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(54) INTERNAL COMBUSTION ENGINE HEAD-COVER STRUCTURE

KOPFABDECKUNGSSTRUKTUR FÜR EINEN VERBRENNUNGSMOTOR

STRUCTURE DE COUVRE-CULASSE DE MOTEUR À COMBUSTION INTERNE

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Description

Technical Field

[0001] The present invention relates to a head cover structure for an internal combustion engine.

Background Art

[0002] Conventionally, the upper portion of the cylinder head for an internal combustion engine is provided with a valve train that drives intake valves and exhaust valves for opening and closing of intake ports and exhaust ports communicating with combustion chambers. Further, the upper portion of the cylinder head is provided with a head cover to cover the valve train.

[0003] For example, in the head cover structure described in Patent Document 1, upper side members, the upper side members being disposed on the upper side of a cam shaft, out of plural bearing members that axially support the cam shaft by sandwiching from the upper side and the lower side are integrally formed with the head cover. The upper side members are disposed at equal intervals along the axial direction of the cam shaft, wherein a cover portion for covering the gap between neighboring upside members is formed substantially in a flat plat shape.

Background Art Document

Patent Document

[0004] Patent Document 1: Chinese Examined Utility Model Registration Application No. CN201206478Y. Document DE4323073 A1 discloses a similar head cover structure.

Disclosure of the Invention

Problems to be Solved by the Invention

[0005] In recent years, in consideration of the layout of an internal combustion engine, it is discussed to attach auxiliary units to a head cover, wherein the auxiliary units are a cam angle sensor (TDC sensor) for detecting the rotational angle of a cam shaft, a common rail for supplying high pressure fuel to a fuel injection device, and the like,.

[0006] However, a conventional head cover structure has a possibly of dropping the detection accuracy of a cam angle sensor by vibration of the head cover. Further, in case of attaching auxiliary units to a head cover with a lower stiffness compared with a cylinder head, the auxiliary units being for example a common rail having been conventionally attached to a cylinder head, it is possible to increase vibration and noise. Therefore, further increasing of the stiffness (in another word, rigidity) of a head cover has been desired.

[0007] On the other hand, weight reduction and downsizing of an internal combustion engine are required. Accordingly, improvement in the stiffness of a head cover by increasing the thickness and the size of the head cover is limited.

[0008] The present invention has been developed to solve these problems, and an object of the invention is to provide a head cover structure, for an internal combustion engine, that enables improvement in the stiffness of a head cover, while inhibiting an increase in thickness and size of the head cover.

Means for Solving the Problems

[0009] A head cover structure, for an internal combustion engine, according to the present invention includes: a cover portion for covering, from an upper side, a valve train including a cam shaft/shafts disposed at a cylinder head; an outer peripheral marginal portion provided along an outer peripheral margin of the cover portion and tightened to the cylinder head; and a plurality of upper side bearing portions provided integrally with the cover portion and the outer peripheral marginal portion to rotatably hold the cam shaft/shafts in collaboration with a plurality of lower side bearing portions provided on the cylinder head, wherein the upper side bearing portions are tightened and fixed to the lower side bearing portions, and wherein the cover portion includes bulging portions bulging substantially in a hemispherical shape between neighboring ones of the upper side bearing portions.

[0010] By this structure, as bulging portions bulging substantially in a hemispherical shape are provided between neighboring ones of the upper side bearing portions, the stiffness of the cover portion is increased by the bulging portions substantially in a hemispherical shape. Further, as the stiffness of the head cover is increased by these bulging portions, it is possible to reduce vibration and sound. Further, as the stiffness of the head cover is increased by the shape of the bulging portions, it is possible to reduce an increase in the thickness and the size of the head cover.

[0011] Further, it is preferable that: the upper side bearing portions include bearing side tightening/fixing portions tightened and fixed to the lower bearing portions; the outer peripheral marginal portion includes outer peripheral side tightening/fixing portions at middle parts between neighboring ones of the upper side bearing portions, the outer peripheral side tightening/fixing portions being tightened and fixed to the cylinder head; first reinforcement limbs are provided between the bearing side tightening/fixing portions and the outer peripheral side tightening/fixing portions; and the bulging portions are provided at parts surrounded by neighboring ones of the upper side bearing portions and the first reinforcement limbs.

[0012] By this structure, as the first reinforcement limbs are provided between the bearing side tightening/fixing portions and the outer peripheral side tightening/fixing

portions, and the bulging portions are provided at parts surrounded by neighboring ones of the upper side bearing portions and the first reinforcement limbs, the stiffness of the head cover is further increased, and it is possible to further reduce vibration and noise.

[0013] Still further, it is preferable that second reinforcement limbs are provided on lower surfaces of the bulging portions, extending from top points of the bulging portions toward the bearing side tightening/fixing portions and the outer peripheral side tightening/fixing portions.

[0014] By this structure, as the stiffness of the bulging portions can be further increased, the stiffness of the head cover is further increased, which enables further reduction in vibration and noise.

[0015] Yet further, it is preferable that: the cam shafts include an intake side cam shaft and an exhaust side cam shaft; the upper side bearing portions are disposed in a plural number respectively along the intake side cam shaft and the exhaust side cam shaft; and the bulging portions are provided at least between the upper side bearing portions along the intake side cam shaft or between the upper side bearing portions along the exhaust side cam shaft.

