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(72) Inventors:
• **Kakemizu, Kenichiro**
1-4-1 Chuo, Wako-shi, Saitama-ken (JP)
• **Hatayama, Atsushi**
1-4-1 Chuo, Wako-shi, Saitama-ken (JP)

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(74) Representative: **Liska, Horst, Dr.-Ing. et al**
Weickmann & Weickmann
Patentanwälte
Postfach 86 08 20
81635 München (DE)

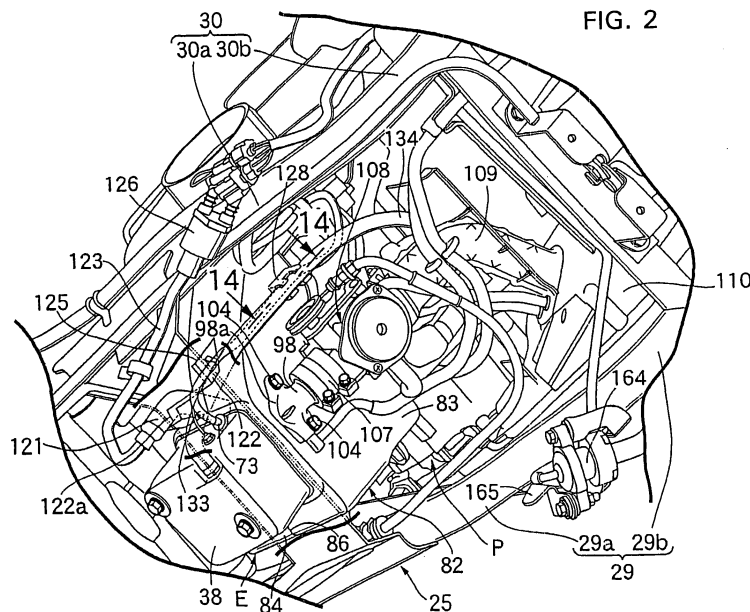
(71) Applicant: **HONDA GIKEN KOGYO KABUSHIKI
KAISHA**
Minato-ku Tokyo (JP)

(54) **Forced air-cooled type engine for motorcycle**

(57) Object; In a forced air-cooled type engine for motorcycle in which an engine main body comprising as a part of component elements thereof a cylinder head having a cylinder axis set substantially horizontally and a spark plug mounted at least one of left and right side surfaces is vertically swingably supported to a vehicle body frame and the cylinder head is covered with a shroud for forming a communication passage for flow of air for forced air cooling between itself and the cylinder head; to increase the degree of freedom in laying out a

high-tension cord and to enable enhancement of flexural durability of the high-tension cord.

Means of Solution: An ignition coil(126)disposed on the rear side of the cylinder head is supported by one of a left-right pair of rear frame members (29 and 30) possessed by the vehicle body frame(25), and an other end portion of the high-tension cord(123)having one end connected to the ignition coil(126)is bent back in a roughly U shape from the front side of a plug cap (121) connected to the spark plug to the rear side of the plug cap (121) and is connected to the plug cap (121).



Description

[0001] The present invention relates to a forced air-cooled type engine for motorcycle in which an engine main body comprising, as a part of component elements thereof, a cylinder head having a cylinder axis set substantially horizontally and a spark plug mounted at least at one of left and right side surfaces thereof is vertically swingably supported to a vehicle body frame, and at least the cylinder head of the engine main body is covered with a shroud forming a communication passage for communication of air for forced air cooling between the engine main body and the cylinder head.

[0002] Conventionally, in the forced air-cooled type engine for motorcycle disclosed in Japanese Patent Laid-open No. Hei 9-144520, a shroud has been provided with a wall portion for regulating a plug cap so as to direct toward the outside of a vehicle body.

[0003] However, in the prior art as above-mentioned, where the spacing between the plug cap and a frame member disposed on the outside of the plug cap of a vehicle body frame is small, it is difficult to lay out a high-tension cord connected to the plug cap directed toward the outside of the vehicle body, and the high-tension cord must be so arranged as to be curved with a small radius of curvature, so that it is difficult to enhance the flexural durability of the high-tension cord.

