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(71) Applicant: **Honda Motor Co., Ltd.**
Minato-ku
Tokyo 107-8556 (JP)

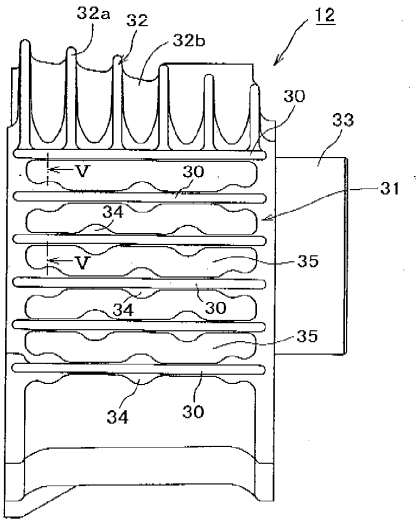
(72) Inventors:
- **KUBOTA, Ryo**
  Wako-shi
  Saitama 351-0193 (JP)
- **SATO, Takehisa**
  Wako-shi
  Saitama 351-0193 (JP)
- **OMORI, Jumpei**
  Wako-shi
  Saitama 351-0193 (JP)

(74) Representative: **Sakellarides, Vasiliki-Vali**
Sakellarides Law Office
70, Adrianou Street
105 56 Athens (GR)

(54) COOLING FIN STRUCTURE FOR VEHICLE-MOUNTED INTERNAL COMBUSTION ENGINE

(57) An internal combustion engine 10 mounted on a motorcycle has a forward-tilted or substantially horizontal cylinder and is provided on its upper surface with a cooling fin structure 31 including cooling fins 30 extending in a direction in which the motorcycle advances. Reinforcing bulges 34 are formed integrally with the cooling fins 30 on the surfaces of the cooling fins 30 such that the reinforcing bulges 34 of each cooling fin 30 are separated from the adjacent cooling fins 30 and from the reinforcing bulges 34 of the adjacent cooling fins 30. The respective reinforcing bulges 34 of the adjacent ones of the cooling fins 30 are arranged alternately. The respective reinforcing bulges 34 of the adjacent cooling fins 30 do not overlap each other when seen in a direction along the length of the cooling fins 30. Bottom walls 35 continuously extending in the running direction of the motorcycle are formed between the adjacent ones of the cooling fins 30. Sand and mud can hardly accumulate in the cooling fin structure 31, which enables easy cleaning of the cooling fin structure. The cooling fin structure can prevent reduction of the cooling ability thereof.

Fig. 4



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Description

TECHNICAL FIELD

[0001] The present invention relates to a cooling fin structure for an internal combustion engine to be mounted on a vehicle, such as a motorcycle.

BACKGROUND ART

[0002] The cylinder block and the cylinder head of an internal combustion engine to be mounted on a vehicle, such as a motorcycle, are provided on their surfaces with cooling fins for cooling the internal combustion engine by air currents. Since cooling fins are comparatively thin, adjacent cooling fins are connected by reinforcing ribs to enhance the rigidity of the cooling fins such that the fins are not caused to generate sounds by wind and vibrations and to increase heat radiating area by the reinforcing ribs. Such a cooling fin structure is described in Patent Document 1.

[0003]

Patent Document 1: JP 8-7070 U

DISCLOSURE OF THE INVENTION

Problem to be Solved by the Invention

[0004] An on-vehicle internal combustion engine provided with cooling fins connected by reinforcing ribs on its outer surface has an upper surface having recesses demarcated by the cooling fins and the reinforcing ribs and arranged in a grid. Sand and mud are liable to accumulate in the recesses to deteriorate engine cooling ability. Moreover, it is difficult to clean the recesses by removing accumulated sand and mud. An attempt to form part of each of the reinforcing ribs in a height lower by far than that of the cooling fins was made with an intention to lessen the adverse effect of such a problem to some extent. However, recesses remained without a change and hence the foregoing problem could not be completely solved.

[0005] The present invention has been made to solve the above problem, and the object of the invention is to provide a cooling fin structure for an on-vehicle internal combustion engine in which sand and mud can hardly accumulate therein and which enables easy cleaning of the cooling fin structure and can prevent reduction of the cooling.

Means for Solving the Problem

[0006] The present invention provides a cooling fin structure for an on-vehicle internal combustion engine, comprising cooling fins formed in parallel arrangement on at least an upper surface of the on-vehicle internal combustion engine, wherein the cooling fins are each provided with reinforcing bulges on surfaces thereof: and the reinforcing bulges on each cooling fin are separated from adjacent cooling fins and from the reinforcing bulges on the adjacent cooling fins.