[0016] By this structure, for an internal combustion engine of a so-called DOHC (Double OverHead Camshaft) type, the stiffness of a head cover can be increased, which enables reducing vibration and noise.

Advantage of the Invention

[0017] According to the present invention, it is possible to provide a head cover structure, for an internal combustion engine, that enables improvement in the stiffness of a head cover.

Brief Description of the Drawings

[0018]

FIG. 1 is a perspective view of a head cover structure, according the present embodiment, for an internal combustion engine;

FIGS. 2A and 2B are perspective views showing a state of a head cover in an upward view from below, wherein FIG. 2A is an entire view and FIG. 2B is an enlarged view of portion A shown in FIG.2A;

FIG. 3 is a cross-sectional view taken along line I-I shown in FIG. 1; and

FIG. 4 is a cross-sectional view taken along line II-II shown in FIG. 1.

Embodiment for Carrying Out the Invention

[0019] An embodiment of the present invention will be described below in detail, referring to FIGS. 1 to 4. The present embodiment will be described, taking an example of a case of applying the invention to a head cover for the engine of a vehicle. In the description, the same reference number will be assigned to the same elements, and overlapping description will be omitted. In describing directions, description of the directions will be based on front (F), back (B), left (L), and right (R) shown in FIG. 1.

[0020] As shown in FIG. 1, an internal combustion engine E is an in-line four cylinder engine of DOHC (Double OverHead Camshaft) type. In addition to a head cover 1 and a cylinder head 2, the basic configuration of the internal combustion engine E includes, though not shown, a cylinder block for housing pistons, connecting rods, cranks, and the like, an oil pan for storing oil, and the like. The internal combustion engine E is transversely installed such that the direction of the row of cylinders is the left/right direction with respect to the vehicle, wherein air is taken in from the back and exhausted from the front.

[0021] The cylinder head 2 is a member forming combustion chambers, intake ports and exhaust ports (not shown). The cylinder head 2 includes intake valves and exhaust valves (not shown) for opening and closing the intake ports and the exhaust ports respectively, and the upper portion of the cylinder head 2 is provided with a valve train 3 to drive these intake valves and exhaust valves. Further, the side portion of the cylinder head 2 (more concretely, for the internal combustion engine E) is provided with a transmission mechanism 4 for transmitting rotation of the cranks to the valve train 3.

[0022] As shown in FIG. 4, the cylinder head 2 includes an outer peripheral wall 21 standing up in a frame shape along the outer peripheral margin of an upper surface 2a, and a central wall 22 standing up from the central portion with respect to the front/back direction of the upper surface 2a. Further, as shown in FIG. 3, between the outer peripheral wall 21 and the central wall 22, the cylinder head 2 is provided with plural lower side bearing portions 23 for axially supporting cam shafts 31, 32 of the valve train 3. The lower side bearing portions 23 are parts in a wall shape extending along the front/back direction, and have respective recessed portions 23a in a semicircular shape at the central portion of the upper surface thereof. The lower side bearing portions 23 are provided at positions corresponding to the positions of upper side bearing portion 13 provided on the later-described head cover 1.

[0023] The valve train 3 includes the pair of cam shafts 31, 32 arranged along the direction of the row of cylinders and in parallel to each other, and plural cams 33 (see FIG. 4) that are fixed respectively to the cam shaft 31 and the cam shaft 32. The cam shaft 31 is an intake side cam shaft for opening and closing the intake valves, and the cam shaft 32 is an exhaust side cam shaft for opening and closing the exhaust valves.

[0024] As shown in FIGS. 1 to 4, the head cover 1 is attached to the upper portion of the cylinder head 2, and is a metal member of an aluminum alloy for covering the valve train 3.

[0025] The head cover 1 mainly includes a cover portion 11 for covering the valve train 3, an outer peripheral

marginal portion 12 forming the outer peripheral margin of the head cover 1, and the upper side bearing portions 13 for axially supporting the cam shafts 31, 32 of the valve train 3. Further, at the central portion with respect to the front/back direction of the head cover 1, a recessed groove portion 14 is extended along the left/right direction for installing a fuel injection device (not shown).

[0026] The outer peripheral marginal portion 12 is a part in a frame shape provided at the outer peripheral margin of the cover portion 11. The outer peripheral marginal portion 12 is arranged on the outer peripheral wall 21 provided on the upper surface of the cylinder head 2. The outer peripheral marginal portion 12 has plural bolt penetration holes 12a for penetration of bolts B, which are tightening members, and the bolt penetration holes 12a are partially provided between neighboring upper side bearing portions 13. These bolt penetration holes 12a correspond to 'outer peripheral side tightening/fixing portion' in claims. Incidentally, bolt tightening holes 21a for tightening the bolts B are formed at positions, the positions corresponding to the bolt penetration holes 12a, of the outer peripheral wall 21 (see FIG. 4).

[0027] The upper side bearing portions 13 are parts for rotatably holding the cam shafts 31, 32 of the valve train 3 in collaboration with the plural lower side bearing portions 23 provided at the cylinder head 2. The upper side bearing portions 13 are wall shaped parts extending along the front/back direction and are provided between the outer peripheral marginal portion 12 and the recessed groove portion 14, being separated from each other along the left/right direction. The upper side bearing portions 13 are arranged on both the left and right sides of the respective cylinders. Incidentally, in the present embodiment, an upper side bearing portion 13c arranged on the left side of the leftmost cylinder serves also as the left end portion 12b (see FIG. 2A) of the outer peripheral marginal portion 12.

