

(19)



Europäisches Patentamt

European Patent Office

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(11)

EP 0 657 234 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
02.12.1998 Bulletin 1998/49

(51) Int. Cl.⁶: **B22C 9/24**

(21) Application number: **94113530.3**

(22) Date of filing: **30.08.1994**

(54) **Mold for casting a laterally central portion of an engine block**

Form zum Giessen des seitlichen Mittelteiles eines Motorblockes

Moule pour la coulée de la partie centrale latérale d'un bloc-moteur

(84) Designated Contracting States:
DE ES FR GB

(30) Priority: **30.08.1993 JP 237403/93**

(43) Date of publication of application:
14.06.1995 Bulletin 1995/24

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DE-C- 84 304 **US-A- 4 757 857**

• **DATABASE WPI Week 7507, Derwent**
Publications Ltd., London, GB; AN 75-10928W
07! & DD-A-109 333 (K RASCH) 5 November 1974

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Description

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a mold for casting a laterally central portion of an engine block of an internal combustion engine to be mounted on a motorcycle or the like according to the preamble of claim 1.

Description of Background Art

Figure 9 shows a conventional multicylinder in-line internal combustion engine having a plurality of cylinders tilted at their upper portions toward the front side of the engine. In such an internal combustion engine, an engine block 01 is formed by integrating a cylinder block and an upper crankcase 02. A crankcase is parted into the upper crankcase 02 of the engine block 01 and a lower crankcase 03 along a plane 04. A crankshaft 05 is rotatably supported in the plane 04, and a main shaft and a counter shaft (both not shown) for supporting gears of a transmission are also rotatably supported in the plane 04. A chain storing chamber 07 for driving overhead valve operating camshafts 06 is defined between the cylinders adjacent to each other rather than at one of right and left sides of the engine block 01. A supporting hole 09 for supporting a tensioner lifter 08 is formed through a wall of the chain storing chamber 07 at an upper side portion thereof so as to be inclined toward a line connecting axial centers of the cylinders.

The US-A-4 757 857 shows a similar mold for an engine block without chamber between adjacent cylinders.

Conventionally, the engine block 01 is cast by using a mold as shown in Figure 9. That is, the mold shown is composed of an upper inner mold 010, a lower inner mold 011, a front outer mold 012, and a rear outer mold 013.

In the engine block 01 cast by using the mold shown in Figure 9, a wall thickness of the engine block 01 at a portion thereof near the supporting hole 09 for the tensioner lifter 08 is made large, so as to reliably bear against vibration of a tensioner. Additionally, a padding of the engine block is increased in relation to mold releasing, and blowholes are easily generated. Furthermore, the amount of cutting of the wall of the supporting hole 09 is increased to result in an increase in cutting time and material cost. Accordingly, it is difficult to improve the productivity.

In addition, a conventional four-cycle internal combustion engine is provided with a cam chain tensioner device for removing slack of an endless chain wound around cam sprockets integral with valve operating cams and a sprocket integral with a crankshaft to provide the endless chain with a proper tension.

A load applied to the valve operating cams is peri-

odically changed in concert with opening and closing timings of intake and exhaust valves, causing a fluctuation in tension of the cam chain. To cope with this problem, Japanese Utility Model Laid Open No. 56-47232 discloses a cam chain tensioner device such that an elastic member is provided under a pin for supporting a lower end of a tensioner body to thereby absorb vibration applied to the tension body due to the fluctuation in the tension of the cam chain.

In the conventional cam chain tensioner device mentioned above, the vibration along a longitudinal direction of the tensioner body can be absorbed, but the vibration along the width of the cam chain cannot be absorbed.

SUMMARY AND OBJECTS OF THE INVENTION

The present invention relates to an improvement in a mold for casting a laterally central portion of an engine block, which has solved the above problem. According to the present invention, there is provided a mold for casting a laterally central portion of an engine block of a multicylinder in-line internal combustion engine having a plurality of cylinders according to claim 1.

With this arrangement, even when the depth of the hole opening into the hollow chamber is large and the wall thickness of the peripheral wall of the hole is accordingly large, a space surrounded by an inner wall surface of the hole can be partially filled with the projection of the lower inner mold projecting into a part of the hole from the hollow chamber and the projection of the upper outer mold projecting into a part of the hole from the outside of the engine.

Accordingly, the thickness of the wall of the engine block cast by using the mold according to the present invention can be made as small as possible to thereby suppress the generation of blowholes and reduce the amount of a molten metal to be poured into the mold, thereby reducing a material cost. Furthermore, a cutting time for formation of the hole can be reduced to thereby greatly improve the productivity.

In addition, a core that must be broken every time of casting is not required to thereby simplify pretreatment and posttreatment of casting, thus contributing to a cost reduction also in this respect. The dependent claims define further embodiments of the mould.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

Figure 1 is a general side view of a two-cylinder four-cycle internal combustion engine manufactured by using a mold for casting a laterally central

portion of an engine block according to the present invention;

Figure 2 is a vertical sectional side view of an essential part of the engine shown in Figure 1;

Figure 3 is a plan view of the engine block of the two cylinder four-cycle internal combustion engine shown in Figure 1;

Figure 4 is a front elevation of the engine block;

Figure 5 is a vertical section taken along the line V-V in Figure 3;

Figure 6 is a vertical section taken along the line VI-VI in Figure 3;

Figure 7 is an enlarged vertical section of a mold as taken along the line VI-VI in Figure 3;

Figure 8 is an enlarged vertical sectional side view of an essential part showing another preferred embodiment of the present invention;

Figure 9 is a vertical sectional side view of a mold for an engine block in the prior art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of the present invention will now be described with reference to Figures 1 to 7.

As shown in Figure 1, in an overhead valve operating cam type of two-cylinder four-cycle internal combustion engine 1 to be mounted on a motorcycle (not shown), a crankshaft 6 is rotatably supported through sliding bearings (not shown) between a lower crankcase 2 and an engine block 3 as an integrated upper crankcase and cylinder block. Thus, a crankcase of the engine 1 is parted into the lower crankcase 2 and the upper crankcase. A cylinder head 4 is mounted on an upper end of the engine block 3, and a head cover 5 is mounted on an upper end of the cylinder head 4. Thus, the lower crankcase 2, the engine block 3, the cylinder head 4, and the head cover 5 are integrally connected together. The lower crankcase 2, the engine block 3, and the cylinder head 4 are formed by die casting of aluminum or aluminum alloy.

As shown in Figure 2, the crankshaft 6 is connected through connecting rods (not shown) to pistons (not shown) vertically reciprocatably fitted in cylinders 7 (see Fig. 3) of the engine block 3, so that the crankshaft 6 is rotationally driven by vertical movement of the pistons.

