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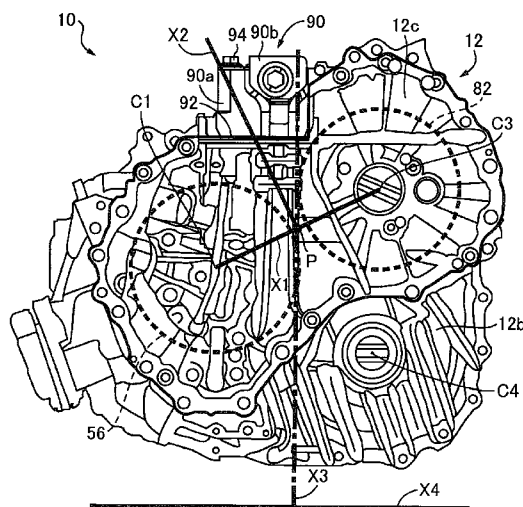
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(54) Title: TRANSAXLE INSTALLATION DEVICE

FIG. 3



(57) Abstract: A transaxle installation device that attaches a transaxle provided therein with an electric motor to a vehicle member via a mount, includes a mount fastening portion. This mount fastening portion is provided on a side wall of a casing of the transaxle"; in a position overlapping a portion of the electric motor, in a radial direction of the electric motor.

TRANSAXLE INSTALLATION DEVICE

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

[0001] The invention relates to a transaxle installation device, and more particularly, to an installation device of a transaxle provided with an electric motor therein.

2. Description of Related Art

10 [0002] A vehicle provided with a transaxle having an electric motor therein, such as a hybrid vehicle, is known. Japanese Patent Application Publication No. 9-309344 (JP 9-309344 A) describes one structure that mounts a transaxle to a vehicle. The described structure is such that a mount is attached to an upper portion of a transmission case, and the transaxle is connected to a member on a vehicle body side via this mount.

15 [0003] When a transaxle is mounted in a vehicle in this way, a mount fastening portion is provided on an upper portion of the transmission case. Therefore, the distance from the mount fastening portion of the transaxle to the member on the vehicle body side (i.e., a vehicle member) becomes longer. Accordingly, a bending moment that is applied to the mount fastening portion and the member on the vehicle body side becomes larger.

20 In particular, a transaxle provided with an electric motor therein, such as that of a hybrid vehicle, is heavier than a transaxle that is not provided with an electric motor. As a result, the bending moment may also further increase.

[0004] In contrast, when the mount fastening portion of the transaxle is provided on a side wall of the case, the distance from the mount fastening portion to the vehicle

25 member is shorter, so the bending moment is reduced. However, with a transaxle provided with an electric motor therein, the overall length (i.e., the axial length) of the transaxle becomes longer than that of a transaxle that is not provided with an electric motor. Therefore, the mounting space for the mount provided between the transaxle and the vehicle member becomes narrow, which may make it difficult to install the transaxle.

SUMMARY OF THE INVENTION

[0005] The invention thus provides a transaxle installation device that enables a transaxle to be installed, while reducing a bending moment applied to a mount fastening
5 portion and a vehicle member, in a transaxle provided with an electric motor therein.

[0006] A first aspect of the invention relates to a transaxle installation device that attaches a transaxle provided therein with an electric motor to a vehicle member via a mount, and includes a mount fastening portion. This mount fastening portion is provided on a side wall of a casing of the transaxle, in a position overlapping a portion of the electric
10 motor, in a radial direction of the electric motor.

[0007] According to this structure, the mount fastening portion is provided on a side wall of the casing of the transaxle, and in a position overlapping a portion of the electric motor in the radial direction. As a result, the distance between the mount fastening portion and a member on the vehicle side (i.e., a vehicle member) for mounting
15 the transaxle becomes shorter than when the mount fastening portion is provided on an upper portion of the casing of the transaxle. Therefore, the bending moment that acts on the mount fastening portion and the vehicle member is reduced. Also, the mount fastening portion is provided on a side wall of the casing, in a position overlapping a portion of the electric motor in the radial direction. As a result, an increase in the overall
20 length (i.e., the length in the axial direction) of the transaxle due to providing the mount fastening portion on the side wall is able to be suppressed, so mounting space of the mount is also ensured.

[0008] In the transaxle installation device described above, the transaxle may be provided therein with a plurality of the electric motors arranged parallel on different
25 rotating shaft centers, and when viewed from a side wall side of the casing, the mount fastening portion may be provided in a position crossing a perpendicular line of a line segment that connects centers of the plurality of electric motors together, the perpendicular line of the line segment passing through a center point of the line segment.

[0009] According to this structure, in the transaxle, a plurality of electric

machines are arranged on different rotating shaft centers, so a projected area of the side wall of the casing becomes larger. Therefore, forward rotation and reverse rotation of the electric motors changes according to the running state of the vehicle, so a large number of out-of-plane resonance modes to which a force, of which the plurality of electric motors are the source of vibration, is linked are generated. The projected area of the side wall is even larger, so vibration tends to increase. In contrast, when viewed from the side wall side of the casing, the mount fastening portion is provided in a position crossing a perpendicular line of a line segment that connects the centers of the rotating shaft centers of the plurality of electric motors together, and the perpendicular line of the line segment passing through a center point of this line segment. As a result, the rigidity of the portion that tends to deform when the out-of-plane resonance modes of the side wall are generated is able to be increased, which enables shaking to be suppressed. In this way, shaking of the side wall when the out-of-plane resonance modes are generated is suppressed, so the noise and vibration characteristics improve.

[0010] In the transaxle installation device described above, the portion of the electric motor may be a coil end that protrudes out in an axial direction from a stator of the electric motor.

[0011] In the transaxle installation device described above, the casing may include a cylindrical case of which both sides in an axial direction are open, and a cover that covers one opening of the case. This cover is connected by a bolt so as to cover the opening of the case, and therefore functions as the side wall of the casing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] 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 skeleton view illustrating the structure of a hybrid vehicle drive system according to an example embodiment to which the invention is preferably applied;

FIG. 2 is a sectional view illustrating the structure of a transaxle in FIG. 1;

FIG. 3 is a view of the transaxle in FIG. 2, as viewed from the side with arrow i;

FIG. 4 is a view of the transaxle in FIG. 2, as viewed from directly above (vertically above);

FIG. 5 is a view of the transaxle in FIG. 2, as viewed from the side with arrow ii;

5 FIG. 6 is an enlarged view of a mount in FIG. 3;

FIG. 7 is an enlarged view of the mount in FIG. 4;

FIG. 8 is an enlarged view of the mount in FIG. 5; and

FIG. 9 is a view showing the transaxle mounted to a vehicle body frame of a vehicle according to the example embodiment.

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DETAILED DESCRIPTION OF EMBODIMENTS

[0013] Hereinafter, example embodiments of the invention will be described in detail with reference to the accompanying drawings. The drawings described in the example embodiment below have been simplified or modified as appropriate, so the scale ratios and the shapes and the like of the portions are not always accurately depicted.

