



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**04.03.2009 Bulletin 2009/10**

(51) Int Cl.:  
**F01L 1/18 (2006.01)**

(21) Application number: **08252811.8**

(22) Date of filing: **22.08.2008**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR**  
 Designated Extension States:  
**AL BA MK RS**

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(30) Priority: **31.08.2007 JP 2007226672**

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(54) **Engine and vehicle**

(57) To provide a structure for determining a position of a rocker arm (412,413) that allows easy maintenance, an engine (100) has a cylinder head (113) in which a valve drive mechanism (400) is provided. The valve drive mechanism (400) includes rocker arm shafts (414,415) that are fitted to the cylinder head (113); rocker arms (412,413) that are fitted to the rocker arm shafts (414,415) so as to be moveable in the axial direction; and a head cover (114) (an upper arranging member) that is attached to the cylinder head (113). The head cover (114) is provided with guide members (731,732) that engage with the rocker arms (412,413), and guide the rocker arms (412,413) to determined positions on the rocker arm shafts (414,415) when the head cover (114) is attached to the cylinder head (113).

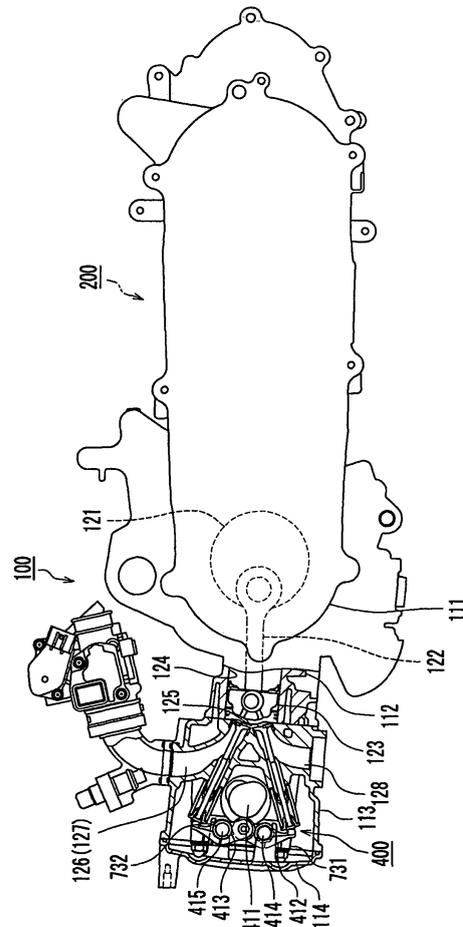


FIG. 2

## Description

### Technical Field

**[0001]** The present invention relates to an engine, and more particularly to a structure for determining the position of a rocker arm of a valve drive mechanism.

### Background Art

**[0002]** Structures for determining the position of a rocker arm of a valve drive mechanism are known such as that described in JP-A-2006-348820. In this document, a rocker arm is rockably supported by a rocker arm shaft provided in a cylinder head. Further, the position of the rocker arm is determined by elastic force of a spring mounted on the rocker arm shaft. In addition, a movement regulation member that regulates movement of the rocker arm in resistance to the elastic force of the spring is provided in a head cover.

**[0003]** As is also described in JP-A-2006-348820, in the structure for determining the position of the rocker arm using the elastic force of the spring mounted on the rocker arm shaft, vibrations when the engine is operating etc. can cause the rocker arm to move along the rocker arm shaft. As a result, ease of performing maintenance work of the rocker arm can be negatively affected because the force determining the position of the rocker arm becomes larger due to spring load increasing.

**[0004]** In addition, the above document describes a structure in which the movement regulation member, which regulates movement of the rocker arm in resistance to the elastic force of the spring, is provided on the head cover. In this structure, movement of the rocker arm caused by vibrations when the engine is operating etc. can be inhibited without making the strength of the spring that large. However, in this structure, there is a slight gap between the rocker arm that is positioned in a determined location by the spring, and the movement regulation member. Thus, vibrations when the engine is operating etc. can cause the rocker arm to oscillate in the axial direction of the rocker arm shaft. If the rocker arm oscillates, it is possible that a knocking sound will be generated by the rocker arm hitting against the movement regulation member or the like.

**[0005]** The invention seeks to provide a new structure for determining the position of a rocker arm that facilitates maintenance.

### Summary

**[0006]** An embodiment of an engine according to the invention has a cylinder head provided with a valve drive mechanism. The valve drive mechanism includes a rocker arm shaft that is fitted to the cylinder head, a rocker arm that is fitted to the rocker arm shaft so as to be moveable in the axial direction, and an upper arranging member that is attached to an upper section of the cylinder

head. The upper arranging member is provided with a guide member that engages with the rocker arm, and guides the rocker arm to a determined position on the rocker arm shaft when the upper arranging member is attached to the cylinder head.

**[0007]** Moreover, the guide member may engage with the rocker arm such that the rocker arm is held at the determined position on the rocker arm shaft when the upper arranging member has been attached to the upper section of the cylinder head.

**[0008]** With such an engine, when the head cover is attached to the cylinder head, the guide member guides the rocker arm to the determined position on the rocker arm shaft. In addition, when the head cover is removed, the position of the rocker arm can be changed, and thus maintenance is easy.

**[0009]** In addition, when a structure is used in which, when the upper arranging member has been attached to the upper section of the cylinder head, the guide member engages the rocker arm and holds the rocker arm in the determined position on the rocker arm shaft, even if the engine vibrates, movement of the rocker arm in the axial direction of the rocker arm shaft can be regulated, and the generation of abnormal noise can be inhibited.

### Brief Description of the Drawings

**[0010]** Embodiments of the invention are described hereinafter, by way of example only, with reference to the drawings.

FIG. 1 is a side view that shows one example of a motorcycle equipped with an engine according to an embodiment of the invention.

FIG. 2 is a cross sectional view of a section of the engine according to the embodiment of the invention.

FIG. 3 is a cross sectional view related to a valve drive mechanism of the engine according to the embodiment of the invention, and shows the positional relationship of a cam shaft, a first rocker arm that opens and closes an intake valve, and a second rocker arm that opens and closes an exhaust valve.

FIG. 4 is a plan view of a cylinder head of the engine according to the embodiment of the invention that shows a state when the first and the second rocker arms are respectively held at first positions.

FIG. 5 is a cross sectional view of the cylinder head including the cam shaft of the engine according to the embodiment of the invention.

FIG. 6 is a plan view of the cylinder head of the engine according to the embodiment of the invention that shows a state when the first rocker arm has moved to a second position.

FIG. 7 is a plan view of the cylinder head of the engine according to the embodiment of the invention that shows a state when the second rocker arm has moved to a second position.

FIG. 8 is a plan view of the cylinder head of the engine

according to the embodiment of the invention that shows a state when a head cover has been removed. FIG. 9 is a bottom surface view of the head cover of the engine according to the embodiment of the invention.

FIG. 10 is a cross sectional view along the direction of arrow F in FIG. 9 showing guide members provided in the head cover of the engine according to the embodiment of the invention.

FIG. 11 is a cross sectional view along the direction of arrow H in FIG. 9 showing a first guide member provided in the head cover of the engine according to the embodiment of the invention.

FIG. 12 is a cross sectional view along the direction of arrow G in FIG. 9 showing a second guide member provided in the head cover of the engine according to the embodiment of the invention.

#### Detailed Description

**[0011]** Hereinafter, an engine according to an embodiment of the invention will be described with reference to the drawings. Note that, in the drawings, structural members or sections that have the same function are denoted with the same reference numerals, and the explanation is given based thereon. Moreover, the invention is not limited to the following embodiment.

**[0012]** In this embodiment, as shown in FIG. 2, an engine 100 includes a cylinder head 113 in which a valve drive mechanism 400 is provided. The valve drive mechanism 400 is provided with rocker arm shafts 414, 415 attached to the cylinder head 113, rocker arms 412, 413 that are fitted to the rocker arm shafts 414, 415 so as to be capable of moving in the axial direction, and a head cover 114 (an upper arranging member) that is attached to the cylinder head 113. The head cover 114 is provided with guide members 731, 732 that engage with the rocker arms 412, 413 when the head cover 114 is attached to the cylinder head 113, and that guide the rocker arms 412, 413 to determined positions on the rocker arm shafts 414, 415.

**[0013]** In the engine 100, when the head cover 114 is attached to the cylinder head 113, the guide members 731, 732 guide the rocker arms 412, 413 to the determined positions on the rocker arm shafts 414, 415. In addition, when the head cover 114 is removed, it is possible to change the positions of the rocker arms 412, 413, and thus maintenance is easy. Next, the engine 100 will be described in detail.

**[0014]** The engine 100 of the embodiment is incorporated, for example, within a swing type engine unit 101 of a scooter motorcycle 1000 (a straddle-type vehicle) as shown in FIG. 1. The engine unit 101 is provided with the single cylinder engine 100 and a transmission case 200 that also serves as a swing arm. In this embodiment, the transmission case 200 houses a V-belt type automatic transmission, and driving force is transmitted to a rear wheel 300 from the engine 100 via the V-belt type auto-

matic transmission.

**[0015]** The engine 100, as can be seen from FIG. 2, includes a crank case 111, a cylinder block 112, the cylinder head 113 and the head cover 114.

