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(54) Water-cooling type engine

(57) A water-cooling type engine includes a cylinder (2), a cylinder head (3), and a sealing gasket (4) disposed between the cylinder (2) and the cylinder head (3). A water passage arrangement is provided so as to permit cooling water to flow from a water inlet (201) in the cylinder (2) to a water outlet (302) in the cylinder (2) or the cyl inder head (3) along a single flowing path.

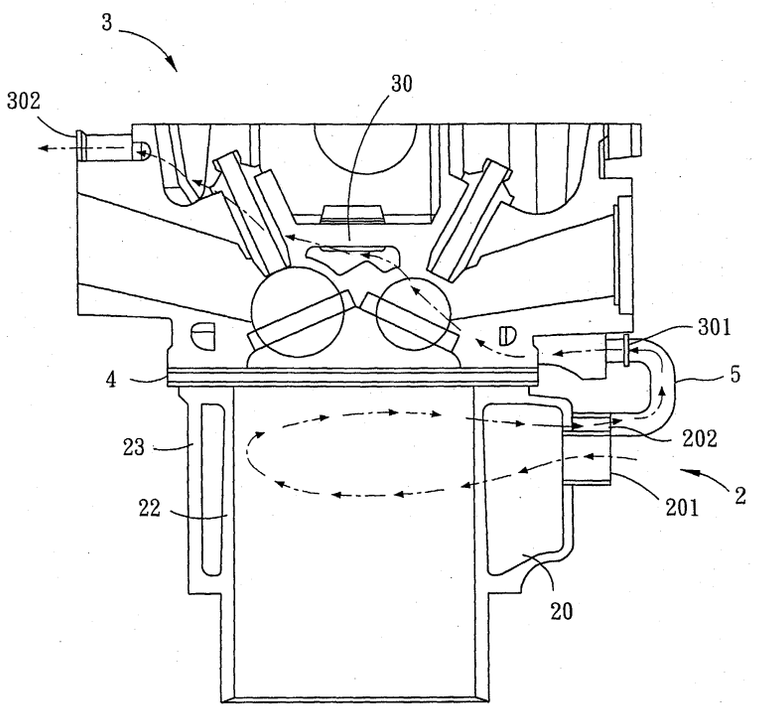

FIG. 1

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Description

[0001] This invention relates to a cooling structure for an engine, and more particularly to a cooling structure for a water-cooling type engine.

[0002] A conventional water-cooling type engine includes a cylinder with a first water passage, a cylinder head with a second water passage, and a sealing gasket disposed between the cylinder and the cylinder head. The first and second water passages extend in a circumferential direction so as to constitute a water jacket. The sealing gasket has an outer peripheral portion that is formed with a plurality of holes, through which cooling water can flow from the first water passage in the cylinder to the second water passage in the cylinder head. As such, the cooling water flows from a water inlet of the first water passage in the cylinder to a water outlet of the second water passage in the cylinder head through the holes in the sealing gasket. Because the holes in the sealing gasket are spaced apart from each of the water inlet of the first water passage and the water outlet of the second water passage at different distances, the cooling water flows from the water inlet of the first water passage into the water outlet of the second water passage via a plurality of paths that have different lengths, thereby resulting in relatively uneven cooling in the engine, which can lead to quick deformation of the engine.

[0003] The object of this invention is to provide a water-cooling type engine that is formed with a single cooling-water path in a cylinder and a cylinder head so that the cooling of the engine is relatively uniform.

[0004] According to this invention, a water-cooling type engine includes a cylinder, a cylinder head, and a sealing gasket disposed between the cylinder and the cylinder head. A water passage arrangement is provided so as to permit cooling water to flow from a water inlet in the cylinder to a water outlet in the cylinder or the cylinder head along a single flowing path. As such, the cooling of the engine is relatively uniform.

[0005] These and other features and advantages of this invention will become apparent in the following detailed description of the preferred embodiments of this invention, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic side view of the first preferred embodiment of a water-cooling type engine according to this invention;

Fig. 2 is a schematic top view of the first preferred embodiment;

Fig. 3 is a schematic top view of the second preferred embodiment of a water-cooling type engine according to this invention;

Fig. 4 is a schematic side view of the third preferred embodiment of a water-cooling type engine according to this invention;

Fig. 5 is a schematic top view of the third preferred embodiment;

Fig. 6 is a schematic top view of the fourth preferred embodiment of a water-cooling type engine according to this invention;

Fig. 7 is a schematic side view of the fifth preferred embodiment of a water-cooling type engine according to this invention;

Fig. 8 is a schematic top view of the fifth preferred embodiment;

Fig. 9 is a schematic top view of the sixth preferred embodiment of a water-cooling type engine according to this invention;

Fig. 10 is a schematic side view of the seventh preferred embodiment of a water-cooling type engine according to this invention; and

Fig. 11 is a schematic top view of the seventh preferred embodiment.

[0006] Before the present invention is described in greater detail in connection with the preferred embodiments, it should be noted that similar elements and structures are designated by like reference numerals throughout the entire disclosure.

[0007] Referring to Figs. 1 and 2, the first preferred embodiment of a water-cooling type engine according to this invention is shown to include a cylinder 2, a cylinder head 3 disposed on the cylinder 2, a sealing gasket 4 disposed between the cylinder 2 and the cylinder head 3, and an auxiliary water conduit 5. The cylinder 2 includes an inner cylinder wall 22 that defines a cylindrical chamber 222, and an outer cylinder wall 23 that is formed integrally with the inner cylinder wall 22 at upper and lower ends thereof so as to define a first water passage 20 between the inner and outer cylinder walls 22, 23. The cylinder head 3 is formed with a second water passage 30 that has a water inlet 301 and a water outlet 302.

[0008] The cylinder 2 further includes a radially extending spacer wall 21 that has a radial inner end 211 that is formed integrally with the inner cylinder wall 22, and a radial outer end 212 that is formed integrally with the outer cylinder wall 23.

[0009] The first water passage 20 in the cylinder 2 has a water inlet 201 permitting introduction of cooling water therethrough, and a water outlet 202. The auxiliary water conduit 5 is connected to the cylinder 2 and the cylinder head 3, and is in fluid communication with the water outlet 202 of the first water passage 20 in the cylinder 2 and the water inlet 301 of the second water passage 30 in the cylinder head 3. The water inlet and outlets 201, 202 in the cylinder 2 are adjacent to and are located on two sides of the spacer wall 21, respectively, so that the cooling water can flow from the water inlet 201 of the first water passage 20 in the cylinder 2 to the water outlet 202 of the first water passage 20 in the cylinder 2 along a circumferential direction. The cooling water further flows from the water outlet 202 of the first water passage 20 in the cylinder 2 into the water inlet 301 of the second water passage 30 in the cylinder head 3, and

exits from the engine through the water outlet 302 of the second water passage 30 in the cylinder head 3.