The cylinder head 4 is provided with intake valves and exhaust valves (both not shown). Valve operating cams (not shown) are located over the intake valves and the exhaust valves on the extensions thereof. Camshafts 9 integral with the valve operating cams are rotatably supported between the cylinder head 4 and a cam holder (not shown).

A cam chain storing chamber 10 for storing an endless chain 13 to be hereinafter described is defined at a laterally central portion between the right and left cylinders 7 in the engine block 3. A drive sprocket 11 is integrally formed on the crankshaft 6 at a central portion

thereof, and cam sprockets 12 each having teeth twice in number that of the drive sprocket 11 is integrally mounted on the camshafts 9 at their central portions. The endless chain 13 is wound around the drive sprocket 11 and the cam sprockets 12 in the cam chain storing chamber 10. Accordingly, two revolutions of the crankshaft 6 bring about one revolution of the cam sprockets 12 and the valve operating cams.

A chain guide 14 is provided in the cam chain storing chamber 10 on the front side of a vehicular body (i.e., on the left side as viewed in Figure 1 where exhaust ports are provided). A cam chain tensioner device 15 is provided in the cam chain storing chamber 10 on the rear side of the vehicular body (i.e., on the right side as viewed in Figure 1 where intake ports are provided), and a chain guide 16 is provided also on the upper side of the cam sprockets 12. The hollow cam chain storing chamber 10 comprises a cooling water passage.

The cam chain tensioner device 15 includes a tensioner body 17 formed with a mounting base portion 18. A pivot pin 19 is integrally fitted with the mounting base portion 18 of the tensioner body 17. The pivot pin 19 is pivotally supported between the lower crankcase 2 and the engine block 3. A tensioner lifter 20 is provided on the rear side of the tensioner body 17 at a position somewhat higher than the center of the tensioner body 17. The tensioner lifter 20 has a rod 21 engaging at its tip with a recess 17a formed on a rear surface of the tensioner body 17. The tensioner lifter 20 is supported in a tensioner lifter supporting hole 22 formed through a rear wall of the engine block 3. The hole 22 comprises a cooling water communicating hole. The rod 21 of the tensioner lifter 20 is driven by a spring, hydraulic pressure, etc. to forward push the tensioner body 17 regardless of pivotal movement of the tensioner body 17, thereby maintaining a substantially constant tensile condition to the endless chain 13.

As shown in Figure 7, a mold for casting the engine block 3 is composed of a lower or front outer mold 23 for defining the shape of a front lower inclined surface of the engine block 3, a upper or rear outer mold 24 for defining the shape of a rear upper inclined surface of the engine block 3 on the side where the cam chain tensioner device 15 is provided, a left outer mold 25 for defining the shape of a left surface of the engine block 3 (see Figure 4 showing a front elevation of the engine block 3, so that the left outer mold 25 is shown on the right-hand side as viewed in Figure 4), a right outer mold 26 for defining the shape of a right surface of the engine block 3 (see Figure 4), an upper inner mold 27 for defining the shape of an upper surface of the engine block 3 and retaining cylinder liners 8, and a lower inner mold 28 for defining the shape of a lower surface of the engine block 3.

As shown in Figure 6, the upper inner mold 27 has right and left liner retaining projections 29 projecting downward so as to retain the cylinder liners 8 in the right

and left cylinders 7 and close the bottom surfaces of the cylinder liners 8. As shown in Figure 7, the upper inner mold 27 is integrally formed with a cam chain storing chamber upper inner mold 30 disposed intermediate of the right and left liner retaining projections 29, for defining an upper portion of an inner surface of the tensioner lifter supporting hole 22.

As shown in Figure 7, the lower inner mold 28 is formed with a cam chain storing chamber lower inner mold 31 opposed to the cam chain storing chamber upper inner mold 30 of the upper inner mold 27, for defining a lower portion of the inner surface of the tensioner lifter supporting hole 22. The lower inner mold 28 is further formed with an upper projection 32 projecting upward from an inner opening edge upper portion 22a of the tensioner lifter supporting hole 22 facing the cam chain storing chamber 10.

The upper or rear outer mold 24 is formed with a lower projection 33 projecting downward from an outer opening edge lower portion 22b of the tensioner lifter supporting hole 22 facing the cam chain storing chamber 10.

The cam chain storing chamber upper inner mold 30 of the upper inner mold 27 and the cam chain storing chamber lower inner mold 31 of the lower inner mold 28 are so formed as to contact together through a bent parting surface 34 inclined upward toward the rear side gradually at a front portion and steeply at a rear portion.

In this preferred embodiment shown in Figures 1 to 7, the lower or front outer mold 23, the upper or rear outer mold 24, the left outer mold 25, the right outer mold 26, the upper inner mold 27, and the lower inner mold 28 are jointed together at their mating faces, and such a jointed mold is set in a die casting apparatus (not shown). Then, the die casting apparatus is operated to pour a molten metal into the mold under pressure, thus obtaining a die casting.

In the engine block 3 thus cast, the cam chain storing chamber 10 is formed without the need of any machining. In particular, a wall thickness t of a portion for defining the tensioner lifter supporting hole 22 facing the cam chain storing chamber 10 is made smaller than a wall thickness T of a thick-walled peripheral wall of the tensioner lifter supporting hole 22 by the upper projection 32 and the lower projection 33. Furthermore, the wall thickness T of the peripheral wall of the tensioner lifter supporting hole 22 is set to a thickness enough to bear against an external force due to vibration or the like applied to the cam chain tensioner device 15. Accordingly, the amount of the molten metal to be required can be minimized to thereby reduce a material cost.

Accordingly, the amount of cutting of the wall of the tensioner lifter supporting hole 22 can be greatly reduced with the result that a working time can be greatly reduced to thereby greatly improve the productivity.

Further, no core that must be broken every time of casting is required to thereby simplify pretreatment and

posttreatment of casting, thus contributing to a cost reduction also in this respect.

As another preferred embodiment shown in Figure 8, a recess 35 may be formed on the cam chain storing chamber upper inner mold 30 at a position adjacent to an upper portion 34a of the bent parting surface 34 and facing the cam chain storing chamber 10. With this structure, a vibration stop for suppressing lateral vibration of the tensioner body 17 can be formed in the cam chain storing chamber 10.

Further, the shape of the bent parting surface 34 may be modified as shown by a broken line in Figure 8 to change the position of the recess 35.