**[0016]** The crank case 111 is formed as an integrated unit with the transmission case 200, and houses a crank shaft 121. A piston 123 is connected to the crank shaft 121 via a connecting rod 122. In this embodiment, the cylinder block 112 is a cast component in which a single cylinder 124 is formed. The piston 123 that is connected to the crank shaft 121 is housed in the cylinder 124. The cylinder head 113 is attached to an opening at a head side of the cylinder 124.

**[0017]** In this embodiment, as shown in FIG. 2 and FIG. 3, the cylinder head 113 has a recess 125 in the surface that faces the cylinder 124. A combustion chamber is formed between the recess 125 and the piston 123. The cylinder head 113 is provided with a pair of intake ports 126, 127 (only one is shown in FIG. 2 and FIG. 3) that open to the combustion chamber, and a single exhaust port 128 that opens to the combustion chamber.

**[0018]** The intake port 126 (127) and the exhaust port 128, as shown in FIG. 3, include respective valve seats 126a (127a) and 128a, valve guides 126b (127b) and 128b. The valve seats 126a (127a), 128a are the members that valve head sections 301 (302), 303 of an intake valve 131 (132) and an exhaust valve 133, described hereinafter, sit on. The valve guides 126b (127b), 128b are members that guide the intake valve 131 (132) and the exhaust valve 133, and are formed by insertion holes through which valve stems 311 (312) and 313 of the intake valve 131 (132) and the exhaust valve 133, described hereinafter, are inserted. In addition, spring seats 126c (127c) and 128c are provided in the periphery of an outer side opening of the valve guides 126b (127b), 128b. Valve springs 321 (322), 323 of the intake valve 131 (132) and the exhaust valve 133, described hereinafter, sit on the spring seats 126c (127c), 128c.

**[0019]** The intake valve 131 (132) and the exhaust valve 133 are respectively provided with the valve head sections 301 (302) and 303, the valve stems 311 (312) and 313, the valve springs 321 (322) and 323, and valve retainers 331 (332) and 333.

**[0020]** The valve head sections 301 to 303 are members that perform a function as valves that fit to the valve seats 126a (127a), 128a of each port 126 to 128. The valve stems 311 to 313 are shafts that support the valve head sections 301 to 303. Each valve 131 to 133 has a structure in which the valve stems 311 to 313 are inserted into the valve guides 126b (127b), 128b from a specific one of the ports 126 to 128 of the cylinder head 113. The valve stems 311 to 313 protrude a determined distance above the cylinder head 113 from the valve guides 126b (127b), 128b when the valve head sections 301 to 303 are fitted against the valve seats 126a (127a), 128a. The valve springs 321 to 323 are attached to the valve stems 311 to 313 that protrude to the outer side of the cylinder head 113. The valve springs 321 to 323 sit on the spring

seats 126c (127c), 128c that are provided in the cylinder head 113. In addition, the valve retainers 331 to 333 are attached to end sections of the valve stems 311 to 313 with the valve springs 321 to 323 in a compressed state. The valve springs 321 to 323 are attached in a compressed state between the valve retainers 331 to 333 and the spring seats 126c (127c), 128c.

**[0021]** Each valve 131 to 133 is pushed up from the cylinder head 113 by elastic reaction force of the valve springs 321 to 323. In this state, the valve head sections 301 to 303 are fitted to the valve seats 126a (127a), 128a of each port 126 to 128, and each port 126 to 128 is closed. If the valve stems 311 to 313 are pushed downward due to any kind of external force, the valve head sections 301 to 303 separate away from the valve seats 126a (127a), 128a of each port 126 to 128, and each port 126 to 128 is opened. Furthermore, when the external force pushing the valve stems 311 to 313 downward ceases, elastic reaction force of the valve springs 321 to 323 pushes the valve retainers 331 to 333 upward. As a result, the valve head sections 301 to 303 sit on the valve seats 126a (127a), 128a of each port 126 to 128, and each port 126 to 128 is closed again.

**[0022]** In this embodiment, the valve stems 311 to 313 are pushed downward by the rocker arms 412, 413, described hereinafter. Shims 341 (342), 343 are attached to tip end sections of the valve stems 311 to 313, and the thickness of each shim 341 to 343 is adjusted such that the clearance between the rocker arms 412, 413 and the valve stems 311 to 313 is adjusted to an appropriate value.

**[0023]** Next, the rocker arm will be explained.

**[0024]** In this embodiment, the rocker arms 412, 413 use roller rocker arms (rocker rollers) that are provided with rollers 476 (486) at contact sections that contact with cams 451, 452, and reduce the contact resistance with the cams 451, 452, thereby improving fuel efficiency.

**[0025]** The rocker arms 412, 413 are provided in a valve gear chamber 600 that is formed in the cylinder head 113.

**[0026]** The cylinder head 113, as shown in FIG. 3, includes a bottom partition wall 610 that divides off a section where the intake port 126 (127) and the exhaust port (128) are formed. Furthermore, as shown in FIG. 3 to FIG. 5, the valve gear chamber 600 is formed to the outer side of the bottom partition wall 610 by four outer walls 611 to 614 that protrude to the opposite side to the cylinder block 112. The valve gear chamber 600 surrounds a bore center line O1 that is an extension of a center line of the cylinder 124. In this embodiment, the valve gear chamber 600 is divided into two sub-chambers by a support wall 615. The support wall 615 is provided between the first outer wall 611 and the second outer wall 612 which face each other, and protrudes from the bottom partition wall 610 of the valve gear chamber 600. One side of the support wall 615 is contiguous with the third outer wall 613. In this embodiment, an opening end of the valve gear chamber 600 is covered by the head cover

114 that can be attached and removed.

**[0027]** As can be seen from FIG. 3 and FIG. 4, the valve stems 311 to 313 of each of the above-described valves 131 to 133 protrude into a first chamber 601 that is between the first outer wall 611 and the support wall 615. Also, as shown in FIG. 3, the valve springs 321 to 323 and the valve retainers 331 to 333 are disposed in the first chamber 601.

**[0028]** The valve guides 126b (127b), 128b of the intake valve 131 (132) and the exhaust valve 133 shown in FIG. 3 open in the first chamber 601 that is between the first outer wall 611 and the support wall 615 as shown in FIG. 4, and the valve stems 311, 312, 313 of each valve 131 to 133 protrude into the first chamber 601.

**[0029]** The valve gear chamber 600 houses the valve drive mechanism 400 that drives the intake valves 131, 132 and the exhaust valve 133 to open and close. The valve drive mechanism 400 is provided with a cam shaft 411, the first rocker arm 412 for intake use, the second rocker arm 413 for exhaust use, the first rocker arm shaft 414 that axially supports the first rocker arm 412, and the second rocker arm shaft 415 that axially supports the second rocker arm 413.

**[0030]** The cam shaft 411, as shown in FIG. 5, is supported by the first outer wall 611 and the support wall 615 of the cylinder head 113 via respective bearings 421, 422. Note that, in order to make the figure easier to understand, the rocker arms 412, 413 and the rocker arm shafts 414, 415 are omitted from FIG. 5.

**[0031]** The cam shaft 411 is provided to extend at right angles with respect to the bore center line O1. The cam shaft 411, as shown in FIG. 4, passes through the support wall 615 and protrudes into a second chamber 602 that is between the support wall 615 and the second outer wall 612 of the cylinder head 113. A sprocket 423 is attached to the protruding section. A chain 424 is hung between the sprocket 423 and the crank shaft 121 (refer to FIG. 2). The chain 424 functions to input rotational driving force to the cam shaft 411 and causes the cam shaft 411 to rotate at a rotational speed that is aligned with the rotation of the crank shaft 121, and half the speed thereof.

**[0032]** The cam shaft 411, as can be seen from FIG. 3 and FIG. 5, is provided with the intake cam 451 and the exhaust cam 452. The intake cam 451 and the exhaust cam 452 are provided at positions that are a determined distance away from the cam shaft 411 in the axial direction so as to correspond respectively with the first rocker arm 412 for intake use and the second rocker arm 413 for exhaust use. Note that, in this embodiment, an oil supply passage 453 is formed in the cam shaft 411 and supplies lubrication oil to cam surfaces of the intake cam 451 and the exhaust cam 452.

**[0033]** Next, the rocker arms 412, 413 will be explained.

**[0034]** The first rocker arm shaft 41-4 that axially supports the first rocker arm 412 and the second rocker arm shaft 415 that axially supports the second rocker arm

413, as shown in FIG. 3, are arranged parallel to the cam shaft 411 at positions that are displaced diagonally to the upper side from the cam shaft 411. More specifically, the first rocker arm shaft 414 and the second rocker arm shaft 415, as shown in FIG. 4, have one end that is fitted to bearing members 461, 462 provided in the first outer wall 611 of the cylinder head 113 at the valve gear chamber 600 side, and another end fitted to bearing holes 463, 464 that pass through the support wall 615.

**[0035]** The first rocker arm 412 for intake use is provided with a cylindrical boss member 471, a roller support member 472, and a pair of arm members 473, 474. A bearing hole 475, through which the first rocker arm shaft 414 is inserted, is formed in the boss member 471, and the first rocker arm shaft 414 is inserted in the bearing hole 475 such that it is slidable in the axial direction and the circumferential direction.