[0010] Fig. 3 shows the second preferred embodiment of a water-cooling type engine according to this invention, which is similar to the first preferred embodiment in construction except that this embodiment includes two cylinders 2, and an inner cylinder wall 22 defining two cylindrical chambers 222.

[0011] Figs. 4 and 5 show the third preferred embodiment of a water-cooling type engine according to this invention, which is similar to the first preferred embodiment in construction except that the water inlet 301 of the second water passage 30 in the cylinder head 3 is in fluid communication with the water outlet 202 of the first water passage 20 via a hole 44 in the sealing gasket 4 instead of through the auxiliary water conduit 5 (see Fig. 1).

[0012] Fig. 6 shows the fourth preferred embodiment of a water-cooling type engine according to this invention, which is similar to the third preferred embodiment in construction except that this embodiment includes two cylinders 2, and an inner cylinder wall 22 defining two cylindrical chambers 222.

[0013] Referring to Figs. 7 and 8, the fifth preferred embodiment of a water-cooling type engine is shown to include a cylinder 2, a cylinder head 3 disposed on the cylinder 2, and a sealing gasket 4 disposed between the cylinder 2 and the cylinder head 3. The cylinder 2 includes an inner cylinder wall 22 that defines a cylindrical chamber 222, and an outer cylinder wall 23 that is formed integrally with the inner cylinder wall 22 at upper and lower ends thereof so as to define a first water passage unit 20 between the inner and outer cylinder walls 22, 23. The cylinder head 3 is formed with a second water passage 30 that has a water inlet 301 and a water outlet 302. The cylinder 2 further includes two aligned, radially extending spacer walls 21, each of which has a radial inner end 211 that is formed integrally with the inner cylinder wall 22, and a radial outer end 212 that is formed integrally with the outer cylinder wall 23. The first water passage unit 20 in the cylinder 2 is divided by the spacer walls 21 into a front passage portion 203 and a rear passage portion 204 that are spaced apart from each other. The front passage portion 203 has an inlet end (203A) distal to the cylinder head 3, an outlet end (203B) proximate to the cylinder head 3, and a water inlet 201 that is adjacent to the inlet end (203A) and that permits introduction of the cooling water therethrough. The rear passage portion 204 has an inlet end (204A) proximate to the cylinder head 3, an outlet end (204B) distal to the cylinder head 3, and a water outlet 202 that is adjacent to the outlet end (204B) and that permits discharging of the cooling water from the engine therethrough. The sealing gasket 4 is formed with a front hole 44 in fluid communication with the outlet end (203B) of the front passage portion 203 of the first water passage unit 20 and the water inlet 301 of the second water passage 30 in the cylinder head 3, and a rear hole 44' in fluid communication with the water outlet 302 of the second water passage 30 in the cylinder head 3 and the inlet end (204A) of the rear passage portion 204 of the first water passage unit 20, thereby permitting flow of the cooling water from the water inlet 201 of the front passage portion 203 to the water outlet 202 of the rear passage portion 204 through the second water passage 30.

[0014] Fig. 9 shows the sixth preferred embodiment of a water-cooling type engine according to this invention, which is similar to the fifth preferred embodiment in construction except that this embodiment includes two cylinders 2, and an inner cylinder wall 22 defining two cylindrical chambers 222.

[0015] Referring to Figs. 10 and 11, the seventh preferred embodiment of a water-cooling type engine according to this invention is shown to include two juxtaposed cylinders 2 interconnected fixedly to constitute a cylinder unit, two juxtaposed cylinder heads 3 interconnected fixedly and disposed respectively on the cylinders 2, and a sealing gasket 4 disposed between the cylinder unit and the cylinder heads 3. Each of the cylinders 2 includes an inner cylinder wall 22 that defines two cylindrical chambers 222, and an outer cylinder wall 23 that is formed integrally with the inner cylinder wall 22 at upper and lower ends thereof so as to define a first water passage 20 between the inner and outer cylinder walls 22, 23. Each of the cylinder heads 3 is formed with a second water passage 30 that has a water inlet 301 and a water outlet 302. Each of the cylinders 2 further includes a radially extending spacer wall 21 that has a radial inner end 211 which is formed integrally with the inner cylinder wall 22 of the corresponding cylinder 2, and a radial outer end 212 which is formed integrally with the outer cylinder wall 23 of the corresponding cylinder 2. The first water passages 20 in the cylinders 2 cross each other, and have a common passage portion 25 that constitutes a portion of each of the first water passages 20. The cylinder unit has a water inlet 201 that is in fluid communication with one of the first water passages 20 in the cylinders 2 at a position among the spacer walls 21 and the common passage portion 25 and that permits introduction of cooling water therethrough, and two water outlets 202 that are formed at two sides of an assembly of the spacer walls 21, that are disposed adj acent to the spacer walls 21, respectively, and that are in fluid communication with the holes 44 in the sealing gasket 4 so as to permit the cooling water to flow from the water inlet 201 into the water outlets 202 along the first water passages 20 in the cylinders 2. The cooling water further flows from the water outlets 202 of the first water passages 20 into the water inlets 301 of the second water passages 30 in the cylinder heads 3 via the holes 44 in the sealing gasket 4, and exits from the engine through the water outlets 302 of the second water passages 30 in the cylinder heads 3.

[0016] In each of the above embodiments, because the cooling water flows in an assembly of one cylinder

2 and one cylinder head 3 from the water inlet 201 to the water outlet 302 along only one flowing path, the cooling of the engine is relatively uniform.

Claims

1. A water-cooling type engine including a cylinder (2) , a cylinder head (3) disposed on the cylinder (2), and a sealing gasket (4) disposed between the cylinder (2) and the cylinder head (3), the cylinder (2) including an inner cylinder wall (22) and an outer cylinder wall (23) that is formed integrally with the inner cylinder wall (22) at upper and lower ends thereof so as to define a first water passage (20) between the inner and outer cylinder walls (22, 23), the cylinder head (3) being formed with a second water passage (30) that has a water inlet (301) in fluid communication with the first water passage (20) in the cylinder (2), and a water outlet (302), the engine being **characterized by**:

the cylinder (2) further including a radially extending spacer wall (21) that has a radial inner end (211) which is formed integrallywith the inner cylinder wall (22) , and a radial outer end (212) which is formed integrally with the outer cylinder wall (23) , the first water passage (20) in the cylinder (2) having a water inlet (201) permitting introduction of cooling water therethrough, and a water outlet (202) in fluid communication with the water inlet (301) of the second water passage (30) in the cylinder head (3) , the water inlet and outlets (201, 202) in the cylinder (2) being adj acent to and being located on two sides of the spacer wall (21) , respectively, so that the cooling water can flow from the water inlet (201) of the first water passage (20) in the cylinder (2) to the water outlet (202) of the first water passage (20) in the cylinder (2) along a circumferential direction.

