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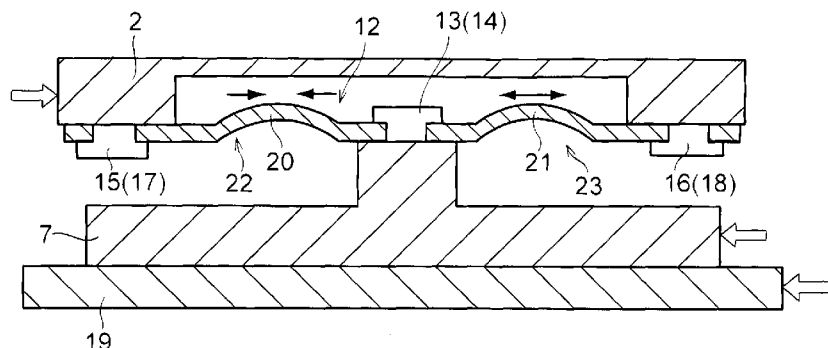
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(54) Title: CLUTCH

FIG. 1



(57) Abstract: A clutch in which a pressure plate that elastically pushes the clutch disc toward the input side rotating member side is arranged on an opposite side of the clutch disc from the input side rotating member, such that the clutch disc is sandwiched between the pressure plate and the input side rotating member, and the pressure plate is connected to a rotating body that rotates together with the input side rotating member, by a connecting mechanism, includes a first connecting portion that transmits torque from the rotating body to the pressure plate as a tensile load so as to increase a rotation speed of the output side rotating member, and a second connecting portion that transmits torque from the pressure plate to the rotating body as a tensile load so as to increase a rotation speed of the input side rotating member.



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CLUTCH

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The invention relates to a clutch configured to transmit torque by placing a clutch disc in frictional contact with an input side rotating member.

2. Description of Related Art

[0002] A clutch configured to transmit torque by squeezing a clutch disc with a flywheel that rotates together with an output shaft of an engine, and a pressure plate that is connected to this flywheel via a clutch cover is known. One such clutch is described in Japanese Patent Application Publication No. 2010-78156 (JP 2010-78156 A). In the clutch described in JP 2010-78156 A, the flywheel and the clutch cover are integrated, and the pressure plate is provided so as to be able to move in the axial direction, on the inner side of the clutch cover. Also, a strap plate formed by a plurality of plate members stacked together is provided so as to both apply elastic force in a direction that moves the pressure plate away from the clutch disc, and make the clutch cover and the pressure plate rotate together. More specifically, one end portion of the strap plate is connected to the clutch cover, and the other end portion of the strap plate is connected to the pressure plate in a position offset in the circumferential direction from a fixing portion that is connected to the clutch cover. Also, a release mechanism that is configured to apply elastic force of a diaphragm spring in a direction against the elastic force of the strap plate, and that reduce the elastic force of this diaphragm spring, is also provided.

SUMMARY OF THE INVENTION

[0003] The clutch provided with a strap plate such as that described in JP 2010-78156 A is normally configured such that a tensile load is applied to the strap plate when transmitting output torque from an engine to a driving wheel. With a clutch

configured to apply a tensile load to the strap plate when transmitting output torque from an engine to the driving wheel in this way, a compression load is applied to the strap plate when transmitting torque from the output side of the clutch such that the engine speed increases. Therefore, when torque transmitted from the output side of the clutch such that the engine speed increases is large, the durability of the strap plate may end up decreasing.

[0004] Also, when a tensile load is applied to the strap plate, a component force of this tensile load acts in a direction that moves the strap plate away from the clutch disc. The component force of the tensile load applied to the pressure plate in this way is able to be estimated relatively easily from the rigidity of the strap plate and the torque input to the clutch and the like. On the other hand, when a compression load is applied to the strap plate, a component force of this compression load acts to push the pressure plate toward the clutch disc side. In this case, it is relatively difficult to estimate the load that pushes the pressure plate toward the clutch disc side, so controllability of the transfer torque capacity of the clutch may decrease.

[0005] The invention provides a clutch reducing a compression load applied to a strap plate.

[0006] A first aspect of the invention relates to a clutch that includes an input side rotating member, an output side rotating member, a clutch disc, a pressure plate, a rotating body, and a connecting mechanism. The clutch disc is connected to the output side rotating member and is arranged opposing the input side rotating member. The clutch disc is configured to transmit torque by being placed in frictional contact with the input side rotating member. The pressure plate is arranged on an opposite side of the clutch disc from the input side rotating member, such that the clutch disc is sandwiched between the pressure plate and the input side rotating member. The pressure plate is configured to elastically push the clutch disc toward the input side rotating member side. The rotating body is configured to rotate together with the input side rotating member. The connecting mechanism connects the rotating body to the pressure plate, and is configured to transmit torque between the rotating body and the pressure plate. The connecting mechanism includes a first connecting portion and a second connecting portion. The first connecting

portion is configured to transmit torque from the rotating body to the pressure plate as a tensile load so as to increase a rotation speed of the output side rotating member. The second connecting member is configured to transmit torque from the pressure plate to the rotating body as a tensile load so as to increase a rotation speed of the input side rotating member.

[0007] According to this aspect, the connecting mechanism is configured to transmit torque as a tensile load when torque is input from the input side rotating member so as to increase the rotation speed of the output side rotating member, as well as when torque is input from the output side rotating member so as to increase the rotation speed of the input side rotating member, so a decrease in durability due to a compression load being excessively applied to the connecting mechanism is able to be inhibited or prevented. Also, a component force of a load applied to the connecting mechanism is able to be inhibited or prevented from acting in a direction that pushes the pressure plate in the axial direction, so controllability of friction force between the pressure plate and the clutch disc is able to be inhibited or prevented from decreasing.

[0008] In the aspect described above, the connecting mechanism may include a first fixing portion, a second fixing portion, and a third fixing portion. The first fixing portion may be located between the second fixing portion and the third fixing portion in a circumferential direction. The first fixing portion may be connected to one of the rotating body and the pressure plate. The second fixing portion and the third fixing portion may be connected to the other of the rotating body and the pressure plate.

[0009] In the aspect described above, a position of the first fixing portion, a position of the second fixing portion, and a position of the third fixing portion may be configured to be the same position in an axial direction when the clutch disc contacts the pressure plate and torque is transmitted.

[0010] According to this aspect, a component force of a load applied to the connecting mechanism in the direction in which the pressure plate pushes the clutch disc is able to be inhibited or prevented even if a compression or tensile load is applied to the connecting mechanism. As a result, controllability of the friction force between the

pressure plate and the clutch disc is able to be inhibited or prevented from decreasing.

[0011] In the aspect described above, the connecting mechanism may include a third connecting portion and a fourth connecting portion. The third connecting portion is connected to the first fixing portion and the second fixing portion, and is configured to elastically deform in an axial direction. The fourth connecting portion is connected to the first fixing portion and the third fixing portion, and is configured to elastically deform in the axial direction. A length of the third connecting portion is the same as a length of the fourth connecting portion.

[0012] According to this aspect, a friction surface of the pressure plate that contacts the clutch disc is able to be inhibited or prevented from slanting when the pressure plate moves in the axial direction. As a result, a torsional load or the like is inhibited or prevented from being applied to the portion of the connecting mechanism that is connected to the pressure plate, so the durability of the connecting mechanism is able to be inhibited or prevented from decreasing.

[0013] In the aspect described above, the first connecting portion may have a first bent portion that protrudes in an axial direction, and the second connecting portion may have a second bent portion that protrudes in the axial direction.

[0014] According to this aspect, the bent portions elastically deform when the pressure plate moves in the axial direction. Therefore, the pressure plate is inhibited or prevented from moving in the circumferential direction as the bent portions elastically deform. Consequently, the pressure plate and the clutch disc are able to be sufficiently separated. As a result, the transmission of torque due to unintentional contact between the pressure plate and the clutch disc is able to be inhibited or prevented. Also, this kind of structure makes it possible to inhibit or prevent the pressure plate and a member that applies a load that changes the friction force between the pressure plate and the clutch disc to the pressure plate, from moving relative to one another in the circumferential direction. As a result, the durability of the pressure plate is able to be inhibited or prevented from decreasing.

[0015] In the aspect described above, a protrusion amount in the axial direction

with respect to a length in a longitudinal direction of one of the first bent portion and the second bent portion is less than a protrusion amount in the axial direction with respect to a length in a longitudinal direction of the other of the first bent portion and the second bent portion. The first bent portion and the second bent portion may be configured to transmit torque as the tensile load. Also, the torque may be the larger of torque that is transmitted from the rotating body to the pressure plate as the tensile load so as to increase the rotation speed of the output side rotating member, and torque that is transmitted from the pressure plate to the rotating body as the tensile load so as to increase the rotation speed of the input side rotating member.

[0016] According to this aspect, the rigidity with respect to a tensile load is able to be increased. As a result, the durability of the connecting mechanism is able to be inhibited or prevented from decreasing.

[0017] The clutch according to the aspect described above may also include a fourth fixing portion that connects the first connecting portion and the second connecting portion to the pressure plate. Also, the first connecting portion may include a fifth connecting portion that is configured to elastically deform such that the fourth fixing portion moves only in an axial direction, when the pressure plate moves in the axial direction. Also, the second connecting portion may include a sixth connecting portion that is configured to elastically deform such that the fourth fixing portion moves only in the axial direction, when the pressure plate moves in the axial direction.

[0018] According to this aspect, when the pressure plate moves in the axial direction, it is inhibited or prevented from simultaneously moving in the circumferential direction. Therefore, the pressure plate and the clutch disc are able to be sufficiently separated. As a result, the transmission of torque due to unintentional contact between the pressure plate and the clutch disc is able to be inhibited or prevented. Also, this kind of structure makes it possible to inhibit or prevent the pressure plate and a member that applies a load that changes the friction force between the pressure plate and the clutch disc to the pressure plate, from moving relative to one another in the circumferential direction. As a result, the durability of the pressure plate is able to be inhibited or prevented from

decreasing.

[0019] The clutch according to the aspect described above may also include a fifth fixing portion that connects the connecting mechanism to one of the rotating body and the pressure plate, and the connecting mechanism may be configured to move relative to the fifth fixing portion in a circumferential direction of the pressure plate.

[0020] According to this aspect, when the pressure plate moves in the axial direction, it is inhibited or prevented from simultaneously moving in the circumferential direction. Therefore, the pressure plate and the clutch disc are able to be sufficiently separated. As a result, the transmission of torque due to unintentional contact between the pressure plate and the clutch disc is able to be inhibited or prevented. Also, this kind of structure makes it possible to inhibit or prevent the pressure plate and a member that applies a load that changes the friction force between the pressure plate and the clutch disc to the pressure plate, from moving relative to one another in the circumferential direction. As a result, the durability of the pressure plate is able to be inhibited or prevented from decreasing.

[0021] In the aspect described above, the connecting mechanism may include a first plate member that has a first through-hole in a location where one of the rotating body and the pressure plate is connected. Also, the fifth fixing portion may include a first fixing member that is disposed in the first through-hole, and an outer diameter of the first fixing member may be smaller than an inner diameter of the first through-hole such that the pressure plate moves relative to the first plate member in the circumferential direction.