**[0036]** The roller support member 472 extends from an outer periphery surface of the boss member 471 in the upward direction of the cam shaft 411, and rotatably supports the roller 476. The roller 476, as shown in FIG. 3, is in rolling contact with an outer periphery surface (cam profile) of the intake cam 451 of the cam shaft 411.

**[0037]** On the other hand, the arm members 473, 474 of the first rocker arm 412, as shown in FIG. 4, protrude from the outer periphery surface of the boss member 471 toward the opposite side from the roller support member 472. The arm members 473, 474 branch into two, and tip ends of the arm members 473, 474 are positioned away from and facing the tip ends of the valve stems 311, 312 of the two intake valves 131 (132) provided in the cylinder head 113. The tip ends of the arm members 473, 474, as shown in FIG. 3, are provided with pressing portions 477, 478 that press head sections of the valve stems 311 (312) of the respective intake valves 131, 132.

**[0038]** The second rocker arm 413 for exhaust use is provided with a cylindrical boss member 481, a roller support member 482, and an arm member 483. A bearing hole 485, through which the second rocker arm shaft 415 is inserted, is formed in the boss member 481, and the second rocker arm shaft 415 is inserted through the bearing hole 485 such that it is slidable in the axial direction and the circumferential direction.

**[0039]** The roller support member 482 protrudes from an outer periphery surface of the boss member 481, and rotatably supports the roller 486. The roller 486, as shown in FIG. 3, is in rolling contact with an outer periphery surface (cam profile) of the intake cam 451 of the cam shaft 411. On the other hand, the arm member 483 of the second rocker arm 413 protrudes from the outer periphery surface of the boss member 481 toward the opposite side from the roller support member 482. A tip end of the arm member 483 is provided with a pressing portion 487 that presses tip ends of the valve stems 311 to 313 of the exhaust valve 133.

**[0040]** In this embodiment, as can be seen from FIG. 3 and FIG. 4, the shims 341 to 343 with the specific thickness are attached to the upper sections of each of the

valve stems 311 to 313. The thickness of the shims 341 to 343 is adjusted to adjust the clearance between the rocker arms 412, 413 and the valve stems 311 to 313 to an appropriate value. This operation is performed with the rocker arms 412, 413 displaced with respect to the position of the head sections of the valve stems 311 to 313, as shown in FIG. 6 and FIG. 7. In this manner, from the point of view of making the adjustment and maintenance of the valve drive mechanism 400 easier, it is better that the rocker arms 412, 413 can be easily displaced with respect to the position of the head sections of the valve stems 311 to 313. In addition, from the point of view of allowing the valve drive mechanism 400 to function normally, a structure is adopted in which the position of the rocker arms 412, 413 on the rocker arm shafts 414, 415 is determined at an appropriate position at which the rocker arms 412, 413 are located at a determined position with respect to the valve stems 311 to 313.

**[0041]** In this embodiment, the boss member 471 of the first rocker arm 412 is supported by the first rocker arm shaft 414 such that it is slidable in the axial direction. More specifically, the first rocker arm 412, as shown in FIG. 4, slides in the axial direction of the first rocker arm shaft 414 between a first position and a second position.

At the first position, the pressing member 477 (478) of the arm member 473 (474) faces the tip end of the valve stem 311 (312), and at the second position, as shown in FIG. 6, the pressing member 477 (478) of the arm member 473 (474) is offset to the side from the tip end of the valve stem 311 (312).

**[0042]** On the other hand, the boss member 481 of the second rocker arm 413 is supported by the second rocker arm shaft 415 such that it is slidable in the axial direction. More specifically, the second rocker arm 413, as shown in FIG. 3, slides in the axial direction of the second rocker arm shaft 415 between a first position and a second position. At the first position, the pressing member 487 of the arm member 483 faces the tip end of the valve stem 313, and at the second position, as shown in FIG. 7, the pressing member 487 of the arm member 483 is displaced to the side from the tip end of the valve stem 313.

**[0043]** In this embodiment, as shown in FIG. 4, at the respective first positions, the first rocker arm 412 abuts against the bearing member 461 provided in the first outer wall 611 at the valve gear chamber 600 side, and the second rocker arm 413 abuts against the support wall 615.

**[0044]** In addition, the pressing members 477, 478, 487 of each of the arm members 473, 474, 483 have their positions determined such that they respectively face the tip ends of the respective valve stems 311 to 313. At this time, when movement toward the respective positions takes place, the first rocker arm 412 and the second rocker arm 413 move in the opposite direction in the axial direction on the respective first rocker arm shaft 414 and the second rocker arm shaft 415.

**[0045]** Moreover, in this embodiment, washers 501, 502 (ring members) are fitted to each of the rocker arm

shafts 414, 415. The washers 501, 502 are fitted at the side that is offset from the first position (the second position side) at which the pressing members 477, 478, 487 of the arm members 473, 474, 483 of the respective rocker arms 412, 413 face the tip ends of the valve stems 311 to 313.

**[0046]** In this embodiment, as described above, after the valve drive mechanism 400 is attached, as shown in FIG. 5, a plate 491 is attached to an upper section of the first chamber 601 of the valve gear chamber 600. As shown in FIG. 4, a through hole 603 is formed in an upper side section of the support wall 615 and the first outer wall 611. The plate 491, as shown in FIG. 5, is attached by screwing a nut 604 to an end of a stud bolt, not shown in the figures, that protrudes from the through hole 603. The plate 491, as shown in FIG. 8, extends and is held between the outer wall 611 and the support wall 615 of the cylinder head 113, and provides reinforcement for the ceiling section of the first chamber 601 of the valve gear chamber 600. Also, the plate 491 has an open central section. The above-described rocker arms 412, 413, and the rocker arm shafts 414, 415 are exposed through an opening 492.

**[0047]** In this embodiment, the head cover 114 is also attached to the ceiling section of the cylinder head 113.

**[0048]** More particularly, the head cover 114, as shown in FIG. 3, is a member that is attached to cover the cylinder head 113. In this embodiment, the above-described valve gear chamber 600 of the cylinder head 113 is covered by the head cover 114. The head cover 114, as shown in FIG. 9, has a shape that can cover the opening of the ceiling section of the valve gear chamber 600 of the cylinder head 113, and bolt holes 701 are formed at positions that correspond with bolt holes 605 (refer to FIG. 4) formed in the outer walls 611 to 614 and the support wall 615.

**[0049]** In addition, in this embodiment, the head cover 114, as shown in FIG. 9, includes pins 711 that protrude in the direction in which the head cover 114 is attached to the cylinder head 113. Holes 712, which the pins 711 provided in the head cover 114 is fitted into, are formed in an upper side section of the outer wall of the valve gear chamber of the cylinder head 113, as shown in FIG. 4 and FIG. 8. In this embodiment, the pins 711 are provided at two locations in the head cover 114, and holes that correspond to the pins 711 are formed in the cylinder head 113. The pins 711 and the holes 712 determine the attachment direction when the head cover 114 is attached to the cylinder head 113. In addition, as a result of providing the pins 711 and the holes 712, looseness when the head cover 114 is attached is reduced, which thus reduces attachment error of the head cover 114.

**[0050]** Note that, in this embodiment, the pins 711 are provided in the head cover 114, and the holes 712 are formed in the cylinder head 113. However, it is sufficient that the pins 711 are provided in one of the members, i.e., the head cover 114 and the cylinder head 113, and the holes are provided in the other member. Thus, al-

though not shown in the figures, the pins may be provided in the cylinder head 113, and the holes, which the pins provided in the cylinder head 113 fit into, may be formed in the head cover 114.

**[0051]** Furthermore, in this embodiment, as can be seen from FIG. 3 and FIG. 5, a seal 721 is attached to the head cover 114. More particularly, as shown in FIG. 9, the seal 721 is fitted into a groove 722 that is formed in an inner side surface of the head cover 114. The groove 722 is formed in a section that abuts against the upper side section of the cylinder head 113. The seal 721 is a ring-shaped seal that has a shape that fits into the groove 722. The head cover 114, as shown in FIG. 3 and FIG. 5, is attached to the upper side section of the cylinder head 113 with the seal 721 fitted into the groove 722. The seal 721 provides air-tight sealing around the entire circumference of the upper side section of the cylinder head 113, and inhibits the entry of foreign matter into the valve gear chamber 600 of the cylinder head 113.

**[0052]** In this embodiment, each of the rocker arms 412, 413 is guided to the determined position on each of the rocker arm shafts 414, 415 by the head cover 114 provided in the upper section of the cylinder head 113. More particularly, the head cover 114, as shown in FIG. 9, is provided with the guide members 731, 732. The guide members 731, 732 engage with the rocker arms 412, 413 when attachment to the cylinder head 113 is carried out, and guide the rocker arms 412, 413 to the determined positions on the rocker arm shafts 414, 415.

**[0053]** In this embodiment, the guide members 731, 732, as shown in FIG. 3 and FIG. 5, are protrusions that protrude in the direction in which the head cover 114 is attached to the cylinder head 113. More particularly, the guide members 731, 732 respectively protrude from the inner side of the head cover 114 toward the positions at which the first rocker arm 412 and the second rocker arm 413, provided in the valve gear chamber 600, are disposed.