2. The water-cooling type engine as claimed in Claim 1, further **characterized by** an auxiliary water conduit (5) that is connected to the cylinder (2) and the cylinder head (3) and that is in fluid communication with the water outlet (202) of the first water passage (20) in the cylinder (2) and the water inlet (301) of the second water passage (30) in the cylinder head (3).

3. The water-cooling type engine as claimed in Claim 1, **characterized in that** the sealing gasket (4) is formed with a hole (44) therethrough that is in fluid communication with the water outlet (202) of the first water passage (20) in the cylinder (2) and the water inlet (301) of the second water passage (30) in the cylinder head (3).

4. A water-cooling type engine including a cylinder (2), a cylinder head (3) disposed on the cylinder (2), and a sealing gasket (4) disposed between the cylinder (2) and the cylinder head (3), the cylinder (2) including an inner cylinder wall (22) and an outer cylinder wall (23) that is formed integrally with the inner cylinder wall (22) at upper and lower ends thereof so as to define a first water passage unit (20) between the inner and outer cylinder walls (22, 23), the cylinder head (3) being formed with a second water passage (30) that has a water inlet (301) in fluid communication with the first water passage (20) in the cylinder (2), and a water outlet (302), the engine being **characterized by**:

the cylinder (2) further including two aligned, radially extending spacer walls (21), each of which has a radial inner end (211) that is formed integrally with the inner cylinder wall (22), and a radial outer end (212) that is formed integrally with the outer cylinder wall (23), the first water passage unit (20) in the cylinder (2) being divided by the spacer walls (21) into a front passage portion (203) and a rear passage portion (204) that are spaced apart from each other, the front passage portion (203) having an inlet end (203A) distal to the cylinder head (3) , an outlet end (203B) proximate to the cylinder head (3), and a water inlet (201) that is adjacent to the inlet end (203A) of the front passage portion (203), the rear passage portion (204) having an inlet end (204A) proximate to the cylinder head (3) , an outlet end (204B) distal to the cylinder head (3), and a water outlet (202) that is adjacent to the outlet end (204B) of the rear passage portion (204) and that permits discharging of the cooling water from the engine therethough; and

the sealing gasket (4) being formed with a front hole (44) in fluid communication with the outlet end (203B) of the front passage portion (203) of the first water passage unit (20) and the water inlet (301) of the second water passage (30) in the cylinder head (3) , and a rear hole (44') in fluid communication with the water outlet (302) of the second water passage (30) in the cylinder head (3) and the inlet end (204A) of therearpassageportion (204) of the firstwaterpassage unit (20) , thereby permitting flow of the cooling water from the water inlet (201) of the first water passage unit (20) to the water outlet (202) of the first water passageunit (20) throughthesecondwaterpassage (30).

5. A water-cooling type engine water-cooling type engine including two juxtaposed cylinders (2) interconnected fixedly to constitute a cylinder unit, two cylinder heads (3) interconnected fixedly and dis-

posed respectively on the cylinders (2) , and a sealing gasket (4) disposed between the cylinder unit and the cylinder heads (3) , each of the cylinders (2) including an inner cylinder wall (22) and an outer cylinder wall (23) that is formed integrally with the inner cylinder wall (22) at upper and lower ends thereof so as to define a first water passage (20) between the inner and outer cylinder walls (22, 23), each of the cylinder heads (3) being formed with a second water passage (30) that has a water inlet (301) in fluid communication with the first water passages (20) in the cylinders (2) , and a water outlet (302), the engine being **characterized by**:

each of the cylinders (2) further including a radially extending spacer wall (21) that has a radial inner end (211) which is formed integrally with the inner cylinder wall (22) of a corresponding one of the cylinders (2), and a radial outer end (212) which is formed integrally with the outer cylinder wall (23) of the corresponding one of the cylinders (2);
the sealing gasket (4) being formed with two holes (44) that are in fluid communication with the water inlets (301) of the second water passages (30) in the cylinder heads (3); and
the first water passages (20) in the cylinders (2) crossing each other and having a common passage portion (25) that constitutes a portion of each of the first water passages (20), the cylinder unit having a water inlet (201) that is in fluid communication with one of the first water passages (20) in the cylinders (2) at a position among the spacer walls (21) and the common passage portion (25) and that permits introduction of cooling water therethrough, and two water outlets (202), that are formed at two sides of an assembly of the spacer walls (21), that are disposed adjacent to the spacer walls (21), respectively, and that are in fluid communication with the holes (44) in the sealing gasket (4) so as to permit the cooling water to flow from the water inlet (201) in the cylinder unit into the water outlets (202) in the cylinder unit along the first water passages (20) in the cylinders (2), after which the cooling water flows into the water inlets (301) of the second water passages (30) in the cylinder heads (3) and exits from the engine through the water outlets (302) of the second water passages (30) in the cylinder heads (3).