[0004] The present invention has been made in consideration of the above circumstances. Accordingly, it is an object of the present invention to provide a forced air-cooled type engine for motorcycle so designed that the degree of freedom in layout of the high-tension cord is increased, and it is possible to contribute to enhancement of flexural durability of the high-tension cord.

[0005] In order to attain the above object, the invention as set forth in claim 1 is characterized in that, in a forced air-cooled type engine for motorcycle, comprising an engine main body comprising, as a part of component elements thereof, a cylinder head having a cylinder axis set substantially horizontally and a spark plug mounted at least at one of left and right side surfaces thereof, the engine main body being vertically swingably supported to a vehicle body frame, and at least the cylinder head of the engine main body being covered with a shroud forming a communication passage for communication of air for forced air cooling between itself and the cylinder head, an ignition coil disposed on the rear side of the cylinder head is supported to one of a left-right pair of rear frame members possessed by the vehicle body frame, and an other end portion of a high-tension cord having one end connected to the ignition coil is bent back in a roughly U shape from the front side of a plug cap connected to the spark plug to the outside of the plug cap and is connected to the plug cap.

[0006] According to such a constitution of the invention as set forth in claim 1, the high-tension cord connected to the plug cap is extended forwards from the plug cap, so that even where the spacing between the

plug cap and the frame member disposed on the outside of the plug cap of the vehicle body frame is small, it is possible to increase the degree of freedom in laying out the high-tension cord by obviating interference thereof with the vehicle body frame, to set the radius of curvature of the high-tension cord to be comparatively large, and thereby to enhance durability of the high-tension cord.

[0007] In addition, the invention as set forth in claim 2 is characterized in that, in addition to the constitution of the invention as set forth in claim 1, the shroud comprises an upper-lower pair of upper and lower cover members connected to each other so as to cooperate with each other in covering the cylinder head, a fitting hole for fitting of the plug cap therein is formed between mating surfaces of both the cover members, the upper cover member is integrally provided with an eaves for covering from the upper side a fitting portion of the plug cap for fitting in the fitting hole, and the plug cap biased to one of directions around the axis of the spark plug by a springy force exerted from the high-tension cord is brought into contact with and engaged with an anti-turning positioning portion formed in the eaves so as to receive the plug cap against the springy force. According to such a constitution, the plug cap is brought into contact with and engaged with the anti-turning positioning portion formed in the eaves by the springy force exerted from the high-tension cord, so that it is possible to prevent the plug cap from turning around the axis of the spark plug during operation of the engine, to thereby prevent vibration of the high-tension cord, and to effectively prevent the high-tension cord from making contact with other component parts. Besides, since the fitting portion of the plug cap for fitting in the fitting hole is covered by the eaves from the upper side, muddy water or the like dropping after colliding on a member disposed on the upper side of the engine main body can be prevented from adhering to connection portions of the high-tension cord and the plug cap.

[0008] Furthermore, the invention as set forth in claim 3 is characterized in that, in addition to the constitution of the invention as set forth in claim 2, a clamp for holding the high-tension cord connected to the plug cap is mounted to a clamp mount seat formed in the upper cover member in connection with the eaves. According to such a constitution, with the high-tension cord held in the vicinity of the plug cap, vibration of the high-tension cord can be prevented more effectively, and the strength of the eaves can be increased by the clamp mount seat.

[0009] Now, a mode for carrying out the present invention will be described below, based on one embodiment of the present invention shown in the accompanying drawings, in which:

Fig. 1 is a side view of a scooter type motorcycle.

Fig. 2 is a perspective view of an intermediate portion of the scooter type motorcycle in the condition

where a vehicle body cover and a luggage box are omitted.

Fig. 3 is an enlarged sectional view taken along line 3-3 of Fig. 1.

Fig. 4 is a view taken along arrow 4 of Fig. 3.

