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(54) **INTERNAL COMBUSTION ENGINE FOR MOTORCYCLE**

VERBRENNUNGSMOTOR FÜR MOTORRAD

MOTEUR A COMBUSTION INTERNE POUR MOTO

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Description

TECHNICAL FIELD

[0001] The present invention relates to an internal combustion engine provided with cooling fins for a motorcycle.

BACKGROUND ART

[0002] Referring to Fig. 5, an internal combustion engine 01 for a small motorcycle is suspended from a front frame 02 extending obliquely downward toward the rear from an upper part of a front fork with the axis C of its cylinder substantially horizontally extended. The internal combustion engine 01 comprises, as principal parts, a crankcase 04, a cylinder 05 and a cylinder head 06. The opposite sides of the cylinder 05 and the cylinder head 06 are covered with a leg shield 03 of a shape shown in Fig. 6 and having right and left side walls substantially vertically extending on the opposite sides, respectively, of the front frame 02.

[0003] In this small motorcycle, a space defined by the internal combustion engine 01, the front frame 03, and the leg shield 03 having the right and the left side wall extending on the opposite sides of the internal combustion engine 01 and the front frame 02 is tapered forward. Various devices 07 are installed in a rear end region between the crankcase 04 and the front frame 02 of the tapered space. If a sufficient space for wind to flow through can be secured in the rear region of the tapered space, cooling fins 05f formed on the upper, lower, right and left side surfaces of the cylinder 05, and cooling fins 06f formed on the upper, lower, right and left side surfaces of the cylinder head 06 are extended parallel to the axis C of the cylinder 05, so that wind W is able to flow in a direction parallel to the axis C through spaces between the cooling fins 05f and 06f to cool the internal combustion engine 01 effectively.

[0004] Even if the crankcase 04 is enlarged, the devices 07 installed in the space between the crankcase 04 and the front frame 02 are enlarged and the number of devices is increased as the internal combustion engine 01 is enlarged, the width of the space between the right and the left side wall of the leg shield 03 cannot be increased because the distance between the right and the left side wall of the leg shield 03 cannot be increased because of restrictions relating to controllability. Consequently, in some cases, a space sufficient for wind to flow through cannot be secured in the depth of the space defined by the front frame 02, and the right and the left side wall of the leg shield 03. If wind is unable to flow through the space, incoming wind is unable to flow rearward through the space, and flows downward along the right and the left side of the cylinder 05 and the cylinder head 06.

[0005] When the cylinder 05 and the cylinder head 06 are provided on their right and left side walls with the

cooling fins 05f and 06f parallel to the axis C of the cylinder 05 as shown in Fig. 5, and wind flows downward, the cooling fins 05f and 06f obstruct the flow of wind and, consequently, the effect of wind in cooling the internal combustion engine is reduced. Furthermore, JP 62 223444 A disclosed a motorcycle according to the preamble part of claim 1. This motorcycle comprises a 2-cycle engine having a substantially cylindrically engine body. The engine includes a cylinder head and a cylinder, the axis of the cylinder extending substantially horizontally. The engine is provided with a first type of cooling fins on the upper and lower sides of the cylinder head and also partly on the lower side of the cylinder, the first type of cooling fins extending in a horizontal and vertical direction. The engine is further provided with a second type of cooling fins on the left and right sides of the cylinder head and of the cylinder, the second type of cooling fins extending diagonal from the upper front to the lower back of the engine.

[0006] It is an object of the present invention to provide a motorcycle comprising an internal combustion engine provided with cooling fins capable of effectively cooling the internal combustion engine when a space sufficient for wind to flow through easily cannot be secured in the depth of a space defined by the internal combustion engine, a front frame and side wall substantially vertically extending on the right and the left side of the front frame.

DISCLOSURE OF THE INVENTION

[0007] To achieve the object, the present invention provides a motorcycle comprising an internal combustion engine according to claim 1.

[0008] When the motorcycle provided with the internal combustion engine runs, wind that impinges against the top of the cylinder head of the internal combustion engine disposed between the right and the left side wall of the leg shield is divided roughly into an upper air stream and a lower air stream, and the upper and the lower air stream flow through spaces between the first cooling fins parallel to the axis of the cylinder and formed on the upper and the lower side surfaces of the cylinder head and the cylinder. When the depth of the space defined by the internal combustion engine, the front frame, and the right and the left side wall of the leg shield is blocked and there is no space sufficient for wind to flow easily through, wind that flows into the space is unable to flow rearward and is divided into right and left air streams, and the right and the left air stream flow downward through the spaces between the second cooling fins perpendicular to the axis of the cylinder and formed on the right and the left side surfaces of the cylinder head and the cylinder.

