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(54) **Camshaft bearing structure for over-head camshaft type internal combustion engine**

Nockenwellenlagerstruktur für eine Brennkraftmaschine mit oben liegenden Nockenwellen

Structure des paliers pour des arbres aux cames d' un moteur à combustion interne avec double arbres aux cames en la culasse

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Description

[0001] The present invention relates to bearing structure of a camshaft for an overhead camshaft (OHC) type internal combustion engine.

[0002] There is generally adopted a multi-cylinder overhead camshaft type internal combustion engine in which on a covered surface of a cylinder head, there are arranged an intake camshaft and an exhaust camshaft in parallel with each other, and each journal portion is axially supported, displaced and covered with a head cover, of a cam chain type having an intake camshaft and an exhaust camshaft which are equipped with cam chain sprockets (See, for example, Patent Literature 1).
Patent Literature 1:
Japanese Patent No. 2744781

[0003] As regards bearing structure of a camshaft of a valve system disclosed in the Patent Literature 1, although it is not obvious in detail, if there exists some distance between a bearing portion of the camshaft and the cam chain sprockets, when tension due to a cam chain to be wound around the cam chain sprockets is exerted on the camshaft as a bending force, it is difficult to secure rigidity of the camshaft, and it causes beating noise.

[0004] US-A-4 658 769, US-A-6 024 063 and DE 199 62 164 A each disclose a camshaft bearing structure for an overhead camshaft type internal combustion engine, in which on a covered surface of a cylinder head, a camshaft is axially supported, disposed and is covered with a head cover, wherein said camshaft is provided with a cam chain sprocket, adjacent to said cam chain sprocket, there is formed a bearing portion on the covered surface of said cylinder head, and between said bearing portion and a bracket, a journal portion to which said camshaft corresponds is axially supported so as to be sandwiched.

[0005] The present invention has been achieved in views of the above-described points, and it is an object of the invention to provide a camshaft bearing structure for an overhead camshaft type internal combustion engine capable of easily securing the rigidity of the camshaft and preventing beating noise from occurring.

[0006] This object is achieved by a camshaft bearing structure for an overhead camshaft type internal combustion engine according to claim 1.

[0007] According to the invention specified in Claim 1, there is provided a camshaft bearing structure for a multi-cylinder overhead camshaft type internal combustion engine, in which on a covered surface of a cylinder head, an intake camshaft and an exhaust camshaft are arranged in parallel with each other, each journal portion is axially supported, disposed and is covered with a head cover, characterized in that substantially at the centers of the intake camshaft and the exhaust camshaft respectively, there are provided cam chain sprockets; adjacent to the cam chain sprocket, bearing portions are formed respectively on the covered surface of the cylinder head; and between each of the bearing portions and each bracket, each journal portion to which the intake camshaft and the exhaust camshaft correspond is axially supported so as to be sandwiched.

[0008] Since bearing portions for axially supporting the intake camshaft and the exhaust camshaft respectively are formed adjacent to each cam chain sprocket, even if tension due to a cam chain to be wound around each cam chain sprocket is exerted on the intake camshaft and the exhaust camshaft as a bending force, it is possible to easily secure rigidity of the intake camshaft and the exhaust camshaft.

[0009] According to the invention specified in Claim 2, there is provided a camshaft bearing structure for an overhead camshaft type internal combustion engine specified in Claim 1, characterized in that adj acent to each of the cam chain sprockets, each bearing portion to be formed on a covered surface of the cylinder head is formed only at one side of each of the cam chain sprockets.

[0010] Even if the bearing portion is formed only at one side of the cam chain sprocket, since the bearing portion is adjacent to the cam chain sprocket, the rigidity of the camshaft can be sufficiently secured.

[0011] According to the invention specified in Claim 3, there is provided a camshaft bearing structure for an overhead camshaft type internal combustion engine specified in Claim 1 or Claim 2, characterized in that the intake camshaft and the exhaust camshaft have cams, each of which directly acts on the intake valve and the exhaust valve respectively.

[0012] Since each cam directly acts on the intake valve and the exhaust valve respectively, it is possible to reduce a number of parts and simplify the structure without necessitating any rocker arm.