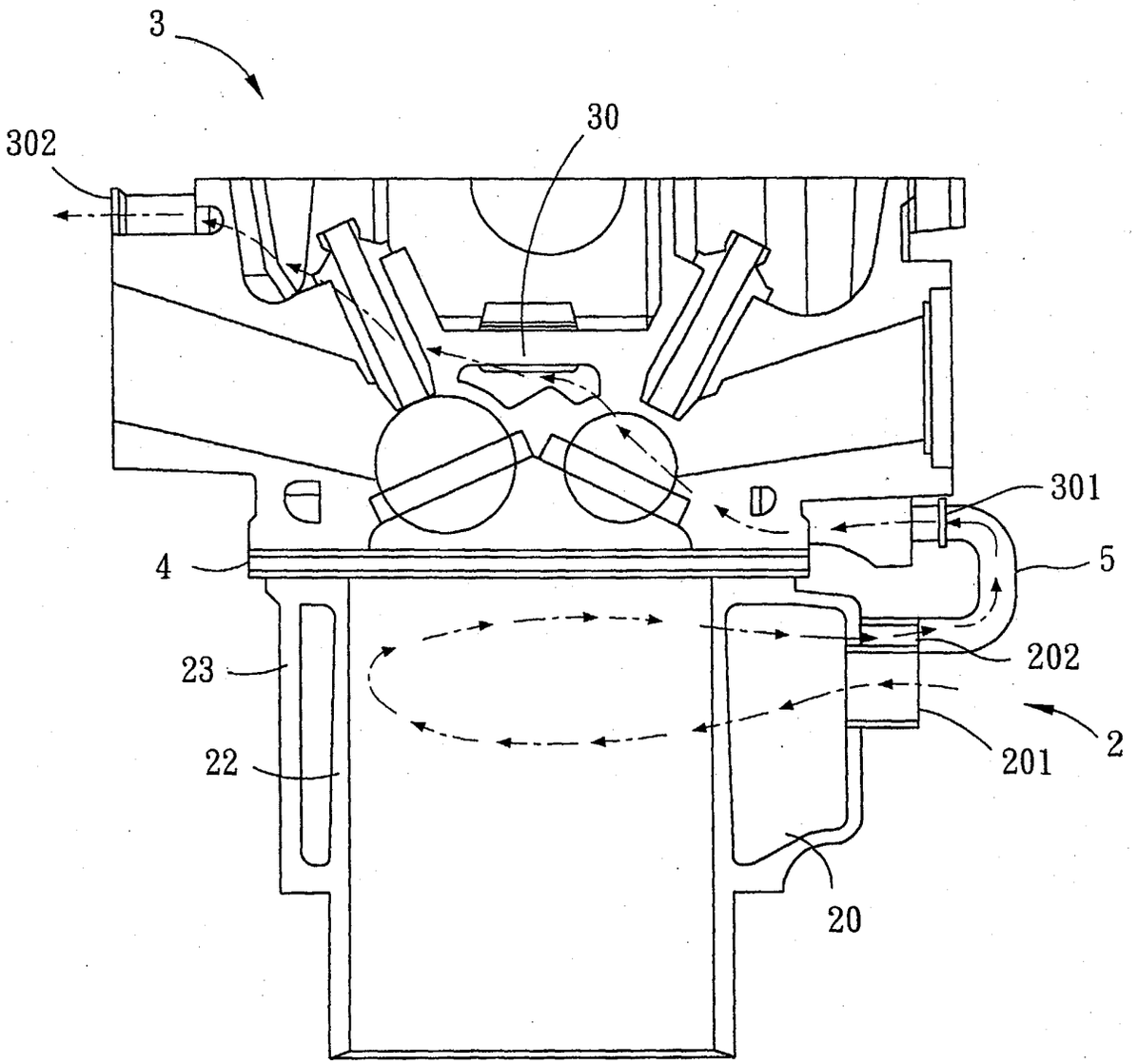

FIG. 1

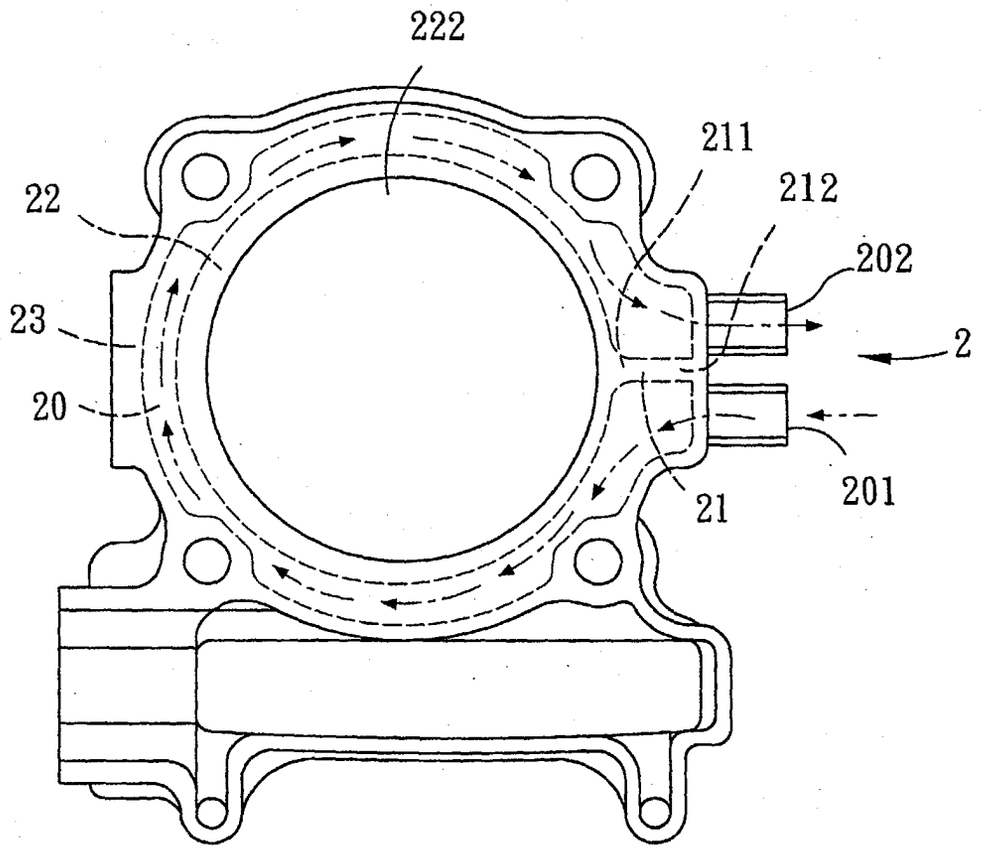

FIG. 2

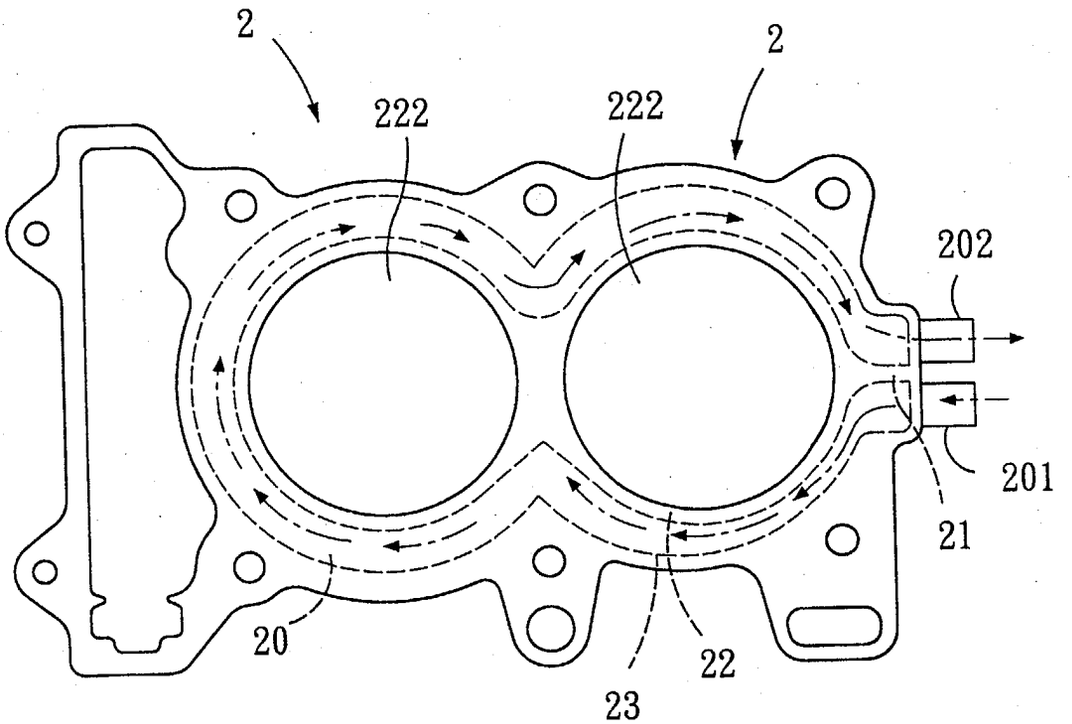

FIG. 3