[0009] Since the internal combustion engine of the present invention for a motorcycle is provided with cooling fins extending in the flowing directions of air streams depending on the arrangement of the devices of the internal combustion engine, the internal combustion engine can be effectively cooled, the temperature of the

lubricating oil can be lowered and the durability of the internal combustion engine can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 is a side elevation of a small motorcycle provided with an internal combustion engine in a preferred embodiment according to the present invention;

Fig. 2 is a perspective view of the internal combustion engine in the preferred embodiment;

Fig. 3 is a perspective view of a cylinder included in the internal combustion engine;

Fig. 4a is a side elevation of the internal combustion engine shown in Fig. 2 of assistance in explaining the function of the embodiment;

Fig. 4b is a sectional view taken on line B-B in Fig. 4a;

Fig. 5 is a perspective view of a conventional internal combustion engine for a small motorcycle; and

Fig. 6 is a perspective view of a leg shield employed in the motorcycle of Fig. 5.

BEST MODE FOR CARRYING OUT THE INVENTION

[0011] Referring to Fig. 1 showing a small motorcycle 1 provided with an internal combustion engine in a preferred embodiment according to the present invention in a side elevation, a principal part of a body frame is formed by connecting a curved rear frame 3 extending obliquely upward toward the rear to the rear end of a front frame 2 extending obliquely downward toward the rear from an upper part of a front fork 5. A head pipe 4 connected to the front part of the front frame 2 supports an upper part of the front fork 5 for turning. A front wheel is supported for rotation on the lower end of the front fork 5. A handlebar 7 is attached to the upper end of the front fork 5.

[0012] An internal combustion engine 8 includes a crankcase 9, a cylinder 10 and a cylinder head 11. The internal combustion engine 8 is suspended from the front frame 2 with the axis C of the cylinder 10 substantially horizontally extended. A chain case 12 is extended rearward from the crankcase 9, and a rear wheel 13 is supported for rotation on a rear end part of the chain case 12. A cushioning device 14 has an upper end connected to a rear part of the rear frame 3 and a lower end connected to a rear part of the chain case 12. A leg shield 15 straddling the front frame 2 has right and left side walls covering the cylinder 10 and the cylinder head 11 of the internal combustion engine 8. The rear frame 3 is covered with a rear cover 16, and a seat 17 is disposed on top of the rear cover 16.

[0013] Referring to Fig. 2 showing the internal combustion engine 8 in a perspective view, the internal combustion engine 8 is disposed under the front frame 2 with the axis C of the cylinder 10 substantially horizontally extended. The motorcycle 1 is supposed to run forward

to the right as viewed in Fig. 2. The internal combustion engine 8 includes as principal components, in addition to the crankcase 9, the cylinder 10 and the cylinder head 11, various devices 18 disposed above the crankcase 9.

5 The cylinder 10 and the cylinder head 11, which are heated at high temperatures, are provided on their outer surfaces with cooling fins,

[0014] First cooling fins 10a parallel to the axis C of the cylinder 10, namely, longitudinal cooling fins, are formed on the upper and the lower side surface of the cylinder 10, and second cooling fins 10b perpendicular or substantially perpendicular to the axis C of the cylinder 10, namely, vertical cooling fins, are formed on the right and the left side surface of the cylinder 10. Similarly, first cooling fins 11a parallel to the axis C of the cylinder 10 are formed on the upper and the lower side surface of the cylinder head 11, and second cooling fins 11b perpendicular or substantially perpendicular to the axis C of the cylinder 10 are formed on the right and the left side surface of the cylinder head 11. The first and the second cooling fins are continuous and straight.

[0015] Fig. 3 is a perspective view of the cylinder 10. The axis C of the cylinder 10 is indicated by a chain line. The arrows U, D, R and L indicate an upward direction, a downward direction, a rightward direction and a leftward direction, respectively, when the internal combustion engine 8 including the cylinder 10 is mounted on the motorcycle. The upper, the lower, the right and the left side surface of the cylinder 10 correspond to the directions indicated by the arrows U, D, R and L, respectively. The axis C of the cylinder 10 coincides with the center axis of a cylinder bore 10c formed in the cylinder 10. A chain chamber 10d for a timing chain is formed beside the cylinder bore 10c. The cylinder 10 is provided with a tensioner lifter mounting hole 10e so as to extend between the upper side surface of the cylinder 10 and the chain chamber 10d. A tensioner lifter takes up a slack in the timing chain. Bolt holes 10f are formed in peripheral parts of the cylinder 10. Connecting bolts are passed through the bolt holes 10f to fasten together the crankcase 9, the cylinder 10 and the cylinder head 11.

[0016] As mentioned above, the first cooling fins 10a parallel to the axis C are formed on the upper and the lower side surface of the cylinder 10, and the second cooling fins 10b perpendicular or substantially perpendicular to the axis C are formed on the right and the left side surface of the cylinder 10. The cooling fins 10a and 10b are formed integrally with the cylinder 10 when the cylinder 10 is formed by casting an aluminum material. The cooling fins 11a and 11b of the cylinder head 11 are formed integrally with the cylinder head 11 when the cylinder head 11 is formed by casting an aluminum material.