[0013] According to the invention specified in Claim 4, there is provided a camshaft bearing structure for an overhead camshaft type internal combustion engine specified in Claim 3, characterized in that in the intake camshaft and the exhaust camshaft, there is formed an oil passage therein; oil is introduced from an introducing oil path formed on the bearing portion adjacent to the cam chain sprocket of the cylinder head to the oil passage; and oil is conducted from an conducting oil path formed in each cam lobe and the journal portion.

[0014] Taking advantage of the structure of directly acting on the intake valve and the exhaust valve respectively, each cam forms an oil passage within the camshaft, oil is introduced from the bearing portion adjacent to the cam chain sprocket, and is conducted from each cam lobe and the journal portion, whereby the lubricating oil path can be simplified.

[0015] Hereinafter, a preferred embodiment of the present invention will be described with reference to the accompanying drawings, in which:

Fig. 1 is a partially longitudinal sectional view showing an internal combustion engine according to one embodiment of the present invention;

Fig. 2 is a top view showing a state in which the cylinder head cover has been removed in the same internal combustion engine;

Fig. 3 is a cross-sectional view taken on line III-III of Fig. 2; and

Fig. 4 is a top view showing a cylinder head.

[0016] Hereinafter, with reference to Figs. 1 to 4, the description will be made of one embodiment according to the present invention.

[0017] An internal combustion engine 1 according to the present embodiment is a parallel four-cylinder four-stroke cycle DOHC (Double Overhead Camshaft) type internal combustion engine, and is mounted on a motorcycle transversely.

[0018] Fig. 1 is a partially longitudinal cross-sectional view showing the internal combustion engine 1, and a cross-sectional view taken on line I-I of Fig. 2; and Fig. 2 is a top view showing a state in which the cylinder head cover has been removed.

[0019] On a cylinder block 2, there are formed four cylinder bores 3 in parallel, and a piston 4 is fitted in each cylinder bore 3 in such a manner as to be freely slidable.

[0020] On a cylinder head 5 to be integrally superimposed on the cylinder block 2, there are formed combustion chambers 6 to oppose to each piston 4 respectively, and on the surface of a ceiling of each combustion chamber 6, there are opened a pair of intake ports and a pair of exhaust ports side by side with each other.

[0021] A valve stem 9a, 10a of an intake valve 9 for opening and closing an opening of an intake port 7 and an exhaust valve 10 for opening and closing an opening of an exhaust port 8 is slidably supported by a valve guide 11, 12 respectively, and between a retainer 13, 14 to be provided at a top end of the valve stem 9a, 10a, and the cylinder head 5, there is interposed a valve spring 15, 16 to bias the intake valve 9 and the exhaust valve 10 in a direction that closes the valve.

[0022] The upper part of the valve stem 9a, 10a is covered with a valve lifter 17, 18 having a bottom and a cylindrical shape, and the end surface of this valve lifter 17, 18 is directly urged by cam lobes 23, 24 of the intake camshaft 21 and the exhaust camshaft 22.

[0023] That is, a direct-acting type, inwhich the valve is directly driven.

[0024] The present internal combustion engine is a DOHC type internal combustion engine, and the intake camshaft 21 and the exhaust camshaft 22 are arranged in parallel with each other on a covered surface of the cylinder head 5 and are disposed with each journal portion 25, 26 axially supported, and their upper parts are covered with a cylinder head cover 19.

[0025] The intake camshaft 21 and the exhaust camshaft 22 are of a center cam chain type, at the substantially central part of which a cam chain sprocket 27, 28 is fitted to.

[0026] A cylinder head 5 which is rectangular when the top view is viewed as shown in Fig. 4 has, at its central part, a cam chain chamber 30 which has been formed as a rectangular hole in a continuous length in the direction of width.

[0027] On both sides of this cam chain chamber 30, there are disposed two each of combustion chambers 6 for each cylinder, and at the center of each combustion chamber 6, there is formed a plug hole 31 for mounting an ignition plug respectively.

[0028] On the periphery of the plug hole 31, there are formed a pair of lifter holes 32, 33 (four in total) along which a pair of valve lifters 17, 18 slide respectively.