[0022] In the aspect described above, the connecting mechanism may include a second plate member and a third plate member. One end portion of the second plate member may have a second through-hole. The third plate member may be provided adjacent to the second plate member in the circumferential direction. One end portion of the third plate member may have a third through-hole. Also, the fifth fixing portion may include a second fixing member that is arranged in the second through-hole and the third through-hole so as to connect the second plate member and the third plate member to one of the rotating body and the pressure plate. A gap between the second fixing member and

an inside wall surface of the second through-hole on the third plate member side may be smaller than a gap between the second fixing member and an inside wall surface of the third through-hole that is opposite an inside wall surface on the second plate member side, when torque is not being input to either the second plate member or the third plate member.

[0023] According to this aspect, one of the plate members transmits torque as a tensile load. In other words, a compression load is able to be inhibited or prevented from being applied to the other plate member. As a result, the durability of the connecting mechanism is able to be inhibited or prevented from decreasing.

[0024] In the aspect described above, a rigidity of one of the first connecting portion and the second connecting portion is higher than a rigidity of the other of the first connecting portion and the second connecting portion. The first connecting portion and the second connecting portion may be configured to transmit torque as the tensile load. Also, the torque may be the larger of torque that is transmitted from the rotating body to the pressure plate as the tensile load so as to increase the rotation speed of the output side rotating member, and torque that is transmitted from the pressure plate to the rotating body as the tensile load so as to increase the rotation speed of the input side rotating member.

[0025] In the aspect described above, the input side rotating member may include an output shaft of an engine mounted in a vehicle, and the output side rotating member may be connected to a cranking portion configured to crank the engine by rotating the output shaft.

[0026] In the aspect described above, the cranking portion may include an electric motor mounted in the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Features, advantages, and technical and industrial significance of exemplary embodiments of the invention will be described below with reference to the accompanying drawings, in which like numerals denote like elements, and wherein:

FIG. 1 is a sectional view illustrating the action of a clutch according to one example embodiment of the invention, and shows a state in which torque is being input from a

clutch cover to a pressure plate so as to increase a rotation speed of an output side rotating member;

FIG. 2 is a sectional view showing a state in which torque is being input from the pressure plate to the clutch cover so as to increase a rotation speed of an input side rotating member, in the clutch shown in FIG. 1;

FIG. 3A is a sectional view illustrating one example of a structure of the clutch according to the example embodiment, and shows a state in which the clutch is transmitting torque, in an example in which arch portions are formed protruding toward the clutch cover side, and FIG. 3B is a sectional view illustrating one example of a structure of the clutch according to the example embodiment, and shows a state in which the clutch is transmitting torque, in an example in which arch portions are formed protruding toward the pressure plate side;

FIG. 4 is a sectional view showing a state in which the clutch shown in FIG. 3A is interrupting the transmission of torque;

FIG. 5 is a side view illustrating an example of the structure of the clutch according to the example embodiment;

FIG. 6 is a side view illustrating another example of the structure of the clutch according to the example embodiment;

FIG. 7 is a sectional view taken along line VII – VII in FIG. 6;

FIG. 8 is a sectional view illustrating yet another example of the structure of the clutch according to the example embodiment, and shows a state in which the clutch is transmitting torque;

FIG. 9 is a sectional view showing a state in which the clutch shown in FIG. 8 is interrupting the transmission of torque;

FIG. 10 is a sectional view illustrating an example of the structure of a clutch capable of transmitting torque by only one strap plate, and shows a state in which torque is being input from the pressure plate to the clutch cover so as to increase the rotation speed of the input side rotating member;

FIG. 11 is a sectional view of a state in which torque is being input from the clutch

cover to the pressure plate so as to increase the rotation speed of the output side rotating member, in the clutch in FIG. 10;

FIG. 12 is a view illustrating the rigidity of the strap plate;

FIG. 13 is a sectional view illustrating an example of the structure of a clutch in which the rigidity of one connecting portion is able to be improved;

FIG. 14 is a sectional view illustrating an example of a structure in which a plurality of strap plates are provided in a continuous manner;

FIG. 15 is a sectional view illustrating another example of a structure in which a plurality of strap plates are provided in a continuous manner;

FIG. 16 is a sectional view illustrating yet another example of a structure in which a plurality of strap plates are provided in a continuous manner;

FIG. 17 is a sectional view illustrating an example of the structure of a clutch provided with a strap plate formed in an annular shape;

FIG. 18 is a gear train view illustrating an example of a vehicle in which the clutch according to the example embodiment is able to be mounted; and

FIG. 19 is a gear train view illustrating another example of a vehicle in which the clutch according to the example embodiment is able to be mounted.

DETAILED DESCRIPTION OF EMBODIMENTS

[0028] One example of the structure of the clutch according to the invention is shown in FIG. 5. FIG. 5 is a side view as viewed from an output side of the clutch 1, with the upper right portion in FIG. 5 showing the internal structure of a clutch cover 2 that corresponds to a rotating body of the invention. Also, the clutch 1 shown in FIG. 5 is a dry-operating clutch that transmits torque to a friction surface without using oil. The clutch according to the invention need only be provided with a connecting mechanism that has a portion that transmits torque as a tensile load so as to increase a rotation speed of an input side rotating member, and a portion that transmits torque as a tensile load so as to increase a rotation speed of an output side rotating member. The structure of other members may be similar to that of a well-known clutch. Therefore, members other than

the structure of a strap plate that corresponds to the connecting mechanism of the invention will be described only briefly here. The clutch 1 shown in FIG. 5 includes the clutch cover 2 that is formed in an annular shape. An inner peripheral portion 3 of this clutch cover 2 is formed protruding toward an output side in an axial direction of the clutch 1. Also, outer peripheral portions 4 of the clutch cover 2 are formed curved toward an input side spaced a predetermined distance apart in a circumferential direction, and curved portions 5 thereof are integrated with the input side rotating member with rivets 6. That is, the clutch cover 2 is configured to rotate together with the input side rotating member.

[0029] Also, an annular-shaped pressure plate 7 that is configured to be able to move in the axial direction is provided on the input side of the clutch cover 2. This pressure plate 7 is a member for pushing the clutch disc that rotates together with the output side rotating member against the input side rotating member. Therefore, the pressure plate 7 is arranged opposing the input side rotating member, and the clutch disc is arranged between the pressure plate 7 and the input side rotating member.

[0030] Furthermore, a diaphragm spring 8 that pushes the pressure plate 7 toward the clutch disc side is provided. This diaphragm spring 8 is formed in an annular shape and has radial slits 10 formed in an inner peripheral portion 9 thereof. An outer peripheral portion 11 of the diaphragm spring 8 is configured to move in the axial direction together with the pressure plate 7. Also, the inner peripheral portion 9 of the diaphragm spring 8 is connected to a release mechanism, not shown, and is configured to reduce a clamping pressure with which the clutch disc is clamped, by pushing the inner peripheral portion 9 of the diaphragm spring 8 in the axial direction with this release mechanism. That is, the outer peripheral portion 11 that is connected to the pressure plate 7 is configured to move toward the output side in the axial direction in response to the inner peripheral portion 9 of the diaphragm spring 8 being pushed. The direction of a load that pushes the inner peripheral portion 9 of the diaphragm spring 8 by the release mechanism may be either toward the input side or toward the output side in the axial direction, depending to the relationship between the position of a point of effort where the diaphragm spring 8 is being pushed, and the position of a fulcrum where the diaphragm spring 8 bends.

Also, the clutch according to the invention is not limited to being configured to push the pressure plate 7 toward the clutch disc side with the diaphragm spring 8 as described above. The clutch according to the invention may alternatively be a clutch configured such that the diaphragm spring 8 applies elastic force so as to move the pressure plate 7 away from the clutch disc. With a clutch structured in this way, it is sufficient to just provide a mechanism that engages the pressure plate 7 with the clutch disc.

[0031] Also, the clutch 1 shown in FIG. 5 has three strap plates 12 that are connected to the clutch cover 2 and the pressure plate 7, in the circumferential direction. Each of these strap plates 12 is formed by a plurality of stacked plate members, and is configured to apply elastic force in a direction that moves the pressure plate 7 away from the clutch disc. Also, each of the strap plates 12 is configured to transmit torque from the clutch cover 2 to the pressure plate 7.

[0032] Here, the detailed structure of the strap plates 12 shown in FIG. 5 will be described. The structure of all three strap plates 12 is the same, so only one will be described to simplify the description. With the strap plate 12 shown in FIG. 5, a center portion 13 of the strap plate 12 is fixed with a rivet 14 to a side surface of the pressure plate 7 that opposes the clutch cover 2. Also, both end portions 15 and 16 of the strap plate 12 are fixed with rivets 17 and 18 to an inside wall surface of the clutch cover 2 that opposes the strap plate 12. The center portion 13 is located between end portions 15 and 16 in a circumferential direction. Also, the center portion 13 where the strap plate 12 is fixed to the pressure plate 7, and both end portions 15 and 16 where the strap plate 12 is fixed to the clutch cover 2, are provided in the same position in the radial direction of the clutch 1. In other words, the distances from a central axis of the clutch 1 to the center portion 13 and both end portions 15 and 16 are the same. The center portion 13 is an example of a first fixing portion in this example embodiment, and the end portions 15 and 16 are an example of a second fixing portion and a third fixing portion in this example embodiment.

[0033] Also, FIG. 3A shows a frame format of a sectional view taken along line III – III in FIG. 5. The example shown in FIG. 3A shows a state in which the pressure

plate 7 is contacting a clutch disc 19. In the example shown in FIG. 3A, first and second arch portions 20 and 21 that protrude toward the clutch cover 2 side in the axial direction are formed on both sides sandwiching the center portion 13 where the strap plate 12 and the pressure plate 7 are connected together. The protruding amounts in the axial direction and the lengths in the length direction of the first arch portion 20 and the second arch portion 21 are the same. That is, the curvature radii of the first arch portion 20 and the second arch portion 21 are formed the same. Moreover, in the example shown in FIG. 3A, when the pressure plate 7 moves in the axial direction, the position of the center portion 13 is configured not to move in the circumferential direction. In other words, the length from the center portion 13 to one end portion 15 and the length from the center portion 13 to the other end portion 16 are formed the same, so that the center portion 13 will only move in the axial direction when the pressure plate 7 moves in the axial direction. Also, when the pressure plate 7 contacts the clutch disc 19 and transmits torque, the positions of the center portion 13 and both end portions 15 and 16 in the axial direction are the same. When the pressure plate 7 and the clutch disc 19 are transmitting torque may be when the pressure plate 7 and the clutch disc 19 are partially engaged, at which time they transmit torque while slipping relative to one another, or when the pressure plate 7 and the clutch disc 19 are fully engaged, at which time they transmit torque while rotating at the same speed. That is, the center portion 13 and both end portions 15 and 16 are configured to be in the same position in the axial direction in any state from a partially engaged state in which the clutch 1 starts to transmit torque, to a fully engaged state in which all of the torque is transmitted. The first arch portion 20 is an example of a third connecting portion, a fifth connecting portion, or a first bent portion in this example embodiment, and the second arch portion 21 is an example of a fourth connecting portion, a sixth connecting portion, or a second bent portion in this example embodiment.