[0017] Figs. 4a and 4b are views of assistance in explaining the function of the present invention. Fig. 4a is a side elevation of the internal combustion engine 8, and Fig. 4b is a sectional view taken on line B-B in Fig. 4a. The internal combustion engine 8 is suspended from the front frame 2. Principal components of the internal com-

bustion engine 8 shown in Figs. 4a and 4b are the crankcase 9, the cylinder 10, the cylinder head 11, and the devices 18 disposed between the front frame 2 and the crankcase 9. The leg shield 15 extends downward on the right and the left side of the internal combustion engine 8 to protect the rider's legs from high-temperature heat. In Fig. 4a, the left side wall of the leg shield 15 is removed. A space defined by the front frame 2, the leg shield 15 and the crankcase 9 is occupied by the devices 18, and gaps for air to flow are scarcely available in the space.

[0018] Wind flows rearward into the space between the front frame 2 and the leg shield 15. Wind Wa that impinges against the top of the cylinder head 11 is divided roughly into an upper air stream and a lower air stream, and the upper and the lower air stream flow through spaces between the first cooling fins 11a and 10a parallel to the axis C and formed on the upper and the lower side surfaces of the cylinder 10 and the cylinder head 11. Wind Wb that flows into the space between the front frame 2 and the cylinder head 11 is unable to flow rearward because the depth of the space is substantially blocked. Therefore, the wind Wb is divided into right and left air streams, and the right and the left air stream flow downward through spaces between the second cooling fins 11b and 10b perpendicular to the axis C and formed on the right and the left side surface of the cylinder head 11 and the cylinder 10. Eventually, the air streams flowed through the spaces between the first cooling fins 11a and 10a parallel to the axis C of the cylinder flow downward along the right and the left side surface of the cylinder 10.

[0019] Since the second cooling fins 11b and 10b perpendicular to the axis C are formed on the right and the left side surfaces of the cylinder head 11 and the cylinder 10, respectively, air that is unable to flow rearward in the space above the cylinder 10 flows downward through spaces between the second cooling fins 11b and 10b of the cylinder head 11 and the cylinder 10. Consequently, the wind cools the internal combustion engine 8 effectively and lowers the temperature of the lubricating oil, and the durability of the internal combustion engine 8 can be improved.

[0020] In the above described embodiment, the second cooling fins 11b and 10b are formed straight, but they may be formed partly in a curved shape to ensure smooth flow of the air therealong.

Claims

1. A motorcycle (1) comprising:

- an internal combustion engine (8) having a cylinder (10), a cylinder head (11) provided in front of the cylinder (10), and a crankcase (9) provided in the rear of the cylinder (10), said internal combustion engine (8) being suspended from a front frame (2) with an axis (C) of the cylinder (10) substantially horizontally extending, where-

in at least one of the cylinder (10) and the cylinder head (11) is provided on upper and lower side surfaces thereof with first cooling fins (10a, 11a) parallel to the axis (C) of the cylinder (10); and

- a leg shield (15) having right and left side walls extending on opposite sides of the front frame (2) that extends obliquely downward toward the rear from an upper part of a front fork (5), the right and left side walls of the leg shield (15) extending on the right and left sides of the front frame (2), respectively, so as to cover the opposite sides of the engine (8), and

characterized in that:

- said motorcycle (1) further comprises devices (18) disposed between an upper part of the crankcase (9) and said front frame (2), so that a space defined by the front frame (2), the leg shield (15) and the crankcase (9) is occupied by the devices (18), such as to substantially block that space for air to flow in the rearward direction; and

- at least one of the cylinder (10) and the cylinder head (11) is provided on right and left side surfaces thereof with second cooling fins (10b, 11b) which continuously extend perpendicularly or substantially perpendicularly to the axis (C) of the cylinder (10).

2. The motorcycle (1) according to claim 1, wherein a chain chamber (10d) is provided through the cylinder (10) and the cylinder head (11) adjacent to the cylinder bore (10c) in the cylinder (10), and wherein the cylinder (10) has a substantially rectangular shape when viewed in the direction of the axis (C) of the cylinder (10).

3. The motorcycle (1) according to claim 1 or 2, wherein said first cooling fins (10a, 11a) and said second cooling fins (10b, 11b) are formed integrally with the cylinder (10) and the cylinder head (11).

Patentansprüche

1. Kraftrad (1), umfassend:

- einen Verbrennungsmotor (8) mit einem Zylinder (10), einem vor dem Zylinder (10) vorgesehenen Zylinderkopf (11) und einen hinter dem Zylinder (10) vorgesehenen Kurbelgehäuse (9), wobei der Verbrennungsmotor (8) von einem Frontrahmen (2) so hängt, dass sich eine Achse (C) des Zylinders (10) im Wesentlichen horizontal erstreckt, worin zumindest einer des Zylinders (10) und des Zylinderkopfs (11) an oberen

und unteren Seitenflächen davon mit ersten Kühlrippen (10a, 11a) parallel zur Achse (C) des Zylinders (10) versehen ist; und ein Beinschild (15), das rechte und linke Seitenwände hat, die sich an entgegengesetzten Seiten des Frontrahmens (2) erstrecken, und sich von einem oberen Teil einer Frontgabel (5) schräg abwärts nach hinten erstreckt, wobei sich die rechten und linken Seitenwände des Beinschildes (15) jeweils an den rechten und linken Seiten des Frontrahmens (2) so erstrecken, dass sie die entgegengesetzten Seiten des Motors (8) abdecken, und