[0029] For each cylinder, between the intake-side lifter hole 32 and the exhaust-side lifter hole 33, there is provided a bearing portion 34, 35 having a semi-circular arc surface, and before and behind each bearing portion 34, 35, there is formed a mating surface 36, 37 with the bracket respectively, and on the mating surface 36, 37, there is provided a bolt hole 36a, 37a respectively.

[0030] In this respect, on both sides of a pair of intake-side lifter holes 32, 32 for each cylinder and on both sides of a pair of exhaust-side lifter holes 33, 33, there are formed boss portions 38, 39 for head bolt.

[0031] Thus, on the present cylinder head 5, in addition to the bearing portion 34, 35, a bearing portion 41, 42 forming a semi-circular arc surface so as to bulge out somewhat further in the cam chain chamber 30 from a boss portion 38, 39 is formed to become coaxial to the bearing portion 34, 35 respectively.

[0032] Before and behind each bearing portion 41, 42, there are formed mating surfaces 43, 44 with the bracket, and on the mating surfaces 43, 44, there are provided bolt holes 43a, 44a respectively.

[0033] In this respect, on the mating surfaces 43, 44, there are formed openings of an introducing oil path 43b, 44b.

[0034] On a covered surface of such a cylinder head 5 as describe above, the intake camshaft 21 and the exhaust camshaft 22 fit and insert a cam chain sprocket 27, 28 into a cam chain chamber 30 respectively to cause each bearing portion 34, 35 and bearing portion 41, 42 to support a journal portion 25, 26, and brackets 45, 46 and brackets 51, 52, each having a semi-circular arc surface corresponding to each bearing portion sandwich the journal portion 25, 26 therebetween to axially support the intake camshaft 21 and the exhaust camshaft 22 pivotally (See Figs. 2 and 3).

[0035] In this respect, the brackets 45, 46 and brackets 51, 52 are fixed by means of bolts 53. A cam lobe 23, 24 of the intake camshaft 21 and the exhaust camshaft 22 abuts against the end surface of a valve lifter 17, 18 which is slidably fitted in the lifter hole 32, 33.

[0036] Between the cam chain sprocket 27, 28 fitted and inserted into the cam chain chamber 30 and a driving sprocket fitted to the crankshaft, an endless cam chain 55 is wound and laid.

[0037] By operating the internal combustion engine 1, a rotation of the crankshaft is transmitted to the intake camshaft 21 and the exhaust camshaft 22 at the rate of

one half rotation through the cam chain 55, and the rotation of this intake camshaft 21 and exhaust camshaft 22 enables the cam lobe 23, 24 to drive the open-close valve of the intake valve 9 and the exhaust valve 10 through the valve lifter 17, 18.

[0038] In the case of the present cylinder head 5, since the bearing portion 41, 42 has been formed so as to bulge out somewhat in the cam chain chamber 30, the bearing portion 41, 42 is brought as close to the cam chain sprocket 27, 28 as possible to be fitted and inserted into the cam chain chamber 30, and is in a state adjacent.

[0039] Therefore, even if tension due to the cam chain 55 to be wound around each cam chain sprocket 27, 28 is exerted on the intake camshaft 21 and the exhaust camshaft 22 as a bending force, the rigidity of the intake camshaft 21 and the exhaust camshaft 22 can be easily secured.

[0040] Accordingly, it is possible to prevent beating noise due to strain in the camshaft from occurring.

[0041] Although the bearing portion 41, 42 is located only at one side of the cam chain sprocket 27, 28, since the bearing portion 41, 42 is adjacent to the cam chain sprocket 27, 28, it is possible to sufficiently secure the rigidity of the intake camshaft 21 and the exhaust camshaft 22.

[0042] Being of a direct-acting type in which the cam lobe 23, 24 of the intake camshaft 21 and the exhaust camshaft 22 directly urges the end surface of the valve lifter 17, 18, it is possible to construct a simple lubricating oil path in which an oil passage 21a (22a), both ends of which have been blocked within the intake camshaft 21 (and exhaust camshaft 22) is formed as shown in Fig. 3.