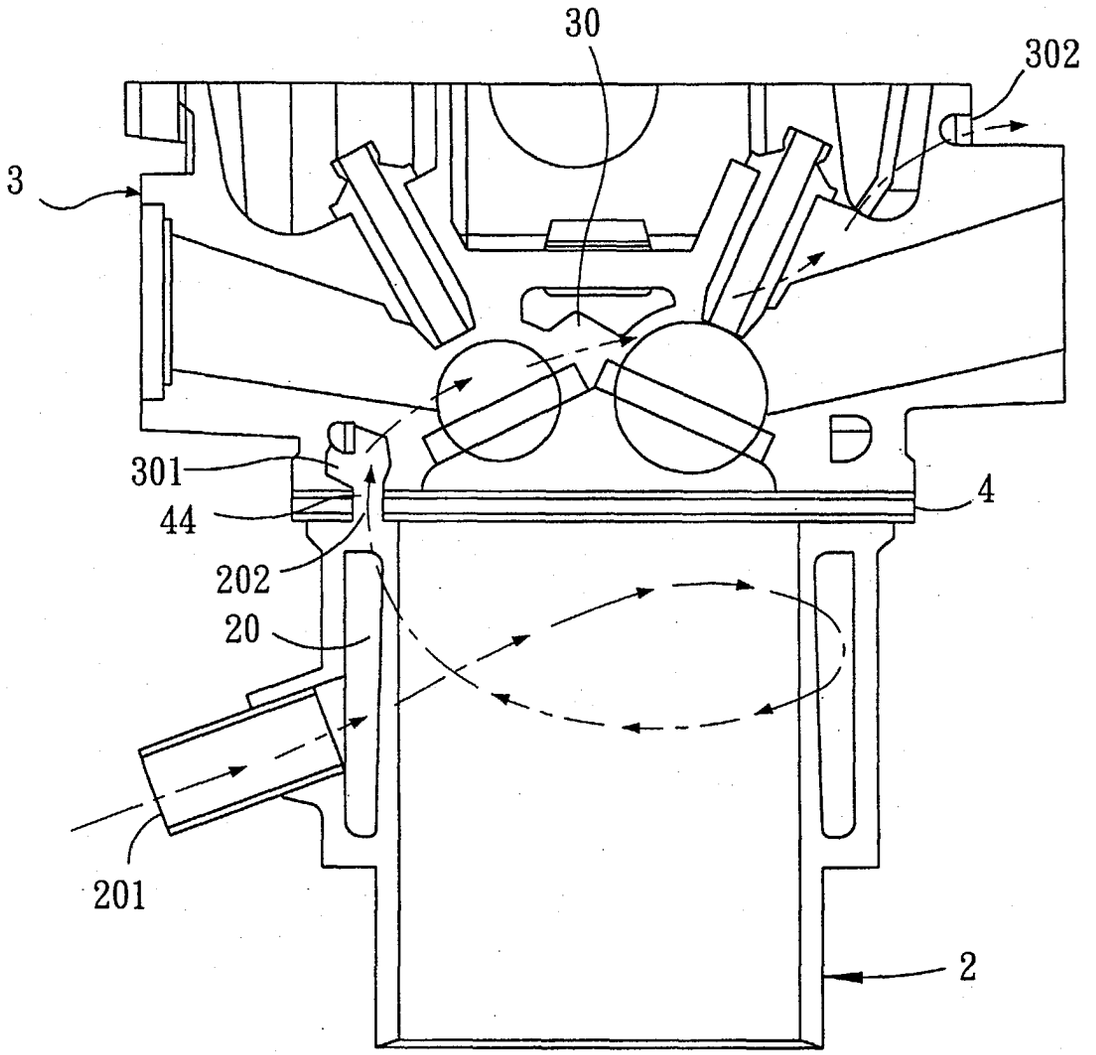

FIG. 4

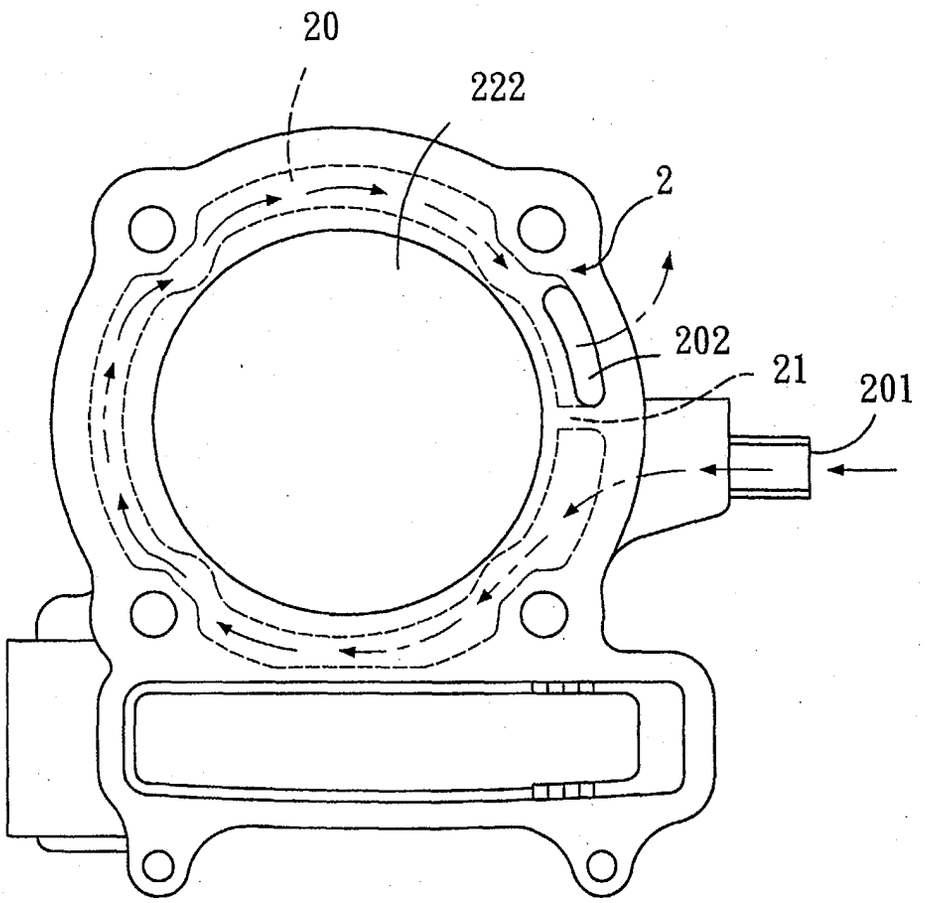

FIG. 5

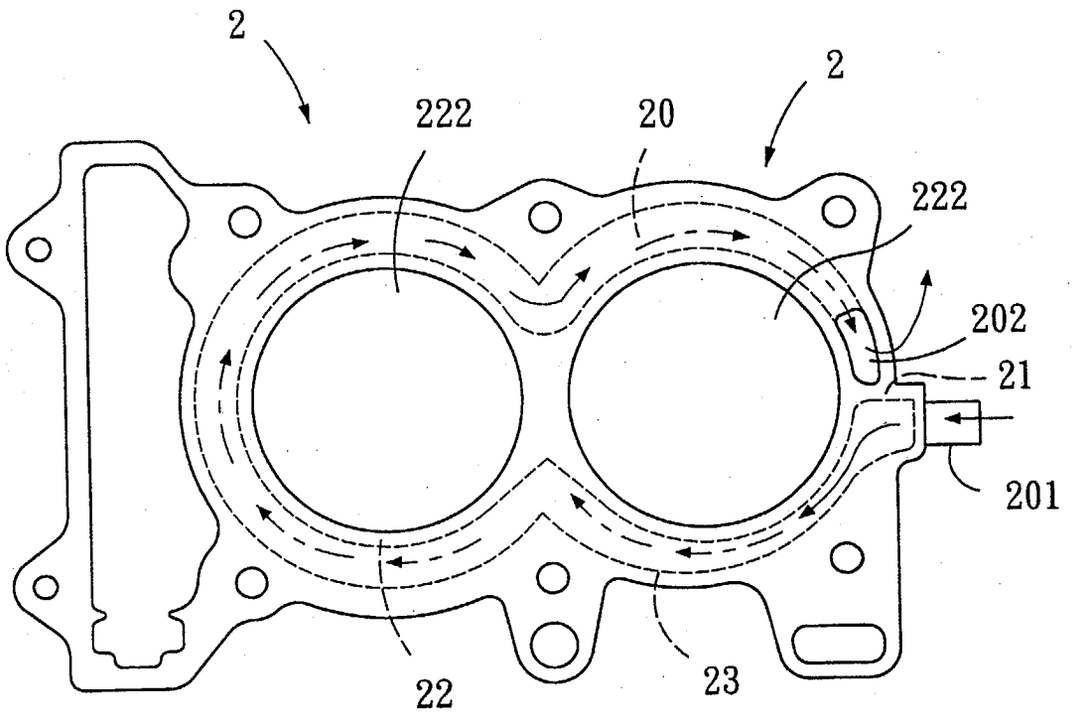

FIG. 6