dadurch gekennzeichnet, dass

das Kraftrad (1) ferner Vorrichtungen (18) aufweist, die zwischen einem oberen Teil des Kurbelgehäuses (9) und dem Frontrahmen (2) angeordnet sind, so dass ein durch den Frontrahmen (2), das Beinschild (15) und das Kurbelgehäuse (9) definierter Raum von den Vorrichtungen (8) belegt ist, um diesen Raum für einen Luftfluss in der rückwärtigen Richtung im Wesentlichen zu blockieren; und zumindest einer des Zylinders (10) und des Zylinderkopfs (11) an rechten und linken Seitenoberflächen davon mit zweiten Kühlrippen (10b, 11 b) versehen ist, die sich senkrecht oder im Wesentlichen senkrecht zur Achse (C) des Zylinders (10) durchgehend erstrecken.

2. Das Kraftrad (1) nach Anspruch 1, worin eine Kettenkammer (10d) den Zylinder (10) und den Zylinderkopf (11) benachbart der Zylinderbohrung (10c) im Zylinder (10) durchsetzt, und worin der Zylinder (10), bei Betrachtung in Richtung der Achse (C) des Zylinders (10), eine im Wesentlichen rechteckige Form hat.
3. Das Kraftrad (1) nach Anspruch 1 oder 2, worin die ersten Kühlrippen (10a, 11 a) und die zweiten Kühlrippen (10b, 11 b) einstückig mit dem Zylinder (10) und dem Zylinderkopf (11) ausgebildet sind.

Revendications

1. Motocyclette (1) comprenant:

- un moteur à combustion interne (8) ayant un cylindre (10), une culasse (11) prévue à l'avant du cylindre (10) et un carter moteur (9) prévu à l'arrière du cylindre (10), ledit moteur à combustion interne (8) étant suspendu à un cadre avant (2) avec un axe (C) du cylindre (10) s'étendant substantiellement horizontalement, dans laquelle au moins le cylindre (10) ou la culasse (11) comprend sur des surfaces latérales supérieures et inférieures de ceux-ci des premières

ailettes de refroidissement (10a, 11a) parallèles à l'axe (C) du cylindre (10); et

- un protège-jambe (15) ayant des parois latérales droite et gauche s'étendant sur des côtés opposés du cadre avant (2), lequel s'étend en oblique vers le bas en direction de l'arrière d'une partie supérieure d'une fourche avant (5), les parois latérales droite et gauche du protège-jambe (15) s'étendant sur les côtés droit et gauche du cadre avant (2), respectivement, de façon à couvrir les côtés opposés du moteur (8), et

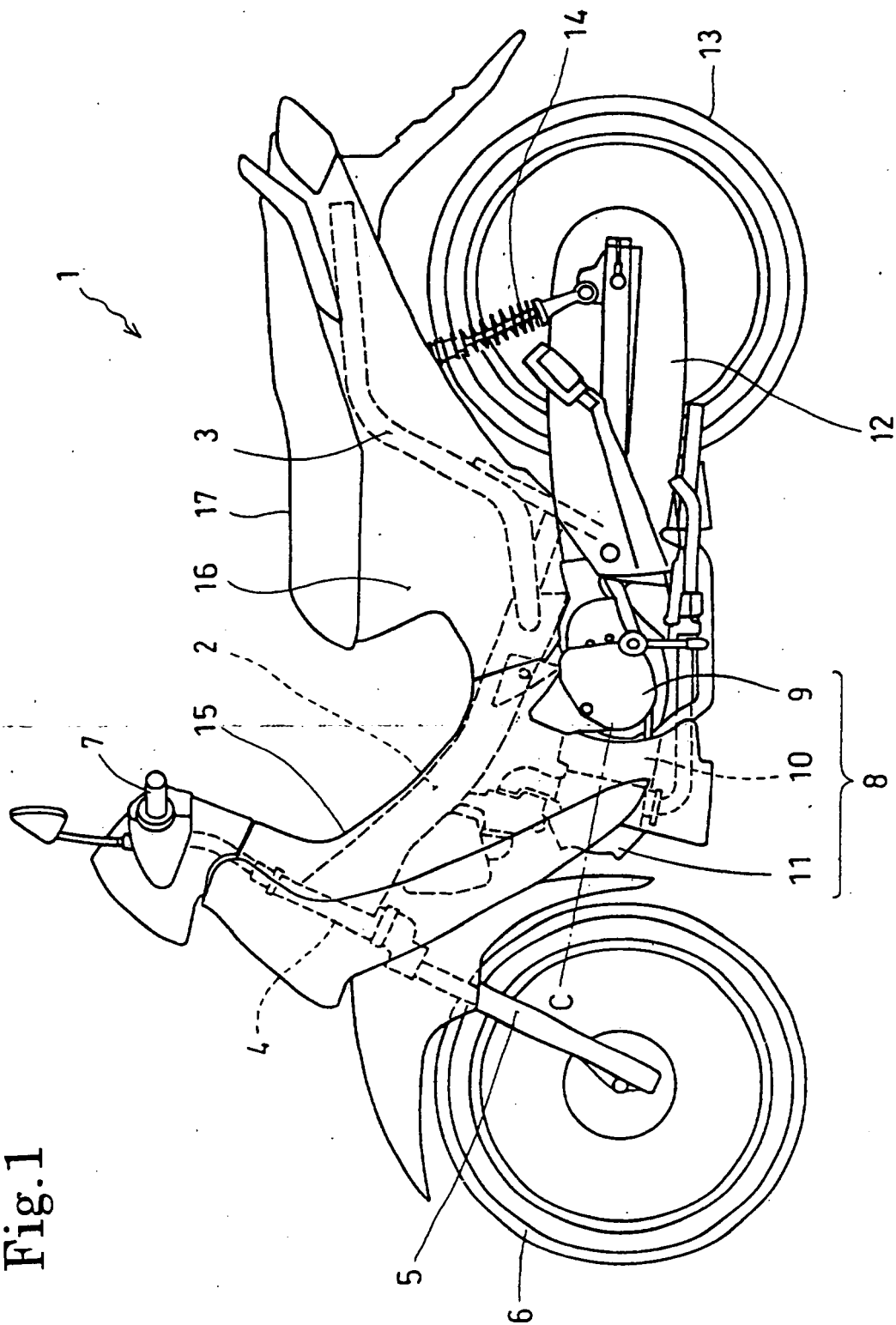
caractérisée en ce que :