[0043] In other words, referring to Fig. 3, oil passes through an oil path 51a (See Fig. 2) formed on a bracket 51 from an introducing oil path 43b opened on a mating surface 43 of the bearing portion 41 adjacent to the cam chain sprocket 27, is introduced into an oil passage 21a of the intake camshaft 21 through an introducing oil path 21b of a journal portion corresponding, and is conducted from a conducting oil path 23a formed on each cam lobe 23 and a conducting oil path 25a formed on a journal portion 25 to supply oil to the cam outer peripheral surface and the bearing for lubrication.

[0044] Since oil is introduced from the introducing oil path 43b of the bearing portion 41 located at substantially center of the intake camshaft 21 to the oil passage 21a of the intake camshaft 21, oil is evenly supplied to both sides of left and right.

[0045] In this respect, the valve system on the exhaust side is also lubricated with similar structure.

Claims

1. Camshaft bearing structure for a multi-cylinder overhead camshaft type internal combustion engine, in which on a covered surface of a cylinder head (5), an intake camshaft (21) and an exhaust camshaft (22) are arranged in parallel with each other, each journal portion (25, 26) is axially supported, disposed and is covered with a head cover (19),
characterized in that
substantially at centers of said intake camshaft (21) and said exhaust camshaft (22) respectively, there are provided cam chain sprockets (27, 28);
adjacent to said cam chain sprockets (27, 28), bearing portions (41, 42) are formed respectively on the covered surface of said cylinder head (5); and
between each of said bearing portions (41, 42) and each bracket (51, 52), each journal portion (25, 26) to which said intake camshaft (21) and said exhaust camshaft (22) correspond is axially supported so as to be sandwiched.

2. The camshaft bearing structure for an overhead camshaft type internal combustion engine according to claim 1,
characterized in that each bearing portion (41, 42) to be formed on the covered surface of said cylinder head (5) adjacent to each of said cam chain sprockets (27, 28) is formed only at one side of each of said cam chain sprockets (27, 28).

3. The camshaft bearing structure for an overhead camshaft type internal combustion engine according to claim 1 or claim 2, **characterized in that** said intake camshaft (21) and said exhaust camshaft (22) have cams (23, 24), each of which directly acts on an intake valve (9) and an exhaust valve (10) respectively.

4. The camshaft bearing structure for an overhead camshaft type internal combustion engine according to claim 3,
characterized in that in said intake camshaft (21) and said exhaust camshaft (22), there is formed an oil passage (21 a, 22a) therein;
oil is introduced from an introducing oil path (43b, 44b) formed on the bearing portion (41, 42) adjacent to said cam chain sprocket (27, 28) of said cylinder head (5) to said oil passage (21 a, 22a); and
oil is conducted from a conducting oil path (23a, 25a) formed in each cam lobe (23, 24) and a journal portion (25, 26).

Patentansprüche

1. Nockenwellen-Lagerstruktur für einen Mehrzylinder-Verbrennungsmotor vom Typ mit oben liegender Nockenwelle, bei der auf einer abgedeckten Oberfläche von einem Zylinderkopf (5) eine Einlassnokkenwelle (21) und eine Auslassnockenwelle (22) parallel zueinander angeordnet sind, wobei jeder Lagerzapfenabschnitt (25, 26) axial gelagert, angeordnet und mit einer Kopfabdeckung (19) abgedeckt ist,

dadurch gekennzeichnet, dass
jeweils im Wesentlichen in der Mitte von der Einlassnockenwelle (21) und der Auslassnockenwelle (22) Steuerketten-Kettenräder (27, 28) vorgesehen sind;
benachbart den Steuerketten-Kettenrädern (27, 28) jeweils Lagerabschnitte (41, 42) auf der abgedeckten Oberfläche von dem Zylinderkopf (5) ausgebildet sind; und
zwischen jedem von den Lagerabschnitten (41, 42) und jeder Halterung (51, 52) jeder Lagerzapfenabschnitt (25, 26) der entsprechenden Einlassnockenwelle (21) und Auslassnockenwelle (22) axial derart gelagert ist, dass er dazwischenliegend angeordnet ist.

2. Nockenwellen-Lagerstruktur für einen Verbrennungsmotor vom Typ mit oben liegender Nockenwelle gemäß Anspruch 1,
dadurch gekennzeichnet, dass
jeder Lagerabschnitt (41, 42), welcher an der abgedeckten Oberfläche von dem Zylinderkopf (5) benachbart jedem der Steuerketten-Kettenräder (27, 28) auszubilden ist, nur auf einer Seite von jedem der Steuerketten-Kettenräder (27, 28) ausgebildet ist.