[0028] As shown in FIGS. 2A, 2B and FIG. 3, the central portion, with respect to the front/back direction, of the lower surfaces of the upper side bearing portions 13 are provided with respective recessed portions 13a in a semicircular shape. These recessed portions 13a provided on the upper side bearing portions 13 and the respective recessed portions 23a provided on the lower side bearing portions 23 form the bearing portions, which axially and rotatably support the respective cam shafts 31, 32. Bolt penetration holes 13b for penetration of bolts B, which are tightening members, are provided on the both the front and back sides of the recessed portions 13a. These bolt penetration holes 13b correspond to 'bearing side tightening/fixing portion' in claims. Incidentally, the lower side bearing portions 23 of the cylinder head 2 are provided with bolt tightening holes 23b for tightening bolts B at positions corresponding to the bolt penetration holes 13b.

[0029] The cover portion 11 is a plate shaped part for covering the valve train 3, and is disposed being separated upward from the valve train 3 (see FIG. 4). The cover portion 11 has bulging portions 111 bulging upward in a substantially hemispherical shape between neighboring upper side bearing portions 13. Further, as shown in FIG. 1, the cover portion 11 has first reinforcement limbs 15 for reinforcing the bulging portions 111. The first reinforcement limbs 15 are extended such as to stand up between the bolt penetration holes 12a of the outer peripheral marginal portion 12 and bolt penetration holes 13b of the upper side bearing portions 13, the bolt penetration holes 12a being provided between neighboring upper side bearing portions 13. Thus, the bulging portions 111 are surrounded by neighboring upper side bearing portions 13 and the first reinforcement limbs, and are thus in a state of being peripherally reinforced.

[0030] Incidentally, regarding the bulging portions 111, it is assumed that 'a substantially hemispherical shape' includes, in addition to a hemispherical shape, a shape that can be recognized to be equal to a hemispherical shape (so-called dome shape, etc.).

[0031] As shown in FIG. 2B, on the lower surface of a bulging portion 111, second reinforcement limbs16 are radially provided, extending from the top point 111a of the bulging portion 111 toward the bolt penetration hole 13b of the upper side bearing portion 13, the bolt penetration hole 12a of the outer peripheral marginal portion 12, the bolt penetration hole 12a being provided between neighboring upper side bearing portions 13, and the recessed groove portion 14. The second reinforcement limbs 16 are disposed substantially symmetrically with the top point 111a as the center. As the bulging portion 111 is thereby uniformly reinforced, vibration and noise can be reduced. Further, in order to avoid interference with the cam 33, the second reinforcement limbs 16 are curved such as to be convex upward along the lower surface of the bulging portion 111 (see FIG. 4).

[0032] As shown in FIG. 1, a common rail 5 is attached to the back end portion of the head cover 1 to supply high pressure fuel to a fuel injection device, not shown. Further, a cam angle sensor 6 is attached to the upper surface of the head cover 1 to detect the rotation angle of the cam shaft 32. Still further, a negative pressure pump 7 is attached to the end portion, on the left side, of the head cover 1 to supply an operational hydraulic pressure to a valve timing adjustable mechanism (not shown) of the valve train 3. Yet further, an engine hanger 8 is attached on the left side of the front end portion of the head cover 1 to hold the internal combustion engine E at a vehicle body frame, not shown. Further, an opening 9 is provided through the upper surface of the right end portion of the head cover 1 to exhaust blow-by gas to a gas-liquid separation chamber (not shown) provided separately from the head cover 1.

[0033] The head cover structure, for an internal combustion engine, according to the present embodiment is basically configured as described above. The operation and advantage thereof will be described below.

[0034] By the head cover structure according to the present embodiment for an internal combustion engine,

the upper side bearing portions 13 for axially supporting the cam shafts 31, 32 are provided integrally with the head cover 1, and bulging portions 111 bulging substantially in a hemispherical shape are formed between neighboring upper side bearing portions 13. Thus, the stiffness of the cover portion 11 is increased by the bulging portions 111 substantially in a hemispherical shape. Accordingly, it is possible to increase the stiffness of the head cover 1 as a whole and thereby reduce vibration and noise, while reducing an increase in the thickness and size of the head cover 1.

[0035] Further, in this structure, first reinforcement limbs 15 are provided between a bolt penetration hole 12a of the outer peripheral marginal portion 12 and bolt penetration holes 13b of upper side bearing portions 13, the bolt penetration hole 12a being provided between the neighboring upper side bearing portions 13; and a bulging portion 111 is provided at a part surrounded by the neighboring upper side bearing portions 13 and the first reinforcement limbs 15. Accordingly, the stiffness of the head cover 1 is further increased, and it is thereby possible to reduce vibration and noise.

[0036] Still further, on the lower surface of the bulging portion 111, second reinforcement limbs16 are radially provided, extending from the top point 111a of the bulging portion 111 toward the bolt penetration holes 13b of the upper side bearing portions 13, the bolt penetration hole 12a of the outer peripheral marginal portion 12, the bolt penetration hole 12a being provided between the neighboring upper side bearing portions 13, and the recessed groove portion 14. Accordingly, the stiffness of a bulging portion 111 can be further increased, and vibration and noise can be further reduced.