Claims

1. Mold for casting a laterally central portion of an engine block (3) for a multicylinder in-line internal combustion engine (1) having a plurality of cylinders tilted in a longitudinal direction perpendicular to a line of arrangement of said cylinders (7), a crankshaft (6) extending horizontally in a lateral direction parallel to said line of arrangement of said cylinders (7), and a crankcase parted into an upper crankcase and a lower crankcase (2) along a plane in which a center line of said crankshaft (6) lies, said crankshaft (6) being rotatably supported in said plane between said upper crankcase and said lower crankcase (2), said upper crankcase being integrated with a cylinder block to form said engine block (3), said lateral central portion of the engine block (3) comprising a hollow chamber (10) defined between said cylinders (7) adjacent to each other and extending in an axial direction of said cylinders (7), a hole (22) being formed through a wall of said hollow chamber (10) at an upper side portion thereof so as to be inclined downward toward a line connecting axial centers of said cylinders (7), said mold comprising:

a lower inner mold (28) so formed as to be released downward in a direction perpendicular to said plane,

an upper inner mold (27) so formed as to be released upward in said axial direction of said cylinders (7);

an upper outer mold (24) so formed as to be released upward in said direction perpendicular to said plane, for forming an upper inclined surface of said engine block (3), and

a lower outer mold (23) so formed as to be released outward along said plane, for forming a lower inclined surface of said engine block (3),

characterized in that

said lower inner mold (28) has a projection (32) projecting upward from an upper portion of an inner opening edge (22a) of said hole

(22) opening into said hollow chamber (10) to form an upper surface of said hole (22) and said upper outer mold (24) has a projection (33) projecting downward from a lower portion of an outer opening edge (22b) of said hole (22) to form a lower surface of said hole (22).

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2. Mold for casting a laterally central portion of an engine block according to claim 1, wherein said lower inner mold (28) and said upper outer mold (24) are shaped to form said hollow chamber (10) as a chain storing chamber (10) for driving overhead valve operating camshafts (9) of the engine (1), and to form said hole (22) as a tensioner lifter supporting hole (22).

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3. Mold for casting a laterally central portion of an engine block according to claim 1, where said lower inner mold (28) and said upper outer mold (24) are shaped to form said hollow chamber (10) as a cooling water passage of the engine (1), and to form said hole (22) as a cooling water communicating hole.

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4. Mold for casting a laterally central portion of an engine block according to claim 1, wherein said upper inner mold (27) includes right and left cylinder liner retaining projections (29).

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5. Mold for casting a laterally central portion of an engine block according to claim 4, wherein said right and left cylinder liner retaining projections (29) project downward from said upper inner mold (27) for retaining a pair of cylinder liners (7, 8) in a right and left cylinder (7, 7) of the engine (1) and close the bottom surfaces of said cylinder liners (7, 8).

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Patentansprüche

1. Form zum Gießen eines seitlich mittleren Abschnitts eines Motorblocks (3) für einen Mehrzylinder-Reihen-Verbrennungsmotor (1) mit einer Mehrzahl von Zylindern, die in einer zu einer Anordnungsline der Zylinder (7) orthogonalen Längsrichtung gekippt sind, einer Kurbelwelle (6), die in Seitenrichtung parallel zu der Anordnungsline der Zylinder (7) verläuft, sowie einem Kurbelgehäuse, das entlang einer Ebene, in der eine Mittellinie der Kurbelwelle (6) liegt, in ein oberes Kurbelgehäuse und ein unteres Kurbelgehäuse (2) geteilt ist, wobei die Kurbelwelle (6) in der Ebene zwischen dem oberen Kurbelgehäuse und dem unteren Kurbelgehäuse (2) drehbar gelagert ist, wobei das obere Kurbelgehäuse mit einem Zylinderblock unter Bildung des Motorblocks (3) integriert ist, wobei der seitlich mittlere Abschnitt des Motorblocks (3) eine hohle Kammer (10) aufweist, die zwischen den einander benachbarten Zylindern (7) definiert ist und

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sich in einer Axialrichtung der Zylinder (7) erstreckt, wobei ein Loch (22) eine Wand der hohlen Kammer (10) an deren oberseitigem Abschnitt derart durchsetzt, daß es zu einer axiale Mitten der Zylinder (7) verbindenden Linie hin nach unten geneigt ist, wobei die Form umfaßt:

eine untere Innenform (28), die ausgebildet ist, um in einer zu der Ebene orthogonalen Richtung nach unten gelöst zu werden,

eine obere Innenform (27), die ausgebildet ist, um in der Axialrichtung der Zylinder nach oben gelöst zu werden;

eine obere Außenform (24), die ausgebildet ist, um in der zu der Ebene orthogonalen Richtung nach oben gelöst zu werden, um eine obere Schrägfläche des Motorblocks (3) zu bilden,

eine untere Außenform (23), die ausgebildet ist, um entlang der Ebene nach außen gelöst zu werden, um eine untere Schrägfläche des Motorblocks (3) zu bilden, dadurch gekennzeichnet, daß

die untere Innenform (28) einen Vorsprung (32) aufweist, der von einem oberen Abschnitt eines Innenöffnungsrandes (22a) des sich in die hohle Kammer (10) öffnenden Lochs (22) nach oben vorsteht, um eine obere Fläche des Lochs (22) zu bilden, und die obere Außenform (24) einen Vorsprung (33) aufweist, der von einem unteren Abschnitt eines Außenöffnungsrandes (22b) des Lochs (22) nach unten vorsteht, um eine untere Fläche des Lochs (22) zu bilden.

2. Form zum Gießen eines seitlich mittleren Abschnitts eines Motorblocks nach Anspruch 1, wobei die untere Innenform (28) und die obere Außenform (24) ausgestaltet sind, um die hohle Kammer (10) als Kettenaufnahmekammer (10) zum Antrieb von oben liegenden Ventilbetätigungs-nockenwellen (9) des Motors (1) auszubilden und um das Loch (22) als Spannerstößel-Halteloch (22) auszubilden.

3. Form zum Gießen eines seitlich mittleren Abschnitts eines Motorblocks nach Anspruch 1, wobei die untere Innenform (28) und die obere Außenform (24) ausgestaltet sind, um die hohle Kammer (10) als Kühlwasserpassage des Motors (1) auszubilden und um das Loch (22) als Kühlwasseranschlußloch auszubilden.

4. Form zum Gießen eines seitlich mittleren Abschnitts eines Motorblocks nach Anspruch 1, wobei die obere Innenform (27) rechte und linke

Zylinderlaufbuchsen-Haltevorsprünge (29) aufweist.

5. Form zum Gießen eines seitlich mittleren Abschnitts eines Motorblocks nach Anspruch 4, wobei die rechten und linken Zylinderlaufbuchsen-Haltevorsprünge (29) von der oberen Innenform (27) nach unten vorstehen, um ein Paar von Zylinderlaufbuchsen (7, 8) in einem rechten und einem linken Zylinder (7, 7) des Motors (1) zu halten und die Bodenflächen der Zylinderlaufbuchsen (7, 8) zu schließen.

