restricting member and adds urging force to the pressure member in a direction in which the driving-side clutch discs and the driven-side clutch discs are brought into the press-contact; and a press-contact assisting cam or a back-torque limiting cam, the press-contact assisting cam being capable of increasing the press-contact force of the driving-side clutch discs and the driven-side clutch discs when the pressure member and the clutch member relatively rotate to move closer to each other if a state in which rotational force input to the input member is transmittable to the output member is established, the back-torque limiting cam releasing the press-contact force of the driving-side clutch discs and the driven-side clutch discs when the pressure member and the clutch member relatively rotate to move away from each other if a rotational speed of the output member exceeds a rotational speed of the input member. The power transmission device is capable of transmitting the rotational force input to the input member to the output member or interrupting the rotational force through the press-contact of the driving-side clutch discs and the driven-side clutch discs or the releasing of the press-contact force thereof. In the power transmission device, the clutch spring is accommodated and attached in an accommodating member attached to the pressure member and when the pressure member rotates relative to the clutch member owing to clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring is capable of generating rotational resistance by the one end being allowed to slide on a surface of the restricting member while an outer circumferential side surface in the longitudinal direction abuts and is held on an inner circumferential wall surface of the accommodating member. The dimension of the clearance between cam surfaces of the press-contact assisting cam or the

back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the outside diameter of the clutch spring from the dimension of the opening diameter of the accommodating member.

[0012] According to the invention of Claim 3, a power transmission device includes: a clutch housing that rotates with an input member and to which a plurality of driving-side clutch discs are attached; a clutch member to which a plurality of driven-side clutch discs are attached and that is coupled to an output member, the driven-side clutch discs being arranged alternately with the driving-side clutch discs of the clutch housing; a pressure member that is attached to the clutch member while being allowed to move in an axial direction of the clutch member and is capable of bringing the driving-side clutch discs and the driven-side clutch discs into press-contact with movement in the axial direction relative to the clutch member or releasing press-contact force thereof; a restricting member that is attached to the clutch member and is capable of restricting movement of the pressure member away from the clutch member by a predetermined dimension; a clutch spring that is attached by one end of the clutch spring abutting on a surface of the restricting member and adds urging force to the pressure member in a direction in which the driving-side clutch discs and the driven-side clutch discs are brought into the press-contact; and a press-contact assisting cam or a back-torque limiting cam, the press-contact assisting cam being capable of increasing the press-contact force of the driving-side clutch discs and the driven-side clutch discs when the pressure member and the clutch member relatively rotate to move closer to each other if a state in which rotational force input to the input member is transmittable to the output member is established, the back-torque limiting cam releasing the press-contact force of the driving-side clutch discs and the driven-side clutch discs when the pressure member and the clutch member relatively rotate to move away from each other if a rotational speed of the output member exceeds a rotational speed of the input member. The power transmission device is capable of transmitting the rotational force input to the input member to the output member or interrupting the rotational force through the press-contact of the driving-side clutch discs and the driven-side clutch discs or the releasing of the press-contact force thereof. In the power transmission device, the clutch spring is inserted and attached in a boss portion provided in the clutch member and when the pressure member rotates relative to the clutch member owing to clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring is capable of generating rotational resistance by an other end being allowed to slide on the surface of the spring seat that constitutes a seat surface of the clutch spring while an inner circumferential side surface in the longitudinal direction abuts and is held on an outer circumferential surface of the boss portion. The dimension of the clearance between cam surfaces of the press-contact assisting cam

or the back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the diameter of the boss portion from the dimension of the inner diameter of the clutch spring.

[0013] According to the invention of Claim 4, in the power transmission device of Claim 1 or 2, the restricting member is formed by hardening a sliding surface on which at least the one end of the clutch spring slides.

[0014] According to the invention of Claim 5, in the power transmission device of Claim 3, the spring seat is formed by hardening a sliding surface on which at least the other end of the clutch spring slides.

Advantageous Effects of Invention

[0015] According to the invention of Claim 1, the clutch spring is accommodated and attached in a depressed portion provided in the pressure member and when the pressure member rotates relative to the clutch member owing to clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring is capable of generating rotational resistance by the one end being allowed to slide on a surface of the restricting member while an outer circumferential side surface in the longitudinal direction abuts and is held on an inner circumferential wall surface of the depressed portion. The dimension of the clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the outside diameter of the clutch spring from the dimension of the opening diameter of the depressed portion.. Accordingly, rotational resistance can be added to the rotation of the pressure member relative to the clutch member by using the clutch spring, and impact or hitting noise accompanied when the cam surfaces of the press-contact assisting cam or the back torque limiting cam abut on each other can be suppressed without employing any other dedicated member. Furthermore, the inner circumferential wall surface of the depressed portion can prevent the clutch spring from leaning or bending when rotational resistance is generated, and necessary rotational resistance can be generated with higher reliability.

[0016] According to the invention of Claim 2, the clutch spring is accommodated and attached in an accommodating member attached to the pressure member and when the pressure member rotates relative to the clutch member owing to clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring is capable of generating rotational resistance by the one end being allowed to slide on a surface of the restricting member while an outer circumferential side surface in the longitudinal direction abuts and is held on an inner circumferential wall surface of the accommodating member. The dimension of the clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam is set so as to be larger than the value obtained by subtracting the

dimension of the outside diameter of the clutch spring from the dimension of the opening diameter of the accommodating member. Accordingly, the inner circumferential wall surface of the accommodating member can prevent the clutch spring from leaning or bending when rotational resistance is generated, and necessary rotational resistance can be generated with higher reliability.

[0017] According to the invention of Claim 3, the clutch spring is inserted and attached in a boss portion provided in the clutch member and when the pressure member rotates relative to the clutch member owing to clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring is capable of generating rotational resistance by an other end being allowed to slide on the surface of the spring seat that constitutes a seat surface of the clutch spring while an inner circumferential side surface in the longitudinal direction abuts and is held on an outer circumferential surface of the boss portion. The dimension of the clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the diameter of the boss portion from the dimension of the inner diameter of the clutch spring. Accordingly, the outer circumferential surface of the boss portion can prevent the clutch spring from leaning or bending when rotational resistance is generated, and necessary rotational resistance can be generated with higher reliability.

[0018] According to the invention of Claim 4, the restricting member is formed by hardening a sliding surface on which at least the one end of the clutch spring slides. Thus, wearing of the sliding surface of the restricting member due to repeated sliding can be suppressed and poor movement caused by the wearing can be prevented.

[0019] According to the invention of Claim 5, the spring seat is formed by hardening a sliding surface on which at least the other end of the clutch spring slides. Thus, wearing of the sliding surface of the spring seat due to repeated sliding can be suppressed and poor movement caused by the wearing can be prevented.

Brief Description of Drawings

[0020]

[Fig. 1] An overall longitudinal cross-sectional view illustrating a power transmission device according to a first embodiment of the present invention.

[Fig. 2] A schematic diagram illustrating a clutch-member-side first cam surface and a pressure-member-side first cam surface that constitute a press-contact assisting cam in the power transmission device.

[Fig. 3] A perspective view illustrating a state in which a pressure member is combined with a clutch member in the power transmission device.

[Fig. 4] A plan view illustrating a state in which the

pressure member is combined with the clutch member in the power transmission device.

[Fig. 5] A cross-sectional view along the line A1-A1 in Fig. 4.

[Fig. 6] An exploded perspective view illustrating the clutch member, the pressure member, and a restricting member in the power transmission device.

[Fig. 7] An exploded perspective view illustrating the clutch member, the pressure member, and the restricting member in the power transmission device.

[Fig. 8] A plan view and a rear view illustrating the clutch member in the power transmission device.

[Fig. 9] A plan view and a rear view illustrating the pressure member in the power transmission device.

[Fig. 10] A plan view and a rear view illustrating the restricting member in the power transmission device.

[Fig. 11] A side view and a front view illustrating a clutch spring in the power transmission device.

[Fig. 12] A schematic diagram illustrating the action of the press-contact assisting cam in the power transmission device.

[Fig. 13] A schematic diagram illustrating the action of a back torque limiting cam in the power transmission device.

[Fig. 14] A cross-sectional view illustrating a process (a state before sliding) in which the clutch spring slides on a surface of the restricting member in the power transmission device.

[Fig. 15] A cross-sectional view illustrating the process (a state during the sliding) in which the clutch spring slides on the surface of the restricting member in the power transmission device.

[Fig. 16] A cross-sectional view illustrating the process (a state after the sliding) in which the clutch spring slides on the surface of the restricting member in the power transmission device.

[Fig. 17] An overall longitudinal cross-sectional view illustrating a power transmission device according to a second embodiment of the present invention.

[Fig. 18] A schematic diagram illustrating a clutch-member-side first cam surface and a pressure-member-side first cam surface that constitute a press-contact assisting cam in the power transmission device.

[Fig. 19] A perspective view illustrating a state in which a pressure member is combined with a clutch member in the power transmission device.

[Fig. 20] A plan view illustrating a state in which the pressure member is combined with the clutch member in the power transmission device.

[Fig. 21] A cross-sectional view along the line A2-A2 in Fig. 20.

[Fig. 22] An exploded perspective view illustrating the clutch member, the pressure member, a restricting member, and an accommodating member in the power transmission device.

[Fig. 23] An exploded perspective view illustrating the clutch member, the pressure member, the re-

stricting member, and the accommodating member in the power transmission device.

[Fig. 24] A plan view and a rear view illustrating the clutch member in the power transmission device.

[Fig. 25] A plan view and a rear view illustrating the pressure member in the power transmission device.

[Fig. 26] A plan view and a rear view illustrating the restricting member in the power transmission device.

[Fig. 27] A plan view and a rear view illustrating the accommodating member in the power transmission device.

[Fig. 28] A cross-sectional view along the line A3-A3 in Fig. 27.

[Fig. 29] A cross-sectional view illustrating a process (a state before sliding) in which a clutch spring slides on a surface of the restricting member in the power transmission device.

[Fig. 30] A cross-sectional view illustrating the process (a state during the sliding) in which the clutch spring slides on the surface of the restricting member in the power transmission device.

[Fig. 31] A cross-sectional view illustrating the process (a state after the sliding) in which the clutch spring slides on the surface of the restricting member in the power transmission device.

[Fig. 32] An overall longitudinal cross-sectional view illustrating a power transmission device according to a third embodiment of the present invention.

[Fig. 33] A perspective view illustrating a state in which a pressure member is combined with a clutch member in the power transmission device.

[Fig. 34] A plan view illustrating a state in which the pressure member is combined with the clutch member in the power transmission device.

[Fig. 35] A cross-sectional view along the line A4-A4 in Fig. 34.

[Fig. 36] An exploded perspective view illustrating the clutch member, the pressure member, and a restricting member in the power transmission device.

[Fig. 37] An exploded perspective view illustrating the clutch member, the pressure member, and the restricting member in the power transmission device.

[Fig. 38] A plan view and a rear view illustrating the clutch member in the power transmission device.

[Fig. 39] A plan view and a rear view illustrating the pressure member in the power transmission device.

[Fig. 40] A plan view and a rear view illustrating the restricting member in the power transmission device.

[Fig. 41] A cross-sectional view illustrating a process (a state before sliding) in which a clutch spring slides on a surface of the restricting member in the power transmission device.

[Fig. 42] A cross-sectional view illustrating the process (a state during the sliding) in which the clutch spring slides on the surface of the restricting member in the power transmission device.

[Fig. 43] A cross-sectional view illustrating the process (a state after the sliding) in which the clutch

spring slides on the surface of the restricting member in the power transmission device.

Description of Embodiments

[0021] Embodiments of the present invention are specifically described below with reference to the drawings.

[0022] A power transmission device according to a first embodiment, which is obtainable by die casting, is arranged in a vehicle, such as a two-wheel vehicle, to transmit the driving power of an engine toward a transmission or a driving wheel or interrupt the driving power as desired. As illustrated in Figs. 1 to 11, the power transmission device is mainly made up of a clutch housing 2 on which a gear 1 as an input member is provided, a clutch member 4 coupled to a shaft 3 as an output member, a pressure member 5 provided on the right end side of the clutch member 4 in Fig. 1, driving-side clutch discs 6 coupled toward the clutch housing 2 and driven-side clutch discs 7 coupled toward the clutch member 4, clutch-member-side first cam surfaces 4a and clutch-member-side second cam surfaces 4b included in the clutch member 4, pressure-member-side first cam surfaces 5a and pressure-member-side second cam surfaces 5b included in the pressure member 5, clutch springs 8, and a restricting member 10. In the drawings, each reference character "S" denotes a damper and each reference character "N" denotes a needle bearing.

[0023] The gear 1 is enabled to rotate about the shaft 3 if the driving force (rotational force) transmitted from the engine is input, and is coupled to the clutch housing 2 with a rivet R or the like. The clutch housing 2 is constituted by a case member like a cylinder that is opened on its right end side in Fig. 1. In the inner circumferential wall of the clutch housing 2, a spline (a spline fitting portion 2a) is provided and the plurality of driving-side clutch discs 6 are attached to the spline fitting portion 2a. Each of the driving-side clutch discs 6 is made of a board material formed like an approximately annular ring and is structured to be capable of rotating with the clutch housing 2 and sliding in the axial direction (the left-right direction in Fig. 1) by being fitted in the spline fitting portion 2a provided in the inner circumferential surface of the clutch housing 2.

[0024] A member provided in the clutch housing 2 constitutes the clutch member 4. The shaft 3 as an output member passes in an approximately central portion of the clutch member 4, and the clutch member 4 and the shaft 3 are coupled to each other by spline fitting and structured so that if the clutch member 4 rotates, the shaft 3 rotates as well. As illustrated in Figs. 6 and 7, a spline (a spline fitting portion 4c) extending in the axial direction (the up-down direction in Figs. 6 and 7) is provided in the outer circumferential side surface of the clutch member 4, and the driven-side clutch discs 7 are fitted in and attached to the spline fitting portion 4c.

[0025] More specifically, as illustrated in Figs. 6 and 7, the spline (the spline fitting portion 4c) provided in the

clutch member 4 is structured to have an uneven shape that is integrally formed in the outer circumferential side surface of the clutch member 4 approximately all around the circumference, and structured so that, by the driven-side clutch discs 7 being fitted in the depressed grooves that constitute the spline, movement of the driven-side clutch discs 7 in the rotational direction is restricted while their axial movement relative to the clutch member 4 is allowed, and rotation with the clutch member 4 is enabled.

[0026] The driven-side clutch discs 7 and the driving-side clutch discs 6 are alternately arranged to be stacked, and each clutch disc 6 and each clutch disc 7, that are adjacent are brought into press-contact or the press-contact force thereof is released. That is, both the clutch discs 6 and the clutch discs 7 are allowed to slide in the axial direction of the clutch member 4, and when pressed by the pressure member 5 in the leftward direction in Fig. 1, are brought into press-contact and the rotational force of the clutch housing 2 becomes transmittable to the shaft 3 through the clutch member 4. When the pressure member 5 cancels the pressing, the press-contact force is released and the clutch member 4 stops following the rotation of the clutch housing 2 and halts such that the transmission of the rotational force to the shaft 3 is stopped.

[0027] The pressure member 5 is attached in a position on the right end side of the clutch member 4 in Fig. 1 while being allowed to move in the axial direction (the left-right direction in Fig. 1) of the clutch member 4 and can bring the driving-side clutch discs 6 and the driven-side clutch discs 7 into press-contact or release the press-contact force thereof with the axial movement relative to the clutch member 4. More specifically, the pressure member 5 is normally urged by the clutch spring 8 in the leftward direction in Fig. 1 and in the shaft 3, a push rod 9 extending in its axial direction is provided. The push rod 9 can be caused to project in the rightward direction in Fig. 1 by a driver operating an operation means, such as an unillustrated clutch lever, and the pressure member 5 can be moved in the rightward direction against the urging force of the clutch spring 8 (i.e. in the direction away from the clutch member 4).

[0028] Thus, when the pressure member 5 moves in the rightward direction, the press-contact force of the driving-side clutch discs 6 and the driven-side clutch discs 7 is released, and the rotational force input to the gear 1 and the clutch housing 2 is interrupted without being transmitted to the clutch member 4 and the shaft 3. That is, the pressure member 5 is structured to be capable of bringing the driving-side clutch discs 6 and the driven-side clutch discs 7 into press-contact or releasing the press-contact force thereof with the axial movement relative to the clutch member 4.

[0029] Further, as illustrated in Fig. 2 and Figs. 5 to 9, the clutch member 4 and the pressure member 5 include the clutch-member-side first cam surfaces 4a and the clutch-member-side second cam surfaces 4b, and the

pressure-member-side first cam surfaces 5a and the pressure-member-side second cam surfaces 5b, respectively, which are each constituted by an inclined surface inclined at a predetermined angle. Accordingly, the clutch-member-side first cam surfaces 4a and the pressure-member-side first cam surfaces 5a are caused to face each other to form a press-contact assisting cam while the clutch-member-side second cam surfaces 4b and the pressure-member-side second cam surfaces 5b are caused to face each other to form a back torque limiting cam.

[0030] The press-contact assisting cam can increase the press-contact force of the driving-side clutch discs 6 and the driven-side clutch discs 7 when the pressure member 5 and the clutch member 4 relatively rotate and move closer to each other if a state in which the rotational force input to the clutch housing 2 (the input member) can be transmitted to the shaft 3 (the output member) is established. That is, the press-contact assisting cam is structured so that, if a state in which the rotational force input to the clutch housing 2 (the input member) can be transmitted to the shaft 3 (the output member) is established, the clutch member 4 rotates relative to the pressure member 5 in the direction "a" as indicated in Fig. 12, and accordingly, the clutch-member-side first cam surfaces 4a and the pressure-member-side first cam surfaces 5a abut on each other and the action of the cam of the cam surfaces moves the pressure member 5 in the direction "b" to increase the press-contact force of the driving-side clutch discs 6 and the driven-side clutch discs 7.

[0031] The back torque limiting cam releases the press-contact force of the driving-side clutch discs 6 and the driven-side clutch discs 7 when the pressure member 5 and the clutch member 4 relatively rotate and move away from each other if the rotational speed of the shaft 3 (the output member) exceeds the rotational speed of the clutch housing 2 (the input member). That is, the back torque limiting cam is structured so that the clutch member 4 rotates relative to the pressure member 5 in the direction "c" as indicated in Fig. 13 if the rotational speed of the shaft 3 (the output member) exceeds the rotational speed of the clutch housing 2 (the input member), and accordingly, the clutch-member-side second cam surfaces 4b and the pressure-member-side second cam surfaces 5b abut on each other and the action of the cam of the cam surfaces moves the pressure member 5 in the direction "d" to release the press-contact force of the driving-side clutch discs 6 and the driven-side clutch discs 7.

[0032] The restricting member 10 is constituted by a member like an annular ring (see Fig. 10) for restricting the movement of the pressure member 5 beyond a predetermined dimension in a direction in which the pressure member 5 moves away from the clutch member 4. As illustrated in Fig. 1 and Figs. 3 to 5, the restricting member 10 is attached at ends of boss portions 4d, which are provided in the clutch member 4, and fixed with bolts B.

In a state in which the restricting member 10 is fixed to the clutch member 4 with the bolts B, a surface 10a of the restricting member 10 faces the pressure member 5 and a back surface 10b of the restricting member 10 faces the outside of the device.

[0033] In the pressure member 5 according to the present embodiment, as illustrated in Figs. 6 and 9, a plurality of (three in the present embodiment) depressed portions 5c are provided at regular intervals in a circumferential direction and, as illustrated in Figs. 1 and 5, the clutch springs 8 are accommodated and attached in the corresponding depressed portions 5c. The clutch spring 8 is attached while its one end 8a abuts on the surface 10a of the restricting member 10 and its other end 8b abuts on the bottom surface of the depressed portion 5c or the vicinity of the bottom surface, and can add urging force to the pressure member 5 in a direction in which the driving-side clutch discs 6 and the driven-side clutch discs 7 are brought into press-contact (the axial direction).

[0034] Specifically, as illustrated in Fig. 11, the clutch spring 8 is constituted by a coil spring that extends in a spiral from the one end 8a to the other end 8b and structured to have an outer circumferential side surface 8c and an inner circumferential side surface 8d in its longitudinal direction (the direction from the one end 8a toward the other end 8b). Thus, when the clutch springs 8 are accommodated in the depressed portions 5c and then the restricting member 10 is fixed at ends of the boss portions 4d, the restricting member 10 shrinks the clutch springs 8 to add urging force to the pressure member 5 in the direction in which the driving-side clutch discs 6 and the driven-side clutch discs 7 are brought into press-contact (the axial direction).

[0035] The clutch spring 8 according to the present embodiment is structured so that, when the pressure member 5 rotates relative to the clutch member 4 owing to the clearance between the cam surfaces of the press-contact assisting cam or the back torque limiting cam (in the present embodiment, the clearance caused between the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a or the clearance caused between the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b), the one end 8a slides on the surface 10a of the restricting member 10 while a side surface (the outer circumferential side surface 8c) is held in the longitudinal direction, and rotational resistance can be generated accordingly.

[0036] The clutch springs 8 according to the present embodiment are accommodated and attached in the depressed portions 5c provided in the pressure member 5 and are structured so that, when the pressure member 5 rotates relative to the clutch member 4 owing to the press-contact assisting cam or the back torque limiting cam, the outer circumferential side surfaces 8c in the longitudinal direction abut and are held on the inner circumferential wall surfaces 5d of the depressed portions

5c.

[0037] For example, as illustrated in Fig. 14, when the back torque limiting cam operates in a state (a set state) in which the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a that constitute the press-contact assisting cam abut on each other and the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam face each other with clearance of a dimension t , as illustrated in Fig. 15, as the pressure member 5 rotates relative to the clutch member 4, the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a that constitute the press-contact assisting cam move away from each other and the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam move closer to each other.

[0038] As illustrated in Fig. 16, when the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam abut on each other and the pressure member 5 further rotates relative to the clutch member 4, the action of the cam moves the pressure member 5 and the clutch member 4 away from each other and releases the press-contact force of the driving-side clutch discs 6 and the driven-side clutch discs 7.

[0039] When the operation of the back torque limiting cam is completed and the set state is recovered, with the rotation of the pressure member 5 relative to the clutch member 4, the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a that constitute the press-contact assisting cam move closer to each other (see Fig. 15) and then abut on each other (see Fig. 14) while the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam move away from each other (see Figs. 14 and 15).

[0040] In the clutch spring 8 according to the present embodiment, when the back torque limiting cam operates from the set state (and also, similarly, when the operation of the back torque limiting cam is completed and the set state is recovered), as illustrated in Fig. 15, the outer circumferential side surface 8c in the longitudinal direction abuts and is held on the inner circumferential wall surface 5d of the depressed portion 5c and leaning or bending due to rotational force is suppressed while the one end 8a slides on the surface 10a of the restricting member 10 to generate rotational resistance. Accordingly, impact caused when the cam surfaces abut on each other can be eased and hitting noise can be suppressed.