3. Nockenwellen-Lagerstruktur für einen Verbrennungsmotor vom Typ mit oben liegender Nockenwelle gemäß Anspruch 1 oder Anspruch 2,
dadurch gekennzeichnet, dass
die Einlassnockenwelle (21) und die Auslassnokkenwelle (22) Nocken (23, 24) haben, von denen jeder direkt auf ein Einlassventil (9) bzw. ein Auslassventil (10) wirkt.

4. Nockenwellen-Lagerstruktur für einen Verbrennungsmotor vom Typ mit oben liegender Nockenwelle gemäß Anspruch 3,
dadurch gekennzeichnet, dass
in der Einlassnockenwelle (21) und der Auslassnokkenwelle (22) ein Öldurchgang (21 a, 22a) ausgebildet ist; Öl von einem Einleitölweg (43b, 44b), welcher an dem Lagerabschnitt (41, 42) benachbart dem Steuerketten-Kettenrad (27, 28) von dem Zylinderkopf (5) ausgebildet ist, zu dem Öldurchgang (21 a, 22a) geleitet wird; und
Öl von einem Leitungsölweg (23a, 25a) geleitet wird, welcher in jedem Nockenbuckel (23, 24) und einem Lagerzapfenabschnitt (25, 26) ausgebildet ist.

Revendications

1. Structure de palier d'arbre à cames pour un moteur à combustion interne de type multicylindre et arbre à cames en tête, dans lequel, sur une surface couverte d'une culasse (5), un arbre à cames d'admission (21) et un arbre à cames d'échappement (22) sont agencés parallèlement l'un à l'autre, chaque partie de tourillonnement (25, 26) est supportée axialement, disposée et couverte avec un couvercle de tête (19), **caractérisée en ce que**
pratiquement au centre dudit arbre à cames d'admission (21) et dudit arbre à cames d'échappement (22), respectivement, sont prévus des pignons à chaîne pour chaîne de came (27, 28) ;
de façon adjacente auxdits pignons à chaîne pour chaîne de came (27, 28) des parties de palier (41, 42) sont formées, respectivement, sur la surface couverte de ladite culasse (5) ; et
entre chacune desdites parties de palier (41, 42) et chaque support (51, 52), chaque partie de tourillonnement (25, 26), à laquelle ledit arbre à cames d'admission (21) et ledit arbre à cames d'échappement (22) correspondent, est supportée axialement de manière à être prise en sandwich.

2. Structure de palier pour arbre à cames pour un moteur à combustion interne de type à arbre à cames en tête selon la revendication 1, **caractérisée en ce que** chaque partie de palier (41, 42), devant être formée sur la surface couverte de ladite culasse (5), de façon adjacente à chacun desdits pignons à chaîne pour chaîne de came (27, 28), est formée uniquement sur un côté de chacun desdits pignons à chaîne pour chaîne de came (27, 28).

3. Structure de palier pour arbre à cames pour un moteur à combustion interne de type à arbre à cames en tête selon la revendication 1 ou la revendication 2, **caractérisée en ce que** ledit arbre à cames d'admission (21) et ledit arbre à cames d'échappement (22) ont des cames (23, 24), chacune d'entre elles agissant directement sur une soupape d'admission (9) et sur une soupape d'échappement (10), respectivement.

4. Structure de palier pour arbre à cames pour un moteur à combustion interne de type à arbre à cames en tête selon la revendication 3,
caractérisée en ce que, dans ledit arbre à cames d'admission (21) et ledit arbre à cames d'échappement (22), est formé en leur sein un passage d'huile (21a, 22a) ;
de l'huile est introduite depuis un chemin d'introduction d'huile (43b, 44b) formé sur la partie de palier (41, 42) adjacente audit pignon à chaîne pour chaîne de came (27, 28) de ladite culasse (5) vers ledit passage d'huile (21a, 22a); et
de l'huile est conduite, venant d'un chemin de conduite d'huile (23a, 25a) formé dans chaque lobe de came (23, 24) et une partie de tourillonnement (25, 26).