Revendications

1. Moule pour la coulée d'une partie centrale latérale d'un bloc-moteur (3) destiné à un moteur (1) à combustion interne à plusieurs cylindres en ligne, comprenant une pluralité de cylindres basculés dans une direction longitudinale perpendiculaire à une ligne d'agencement desdits cylindres (7) ; un vilebrequin (6) s'étendant horizontalement dans une direction latérale parallèle à ladite ligne d'agencement desdits cylindres (7) ; et un carter de vilebrequin scindé en un carter supérieur de vilebrequin et en un carter inférieur (2) de vilebrequin, le long d'un plan dans lequel se trouve un axe médian dudit vilebrequin (6), ledit vilebrequin (6) étant en appui rotatif dans ledit plan, entre ledit carter supérieur de vilebrequin et ledit carter inférieur (2) de vilebrequin, ledit carter supérieur de vilebrequin étant combiné à un bloc-cylindres pour former ledit bloc-moteur (3), ladite partie centrale latérale du bloc-moteur (3) comprenant une cavité (10) définie entre lesdits cylindres (7) mutuellement adjacents, et s'étendant dans une direction axiale desdits cylindres (7), un trou (22) étant pratiqué à travers une paroi de ladite cavité (10), dans une région latérale supérieure de cette dernière, de manière à être incliné vers le bas en direction d'une ligne reliant des axes médians desdits cylindres (7), ledit moule comprenant :

un moule interne inférieur (28) configuré de façon à être libéré vers le bas, dans une direction perpendiculaire audit plan, un moule interne supérieur (27) configuré de façon à être libéré vers le haut, dans ladite direction axiale desdits cylindres (7), un moule externe supérieur (24) configuré de façon à être libéré vers le haut, dans ladite direction perpendiculaire audit plan, afin de former une surface inclinée supérieure dudit bloc-moteur (3), et un moule externe inférieur (23) configuré de façon à être libéré vers l'extérieur, le long dudit plan, afin de former une surface inclinée inférieure dudit bloc-moteur (3),

caractérisé par le fait que

ledit moule interne inférieur (28) présente une protubérance (32) faisant saillie vers le haut, à partir d'une région supérieure d'un bord d'ouverture intérieure (22a) dudit trou (22), débouchant dans ladite cavité (10), de manière à former une surface supérieure dudit trou (22), et

ledit moule externe supérieur (24) présente une protubérance (33) faisant saillie vers le bas à partir d'une région inférieure d'un bord d'ouverture extérieure (22b) dudit trou (22), de manière à former une surface inférieure dudit trou (22).

2. Moule pour la coulée d'une partie centrale latérale d'un bloc-moteur, selon la revendication 1, dans lequel ledit moule interne inférieur (28) et ledit moule externe supérieur (24) sont configurés de façon à donner, à ladite cavité (10), la forme d'une chambre (10) de logement de chaîne pour entraîner des arbres à cames (9) actionnant des soupapes en tête du moteur (1), et à donner, audit trou (22), la forme d'un trou (22) de support de poussoir de tendeur.
3. Moule pour la coulée d'une partie centrale latérale d'un bloc-moteur, selon la revendication 1, dans lequel ledit moule interne inférieur (28) et ledit moule externe supérieur (24) sont configurés de façon à donner, à ladite cavité (10), la forme d'un passage d'eau de refroidissement du moteur (1), et à donner, audit trou (22), la forme d'un trou de communication d'eau de refroidissement.
4. Moule pour la coulée d'une partie centrale latérale d'un bloc-moteur, selon la revendication 1, dans lequel ledit moule interne supérieur (27) comporte des appendices (29) de droite et de gauche, retenant des chemises de cylindres.
5. Moule pour la coulée d'une partie centrale latérale d'un bloc-moteur, selon la revendication 4, dans lequel lesdits appendices (29) de droite et de gauche, retenant des chemises de cylindres, dépassent vers le bas à partir dudit moule interne supérieur (27), pour retenir une paire de chemises (7, 8) dans un cylindre (7, 7) de droite et de gauche du moteur (1), et obturent les surfaces de fond desdites chemises (7, 8) des cylindres.