Fig. 5 is a view taken along arrow 5 of Fig. 3.

Fig. 6 is a sectional view taken along line 6-6 of Fig. 3.

Fig. 7 is a view of a head cover from the cylinder head side.

Fig. 8 is a sectional view taken along line 8-8 of Fig. 7.

Fig. 9 is an enlarged sectional view taken along line 9-9 of Fig. 6.

Fig. 10 is a sectional view taken along line 10-10 of Fig. 9.

Fig. 11 is a sectional view taken along line 11-11 of Fig. 4.

Fig. 12 is an enlarged sectional view taken along line 12-12 of Fig. 5.

Fig. 13 is a sectional view taken along line 13-13 of Fig. 5.

Fig. 14 is an enlarged sectional view taken along line 14-14 of Fig. 2.

Fig. 15 is a sectional view taken along line 15-15 of Fig. 14.

Fig. 16 is a sectional view taken along line 16-16 of Fig. 14.

Fig. 17 is a sectional view taken along line 17-17 of Fig. 14.

[0010] Figs. 1 to 17 show one embodiment of the present invention, in which Fig. 1 is a side view of a scooter type motorcycle; Fig. 2 is a perspective view of an intermediate portion of the scooter type motorcycle in the condition where a vehicle body cover and a luggage box are omitted; Fig. 3 is an enlarged sectional view taken along line 3-3 of Fig. 1; Fig. 4 is a view taken along arrow 4 of Fig. 3; Fig. 5 is a view taken along arrow 5 of Fig. 3; Fig. 6 is a sectional view taken along line 6-6 of Fig. 3; Fig. 7 is a view of a head cover from the cylinder head side; Fig. 8 is a sectional view taken along line 8-8 of Fig. 7; Fig. 9 is an enlarged sectional view taken along

line 9-9 of Fig. 6; Fig. 10 is a sectional view taken along line 10-10 of Fig. 9; Fig. 11 is a sectional view taken along line 11-11 of Fig. 4; Fig. 12 is an enlarged sectional view taken along line 12-12 of Fig. 5; Fig. 13 is a sectional view taken along line 13-13 of Fig. 5; Fig. 14 is an enlarged sectional view taken along line 14-14 of Fig. 2; Fig. 15 is a sectional view taken along line 15-15 of Fig. 14; Fig. 16 is a sectional view taken along line 16-16 of Fig. 14; and Fig. 17 is a sectional view taken along line 17-17 of Fig. 14.

[0011] First, in Figs. 1 and 2, the vehicle body frame 25 of the scooter type motorcycle comprises a main frame pipe 27 with a head pipe 26 attached to the front end thereof, a cross pipe 28 attached perpendicularly to the rear end of the main frame pipe 27, and rear frame pipes 29 and 30 as a left-right pair of rear frame members with their front ends connected respectively to both end portions of the cross pipe 28.

[0012] The main frame pipe 27 comprises a down frame portion 27a inclined rearwardly downwards from the head pipe 26, and a lower frame portion 27b extended rearwards roughly horizontally from the rear end of the down frame portion 27a, which are integrally connected to each other. The left-right pair of rear frame pipes 29 and 30 comprise rise frame portions 29a and 30a extending rearwardly upwards from both end portions of the cross pipe 28, and upper frame portions 29b and 30b extending rearwards roughly horizontally from the rear ends of the rise frame portions 29a and 30a and bent in a horizontal plane so that openings at rear end portions thereof face each other, which are integrally connected to each other, respectively.

[0013] A front fork 31 astride a front wheel WF is steerably supported to the head pipe 26, and a steering handle 32 is connected to the upper end of the front fork 31.

[0014] A front portion of a power unit P is vertically swingably supported to front portions of both the rear frame pipes 29 and 30 of the vehicle body frame 25 through a link mechanism 33, and a rear wheel WR disposed on the right side of a rear portion of the power unit P is pivotably supported to a rear portion of the power unit P.