**[0054]** In this embodiment, the guide members 731, 732, as shown in FIG. 9 and FIG. 10, include recesses 733, 734 that have a circular arc shape that corresponds with the outer periphery surface of the rocker arm shafts 414, 415. When the head cover 114 is attached to the cylinder head 113, as shown in FIG. 3, the first rocker arm shaft 414 and the second rocker arm shaft 415 are fitted in the recesses 733, 734. Also, in this embodiment, the guide members 731, 732 extend toward the outer side of the pair of rocker arm shafts 414, 415 that are parallel. Slanting surfaces 735, 736 are provided at tip ends of the guide members 731, 732.

**[0055]** In this embodiment, the protrusions that act as the guide members 731, 732 are provided at positions that are offset from the determined position (the first position) on the rocker arm shaft 414 to which the rocker arms 412, 413 are guided when the head cover 114 is attached to the cylinder head 113. In addition, normal lines of the slanting surfaces 735, 736 are oriented toward the first positions that determine the positions on the rock-

er arm shafts 414, 415 of the rocker arms 412, 413.

**[0056]** More particularly, the first guide member 731 that guides the first rocker arm 412 is provided on the first rocker arm shaft 414, as shown in FIG. 9 and FIG. 11, at a position that is offset from the first position, at which the pressing member 477 (478) of the first rocker arm 412 faces the tip end of the valve stem 311 (312), toward the second position. A normal line h1 of the slanting surface 735 of the first guide member 731 is oriented toward the first position that determines the position on the first rocker arm shaft 414 of the first rocker arm 412, with respect to the direction in which the head cover 114 is attached to the cylinder head 113.

**[0057]** Moreover, the second guide member 732 that guides the second rocker arm 413 is provided on the second rocker arm shaft 415, as shown in FIG. 9 and FIG. 12, at a position that is offset from the first position, at which the pressing member 487 of the second rocker arm 413 faces the tip end of the valve stem 313, toward the second position. A normal line h2 of the slanting surface 736 of the second guide member 732 is oriented toward the first position that determines the position on the second rocker arm shaft 415 of the second rocker arm 413, with respect to the direction in which the head cover 114 is attached to the cylinder head 113.

**[0058]** In this embodiment, when the head cover 114 is attached to the cylinder head 113, the slanting surfaces 735, 736 of the guide members 731, 732 abut against (refer to FIG. 8) the washers 501, 502 fitted to the rocker arm shafts 414, 415. Also, when the head cover 114 is attached to the cylinder head 113, the rocker arms 412, 413 move toward the above-described determined first positions along the rocker arm shafts 414, 415. Once the head cover 114 is attached to the cylinder head 113, side surfaces 737, 738 of the guide members 731, 732 abut against the washers 501, 502, and the rocker arms 412, 413 are held at the first positions on the rocker arm shafts 414, 415.

**[0059]** In addition, in this embodiment, as shown in FIG. 9, the head cover 114 is provided with blocking members 741, 742 that block the washers 501, 502 when the head cover 114 is attached to the cylinder head 113 and the washers 501, 502 are tucked in with respect to the guide members 731, 732 at the opposite side from the first positions on the rocker arm shafts 414, 415. In this embodiment, the guide members 731, 732 are provided with the ribs 741, 742 on the opposite side to the first positions of the rocker arm shafts 414, 415, and the ribs 741, 742 function as the above-described blocking members.

**[0060]** When the head cover 114 is attached to the cylinder head 113, if the washers 501, 502 are tucked in with respect to the guide members 731, 732 at the opposite side from the first positions of the rocker arm shafts 414, 415, the ribs 741, 742 block the washers 501, 502 so that the head cover 114 cannot be attached to the cylinder head 113. As a result, mistakes caused by carelessness of the worker performing the assembly etc. can

be inhibited, and the position of the rocker arms 412, 413 can be determined accurately with greater certainty.

**[0061]** Moreover, in this embodiment, as shown in FIG. 4, the pair of rocker arm shafts 414, 415 are arranged in parallel in the cylinder head 113. In addition, the rocker arms 412, 413 are respectively fitted to the rocker arm shafts 414, 415. Also, the first rocker arm 412 and the second rocker arm 413 are structured such that, when the pressing members 477, 478, 487 (refer to FIG. 3) of the arm members 473, 474, 483 are respectively moved toward the determined positions that face the tip ends of the valve stems 311, 312, 313, the first rocker arm 412 and the second rocker arm 413 respectively move in opposite directions in the axial direction of the first rocker arm shaft 414 and the second rocker arm shaft 415.

**[0062]** As shown in FIG. 9, the guide member 731 that guides the first rocker arm 412 and the guide member 732 that guides the second rocker arm 413 are respectively provided in the head cover 114. When the head cover 114 is attached to the cylinder head 113, the guide members 731, 732 cause the rocker arms 412, 413 fitted to the pair of rocker arm shafts 414, 415 to move in reciprocal directions.

**[0063]** As a result, when the head cover 114 is attached to the cylinder head 113, an offsetting effect is achieved with respect to the force necessary to move the rocker arms 412, 413. Thus, the force necessary to attach the head cover 114 is reduced.

**[0064]** In addition, in this embodiment, the guide members 731, 732, as described above, protrude toward the inner side of the head cover 114. Recesses are formed at the outer side of the head cover 114 at the sections where the guide members 731, 732 are formed, and thus forgeability is improved and weight reduction is promoted.

**[0065]** In this manner, the head cover 114 is provided with the guide members 731, 732 that engage with the rocker arms 412, 413 when the head cover 114 is attached to the cylinder head 113, and that guide the rocker arms 412, 413 to the determined positions (the first positions) on the rocker arm shafts 414, 415.

**[0066]** In the engine 100, when the head cover 114 is attached to the cylinder head 113, as a result of providing the guide members 731, 732, the rocker arms 412, 413 are guided to the determined positions (the first positions) on the rocker arm shafts 414, 415. In addition, when the head cover 114 is removed, the position of the rocker arms 412, 413 can be changed.

**[0067]** Furthermore, in this embodiment, a spring that urges the rocker arms 412, 413 to the determined positions on the rocker arm shafts 414, 415 is not used as in the technology described in JP-A-2006-348820. Thus, when the head cover 114 is removed, the position of the rocker arms 412, 413 can easily be changed, and maintenance work can be carried out easily.

**[0068]** Also, in this embodiment, once the head cover 114 is attached to the upper section of the cylinder head 113, the guide members 731, 732 engage with the rocker

arms 412, 413 and hold the rocker arms 412, 413 at the determined positions on the rocker arm shafts 414, 415. As a result, even if the engine 100 vibrates, movement of the rocker arms 412, 413 in the axial direction of the rocker arm shafts can be regulated, and the generation of abnormal noise can be inhibited.

**[0069]** Furthermore, in this embodiment, the rocker arms 412, 413 have a structure in which the guide members 731, 732 provided in the head cover 114 abut against the washers 501, 502 fitted to the rocker arm shafts 414, 415. The washers 501, 502 are interposed between the guide members 731, 732 provided in the head cover 114 and the rocker arms 412, 413. As a result, the guide members 731, 732 do not directly come into contact with the rocker arms 412, 413 that rock strongly during use, and thus the generation of vibration and wear in the head cover 114 can be reduced. In addition, as a result of interposing the washers 501, 502 between the guide members 731, 732 provided in the head cover 114 and the rocker arms 412, 413, when the head cover 114 is assembled to the cylinder head 113, the force acting on the washers 501, 502 from the guide members 731, 732 acts on the rocker arms 412, 413 via the washers 501, 502. Thus, because an axial direction force acts on the rocker arms 412, 413, resistance when assembling the head cover 114 to the cylinder head 113 can also be reduced. Accordingly, it is favorable that the washers 501, 502 have a required strength, and have such a surface structure that a surface treatment allows wear to be reduced. A plurality of the washers 501, 502 may be interposed between the rocker arms 412, 413 and the guide members 731, 732.

**[0070]** In addition, in this embodiment, the guide members 731, 732, as shown in FIG. 5 and FIG. 9, are provided with the slanting surfaces 735, 736 that guide the rocker arms 412, 413 when the head cover 114 is attached to the cylinder head 113. Providing the slanting surfaces 735, 736 allows the rocker arms 412, 413 to be guided, and thus because the rocker arms 412, 413 can be guided in a continuous gradual manner as the head cover 114 is assembled to the cylinder head 113, resistance when the head cover 114 is assembled to the cylinder head 113 is reduced, and the assembly operation is made easier.

**[0071]** Hereinabove, the engine according to the embodiment of the invention is described. However, the engine according to the invention is not limited to the above-described embodiment.

**[0072]** For example, the engine, and particularly the structure of the valve drive mechanism etc., described as an example in the above embodiment is just one example of an embodiment to which the invention is applied. However, the invention is not limited to the above-described embodiment. The engine, and particularly the structure of the valve drive mechanism etc., can be applied to various structures.