[0037] Yet further, as second reinforcement limbs 16 are disposed substantially symmetrically with a top point 111a as the center, a bulging portion 111 can be uniformly reinforced, and vibration and noise can thereby be reduced.

[0038] Further, as the stiffness of the entire head cover 1 is increased by bulging portions 111, auxiliary units, such as the common rail 5, the cam angle sensor 6, the negative pressure pump 7, the engine hanger 8, and the like can be attached to the head cover 1. Thus, it is possible to improve the degree of freedom of the layout of the internal combustion engine E.

[0039] An embodiment of the present invention has been described in detail, referring to the drawings, however, the invention is not limited thereto, and modifications and changes can be made, as appropriate, in a scope without departing from the spirit of the invention.

[0040] For example, in the present embodiment, the invention is applied to an internal combustion engine E of a so-called DOHC type, however, without being limited thereto, the invention may also be applied to an internal combustion engine, for example, of a SOHC (Single OverHead Camshaft) type.

[0041] Further, in the present embodiment, a gas-liquid separation chamber is separately provided outside the head cover 1, however, a gas-liquid separation chamber may be provided inside the head cover 1. Incidentally, in the present embodiment, weight reduction and downsizing of the head cover 1 can be attained by providing a gas-liquid separation chamber of, for example, a resin separately from the head cover 1 wherein the gas-liquid separation chamber communicates with the opening 9.

[0042] Still further, in the present embodiment, bulging portion 111 are formed between all neighboring upper side bearing portions 13, however, the invention is not limited thereto, and it is only necessary that bulging portion 111 are formed at positions, at which reinforcement is necessary, out of positions between all plural neighboring upper side bearing portions 13.

Description of Reference Symbols

[0043]

1..	head cover
11..	cover portion
111..	bulging portion
12..	outer peripheral marginal portion
13..	upper side bearing portion
13b..	bolt penetration hole
15..	first reinforcement limb
16..	second reinforcement limb
2..	cylinder head
23..	lower side bearing portion
3..	valve train

Claims

1. A head cover structure for an internal combustion engine, comprising:

a cover portion (11) for covering, from an upper side, a valve train including a cam shaft/shafts (31, 32) disposed at a cylinder head (2);
an outer peripheral marginal portion (12) provided along an outer peripheral margin of the cover portion (11) and tightened to the cylinder head (2); and
a plurality of upper side bearing portions (13) provided integrally with the cover portion (11) and the outer peripheral marginal portion (12) to rotatably hold the cam shaft/shafts (31, 32) in collaboration with a plurality of lower side bearing portions (23) provided on the cylinder head (2),
wherein the upper side bearing portions (13) are tightened and fixed to the lower side bearing portions (23),
and wherein the cover portion (13) includes bulging portions (111), **characterized in that** said bulging portions substantially bulge in a hemispherical shape between neighboring ones

of the upper side bearing portions (13) .

2. The head cover structure for an internal combustion engine according to claim 1,
wherein the upper side bearing portions (13) include bearing side tightening/fixing portions (13b) tightened and fixed to the lower bearing portions,
wherein the outer peripheral marginal portion (12) includes outer peripheral side tightening/fixing portions (12a) at middle parts between neighboring ones of the upper side bearing portions (13), the outer peripheral side tightening/fixing portions (12a) being tightened and fixed to the cylinder head (2),
wherein first reinforcement limbs (15) are provided between the bearing side tightening/fixing portions and the outer peripheral side tightening/fixing portions,
and wherein the bulging portions (111) are provided at parts surrounded by neighboring ones of the upper side bearing portions (13) and the first reinforcement limbs (15).

3. The head cover structure for an internal combustion engine according to claim 2,
wherein second reinforcement limbs (16) are provided on lower surfaces of the bulging portions (111), extending from top points of the bulging portions (15) toward the bearing side tightening/fixing portions and the outer peripheral side tightening/fixing portions.

4. The head cover structure for an internal combustion engine according to any one of claims 1 to 3,
wherein the cam shafts (31,32) include an intake side cam shaft (31) and an exhaust side cam shaft (32),
wherein the upper side bearing portions (13) are disposed in a plural number respectively along the intake side cam shaft (31) and the exhaust side cam shaft (32),
and wherein the bulging portions (111) are provided at least between the upper side bearing portions (13) along the intake side cam shaft (31) or between the upper side bearing (13) portions along the exhaust side cam shaft (32).

Patentansprüche

1. Kopf-Abdeckungs-Struktur für einen Verbrennungsmotor, umfassend:

einen Abdeckungsabschnitt (11) zum Abdecken eines Ventilzugs von einer oberen Seite, umfassend eine Nockenwelle / Nockenwellen (31, 32), welche an einem Zylinderkopf (2) angeordnet ist/sind;
einen äußeren Umfangsrandabschnitt (12), welcher entlang eines äußeren Umfangsrands des Abdeckungsabschnitts (11) vorgesehen ist und an den Zylinderkopf (2) festgemacht ist; und
eine Mehrzahl von oberen Seiten-Lager-Abschnitten (13), welche integral mit dem Abdeckungsabschnitt (11) und dem äußeren Umfangsrandabschnitt (12) bereitgestellt sind, um die Nockenwelle / Nockenwellen (31, 32) in Zusammenarbeit mit einer Mehrzahl von unteren Seiten-Lager-Abschnitten (23), welche an dem Zylinderkopf (2) vorgesehen sind, rotierbar zu halten,
wobei die oberen Seiten-Lager-Abschnitte (13) an die unteren Seiten-Lager-Abschnitte (23) festgemacht und befestigt sind,
und wobei der Abdeckungsabschnitt (13) Wulstabschnitte (111) umfasst,
dadurch gekennzeichnet, dass sich die Wulstabschnitte im Wesentlichen in einer hemisphärischen Form zwischen Benachbarten der oberen Seiten-Lager-Abschnitte (13) auswölben.