[0041] In particular, in the present embodiment, the dimension t of the clearance between the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the outside diameter of the clutch spring 8 (the diameter of the outer

circumferential side surface 8c) from the dimension of the opening diameter of the depressed portion 5c. As a result, rotational resistance can be added with higher reliability while leaning or bending of the clutch spring 8 can be suppressed.

[0042] Thus, at normal times, the clutch spring 8 according to the present embodiment has a function of adding urging force in the axial direction and bringing the driving-side clutch discs 6 and the driven-side clutch discs 7 into press-contact and a function of generating rotational resistance by the one end 8a sliding on a surface of the restricting member 10 when the pressure member 5 rotates relative to the clutch member 4 owing to the clearance between the cam surfaces of the back torque limiting cam (or the press-contact assisting cam).

[0043] Next, a second embodiment of the present invention is described.

[0044] Similar to the first embodiment, a power transmission device according to the second embodiment, which is obtainable by die casting, is arranged in a vehicle, such as a two-wheel vehicle, to transmit the driving power of an engine to a transmission or a driving wheel or interrupt the driving power as desired. As illustrated in Figs. 17 to 28, the power transmission device is mainly made up of a clutch housing 2 on which a gear 1 as an input member is provided, a clutch member 4 coupled to a shaft 3 as an output member, a pressure member 5, driving-side clutch discs 6 and driven-side clutch discs 7, clutch springs 8, a restricting member 10, and accommodating members 11. Identical reference signs are given to components similar to those in the first embodiment and detailed description thereof will be omitted.

[0045] In the pressure member 5 according to the present embodiment, as illustrated in Figs. 22, 23, and 25, a plurality of (three in the present embodiment) insertion holes h are provided at regular intervals in a circumferential direction and, as illustrated in Figs. 17 and 21, the accommodating members 11 are attached in the corresponding insertion holes h and the clutch springs 8 are accommodated and attached in the corresponding accommodating members 11. As illustrated in Figs. 22, 23, 27, and 28, the accommodating member 11 is constituted by a tubular member with a bottom, which includes an accommodating-member-side cam surface 11a, an inner circumferential wall surface 11b, and a flange portion 11c, and is attached while accommodating the clutch spring 8 so that the flange portion 11c abuts on an opening edge portion of the insertion hole h.

[0046] Further, as illustrated in Fig. 18 and Figs. 21 to 25, the clutch member 4 and the pressure member 5 include clutch-member-side first cam surfaces 4a and clutch-member-side second cam surfaces 4b, and pressure-member-side first cam surfaces 5a, respectively, which are each constituted by an inclined surface inclined at a predetermined angle. Thus, the clutch-member-side first cam surfaces 4a and the pressure-member-side first cam surfaces 5a are caused to face each other to form a press-contact assisting cam while the clutch-member-

side second cam surfaces 4b and the accommodating-member-side cam surfaces 11a included in the accommodating members 11 are caused to face each other to form a back torque limiting cam.

[0047] The restricting member 10 is constituted by a member like an annular ring (see Fig. 26) for restricting the movement of the pressure member 5 beyond a predetermined dimension in a direction in which the pressure member 5 moves away from the clutch member 4 and, as illustrated in Fig. 17 and Figs. 19 to 21, is attached at ends of boss portions 4d provided in the clutch member 4 and fixed with bolts B. In a state in which the restricting member 10 is fixed to the clutch member 4 with the bolts B, a surface 10a of the restricting member 10 faces the pressure member 5 and a back surface 10b of the restricting member 10 faces the outside of the device.

[0048] Similar to the first embodiment, the clutch spring 8 according to the present embodiment is attached so that its one end 8a abuts on a surface 10a of the restricting member 10 and its other end 8b abuts on a bottom surface of the accommodating member 11 or the vicinity of the bottom surface, and is structured to be capable of adding urging force to the pressure member 5 in a direction in which the driving-side clutch discs 6 and the driven-side clutch discs 7 are brought into press-contact (the axial direction). Similar to the first embodiment, the clutch spring 8 is constituted by a coil spring that extends in a spiral from the one end 8a to the other end 8b and structured to have an outer circumferential side surface 8c and an inner circumferential side surface 8d in its longitudinal direction (the direction from the one end 8a toward the other end 8b) (see Fig. 11).

[0049] The clutch spring 8 according to the present embodiment is structured so that, when the pressure member 5 rotates relative to the clutch member 4 owing to clearance between the cam surfaces of the press-contact assisting cam or the back torque limiting cam (in the present embodiment, the clearance caused between the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a or the clearance caused between the clutch-member-side second cam surface 4b and the accommodating-member-side cam surface 11a), the one end 8a slides on the surface 10a of the restricting member 10 while a side surface (the outer circumferential side surface 8c) is held in the longitudinal direction, and rotational resistance can be generated accordingly.

[0050] The clutch springs 8 according to the present embodiment are accommodated and attached in the accommodating member 11 attached in the pressure member 5 and are structured so that, when the pressure member 5 rotates relative to the clutch member 4 owing to the press-contact assisting cam or the back torque limiting cam, the outer circumferential side surfaces 8c in the longitudinal direction abut and are held on the inner circumferential wall surfaces 11b of the accommodating members 11.

[0051] For example, as illustrated in Fig. 29, when the

back torque limiting cam operates in a state (a set state) in which the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a that constitute the press-contact assisting cam abut on each other and the clutch-member-side second cam surface 4b and the accommodating-member-side cam surface 11a of the accommodating member 11 that constitute the back torque limiting cam face each other with clearance of a dimension t , as illustrated in Fig. 30, with the rotation of the pressure member 5 relative to the clutch member 4, the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a that constitute the press-contact assisting cam move away from each other and the clutch-member-side second cam surface 4b and the accommodating-member-side cam surface 11a that constitute the back torque limiting cam move closer to each other.

[0052] As illustrated in Fig. 31, when the clutch-member-side second cam surface 4b and the accommodating-member-side cam surface 11a that constitute the back torque limiting cam abut on each other and the pressure member 5 further rotates relative to the clutch member 4, the action of the cam moves the pressure member 5 and the clutch member 4 away from each other and releases the press-contact force of the driving-side clutch discs 6 and the driven-side clutch discs 7.

[0053] When the operation of the back torque limiting cam is completed and the set state is recovered, with the rotation of the pressure member 5 relative to the clutch member 4, the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a that constitute the press-contact assisting cam move closer to each other (see Fig. 30) and then abut on each other (see Fig. 29) while the clutch-member-side second cam surface 4b and the accommodating-member-side cam surface 11a that constitute the back torque limiting cam move away from each other (see Figs. 29 and 30).

[0054] In the clutch spring 8 according to the present embodiment, when the back torque limiting cam operates from the set state (and also, similarly, when the operation of the back torque limiting cam is completed and the set state is recovered), as illustrated in Fig. 30, the outer circumferential side surface 8c in the longitudinal direction abuts and is held on the inner circumferential wall surface 11b of the accommodating member 11 and leaning or bending due to rotational force is suppressed while the one end 8a slides on the surface 10a of the restricting member 10 to generate rotational resistance. Accordingly, impact caused when the cam surfaces abut on each other can be eased and hitting noise can be suppressed.

[0055] In particular, in the present embodiment, the dimension t of the clearance between the clutch-member-side second cam surface 4b and the accommodating-member-side cam surface 11a that constitute the back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the outside diameter of the clutch spring 8 (the diameter of the outer circumferential side surface 8c) from the dimension of

the opening diameter of the accommodating member 11. As a result, rotational resistance can be added with higher reliability while leaning or bending of the clutch spring 8 can be suppressed.

[0056] Thus, at normal times, the clutch spring 8 according to the present embodiment has a function of adding urging force in the axial direction and bringing the driving-side clutch discs 6 and the driven-side clutch discs 7 into press-contact and a function of generating rotational resistance by the one end 8a sliding on the surface 10a of the restricting member 10 when the pressure member 5 rotates relative to the clutch member 4 owing to the clearance between the cam surfaces of the back torque limiting cam (or the press-contact assisting cam).

[0057] Next, a third embodiment of the present invention is described.

[0058] Similar to the first and second embodiments, a power transmission device according to the third embodiment, which is obtainable by die casting, is arranged in a vehicle, such as a two-wheel vehicle, to transmit the driving power of an engine to a transmission or a driving wheel or interrupt the driving power as desired. As illustrated in Figs. 32 to 40, the power transmission device is mainly made up of a clutch housing 2 on which a gear 1 as an input member is provided, a clutch member 4 coupled to a shaft 3 as an output member, a pressure member 5, driving-side clutch discs 6 and driven-side clutch discs 7, clutch springs 8, a restricting member 10, and spring seats 12, which each constitute a seat surface of the clutch spring 8. Identical reference signs are given to components similar to those in the first and second embodiments and detailed description thereof will be omitted.

[0059] In the clutch member 4 according to the present embodiment, as illustrated in Figs. 36 and 38, a plurality of (three in the present embodiment) boss portions 4d are provided at regular intervals in a circumferential direction and, as illustrated in Figs. 32 and 35, the clutch springs 8 are inserted in the corresponding boss portions 4d to be attached. When the clutch spring 8 is attached in the boss portion 4d, its one end 8a abuts on a surface 10a of the restricting member 10 and its other end 8b abuts on the spring seat 12 attached to the pressure member 5. The spring seat 12 forms a seat surface of the clutch spring 8 and is structured to be capable of pressing the pressure member 5 on reception of the urging force of the clutch spring 8.

[0060] Further, as illustrated in Figs. 32 to 39, the clutch member 4 and the pressure member 5 include clutch-member-side first cam surfaces 4a and clutch-member-side second cam surfaces 4b, and pressure-member-side first cam surfaces 5a and pressure-member-side second cam surfaces 5b, respectively, which are each constituted by an inclined surface inclined at a predetermined angle. Accordingly, the clutch-member-side first cam surfaces 4a and the pressure-member-side first cam surfaces 5a are caused to face each other to form a press-

contact assisting cam while the clutch-member-side second cam surfaces 4b and the pressure-member-side second cam surfaces 5b are caused to face each other to form a back torque limiting cam.

[0061] The restricting member 10 is constituted by a member like an annular ring (see Fig. 40) for restricting the movement of the pressure member 5 beyond a predetermined dimension in a direction in which the pressure member 5 moves away from the clutch member 4 and, as illustrated in Fig. 32 and Figs. 33 to 35, is attached at ends of boss portions 4d provided in the clutch member 4 and fixed with bolts B. In a state in which the restricting member 10 is fixed to the clutch member 4 with the bolts B, a surface 10a of the restricting member 10 faces the pressure member 5 and a back surface 10b of the restricting member 10 faces the outside of the device.

[0062] Similar to the first and second embodiments, the clutch spring 8 according to the present embodiment is attached so that the one end 8a abuts on the surface 10a of the restricting member 10 and the other end 8b abuts on the spring seat 12, and is structured to be capable of adding urging force to the pressure member 5 in a direction in which the driving-side clutch discs 6 and the driven-side clutch discs 7 are brought into press-contact (the axial direction). Similar to the first and second

embodiments, the clutch spring 8 is constituted by a coil spring that extends in a spiral from the one end 8a to the other end 8b and structured to have an outer circumferential side surface 8c and an inner circumferential side surface 8d in its longitudinal direction (the direction from the one end 8a toward the other end 8b) (see Fig. 11).

[0063] The clutch spring 8 according to the present embodiment is structured so that, when the pressure member 5 rotates relative to the clutch member 4 owing to clearance between the cam surfaces of the press-contact assisting cam or the back torque limiting cam (in the present embodiment, the clearance caused between the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a or the clearance caused between the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b), the other end 8b slides on a surface of the spring seat 12 while a side surface (the inner circumferential side surface 8d) is held in the longitudinal direction, and rotational resistance can be generated accordingly.

[0064] The clutch springs 8 according to the present embodiment are inserted and attached in the boss portions 4d provided in the clutch member 4 and are structured so that, when the pressure member 5 rotates relative to the clutch member 4 owing to the press-contact assisting cam or the back torque limiting cam, the inner circumferential side surfaces 8d in the longitudinal direction abut and are held on the outer circumferential surfaces of the boss portions 4d.

[0065] For example, as illustrated in Fig. 41, when the back torque limiting cam operates in a state (a set state) in which the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a that con-

stitute the press-contact assisting cam abut on each other and the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam face each other with clearance of a dimension t, as illustrated in Fig. 42, with the rotation of the pressure member 5 relative to the clutch member 4, the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a that constitute the press-contact assisting cam move away from each other and the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam move closer to each other.

[0066] As illustrated in Fig. 43, when the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam abut on each other and the pressure member 5 further rotates relative to the clutch member 4, the action of the cam moves the pressure member 5 and the clutch member 4 away from each other and releases the press-contact force of the driving-side clutch discs 6 and the driven-side clutch discs 7.

[0067] When the operation of the back torque limiting cam is completed and the set state is recovered, with the rotation of the pressure member 5 relative to the clutch member 4, the clutch-member-side first cam surface 4a and the pressure-member-side first cam surface 5a that constitute the press-contact assisting cam move closer to each other (see Fig. 42) and then abut on each other (see Fig. 41) while the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam move away from each other (see Figs. 41 and 42).

[0068] In the clutch spring 8 according to the present embodiment, when the back torque limiting cam operates from the set state (and also, similarly, when the operation of the back torque limiting cam is completed and the set state is recovered), as illustrated in Fig. 42, the inner circumferential side surface 8d in the longitudinal direction abuts and is held on the outer circumferential surface of the boss portion 4d and leaning or bending due to rotational force is suppressed while the other end 8b slides on a surface of the spring seat 12 to generate rotational resistance. Accordingly, impact caused when the cam surfaces abut on each other can be eased and hitting noise can be suppressed.

[0069] In particular, in the present embodiment, the dimension t of the clearance between the clutch-member-side second cam surface 4b and the pressure-member-side second cam surface 5b that constitute the back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the outside diameter of the boss portion 4d (the diameter) from the dimension of the inside diameter of the clutch spring 8 (the diameter of the inner circumferential side surface 8d). As a result, rotational resistance can be added with higher reliability while leaning or bending of the clutch spring 8 can be suppressed.

[0070] Thus, at normal times, the clutch spring 8 according to the present embodiment has a function of adding urging force in the axial direction and bringing the driving-side clutch discs 6 and the driven-side clutch discs 7 into press-contact and a function of generating rotational resistance by the other end 8b sliding on a surface of the spring seat 12 when the pressure member 5 rotates relative to the clutch member 4 owing to the clearance between the cam surfaces of the back torque limiting cam (or press-contact assisting cam).

[0071] According to the above-described first and second embodiments, when the pressure member 5 rotates relative to the clutch member 4 owing to the clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring 8 can generate rotational resistance by the one end 8a sliding on the surface 10a of the restricting member 10 while a side surface (the outer circumferential side surface 8c in the first and second embodiments) is held in the longitudinal direction. Thus, the rotational resistance can be added to the rotation of the pressure member 5 relative to the clutch member 4 by using the clutch springs 8 and impact or hitting noise accompanied when the cam surfaces of the press-contact assisting cam or the back torque limiting cam abut on each other can be suppressed without employing any other dedicated member (by utilizing the restricting member 10).

[0072] According to the above-described third embodiment, when the pressure member 5 rotates relative to the clutch member 4 owing to the clearance between the cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring 8 can generate rotational resistance by the other end 8b sliding on a surface of the spring seat 12 while a side surface (the inner circumferential side surface 8d in the third embodiment) is held in the longitudinal direction. Thus, the rotational resistance can be added to the rotation of the pressure member 5 relative to the clutch member 4 by using the clutch springs 8 and impact or hitting noise accompanied when the cam surfaces of the press-contact assisting cam or the back torque limiting cam abut on each other can be suppressed without employing any other dedicated member (by utilizing the spring seats 12).

[0073] In particular, according to the above-described first embodiment, the clutch springs 8 are accommodated and attached in the depressed portions 5c provided in the pressure member 5 and when the pressure member 5 rotates relative to the clutch member 4 owing to the press-contact assisting cam or the back torque limiting cam, the outer circumferential side surface 8c in the longitudinal direction abuts and is held on the inner circumferential wall surface 5d of the depressed portion 5c. Accordingly, the inner circumferential wall surface 5d of the depressed portion 5c can prevent the clutch spring 8 from leaning or bending when rotational resistance is generated and necessary rotational resistance can be generated with higher reliability.

[0074] According to the above-described second em-

bodiment, the clutch springs 8 are accommodated and attached in the accommodating members 11 attached in the pressure member 5 and when the pressure member 5 rotates relative to the clutch member 4 owing to the press-contact assisting cam or the back torque limiting cam, the outer circumferential side surface 8c in the longitudinal direction abuts and is held on the inner circumferential wall surface 11b of the accommodating member 11. Accordingly, the inner circumferential wall surface 11b of the accommodating member 11 can prevent the clutch spring 8 from leaning or bending when rotational resistance is generated and necessary rotational resistance can be generated with higher reliability.

[0075] In addition, according to the above-described third embodiment, the clutch springs 8 are inserted and attached in the boss portions 4d provided in the clutch member 4 and is structured so that when the pressure member 5 rotates relative to the clutch member 4 owing to the press-contact assisting cam or the back torque limiting cam, the inner circumferential side surface 8d in the longitudinal direction abuts and is held on the outer circumferential surface of the boss portion 4d. Accordingly, the outer circumferential surface of the boss portion 4d can prevent the clutch spring 8 from leaning or bending when rotational resistance is generated and necessary rotational resistance can be generated with higher reliability.

[0076] Although the present embodiments are described above, the present invention is not limited to these embodiments. For example, regarding the surface 10a of the restricting member 10 or a surface of the spring seat 12, it is preferable that the sliding surface on which at least the one end 8a or the other end 8b of the clutch spring 8 slides be formed by hardening and preferable that carburization or the like be employed as the hardening. Thus, regarding the restricting member 10 or the spring seat 12, forming the sliding surface on which at least the one end 8a or the other end 8b of the clutch spring 8 slides by hardening makes it possible to suppress wearing of the sliding surface of the restricting member 10 or the spring seat 12 due to repeated sliding and prevent poor movement caused by the wearing.

[0077] Although both of the press-contact assisting cam and the back-torque limiting cam are provided in the present embodiments, for example, the present invention may be applied to a power transmission device including the back-torque limiting cam only instead of further including the press-contact assisting cam. In addition, the power transmission device according to the present invention is applicable not only to motorcycles but also to various multiple disc clutch type power transmission devices used for automobiles, three-wheel or four-wheel buggies, or machines for general use.

55 Industrial Applicability

[0078] The present invention is also applicable to, for example, a power transmission device with a different

external appearance or with another added function as long as the power transmission device enables that, when the pressure member rotates relative to the clutch member owing to the clearance between the cam surfaces of the press-contact assisting cam or the back torque limiting cam, rotational resistance is generated by one end or the other end sliding on a surface of the restricting member or the spring seat that constitutes a seat surface of the clutch spring while a side surface of the clutch spring is held in the longitudinal direction.

Reference Signs List

[0079]

1	gear (input member)	5
2	clutch housing (input member)	
2a	spline fitting portion	
3	shaft (output member)	
4	clutch member	10
4a	clutch-member-side first cam surface	
4b	clutch-member-side second cam surface	
4c	spline fitting portion	
4d	boss portion	
5	pressure member	15
5a	pressure-member-side first cam surface	
5b	pressure-member-side second cam surface	
5c	depressed portion	
5d	inner circumferential wall surface	
6	driving-side clutch disc	20
7	driven-side clutch disc	
8	clutch spring	
8a	one end	
8b	other end	
8c	outer circumferential side surface	25
8d	inner circumferential side surface	
9	push rod	
10	restricting member	
10a	surface	
10b	back surface	30
11	accommodating member	
11a	accommodating-member-side cam surface	
11b	inner circumferential wall surface	
11c	flange portion	
12	spring seat	35
h	insertion hole	

Claims

1. A power transmission device comprising:

a clutch housing (2) that rotates with an input member and to which a plurality of driving-side clutch discs (6) are attached;
a clutch member (4) to which a plurality of driven-side clutch discs (7) are attached and that is coupled to an output member, the driven-side clutch

discs (7) being arranged alternately with the driving-side clutch discs (6) of the clutch housing (2); a pressure member (5) that is attached to the clutch member (4) while being allowed to move in an axial direction of the clutch member (4) and is capable of bringing the driving-side clutch discs (6) and the driven-side clutch discs (7) into press-contact with movement in the axial direction relative to the clutch member (4) or releasing press-contact force thereof; a restricting member (10) that is attached to the clutch member (4) and is capable of restricting movement of the pressure member (5) away from the clutch member (4) by a predetermined dimension; a clutch spring (8) that is attached by one end (8a) of the clutch spring (8) abutting on a surface of the restricting member (10) and adds urging force to the pressure member (5) in a direction in which the driving-side clutch discs (6) and the driven-side clutch discs (7) are brought into the press-contact; and a press-contact assisting cam or a back-torque limiting cam, the press-contact assisting cam being capable of increasing the press-contact force of the driving-side clutch discs (6) and the driven-side clutch discs (7) when the pressure member (5) and the clutch member (4) relatively rotate to move closer to each other if a state in which rotational force input to the input member is transmittable to the output member is established, the back-torque limiting cam releasing the press-contact force of the driving-side clutch discs (6) and the driven-side clutch discs (7) when the pressure member (5) and the clutch member (4) relatively rotate to move away from each other if a rotational speed of the output member exceeds a rotational speed of the input member, the power transmission device being capable of transmitting the rotational force input to the input member to the output member or interrupting the rotational force through the press-contact of the driving-side clutch discs (6) and the driven-side clutch discs (7) or the releasing of the press-contact force thereof, wherein the clutch spring (8) is accommodated and attached in a depressed portion (5c) provided in the pressure member (5) and when the pressure member (5) rotates relative to the clutch member (4) owing to clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring (8) is capable of generating rotational resistance by the one end (8a) being allowed to slide on a surface of the restricting member (10) while an outer circumferential side surface (8c) in the longitudinal direction abuts and is held on an inner circum-

ferential wall surface (5d) of the depressed portion (5c),

characterized in that

the dimension of the clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the outside diameter of the clutch spring (8) from the dimension of the opening diameter of the depressed portion (5c).