[0007] Preferably, the reinforcing bulges of adjacent ones of the parallel cooling fins are arranged alternately.

[0008] Preferably, the reinforcing bulges are formed such that the respective reinforcing bulges of the adjacent cooling fins do not overlap each other when viewed in a direction along the length of the cooling fins.

[0009] In an embodiment of the present invention, the on-vehicle internal combustion engine has a forward-tilted or substantially horizontal cylinder, is suspended from a main frame extending obliquely downward to the rear from a head pipe included in a motorcycle and is provided with an air intake system for taking air into the engine, including parts disposed between the upper surface of a cylinder head and the main frame, and the cooling fins extends in a direction in which the motorcycle advances.

[0010] Typically, the outermost one of the cooling fins is not provided with the reinforcing bulges on at least an outer surface thereof.

Effect of the Invention

[0011] The cooling fins in the present invention are provided on their surfaces with the reinforcing bulges. Therefore, the rigidity of the cooling fins is enhanced by the reinforcing bulges and hence the fins are prevented from generating sounds and noise (reduction of sounds and noise). The reinforcing bulges increase the surface areas of the cooling fins to improve cooling ability. The cooling fin structure of the present invention differs from the conventional cooling fin structure in that the reinforcing bulges on the cooling fins are separated from adjacent cooling fins and from the reinforcing bulges on the adjacent cooling fins. Therefore, the adjacent fins are not connected by the reinforcing bulges and hence the cooling fins and the reinforcing bulges do not form recesses. Consequently, continuous bottom walls extending through the length of the cooling fins are formed between the adjacent ones of the cooling fins. Thus, grit and dust particles and mud that have entered the spaces between the adjacent ones of the cooling fins can hardly accumulate in those spaces and can be easily washed away with water even if grit and dust particles and mud accumulate in those spaces.

[0012] Since the reinforcing bulges of adjacent ones of the parallel cooling fins are arranged alternately, reduction of the sectional area of an air passage between the adjacent ones of the cooling fins caused by the reinforcing bulges can be limited to a least extent and comparatively large grit particles and lumps of mud which have entered the spaces between the adjacent ones of the cooling fins are rarely caught by the reinforcing bulges , can easily roll in the space and can easily go out of the space. Therefore, air passages between the adjacent ones of the cooling fins can be easily cleaned. Air

can easily flow through the air passages because the air passages are not narrowed.

[0013] Since the reinforcing bulges are arranged such that the respective reinforcing bulges of the adjacent cooling fins do not coincide with each other with respect to a direction along the length of the cooling fins, cooling air can easily flow through spaces each formed between adjacent cooling fins, sand and mud are rarely stuck in the spaces each between the adjacent cooling fins and the spaces can be easily cleaned.

[0014] The on-vehicle internal combustion engine is suspended from the main frame extending obliquely downward to the rear from the head pipe of the motorcycle and is provided with an air intake system for taking air into the engine, including parts disposed between the upper surface of a cylinder head and the main frame. Therefore, rainwater, which has adhered to the main frame and the parts of the air intake system while the vehicle is running, drips easily onto the cooling fin structure on the upper part of the internal combustion engine. Rainwater and such which have dripped onto the cooling fin structure can easily flow in the running direction of the vehicle and separate from the cooling fin structure because the cooling fins and the reinforcing bulges do not form divided recesses.

[0015] When the outermost ones of the cooling fins are not provided with the reinforcing bulges on at least their outer surfaces, the cooling fin structure is given an improved appearance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a side elevation of a motorcycle provided with an internal combustion engine including a cooling fin structure in a preferred embodiment of the present invention;

Fig. 2 is an enlarged side elevation of a part of Fig. 1 including the internal combustion engine and an intake system;

Fig. 3 is a side elevation of a cylinder block included in the internal combustion engine shown in Fig. 2;

Fig. 4 is a plan view of the cylinder block shown in Fig. 3 and having the cooling fin structure of the present invention;

Fig. 5 is a sectional view taken on the line V-V in Fig. 4;

Fig. 6 is a top view of the cylinder block as viewed from the front side with respect to the running direction; and

Fig. 7 is a plan view of the on-vehicle internal combustion engine.