2. Kopf-Abdeckungs-Struktur für einen Verbrennungsmotor nach Anspruch 1,
wobei die oberen Seiten-Lager-Abschnitte (13) Lager-Seiten-Festmachungs-/-Befestigungs-Abschnitte (13b) umfassen, welche an die unteren Seiten-Lager-Abschnitte festgemacht und befestigt sind,
wobei der äußere Umfangsrandabschnitt (12) äußere Umfangs-Seiten-Festmachungs-/-Befestigungs-Abschnitte (12a) an Mittelteilen zwischen Benachbarten der oberen Seiten-Lager-Abschnitte (13) umfasst, wobei die äußeren Umfangs-Seiten-Festmachungs-/- Befestigungs-Abschnitte (12a) an den Zylinderkopf (2) festgemacht und befestigt sind,
wobei erste Verstärkungsschenkel (15) zwischen den Lager-Seiten-Festmachungs-/-Befestigungs-Abschnitten und den äußeren Umfangs-Seiten-Festmachungs-/-Befestigungs-Abschnitten vorgesehen sind, und wobei die Wulstabschnitte (111) an Teilen vorgesehen sind, welche von Benachbarten der oberen Seiten-Lager-Abschnitte (13) und den ersten Verstärkungsschenkeln (15) umgeben sind.

3. Kopf-Abdeckungs-Struktur für einen Verbrennungsmotor nach Anspruch 2,
wobei zweite Verstärkungsschenkel (16) an unteren Flächen der Wulstabschnitte (111) vorgesehen sind, welche sich von oberen Punkten der Wulstabschnitte (15) in Richtung der Lager-Seiten-Festmachungs-/-Befestigungs-Abschnitte und der Umfangs-Seiten-Festmachungs-/-Befestigungs-Abschnitte erstrecken.

4. Kopf-Abdeckungs-Struktur für einen Verbrennungsmotor nach einem der Ansprüche 1 bis 3,
wobei die Nockenwellen (31, 32) eine Einlass-Seiten-Nockenwelle (31) und eine Auslass-Seiten-No-

ckenwelle (32) umfassen,
wobei die oberen Seiten-Lager-Abschnitte (13) in einer Vielzahl jeweils entlang der Einlass-Seiten-Nockenwelle (31) und der Auslass-Seiten-Nockenwelle (32) angeordnet sind,
und wobei die Wulstabschnitte (111) wenigstens zwischen den oberen Seiten-Lager-Abschnitten (13) entlang der Einlass-Seiten-Nockenwelle (31) oder zwischen den oberen Seiten-Lager-Abschnitten (13) entlang der Auslass-Seiten-Nockenwelle (32) angeordnet sind.