2. A power transmission device comprising:

a clutch housing (2) that rotates with an input member and to which a plurality of driving-side clutch discs (6) are attached;
 a clutch member (4) to which a plurality of driven-side clutch discs (7) are attached and that is coupled to an output member, the driven-side clutch discs (7) being arranged alternately with the driving-side clutch discs (6) of the clutch housing (2);
 a pressure member (5) that is attached to the clutch member (4) while being allowed to move in an axial direction of the clutch member (4) and is capable of bringing the driving-side clutch discs (6) and the driven-side clutch discs (7) into press-contact with movement in the axial direction relative to the clutch member (4) or releasing press-contact force thereof;
 a restricting member (10) that is attached to the clutch member (4) and is capable of restricting movement of the pressure member (5) away from the clutch member (4) by a predetermined dimension;
 a clutch spring (8) that is attached by one end (8a) of the clutch spring (8) abutting on a surface of the restricting member (10) and adds urging force to the pressure member (5) in a direction in which the driving-side clutch discs (6) and the driven-side clutch discs (7) are brought into the press-contact; and
 a press-contact assisting cam or a back-torque limiting cam, the press-contact assisting cam being capable of increasing the press-contact force of the driving-side clutch discs (6) and the driven-side clutch discs (7) when the pressure member (5) and the clutch member (4) relatively rotate to move closer to each other if a state in which rotational force input to the input member is transmittable to the output member is established, the back-torque limiting cam releasing the press-contact force of the driving-side clutch discs (6) and the driven-side clutch discs (7) when the pressure member (5) and the clutch member (4) relatively rotate to move away from each other if a rotational speed of the output member exceeds a rotational speed of the input member,

the power transmission device being capable of transmitting the rotational force input to the input member to the output member or interrupting the rotational force through the press-contact of the driving-side clutch discs (6) and the driven-side clutch discs (7) or the releasing of the press-contact force thereof, wherein

the clutch spring (8) is accommodated and attached in an accommodating member (11) attached to the pressure member (5) and when the pressure member (5) rotates relative to the clutch member (4) owing to clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring (8) is capable of generating rotational resistance by the one end (8a) being allowed to slide on a surface of the restricting member (10) while an outer circumferential side surface (8c) in the longitudinal direction abuts and is held on an inner circumferential wall surface (11b) of the accommodating member (11), **characterized in that** the dimension of the clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the outside diameter of the clutch spring (8) from the dimension of the opening diameter of the accommodating member (11).

3. A power transmission device comprising:

a clutch housing (2) that rotates with an input member and to which a plurality of driving-side clutch discs (6) are attached;
 a clutch member (4) to which a plurality of driven-side clutch discs (7) are attached and that is coupled to an output member, the driven-side clutch discs (7) being arranged alternately with the driving-side clutch discs (6) of the clutch housing (2);
 a pressure member (5) that is attached to the clutch member (4) while being allowed to move in an axial direction of the clutch member (4) and is capable of bringing the driving-side clutch discs (6) and the driven-side clutch discs (7) into press-contact with movement in the axial direction relative to the clutch member (4) or releasing press-contact force thereof;
 a restricting member (10) that is attached to the clutch member (4) and is capable of restricting movement of the pressure member (5) away from the clutch member (4) by a predetermined dimension;
 a clutch spring (8) that is attached by one end (8a) of the clutch spring (8) abutting on a surface of the restricting member (10) and adds urging force to the pressure member (5) in a direction in which the driving-side clutch discs (6) and the driven-side clutch discs (7) are brought into the

press-contact; and

a press-contact assisting cam or a back-torque limiting cam, the press-contact assisting cam being capable of increasing the press-contact force of the driving-side clutch discs (6) and the driven-side clutch discs (7) when the pressure member (5) and the clutch member (4) relatively rotate to move closer to each other if a state in which rotational force input to the input member is transmittable to the output member is established, the back-torque limiting cam releasing the press-contact force of the driving-side clutch discs (6) and the driven-side clutch discs (7) when the pressure member (5) and the clutch member (4) relatively rotate to move away from each other if a rotational speed of the output member exceeds a rotational speed of the input member,

the power transmission device being capable of transmitting the rotational force input to the input member to the output member or interrupting the rotational force through the press-contact of the driving-side clutch discs (6) and the driven-side clutch discs (7) or the releasing of the press-contact force thereof, wherein

the clutch spring (8) is inserted and attached in a boss portion (4d) provided in the clutch member (4) and when the pressure member (5) rotates relative to the clutch member (4) owing to clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam, the clutch spring (8) is capable of generating rotational resistance by another end (8b) being allowed to slide on the surface of the spring seat (12) that constitutes a seat surface of the clutch spring (8) while an inner circumferential side surface (8d) in the longitudinal direction abuts and is held on an outer circumferential surface of the boss portion (4d), **characterized in that**

the dimension of the clearance between cam surfaces of the press-contact assisting cam or the back torque limiting cam is set so as to be larger than the value obtained by subtracting the dimension of the diameter of the boss portion (4d) from the dimension of the inner diameter of the clutch spring (8).

4. The power transmission device according to Claim 1 or 2, wherein the restricting member (10) is formed by hardening a sliding surface on which at least the one end (8a) of the clutch spring (8) slides.
5. The power transmission device according to Claim 3, wherein the spring seat (12) is formed by hardening a sliding surface on which at least the other end (8b) of the

clutch spring (8) slides.

Patentansprüche

1. Leistungsübertragungsvorrichtung umfassend:

ein Kupplungsgehäuse (2), das sich mit einem Antriebselement dreht, und an dem mehrere antriebsseitige Kupplungsscheiben (6) befestigt sind;

ein Kupplungselement (4), an dem mehrere abtriebsseitige Kupplungsscheiben (7) befestigt sind und das mit einem Abtriebselement gekoppelt ist, wobei die abtriebsseitigen Kupplungsscheiben (7) abwechselnd mit den antriebsseitigen Kupplungsscheiben (6) des Kupplungsgehäuses (2) angeordnet sind;

ein Druckelement (5), das an dem Kupplungselement (4) befestigt ist, während es sich in einer axialen Richtung des Kupplungselements (4) bewegen kann, und das in der Lage ist, die antriebsseitigen Kupplungsscheiben (6) und die abtriebsseitigen Kupplungsscheiben (7) mit einer Bewegung in der axialen Richtung relativ zu dem Kupplungselement (4) in Druckkontakt zu bringen oder deren Druckkontaktkraft zu lösen;

ein Begrenzungselement (10), das an dem Kupplungselement (4) befestigt ist und in der Lage ist, die Bewegung des Druckelements (5) weg von dem Kupplungselement (4) um eine vorgegebene Abmessung zu begrenzen;

eine Kupplungsfeder (8), die mittels einem Ende (8a) der Kupplungsfeder (8) befestigt ist, welches an einer Oberfläche des Begrenzungselements (10) anliegt und die dem Druckelement (5) eine Druckkraft in einer Richtung zuführt, in der die antriebsseitigen Kupplungsscheiben (6) und die abtriebsseitigen Kupplungsscheiben (7) in Druckkontakt gebracht werden; und

eine Druckkontakt-Unterstützungsnocke oder eine Nocke für die hintere Drehmomentbegrenzung, wobei die Druckkontakt-Unterstützungsnocke in der Lage ist, die Druckkontaktkraft der antriebsseitigen Kupplungsscheiben (6) und der abtriebsseitigen Kupplungsscheiben (7) zu erhöhen, wenn sich das Druckelement (5) und das Kupplungselement (4) relativ drehen, um sich näher zueinander zu bewegen, wenn ein Zustand hergestellt ist, in dem eine auf das Antriebselement eingegebene Drehkraft auf das Abtriebselement übertragbar ist, die Nocke für die hintere Drehmomentbegrenzung die Druckkontaktkraft der antriebsseitigen Kupplungsscheiben (6) und der abtriebsseitigen Kupplungsscheiben (7) löst, wenn sich das Druckelement (5) und das Kupplungselement (4) relativ drehen, um sich voneinander weg zu bewegen,

wenn eine Drehgeschwindigkeit des Abtriebs-
elements eine Drehgeschwindigkeit des Antrieb-
elements übersteigt, die Leistungsübertra-
gungsvorrichtung in der Lage ist, die auf das An-
triebselement eingegebene Drehkraft auf das
Abtriebsselement zu übertragen oder die Dreh-
kraft durch den Druckkontakt der antriebssei-
tigen Kupplungsscheiben (6) und der abtriebssei-
tigen Kupplungsscheiben (7) zu unterbrechen
oder die Druckkontaktkraft derselben zu lösen,
wobei
die Kupplungsfeder (8) in einem vertieften Ab-
schnitt (5c), der in dem Druckelement (5) vor-
gesehen ist, untergebracht und befestigt ist, und
wenn sich das Druckelement (5) relativ zu dem
Kupplungselement (4) aufgrund eines Abstands
zwischen den Nockenflächen der Druckkontakt-
Unterstützungsnocke oder der Nocke für die
hintere Drehmomentbegrenzung dreht, die
Kupplungsfeder (8) in der Lage ist, einen Dreh-
widerstand zu erzeugen, indem das eine Ende
(8a) auf einer Oberfläche des Begrenzungsele-
ments (10) gleiten kann, während eine äußere
Umfangsseitenfläche (8c) in Längsrichtung an
einer inneren Umfangswandfläche (5d) des ver-
tieften Abschnitts (5c) anliegt und gehalten wird,
dadurch gekennzeichnet, dass
die Abmessung des Abstands zwischen den No-
ckenflächen der Druckkontakt-Unterstützungs-
nocke oder der Nocke für die hintere Drehmo-
mentbegrenzung so eingestellt wird, dass sie
größer ist als der Wert, der sich ergibt, wenn
man die Abmessung des Außendurchmessers
der Kupplungsfeder (8) von der Abmessung des
Öffnungsdurchmessers des vertieften Ab-
schnitts (5c) subtrahiert.

2. Leistungsübertragungsvorrichtung umfassend:

ein Kupplungsgehäuse (2), das sich mit einem
Antriebselement dreht, und an dem mehrere an-
triebsseitige Kupplungsscheiben (6) befestigt
sind;
ein Kupplungselement (4), an dem mehrere ab-
triebsseitige Kupplungsscheiben (7) befestigt
sind und das mit einem Abtriebsselement gekop-
pelt ist, wobei die abtriebsseitigen Kupplungs-
scheiben (7) abwechselnd mit den antriebssei-
tigen Kupplungsscheiben (6) des Kupplungsge-
häuses (2) angeordnet sind;
ein Druckelement (5), das an dem Kupplungs-
element (4) befestigt ist, während es sich in einer
axialen Richtung des Kupplungselements (4)
bewegen kann, und das in der Lage ist, die an-
triebsseitigen Kupplungsscheiben (6) und die
abtriebsseitigen Kupplungsscheiben (7) mit ei-
ner Bewegung in der axialen Richtung relativ zu
dem Kupplungselement (4) in Druckkontakt zu

bringen oder deren Druckkontaktkraft zu lösen;
ein Begrenzungselement (10), das an dem
Kupplungselement (4) befestigt ist und in der
Lage ist, die Bewegung des Druckelements (5)
weg von dem Kupplungselement (4) um eine
vorgegebene Abmessung zu begrenzen;
eine Kupplungsfeder (8), die mittels einem Ende
(8a) der Kupplungsfeder (8) befestigt ist, wel-
ches an einer Oberfläche des Begrenzungsele-
ments (10) anliegt und die dem Druckelement
(5) eine Druckkraft in einer Richtung zuführt, in
der die antriebsseitigen Kupplungsscheiben (6)
und die abtriebsseitigen Kupplungsscheiben (7)
in Druckkontakt gebracht werden; und
eine Druckkontakt-Unterstützungsnocke oder
eine Nocke für die hintere Drehmomentbegren-
zung, wobei die Druckkontakt-Unterstützungs-
nocke in der Lage ist, die Druckkontaktkraft der
antriebsseitigen Kupplungsscheiben (6) und der
abtriebsseitigen Kupplungsscheiben (7) zu er-
höhen, wenn sich das Druckelement (5) und das
Kupplungselement (4) relativ drehen, um sich
näher zueinander zu bewegen, wenn ein Zu-
stand hergestellt ist, in dem eine auf das An-
triebselement eingegebene Drehkraft auf das
Abtriebsselement übertragbar ist, die Nocke für
die hintere Drehmomentbegrenzung die Druck-
kontaktkraft der antriebsseitigen Kupplungs-
scheiben (6) und der abtriebsseitigen Kupp-
lungsscheiben (7) löst, wenn sich das Drucke-
lement (5) und das Kupplungselement (4) relativ
drehen, um sich voneinander weg zu bewegen,
wenn eine Drehgeschwindigkeit des Abtriebs-
elements eine Drehgeschwindigkeit des Antrieb-
elements übersteigt, die Leistungsübertra-
gungsvorrichtung in der Lage ist, die auf das An-
triebselement eingegebene Drehkraft auf das
Abtriebsselement zu übertragen oder die Dreh-
kraft durch den Druckkontakt der antriebssei-
tigen Kupplungsscheiben (6) und der abtriebssei-
tigen Kupplungsscheiben (7) zu unterbrechen
oder die Druckkontaktkraft derselben zu lösen,
wobei
die Kupplungsfeder (8) in einem Aufnahmeele-
ment (11), das an dem Druckelement (5) befestigt
ist, untergebracht und befestigt ist, und wenn
sich das Druckelement (5) relativ zu dem Kupp-
lungselement (4) aufgrund eines Abstands zwis-
chen den Nockenflächen der Druckkontakt-
Unterstützungsnocke oder der Nocke für die
hintere Drehmomentbegrenzung dreht, die
Kupplungsfeder (8) in der Lage ist, einen Dreh-
widerstand zu erzeugen, indem das eine Ende
(8a) auf einer Oberfläche des Begrenzungsele-
ments (10) gleiten kann, während eine äußere
Umfangsseitenfläche (8c) in Längsrichtung an
einer inneren Umfangswandfläche (11b) des
Aufnahmeelements (11) anliegt und gehalten

wird,

dadurch gekennzeichnet, dass

die Abmessung des Abstands zwischen den Nockenflächen der Druckkontakt-Unterstützungsnocke oder der Nocke für die hintere Drehmomentbegrenzung so eingestellt wird, dass sie größer ist als der Wert, der sich ergibt, wenn man die Abmessung des Außendurchmessers der Kupplungsfeder (8) von der Abmessung des Öffnungsdurchmessers des Aufnahmeelements (11) subtrahiert.

3. Leistungsübertragungsvorrichtung umfassend:

ein Kupplungsgehäuse (2), das sich mit einem Antriebselement dreht, und an dem mehrere antriebsseitige Kupplungsscheiben (6) befestigt sind;
 ein Kupplungselement (4), an dem mehrere abtriebsseitige Kupplungsscheiben (7) befestigt sind und das mit einem Abtriebsselement gekoppelt ist, wobei die abtriebsseitigen Kupplungsscheiben (7) abwechselnd mit den antriebsseitigen Kupplungsscheiben (6) des Kupplungsgehäuses (2) angeordnet sind;
 ein Druckelement (5), das an dem Kupplungselement (4) befestigt ist, während es sich in einer axialen Richtung des Kupplungselements (4) bewegen kann, und das in der Lage ist, die antriebsseitigen Kupplungsscheiben (6) und die abtriebsseitigen Kupplungsscheiben (7) mit einer Bewegung in der axialen Richtung relativ zu dem Kupplungselement (4) in Druckkontakt zu bringen oder deren Druckkontaktkraft zu lösen;
 ein Begrenzungselement (10), das an dem Kupplungselement (4) befestigt ist und in der Lage ist, die Bewegung des Druckelements (5) weg von dem Kupplungselement (4) um eine vorgegebene Abmessung zu begrenzen;
 eine Kupplungsfeder (8), die mittels einem Ende (8a) der Kupplungsfeder (8) befestigt ist, welches an einer Oberfläche des Begrenzungselements (10) anliegt und die dem Druckelement (5) eine Druckkraft in einer Richtung zuführt, in der die antriebsseitigen Kupplungsscheiben (6) und die abtriebsseitigen Kupplungsscheiben (7) in Druckkontakt gebracht werden; und
 eine Druckkontakt-Unterstützungsnocke oder eine Nocke für die hintere Drehmomentbegrenzung, wobei die Druckkontakt-Unterstützungsnocke in der Lage ist, die Druckkontaktkraft der antriebsseitigen Kupplungsscheiben (6) und der abtriebsseitigen Kupplungsscheiben (7) zu erhöhen, wenn sich das Druckelement (5) und das Kupplungselement (4) relativ drehen, um sich näher zueinander zu bewegen, wenn ein Zustand hergestellt ist, in dem eine auf das Antriebselement eingegebene Drehkraft auf das

Abtriebsselement übertragbar ist, die Nocke für die hintere Drehmomentbegrenzung die Druckkontaktkraft der antriebsseitigen Kupplungsscheiben (6) und der abtriebsseitigen Kupplungsscheiben (7) löst, wenn sich das Druckelement (5) und das Kupplungselement (4) relativ drehen, um sich voneinander weg zu bewegen, wenn eine Drehgeschwindigkeit des Abtriebsselements eine Drehgeschwindigkeit des Antriebselements übersteigt, die Leistungsübertragungsvorrichtung in der Lage ist, die auf das Antriebselement eingegebene Drehkraft auf das Abtriebsselement zu übertragen oder die Drehkraft durch den Druckkontakt der antriebsseitigen Kupplungsscheiben (6) und der abtriebsseitigen Kupplungsscheiben (7) zu unterbrechen oder die Druckkontaktkraft derselben zu lösen, wobei

die Kupplungsfeder (8) in einem Nabenabschnitt (4d), der in dem Kupplungselement (4) vorgesehen ist, eingesetzt und befestigt ist, und wenn sich das Druckelement (5) relativ zu dem Kupplungselement (4) aufgrund eines Abstands zwischen den Nockenflächen der Druckkontakt-Unterstützungsnocke oder der Nocke für die hintere Drehmomentbegrenzung dreht, die Kupplungsfeder (8) in der Lage ist, einen Drehwiderstand zu erzeugen, indem ein anderes Ende (8b) auf der Oberfläche des Federsitzes (12) gleiten kann, der eine Sitzfläche der Kupplungsfeder (8) bildet, während eine innere Umfangsflächenfläche (8d) in Längsrichtung an einer äußeren Umfangswandfläche des Nabenabschnitts (4d) anliegt und gehalten wird,

dadurch gekennzeichnet, dass

die Abmessung des Abstands zwischen den Nockenflächen der Druckkontakt-Unterstützungsnocke oder der Nocke für die hintere Drehmomentbegrenzung so eingestellt wird, dass sie größer ist als der Wert, der sich ergibt, wenn man die Abmessung des Durchmessers des Nabenabschnitts (4d) von der Abmessung des Innendurchmessers der Kupplungsfeder (8) subtrahiert.

4. Leistungsübertragungsvorrichtung nach Anspruch 1 oder 2, wobei das Begrenzungselement (10) durch Härten einer Gleitfläche gebildet wird, auf der mindestens das eine Ende (8a) der Kupplungsfeder (8) gleitet.
5. Leistungsübertragungsvorrichtung nach Anspruch 3, wobei der Federsitz (12) durch Härten einer Gleitfläche gebildet wird, auf der mindestens das andere Ende (8b) der Kupplungsfeder (8) gleitet.

Revendications

1. Dispositif de transmission de puissance comprenant :

un carter d'embrayage (2) qui est entraîné en rotation avec un élément d'entrée et auquel une pluralité de disques d'embrayage de côté d'entraînement (6) est liée ;
 un élément d'embrayage (4) auquel une pluralité de disques d'embrayage de côté entraîné (7) est liée et qui est couplé à un élément de sortie, les disques d'embrayage de côté entraîné (7) étant agencés en alternance avec les disques d'embrayage de côté d'entraînement (6) du carter d'embrayage (2) ;
 un élément de pression (5) qui est lié à l'élément d'embrayage (4) tout en pouvant effectuer un déplacement dans une direction axiale de l'élément d'embrayage (4) et qui permet d'amener les disques d'embrayage de côté d'entraînement (6) et les disques d'embrayage de côté entraîné (7) en contact par pression avec le déplacement dans la direction axiale par rapport à l'élément d'embrayage (4) ou la libération de la force de contact par pression ;
 un élément de restriction (10) qui est lié à l'élément d'embrayage (4) et qui permet de restreindre l'éloignement de l'élément de pression (5) par rapport à l'élément d'embrayage (4) sur une dimension prédéterminée ;
 un ressort d'embrayage (8) qui est lié par une extrémité (8a) du ressort d'embrayage (8) qui vient en butée sur une surface de l'élément de restriction (10) et qui ajoute une force de poussée sur l'élément de pression (5) dans une direction dans laquelle les disques d'embrayage de côté d'entraînement (6) et les disques d'embrayage de côté entraîné (7) sont amenés en contact par pression ; et
 une came d'assistance de contact par pression ou une came de limitation de contre-couple, la came d'assistance de contact par pression permettant d'augmenter la force de contact par pression des disques d'embrayage de côté d'entraînement (6) et des disques d'embrayage de côté entraîné (7) lorsque l'élément de pression (5) et l'élément d'embrayage (4) sont entraînés en rotation de façon relative pour être rapprochés l'un de l'autre si un état dans lequel une force de rotation qui est entrée sur l'élément d'entrée peut être transmise à l'élément de sortie est établi, la came de limitation de contre-couple libérant la force de contact par pression des disques d'embrayage de côté d'entraînement (6) et des disques d'embrayage de côté entraîné (7) lorsque l'élément de pression (5) et l'élément d'embrayage (4) sont entraînés en ro-

tation de façon relative pour être éloignés l'un de l'autre si une vitesse de rotation de l'élément de sortie excède une vitesse de rotation de l'élément d'entrée, le dispositif de transmission de puissance permettant de transmettre la force de rotation qui est entrée sur l'élément d'entrée à l'élément de sortie ou d'interrompre la force de rotation par l'intermédiaire du contact par pression des disques d'embrayage de côté d'entraînement (6) et des disques d'embrayage de côté entraîné (7) ou de la libération de la force de contact par pression ; dans lequel le ressort d'embrayage (8) est logé et est lié dans une partie en creux (5c) qui est ménagée dans l'élément de pression (5) et lorsque l'élément de pression (5) est entraîné en rotation par rapport à l'élément d'embrayage (4) du fait d'un jeu entre des surfaces de came de la came d'assistance de contact par pression ou de la came de limitation de contre-couple, le ressort d'embrayage (8) permet de générer une résistance à la rotation au moyen de l'extrémité considérée (8a) qui est amenée à coulisser sur une surface de l'élément de restriction (10) tandis qu'une surface latérale circonférentielle externe (8c) dans la direction longitudinale vient en butée et est maintenue sur une surface de paroi circonférentielle interne (5d) de la partie en creux (5c) ;

caractérisé en ce que :

la dimension du jeu entre des surfaces de came de la came d'assistance de contact par pression ou de la came de limitation de contre-couple est définie de telle sorte qu'elle soit plus importante que la valeur qui est obtenue en soustrayant la dimension du diamètre externe du ressort d'embrayage (8) de la dimension du diamètre d'ouverture de la partie en creux (5c).