15 [0014] FIG. 1 is a skeleton view illustrating the structure of a hybrid vehicle drive system 6 (hereinafter, referred to as "drive system 6") to which the invention is preferably applied. The drive system 6 functions as a driving power source (i.e., a power source) for running, and includes an engine 8 and a transaxle 10. The engine 8 is a gasoline engine or a diesel engine or the like. The transaxle 10 is a power transmitting apparatus that transmits the power of the engine 8 to driving wheels 9. The transaxle 10 is configured to include four rotating shaft centers (C1 to C4) that are parallel to each other inside a casing 12 that is a case of the transaxle 10. The first shaft center C1 is aligned with a rotating shaft center of the engine 8. An input shaft 14, a power splitting mechanism 28, and a first rotor shaft 16 of a first electric motor MG1 are rotatably supported on the first shaft center C1. A countershaft 18 is rotatably arranged on the second shaft center C2. A power transfer shaft 20 and a second rotor shaft 22 of a second electric motor MG2 are rotatably supported on the third shaft center C3. A differential gear 24 (differential gear unit) is rotatably supported on the fourth shaft center C4. In this way, the first electric

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motor MG1 and the second electric motor MG2 are provided inside the transaxle 10. The first electric motor MG1 and the second electric motor MG2 are arranged parallel on different rotating shaft centers, so the electric motors are able to overlap one another in the radial direction. This structure enables the length of the transaxle 10 in the axial direction to be shorter than it is when the first electric motor MG1 and the second electric motor MG2 are arranged in series on the same rotating shaft center. The first electric motor MG1 and the second electric motor MG2 correspond to the electric motor of the invention.

[0015] FIG. 2 is a sectional view showing the structure of the transaxle 10 in FIG. 1 in detail. The casing 12 that protects the inside of the transaxle 10 is a non-rotating member that is formed by three case members, i.e., a housing 12a, a cylindrical case 12b, and a cover 12c. The cover 12c is a member that closes (i.e., covers) an opening at one end of the cylindrical case 12b in the axial direction, and functions as a side wall. The casing 12 is formed as a single casing by the end surfaces (mating faces) of these case members being fastened together by bolts. The cylindrical case 12b is a portion of the casing 12. A partition wall 13 that extends toward the inside of the casing 12 from a side of a cylindrical outside wall of the cylindrical case 12b is formed on the case 12b. This partition wall 13 is formed substantially perpendicular to each of the rotating shaft centers (C1 to C4). A motor chamber 19 that houses the first electric motor MG1 and the second electric motor MG2 is formed inside the casing 12 by this motor chamber 19. Also, a gear chamber 21 is formed on the opposite side of the partition wall 13 from the motor chamber 19, in the casing 12. The power splitting mechanism 28, the countershaft 18, the power transfer shaft 20, and the differential gear 24 and the like are housed in this gear chamber 21. In this way, the partition wall 13 serves as a wall that separates the motor chamber 19 from the gear chamber 21.

[0016] The input shaft 14 is supported by the housing 12a that forms the casing 12, via a needle roller bearing and a thrust bearing, and is able to rotate about the shaft center C1. A damper device 26 and the power splitting mechanism 28 that is formed by a planetary gear unit are arranged on an outer peripheral side of the input shaft 14.

[0017] The damper device 26 has a function of absorbing torque fluctuation

transmitted from the engine 8, and is interposed, so as to be able to transmit power, between the engine 8 and the input shaft 14. An outer peripheral portion of the damper device 26 is fastened to a disk-shaped flywheel 34 by a bolt 36. The flywheel 34 is connected to a crankshaft 32 of the engine 8. An inner peripheral portion of the damper
5 device 26 is spline-engaged to one end of the input shaft 14 in the axial direction.

[0018] The power splitting mechanism 28 is formed mainly by a sun gear S that is able to rotate about the first shaft center C1, a ring gear R that is arranged on an outer peripheral side, and a carrier CA that rotatably and revolvably supports pinion gears that are in mesh with the sun gear S and the ring gear R. The sun gear S is connected, so as to
10 be unable to rotate relative to, the first rotor shaft 16 of the first electric motor MG1 by spline-engagement. The carrier CA is connected, so as to be unable to rotate relative to, a flange portion 14a that extends in the radial direction from the input shaft 14. The ring gear R is integrally formed on an inner peripheral portion of a compound gear shaft 40 on which a counter drive gear 38 that will be described later is formed. Accordingly,
15 rotation of the ring gear R is transmitted to the counter drive gear 38.

[0019] The compound gear shaft 40 is rotatably supported about the first shaft center C1 by the casing 12 via a first bearing 42 and a second bearing 46 that are arranged one at each end in the axial direction. Also, the first rotor shaft 16 is rotatably supported about the first shaft center C1 by the casing 12 via a third bearing 48 and a fourth bearing
20 50.

[0020] The first electric motor MG1 is arranged on an outer peripheral side of the first rotor shaft 16. The first electric motor MG1 is configured to mainly include a stator 52, a rotor 54, and a coil end 56 that protrudes out from the stator 52 in the axial direction. The first electric motor MG1 is a so-called motor-generator that has a motor function and a
25 generator function. The stator 52 of this first electric motor MG1 is fixed in a non-rotatable manner to the casing 12 (i.e., the case 12b) by a bolt. The inner peripheral portion of the rotor 54 is fixed to the first rotor shaft 16 so as not to be able to rotate relative to the first rotor shaft 16. Therefore, rotation of the first electric motor MG1 is transmitted to the first rotor shaft 16. Also, a resolver 58 for detecting a rotation speed of

the first rotor shaft 16, i.e., a rotation speed of the first electric motor MG1, is provided.

[0021] The countershaft 18 that is arranged on the second shaft center C2 is rotatably supported about the second shaft center C2 by the casing 12 via a fifth bearing 60 and a sixth bearing 62 that are arranged one at each end in the axial direction.

5 [0022] A counter driven gear 64 that is in mesh with both the counter drive gear 38 formed on the compound gear shaft 40, and a reduction gear 72 that will be described later, is formed on the engine 8 side (i.e., the right side in FIG. 2) of the countershaft 18 in the axial direction. Also, a differential drive gear 66 that is in mesh with a differential ring gear 65 of the differential gear 24 is formed on the cover 12c side (i.e., the left side in
10 FIG. 2) of the countershaft 18 in the axial direction.

[0023] The power transfer shaft 20 that is arranged on the third shaft center C3 is connected to the second electric motor MG2. Also, the power transfer shaft 20 is rotatably supported about the third shaft center C3 by the casing 12 via a seventh bearing 68 and an eighth bearing 70.

15 [0024] The reduction gear 72 that is in mesh with the counter driven gear 64 is formed on the power transfer shaft 20. Also, an end portion on the cover 12c side (i.e., the left side in the FIG. 2) of the power transfer shaft 20 in the axial direction is spline-engaged to the second rotor shaft 22 so as to be unable to rotate relative to the second rotor shaft 22. The second rotor shaft 22 is rotatably supported about the third
20 shaft center C3 by the casing 12 via a ninth bearing 74 and a tenth bearing 76.