FIG. 1

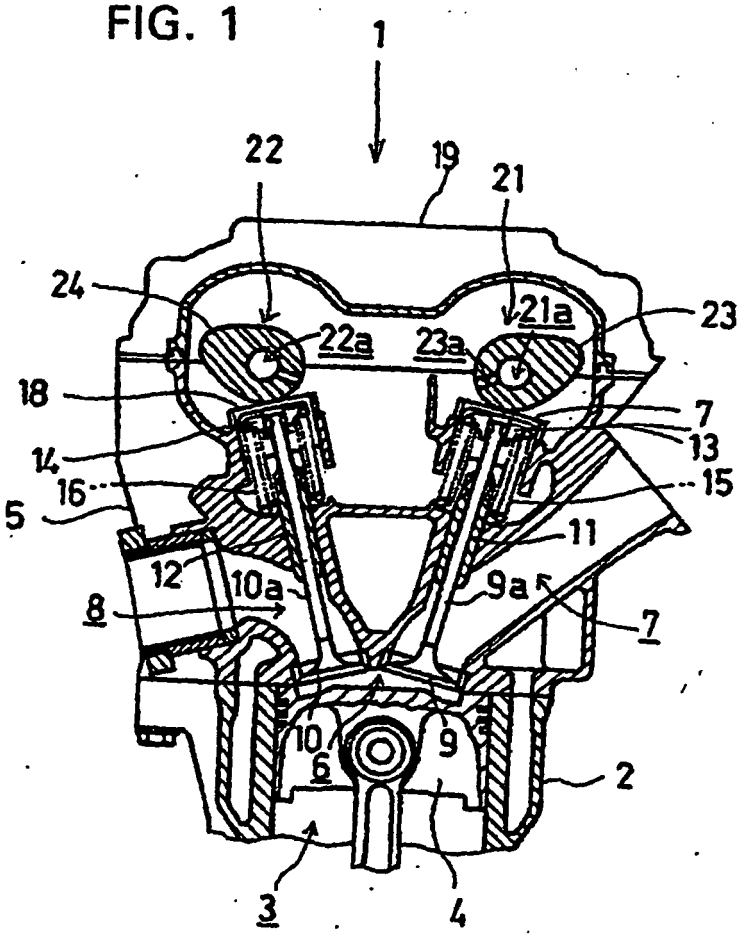
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FIG. 2