Revendications

1. Structure de couvre-culasse pour un moteur à combustion interne, comprenant :

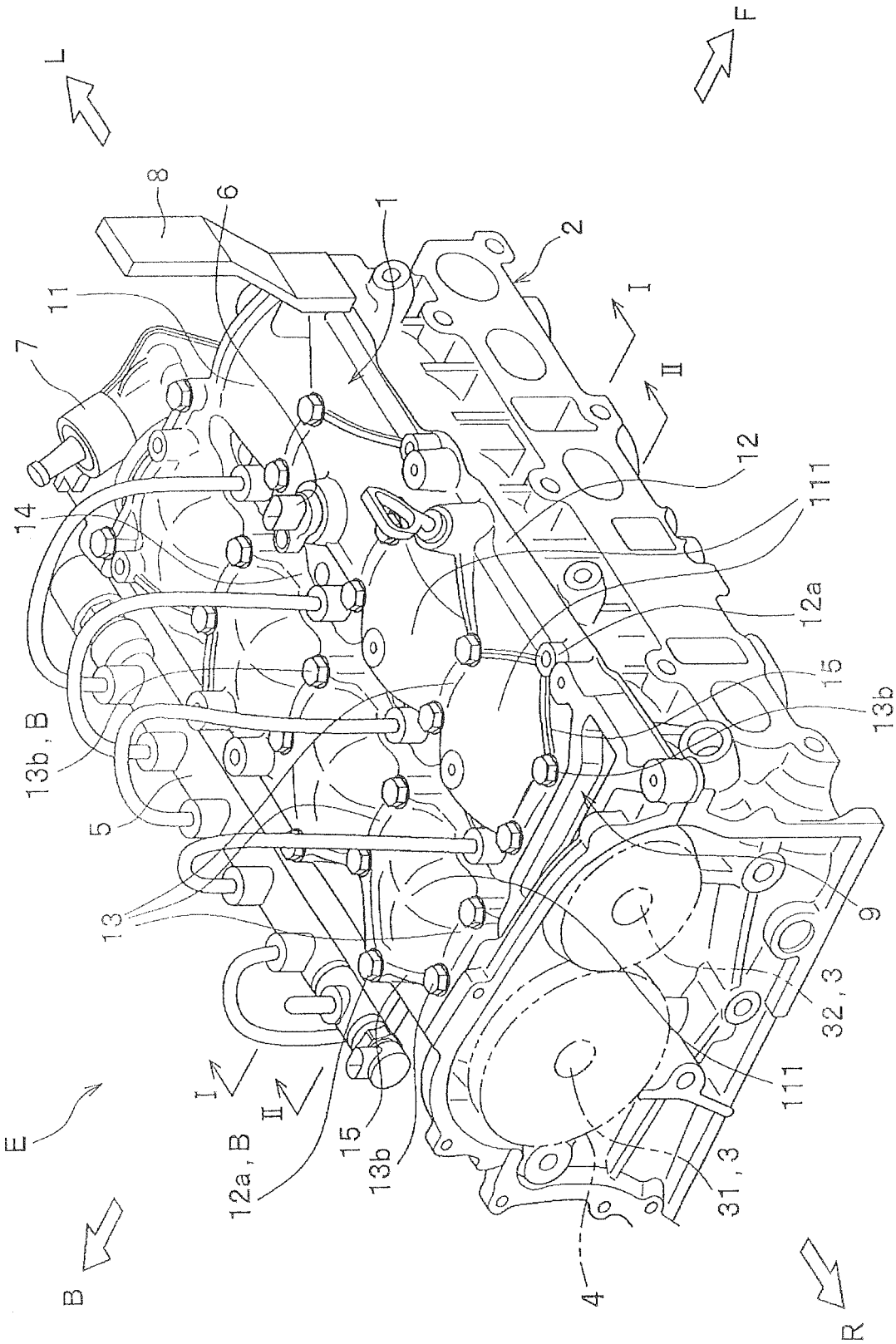
une partie couvrante (11) pour couvrir, depuis un côté supérieur, un train de soupapes comprenant un arbre/des arbres à cames (31, 32) disposés au niveau d'une culasse (2) ;
une partie marginale périphérique extérieure (12) située le long d'une marge périphérique extérieure de la partie couvrante (11) et serrée sur la culasse (2) ; et
une pluralité de parties paliers côté supérieur (13) formées d'un seul tenant avec la partie couvrante (11) et la partie marginale périphérique extérieure (12) pour maintenir en rotation l'arbre/les arbres à cames (31, 32) en collaboration avec une pluralité de parties paliers côté inférieur (23) disposées sur la culasse (2),
dans laquelle les parties paliers côté supérieur (13) sont serrées et fixées sur les parties paliers côté inférieur (23),
et dans laquelle la partie couvrante (13) comprend des parties de gonflement (111), **caractérisée en ce que** lesdites parties de gonflement gonflent sensiblement selon une forme hémisphérique entre des parties voisines parmi les parties paliers côté supérieur (13).

2. Structure de couvre-culasse pour un moteur à combustion interne selon la revendication 1,
dans laquelle les parties paliers côté supérieur (13) comprennent des parties de serrage/fixation côté palier (13b) serrées et fixées sur les parties paliers inférieures,
dans laquelle la partie marginale périphérique extérieure (12) comprend des parties de serrage/fixation côté périphérique extérieur (12a) au niveau de parties centrales entre des parties voisines parmi les parties paliers côté supérieur (13), les parties de serrage/fixation côté périphérique extérieur (12a) étant serrées et fixées sur la culasse (2),
dans laquelle des premières branches de renforcement (15) sont disposées entre les parties de serrage/fixation côté palier et les parties de serrage/fixation côté périphérique extérieur,
et dans laquelle les parties de gonflement (111) sont disposées au niveau de parties entourées par des parties voisines parmi les parties paliers côté supérieur (13) et les premières branches de renforcement (15).

3. Structure de couvre-culasse pour un moteur à combustion interne selon la revendication 2,
dans laquelle des secondes branches de renforcement (16) sont disposées sur des surfaces inférieures des parties de gonflement (111), s'étendant depuis des points hauts des parties de gonflement (15) vers les parties de serrage/fixation côté palier et les parties de serrage/fixation côté périphérique extérieur.

4. Structure de couvre-culasse pour un moteur à combustion interne selon l'une quelconque des revendications 1 à 3,
dans laquelle les arbres à cames (31, 32) comprennent un arbre à cames côté admission (31) et un arbre à cames côté échappement (32),
dans laquelle les parties paliers côté supérieur (13) sont disposées en une pluralité respectivement le long de l'arbre à cames côté admission (31) et de l'arbre à cames côté échappement (32),
et dans laquelle les parties de gonflement (111) sont disposées au moins entre les parties paliers côté supérieur (13) le long de l'arbre à cames côté admission (31) ou entre les parties paliers côté supérieur (13) le long de l'arbre à cames côté échappement (32).