2. Dispositif de transmission de puissance comprenant :

un carter d'embrayage (2) qui est entraîné en rotation avec un élément d'entrée et auquel une pluralité de disques d'embrayage de côté d'entraînement (6) est liée ;
 un élément d'embrayage (4) auquel une pluralité de disques d'embrayage de côté entraîné (7) est liée et qui est couplé à un élément de sortie, les disques d'embrayage de côté entraîné (7) étant agencés en alternance avec les disques d'embrayage de côté d'entraînement (6) du carter d'embrayage (2) ;
 un élément de pression (5) qui est lié à l'élément d'embrayage (4) tout en pouvant effectuer un déplacement dans une direction axiale de l'élément d'embrayage (4) et qui permet d'amener les disques d'embrayage de côté d'entraînement (6) et les disques d'embrayage de côté

entraîné (7) en contact par pression avec le déplacement dans la direction axiale par rapport à l'élément d'embrayage (4) ou de libérer la force de contact par pression ;

un élément de restriction (10) qui est lié à l'élément d'embrayage (4) et qui permet de restreindre l'éloignement de l'élément de pression (5) par rapport à l'élément d'embrayage (4) sur une dimension prédéterminée ;

un ressort d'embrayage (8) qui est lié par une extrémité (8a) du ressort d'embrayage (8) qui vient en butée sur une surface de l'élément de restriction (10) et qui ajoute une force de poussée sur l'élément de pression (5) dans une direction dans laquelle les disques d'embrayage de côté d'entraînement (6) et les disques d'embrayage de côté entraîné (7) sont amenés en contact par pression; et

une came d'assistance de contact par pression ou une came de limitation de contre-couple, la came d'assistance de contact par pression permettant d'augmenter la force de contact par pression des disques d'embrayage de côté d'entraînement (6) et des disques d'embrayage de côté entraîné (7) lorsque l'élément de pression (5) et l'élément d'embrayage (4) sont entraînés en rotation de façon relative pour être rapprochés l'un de l'autre si un état dans lequel une force de rotation qui est entrée sur l'élément d'entrée peut être transmise à l'élément de sortie est établi, la came de limitation de contre-couple libérant la force de contact par pression des disques d'embrayage de côté d'entraînement (6) et des disques d'embrayage de côté entraîné (7) lorsque l'élément de pression (5) et l'élément d'embrayage (4) sont entraînés en rotation de façon relative pour être éloignés l'un de l'autre si une vitesse de rotation de l'élément de sortie excède une vitesse de rotation de l'élément d'entrée, le dispositif de transmission de puissance permettant de transmettre la force de rotation qui est entrée sur l'élément d'entrée à l'élément de sortie ou d'interrompre la force de rotation par l'intermédiaire du contact par pression des disques d'embrayage de côté d'entraînement (6) et des disques d'embrayage de côté entraîné (7) ou de la libération de la force de contact par pression ; dans lequel le ressort d'embrayage (8) est logé et est lié dans un élément de logement (11) qui est lié à l'élément de pression (5) et lorsque l'élément de pression (5) est entraîné en rotation par rapport à l'élément d'embrayage (4) du fait d'un jeu entre des surfaces de came de la came d'assistance de contact par pression ou de la came de limitation de contre-couple, le ressort d'embrayage (8) permet de générer une résistance à la rotation au moyen de l'extrémité considérée (8a) qui est

amenée à coulisser sur une surface de l'élément de restriction (10) tandis qu'une surface latérale circonférentielle externe (8c) dans la direction longitudinale vient en butée et est maintenue sur une surface de paroi circonférentielle interne (11b) de l'élément de logement (11) ;

caractérisé en ce que :

la dimension du jeu entre des surfaces de came de la came d'assistance de contact par pression ou de la came de limitation de contre-couple est définie de telle sorte qu'elle soit plus importante que la valeur qui est obtenue en soustrayant la dimension du diamètre externe du ressort d'embrayage (8) de la dimension du diamètre d'ouverture de l'élément de logement (11).

3. Dispositif de transmission de puissance comprenant :

un carter d'embrayage (2) qui est entraîné en rotation avec un élément d'entrée et auquel une pluralité de disques d'embrayage de côté d'entraînement (6) est liée ;

un élément d'embrayage (4) auquel une pluralité de disques d'embrayage de côté entraîné (7) est liée et qui est couplé à un élément de sortie, les disques d'embrayage de côté entraîné (7) étant agencés en alternance avec les disques d'embrayage de côté d'entraînement (6) du carter d'embrayage (2) ;

un élément de pression (5) qui est lié à l'élément d'embrayage (4) tout en pouvant effectuer un déplacement dans une direction axiale de l'élément d'embrayage (4) et qui permet d'amener les disques d'embrayage de côté d'entraînement (6) et les disques d'embrayage de côté entraîné (7) en contact par pression avec le déplacement dans la direction axiale par rapport à l'élément d'embrayage (4) ou de libérer la force de contact par pression ;

un élément de restriction (10) qui est lié à l'élément d'embrayage (4) et qui permet de restreindre l'éloignement de l'élément de pression (5) par rapport à l'élément d'embrayage (4) sur une dimension prédéterminée ;

un ressort d'embrayage (8) qui est lié par une extrémité (8a) du ressort d'embrayage (8) qui vient en butée sur une surface de l'élément de restriction (10) et qui ajoute une force de poussée sur l'élément de pression (5) dans une direction dans laquelle les disques d'embrayage de côté d'entraînement (6) et les disques d'embrayage de côté entraîné (7) sont amenés en contact par pression; et

une came d'assistance de contact par pression ou une came de limitation de contre-couple, la came d'assistance de contact par pression permettant d'augmenter la force de contact par

pression des disques d'embrayage de côté d'entraînement (6) et des disques d'embrayage de côté entraîné (7) lorsque l'élément de pression (5) et l'élément d'embrayage (4) sont entraînés en rotation de façon relative pour être rapprochés l'un de l'autre si un état dans lequel une force de rotation qui est entrée sur l'élément d'entrée peut être transmise à l'élément de sortie est établi, la came de limitation de contre-couple libérant la force de contact par pression des disques d'embrayage de côté d'entraînement (6) et des disques d'embrayage de côté entraîné (7) lorsque l'élément de pression (5) et l'élément d'embrayage (4) sont entraînés en rotation de façon relative pour être éloignés l'un de l'autre si une vitesse de rotation de l'élément de sortie excède une vitesse de rotation de l'élément d'entrée, le dispositif de transmission de puissance permettant de transmettre la force de rotation qui est entrée sur l'élément d'entrée à l'élément de sortie ou d'interrompre la force de rotation par l'intermédiaire du contact par pression des disques d'embrayage de côté d'entraînement (6) et des disques d'embrayage de côté entraîné (7) ou de la libération de la force de contact par pression ; dans lequel le ressort d'embrayage (8) est inséré et est lié dans une partie de bossage (4d) qui est ménagée dans l'élément d'embrayage (4) et lorsque l'élément de pression (5) est entraîné en rotation par rapport à l'élément d'embrayage (4) du fait d'un jeu entre des surfaces de came de la came d'assistance de contact par pression ou de la came de limitation de contre-couple, le ressort d'embrayage (8) permet de générer une résistance à la rotation au moyen d'une autre extrémité (8b) qui est amenée à coulisser sur la surface du siège de ressort (12) qui constitue une surface de siège du ressort d'embrayage (8) tandis qu'une surface latérale circonférentielle interne (8d) dans la direction longitudinale vient en butée et est maintenue sur une surface circonférentielle externe (11b) de la partie de bossage (4d) ;

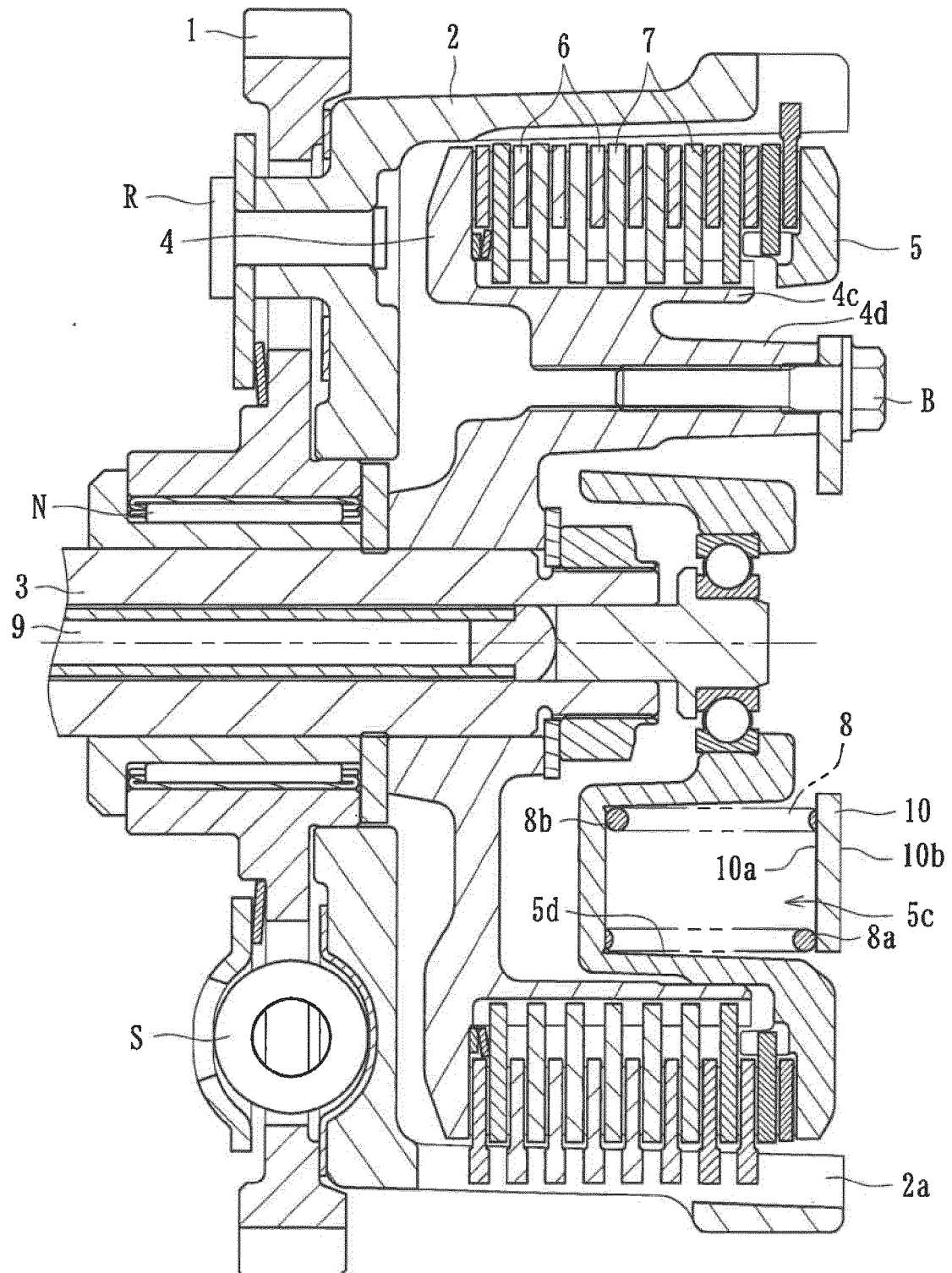
caractérisé en ce que :

la dimension du jeu entre des surfaces de came de la came d'assistance de contact par pression ou de la came de limitation de contre-couple est définie de telle sorte qu'elle soit plus importante que la valeur qui est obtenue en soustrayant la dimension du diamètre de la partie de bossage (4d) de la dimension du diamètre interne du ressort d'embrayage (8).

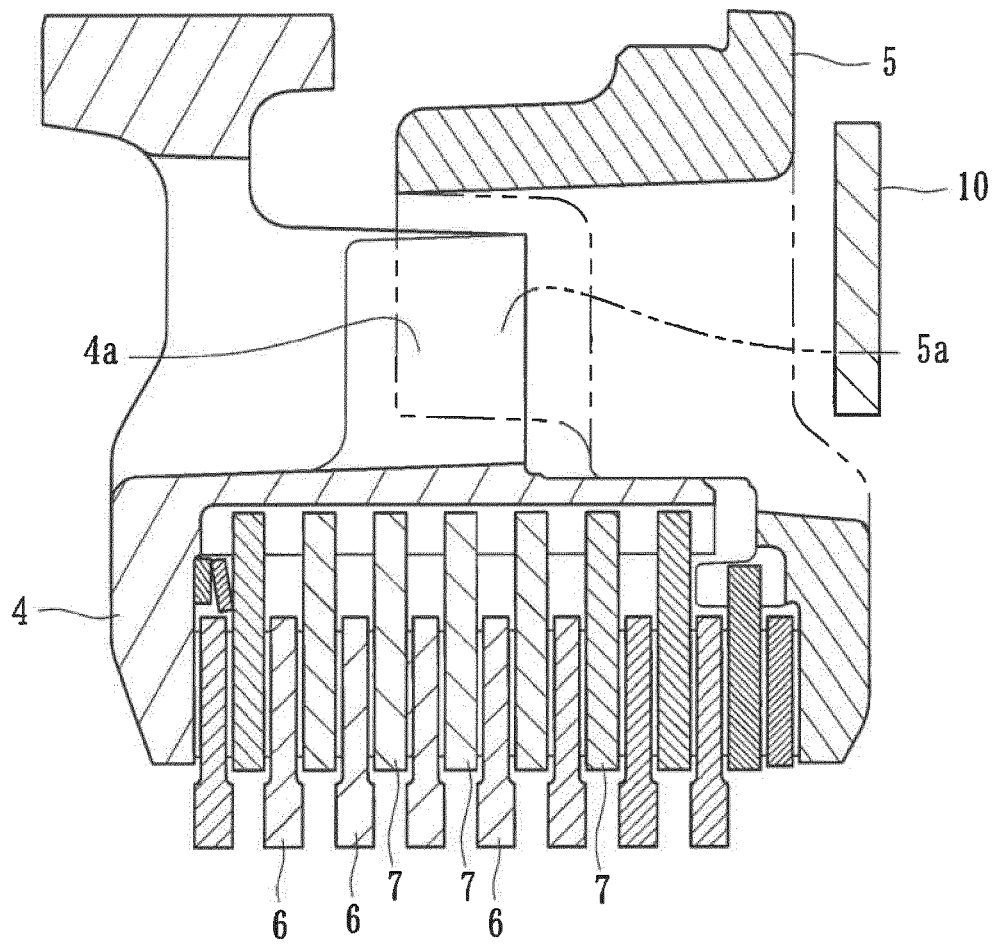
l'extrémité considérée (8a) du ressort d'embrayage (8) coulisse.

5. Dispositif de transmission de puissance selon la revendication 3, dans lequel : le siège de ressort (12) est formé en durcissant une surface de coulisement sur laquelle au moins l'autre extrémité (8b) du ressort d'embrayage (8) coulisse.
4. Dispositif de transmission de puissance selon la revendication 1 ou 2, dans lequel : l'élément de restriction (10) est formé en durcissant une surface de coulisement sur laquelle au moins

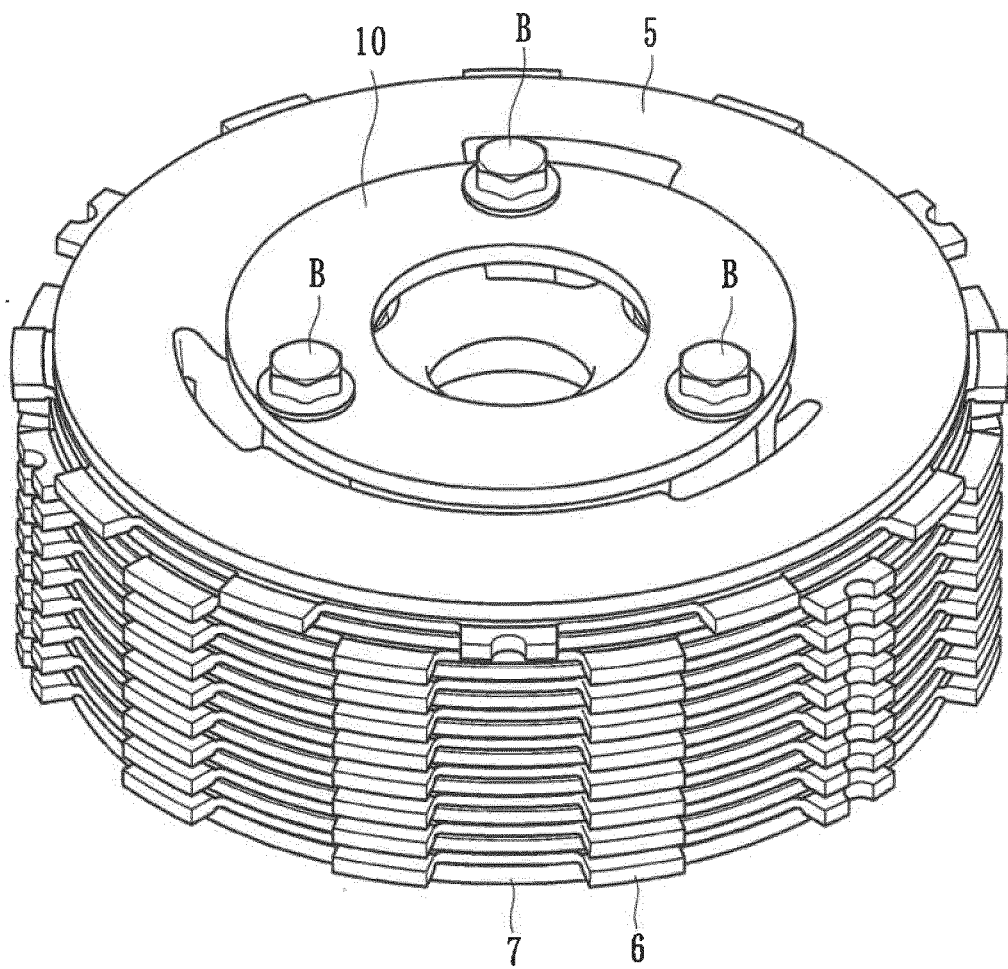
[Fig. 1]



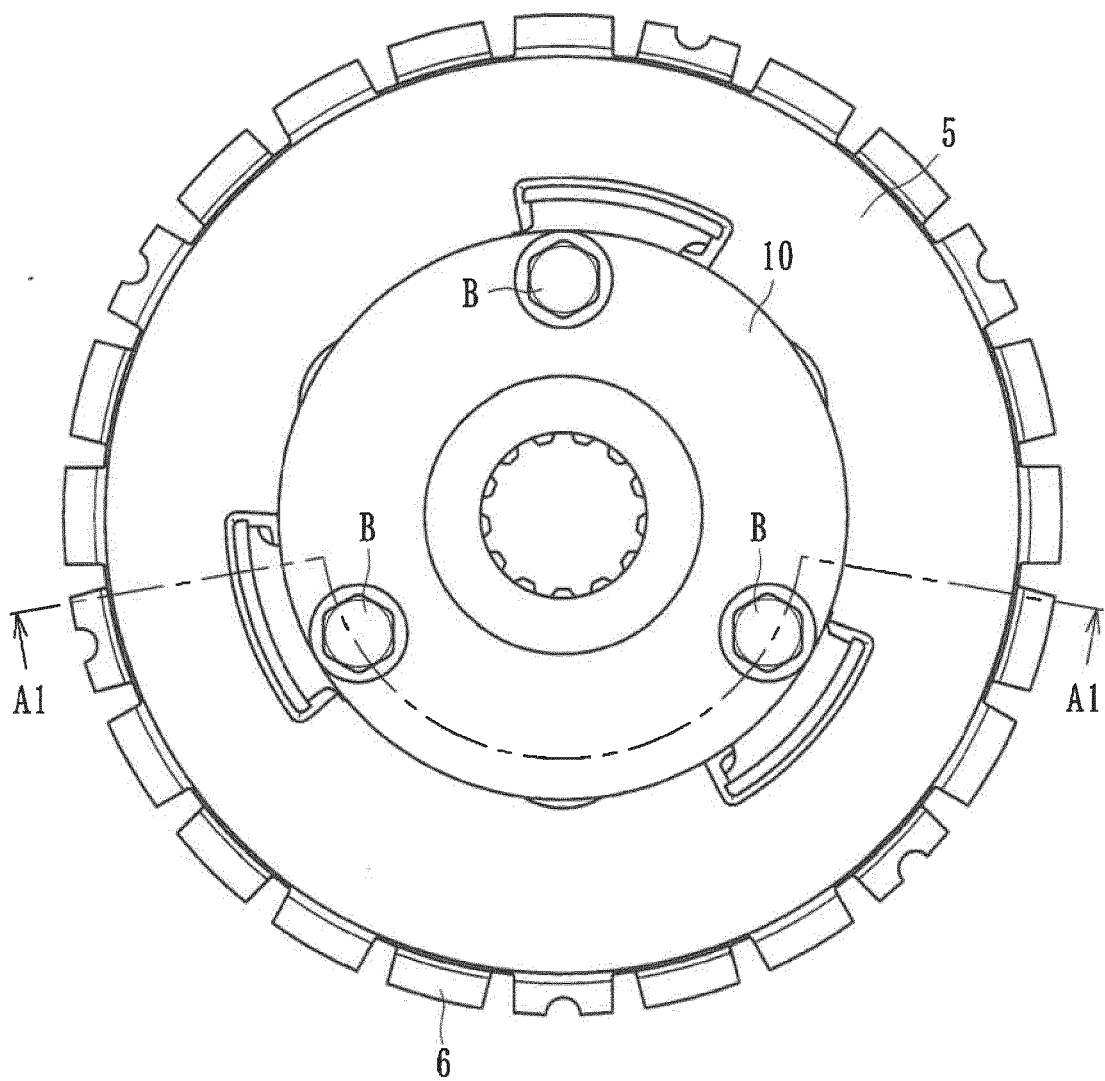
[Fig. 2]