REFERENCE CHARACTERS

[0017] 1 ... Motorcycle, 3 ... Front fork, 4 ... Head pipe, 5 ... Main frame, 6 ... Rear frame, 10 ... Internal combustion engine, 11 ... Crankcase, 12 ... Cylinder block, 13 ... Cylinder head, 14 ... Head cover, 15 ... Chain case, 17 ... Shock absorber, 18 ... Leg shield, 20 ... Air intake system, 30 ... Cooling fin, 31 ... Cooling fin structure, 32 ... Cooling fin, 32a ... Cooling fin, 32b ... Reinforcing rib, 34 ... Reinforcing ridge, 35 ... Bottom wall, 40 ... Cooling fin, 40a ... Cooling fin, 40b ... Reinforcing rib

BEST MODE FOR CARRYING OUT THE INVENTION

[0018] A cooling fin structure according to the present invention for an on-vehicle internal combustion engine will be described with reference to the accompanying drawings.

[0019] Fig. 1 shows a motorcycle provided with an internal combustion engine including a cooling fin structure in a preferred embodiment of the present invention. Referring to Fig. 1, the motorcycle 1 has a body frame including, as principal components, a front fork 3 supporting a front wheel 2, a head pipe 4 connected to an upper part of the front fork 3, a main frame 5 extending obliquely downward to the rear from the head pipe 4, and a carrier frame 6 connected to the rear end of the main frame 5, curved in an upward convex shape and extending obliquely upward toward the rear, which are united in a unit to form the body frame. The upper part of the front fork 3 is rotatably supported in the head pipe 4. A transverse handlebar 7 is disposed above the head pipe 4. A seat 8 is disposed above the rear frame 6. Indicated at 9 is a body cover.

[0020] The internal combustion engine 10 is disposed under the main frame 5 and is supported with its cylinder axis tilted forward so as to rise at a small inclination toward the front or with its axis extended substantially horizontally. The internal combustion engine 10 includes a crankcase 11, a cylinder block 12, a cylinder head 13 and a head cover 14. A chain case 15 extends rearward from the crankcase 11. A rear wheel 16 is supported on a rear end part of the chain case 15. The rear end of the chain case 15 is connected to the rear part of the rear frame 6 by a shock absorber 17. A leg shield 18 straddling the main frame 5 covers the cylinder block 12 and the cylinder head 13 of the internal combustion engine 10 from transverse directions. The rear frame 6 is covered with a rear cover 19. The seat 8 is placed on the rear cover 19.

[0021] The internal combustion engine 10 is suspended from the main frame 5. Referring to Fig. 2 showing a part of Fig. 1 in on an enlarged scale, the internal combustion engine 10 has a forward tilted or substantially horizontal cylinder, and an air intake system 20 is connected to an upper part of the cylinder head 13. The air intake system 20 includes an intake pipe 21, a throttle 22, an air cleaner 23 and so on. Intake air flows through the air cleaner 23, the air intake system 20 and the cylinder head 13 into the cylinder. An injector 24 injects fuel into the intake air. The air intake system 20 is disposed below the main frame 5; that is, the air intake system 20

is disposed in a space between the main frame 5 and the cylinder head 13. As shown in Fig. 7 showing the internal combustion engine 10 in a plan view, cooling fins 30 for air-cooling the internal combustion engine 10 are formed on the upper surface of cylinder block 12. The cooling fins 30 form a cooling fin structure 31 characterizing the present invention.

[0022] Fig. 7 shows the intake pipe 25 of the air intake system 20. A fuel tube 26 for carrying fuel to the injector 24 is connected to a joint cap 27. In Fig. 7, indicated at 28 is a connector for the electrical equipment of the injector 24 and at 29 is a throttle body. The letter F indicates imaginary air flow in the body frame. As shown, the body cover 9 is open toward the front to facilitate taking in cooling air.

[0023] The cooling fin structure 31 will be described with reference to Figs. 3 to 5. Fig. 3 is a side elevation of the cylinder block 12 taken from the left side of the vehicle. The cooling fin structure 31 including the cooling fins 30 is formed on the upper surface of the cylinder block 12. In this embodiment, the left side surface of the cylinder block 12 is not provided with any cooling fins. Indicated at 33 is a cylinder sleeve defining a cylinder bore. The cylinder sleeve 33 extends toward the rear. As obvious from Fig. 4 showing the cooling fin structure 31 in a plan view, the cooling fins 30 of the cooling fin structure 31 are extended parallel to the running direction of the vehicle. In this embodiment, the right side surface of the cylinder block 12 is provided with cooling fins 32 as shown in Fig. 4. The cooling fins 32 will be described later.