Fig. 1

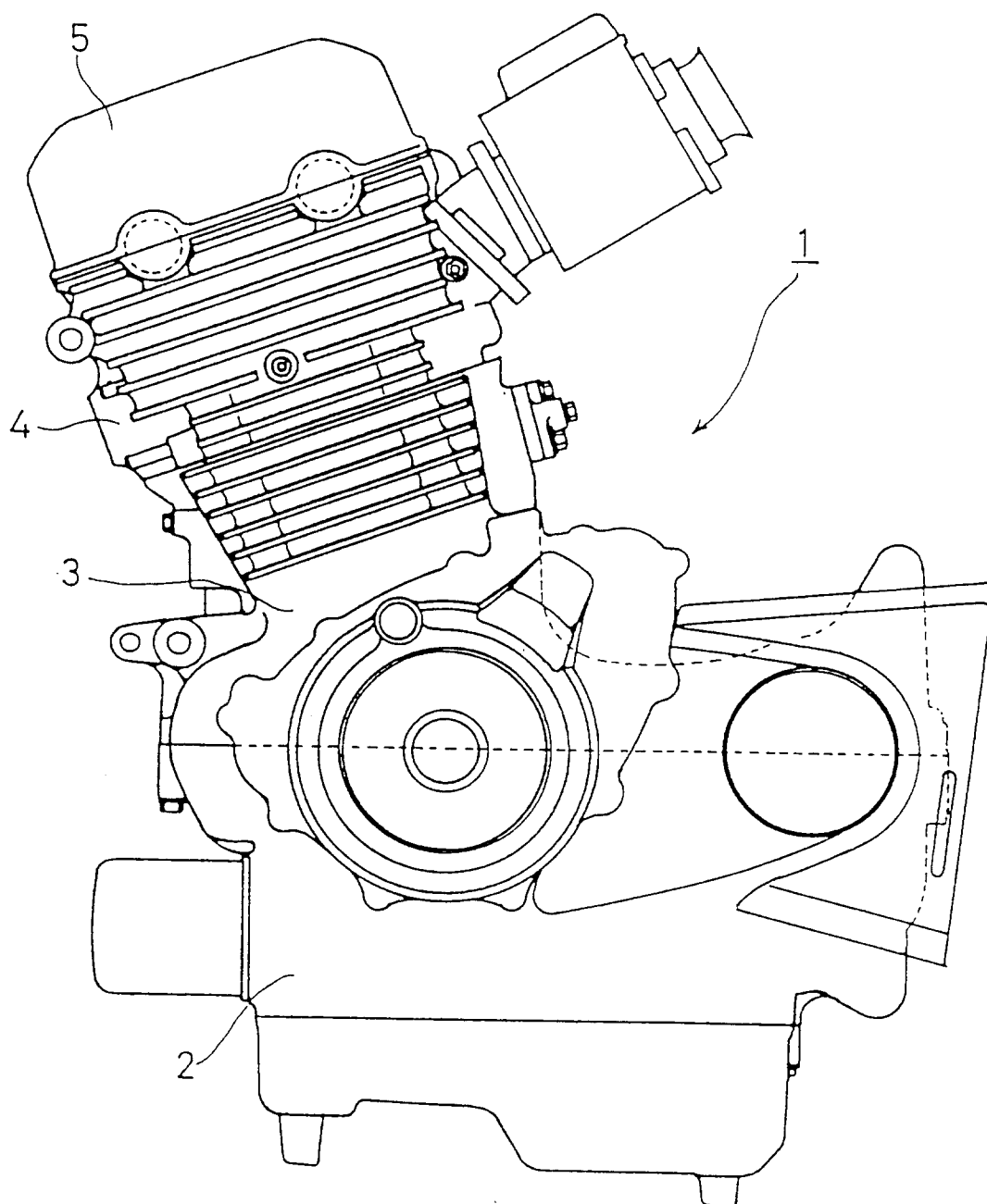
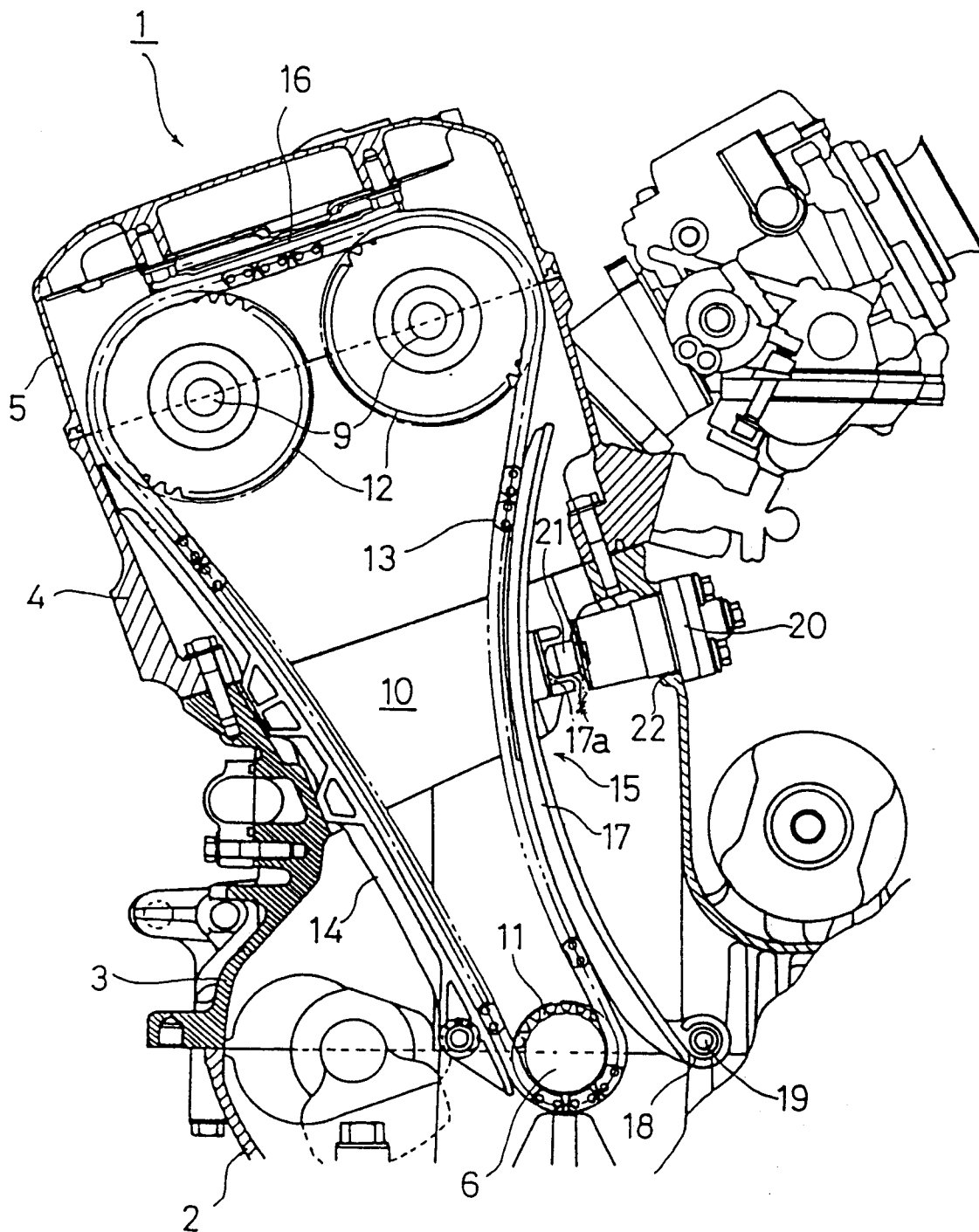