- ladite motocyclette (1) comprend en outre des dispositifs (18) disposés entre une partie supérieure du carter moteur (9) et ledit cadre avant (2), de telle façon qu'un espace défini par le cadre avant (2), le protège-jambe (15) et le carter moteur (9) est occupé par les dispositifs (18), de façon à bloquer substantiellement cet espace pour la circulation de l'air dans la direction arrière; et

- au moins le cylindre (10) ou la culasse (11) comprend sur des surfaces latérales droites et gauches de ceux-ci des deuxième ailettes de refroidissement (10b, 11b) qui s'étendent en continu perpendiculairement ou sensiblement perpendiculairement à l'axe (C) du cylindre (10).

2. Motocyclette (1) suivant la revendication 1, dans laquelle une chambre à chaîne (10d) est prévue à travers le cylindre (10) et la culasse (11) en position adjacente à l'alésage (10c) dans le cylindre (10), et dans laquelle le cylindre (10) a une forme substantiellement rectangulaire lorsqu'on regarde dans la direction de l'axe (C) du cylindre (10).
3. Motocyclette (1) suivant la revendication 1 ou 2, dans laquelle lesdites premières ailettes de refroidissement (10a, 11a) et lesdites deuxième ailettes de refroidissement (10b, 11b) sont formées d'un seul tenant avec le cylindre (10) et la culasse (11).