[0015] In Figs. 3 to 6, the power unit P is comprised of a forced air-cooled type single-cylinder 4-cycle engine E disposed on the front side of the rear wheel WR, and a non-stage transmission M provided between the engine E and the rear wheel WR.

[0016] An engine main body 34 of the engine E comprises a crankcase 35, a cylinder block 36 connected to the crankcase 35, a cylinder head 37 connected to the cylinder block 36 on the opposite side of the crankcase 35, and a head cover 38 connected to the cylinder head 37 on the opposite side of the cylinder block 36, and is disposed between both the rear frame pipes 29 and 30 of the vehicle body frame 25. The cylinder head 37 is disposed between lower portions of the rise frame portions 29a and 30a of both the rear frame pipes 29 and 30.

[0017] The cylinder block 36 is so disposed that the axis of a cylinder bore 39 provided in the cylinder block 36, i.e., the cylinder axis C is roughly horizontal while being slightly forwardly upwards along the front-rear direction of the motorcycle, and a combustion chamber 41 is formed between the cylinder head 37 and a piston 40 slidably fitted to the cylinder bore 39. The piston 40 is connected to a crankshaft 44 having an axis of rotation parallel to the axis of rotation of the rear wheel WR, through a connecting rod 42 and a crank pin 43.

[0018] The crankshaft 44 is rotatably supported to the crankcase 35 comprised of a pair of case portions 35a and 35b connected to each other on a plain surface containing the cylinder axis C and orthogonal to the axis of the crankshaft 44. The crankshaft 44 has a structure in which a first ball bearing 45 is interposed between the case member 35a on one side and the crankshaft 44, whereas a second ball bearing 46 is interposed between the case member 35b on the other side and the crankshaft 44.

[0019] An intake port 47 capable of communication to the combustion chamber 41 is provided at an upper side surface of the cylinder head 37, and an exhaust port 48 capable of communication to the combustion chamber 41 is provided at a lower side surface of the cylinder head 37. An intake valve 49 and an exhaust valve 50 for opening and closing the intake port 47 and the exhaust port 48 respectively are disposed in the cylinder head 37 so that their projections onto a plain surface orthogonal to the axis of rotation of the crankshaft 44 are arranged in a roughly V shape, and are respectively spring-biased in the directions for closing the intake port 47 and the exhaust port 48. A spark plug 51 fronting to the combustion chamber 41 is mounted to one of left and right surfaces of the cylinder head 37, in this embodiment, to the right side surface as viewed from a rider directed toward the forward side of the running direction of the motorcycle.

[0020] A valve-operating mechanism 52 for opening/closing the intake valve 49 and the exhaust valve 50 is contained between the cylinder head 37 and the cylinder cover 38. The valve-operating mechanism 52 comprises a camshaft 55 having an axis parallel to the axis of the crankshaft 44, rotatably supported to the cylinder head 37 and having intake and exhaust cams 53 and 54, intake-side and exhaust-side rocker shafts 56 and 57 having axes parallel to the camshaft 55 and supported to the cylinder head 37, an intake-side rocker arm 58 swingably supported to the intake-side rocker shaft 56 so as to drive the intake valve 49 in the manner of being driven by the intake cam 53, and an exhaust-side rocker arm 59 swingably supported to the exhaust-side rocker shaft 57 so as to open/close the exhaust valve 50 in the manner of being driven by the exhaust cam 54.

[0021] A driven sprocket 60 is fixed to one end portion of the camshaft 55. On the other hand, a driving sprocket 61 is fixed to the crankshaft 44 at a position corresponding to the driven sprocket 60 on the outer side of the

second ball bearing 46, an endless cam chain 62 is wrapped around the driving and driven sprockets 61 and 60, and the cam chain 62 is movably contained in a containing chamber 63 formed over the range of the cylinder block 36, the cylinder head 37 and the head cover 38. By such an arrangement of the driving sprocket 61, the driven sprocket 60 and the cam chain 62, the camshaft 55 is driven to rotate at a revolution number of 1/2 times the revolution number of the crankshaft 44.