[0034] Furthermore, FIG. 4 is a view of a state in which the transmission of torque is interrupted by the pressure plate 7 being moved away from the clutch disc 19. As shown in the example shown in FIG. 4, when the pressure plate 7 is moved away from the clutch disc 19, the center portion 13 is configured not to move in the circumferential

direction because the arch portions 20 and 21 of the strap plate 12 flexibly deform in the axial direction.

[0035] Next, the operation of the clutch 1 structured as described above will be described. The clutch 1 is configured such that the elastic force of the diaphragm spring 8 and the elastic force of the strap plate 12 are applied to the pressure plate 7, and the pressure plate 7 moves in the axial direction according to the difference between these elastic forces. More specifically, when the elastic force of the diaphragm spring 8 is greater than the elastic force of the strap plate 12, the pressure plate 7 is pushed and moved toward the clutch disc 19 side. Conversely, when the elastic force of the diaphragm spring 8 is less than the elastic force of the strap plate 12, the pressure plate 7 is moved away from the clutch disc 19. Therefore, in the example described above, friction force between the pressure plate 7 and the clutch disc 19 is reduced by pushing on the diaphragm spring 8 with the release mechanism so as to reduce the elastic force of the diaphragm spring 8. In other words, the transfer torque capacity of the clutch 1 is controlled by controlling the load with which the release mechanism pushes on the diaphragm spring 8. Therefore, when the diaphragm spring 8 is pushed on by the release mechanism such that the elastic force of the diaphragm spring 8 becomes less than the elastic force of the strap plate 12, the pressure plate 7 moves away from the clutch disc 19 as shown in FIG. 4. When the pressure plate 7 moves away from the clutch disc 19 in this way, the friction force acting on the clutch disc 19 becomes 0, and as a result, the clutch 1 is released such that the transmission of torque between the input side rotating member and the output side rotating member is interrupted.

[0036] Conversely, when the release mechanism is not pushing on the diaphragm spring 8, or when the release mechanism is pushing on the diaphragm spring 8 but the pressure is relatively small such that the elastic force of the diaphragm spring 8 is larger than the elastic force of the strap plate 12, the pressure plate 7 contacts the clutch disc 19 as shown in FIG. 3. As a result, torque is able to be transmitted between the input side rotating member and the output side rotating member. The transfer torque capacity of the input side rotating member and the output side rotating member changes according to the

pressure applied to the pressure plate 7.

[0037] When the pressure plate 7 is contacting the clutch disc 19 and torque is being transmitted as shown in FIG. 3A, a compression load and a tensile load are applied to the strap plate 12. In FIG. 1, the direction of the load applied to each member when torque is input from the input side rotating member to the clutch 1 such that the rotation speed of the output side rotating member increases is shown by the arrows. In the example shown in FIG. 1, torque is input from the left side in the drawing, to the clutch cover 2 that is connected the input side rotating member. On the other hand, the rotation speed of the clutch disc 19 that is connected to the output side rotating member increases by the torque transmitted from the clutch cover 2, so in the example shown in FIG. 1, a load from the right side in the drawing is applied with inertia force of the output side rotating member as reaction force of the torque input from the clutch cover 2. As a result, a compression load is applied to a first connecting portion 22 between the center portion 13 and one end portion 15, and a tensile load is applied to a second connecting portion 23 between the center portion 13 and the other end portion 16. In other words, the first connecting portion 22 transmits torque from the clutch cover 2 to the pressure plate 7 as a compression load, and the second connecting portion 23 transmits torque from the clutch cover 2 to the pressure plate 7 as a tensile load.

[0038] Conversely, when torque is input from the output side rotating member to the clutch 1 such that the rotation speed of the input side rotating member increases, the direction of the load applied to the strap plate 12 is reversed. In FIG. 2, the direction of the load acting on the members when torque is input from the output side rotating member to the clutch 1 such that the rotation speed of the input side rotating member increases, is shown by the arrows. In the example shown in FIG. 2, torque is input toward the right side in the drawing, to the clutch disc 19. Therefore, torque is transmitted to the right side in the drawing, to the pressure plate 7 that is contacting the clutch disc 19. On the other hand, inertia force of the input side rotating member and a member connected to this input side rotating member is applied to the clutch cover 2, so reaction force against the torque that is transmitted from the clutch disc 19 is applied, and this reaction force is toward the

left side in the drawing. As a result, a tensile load is applied to the first connecting portion 22, and a compression load is applied to the second connecting portion 23. In other words, the first connecting portion 22 transmits torque from the pressure plate 7 to the clutch cover 2 as a tensile load, and the second connecting portion 23 transmits torque from the pressure plate 7 to the clutch cover 2 as a compression load.

[0039] In the clutch 1 structured as described above, if torque is input from the input side rotating member so as to increase the rotation speed of the output side rotating member, or is input from the output side rotating member so as to increase the rotation speed of the input side rotating member, one of the connecting portions 22 (23) of the strap plate 12 transmits this torque as a tensile load. Therefore, the compression load that is applied to the other connecting portion 23 (22) of the strap plate 12 is able to be cancelled out. In other words, the compression load is able to be inhibited or prevented from being excessively applied to the strap plate 12, and as a result, the durability of the strap plate 12 is able to be inhibited or prevented from decreasing.

[0040] Also, in the example described above, the arch portions 20 and 21 are formed on the connecting portions 22 and 23, respectively. By forming the arch portions 20 and 21 on the strap plate 12 in this way, the arch portions 20 and 21 flexibly deform when the pressure plate 7 contacts the clutch disc 19. In other words, there is no displacement in the axial direction between the first arch portion 20 and one end portion 15, or between the second arch portion 21 and the other end portion 16. That is, the arch portions 20 and 21 flexibly deform in the axial direction with a boundary position of the arch portions 20 and 21 and the portion thereof that is not displaced in the axial direction as the fulcrum. When the arch portions 20 and 21 flexibly deform in this way, and the rigidity of the first connecting portion 22 and the second connecting portion 23 is the same, the pressure plate 7 moves toward or away from the clutch disc 19 without the center portion 13 moving in the circumferential direction. Therefore, a decrease in the displacement amount of the pressure plate 7 in the axial direction is able to be suppressed or prevented by the center portion 13 that connects the strap plate 12 to the pressure plate 7 being displaced in the circumferential direction. In other words, a decrease in the amount

that the pressure plate 7 is displaced in the axial direction is able to be suppressed or prevented. That is, the pressure plate 7 is able to be sufficiently separated from the clutch disc 19. As a result, drag loss caused by the pressure plate 7 unintentionally contacting the clutch disc 19 and transmitting torque or the like is able to be inhibited or prevented. Also, wear due to the contact position of the pressure plate 7 and the diaphragm spring 8 moving in the circumferential direction is also able to be inhibited or prevented, and as a result, a decrease in the durability of the pressure plate 7 is able to be suppressed or prevented.

[0041] FIG. 3A shows an example in which the arch portions 20 and 21 are formed protruding toward the clutch cover 2 side. The center portion 13 need only be inhibited or prevented from being displaced in the circumferential direction by the arch portions 20 and 21 flexibly deforming. Therefore, the arch portions 20 and 21 may also be formed protruding toward the pressure plate 7 side, as shown in FIG. 3B.

[0042] Furthermore, when the pressure plate 7 contacts the clutch disc 19 and torque is transmitted, a component force of the compression load or the tensile load that acts on the connecting portions 22 and 23 does not act to move the pressure plate 7 in the axial direction, due to the positions of the center portion 13 and both end portions 15 and 16 being the same in the axial direction. Therefore, a change in the load that pushes on the clutch disc 19 due to this component force being applied to the pressure plate 7 is able to be inhibited or prevented. As a result, the controllability of the friction force between the pressure plate 7 and the clutch disc 19, i.e., the transfer torque capacity of the clutch 1, is able to be inhibited or prevented from decreasing.

[0043] Also, by having the lengths of the arch portions 20 and 21 be the same, the pressure plate 7 can be made to move only in the axial direction, i.e., the pressure plate 7 is able to be inhibited or prevented from moving in the circumferential direction. As a result, the friction surface of the pressure plate 7 that opposes the clutch disc 19 is able to be inhibited or prevented from slanting. Therefore, a torsional load or the like is inhibited or prevented from being applied to the center portion 13 where the strap plate 12 and the pressure plate 7 are connected, so a decrease in the durability of the strap plate 12 is able to

be inhibited or prevented.

[0044] Moreover, the distances between the central axis of the clutch 1 and the center portion 13 and both end portions 15 and 16 are the same. Therefore, the longitudinal direction of the first connecting portion 22 and the second connecting portion 23, and the tangential direction of an arc that connects the center portion 13 and the end portions 15 and 16 are able to be made almost the same, the shorter the distance between the center portion 13 and one end portion 15 and the distance between the center portion 13 and the other end portion 16 are. As a result, the majority of the load that is transmitted by the strap plate 12 acts in the longitudinal direction of the connecting portions 22 and 23. Therefore, it is possible to inhibit or prevent a load from acting in the width direction of the strap plate 12, so a decrease in the durability of the strap plate 12 is able to be inhibited or prevented.

[0045] The clutch according to this example embodiment need only be configured such that one of the connecting portions of the connecting mechanism transmits torque as a tensile load, when the clutch is transmitting torque from the clutch cover 2 to the pressure plate 7 so as to increase the rotation speed of the input side rotating member, or when the clutch is transmitting torque from the pressure plate 7 to the clutch cover 2 so as to increase the rotation speed of the output side rotating member. Therefore, the arch portions 20 and 21 as shown in FIGS. 3A and 3B may also be omitted. Also, the first connecting portion 22 and the second connecting portion 23 are not limited to being integrated together. More specifically, when torque is input to the clutch 1 from the input side rotating member so as to increase the rotation speed of the output side rotating member, a strap plate that transmits this torque as a tensile load may be provided, and when torque is input to the clutch 1 from the output side rotating member so as to increase the rotation speed of the input side rotating member, another strap plate that transmits this torque as a tensile load may be provided. That is, a plurality of strap plates are provided and the configuration need only be such that at least one of these strap plates transmits torque as a tensile load. Moreover, the structure is not limited to one in which both end portions 15 and 16 that connect the clutch cover 2 and the pressure plate 7 together are

provided one on each side of the center portion 13 that connects the strap plate 12 and the pressure plate 7 together. The strap plate 12 and the pressure plate 7 may be fixed in two locations, and the strap plate 12 and the clutch cover 2 may be connected between these fixing portions in the circumferential direction.

[0046] FIGS. 6 and 7 are views of an example of the clutch 1 having this kind of structure. FIG. 7 shows a frame format of a sectional view taken along line VII – VII in FIG. 6. Also, structure similar to that in FIGS. 3A, 3B, 4, and 5 will be denoted by like reference characters and descriptions of this structure will be omitted. In the example shown in FIGS. 6 and 7, a first strap plate 24 and a second strap plate 25 are provided, with one end portion of each being connected to the clutch cover 2, and the other end portion of each being connected to the pressure plate 7. Also, in the example shown in FIG. 7, a left side end portion of the first strap plate 24 is connected to the pressure plate 7, and a right side end portion of the first strap plate 24 is connected to the clutch cover 2. Moreover, a left side end portion of the second strap plate 25 is connected to the clutch cover 2, and a right side end portion of the second strap plate 25 is connected to the pressure plate 7. That is, the first strap plate 24 and the second strap plate 25 are connected to the pressure plate 7, sandwiching a portion where the clutch cover 2 is connected to the first strap plate 24 and the second strap plate 25 in the circumferential direction. In the example shown in FIGS. 6 and 7, the first strap plate 24 and the second strap plate 25 are formed as a pair of connecting members, and three of these pairs of connecting members are provided in the circumferential direction.