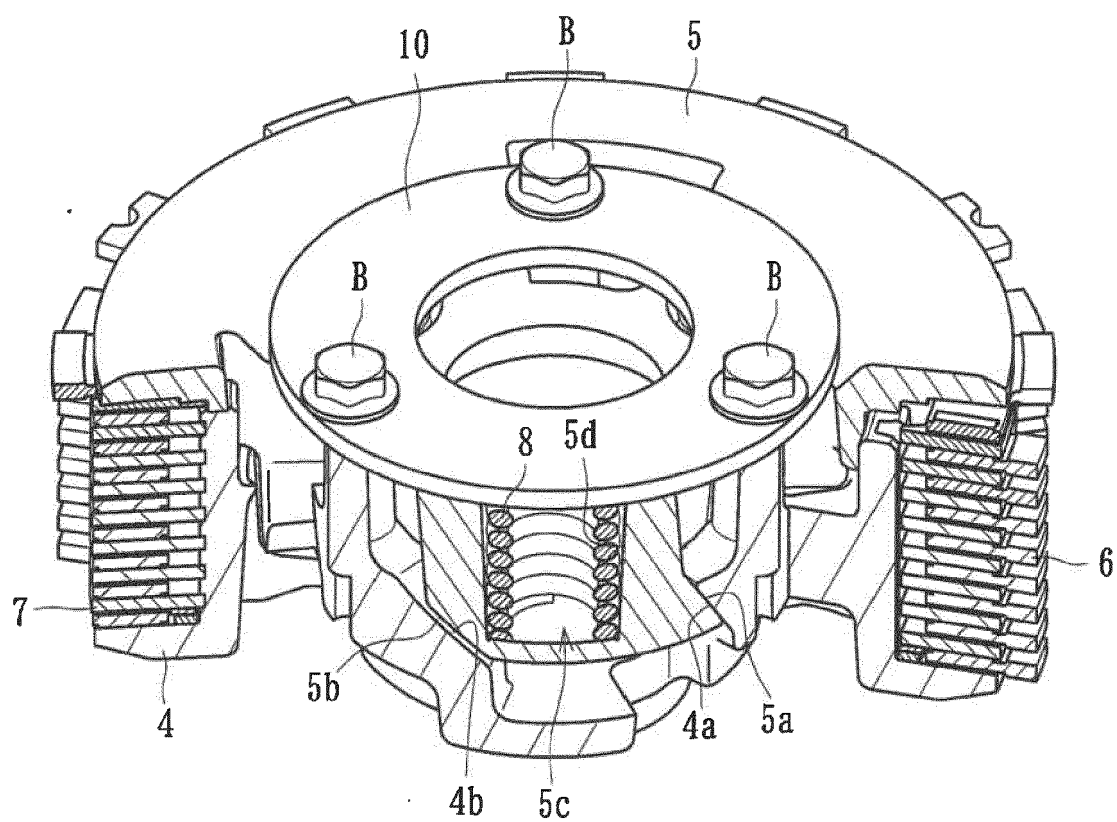
[Fig. 3]



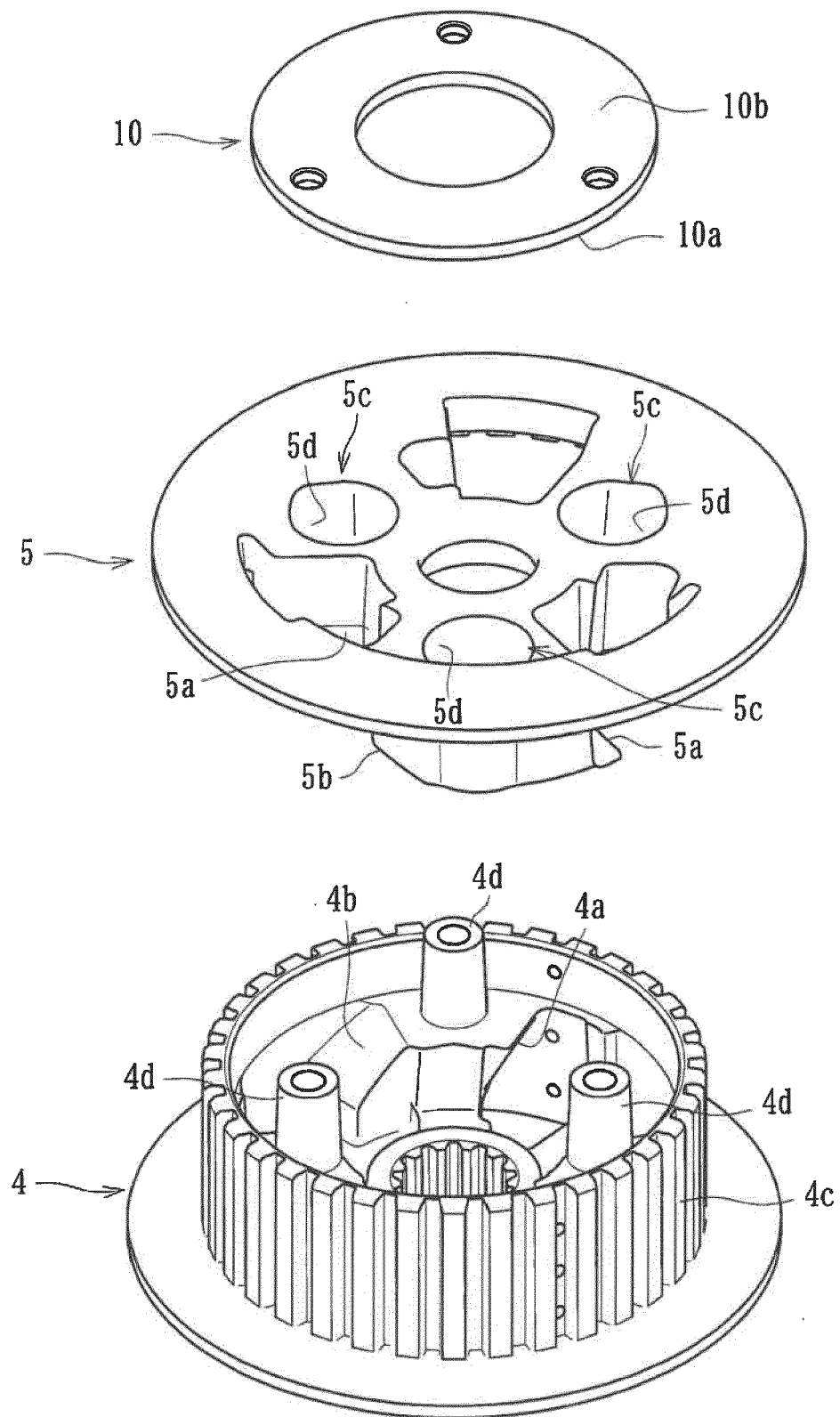
[Fig. 4]



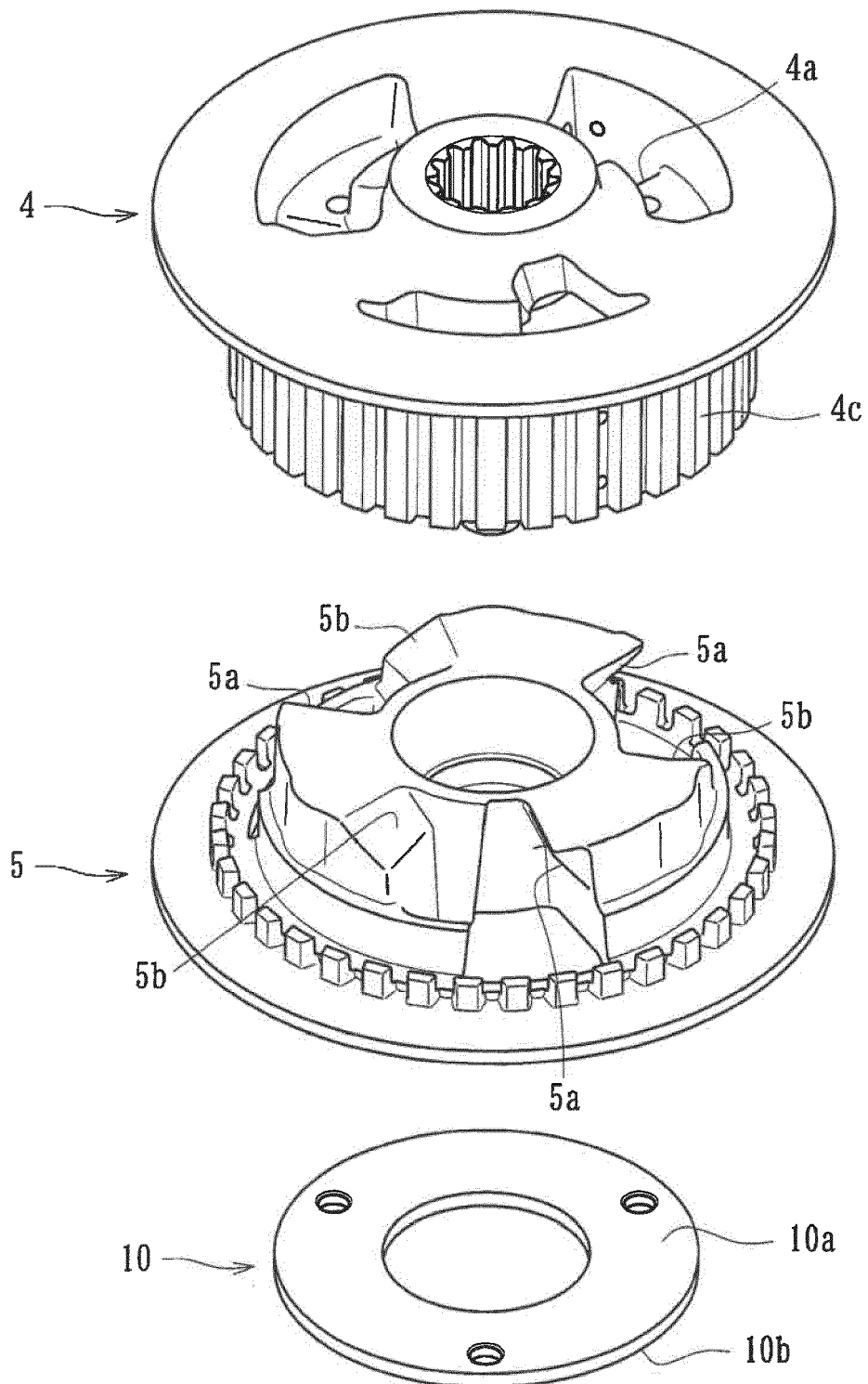
[Fig. 5]



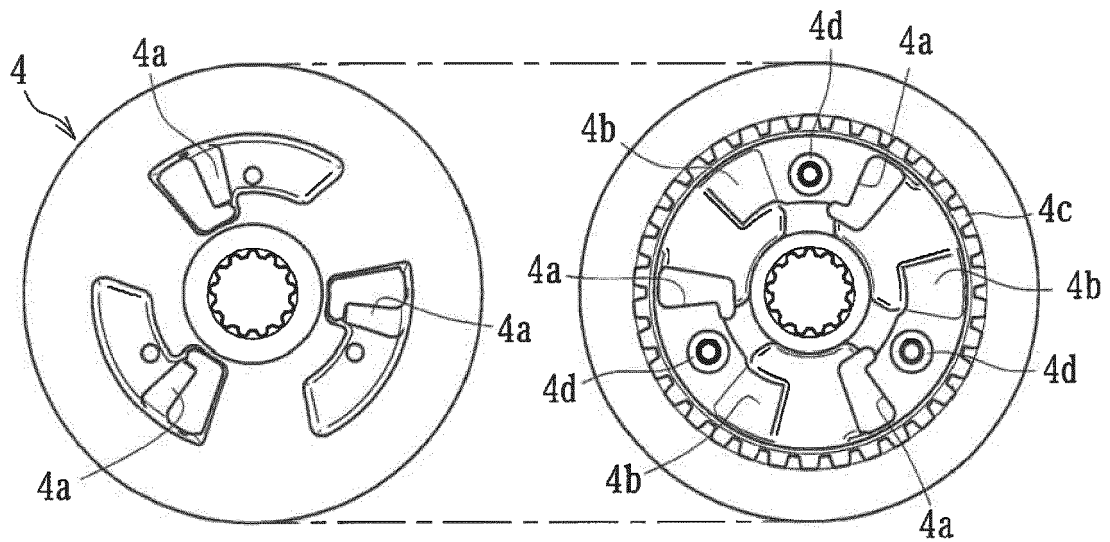
[Fig. 6]



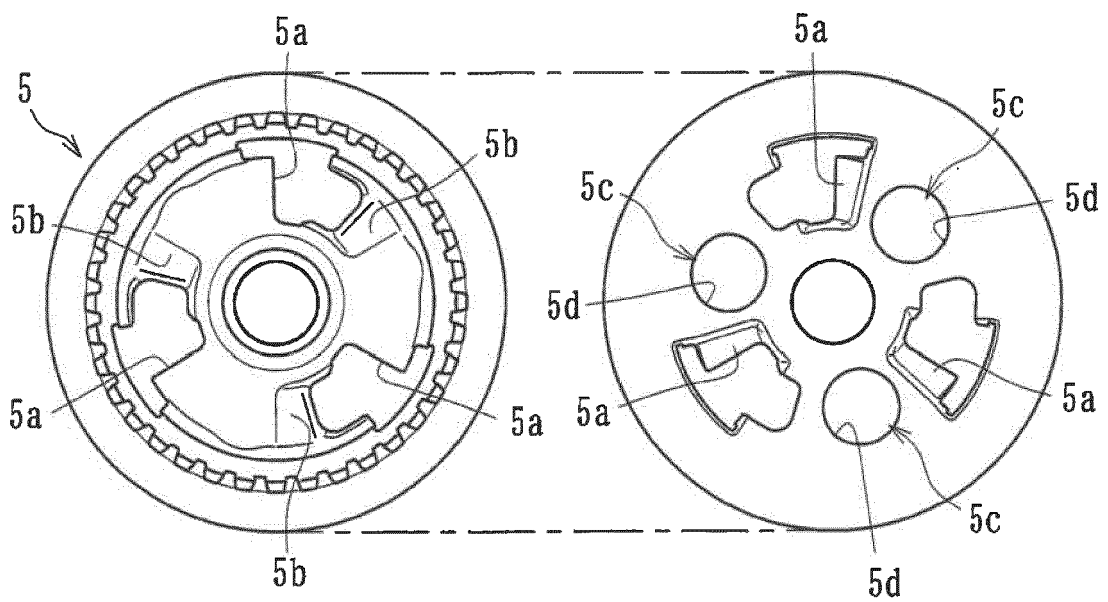
[Fig. 7]



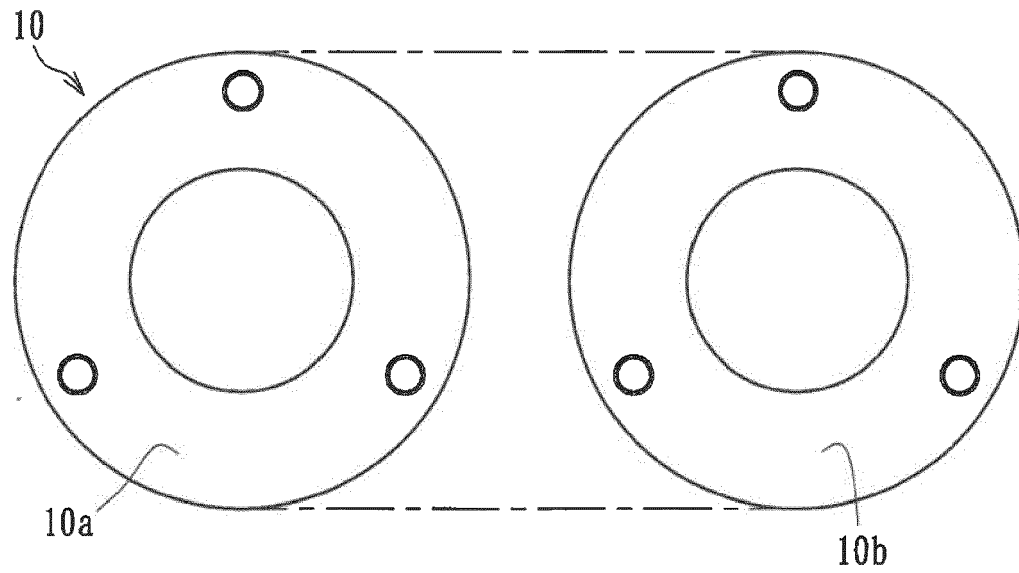
[Fig. 8]



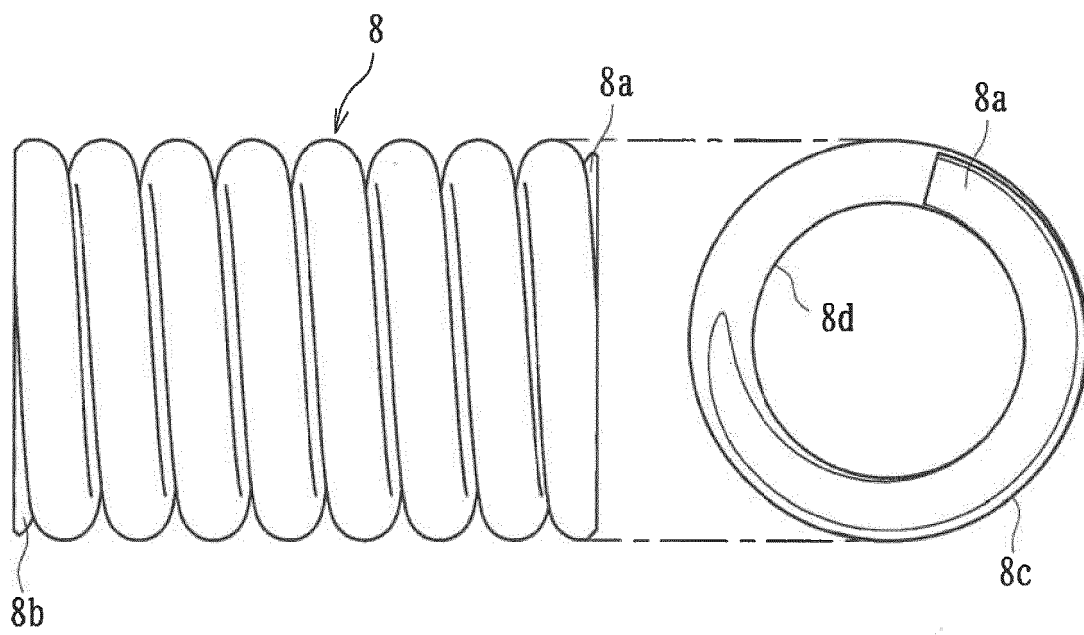
[Fig. 9]



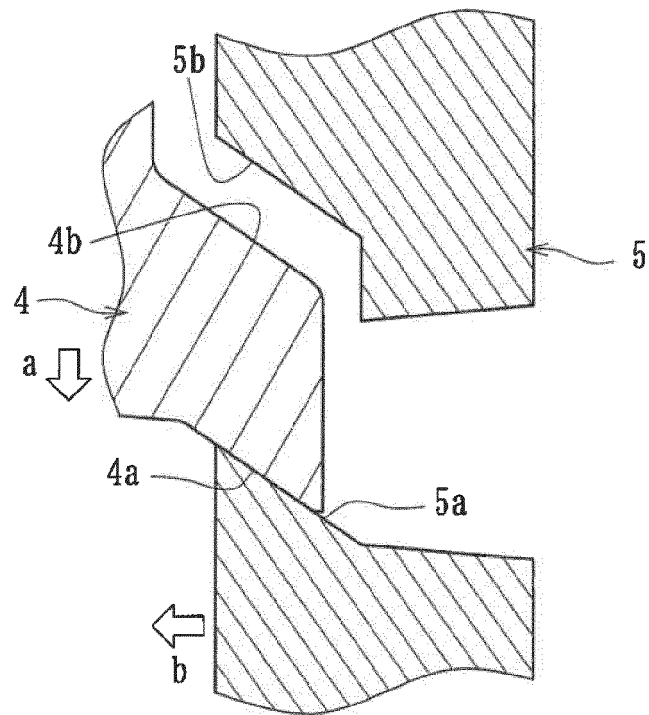
[Fig. 10]



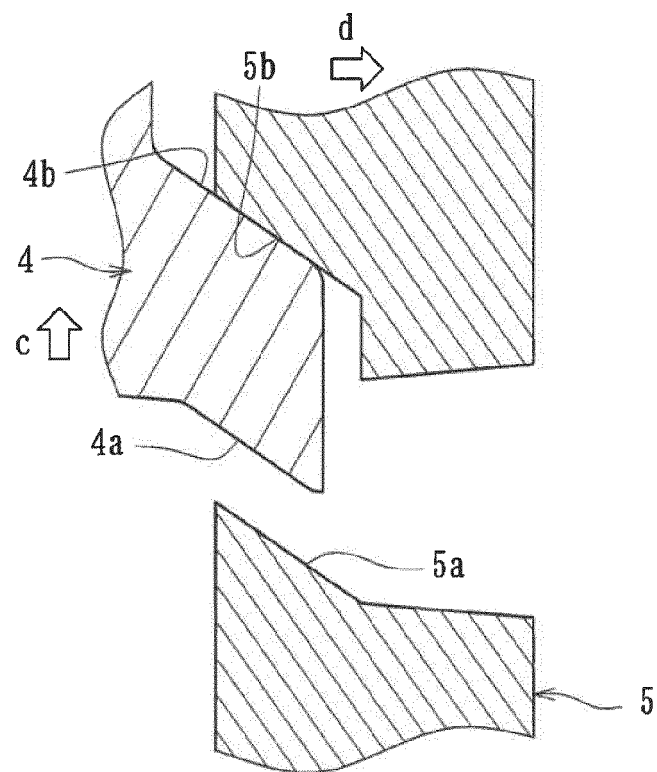
[Fig. 11]



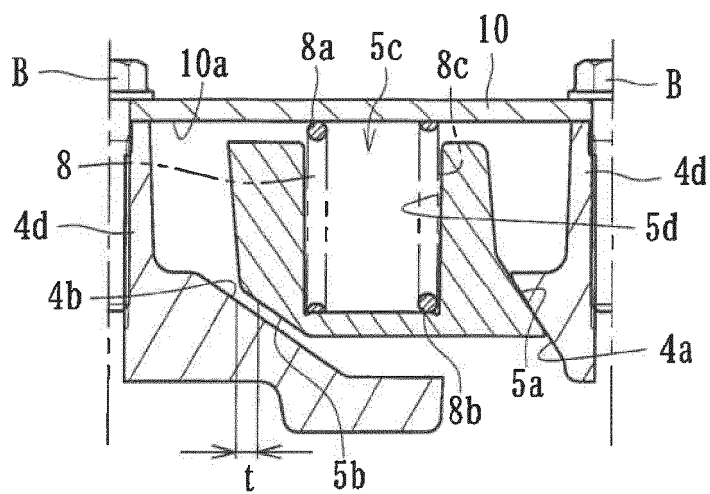
[Fig. 12]



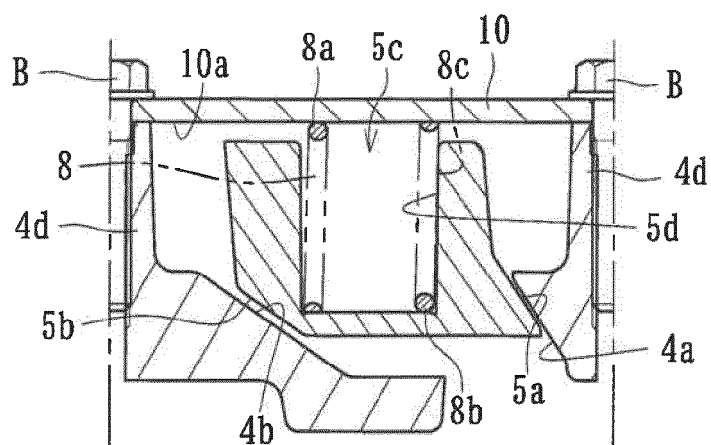
[Fig. 13]