[0025] The second electric motor MG2 that functions as a power source is arranged on an outer peripheral side of the second rotor shaft 22. The second electric motor MG2 is configured to mainly include a stator 78, a rotor 80, and a coil end 82 that protrudes out from the stator 78 in the axial direction. The second electric motor MG2 is
25 a so-called motor-generator that has a motor function and a generator function, similar to the first electric motor MG1. The stator 78 of this second electric motor MG2 is fixed in a non-rotatable manner to the case 12b (i.e., the casing 12) by a bolt. The inner peripheral portion of the rotor 80 is fixed to the second rotor shaft 22 so as not to be able to rotate relative to the second rotor shaft 22. Therefore, the rotation of the second electric motor

MG2 is transmitted to the second rotor shaft 22. Also, the second rotor shaft 22 is spline-engaged to the power transfer shaft 20, so the rotation of the second rotor shaft 22, i.e., the second electric motor MG2, is transmitted to the reduction gear 72. Further, a resolver 84 for detecting a rotation speed of the second rotor shaft 22, i.e., a rotation speed of the second electric motor MG2, is provided.

[0026] The differential gear 24 is rotatably supported about the fourth shaft center C4 by the casing 12 via an eleventh bearing 86 and a twelfth bearing 88. The differential gear 24 functions as a differential gear unit (i.e., a final reduction gear) that is arranged on the fourth shaft center C4. The specific structure and operation of the differential gear 24 is well-known, so descriptions thereof will be omitted. The reason that the differential gear 24 that is in mesh with the differential drive gear 66 is illustrated as a separate body in the drawing is because in actuality, the first shaft center C1 to the fourth shaft center C4 are not arranged on one plane.

[0027] FIGS. 3 to 5 are views schematically showing the external appearance of the transaxle 10. FIG. 3 is a view of the transaxle 10 shown in FIG. 2, as viewed from the side with arrow i. FIG. 4 is a view of the transaxle 10 shown in FIG. 2, as viewed from directly above (i.e., the vertically above side). FIG. 5 corresponds to a view of the transaxle 10 shown in FIG. 2, as viewed from the side with arrow ii. As shown in FIG. 3, the rotating shaft centers C1 to C4 (C2 is not shown) are not arranged on a single straight line. Also, as shown in FIGS. 3 to 5, the casing 12 that is the protective member of the transaxle 10 is formed from three case members, i.e., the housing 12a, the case 12b, and the cover 12c. The housing 12a is adjacent to the engine 8. The case 12b has a cylindrical shape of a predetermined width dimension, with both ends in the width direction open. The cover 12c is arranged covering one of the openings of the case 12b. The casing 12 functions as a single casing by the end surfaces (mating faces) of these case members being joined together by bolts. The cover 12c corresponds to the side wall of the invention.

[0028] Also, as shown in FIGS. 3 to 5, a mount 90 for mounting the transaxle 10 to a vehicle body frame 100 (i.e., a vehicle member) that will be described later is attached

to the cover 12c of the casing 12. Although not shown, a pair of other mounts are attached, one to a vehicle front side of the housing 12a and the other to a vehicle rear side of the housing 12a, for example, to the transaxle 10.

[0029] As shown in FIG. 3, a rectangular mount fastening seating face 92 formed substantially parallel to a ground surface is formed on the cover 12c. The mount 90 is placed on the mount fastening seating face 92 and fastened and fixed thereto by bolts 94. The mount fastening seating face 92 corresponds to a mount fastening portion for fastening the mount of the invention.

[0030] FIGS. 6 to 8 are enlarged views of the mount 90 shown in FIGS. 3 to 5. FIG. 6 corresponds to an enlarged view of the mount 90 in FIG. 3. FIG. 7 corresponds to an enlarged view of the mount 90 in FIG. 4. FIG. 8 corresponds to an enlarged view of the mount 90 in FIG. 5. As shown in FIGS. 6 to 8, the mount 90 includes a main body portion 90a that is fixed to the cover 12c, and a connecting portion 90b within which an interference member of rubber or the like is interposed.

[0031] The main body portion 90a is formed in a rectangular parallelepiped shape, and through-holes 96 for inserting the bolts 94 are formed, as shown by the broken lines in FIG. 8 (not shown in FIG. 6). Only one through-hole 96 is shown in FIG. 8, but in actuality, the same number of through-holes 96 as there is bolts 94 are formed (three in this example embodiment). Then, with the bolts 94 inserted through the through-holes 96, the bolts 94 protrude out from a contact surface 98 of the main body portion 90a that contacts the mount fastening seating face 92 formed on the cover 12c. An external threaded portion 94a of each bolt 94 that further protrudes from this contact surface 98 is screwed into (i.e., bolted to) a screw hole, not shown, formed in the mount fastening seating face 92 of the cover 12c. As a result, the main body portion 90a of the mount 90 is fixed by the bolts 94 to the mount fastening seating face 92 of the cover 12c. Also, the connecting portion 90b has an interference member or rubber or the like provided therein, so vibration generated in the transaxle 10 is able to be absorbed or damped by this interference member.

[0032] FIG. 9 is a view showing the transaxle 10 mounted to the vehicle body frame 100 of the vehicle. As shown in FIG. 9, the transaxle 10 is connected and held to

the vehicle body frame 100 via the mount 90 that is attached to the cover 12c of the casing 12. A connecting member 102 is fixed to the vehicle body frame 100 by a plurality of bolts 104. This connecting member 102 is connected and fixed to the connecting portion 90b of the mount 90. The transaxle 10 is connected to the vehicle body frame 100 via a plurality of other mounts, but these are omitted in this example embodiment. Also, the transaxle installation device of the invention includes the mount fastening seating face 92 that is formed on the cover 12c, the mount 90 that is attached onto this mount fastening seating face 92, and the connecting member 102 that is attached to the vehicle body frame 100, and the like. Further, the vehicle body frame 100 corresponds to a vehicle member of the invention.

[0033] Returning to FIG. 3, two circles indicated by the broken lines on the cover 12c show an outside diameter line of the coil end 56 of the first electric motor MG1 and an outside diameter line of the coil end 82 of the second electric motor MG2. As shown in FIG. 3, the mount fastening seating face 92 is provided in a location avoiding these outside diameter lines of the coil ends 56 and 82. That is, the mount fastening seating face 92 is provided in a position that does not interfere with the coil end 56 of the first electric motor MG1 or the coil end 82 of the second electric motor MG2.

[0034] Further, a square Q indicated by the bold alternate long and short dash line in FIG. 2 shows the position where the mount fastening seating face 92, i.e., the mount 90, is mounted. As shown in FIG. 2, the mount fastening seating face 92 and the mount 90 are provided in a position that partially overlaps in the radial direction with the coil end 82 of the second electric motor MG2. That is, the positions of the mount fastening seating face 92 and the mount 90, and the coil end 82 of the second electric motor MG2, in the axial direction, are partially equal. The coil end 82 of the second electric motor MG2 corresponds to a portion of the electric motor of the invention.