Fig. 2



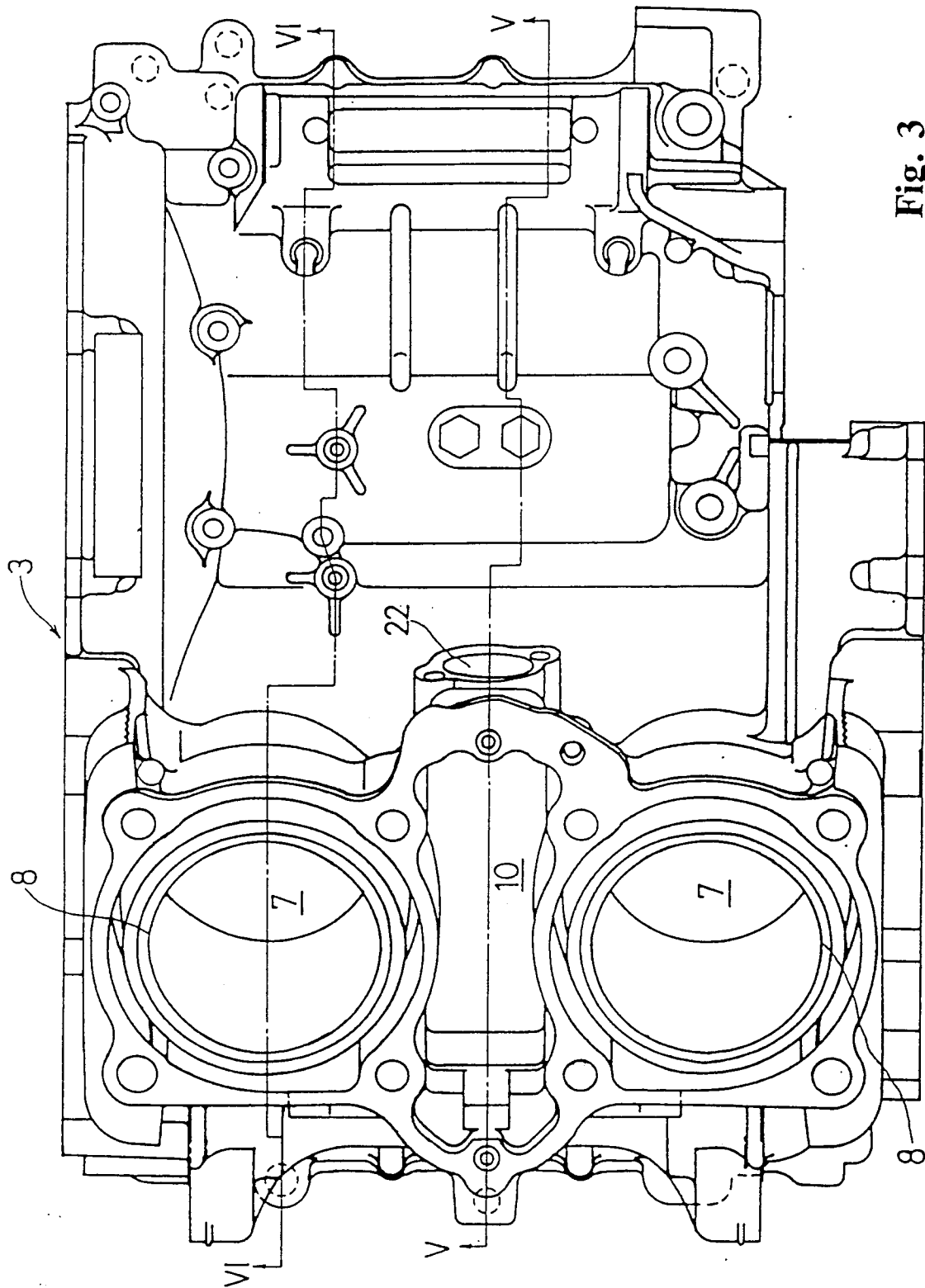


Fig. 3

Fig. 4

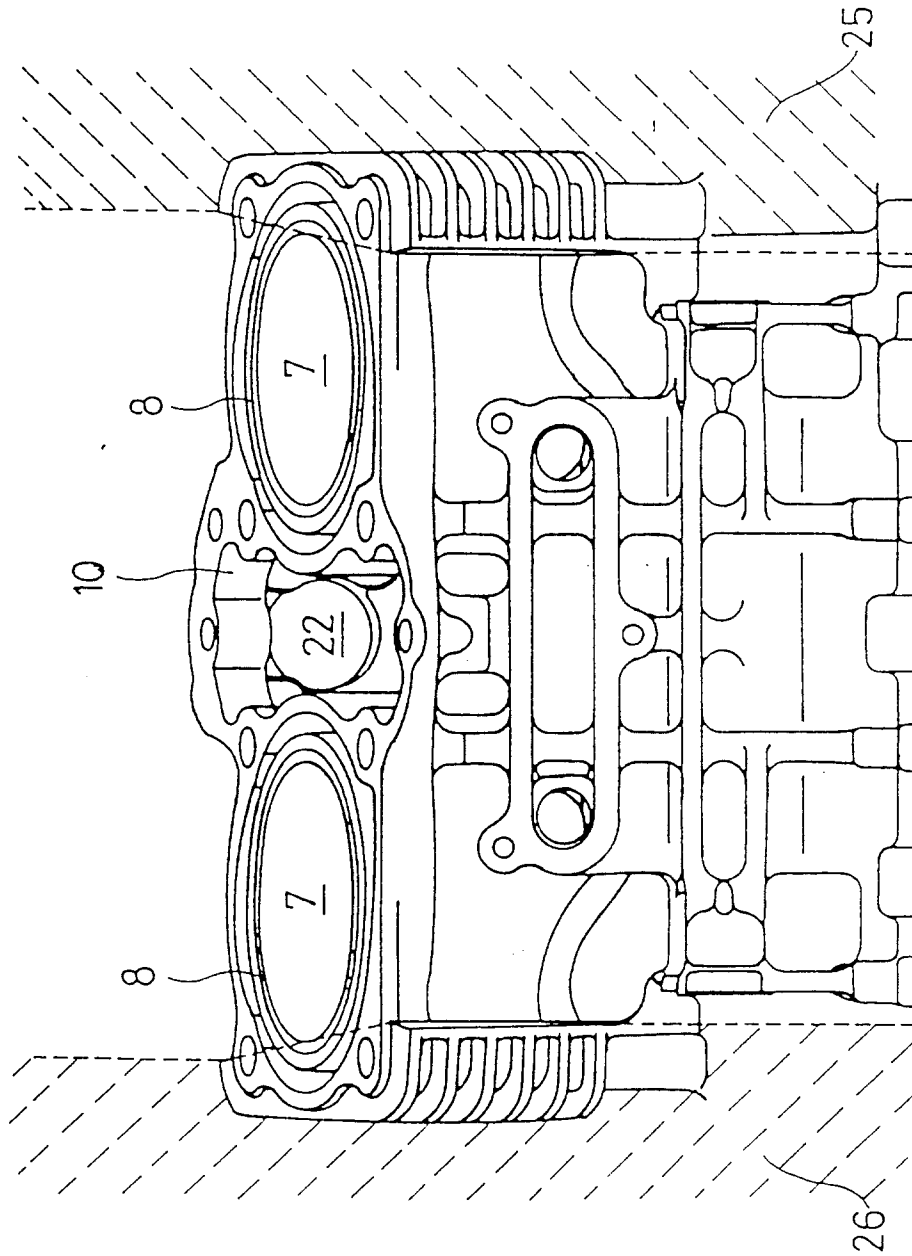