[0024] As obvious from Fig. 4, the number of the cooling fins 30 of the cooling fin structure 31 in this embodiment is, for example, six. The parallel cooling fins 30 extend in the running direction of the vehicle. Reinforcing ridges or bulges 34 are formed integrally with the cooling fins 30 on the surfaces of the cooling fins 30. Each reinforcing bulge 34 extends vertically along the height of the cooling fin 30. The surfaces of the reinforcing bulges 34 have the shape of a circular arc in cross section in a horizontal plane. Desirably, the reinforcing bulges 34 have a curved section gently rising from the flat surface of the cooling fins 30. It is recommended to avoid using reinforcing bulges having a cross section with corners - The respective reinforcing bulges 34 of adjacent cooling fins 30 are not opposite to each other with respect to a direction perpendicular to the cooling fins 30, namely, a direction along the width of the vehicle.

[0025] The height of the reinforcing bulges 34 is far less than the distance between adjacent cooling fins 30. Therefore, even if the respective reinforcing bulges 34 of the adjacent cooling fins 30 are opposite to each other with respect to a direction perpendicular to the cooling fins 30, there is a gap between the opposite reinforcing bulges 34; that is, the reinforcing bulges 34 are formed such that the reinforcing bulges 34 of adjacent cooling fins 30 are separate from each other in a state where the respective reinforcing bulges 34 of adjacent cooling fins 30 are not opposite to each other with respect to a direction perpendicular to the cooling fins 30. The reinforcing bulges 34 of one of adjacent cooling fins 30 are not connected to parts of the surface not provided with the reinforcing bulges 34 of the other cooling fin 30.

[0026] As obvious from Fig. 5 showing an enlarged sectional view taken on the line V-V in Fig. 4, the length of the reinforcing bulges 34 is slightly smaller than the height of the cooling fins 30 on which the reinforcing bulges 34 are formed. Each reinforcing bulges 34 rises gradually in a gentle curve from a part of the cooling fin 30 slightly below the top edge of the cooling fin 30, extends downward linearly to a bottom wall 35 extending between adjacent cooling fins 30. It is important to determine dimensions such that the respective reinforcing bulges 34 of adjacent cooling fins 30 do not overlap each other as viewed in a direction parallel to the length of the cooling fins 30, namely, in a direction into the paper. When the reinforcing bulges 34 are thus formed, the straight bottom wall 35 continuously extending in a direction parallel to the length of the cooling fins 30 is formed between adjacent cooling fins 30. The right end cooling fin 30 shown in the right half of Fig. 5 is not provided with the reinforcing bulges 34. Therefore, the right bottom wall 35 looks wider than the left bottom wall 35. Actually, the two reinforcing bulges 34 opposite to each other in Fig. 5 are not formed at the same position with respect to the length of the cooling fins 30. Therefore, the width of the left bottom wall 35 at each reinforcing bulge 34 is actually equal to that of the right bottom wall 35. The zigzag bottom walls 35 having parts of a minimum width corresponding to that width extend in the running direction of the vehicle.

[0027] Fig. 6 is an end view of the cylinder block 12 taken from the front side of the vehicle. The upper surface of the cylinder block 12 is provided with the cooling fin structure 31 including the cooling fins 30 and the reinforcing bulges 34 as shown in Fig. 6. A space 39 in which a timing chain, not shown, is extended is shown on the right side in Fig. 6, namely, the left side with respect to the running direction of the vehicle. As is generally known, the timing chain is extended between a drive sprocket, not shown, mounted on the crankshaft held in the crankcase 11 and a driven sprocket, not shown, mounted on a camshaft disposed in a valve train chamber to transmit the rotation of the crankshaft to the camshaft. The cooling fins 32 are shown in a left part in Fig. 6. These cooling fins 32 include parallel vertical cooling fins 32a perpendicular to the axis of the cylinder and reinforcing ribs 32b parallel to the axis of the cylinder and connecting adjacent ones of the cooling fins 32a. The reinforcing ribs 32b have a height lower than that of the cooling fins 32a.

[0028] As shown also in Fig. 6, the lower surface of the cylinder block 12 is provided with cooling fins 40a similar in construction to the cooling fins 32, and reinforcing ribs 40b perpendicular to the axis of the cylinder and connecting adjacent ones of the cooling fins 40a. The reinforcing ribs 40b have a height lower than that of the cooling fins 40a. Each reinforcing ribs 40b has an outward concave edge. The cooling fins 32 and 40 have cooling

fin construction based on basically the same principle as that mentioned in Patent Document 1.