[0035] In this way, the mount fastening seating face 92 and the mount 90 are provided in a position that overlaps in the radial direction with the coil end 82 of the second electric motor MG2, but does not interfere with the coil end 56 of the first electric motor MG1 or the coil end 82 of the second electric motor MG2. Therefore, the mount

fastening seating face 92 and the mount 90 are provided in an outer space of the cover 12c formed in a position that overlaps with the coil end 82 of the second electric motor MG2 in the radial direction. As a result, an increase in the overall length (i.e., the length in the axial direction) of the transaxle 10 due to providing the mount 90 is able to be suppressed, so mounting space of the mount is also ensured.

[0036] Further, when the mount fastening seating face 92 and the mount 90 are provided on the cover 12c, a distance L between the vehicle body frame 100 and the mount fastening portion of the cover 12c when the transaxle 10 shown in FIG. 9 is mounted to the vehicle is shorter. As a result, a bending moment M that is applied to the vehicle body frame 100 and the mount fastening seating face 92 is reduced. Thus, strength and rigidity taking into account the bending moment M are able to be easily ensured. As a result, reinforcing ribs or the like formed on the cover 12c are able to be reduced, which enables the transaxle 10 to also be lighter in weight. In a structure to which the invention is not applied, the mount 90 is provided on an upper portion (i.e., the case 12b) of the casing 12, so the distance between the vehicle body frame 100 and the mount fastening portion is, for example, approximately a distance L' shown in FIG. 9, which is longer than the distance L in this example embodiment, so the bending moment M is also larger.

[0037] Also, with the transaxle 10, the first electric motor MG1 and the second electric motor MG2 therein are arranged on different rotating shaft centers, so the projected area of the cover 12c is larger. Therefore, there is a tendency for the effect of an out-of-plane resonance mode in which the first electric motor MG1 and the second electric motor MG2 in conjunction shake the cover 12c to also increase. Thus, in the view from the cover 12c side of the casing 12 shown in FIG. 3, the mount fastening seating face 92 and the mount 90 are provided in a position that crosses a perpendicular line X2 of a line segment X1 that connects the first shaft center C1 of the first electric motor MG1 to the third shaft center C3 of the second electric motor MG2, with the perpendicular line X2 of the line segment X1 passing through a center point P of the line segment X1. That is, a plane in the axial direction that includes the perpendicular line X2 intersects the mount fastening seating face 92. Providing the mount fastening seating face 92 and the mount

90 in this kind of position effectively suppresses the out-of-plane resonance mode in which the first electric motor MG1 and the second electric motor MG2 in conjunction shake the cover 12c. That is, when the mount 90 is provided in this position, the rigidity and weight of the portion where the cover 12c tends to vibrate (i.e., the portion of the cover 12c that overlaps with the perpendicular line X2) increase through the use of the weight and rigidity of mount 90, so shaking due to the out-of-plane resonance mode is able to be suppressed. As a result, shaking of the cover 12c from the out-of-plane resonance mode is suppressed, so noise and vibration characteristics are also improved.

[0038] Also, in the view from the cover 12c side of the casing 12 shown in FIG. 3, the mount fastening seating face 92 and the mount 90 are provided in a position crossing a line X3 that is shown by an alternate long and short line perpendicular to a ground surface X4, and that passes through a center point of the line segment X1 that connects the first shaft center C1 of the first electric motor MG1 to the third shaft center C3 of the second electric motor MG2. Providing the mount fastening seating face 92 and the mount 90 in this kind of position also enables the out-of-plane resonance mode in which the first electric motor MG1 and the second electric motor MG2 in conjunction shake the cover 12c to be effectively suppressed.

[0039] As described above, according to this example embodiment, the mount fastening seating face 92 and the mount 90 are provided on the cover 12c of the casing 12 of the transaxle 10, in a position overlapping a portion of the coil end 82 of the second electric motor MG2 in the radial direction. As a result, the distance L between the mount fastening seating face 92 and the mount 90, and the vehicle body frame 100 is able to be shorter than it is when the mount fastening seating face 92 and the mount 90 are provided on the case 12b of the casing 12. Therefore, the bending moment M that acts on the vehicle body frame 100 and the mount fastening seating face 92 is able to be reduced. Also, the mount fastening seating face 92 is provided on the cover 12c of the casing 12, in a position partially overlapping the coil end 82 of the second electric motor MG2 in the radial direction. As a result, an increase in the overall length (i.e., the length in the axial direction) of the transaxle 10 due to the mount fastening seating face 92 being provided on

the cover 12c is also able to be suppressed, so the mounting space of the mount is suitably ensured.

[0040] Further, according to this example embodiment, the first electric motor MG1 and the second electric motor MG2 are arranged on different rotating shaft centers C1 and C3, so the projected area of the cover 12c of the casing 12 is larger. Forward rotation and reverse rotation of the electric motors MG1 and MG2 changes according to the running state of the vehicle. Therefore, a large number of out-of-plane resonance modes to which a force, of which the electric motors MG1 and MG2 are the source of vibration, is linked are generated, and the projected area of the cover 12c is even larger, so vibration may increase. According to this example embodiment, when viewed from the cover 12c side of the casing 12, the mount fastening seating face 92 and the mount 90 are provided in positions straddling the perpendicular line X2 of the line segment X1 connecting the centers of the rotating shaft centers C1 and C3 of the electric motors MG1 and MG2 together, which passes through the center point P of this line segment X1. As a result, the rigidity of the portion that tends to deform when the out-of-plane resonance modes of the cover 12c are generated is able to be increased, so shaking can be suppressed. In this way, shaking of the cover 12c when the out-of-plane resonance modes are generated is suppressed, so the noise and vibration characteristics improve.

[0041] Heretofore, an example embodiment of the invention has been described in detail with reference to the accompanying drawings. However, the invention may also be applied in other modes.

[0042] For example, the transaxle 10 of the example embodiment described above has therein two electric motors, but the number of electric motors may also be one or three or more. For example, the first electric motor MG1 and a third electric motor may be arranged on the first shaft center C1, and the second electric motor MG2 may be arranged on a third shaft center.

[0043] Also, the casing 12 of the example embodiment described above is formed by the housing 12a, the case 12b, and the cover 12c, but the casing 12 does not necessarily have to be formed by three case members. The structure may be modified appropriately.

[0044] Also, the cover 12c that functions as a side wall in the example embodiment described above is integrally fixed to the case 12b by a bolt, but these may also be integrally molded.

5 [0045] Also, the transaxle of the example embodiment described above includes the power splitting mechanism 28, the first electric motor MG1, and the second electric motor MG2. However, the structure may also be modified appropriately as long as an electric motor is provided. For example, an electric motor and a stepped transmission or a continuously variable transmission or the like may be provided.