Fig.1



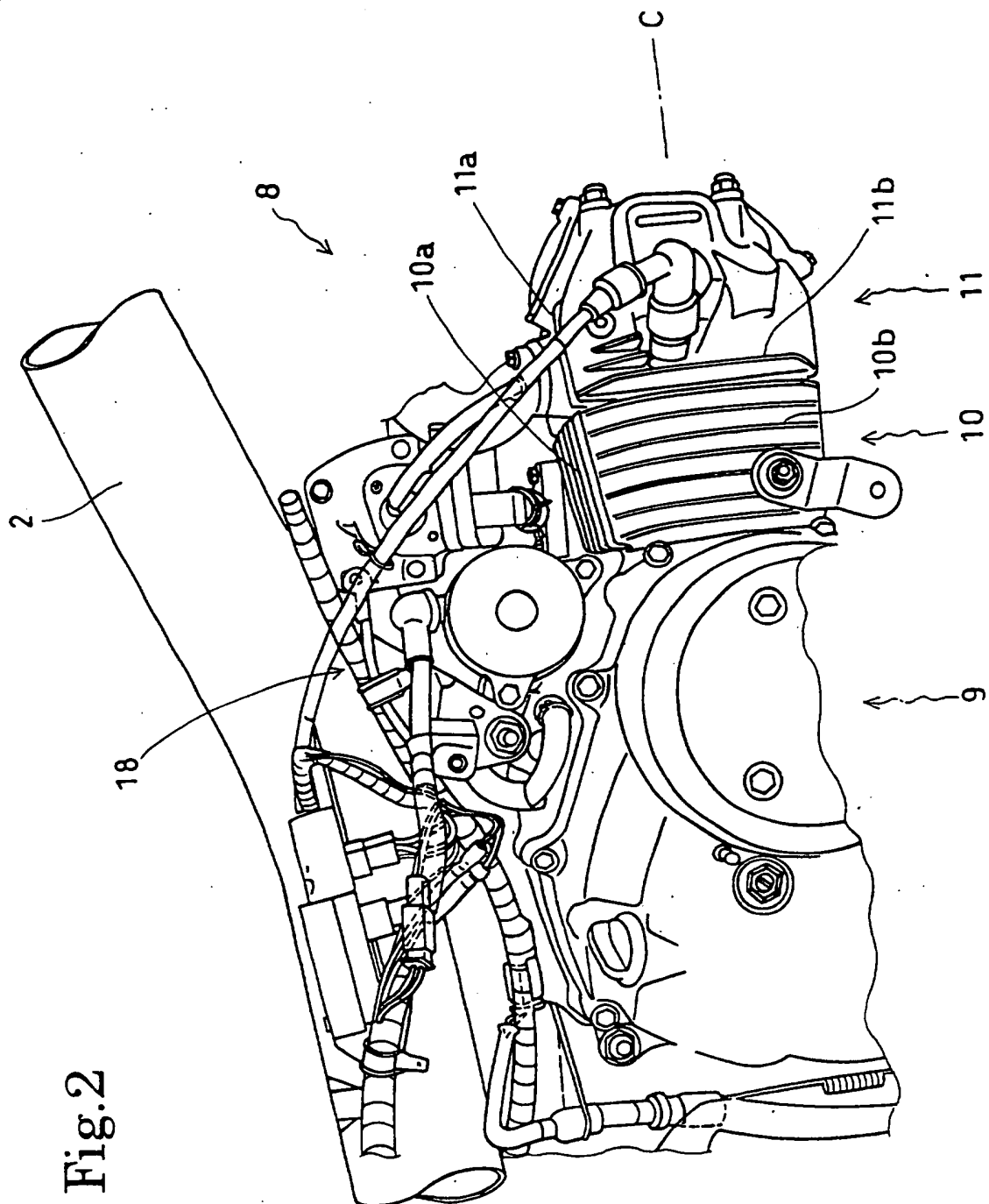


Fig. 2

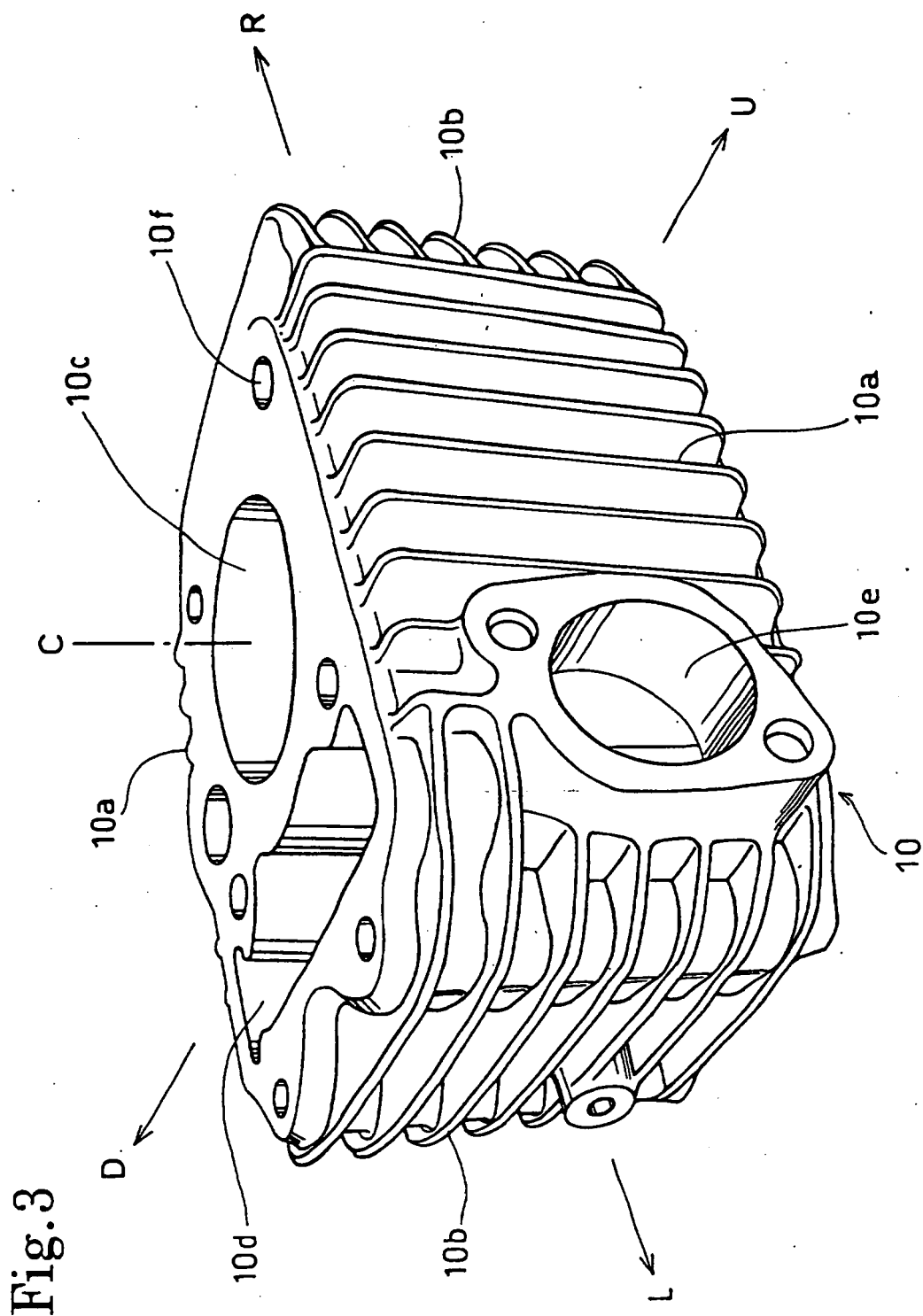


Fig.4a

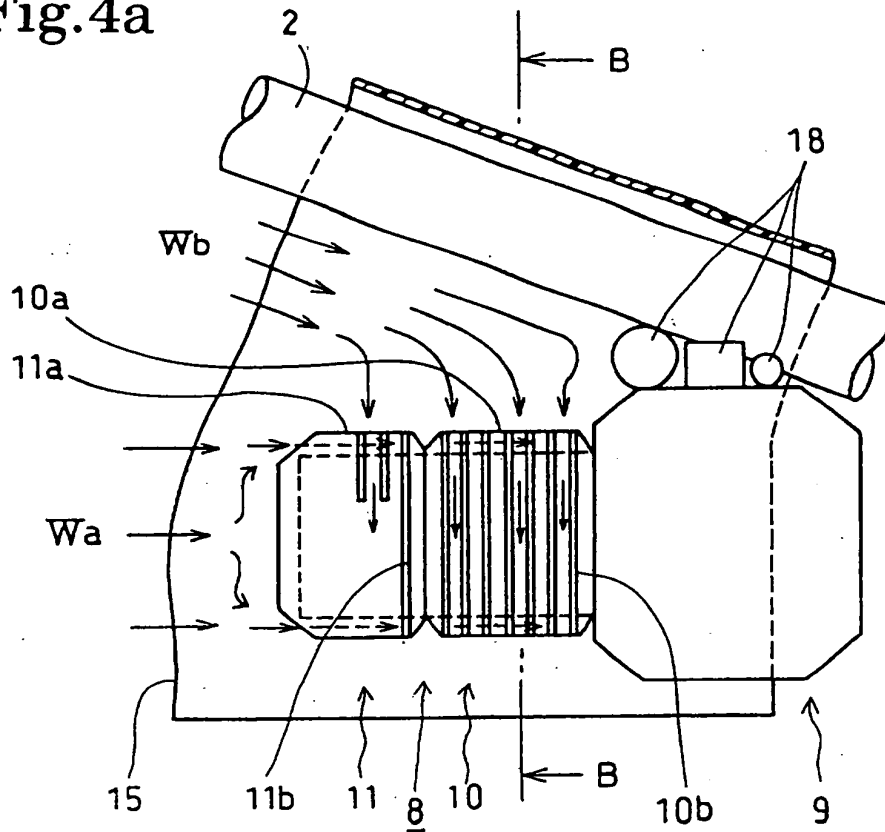