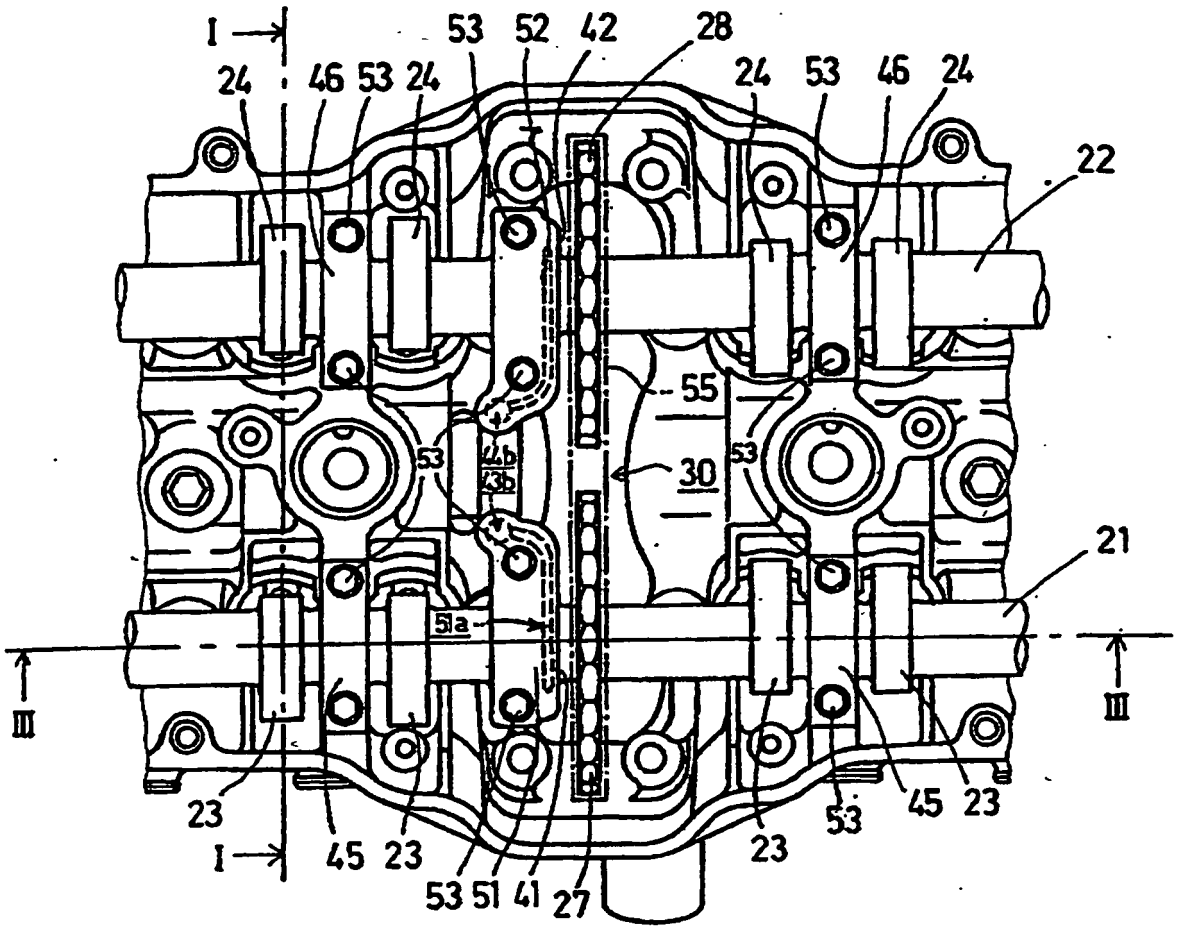
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FIG. 3