10 [0046] Also, in the transaxle 10 of the example embodiment described above, the first electric motor MG1 and the second electric motor MG2 are arranged on different rotating shaft centers, but they may also be arranged on the same shaft center.

15 [0047] Also, in the example embodiment described above, the coil end 82 of the second electric motor MG2 is overlapping in the radial direction with the mount fastening seating face 92 and the mount 90, but it may also overlap in the radial direction with the coil end 56 of the first electric motor MG1, or with the coil ends 56 and 82 of both of the electric motors.

20 [0048] Further, in the example embodiment described above, the mount fastening seating face 92 is formed substantially parallel to the ground surface, but the invention is not necessarily limited to this. That is, the mount fastening seating face 92 may also have a slope.

[0049] The example embodiment described above is only one example embodiment. The invention may be carried out in modes that have been modified or improved in any of a variety of ways based on the knowledge of one skilled in the art.

CLAIMS:

1. A transaxle installation device that attaches a transaxle provided therein with an electric motor to a vehicle member via a mount, the transaxle installation device comprising:

a mount fastening portion that is provided on a side wall of a casing of the transaxle, in a position overlapping a portion of the electric motor, in a radial direction of the electric motor.

2. The transaxle installation device according to claim 1, wherein

the transaxle is provided therein with a plurality of the electric motors arranged parallel on different rotating shaft centers; and

when viewed from a side wall side of the casing, the mount fastening portion is provided in a position crossing a perpendicular line of a line segment that connects centers of the plurality of electric motors together, the perpendicular line of the line segment passing through a center point of the line segment.

3. The transaxle installation device according to claim 1 or 2, wherein the portion of the electric motor is a coil end that protrudes out in an axial direction from a stator of the electric motor.

4. The transaxle installation device according to any one of claims 1 to 3, wherein the casing includes a cylindrical case of which both sides in an axial direction are open, and a cover that covers one opening of the case.

FIG. 1

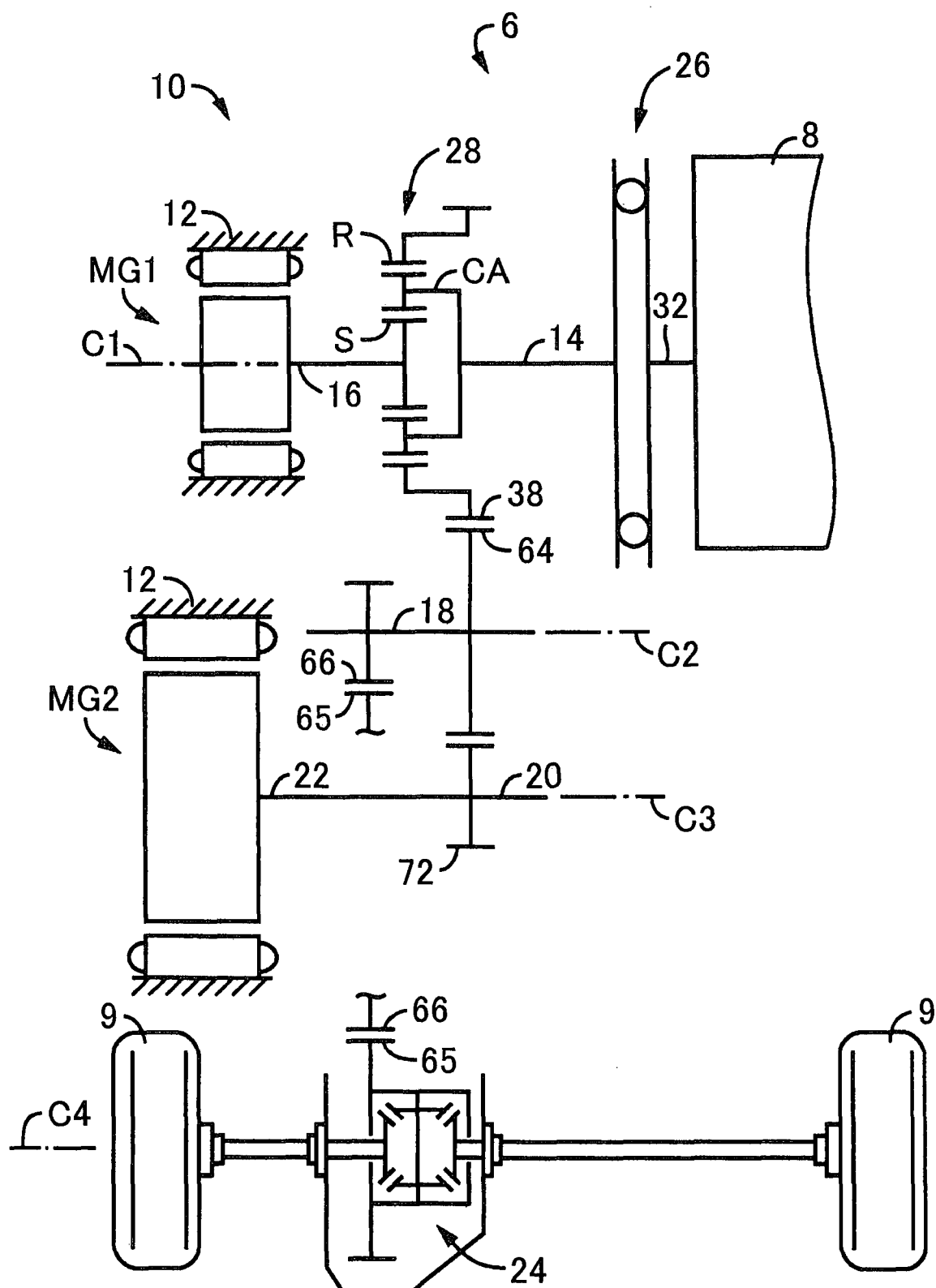
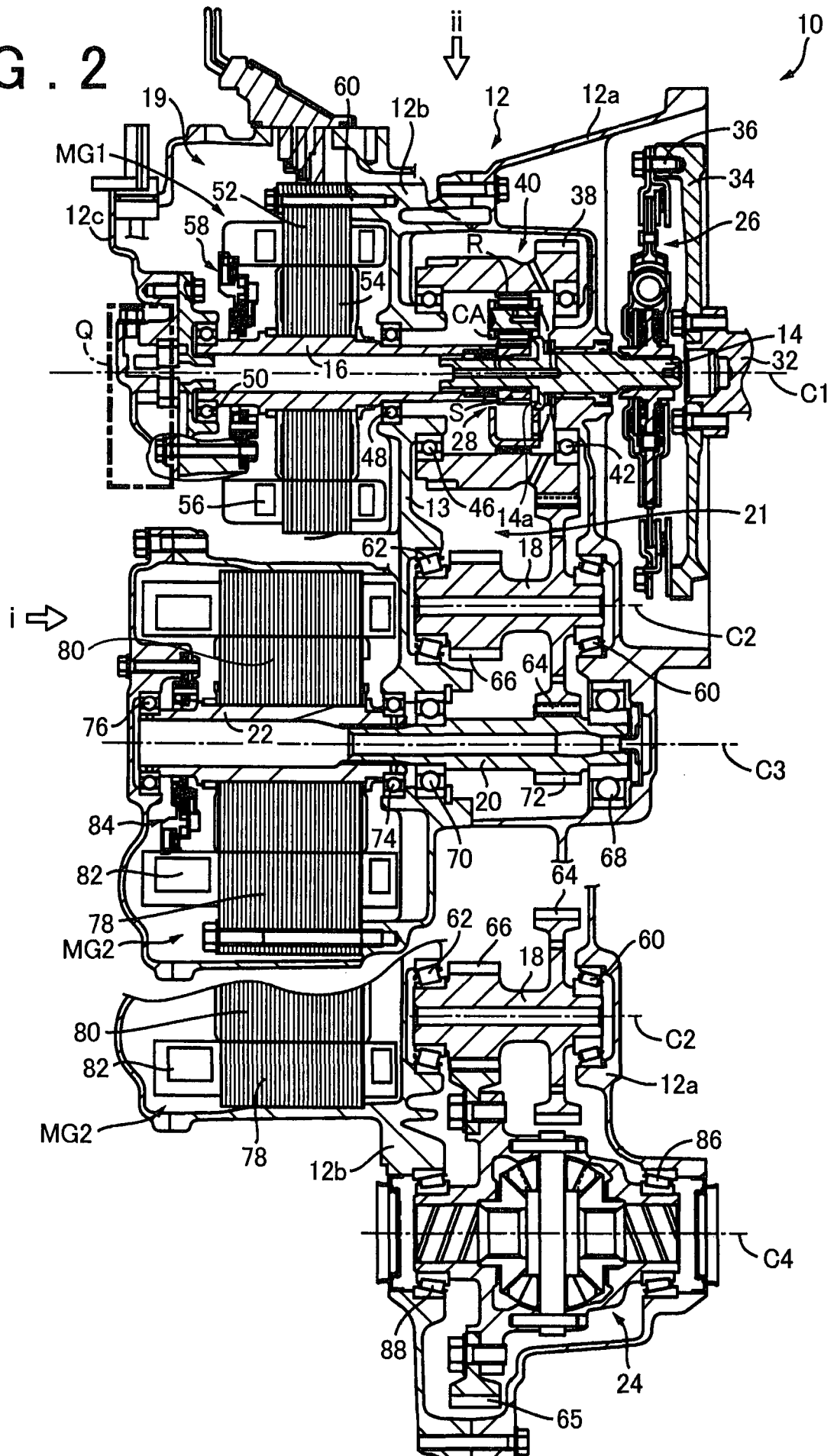