[0022] A drive gear 64 is fixed to the crankshaft 44 on the outer side of the first ball bearing 45, and an oil pump 66 mounted to the crankcase 35 so as to pump up an oil from an oil reservoir portion 65 formed at a lower portion of the inside of the crankcase 35 through an oil strainer 79 is driven by the drive gear 64.

[0023] A portion of the oil discharged from the oil pump 66 is used for lubricating the valve-operating mechanism 52; the crankcase 35, the cylinder block 36, the cylinder head 37 and the head cover 38 are provided with an oil supply passage 67 for guiding the oil from the oil pump 66 to the valve-operating mechanism 52. Moreover, in the cylinder head 37, the oil supply passage 67 is arranged at a position nearer to the intake port 47 than to the exhaust port 48; in this embodiment, the oil supply passage 67 is arranged at such a position as to intersect the intake port 47 on a projection onto a plain surface orthogonal to the axis of the crankshaft 44.

[0024] Referring to Figs. 7 and 8 as well, a downstream end portion of the oil supply passage 67 is comprised of a communication groove 68 which is provided in a connecting surface of the head cover 38 for connection to the cylinder head 37 in such a manner as to be supplied at one end thereof with the oil from the side of the cylinder head 37, and a bottomed communication hole 69 which is provided in a side wall of the head cover 38 in connection with the other end of the communication groove 68. A jet hole 70 in connection with an inner end portion of the communication hole 69 is provided in an inside surface of a side wall of the head cover 38 so as to jet the oil toward the valve-operating mechanism 52.

[0025] In addition, the head cover 38 is provided with a bottomed detection hole 71 in connection with one end of the communication groove 68, and a mount boss 72 projecting outwards from an outside surface of the head cover 38 at a position corresponding to the detection hole 71 is integrally projected. A temperature sensor 73 is mounted to the mount boss 72 in the manner of projecting a detection element portion 73a into the detection hole 71. Namely, the temperature sensor 73 is mounted to the head cover 38 of the engine main body 34 in such a manner that the detection element portion 73a fronts to the oil supply passage 67.

[0026] Paying attention to Fig. 3, a generator 76 comprising a stator 74 fixed to the crankcase 35 and an outer rotor 75 fixed to the crankshaft 44 so as to surround the stator 74 is disposed on the outer side of the drive gear 64, and a fan 77 is fixed to the crankshaft 44 on the outer

side of the generator 76. The fan 77 comprises a plurality of vanes 77b, 77b ... integrally provided at an outer circumferential portion of a base portion 77a fastened to the outer rotor 75 of the generator 76 by a plurality of, for example, four bolts 78, 78

[0027] At least the cylinder block 36 and the cylinder head 37 of the engine main body 34, in this embodiment, a part of the crankcase 35, the cylinder block 36 and the cylinder head 37 are covered with a shroud 82, and air for forced air cooling which is ejected from the fan 77 flows through a communication passage 81 formed between the engine main body 34 and the shroud 82. In addition, a plurality of cooling fins 36a ... and 37a ... are projected on the outside surfaces of the cylinder block 36 and the cylinder head 37 for enabling efficient cooling by the cooling air flowing through the communication passage 81.

[0028] The shroud 82 is comprised of an upper-lower pair of upper and lower cover members 83 and 84 connected to each other so as to cooperate with each other in covering the cylinder block 36 and the cylinder head 37, and a fan cover 85 connected to both the cover members 83 and 84 so as to cover a part of the crankcase 35. The upper cover member 83, the lower cover member 84 and the fan cover 85 are respectively formed of a synthetic resin.

[0029] A plurality of engaging pawls 87 ... projecting from a mating surface 86 of the upper cover member 83 for mating with the lower cover member 84 to the side of the lower cover member 84 are projected on the upper cover member 83, and the lower cover member 84 is provided with locking portions 88 ... for springy engagement of the engaging pawls 87 The upper and lower cover members 83 and 84 are respectively integrally provided with a plurality of fastened portions 89 ... and 90 ... which make contact with each other at the mating surface 86, and the fastened portions 89 ... and 90 ... thus making contact with each other are fastened to each other by screw members 91

[0030] Thus, the springy engagement of the engaging pawls 87 ... with the locking portions 88 ... and the fastening of the fastened portions 89 ... and 90 ... by the screw members 91 ... ensure that the upper and lower cover members 83 and 84 are connected to each other, and the head cover 38 is projected to the front side from the upper and lower cover members 83 and 84.