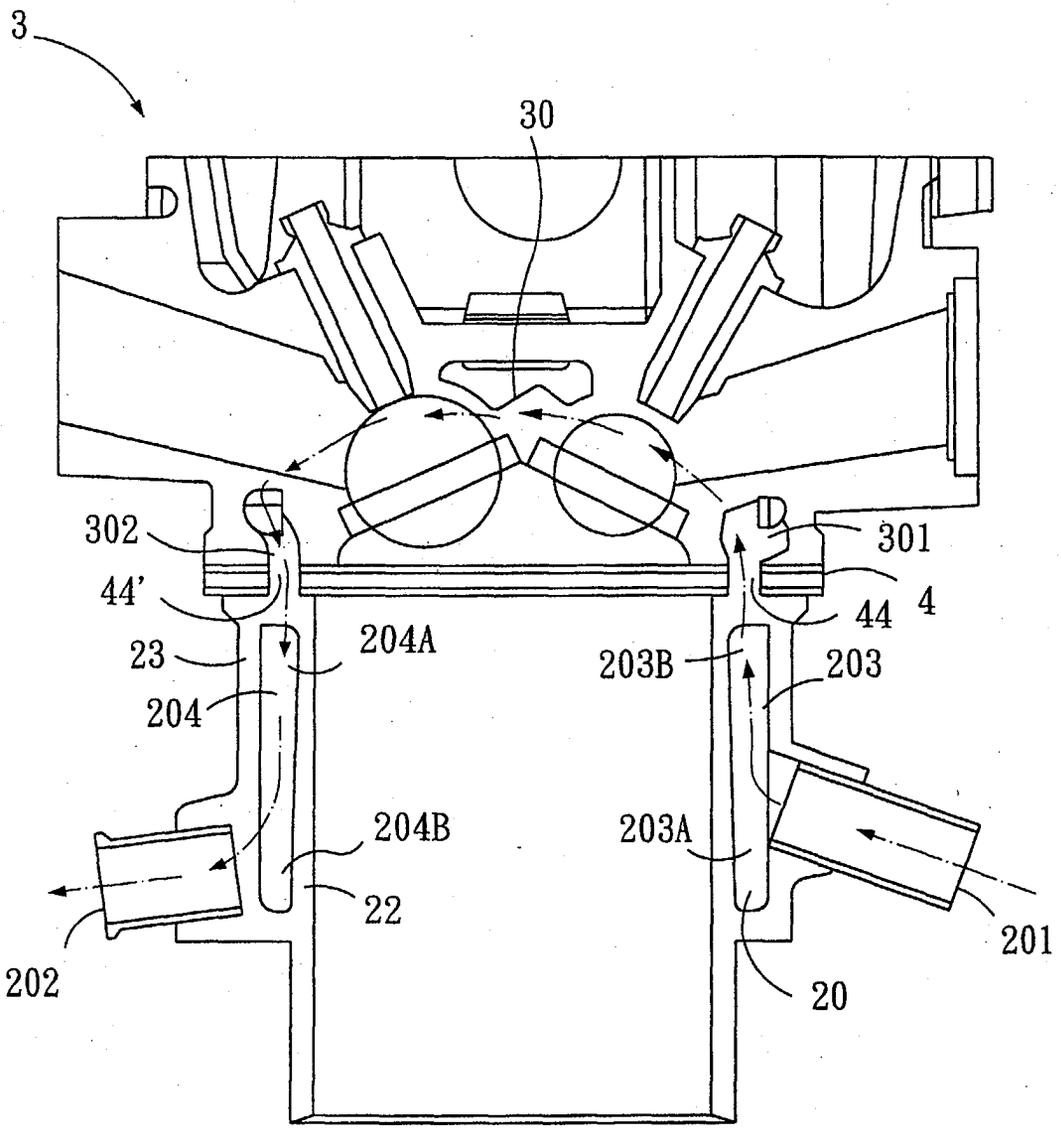

FIG. 7

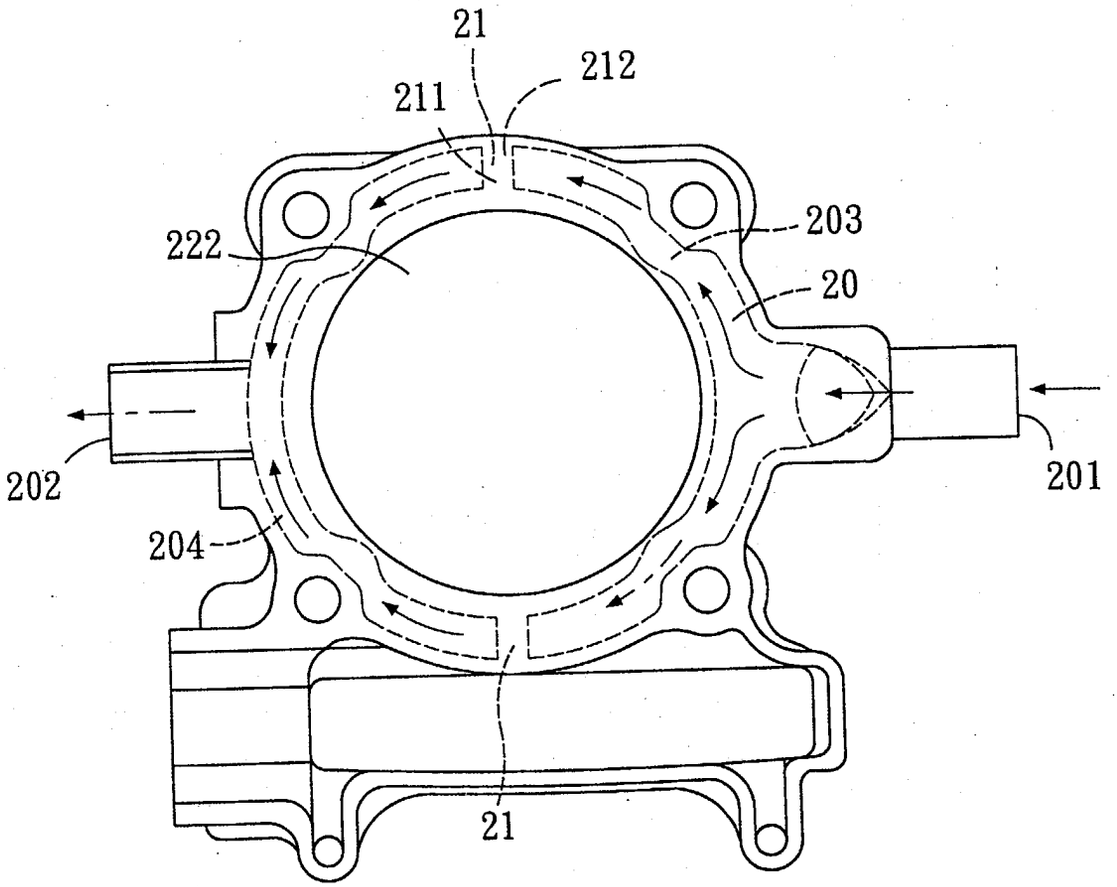

FIG. 8

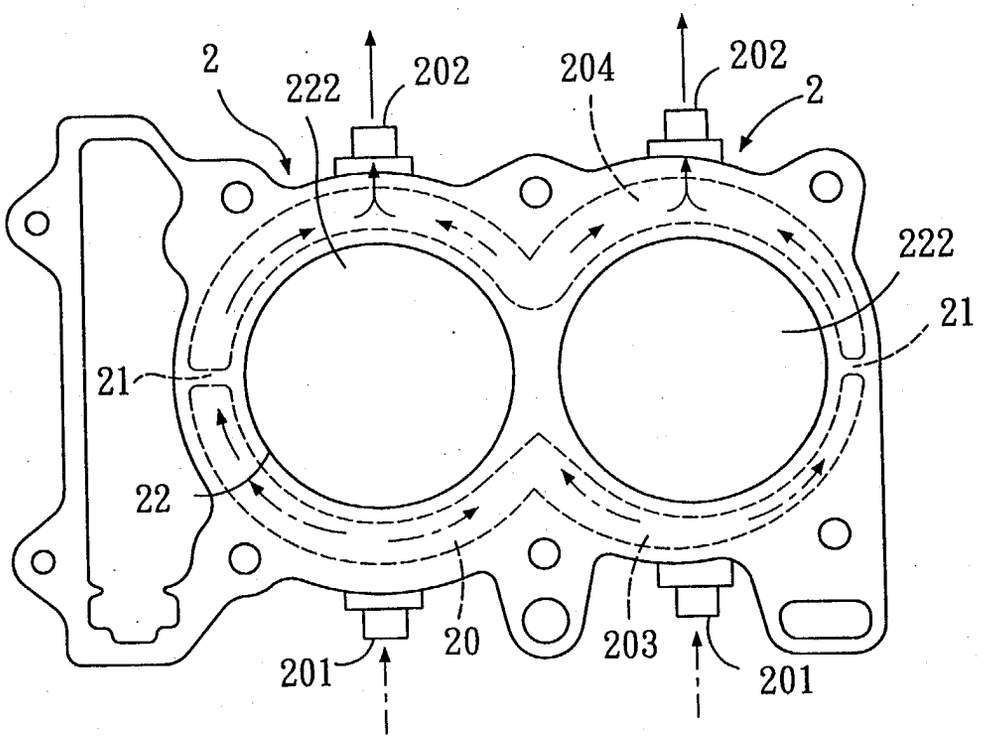

FIG. 9