Fig. 5

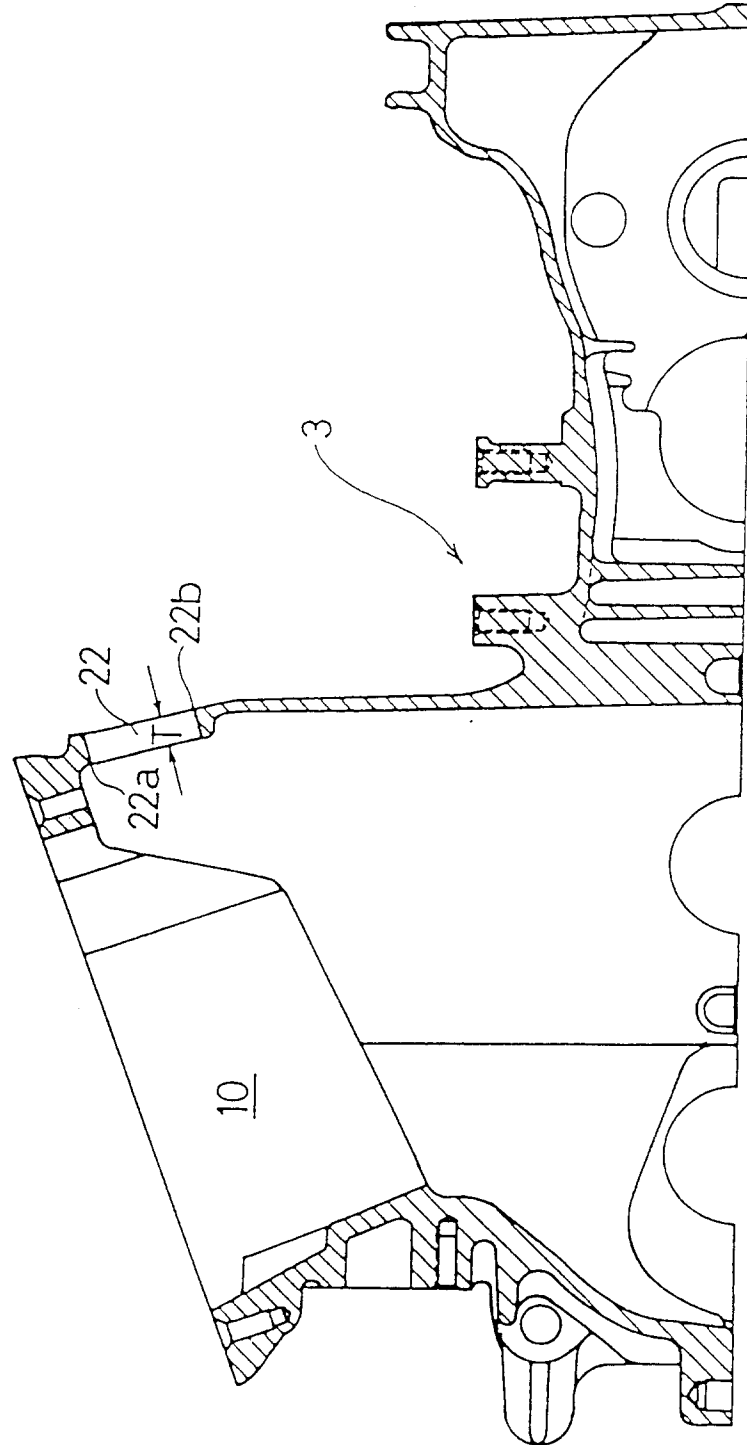
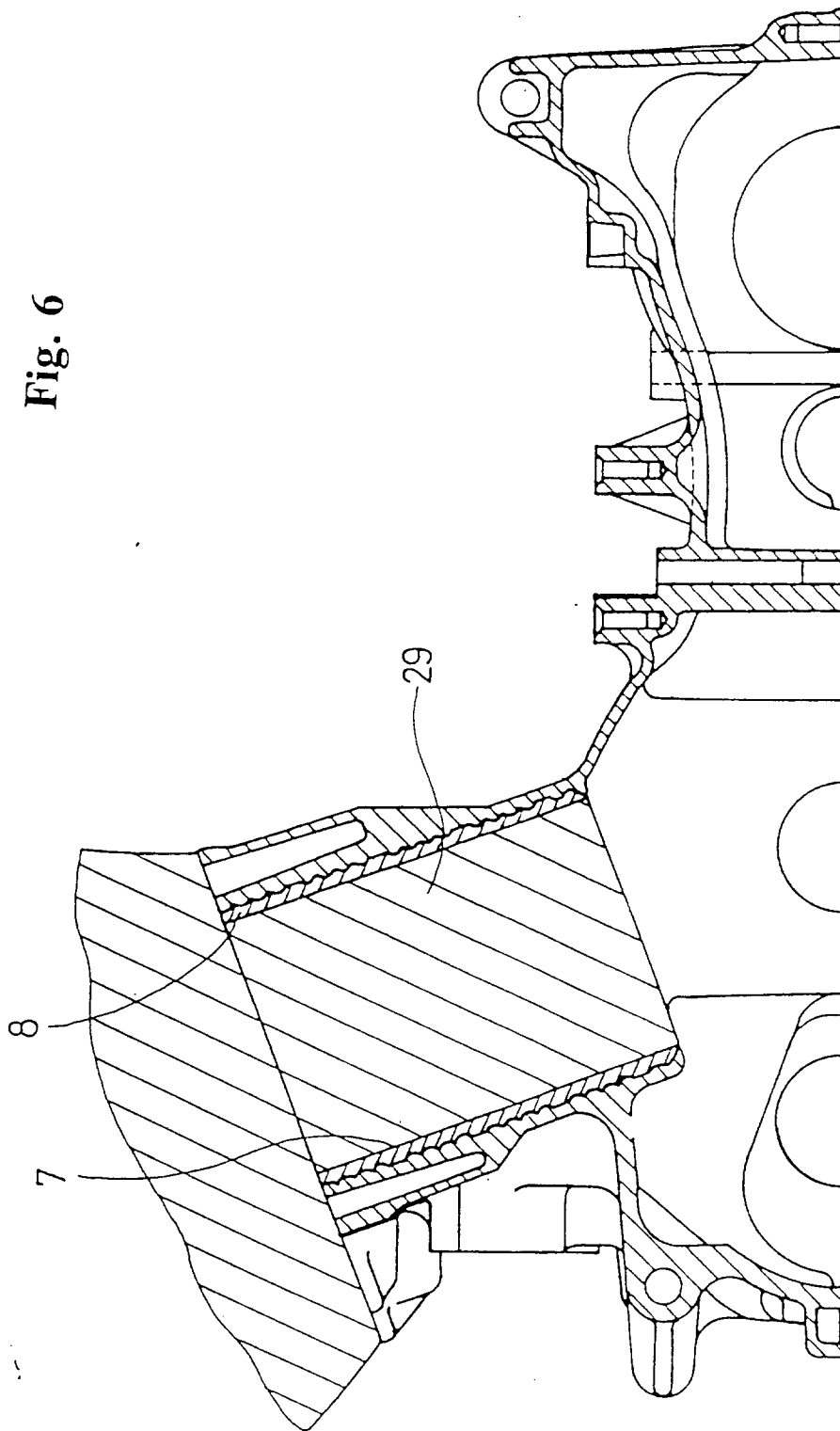