[0031] The fan cover 85 is fastened to the case member 35a so as to cover the case member 35a, which is a part of the crankcase 35, and the fan 77, and is fastened to the upper and lower cover members 83 and 84 by a plurality of screw members 92

[0032] The fan cover 85 is provided with a suction tube 94 forming a suction port 93 for sucking in air from the exterior to the side of the fan 77, in such a manner as to correspond to the fan 77 on the outside thereof, and a louver 95 is provided at the suction port 93.

[0033] The louver 95 is comprised of a plurality of, for example, five ring portions 95a to 95d disposed concen-

trically with the connection tube 94, and a plurality of connection portions 95e ... extending radially to connect between the connection tube 94 and the ring portions 95a to 95d. For example, a triangular timing mark 96 for matching the phase of the crankshaft 44 is marked on the outside surface of the fan cover 85 at a position corresponding to one of the connection portions 95e The timing mark 96 is, for example, for matching the timing for ignition; with one of a plurality of, for example, four bolts 78 ... for fixing the fan 77 to the crankshaft 44 coinciding with the connection portion 95e of the louver 95 which corresponds to the timing mark 96, phase matching of the ignition timing can be easily carried out.

[0034] The timing mark 96 can be used not only for matching the ignition timing but also for matching the timings for TDC and BDC; besides, the timing mark 96 can also be used for matching the timing for modification of operation characteristics in the case where the valve-operating mechanism 52 is so constituted that the operation characteristics of at least one of the intake valve 49 and the exhaust valve 50 can be modified.

[0035] Referring to Figs. 9 and 10 as well, a flat mount surface 97 with the intake port 47 opened therein is provided at an upper side surface of the cylinder head 37, and the downstream end of an inlet pipe 98 is fastened to the mount surface 97 with an insulator 99 interposed therebetween.

[0036] The downstream end of the inlet pipe 98 is integrally provided with a flange portion 98a, and the insulator 99 having an intake hole 100 communicated to the intake port 47 and the mount surface 97 are formed to have shapes corresponding to the flange portion 98a.

[0037] Gaskets 101 and 102 surrounding the intake hole 100 in an endless manner are mounted respectively to both surfaces of the insulator 99, and the gasket 101 on one side is interposed between the insulator 99 and the mount surface 97, whereas the gasket 102 is interposed between the insulator 99 and the flange portion 98a. The thickness T of the insulator 99 is set to be larger than the spacing S between the mount surface 97 and the upper cover member 83 of the shroud 82.

[0038] The mount surface 97 is provided with bottomed screw holes 103, 103 on both sides of the intake port 47, bolts 104, 104 inserted in the flange portion 98a and the insulator 99 are screwed into the screw holes 103, 103. By fastening the bolts 104, 104, the inlet pipe 98 is fastened to the mount surface 97 with the insulator 99 interposed therebetween.

[0039] Meanwhile, the upper cover member 83 of the shroud 82 covering the cylinder head 37 is provided with an opening portion 105 for fitting and positioning of the insulator 99. As shown in Fig. 10, the opening portion 105 is formed to be larger than the insulator 99, and an air discharge port 106 for discharging cooling air having flowed through the communication passage 81 to the exterior is formed between a side surface of a part of the opening portion 105 and a side surface of a part of the insulator 99.

[0040] The upstream end of the inlet pipe 98 is connected to the downstream end of a carburetor 108 disposed on the rear side of the inlet pipe 98, through a connection hose 107 therebetween, and the upstream end of the carburetor 108 is connected to an air cleaner 110 disposed on the left side of the rear wheel WR, through a connecting tube 109 therebetween.