[0047] By connecting the clutch cover 2 and the pressure plate 7 together in this way, one of the strap plates 24 (25), from among the first strap plate 24 and the second strap plate 25, transmits torque to the pressure plate 7 as a tensile load when torque is input from the input side rotating member so as to increase the rotation speed of the output side rotating member. Conversely, when transmitting torque from the output side rotating member so as to increase the rotation speed of the input side rotating member, the other strap plate 25 (24) transmits torque to the pressure plate 7 as a tensile load. Therefore, just as in the example shown in FIG. 1, one of the strap plates 24 (25) transmits torque to

the pressure plate 7 as a tensile load when torque is input from the input side rotating member so as to increase the rotation speed of the output side rotating member, as well as when torque is input from the output side rotating member so as to increase the rotation speed of the input side rotating member. Therefore, when the clutch 1 is transmitting torque, a tensile load is able to be applied to the connecting members that connect the clutch cover 2 and the pressure plate 7 together. Hence, a compression load that is applied to one of the strap plates 24 (25) is able to be cancelled out. In other words, it is possible to inhibit or prevent the compression load from being excessively applied to the strap plate 24 (25). As a result, a decrease in the durability of the strap plate 24 (25) is able to be inhibited or prevented.

[0048] Also, in the example shown in FIGS. 1 to 4, the arch portions 20 and 21 are formed on the pressure plate 7 to inhibit or prevent the pressure plate 7 from moving in the circumferential direction. It is sufficient that the elastic force of the strap plate 12 be able to be inhibited or prevented from acting in the circumferential direction. FIGS. 8 and 9 are views of another example to inhibit or prevent the elastic force of the strap plate 12 from acting in the circumferential direction. FIG. 8 is a view showing a state in which the pressure plate 7 is contacting the clutch disc 19 such that torque is being transmitted. FIG. 9 is a view showing a state in which the pressure plate 7 is separated from the clutch disc 19 such that the transmission of torque is interrupted. Also, structure similar to that in FIGS. 1 to 4 will be denoted by like reference characters and descriptions of this structure will be omitted. In the example shown in FIGS. 8 and 9, a third strap plate 26, one end portion of which is connected to the clutch cover 2 and the other end portion of which is connected to the pressure plate 7, and a fourth strap plate 27, one end of which is connected to the pressure plate 7 and the other end of which is connected to the clutch cover 2, are provided. Also, there has a first through-hole 28 having an elongated shape in the other end portion of the third strap plate 26, and there has a second through-hole 29 having an elongated shape in the one end portion of the fourth strap plate 27. A rivet 30 is inserted through these through-holes 28 and 29, such that the pressure plate 7 and strap plates 26 and 27 are configured to be able to move together in the axial direction. The

rivet 30 is an example of a fifth fixing portion in this example embodiment, the third strap plate 26 is an example of a first plate member or a second plate member in this example embodiment, and the fourth strap plate 27 is an example of a third plate member in this example embodiment.

[0049] By having the through-holes 28 and 29 in the strap plates 26 and 27, respectively, and connecting the strap plates 26 and 27 to the pressure plate 7, there is a gap between an inside wall surface of the through-holes and an outer peripheral surface of the rivet 30. Therefore, the other end portion of the third strap plate 26 and the rivet 30 are able to move relative to one another in the circumferential direction, and the one end portion of the fourth strap plate 27 and the rivet 30 are able to move relative to one another in the circumferential direction. Therefore, when the pressure plate 7 is moved away from the clutch disc 19, a load in the circumferential direction is able to be inhibited or prevented from being applied to the pressure plate 7 from the strap plates 26 and 27. In other words, only a load in a direction that moves the pressure plate 7 in the axial direction is applied from the strap plates 26 and 27. As a result, the pressure plate 7 is able to be inhibited or prevented from moving in the circumferential direction.

[0050] There may be a through-hole in one end portion of the third strap plate 26, and the third strap plate 26 may be connected to the clutch cover 2 by a rivet having an outer diameter that is smaller than an inner diameter of this through-hole. Also, there may be a through-hole in the other end portion of the fourth strap plate 27, and the fourth strap plate 27 may be connected to the clutch cover 2 by a rivet having an outer diameter that is smaller than an inner diameter of this through-hole. That is, there may be a through-hole in a portion that connects a strap plate to the clutch cover 2 or the pressure plate 7, and the strap plate may be connected to the clutch cover 2 or the pressure plate 7 by a fixing member that has an outer diameter that is smaller than an inner diameter of this through-hole.

[0051] Furthermore, torque may be transmitted to the pressure plate 7 as a tensile load by only one strap plate 26 (27), from among the strap plates 26 and 27, by having the position of an inside wall surface on a tip end side of the first through-hole 28 be closer to

the rivet 30 than the position of the inside wall surface on the side of the second through-hole 29 that is connected to the clutch cover 2, and having the position of an inside wall surface on a tip end side of the second through-hole 29 be closer to the rivet 30 than the position of the inside wall surface on the side of the first through-hole 28 that is connected to the clutch cover 2, when torque is not being input to the strap plates 26 and 27. FIGS. 10 and 11 are views of a state in which the strap plates 26 and 27 structured in this way are transmitting torque. FIG. 10 is a view showing a state in which torque is being input from the input side rotating member such that the rotation speed of the output side rotating member increases, and FIG. 11 is a view showing a state in which torque is being input from the output side rotating member such that the rotation speed of the input side rotating member increases.

[0052] As shown in FIG. 10, when torque is being input from the input side rotating member such that the rotation speed of the output side rotating member increases, the inside wall surface of the fourth strap plate 27 contacts the outer peripheral surface of the rivet 30, and the inside wall surface of the third strap plate 26 does not contact the outer peripheral surface of the rivet 30. That is, torque is transmitted by only the fourth strap plate 27. Therefore, a tensile load is applied to the fourth strap plate 27, and a load in the longitudinal direction is not applied to the third strap plate 26. Also, as shown in FIG. 11, when torque is being input from the output side rotating member such that the rotation speed of the input side rotating member increases, the inside wall surface of the third strap plate 26 contacts the outer peripheral surface of the rivet 30, and the inside wall surface of the fourth strap plate 27 does not contact the outer peripheral surface of the rivet 30. That is, torque is transmitted by only the third strap plate 26. Therefore, a tensile load is applied to the third strap plate 26, and a load in the length direction is not applied to the fourth strap plate 27. Thus, this kind of structure makes it possible to have only one strap plate 26 (27) transmit torque as a tensile load, and inhibit or prevent a compression load from being applied to the other strap plate 27 (26). As a result, a decrease in the durability of the strap plates 26 and 27 is able to be inhibited or prevented. Furthermore, it is possible to inhibit or prevent a compression load from being applied to the strap plates

26 and 27, so the controllability of the friction force between the pressure plate 7 and the clutch disc 19, i.e., the transfer torque capacity of the clutch 1, is able to be inhibited or prevented from decreasing.

[0053] Moreover, each of the strap plates 12, 24, 25, 26, and 27 described above may also be structured such that the rigidity with respect to a tensile load is greater than the rigidity with respect to a compression load, as shown in FIG. 12. In other words, the structure may be made to distort easily when a load is applied in the compression direction. The horizontal axis in FIG. 12 represents the amount of distortion, with the right side representing the distortion amount in the tensile direction, and the left side representing the distortion amount in the compression direction. Also, the vertical axis in FIG. 12 represents the load applied to the strap plate, with the upper side representing the load in the tensile direction, and the lower side representing the load in the compression direction. Further, the rigidity in the tensile direction and the rigidity in the compression direction are able to be changed by the material and shape of the strap plate, as shown in FIG. 12.

[0054] By making the rigidity with respect to the tensile load larger than the rigidity with respect to the compression load in this way, the percentage of torque that is transmitted by the connecting portion or the strap plate to which the tensile load is applied is larger than the percentage of torque that is transmitted by the connecting portion or the strap plate to which the compression load is applied, when torque is transmitted by each of the strap plates 12, 24, 25, 26, and 27. As a result, it is possible to inhibit or prevent a compression load from being excessively applied to the strap plate, so the durability of the strap plate can be improved.

[0055] Also, when the amount of torque input to the clutch 1 from the output side rotating member to increase the rotation speed of the input side rotating member is different than the amount of torque input to the clutch 1 from the input side rotating member to increase the rotation speed of the output side rotating member, the rigidity of the portion of the strap plate 12 to which the tensile load is applied may be made larger when a relatively large amount of torque is input to the clutch 1. FIG. 13 is a view of an example of the structure of the strap plate 12 structured in this way. With the structure

shown in FIG. 13, the curvature radius of the first arch portion 20 shown in FIG. 1 has been changed. The other structure may be similar to the structure shown in FIG. 1. Also, in the example shown in FIG. 13, a large tensile load is applied to the first arch portion 20 of the strap plate 12, when the clutch disc 19 is rotating toward the left and torque is transmitted from this clutch disc 19 toward the right in the drawing via the pressure plate 7 and the strap plate 12, so as to increase the rotation speed of the clutch cover 2.

[0056] In the example shown in FIG. 13, the curvature radius of the first arch portion 20 is formed larger than the curvature radius of the second arch portion 21. Also, the amount that the first arch portion 20 and the second arch portion 21 protrude toward the clutch cover 2 side in the axial direction is the same. In other words, the protrusion amount in the axial direction with respect to the length in the longitudinal direction of the first arch portion 20 is less than the protrusion amount in the axial direction with respect to the length in the longitudinal direction of the second arch portion 21. Therefore, the length from one end portion 15 to the center portion 13 is longer than the length from the center portion 13 to the other end portion 16. By making the curvature radius of the first arch portion 20 larger than the curvature radius of the second arch portion 21 in this way, the rigidity of the first arch portion 20 with respect to a tensile load is greater than the rigidity of the second arch portion 21 with respect to a tensile load, so the durability of the strap plate 12 is able to be improved.

[0057] In FIG. 13, an example in which the rigidities of the first arch portion 20 and the second arch portion 21 are made different due to the shape of the strap plate 12 is given. The rigidities may also be made different by changing the material of the first arch portion 20 and the second arch portion 21. Also, when two strap plates are connected to the pressure plate 7, the rigidity of the strap plate to which a relatively large tensile load is applied may be increased.

[0058] Moreover, with the structure shown in FIG. 1, an example is given in which three strap plates are provided spaced a predetermined distance apart in the circumferential direction. Strap plates may also be provided continuously without spaces therebetween, as shown in FIGS. 14 to 16. In the example shown in FIG. 16, the arch

portions 20 and 21 are not provided. More specifically, one end portion of a sixth strap plate 31 and one end portion of a seventh strap plate 32 may also be connected to the clutch cover 2 via one rivet 33, as shown in FIG. 14. Also, a center portion of an eighth strap plate 34 may be connected to the clutch cover 2 and both end portions of this eighth strap plate 34 may be connected to the pressure plate 7, and one end portion of a ninth strap plate 35 that is adjacent to the eighth strap plate 34 may be integrally connected to the portion where the eighth strap plate 34 is connected to the pressure plate 7, as shown in FIG. 15. Moreover, a plurality of strap plates 36, each being configured such that one end portion is connected to the clutch cover 2 and the other end portion is connected to the pressure plate 7, may be provided continuously in the circumferential direction, as shown in FIG. 16. The strap plates in FIGS. 14 and 15 are structured similar to the strap plate 12 shown in FIG. 1.