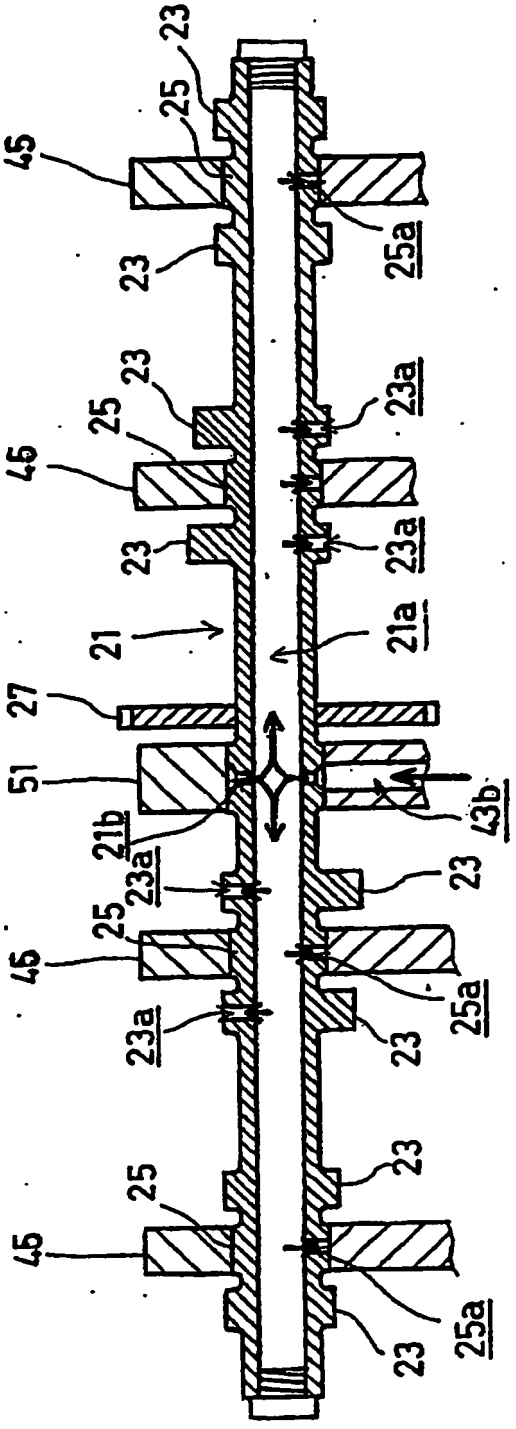
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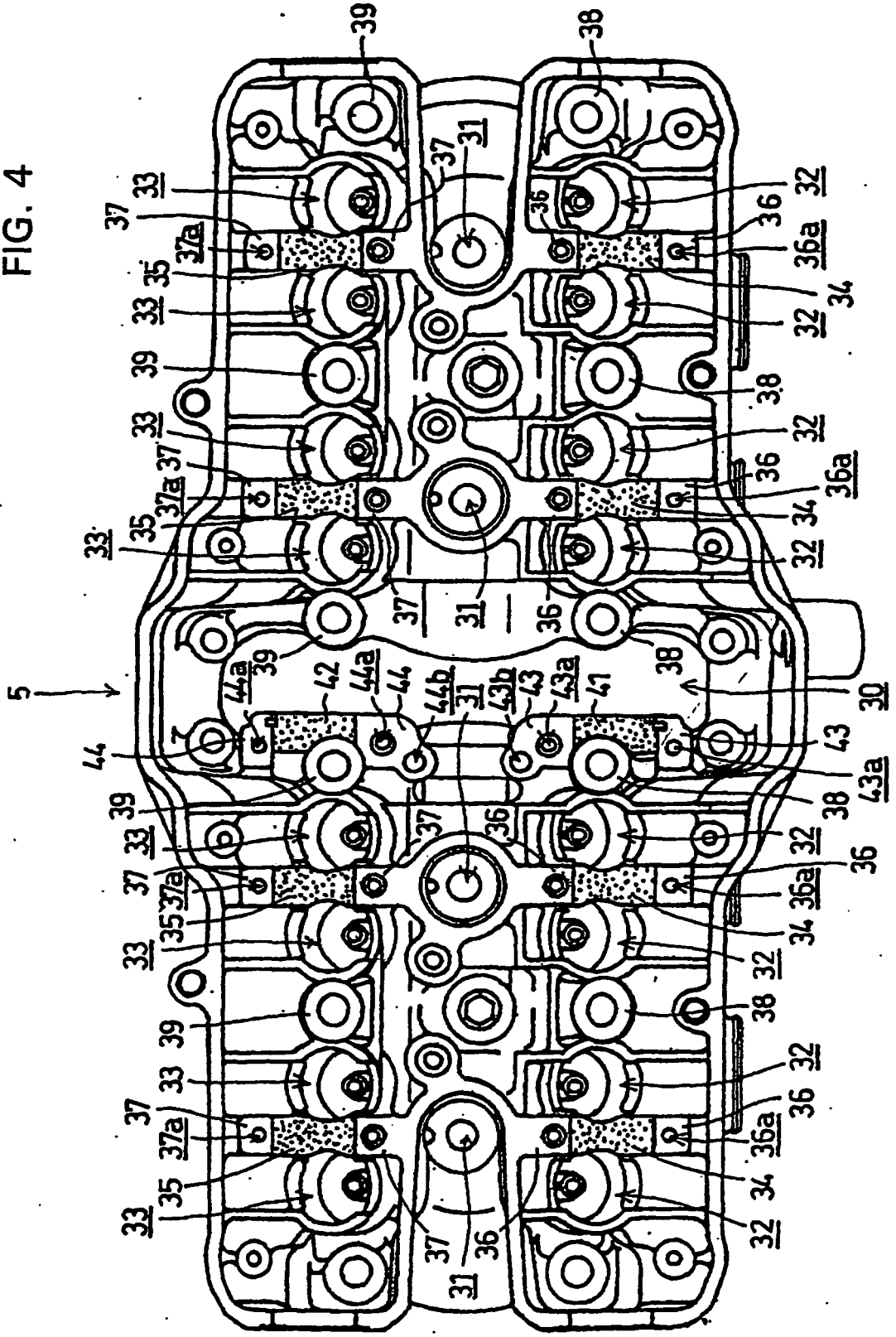
FIG. 4



REFERENCES CITED IN THE DESCRIPTION

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