**[0073]** In addition, in the above example, the upper arranging member disposed at the upper section of the

cylinder head 113 and provided with the guide members 731, 732 is the head cover 114 that covers the top section of the cylinder head 113. However, the upper arranging member is not limited to being the head cover 114. So long as the upper arranging member is a member that is disposed at the upper section of the cylinder head 113, and that has the guide members 731, 732 like those described above, the upper arranging member may be a member like a cam carrier, a cam holder etc. that supports a cam member of the valve drive mechanism.

**[0074]** Furthermore, in the above description, a structure is described in which the washers, that can abut against the rocker arms, are fitted to the rocker arm shafts. However, a structure in which the washers are not provided and the rocker arms directly abut against the guide members may be used. In this case, it is favorable that surface treatment is applied to the section where the rocker arms and the guide members contact so as to inhibit wear.

**[0075]** Furthermore, the members fitted to the rocker arm shafts are not limited to washers. Any member with a ring-like shape may be used. Note that, it is particularly favorable that the ring-shaped members have the required strength, material etc. to achieve the same effects as the above-described washers.

**[0076]** The above-described engine can be applied as an engine mounted in a straddle-type vehicle like a scooter motorcycle, for example. In addition, the above-described structure of the engine can be favorably used in not just the above-described type of engine, but also in various other types of engine. Description of the Reference Numerals and Signs

1000 Motorcycle (Vehicle)  
 100 Engine  
 113 Cylinder head  
 114 Head cover  
 301-303 Valve head sections  
 311-313 Valve stems  
 321-323 Valve springs  
 331-333 Valve retainers  
 341-343 Shims  
 400 Valve drive mechanism  
 411 Cam shaft  
 412 First rocker arm  
 413 Second rocker arm  
 414 First rocker arm shaft  
 415 Second rocker arm shaft  
 423 Sprocket  
 424 Chain  
 451, 452 Cam  
 453 Oil supply passage  
 461 Bearing member  
 463 Bearing hole  
 471, 481 Boss member  
 472, 482 Roller support members  
 473, 474, 483 Arm members  
 475, 485 Bearing holes

476, 486 Rollers  
 477, 478, 487 Pressing members  
 491 Plate  
 492 Opening  
 501, 502 Washers (Ring-shaped members) 5  
 600 Valve gear chamber  
 711 Pin  
 712 Hole  
 731 First guide member (Protrusion)  
 732 Second guide member (Protrusion) 10  
 735 Slanting surface  
 736 Slanting surface  
 741, 742 Ribs (blocking members)  
 h1 Normal line of slanting surface  
 h2 Normal line of slanting surface 15

### Claims

1. An engine having a cylinder head provided with a valve drive mechanism, wherein the valve drive mechanism includes a rocker arm shaft that is fitted to the cylinder head, a rocker arm that is fitted to the rocker arm shaft so as to be moveable in the axial direction, and an upper arranging member that is attached to an upper section of the cylinder head, wherein the upper arranging member is provided with a guide member that engages with the rocker arm, and guides the rocker arm to a determined position on the rocker arm shaft when the upper arranging member is attached to the cylinder head. 20
2. The engine according to claim 1, wherein a ring-shaped member is fitted to the rocker arm shaft such that the ring-shaped member can abut against the rocker arm, and the guide member guides the rocker arm to the determined position on the rocker arm shaft via the ring-shaped member when the upper arranging member is attached to the cylinder head. 25
3. The engine according to claim 1 or claim 2, wherein when the upper arranging member has been attached to the cylinder head, the upper arranging member covers a section where the rocker arm is fitted to the rocker arm shaft. 30
4. The engine according to claim 3, wherein the guide member is a protrusion that protrudes in the direction in which the upper arranging member is attached to the cylinder head. 35
5. The engine according to claim 4, wherein the ring-shaped member that can abut against the rocker arm is fitted to the rocker arm shaft, and the upper arranging member has a blocking member that, when the upper arranging member is attached to the cylinder head, blocks the ring-shaped member in the case that the ring-shaped member is tucked away with respect to the guide members at the opposite side from the determined position on the rocker arm shaft. 40
6. The engine according to claim 1 or claim 2, wherein when the upper arranging member has been attached to the upper section of the cylinder head, the guide member engages with the rocker arm or the ring-shaped member, and holds the rocker arm at the determined position on the rocker arm shaft. 45
7. The engine according to claim 6, wherein the protrusion has a slanting surface that abuts against the rocker arm or the ring-shaped member when the upper arranging member is attached to the cylinder head, and guides the rocker arm to the determined position on the rocker arm shaft. 50
8. The engine according to claim 7, wherein the protrusion is located at a position that is offset from the determined position on the rocker arm shaft to which the rocker arm is guided when the upper arranging member is attached to the cylinder head, and a normal line of the slanting surface is oriented toward the determined position on the rocker arm shaft that determines the position of the rocker arm. 55
9. The engine according to any one of the preceding claims, wherein one member among the upper arranging member and the cylinder head has a pin that protrudes in the direction in which the upper arranging member is attached to the cylinder head, and a hole into which the pin is fitted when the upper arranging member is attached to the cylinder head is formed in the other member among the upper arranging member and the cylinder head.
10. The engine according to any one of the preceding claims, wherein the upper arranging member is a head cover that covers a top section of the cylinder head.
11. The engine according to any one of the preceding claims, wherein the pair of the rocker arm shafts are arranged in parallel in the cylinder head, and the rocker arms are fitted to the pair of the rocker arm shafts, and the guide members cause the rocker arms fitted to the pair of the rocker arm shafts to move in reciprocal directions when the upper arranging member is attached to the cylinder head.
12. A vehicle comprising the engine according to any one of the preceding claims.