[0029] The cooling fin structure in the preferred embodiment of the present invention for an on-vehicle internal combustion engine is formed in the foregoing construction. When the vehicle runs, incoming air flows past the head cover 14, the cylinder head 13, the cylinder block 12 and the crankcase 11 to cool the internal combustion engine 10. The reinforcing bulges 34 are formed on the surfaces of the cooling fins 30 integrally therewith such that the respective reinforcing bulges 34 of the cooling fins 30 are not connected to the adjacent cooling fins 30 and to the reinforcing bulges 34 on the adjacent cooling fins 30. Therefore, the rigidity of the cooling fins 30 is enhanced by the reinforcing bulges 34 and the reinforcing bulges 34 increase the surface area of the cooling fin structure 31 to improve the cooling ability. Since the adjacent cooling fins 30, differing from the conventional cooling fins, are not connected by the reinforcing bulges 34, the cooling fins 30 and the reinforcing bulges 34 do not form divided recesses, and the continuous bottom walls 35 extending through the length of the cooling fins 30 are formed between adjacent ones of the cooling fins 30. Thus, grit and dust particles and mud that have entered the spaces between adjacent ones of the cooling fins 30 can hardly accumulate in those spaces and can be easily washed away with water even if grit and dust particles and mud accumulate in those space. The reinforcing bulges 34 having a gently curved section exert low resistance against the air flow.

[0030] The respective reinforcing bulges 34 of the adjacent cooling fins 30 are arranged alternately and hence reduction of the sectional area of the air passages formed between the adjacent ones of the cooling fins 30 by the reinforcing bulges 34 can be limited to the least extent, and comparatively large grit particles and lumps of mud that have entered the spaces between the adjacent ones of the cooling fins 30 are rarely caught by the reinforcing bulges 34, can easily roll in the spaces and can easily go out of the spaces. Therefore, air passages each between the adjacent cooling fins can be easily cleaned. Air can easily flow through the air passages because the air passages are not narrowed.

[0031] Since the respective reinforcing bulges 34 of the adjacent cooling fins 30 do not overlap each other as viewed in a direction parallel to the length of the cooling fins 30, cooling air can flow smoothly throughout the spaces between the adjacent ones of the cooling fins 30, and grit particles and lumps of mud are rarely stuck in the spaces so that the spaces can be easily cleaned.

[0032] In the illustrated embodiment, the internal combustion engine 10 is suspended from the main frame 5 extending obliquely downward to the rear from the head pipe 4 of the motorcycle and the air intake system 20 is disposed in the space between the main frame 5 and the cylinder head 13. Therefore, rainwater adhering to the main frame 5 and the air intake system 20 while the vehicle is running drips easily onto the cooling fin structure 31 on the upper part of the internal combustion engine 10. Rainwater and such which have dripped onto the cooling fin structure 31 can easily flow in the running direction of the vehicle and separate from the cooling fin structure 31 because the cooling fins 30 and the reinforcing bulges 34 do not form divided recesses but form the continuous bottom walls 35 extending in the running direction

[0033] In the illustrated embodiment shown, for example the left end cooling fin 30, namely, the outermost cooling fin 30 with respect to the width of the vehicle, is provided with the reinforcing bulges 34 on its opposite surfaces as shown in Fig. 4. The outermost cooling fin 30 may be not provided with any reinforcing bulges 34 at all or may be not provided with any reinforcing bulges 34 only on its outer surface with respect to the width of the vehicle; that is, at least the outer surface, with respect to the width of the vehicle, of the outermost cooling fin 30 may be not provided with the reinforcing bulges 34, which improves the appearance of the engine including the cooling fin structure 31.

[0034] In the illustrated preferred embodiment of the invention, the cooling fin structure is formed only on the upper surface of the cylinder block. The cooling fin structure may be formed also on the upper surface of the cylinder head and when necessary, the cooling fin structure can be formed on surfaces other than the upper surfaces of the cylinder block and the cylinder head.

Claims

1. A cooling fin structure for an on-vehicle internal combustion engine, comprising cooling fins formed in parallel arrangement on at least an upper surface of the on-vehicle internal combustion engine;
   wherein the cooling fins are each provided with reinforcing bulges on surfaces thereof; and the reinforcing bulges on each cooling fin are separated from adjacent cooling fins and from the reinforcing bulges on the adjacent cooling fins.

2. The cooling fin structure for an on-vehicle internal combustion engine according to claimed 1, wherein the respective reinforcing bulges of adjacent ones of the parallel cooling fins are arranged alternately.