[0059] Also, in each configuration example described above, a plurality of strap plates are provided. A configuration in which a strap plate 37 is formed in an annular shape and is connected to the clutch cover 2 and the pressure plate 7 in a plurality of locations, as shown in FIG. 17, may also be employed. In this case, the location where the strap plate 37 is connected to the clutch cover 2 and the location where the strap plate 37 is connected to the pressure plate 7 are provided alternately in the circumferential direction.

[0060] Next, an example of a vehicle in which the clutch structured as described above is able to be mounted will be described. FIG. 18 is a gear train view illustrating this example. The vehicle shown in FIG. 18 is provided with a clutch 1 that may be the target in the example embodiment, on an output shaft 39 of an engine 38, and a first motor-generator 41 is provided on an output shaft 40 of this clutch 1. Driving wheels 45 are connected via another clutch 43 and a transmission 44 to an output shaft 42 of the first motor-generator 41. Also, FIG. 19 is a view of another structure of a vehicle in which the clutch is able to be mounted. In the example shown in FIG. 19, a dual clutch transmission 48 is connected to an output shaft 47 of an engine 46 via the clutch 1 that may be the target in the example embodiment, and driving wheels 51 are connected to an output shaft 49 of

this dual clutch transmission 48 via a differential gear 50. Further, a second motor-generator 52 is connected to the dual clutch transmission 48. The vehicles structured as shown in FIGS. 18 and 19 are able to run by outputting torque from the first motor-generator 41 or the second motor-generator 52, and at this time, power loss due to the engine 38 (46) being dragged is able to be reduced by releasing the clutch 1. That is, the engine 38 (46) can be stopped when torque is being output from only the motor-generator 41 (52). Also, the vehicles are able to run by outputting torque from the engine 38 (46) and the motor-generator 41 (52). Moreover, the engine 38 (56) is able to be cranked by engaging the clutch 1 and outputting torque from the motor-generator 41 (52). Therefore, in order to inhibit or prevent the durability of the clutch 1 from decreasing, a tensile load is applied to the strap plate both when torque is transmitted from the input side to increase the rotation speed on the output side of the clutch 1, and when torque is transmitted from the output side to increase the rotation speed on the input side.

[0061] In FIGS. 18 and 19, an example in which torque is transmitted from the output side to increase the rotation speed on the input side of the clutch 1 by cranking the engine 38 (46) is illustrated. The clutch need only be such that torque is transmitted from the output side to increase the rotation speed on the input side of the clutch 1. Therefore, there are times when torque is transmitted from the output side to increase the rotation speed on the input side, just as when applying an engine brake to the driving wheels. Therefore, the clutch according to the example embodiment may also be mounted in a vehicle other than a vehicle in which a motor-generator that cranks the engine 38 (46) is provided on the output side of the clutch 1, as shown in FIGS. 18 and 19.

CLAIMS:

1. A clutch comprising:

an input side rotating member;

an output side rotating member;

a clutch disc connected to the output side rotating member, the clutch disc being arranged opposing the input side rotating member, the clutch disc being configured to transmit torque by being placed in frictional contact with the input side rotating member;

a pressure plate arranged on an opposite side of the clutch disc from the input side rotating member such that the clutch disc is sandwiched between the pressure plate and the input side rotating member, the pressure plate being configured to elastically push the clutch disc toward the input side rotating member side;

a rotating body configured to rotate together with the input side rotating member; and

a connecting mechanism that connects the rotating body to the pressure plate, the connecting mechanism being configured to transmit torque between the rotating body and the pressure plate, the connecting mechanism including a first connecting portion and a second connecting portion, the first connecting portion being configured to transmit torque from the rotating body to the pressure plate as a tensile load so as to increase a rotation speed of the output side rotating member, and the second connecting portion being configured to transmit torque from the pressure plate to the rotating body as a tensile load so as to increase a rotation speed of the input side rotating member.

2. The clutch according to claim 1, wherein

the connecting mechanism includes a first fixing portion, a second fixing portion, and a third fixing portion, the first fixing portion is located between the second fixing portion and the third fixing portion in a circumferential direction, the first fixing portion is connected to one of the rotating body and the pressure plate, the second fixing portion and the third fixing portion are connected to the other of the rotating body and the pressure plate.

3. The clutch according to claim 2, wherein

a position of the first fixing portion, a position of the second fixing portion, and a position of the third fixing portion are configured to be the same position in an axial direction when the clutch disc contacts the pressure plate and torque is transmitted.

4. The clutch according to claim 2 or 3, wherein

the connecting mechanism includes a third connecting portion and a fourth connecting portion, the third connecting portion is connected to the first fixing portion and the second fixing portion, the third connecting portion is configured to elastically deform in an axial direction, the fourth connecting portion is connected to the first fixing portion and the third fixing portion, the fourth connecting portion is configured to elastically deform in the axial direction, and a length of the third connecting portion is the same as a length of the fourth connecting portion.

5. The clutch according to any one of claims 1 to 4, wherein

the first connecting portion has a first bent portion that protrudes in an axial direction, and the second connecting portion has a second bent portion that protrudes in the axial direction.

6. The clutch according to claim 5, wherein

a protrusion amount in the axial direction with respect to a length in a longitudinal direction of one of the first bent portion and the second bent portion is less than a protrusion amount in the axial direction with respect to a length in a longitudinal direction of the other of the first bent portion and the second bent portion, the first bent portion and the second bent portion are configured to transmit torque as the tensile load, the torque is the larger of torque that is transmitted from the rotating body to the pressure plate as the tensile load so as to increase the rotation speed of the output side rotating member, and torque that is transmitted from the pressure plate to the rotating body as the tensile load so

as to increase the rotation speed of the input side rotating member.

7. The clutch according to any one of claims 1 to 6, further comprising:

a fourth fixing portion that connects the first connecting portion and the second connecting portion to the pressure plate, wherein

the first connecting portion includes a fifth connecting portion configured to elastically deform such that the fourth fixing portion moves only in a axial direction, when the pressure plate moves in an axial direction and

the second connecting portion includes a sixth connecting portion configured to elastically deform such that the fourth fixing portion moves only in the axial direction, when the pressure plate moves in the axial direction.

8. The clutch according to any one of claims 1 to 7, further comprising:

a fifth fixing portion that connects the connecting mechanism to one of the rotating body and the pressure plate, wherein

the connecting mechanism is configured to move relative to the fifth fixing portion in a circumferential direction of the pressure plate.

9. The clutch according to claim 8, wherein

the connecting mechanism includes a first plate member having a first through-hole in a location where one of the rotating body and the pressure plate is connected, the fifth fixing portion includes a first fixing member disposed in the first through-hole, and an outer diameter of the first fixing member is smaller than an inner diameter of the first through-hole such that the pressure plate moves relative to the first plate member in the circumferential direction.

10. The clutch according to claim 8, wherein

the connecting mechanism includes a second plate member and a third plate member, one end portion of the second plate member has a second through-hole, the third plate

member is provided adjacent to the second plate member in the circumferential direction, one end portion of the third plate member has a third through-hole, the fifth fixing portion includes a second fixing member, the second fixing member is arranged in the second through-hole and the third through-hole so as to connect the second plate member and the third plate member to one of the rotating body and the pressure plate, and a gap between the second fixing member and an inside wall surface of the second through-hole on the third plate member side is smaller than a gap between the second fixing member and an inside wall surface of the third through-hole that is opposite an inside wall surface on the second plate member side, when torque is not being input to either the second plate member or the third plate member.

11. The clutch according to any one of claims 1 to 10, wherein

a rigidity of one of the first connecting portion and the second connecting portion is higher than a rigidity of the other of the first connecting portion and the second connecting portion, the first connecting portion and the second connecting portion are configured to transmit torque as the tensile load, the torque is the larger of torque that is transmitted from the rotating body to the pressure plate as the tensile load so as to increase the rotation speed of the output side rotating member, and torque that is transmitted from the pressure plate to the rotating body as the tensile load so as to increase the rotation speed of the input side rotating member.

12. The clutch according to any one of claims 1 to 11, wherein:

the input side rotating member includes an output shaft of an engine mounted in a vehicle, and

the output side rotating member is connected to a cranking portion configured to crank the engine by rotating the output shaft.

13. The clutch according to claim 12, wherein

the cranking portion includes an electric motor mounted in the vehicle.