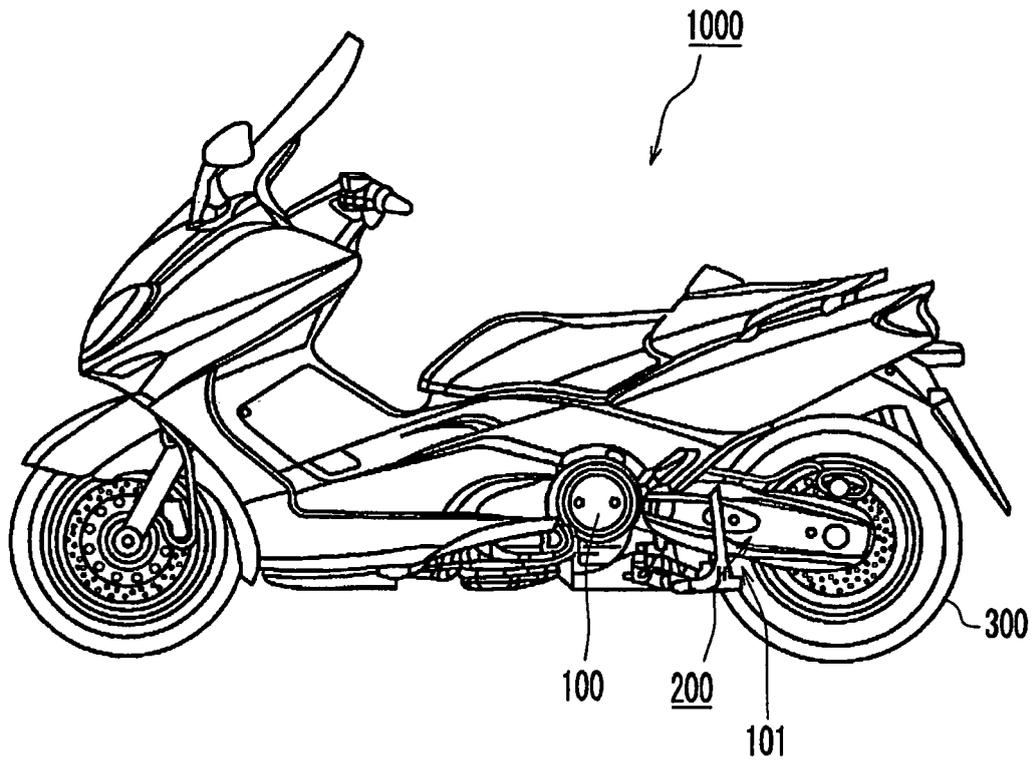


FIG. 1

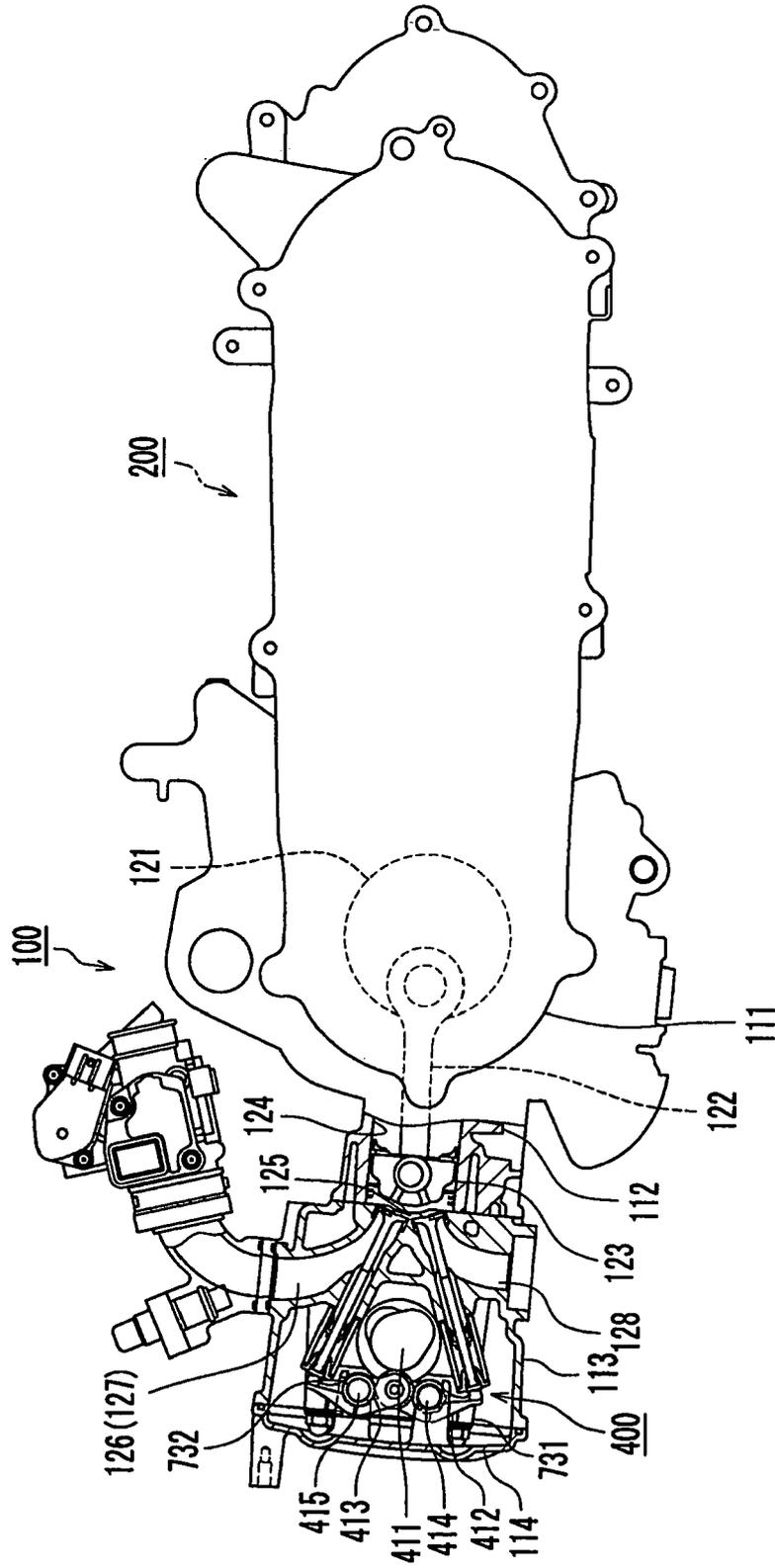


FIG. 2

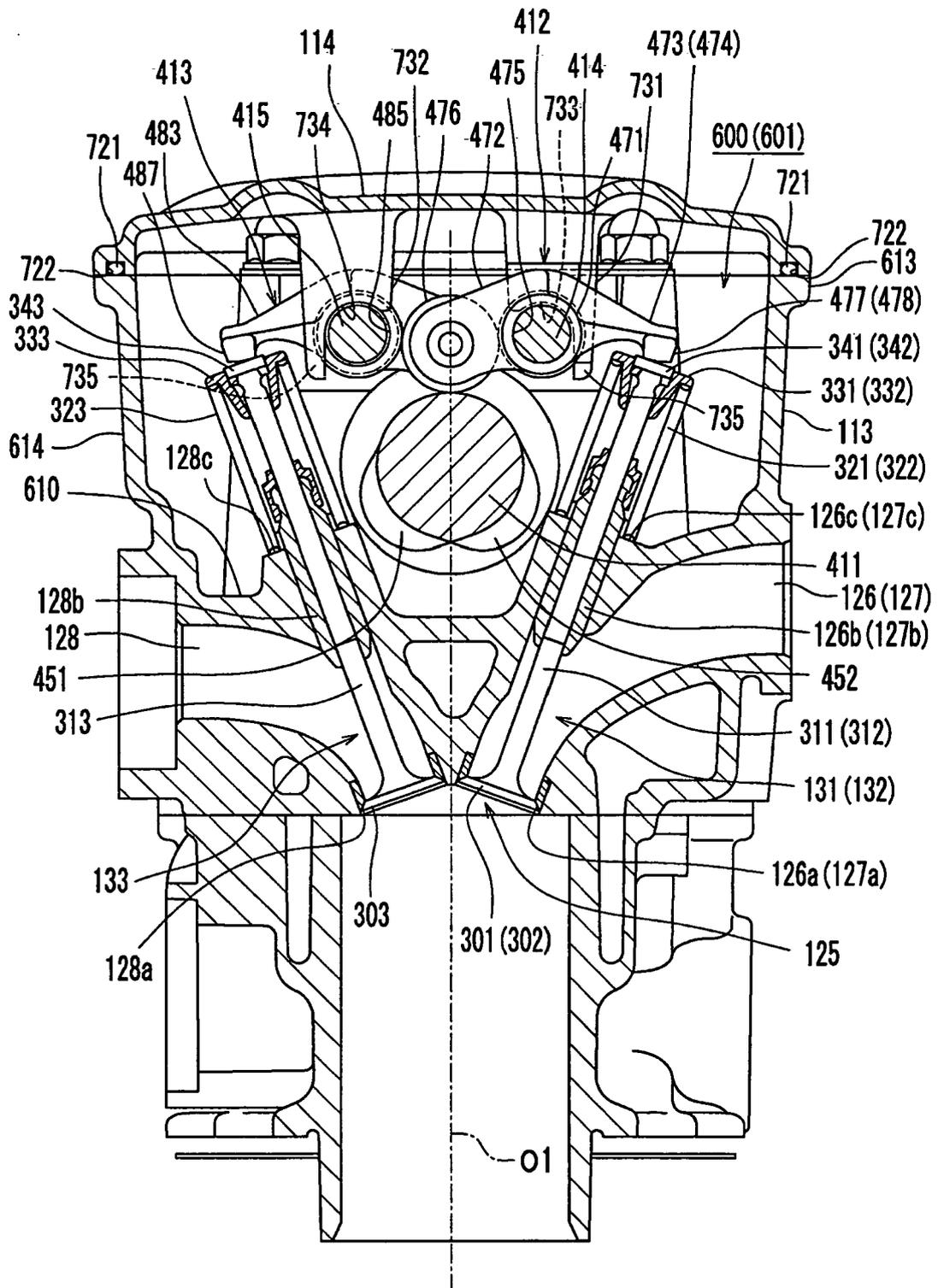


FIG. 3

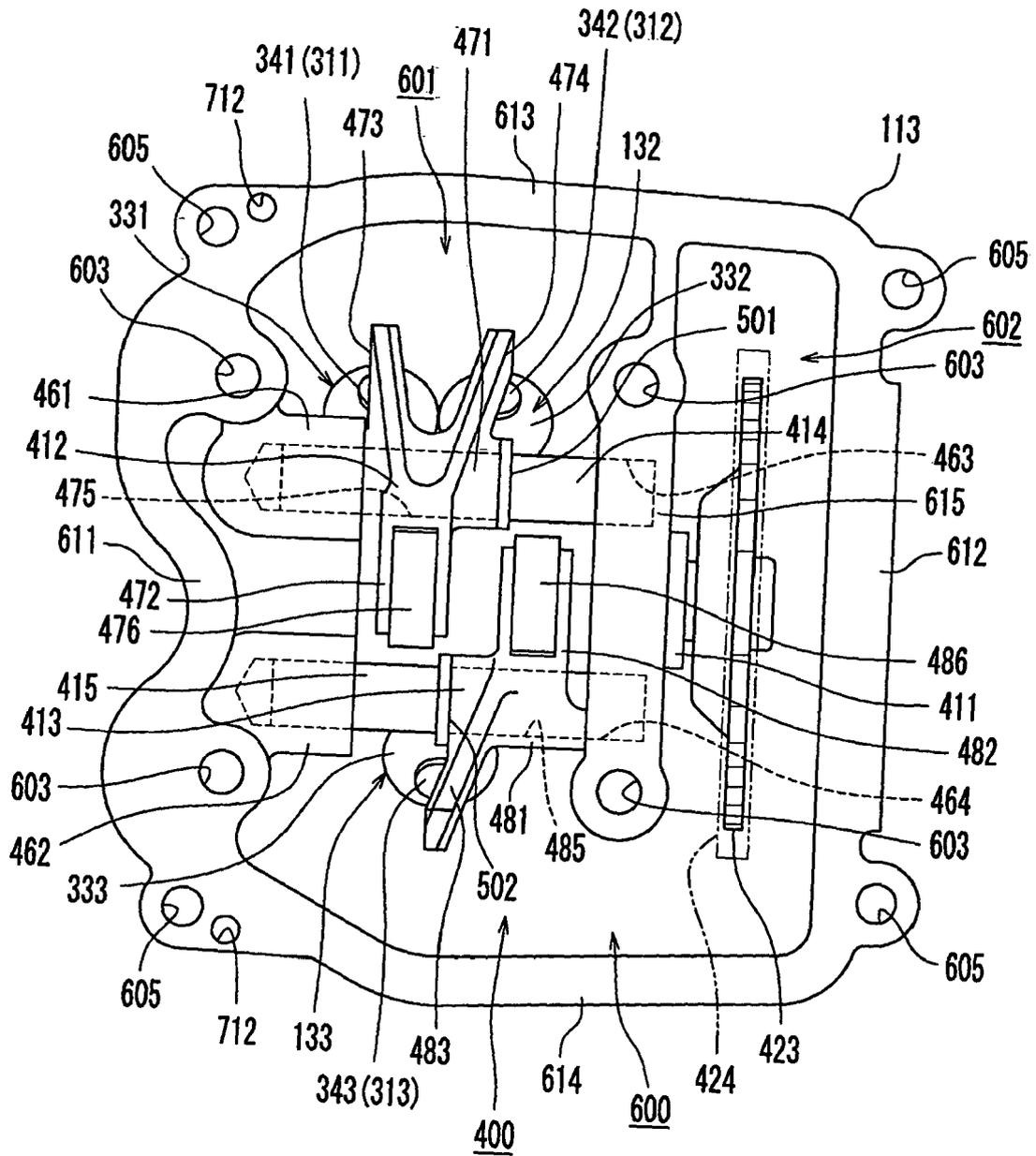


FIG. 4