FIG.1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7
I
II
12
14
111
12a
15
13b
13b, B
5
13
9
32, 3
E
I
II
15
13b
12a, B
111
31, 3
B
4
R

FIG.2A

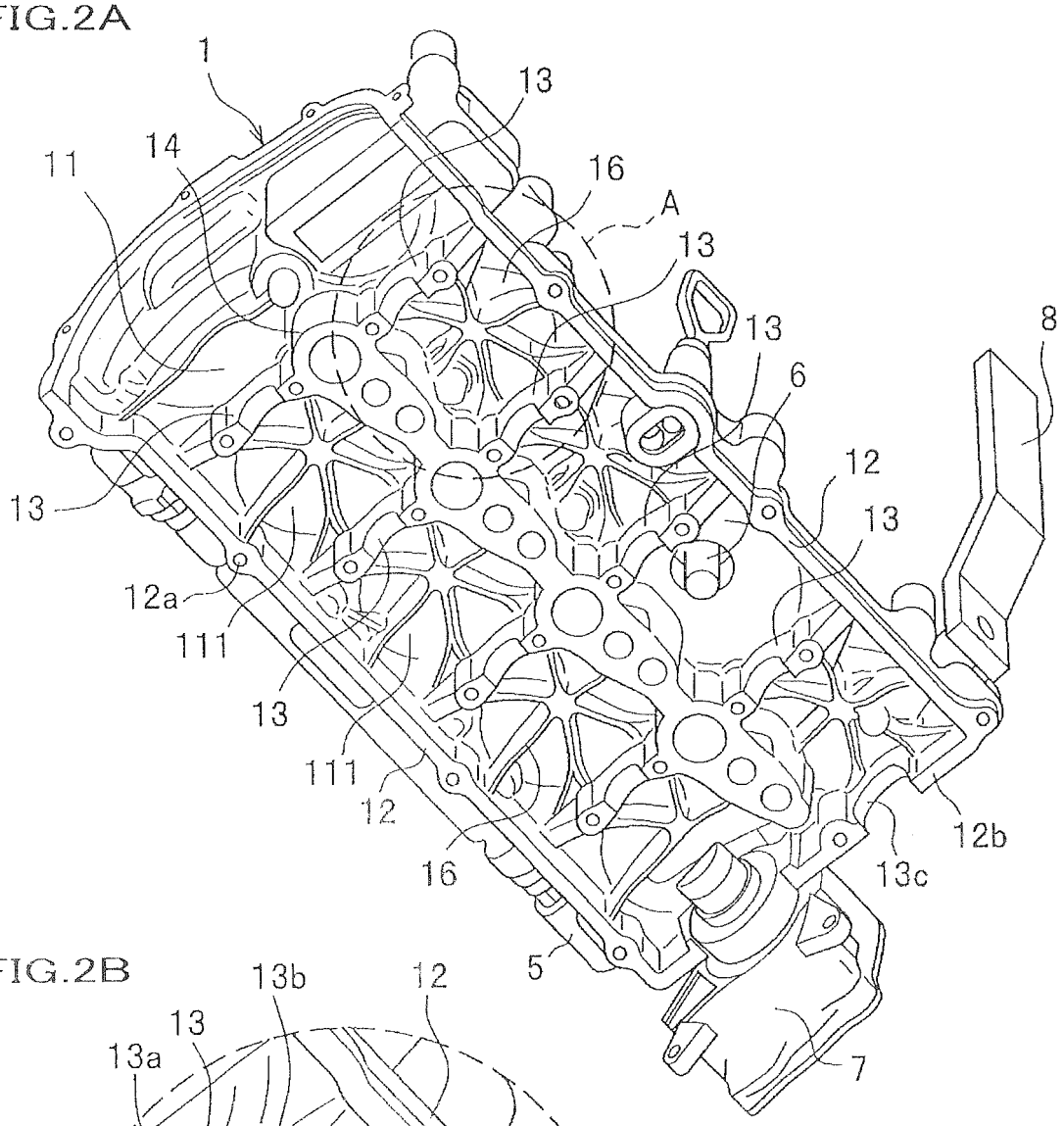

1
13
14
11
16
A
13
13
8
6
12
13
13
12a
111
13
111
12
16
12b
13c
5
7

FIG.2B

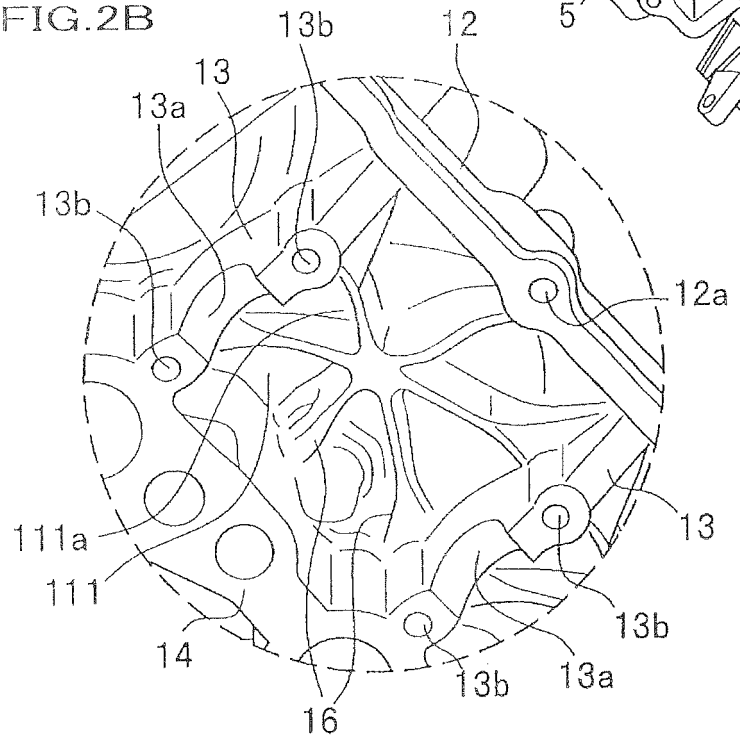

13b
12
13
13a
13b
12a
111a
13