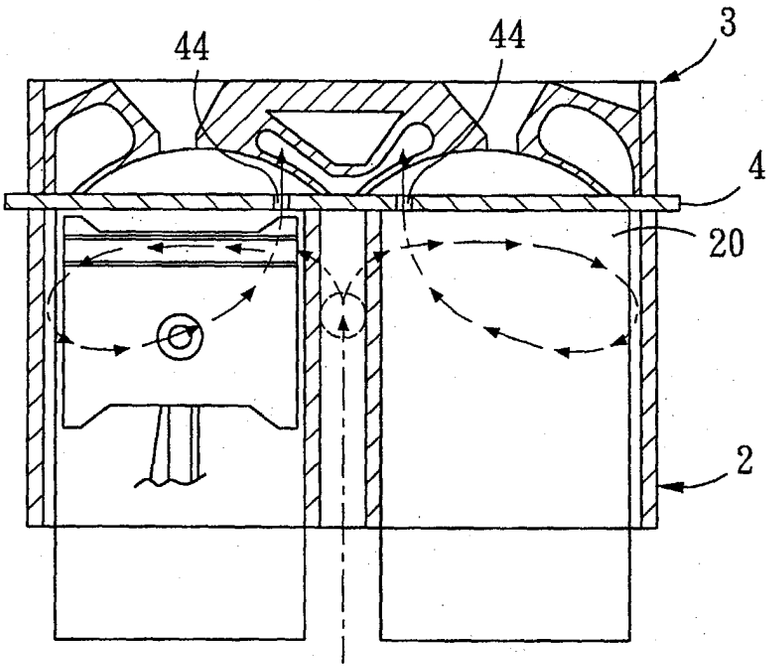

FIG. 10

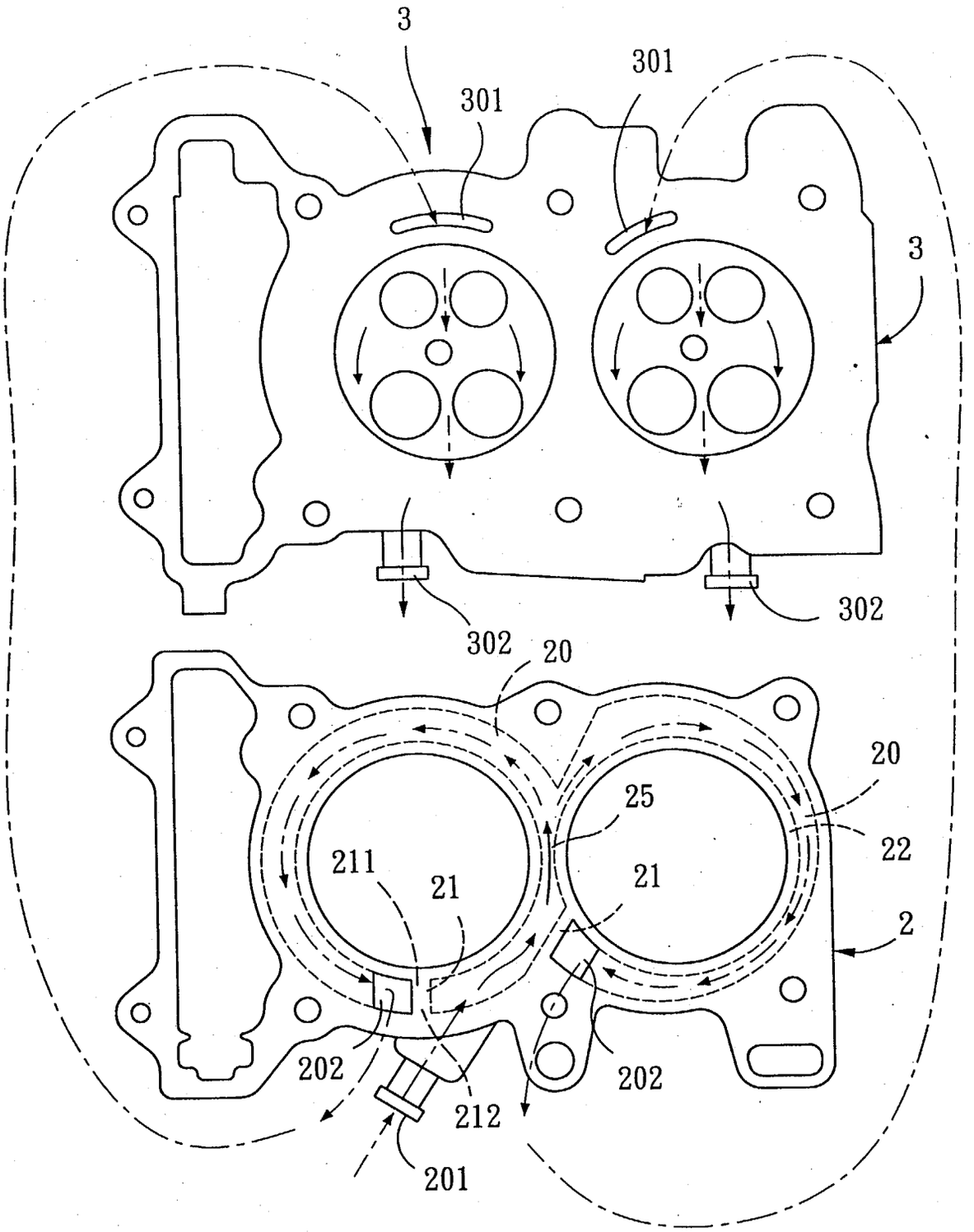

FIG. 11

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 25 3041

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 March 2004	Kooijman, F

CATEGORY OF CITED DOCUMENTS

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