Fig. 6



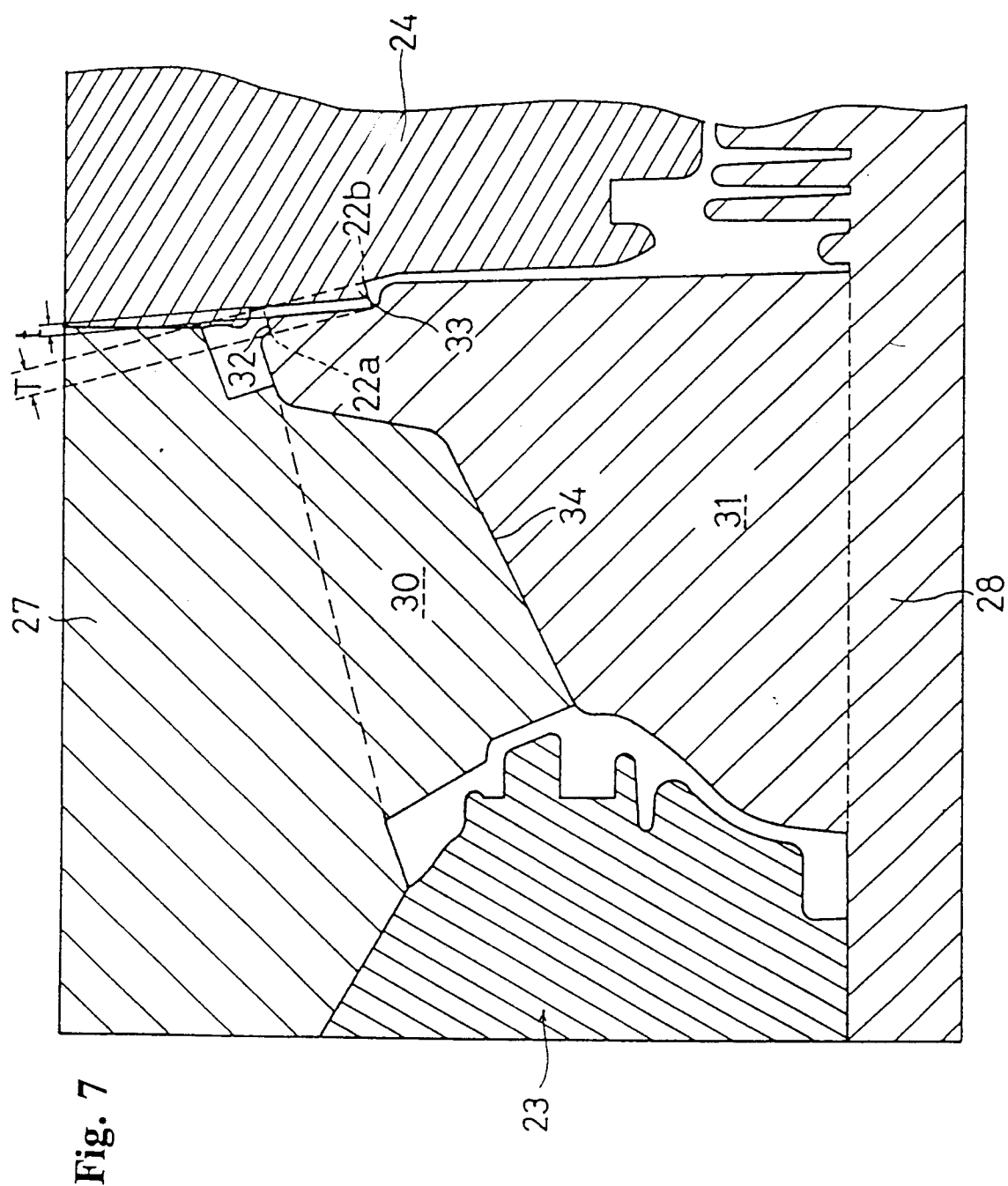


Fig. 8

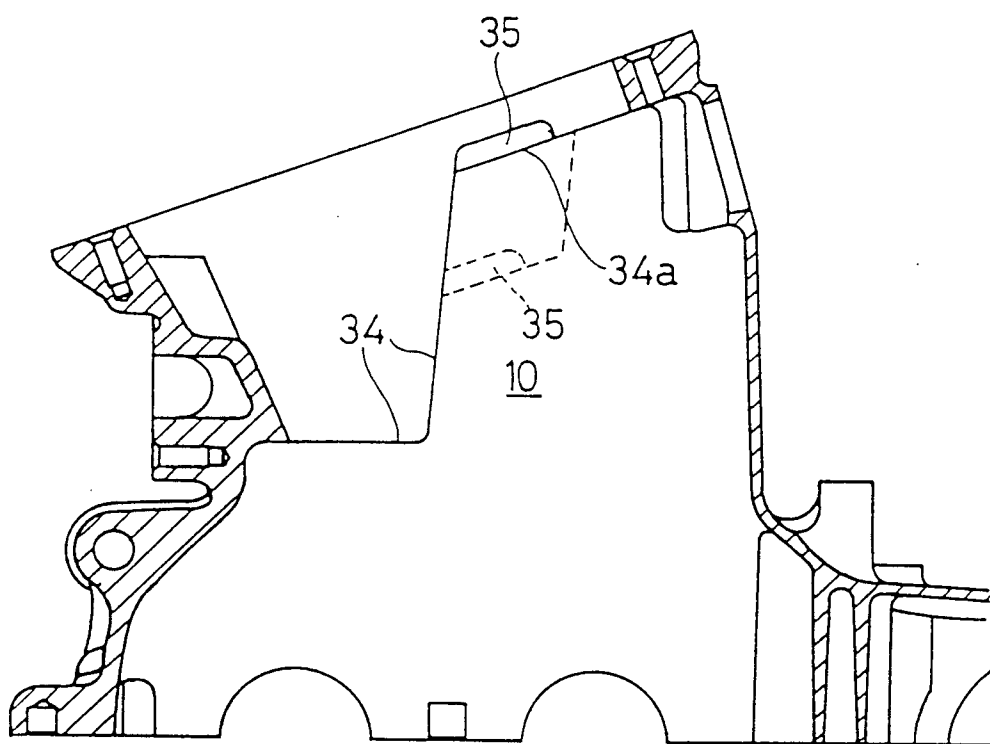


Fig. 9 PRIOR ART