FIG. 2



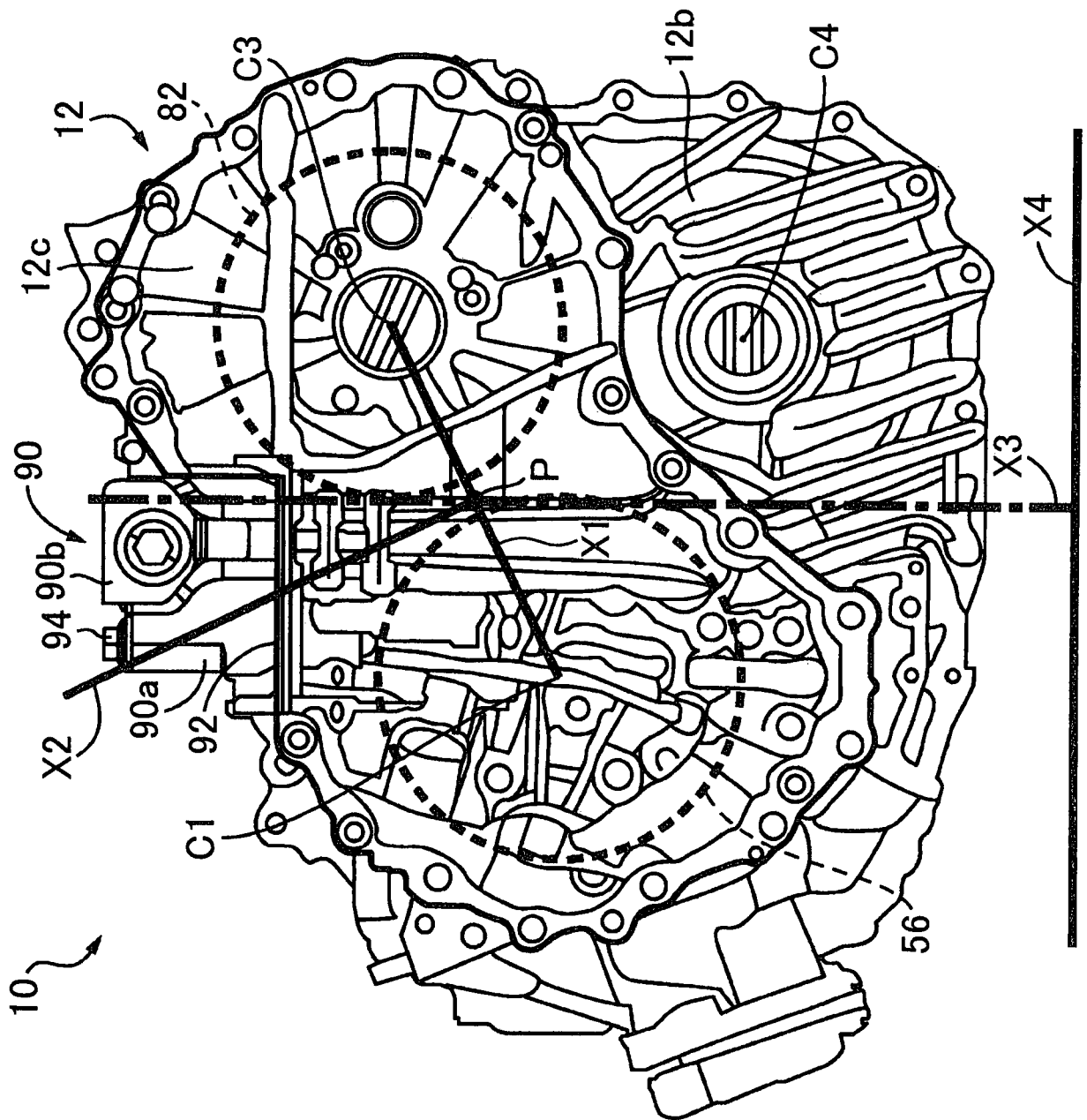


FIG. 3

FIG. 4

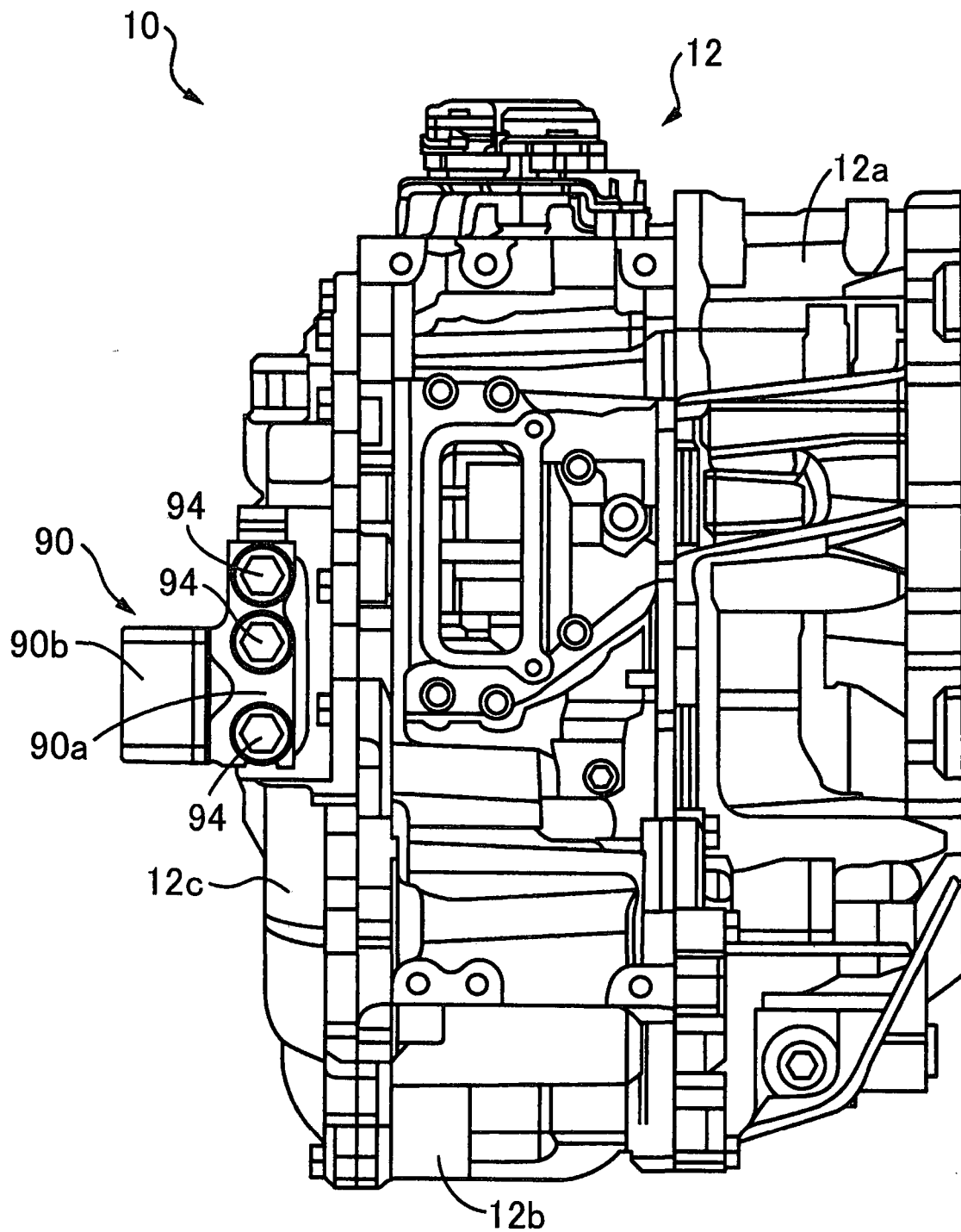