FIG. 1

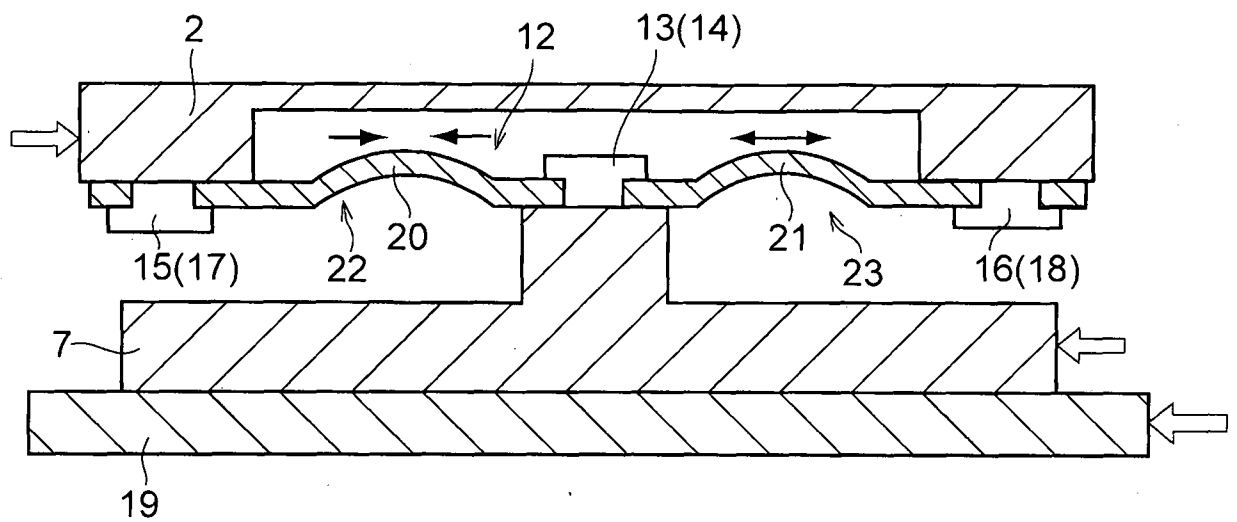


FIG. 2

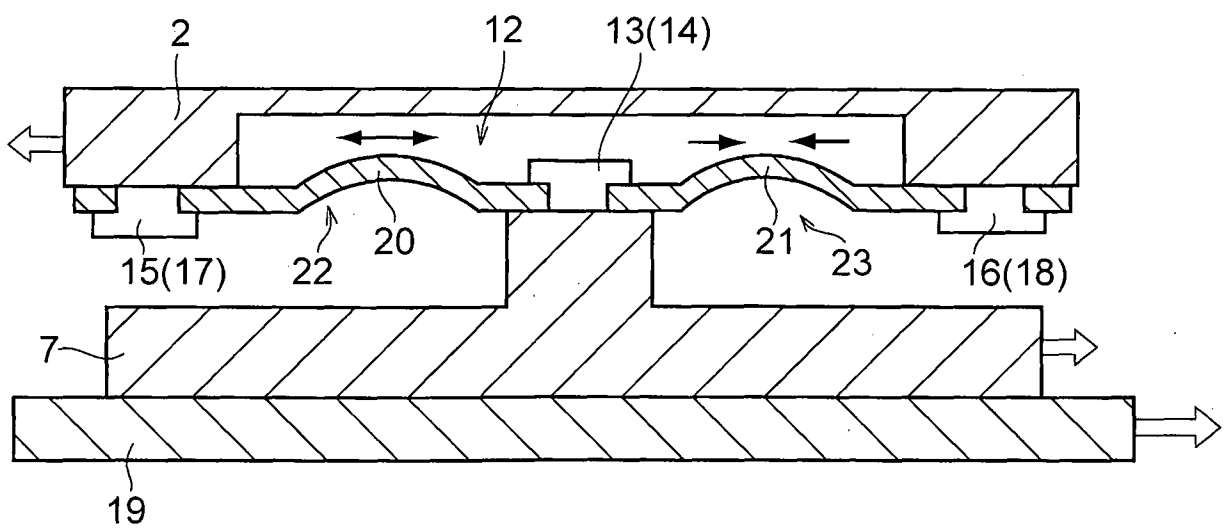


FIG. 3A

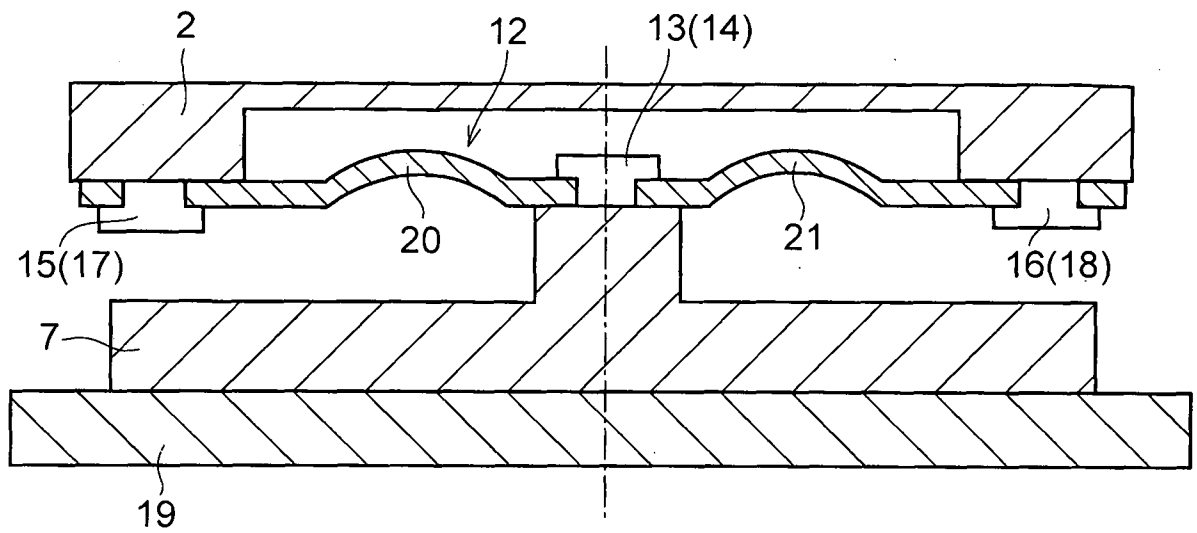


FIG. 3B

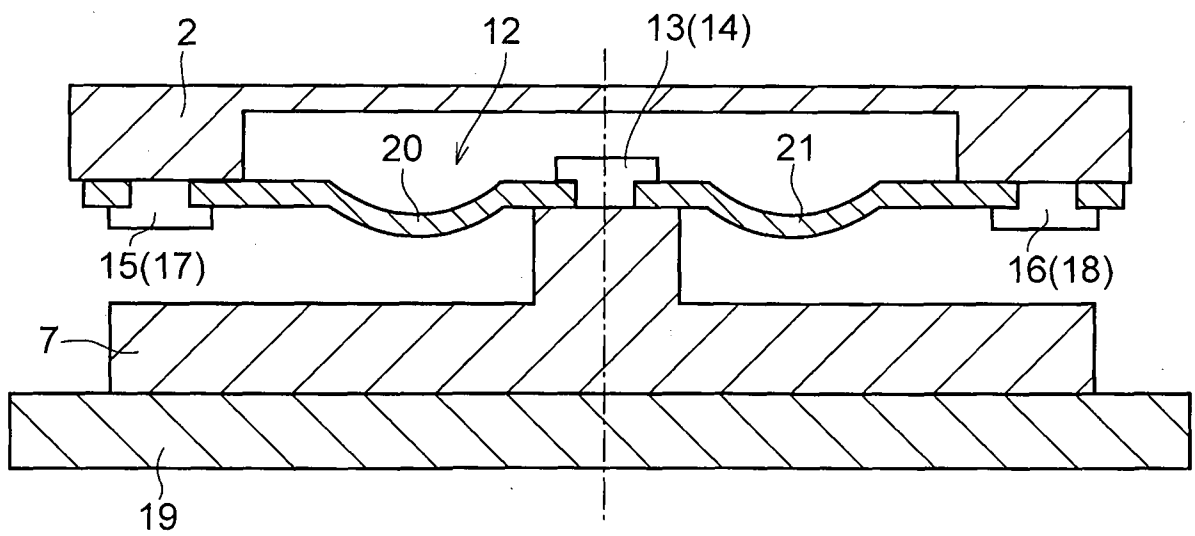


FIG. 4

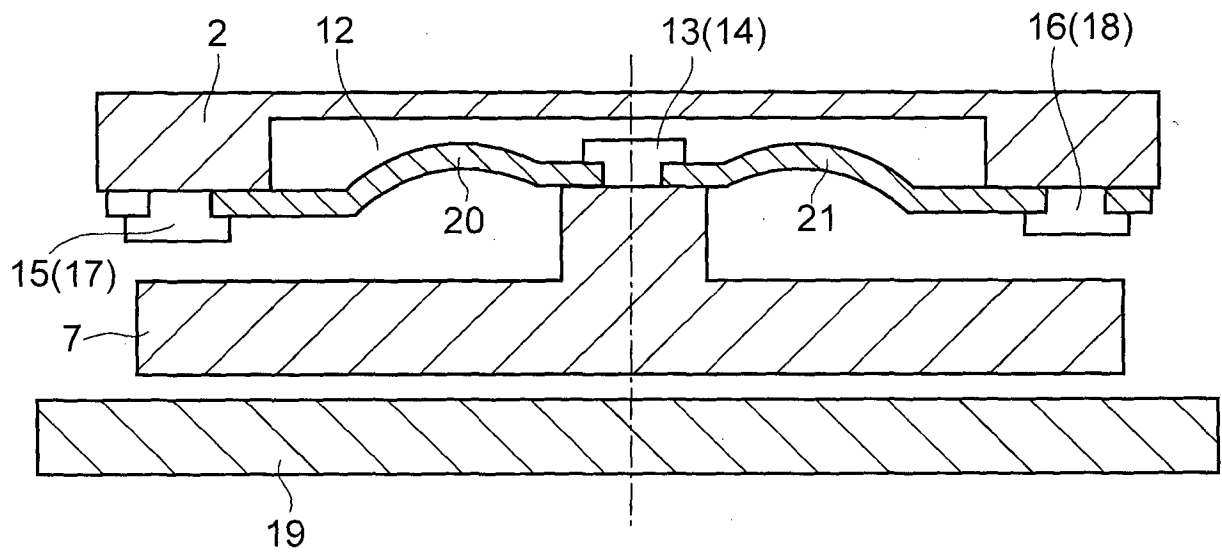


FIG. 5

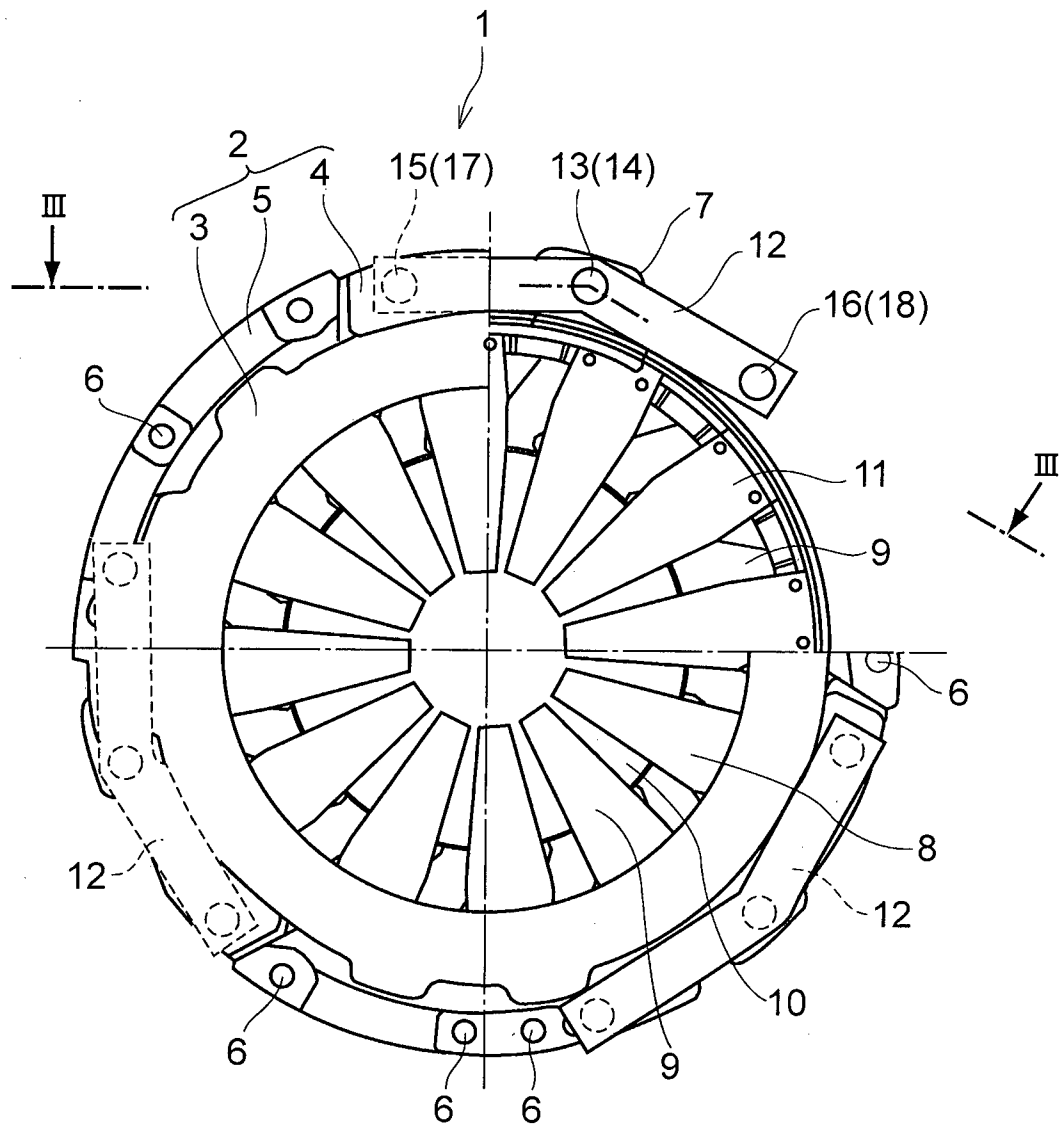


FIG. 6

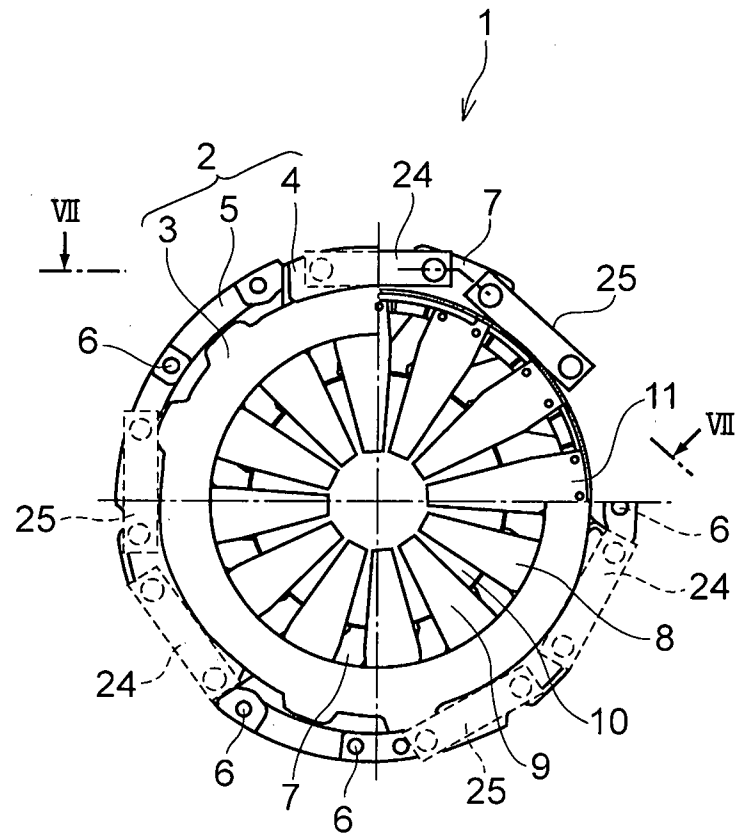


FIG. 7

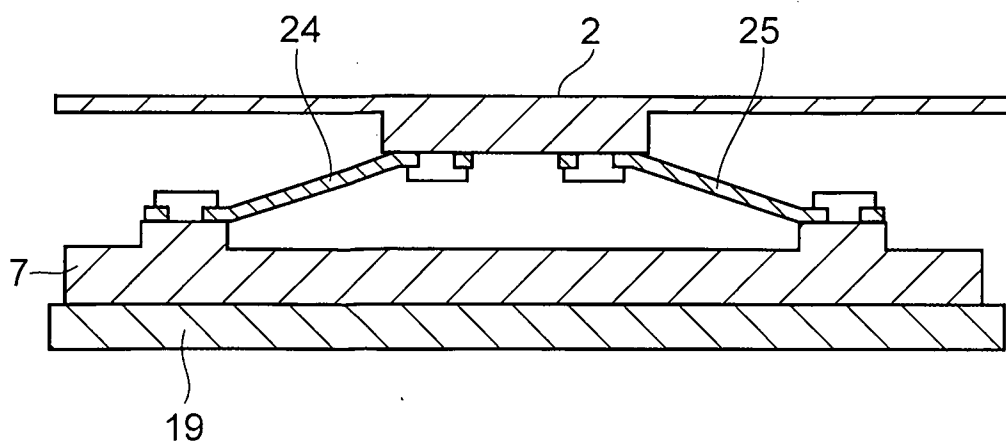


FIG. 8

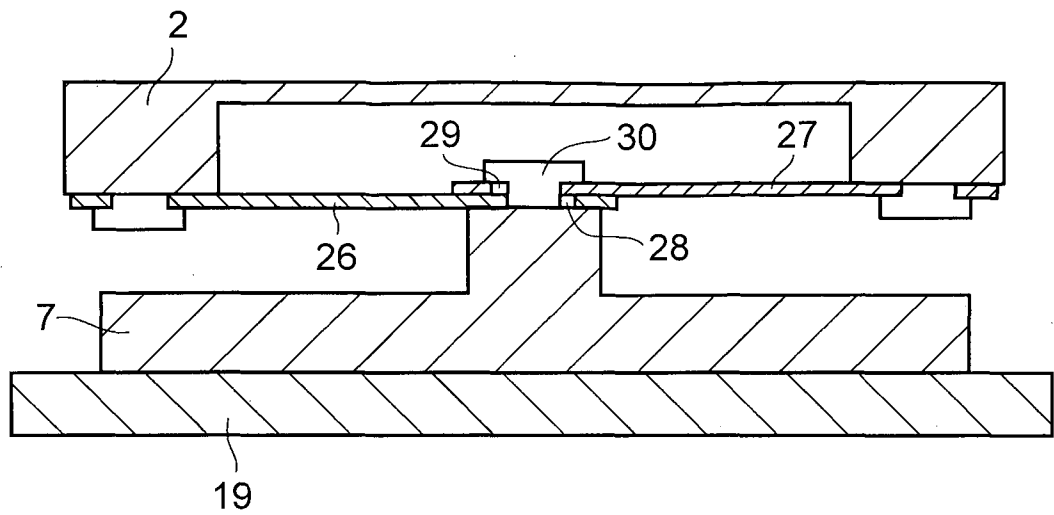


FIG. 9

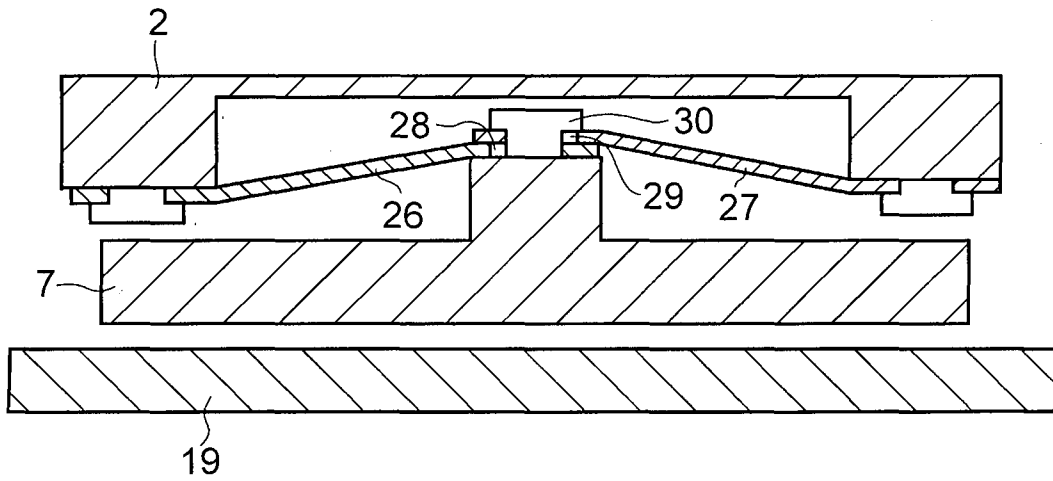


FIG. 10

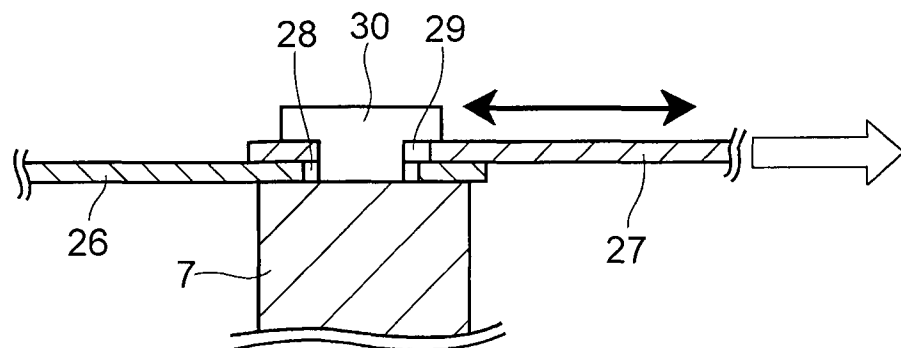


FIG. 11

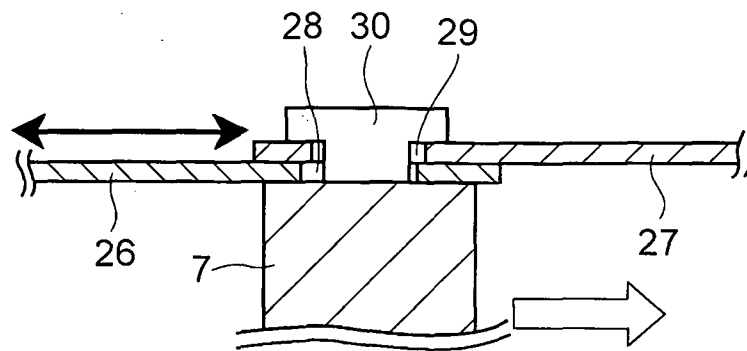


FIG. 12

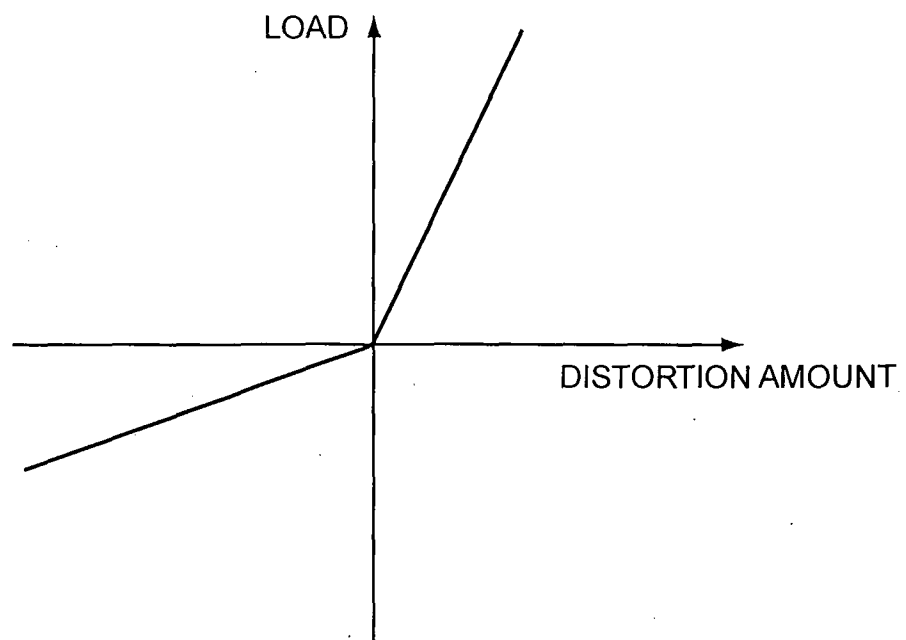


FIG. 13