Fig.4b

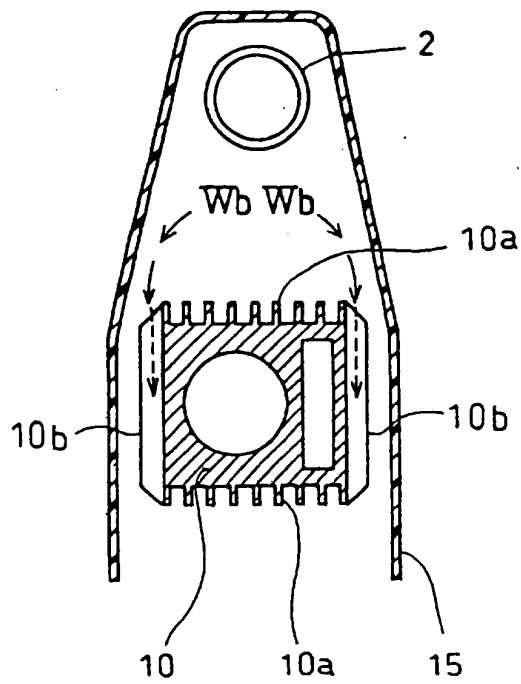


Fig.5

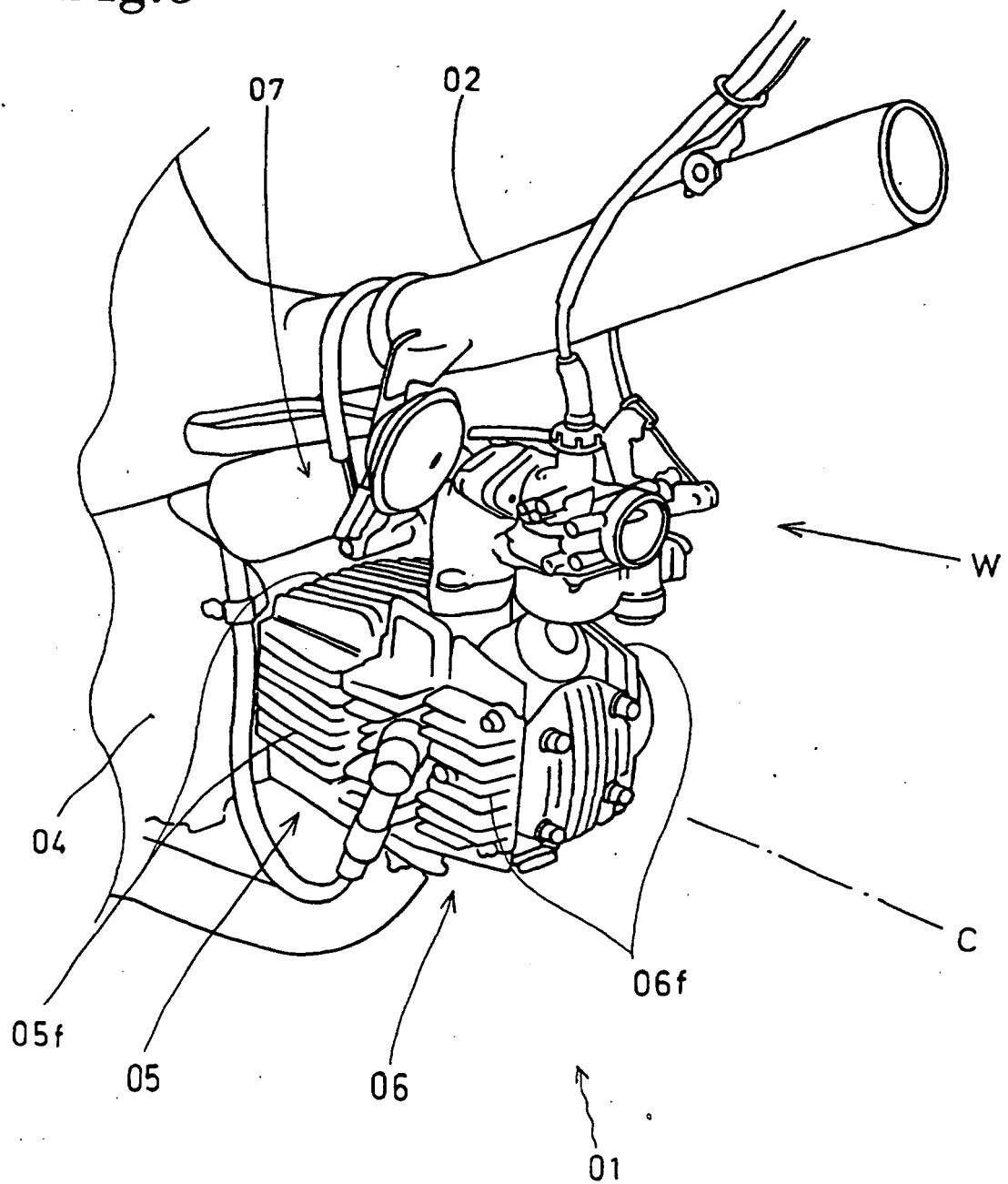