FIG. 5

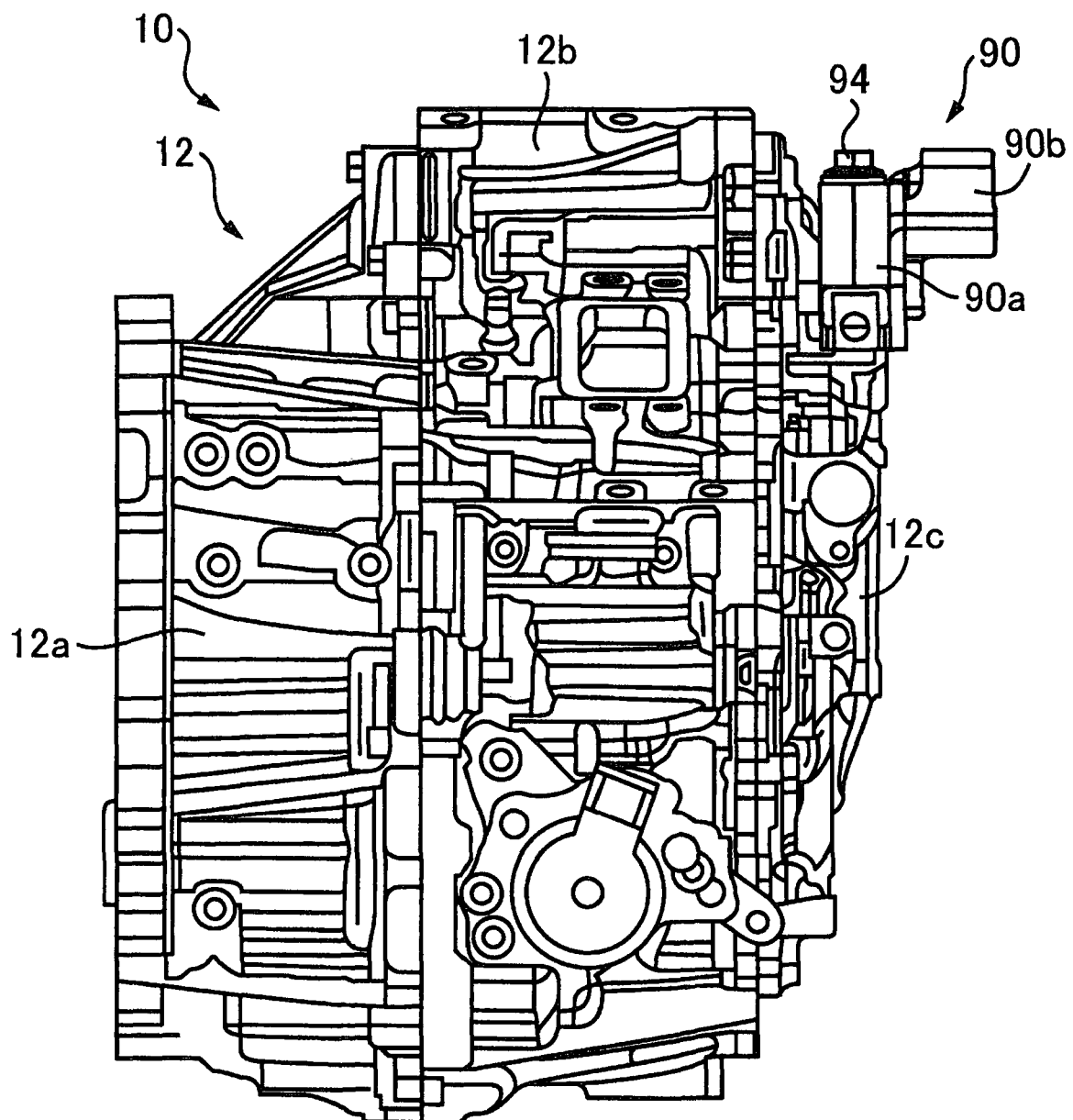


FIG. 6

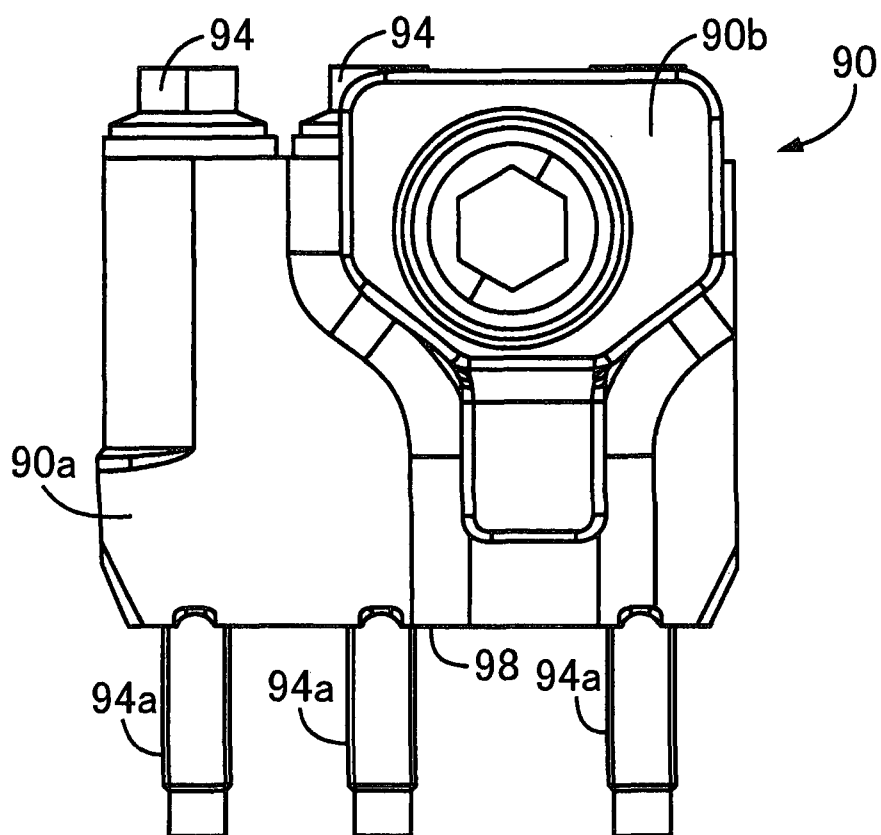