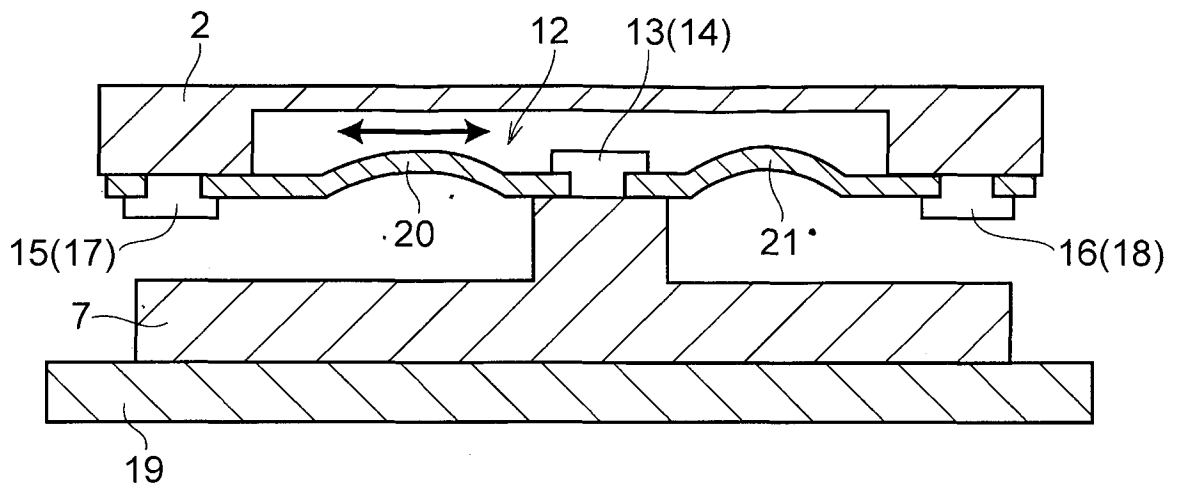


FIG. 14

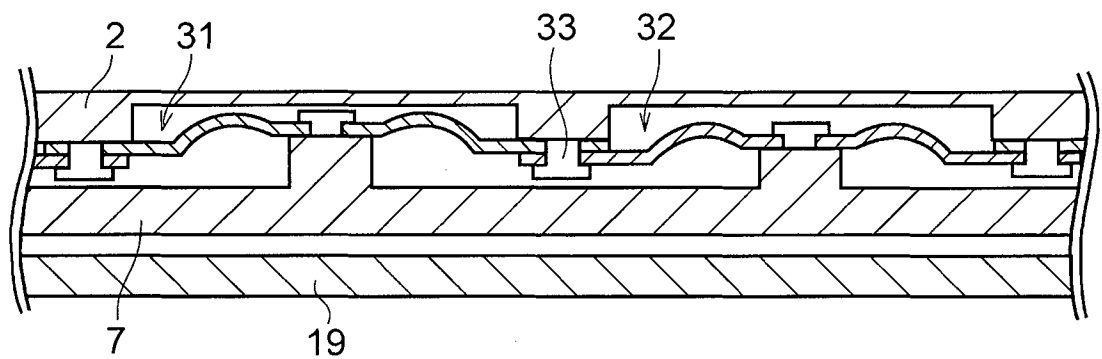


FIG. 15

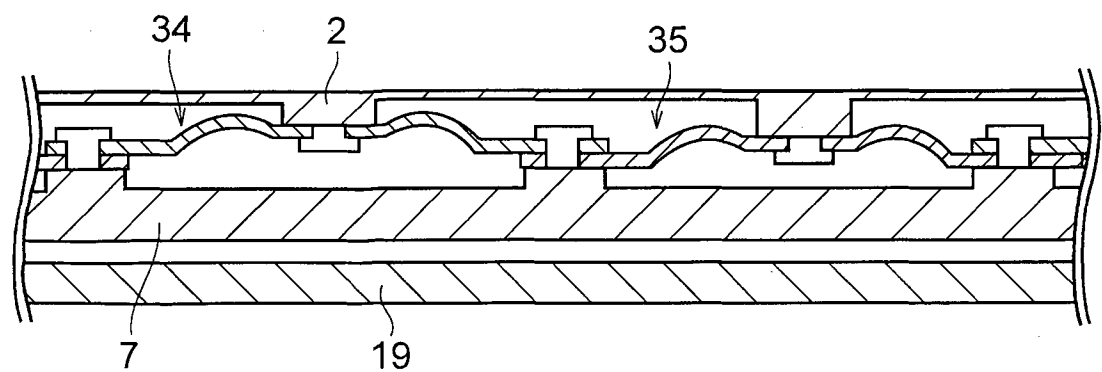


FIG. 16

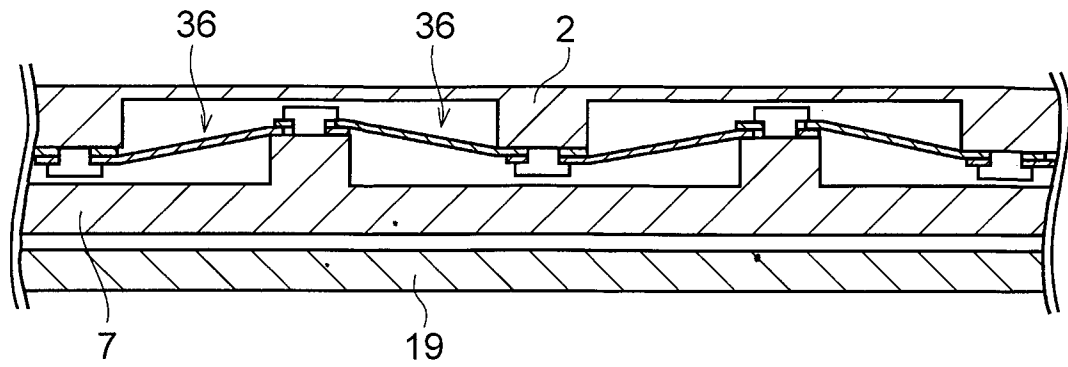


FIG. 17

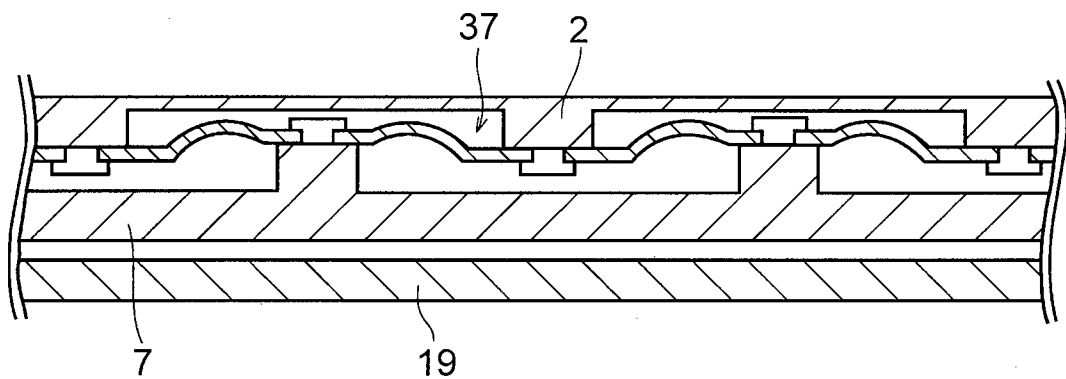


FIG. 18

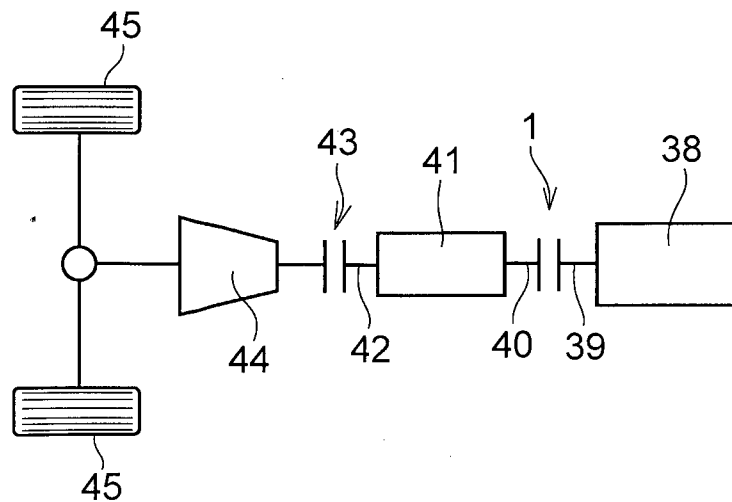
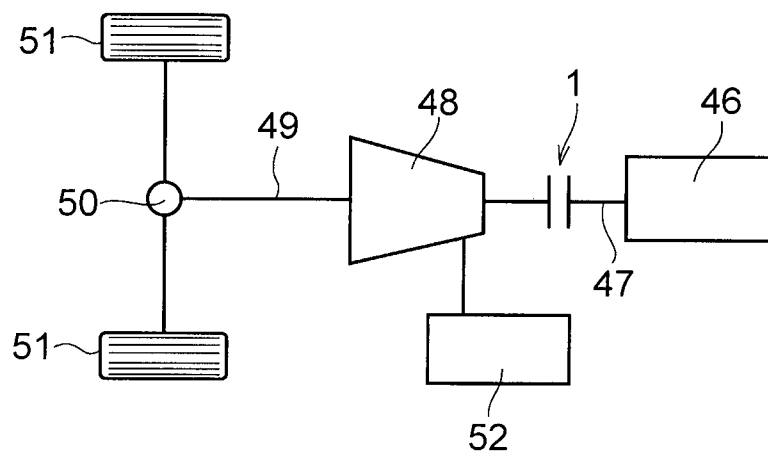


FIG. 19



INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/001419

A. CLASSIFICATION OF SUBJECT MATTER

INV. F16D13/58
ADD. F16D13/70

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 131 716 A (FUKUDA YOSHINOBU [JP]) 17 October 2000 (2000-10-17) column 9, line 42 - column 12, line 52; figures 1-3	1-13
X	US 4 619 353 A (MAEDA SHIGEHO [JP]) 28 October 1986 (1986-10-28) column 1, line 65 - column 3, line 4; figures 1,2	1-3,12
X	US 2012/152679 A1 (VANNI JEREMY [US]) 21 June 2012 (2012-06-21) paragraph [0017] - paragraph [0025]; figures 1-5	1
A	GB 2 177 466 A (AUTOMOTIVE PRODUCTS PLC) 21 January 1987 (1987-01-21) page 2, line 108 - page 3, line 26; figures 1-4	1-13

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

28 November 2014

Date of mailing of the international search report

08/12/2014

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Authorized officer

Schmid, Klaus

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2014/001419

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