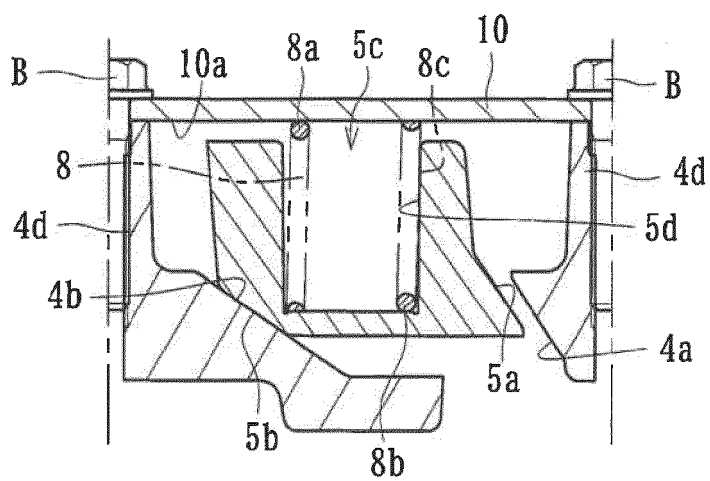
[Fig. 14]



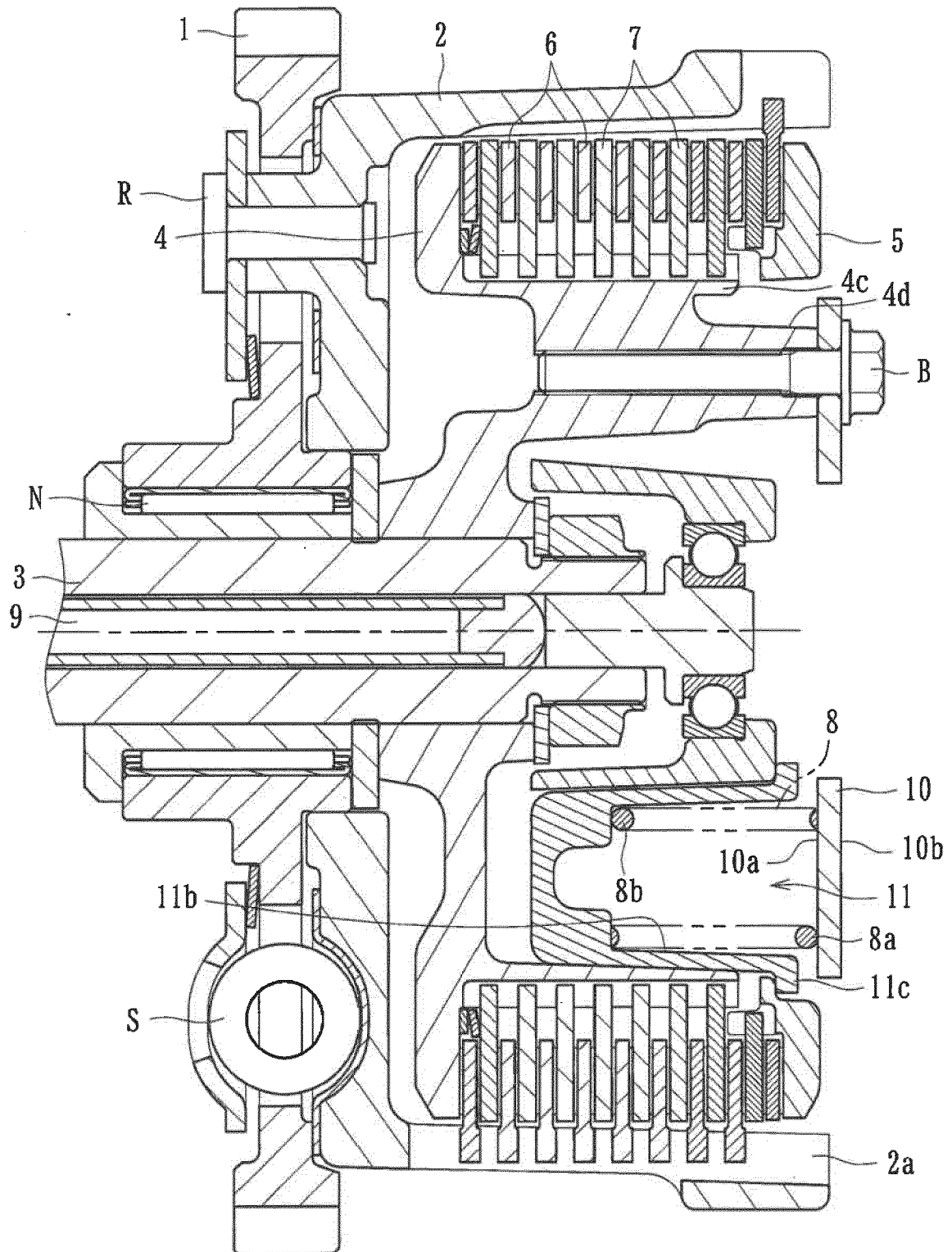
[Fig. 15]



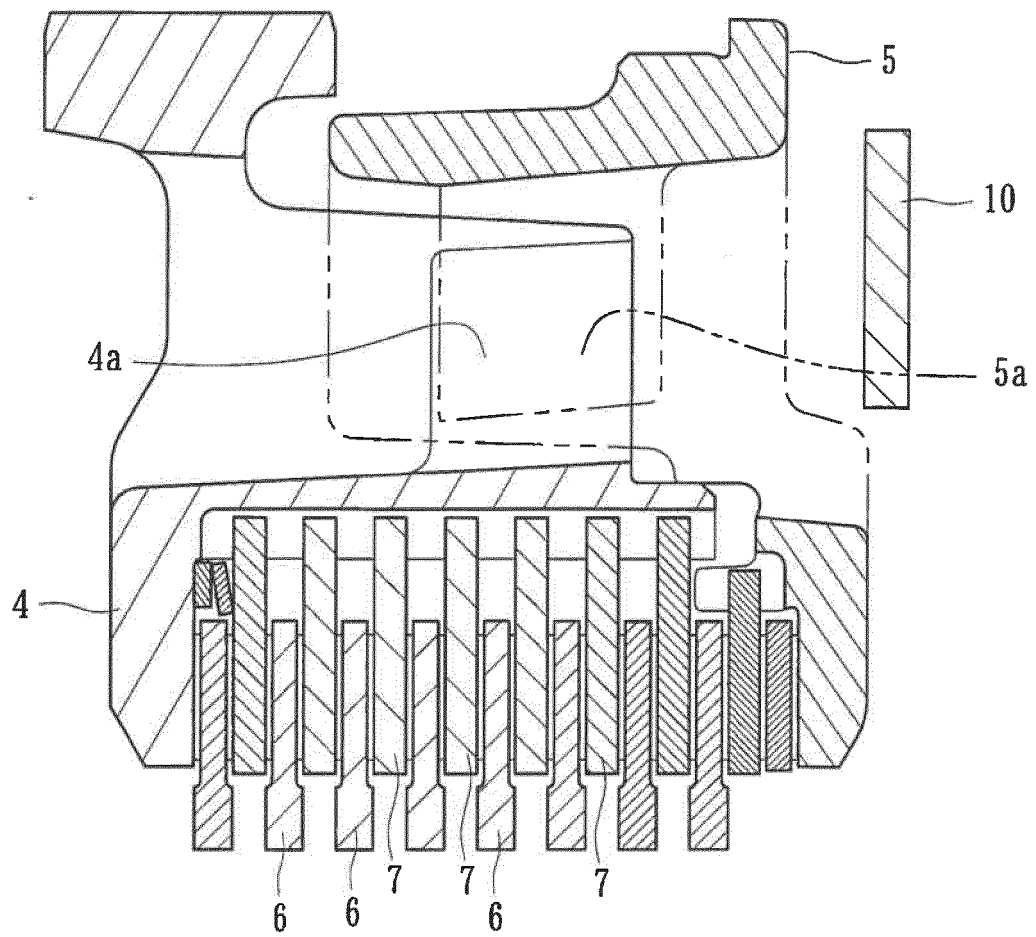
[Fig. 16]



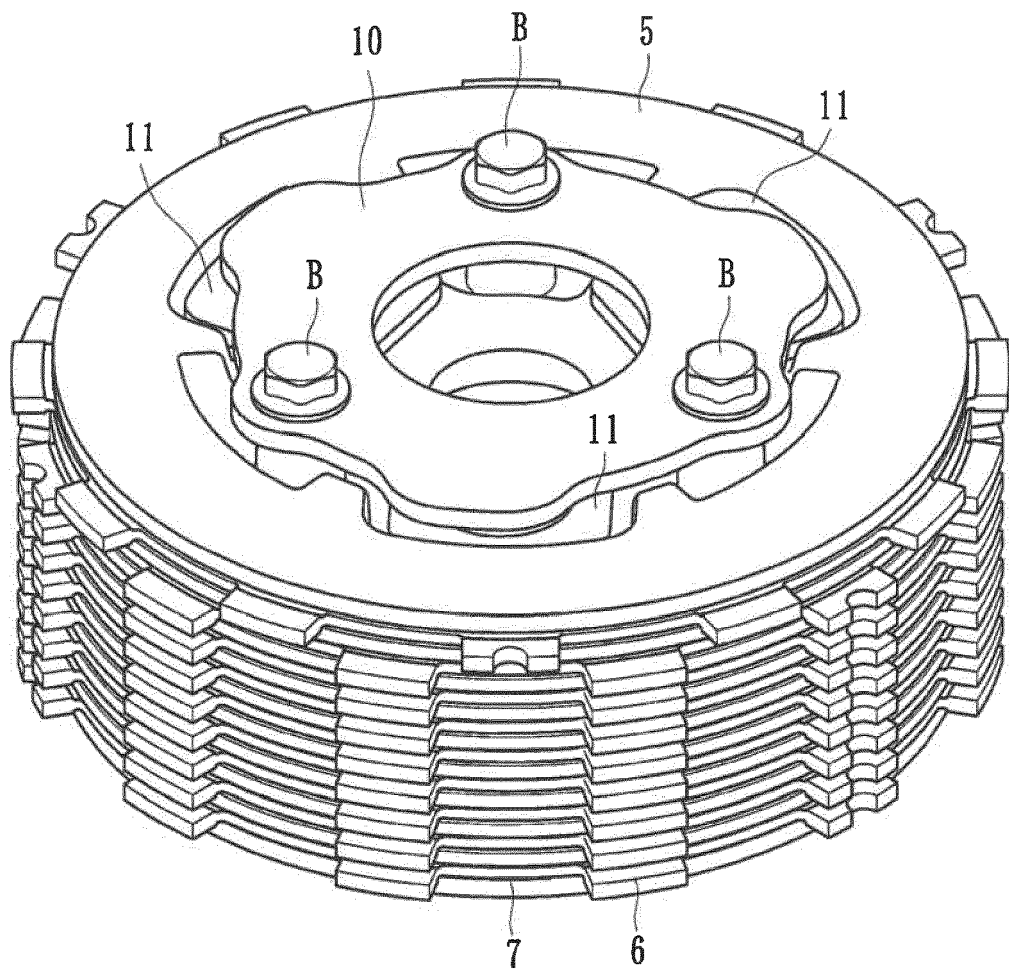
[Fig. 17]



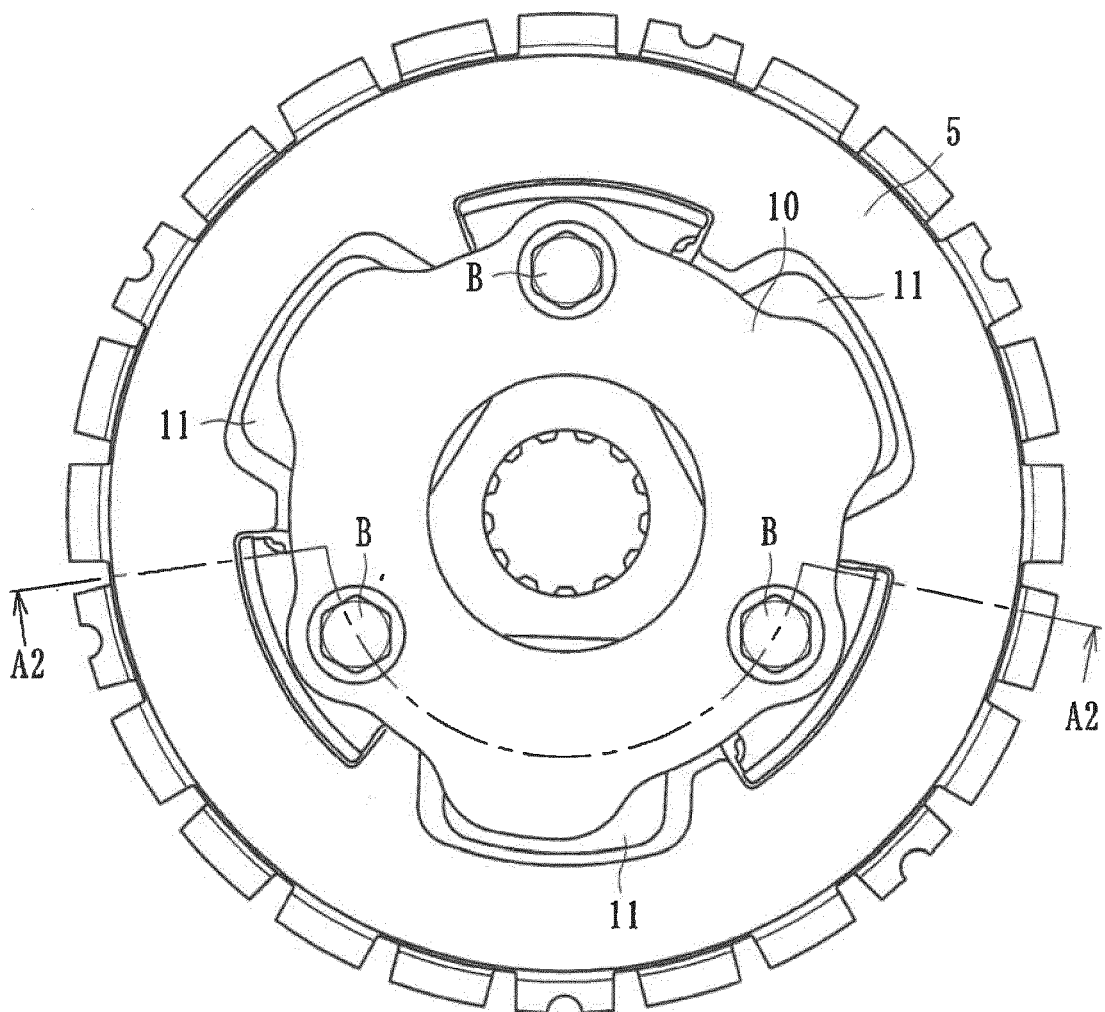
[Fig. 18]



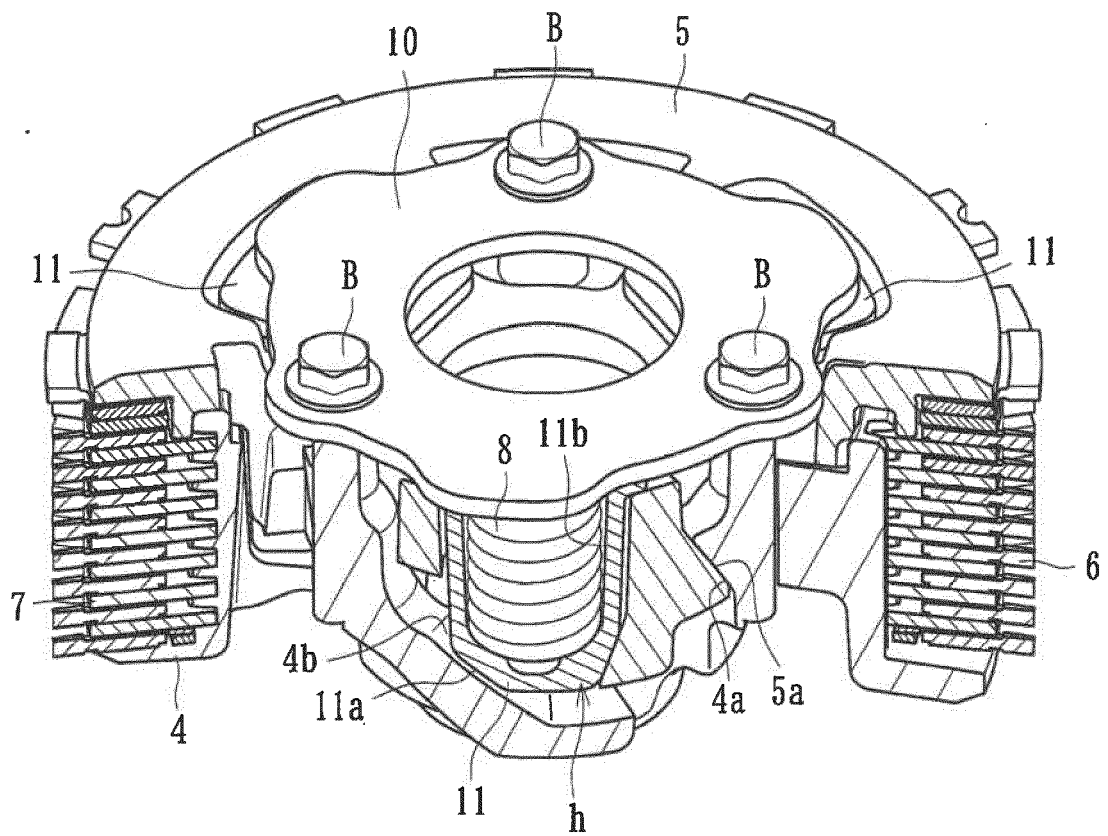
[Fig. 19]



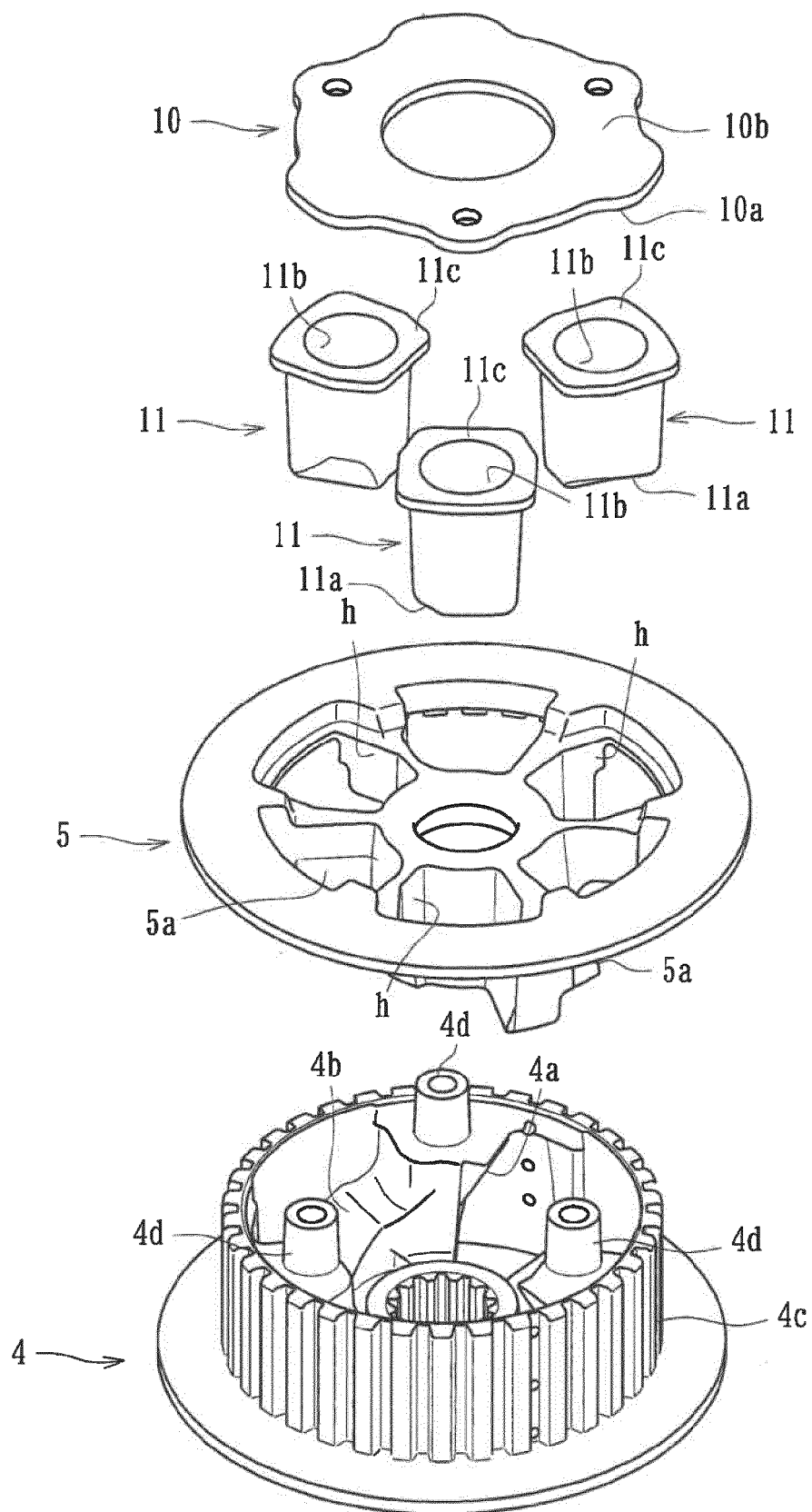
[Fig. 20]