FIG. 7

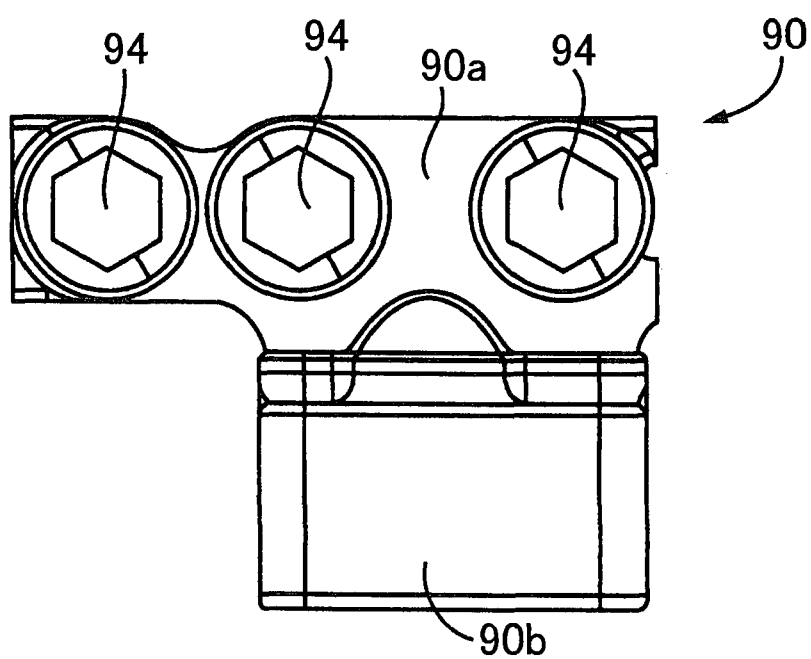


FIG. 8

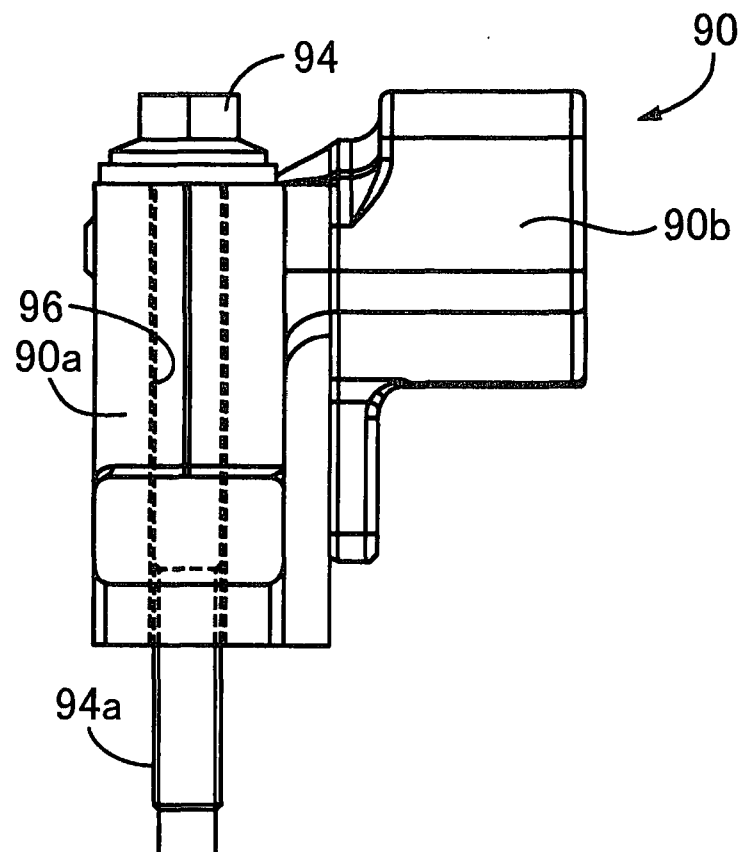


FIG. 9