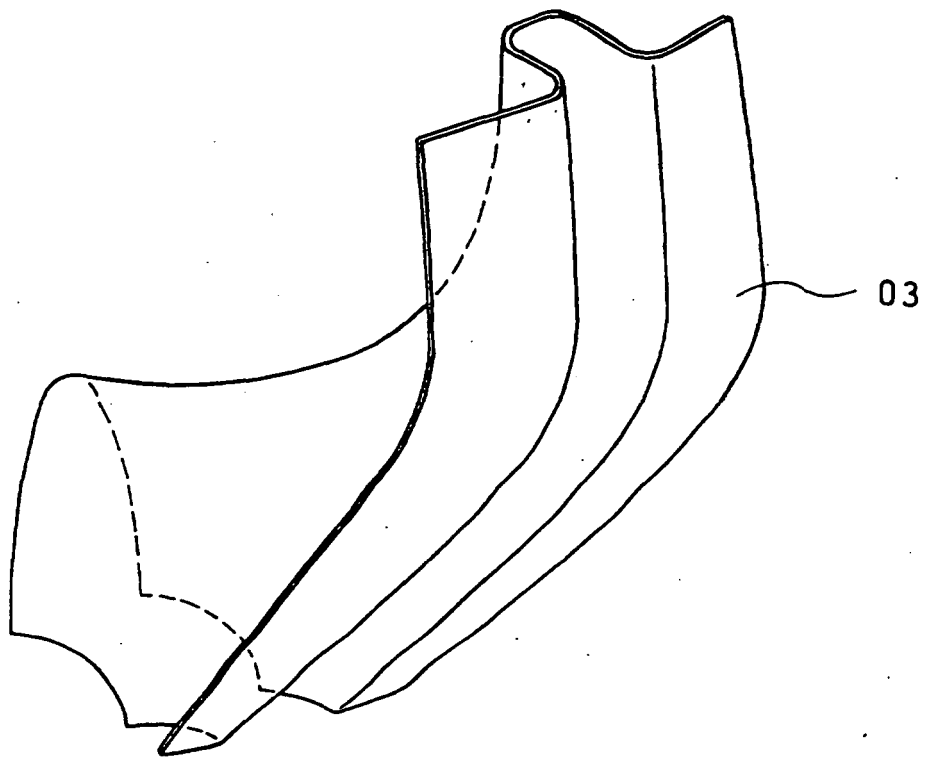


Fig.6



REFERENCES CITED IN THE DESCRIPTION

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