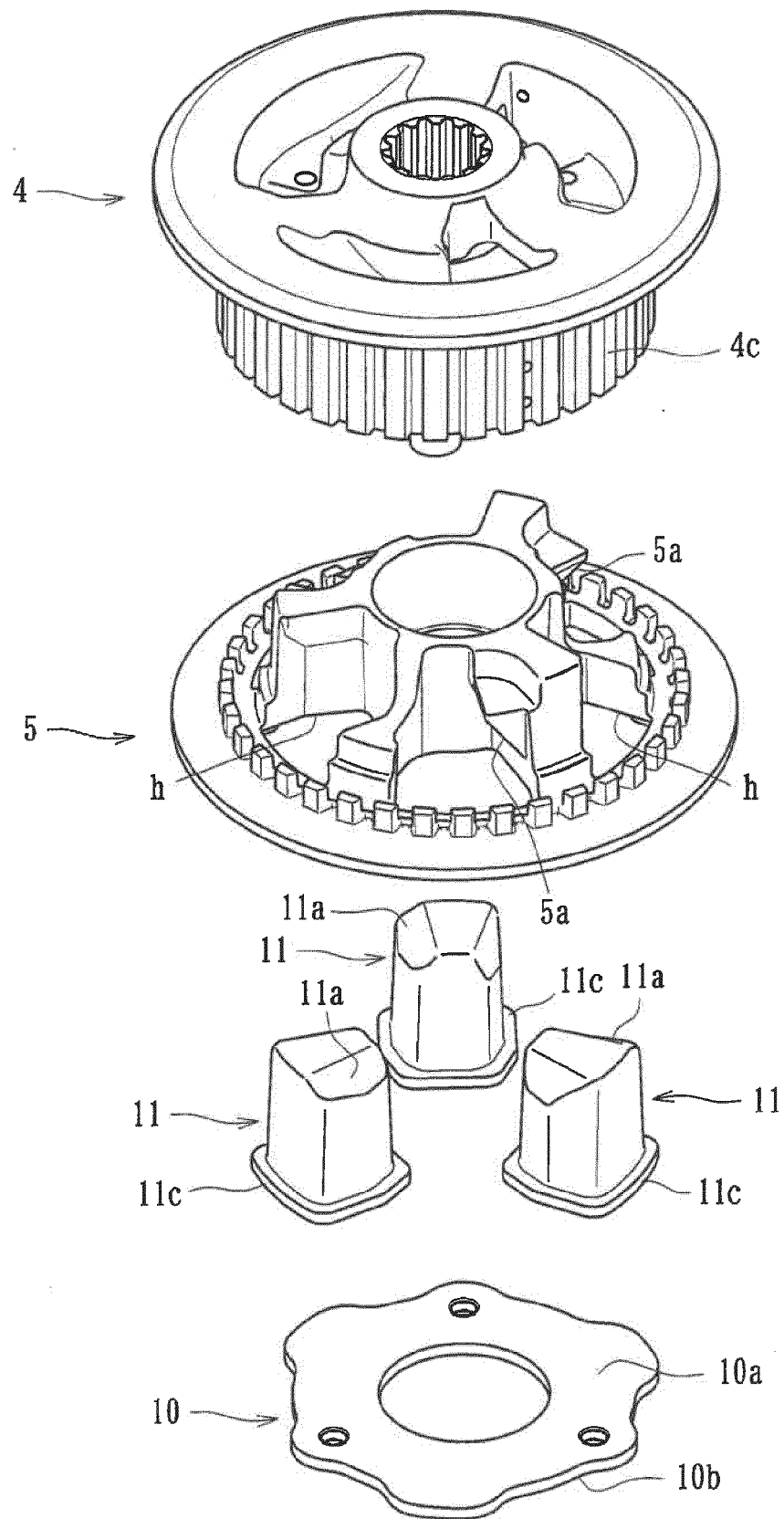
[Fig. 21]



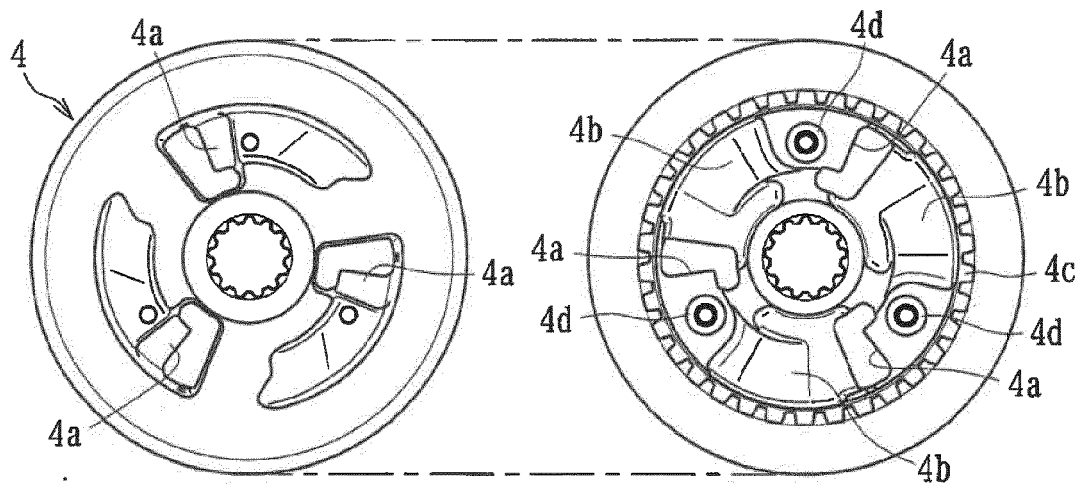
[Fig. 22]



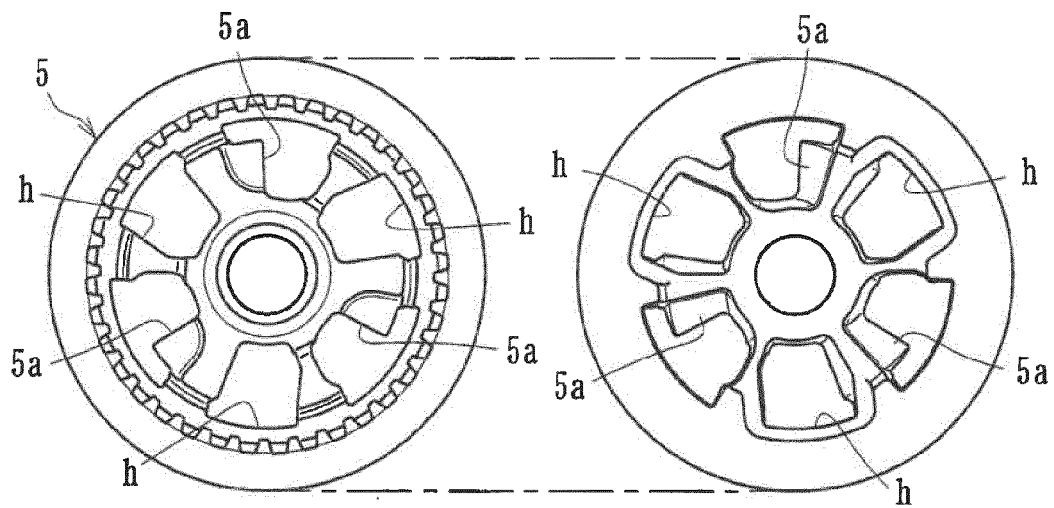
[Fig. 23]



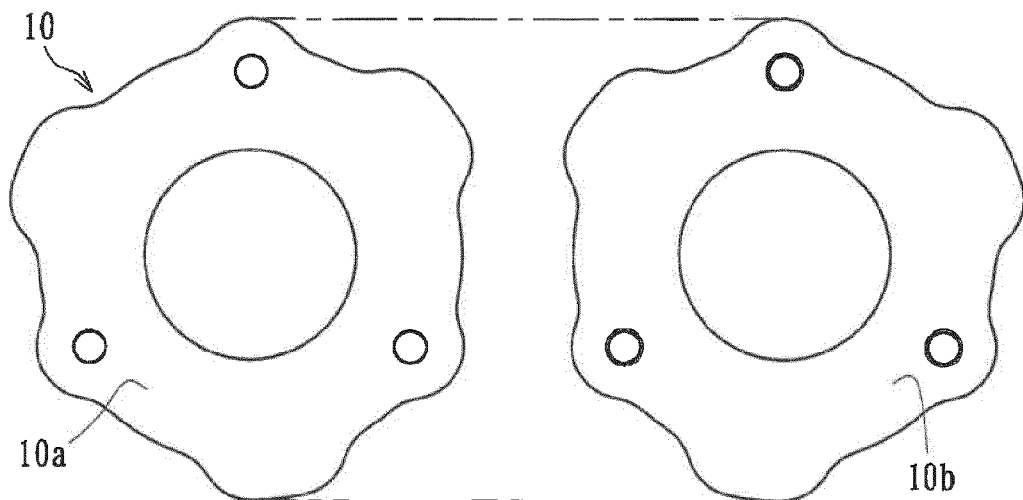
[Fig. 24]



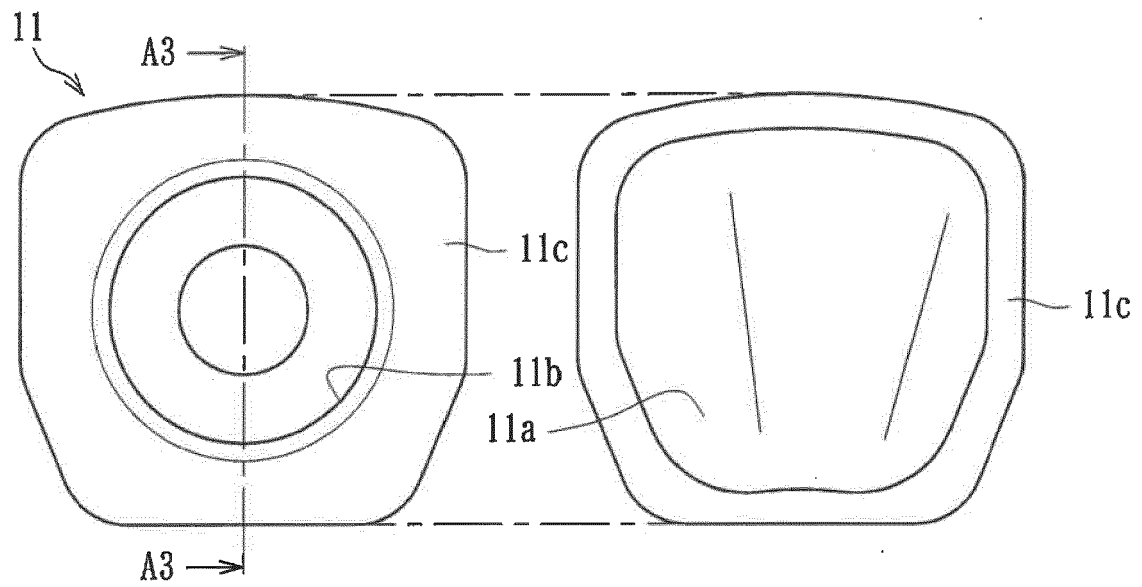
[Fig. 25]



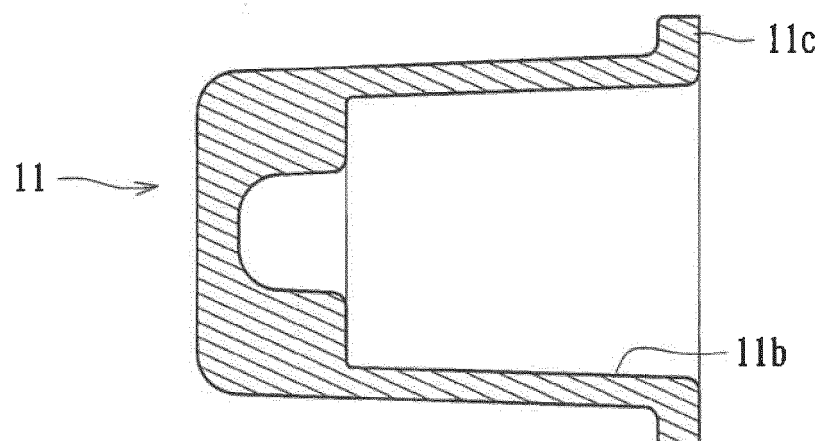
[Fig. 26]



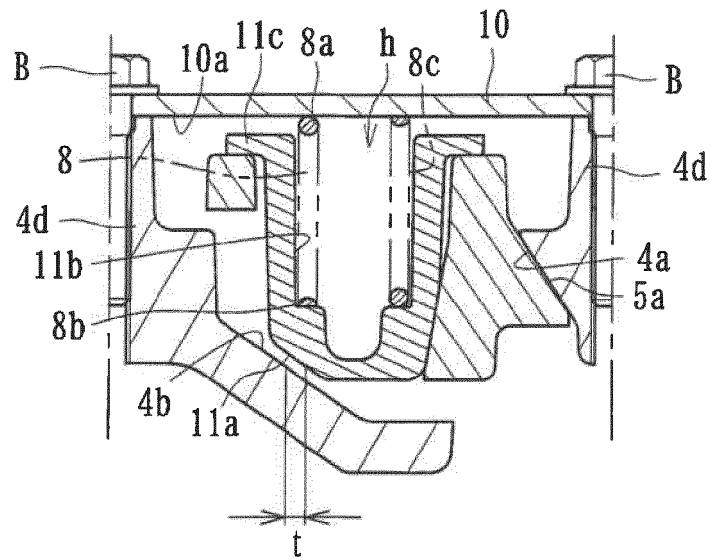
[Fig. 27]



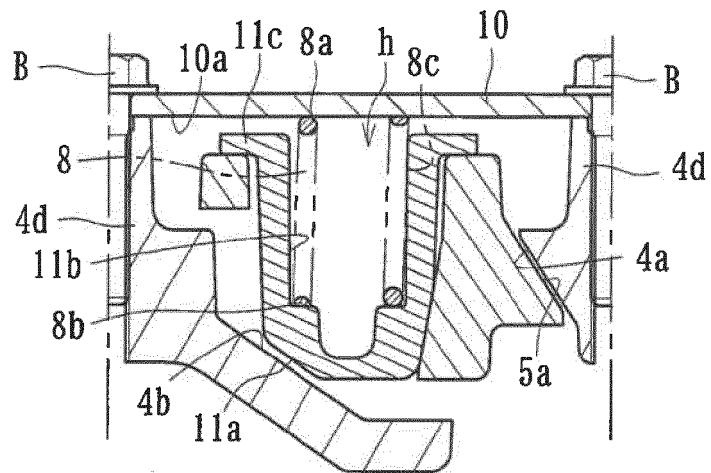
[Fig. 28]



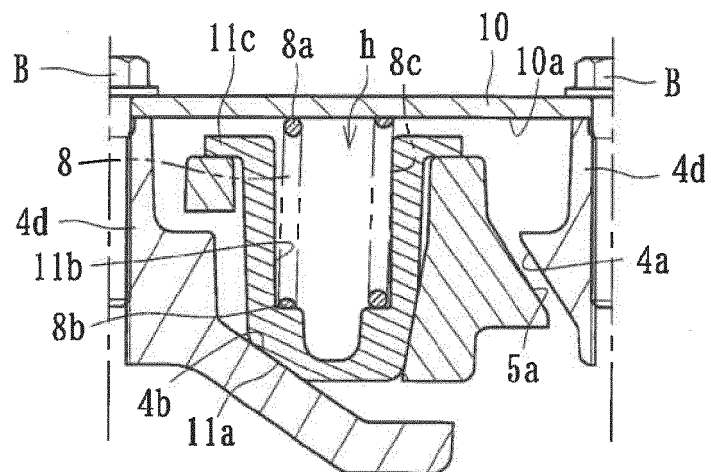
[Fig. 29]



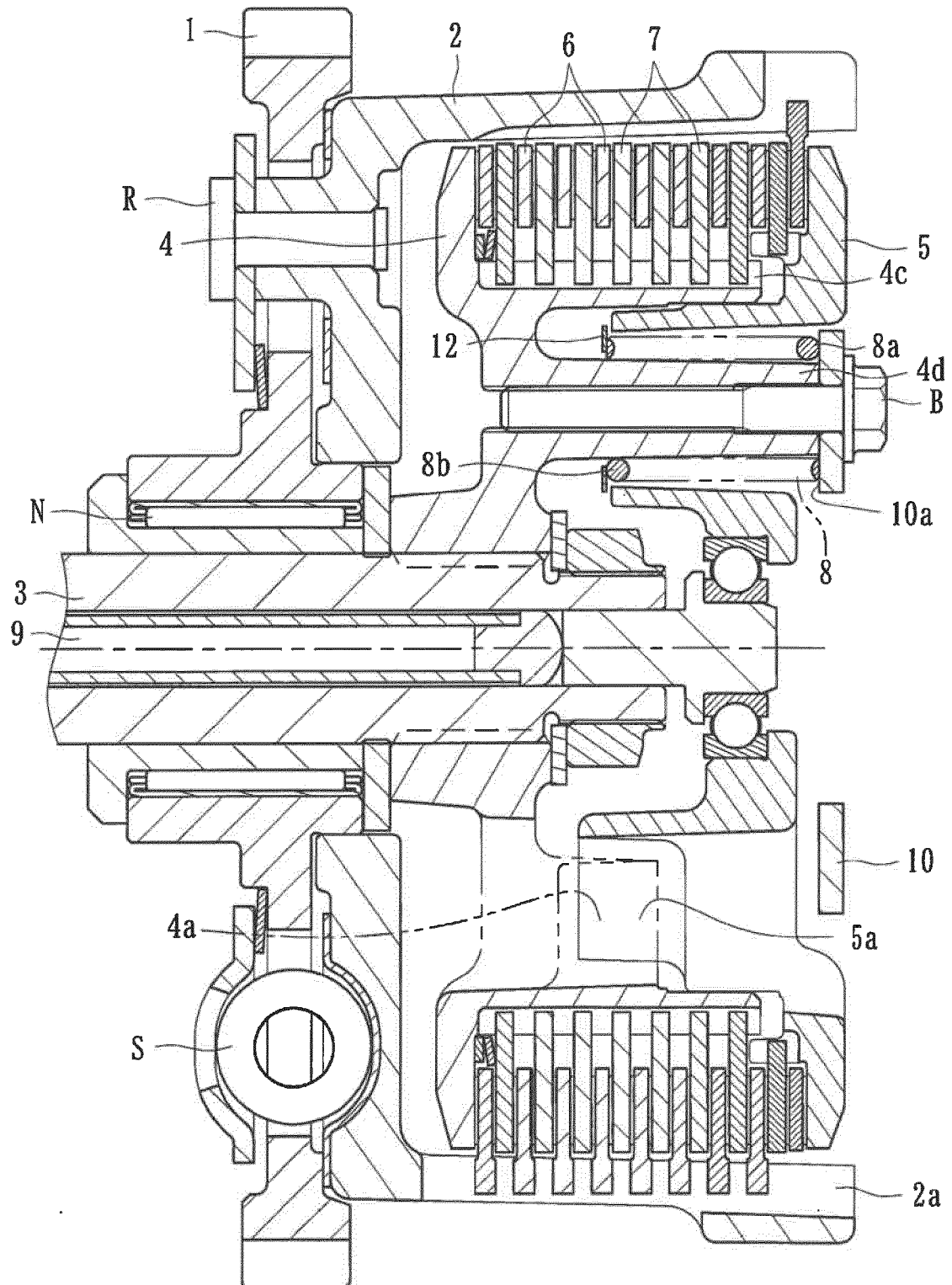
[Fig. 30]



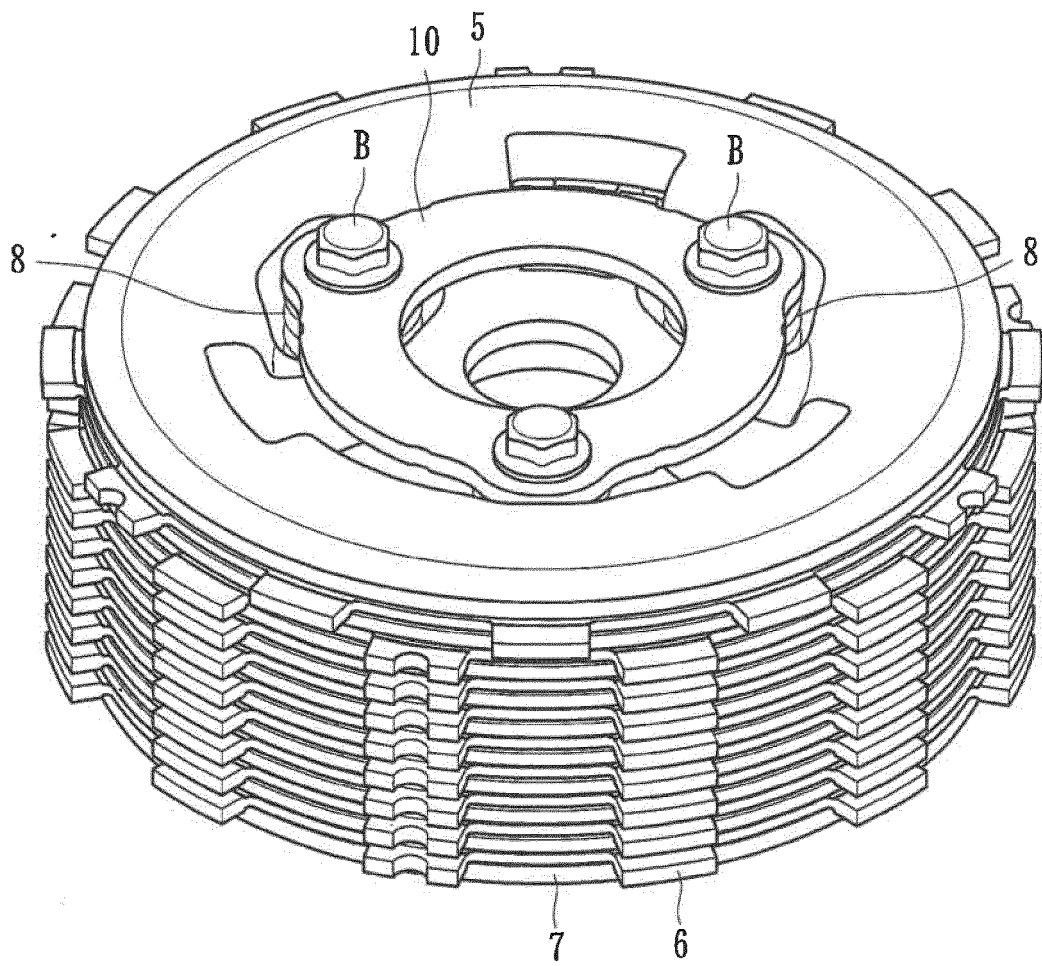
[Fig. 31]