3. The cooling fin structure for an on-vehicle internal combustion engine according to claim 2, wherein the reinforcing bulges are formed such that the respective reinforcing bulges of the adjacent cooling fins do not overlap each other with each other when viewed in a direction along the length of the cooling fins.

4. The cooling fin structure for an on-vehicle internal combustion engine according to any one of claims 1 to 3, wherein the on-vehicle internal combustion engine has a forward-tilted or substantially horizontal

cylinder, is suspended from a main frame extending obliquely downward to a rear from a head pipe included in a motorcycle and is provided with an air intake system for taking air into the engine, including parts disposed between the upper surface of a cylinder head and the main frame, and the cooling fins extends in a direction in which the motorcycle advances.

5. The cooling fin structure for an on-vehicle internal combustion engine according to any one of claims 1 to 4, wherein an outermost one of the cooling fins is not provided with the reinforcing bulges on at least an outer surface thereof.

Amended claims under Art. 19.1 PCT

1. (Amended) A cooling fin structure in a motorcycle provided with a head pipe, a main frame extending obliquely downward from the head pipe, and an internal combustion engine suspended from the main frame and having a cylinder head and a cylinder block which includes a forward tilted or substantially horizontal cylinder, wherein an air intake system for taking air into the engine is provided between an upper surface of the cylinder head and the main frame, **characterized in that**:

the cooling fin structure includes a plurality of cooling fins upstanding on an upper surface of the cylinder block and extending in parallel in a direction in which the motorcycle advances; and the cooling fins on the cylinder block are each provided on surfaces thereof with reinforcing bulges extending in an upstanding direction of the cooling fins; and the reinforcing bulges on each cooling fin are spaced from adjacent cooling fins and from the reinforcing bulges on adjacent cooling fins.

2. The cooling fin structure according to claimed 1, wherein the respective reinforcing bulges of adjacent ones of the parallel cooling fins are arranged alternately.

3. The cooling fin structure according to claim 2, wherein the reinforcing bulges are formed such that the respective reinforcing bulges of the adjacent cooling fins do not overlap each other with each other when viewed in a direction along the length of the cooling fins.

4. (Cancelled)

5. The cooling fin structure according to any one of claims 1 to 3, wherein an outermost one of the cooling fins is not provided with the reinforcing bulges on at least an outer surface thereof.

6. (Added) The cooling fin structure according to any one of claims 1 to 3 , wherein the reinforcing bulges on adjacent ones of the cooling fins are spaced apart in a direction transverse to the cooling fins by a distance which is greater than a thickness of tip portions of the cooling fins.

7. (Added) The cooling fin structure according to any one of claims 1 to 3, wherein the plurality of cooling fins have a same length in the direct ion in which the cylinderr extends.

8. (Added) The cooling fin structure according to any one of claims 1 to 3, wherein the cooling fin structure is enclosed in a body cover which opens forwardly of the motorcycle.