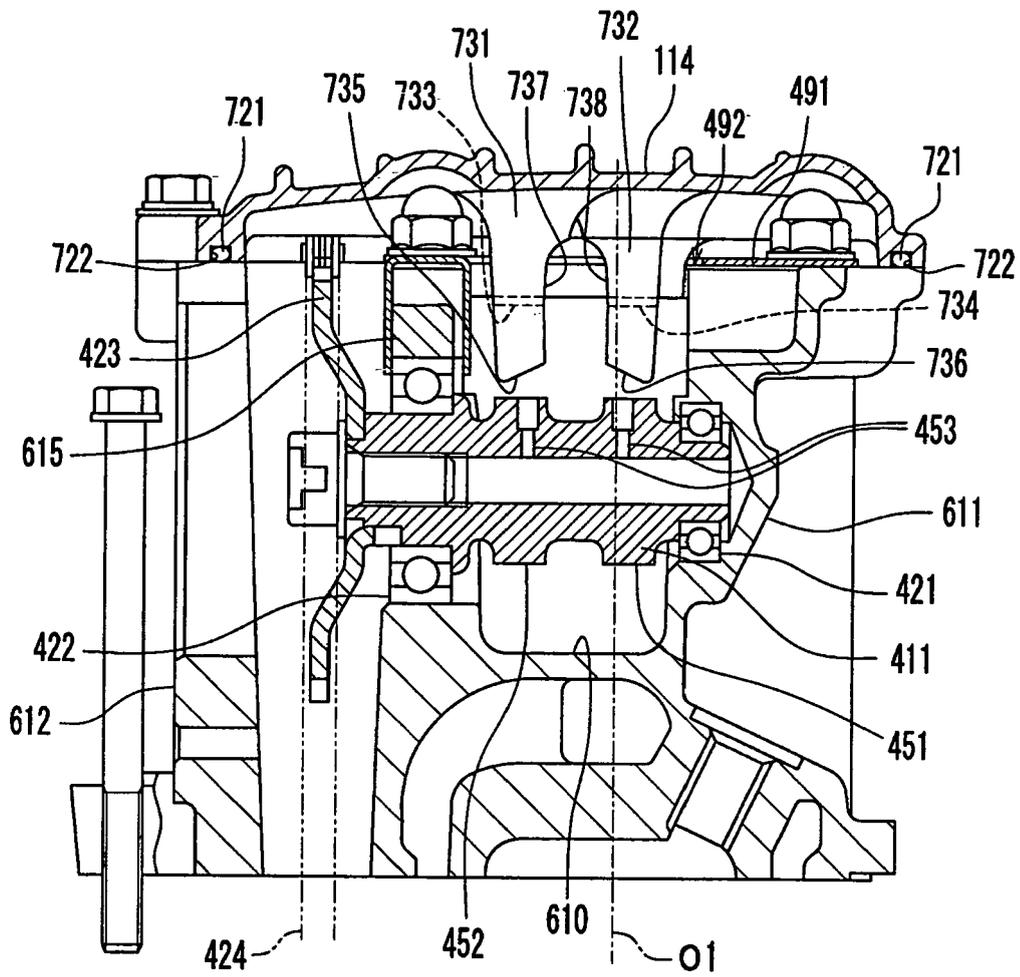


FIG. 5

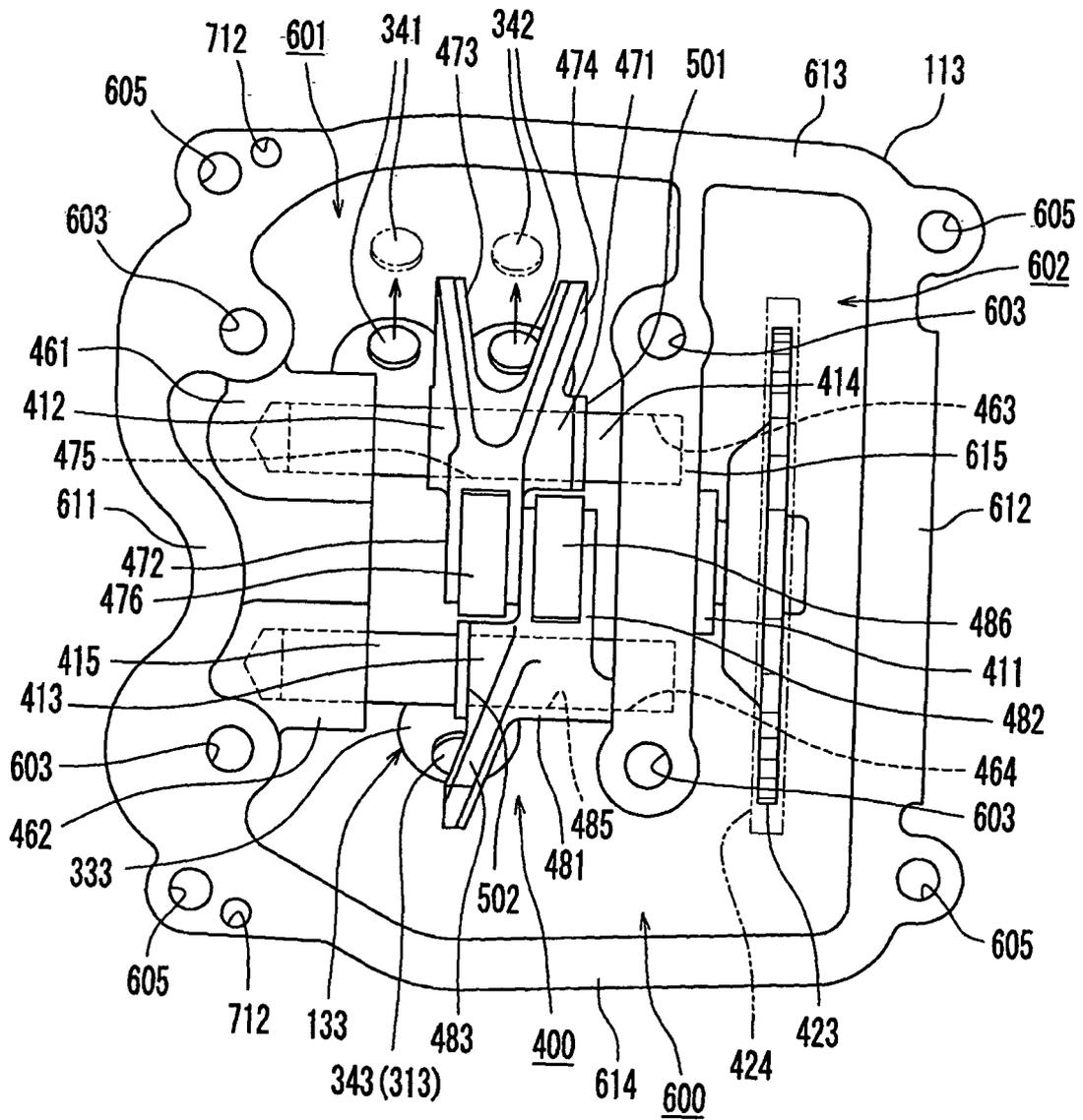


FIG. 6

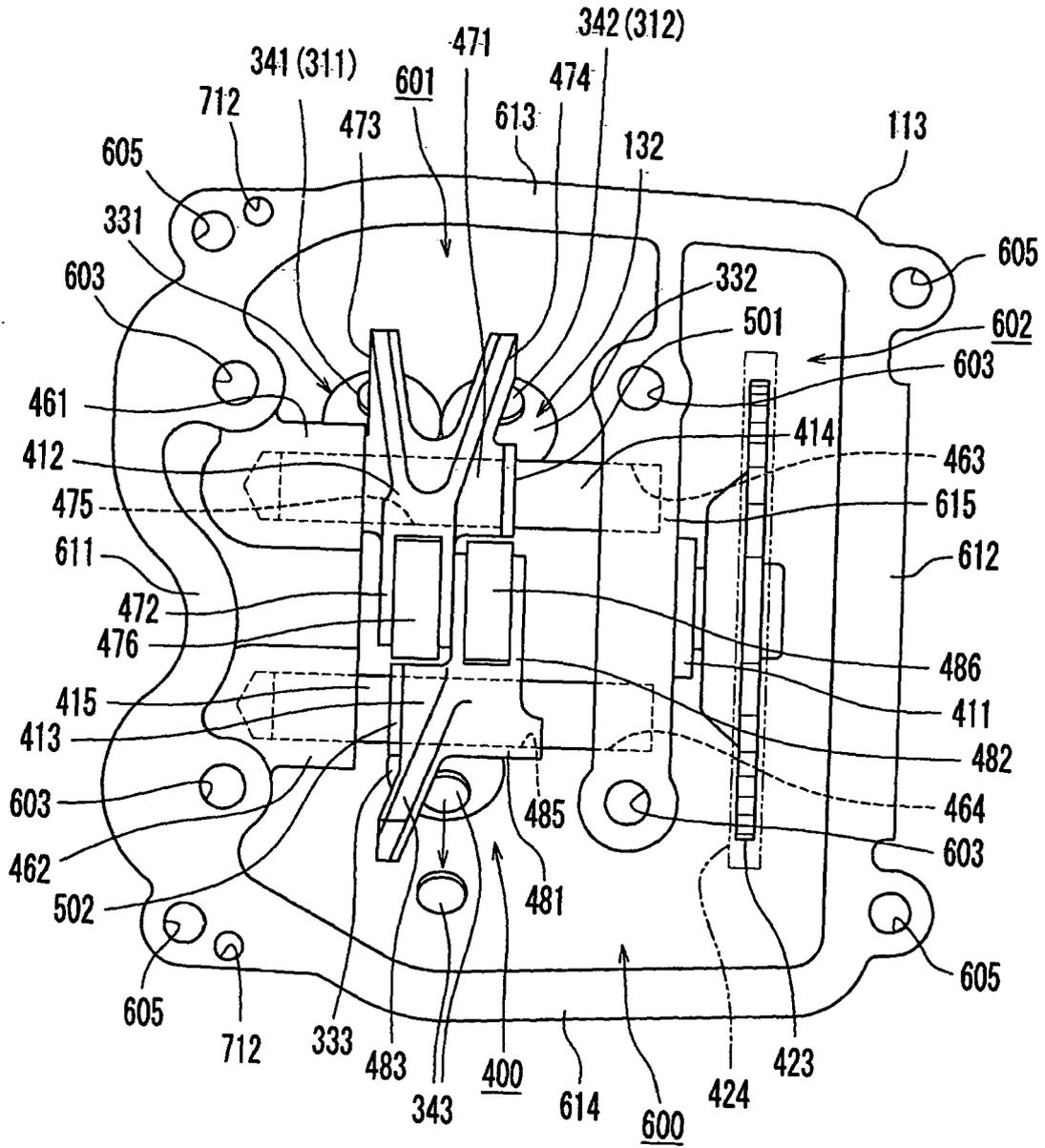


FIG. 7



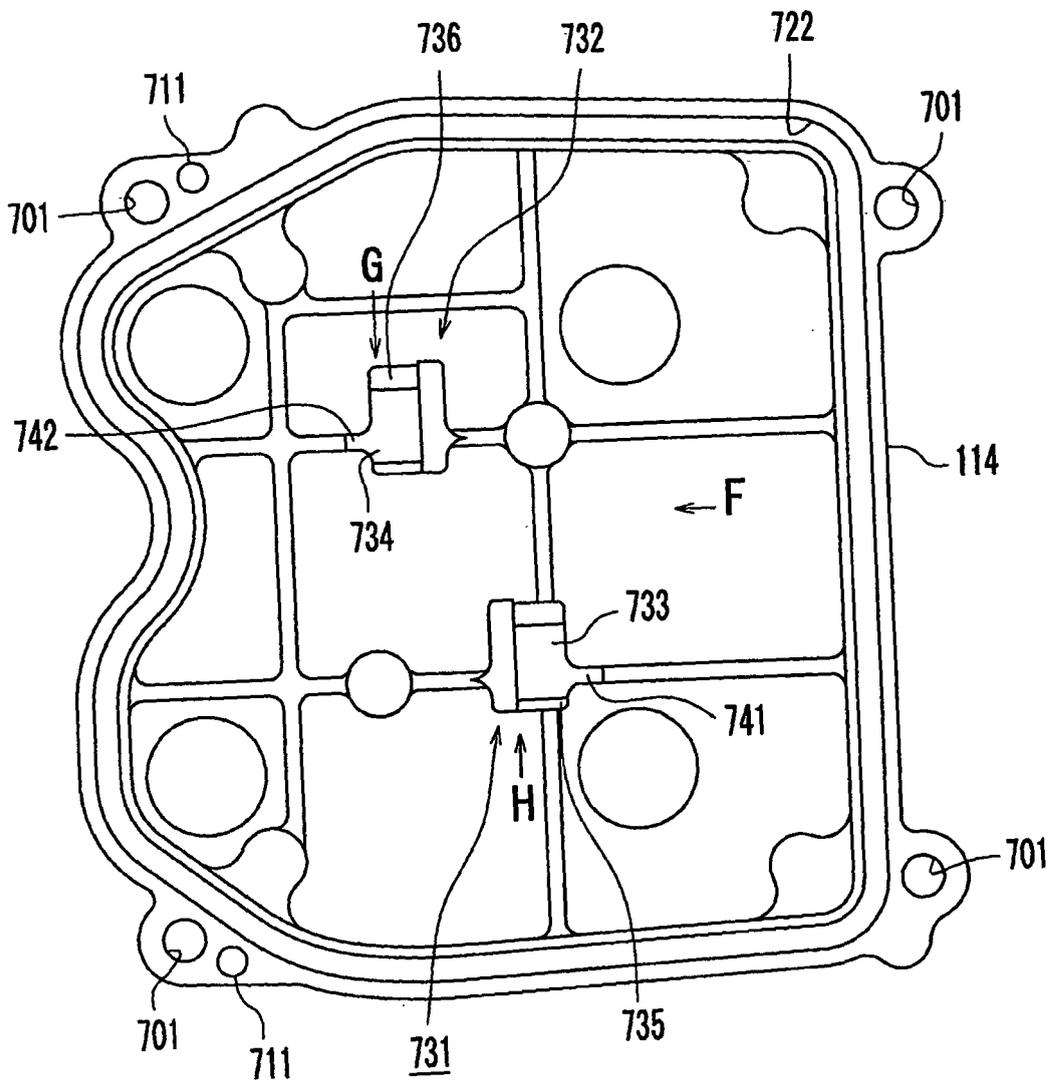


FIG. 9

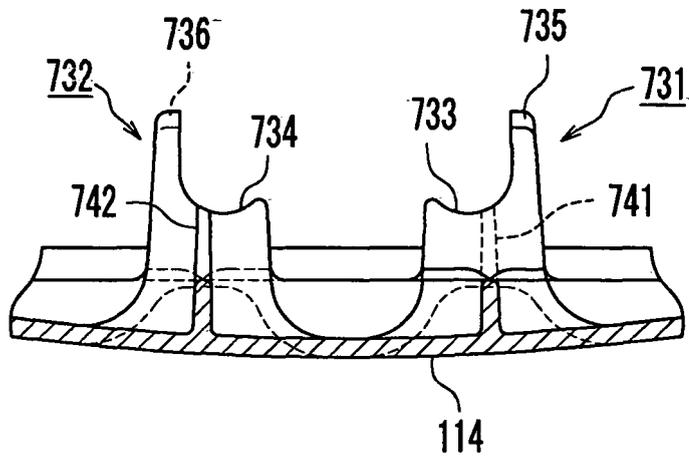