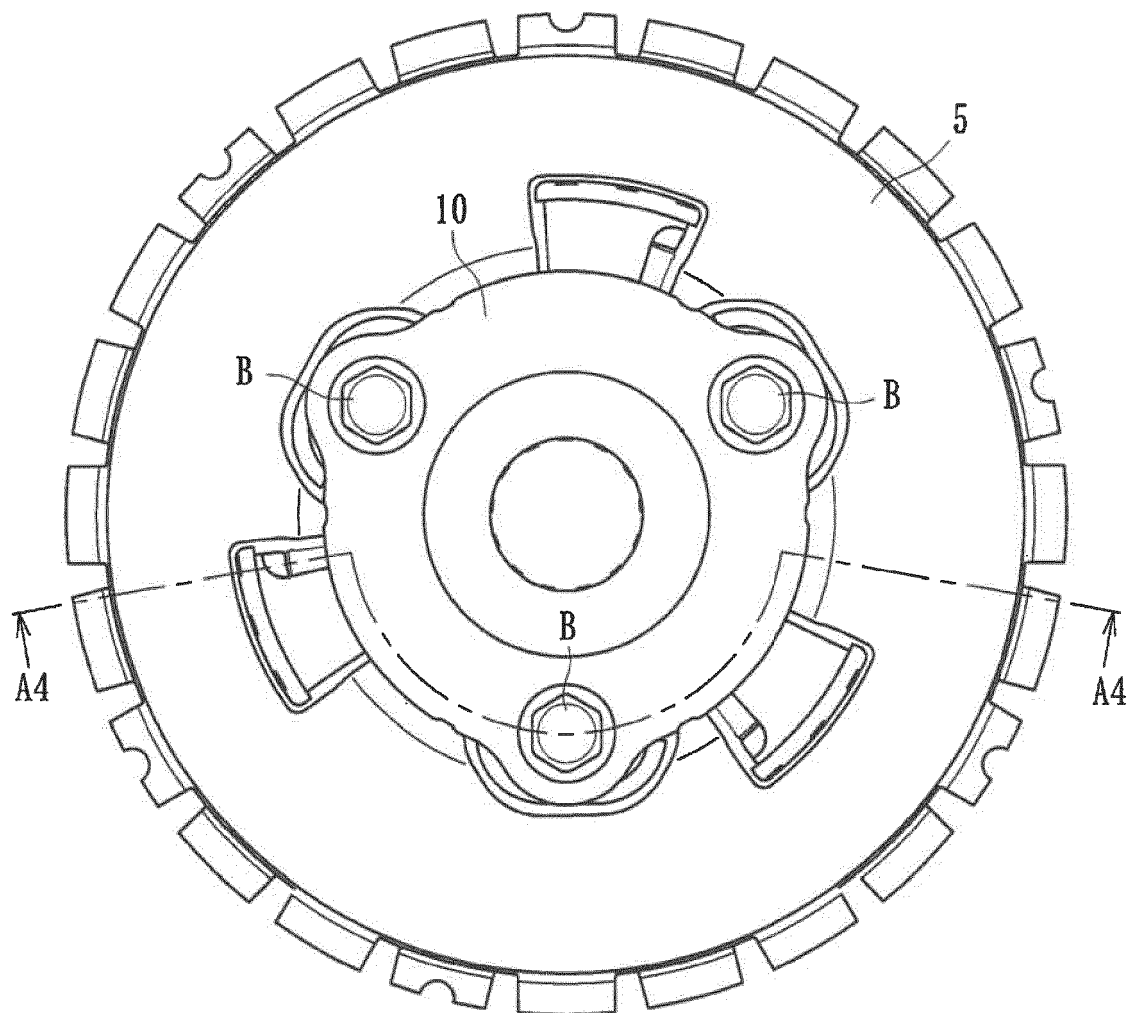
[Fig. 32]



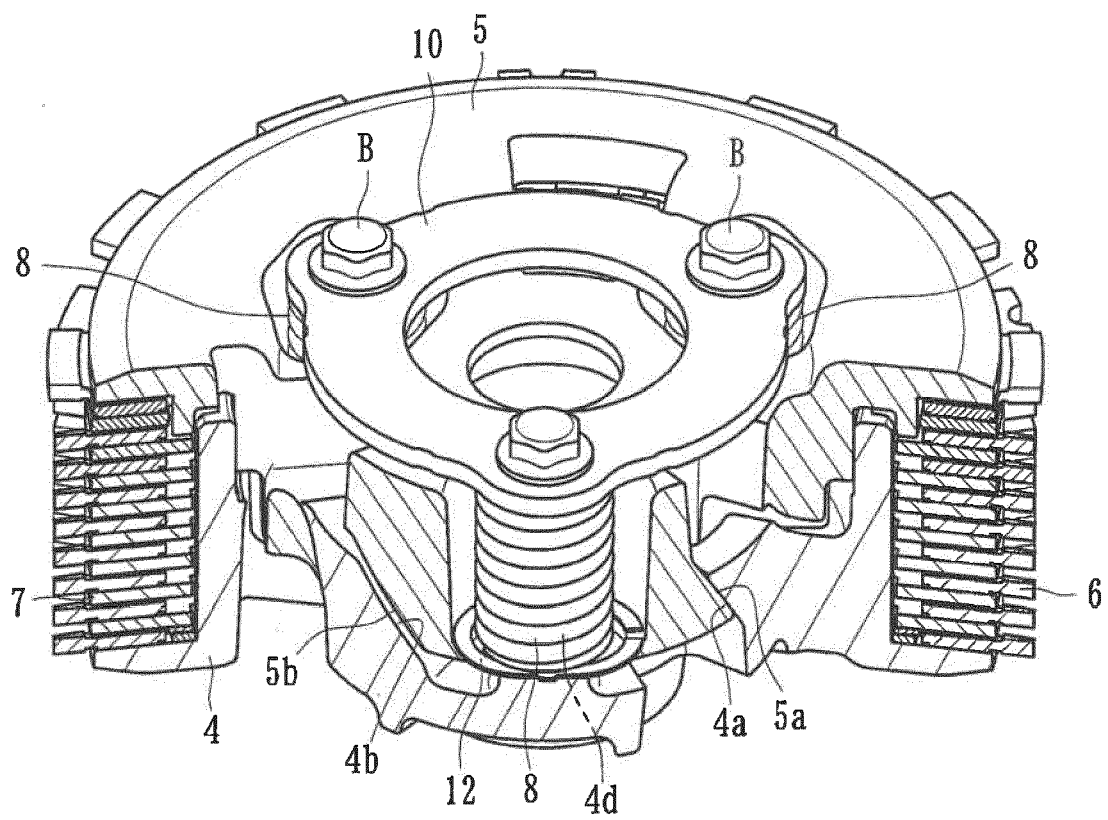
[Fig. 33]



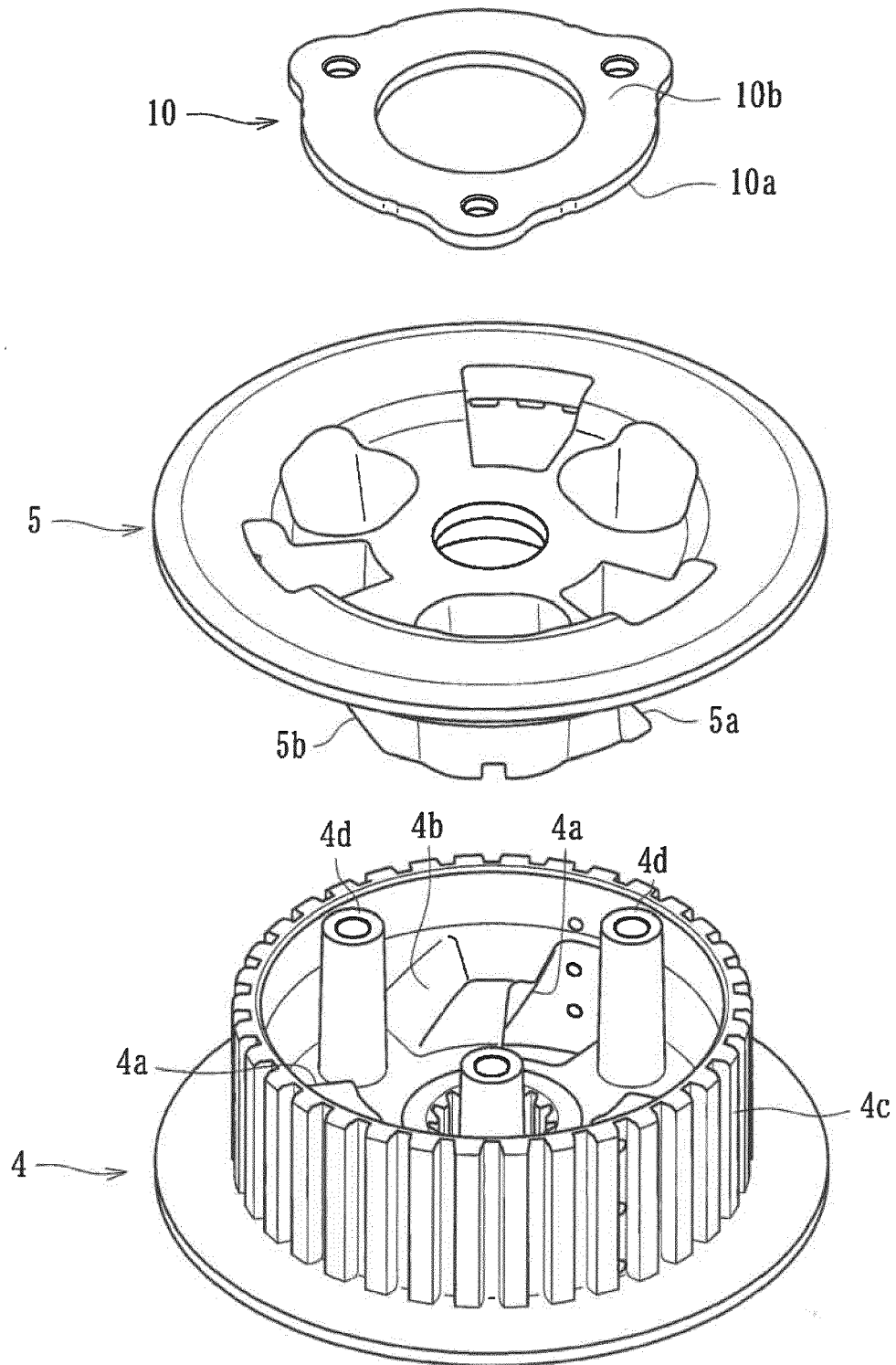
[Fig. 34]



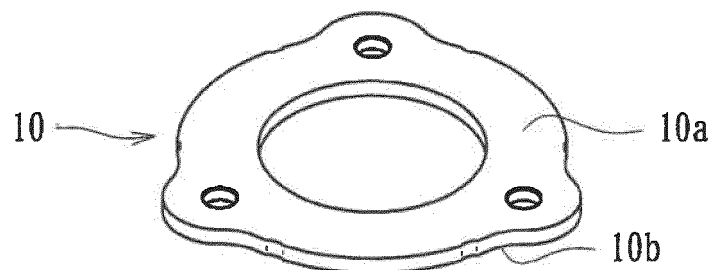
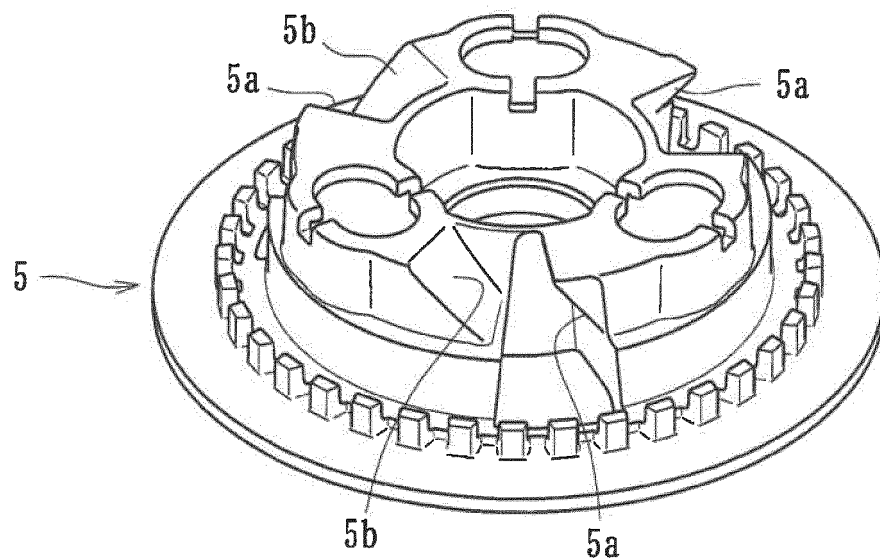
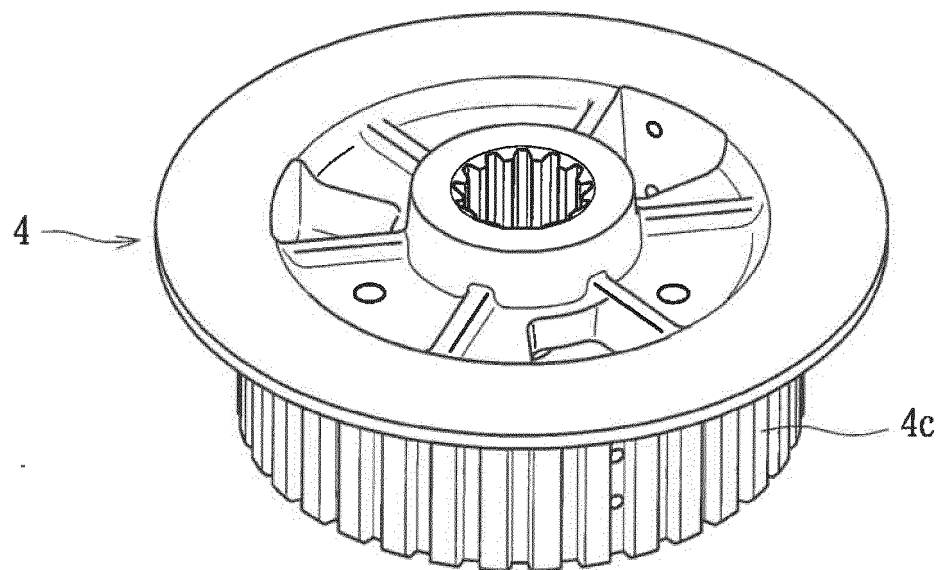
[Fig. 35]



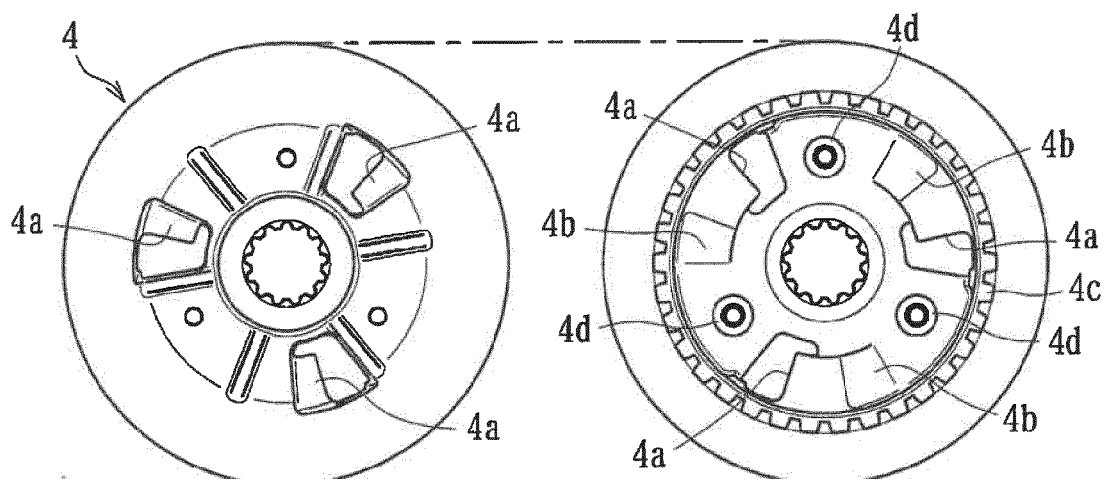
[Fig. 36]



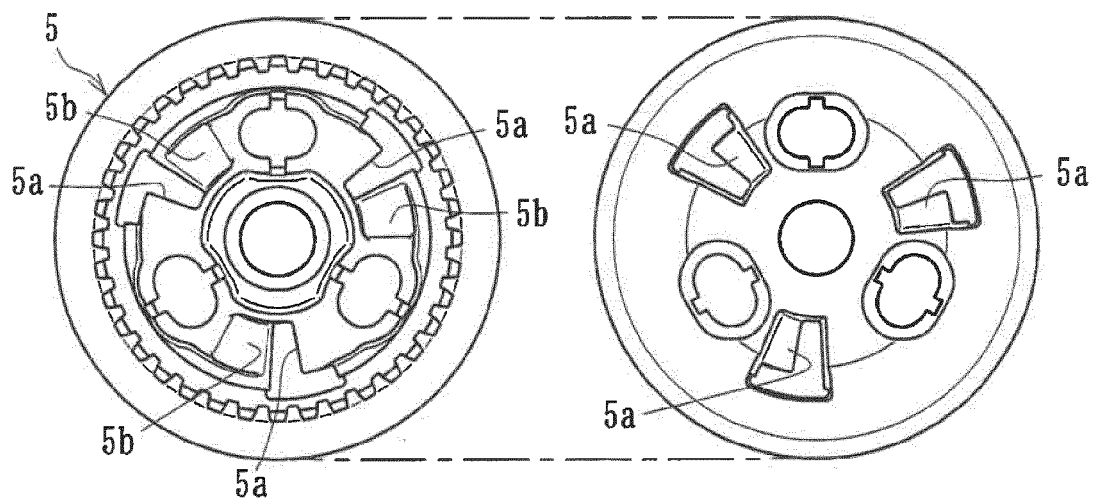
[Fig. 37]



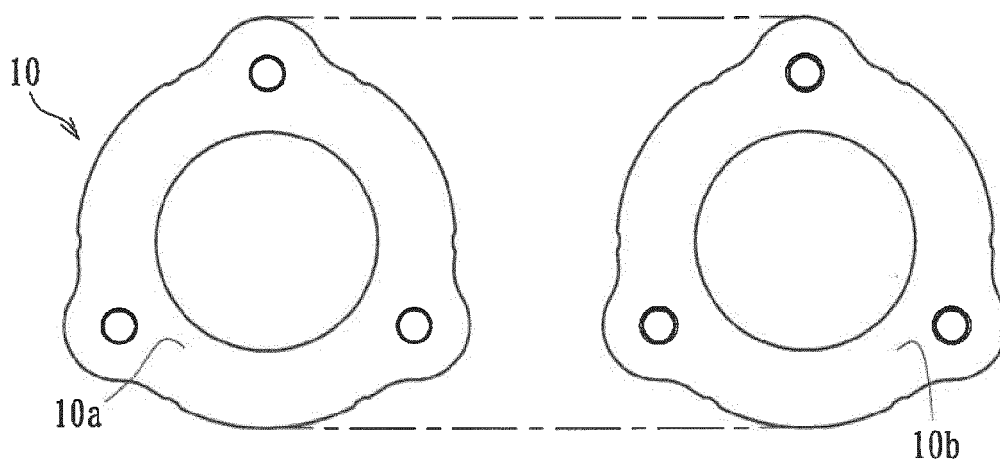
[Fig. 38]



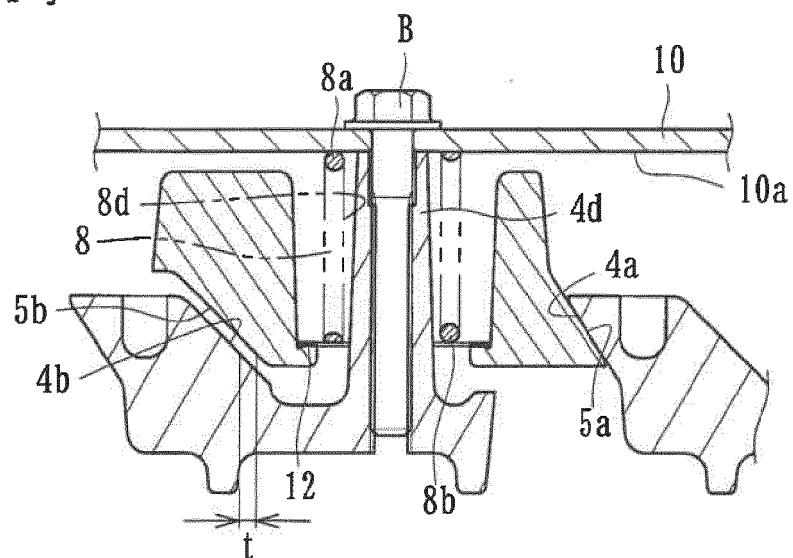
[Fig. 39]



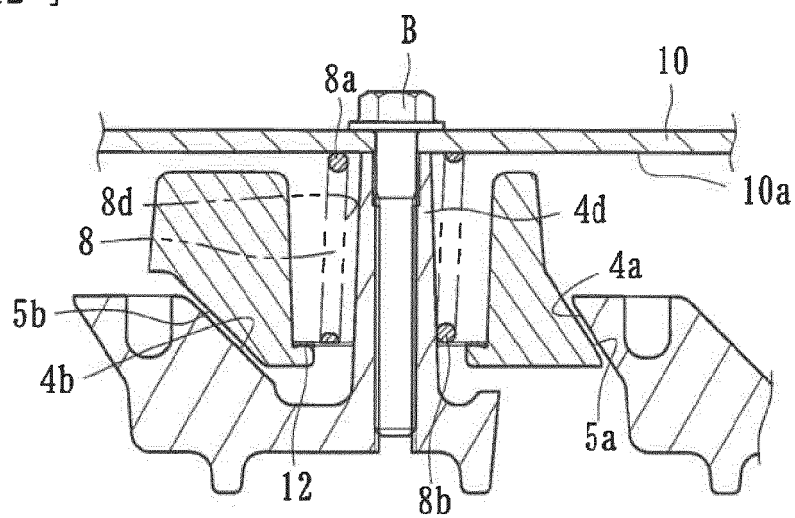
[Fig. 40]



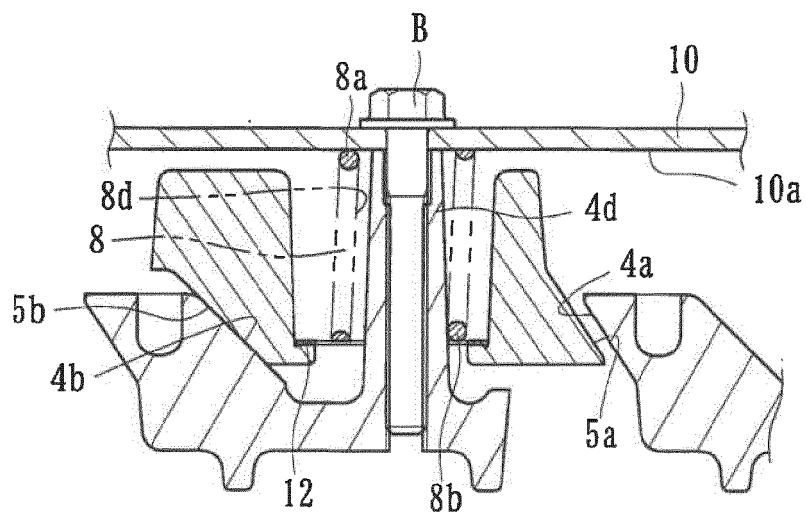
[Fig. 41]



[Fig. 42]



[Fig. 43]



REFERENCES CITED IN THE DESCRIPTION

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