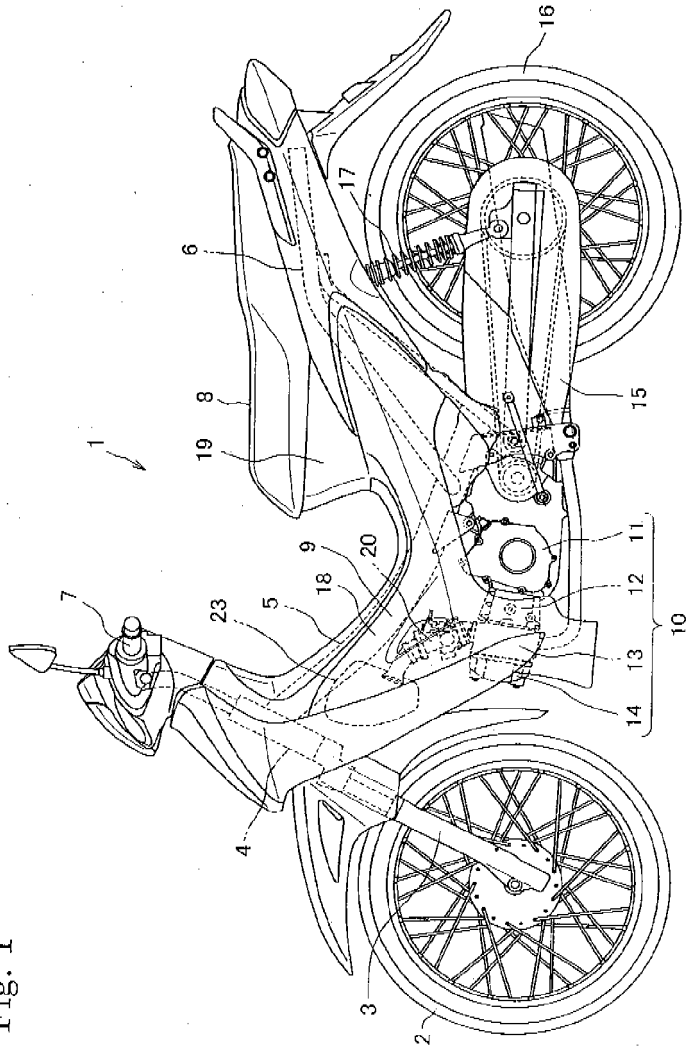

Fig. 1

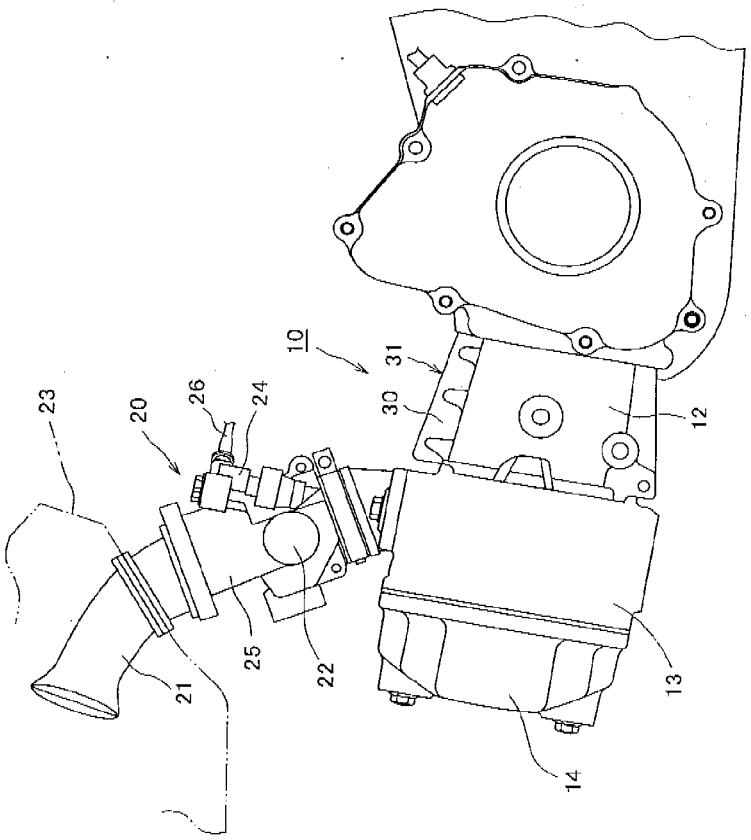

Fig. 2

Fig. 3

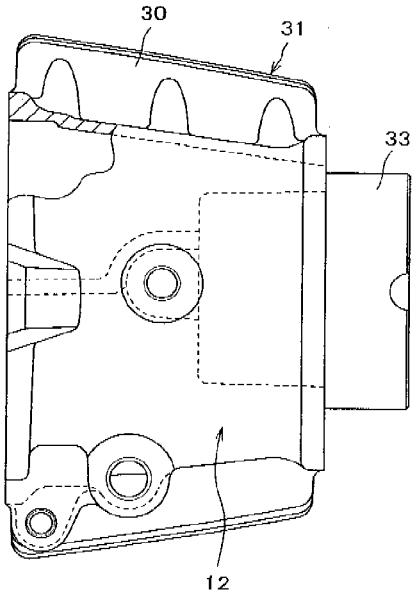

Fig. 4

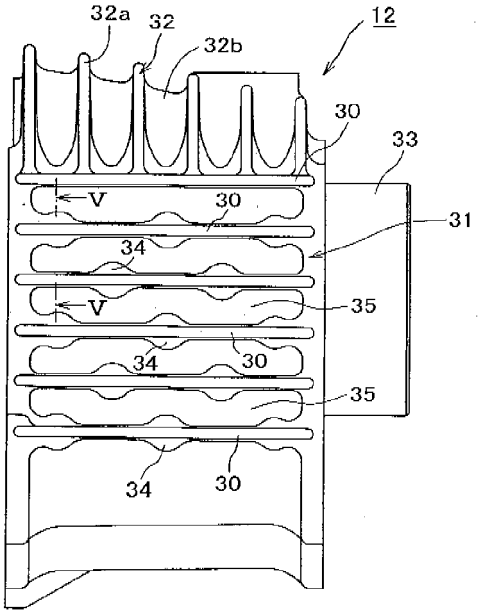
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Fig. 5