111
13b
14
13b
13a
16

FIG.3

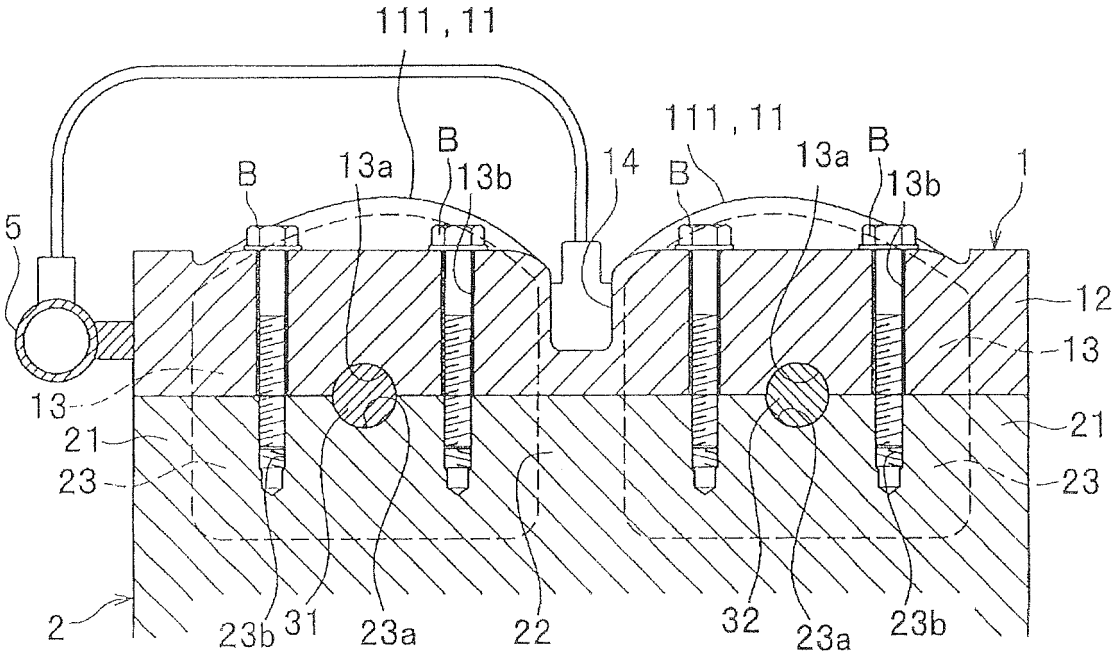
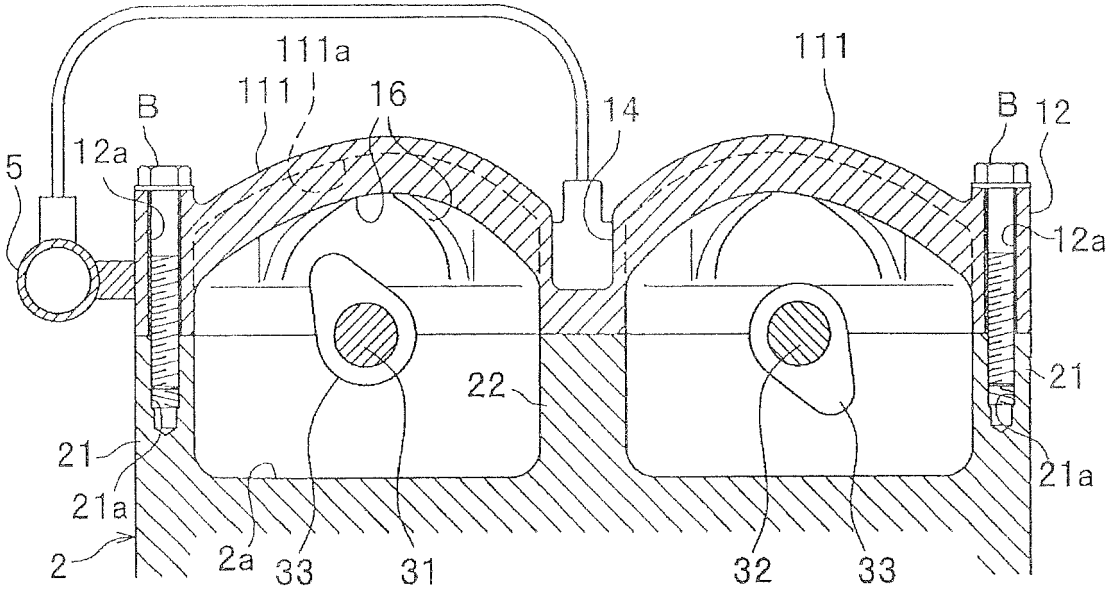

111, 11
111, 11
B
13a
13b
14
1
5
12
13
21
23
2
23b
31
23a
22
32

FIG.4


111a
111
16
B
12a
5
14
12
21
21a
2
2a
33
31
22
32

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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