FIG. 10

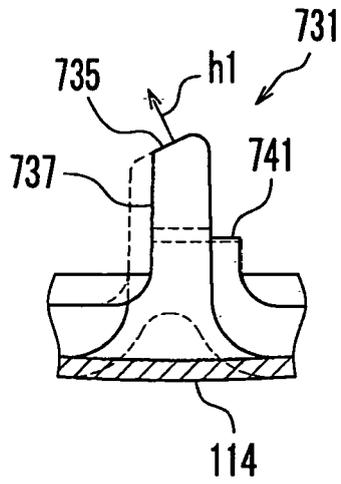


FIG. 11

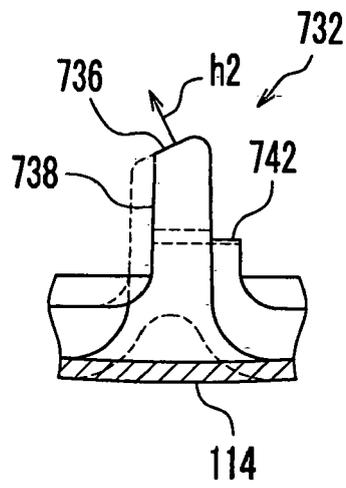


FIG. 12

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2006348820 A [0002] [0003] [0067]