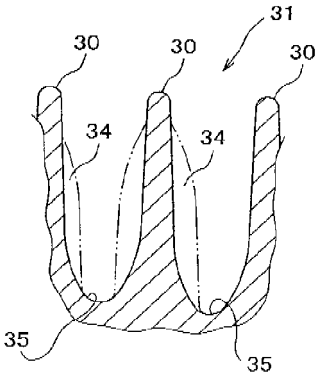
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Fig. 6

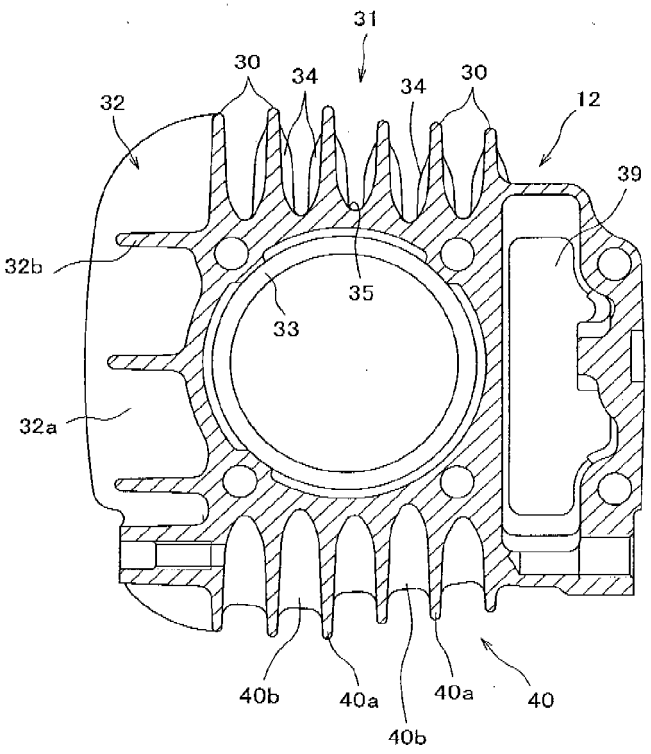
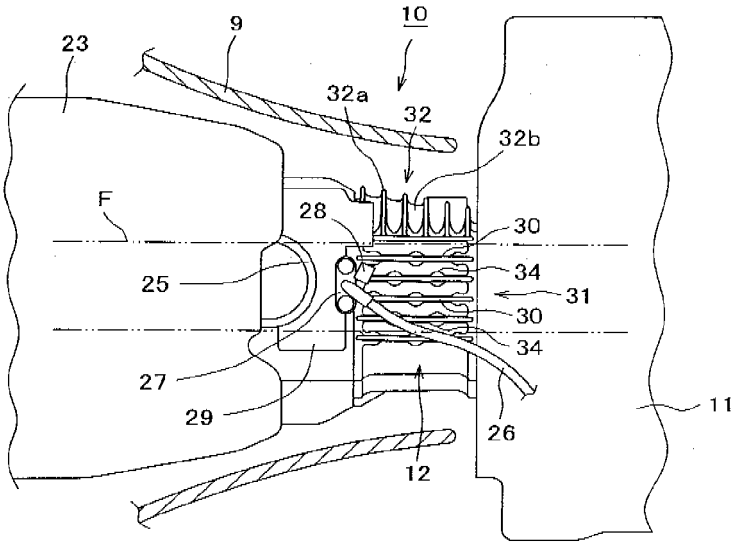


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/052985

A. CLASSIFICATION OF SUBJECT MATTER
F02F1/06(2006.01)i, *F01P1/02*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F02F1/06, F01P1/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009
Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 44-3685 Y1 (Yamaha Motor Co., Ltd.), 12 February, 1969 (12.02.69), Figs. 1 to 2 (Family: none)	1-3,5 4
Y	JP 2007-205199 A (Honda Motor Co., Ltd.), 16 August, 2007 (16.08.07), Figs. 1, 5 & BRA PI0700164 & CN 101011934 A & AR 59230 A	4
A	JP 31-10604 Y1 (Hisanobu TAKAMI), 05 July, 1956 (05.07.56), Figs. 1 to 2 (Family: none)	1-5

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
08 May, 2009 (08.05.09)	19 May, 2009 (19.05.09)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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Patent documents cited in the description

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