[0041] In Fig. 11, the carburetor 108 is provided auxiliarily with an auto-by starter 111 controlled by applying an electric current based on a value detected by the temperature sensor 73. The auto-by starter 111 is mounted to a carburetor main body 112 of the carburetor 108 so as to open/close an intermediate portion of a starting fuel-air mixture passage 113 provided in the carburetor main body 112 so as to bypass a throttle valve (not shown) provided with the carburetor 108.

[0042] A bleed pipe 114 is fixed to the carburetor main body 112 so as to be interposed at a portion of the starting fuel-air mixture passage 113 on the upstream side of the auto-by starter 111, and a fuel nozzle 115 into an upper portion of which a lower portion of the bleed pipe 114 is projected is fixed to a lower portion of the carburetor main body 112. In addition, a fuel case 116 for reserving a fuel is fixed to a lower portion of the carburetor main body 112, and a lower portion of the fuel nozzle 115 is projected into the fuel in the fuel case 116.

[0043] The auto-by starter 111 comprises a needle valve 118 inserted in an advanceable/retractable manner into a nozzle 117 provided at an intermediate portion of the starting fuel-air mixture passage 113 on the downstream side of the bleed pipe 114, and the position of the needle valve 118 in the nozzle 117 is determined by current-carrying control of the auto-by starter 111, whereby the quantity of a starting fuel-air mixture flowing through the starting fuel-air mixture passage 113 is determined.

[0044] A fitting hole 120 is formed between the mating surfaces 86 of the upper and lower cover members 83 and 84 constituting a part of the shroud 82. A plug cap 121 connected to the spark plug 51 is fitted to the fitting hole 101 while having a flange portion 121a making contact with the outside surfaces of the upper and lower cover members 83 and 84 in the surroundings of the fitting hole 120.

[0045] Of the upper and lower cover members 83 and 84, the upper cover member 83 is integrally provided with an eaves 122 for covering from the upper side a fitting portion of the plug cap 121 for fitting in the fitting hole 120. As shown in Fig. 12, the eaves 122 is provided at its tip end portion with an anti-turning positioning portion 122a to be brought into contact with and engaged with the plug cap 121 so as to inhibit the plug cap 121 from rotating around the axis of the spark plug 51.

[0046] The eaves 122 is so formed as to cover from the upper side the fitting portion of the plug cap 121 for fitting in the fitting hole 120 which takes such a posture that at least a part of a high-tension cord 123 connected to the plug cap 121 is extended forwards from the plug

cap 121, and the anti-turning positioning portion 122a is formed in the eaves 122 so as to receive the plug cap 121 biased to one of directions around the axis of the spark plug 51 by a springy force exerted from the high-tension cord 123, against the springy force.

[0047] Referring to Fig. 13 as well, the upper cover member 83 is integrally provided with a clamp mount seat 125 in continuity with the eaves 122, and a clamp 124 springily mounted to the clamp mount seat 125 holds the high-tension cord 123 connected to the plug cap 121.

[0048] Meanwhile, the engine main body 34 is supported to the vehicle body frame 25 with the cylinder head 37 disposed between lower portions of the riser frame portions 29a and 30a at front portions of the left-right pair of rear frame pipes 29 and 30, the plug cap 121 is also disposed at lower portions of both the rise frame portions 29a and 30a, and an ignition coil 126 is supported to an upper portion of the right-side rise frame portion 30a, which is one of both the rise frame portions 29a and 30a, as clearly shown in Fig. 12.

[0049] Of the high-tension cord 123 having one end in connection with the ignition coil 126, an other end portion is bent in a roughly U shape from the front side of the plug cap 121 engaged with the anti-turning positioning portion 122a to the rear side of the plug cap 121, and is connected to the plug cap 121.

[0050] Referring to Figs. 14 to 17 as well, the upper cover member 83 of the shroud 82 is integrally provided with a pair of hooks 128, 128 rising from an outside surface of the upper cover member 83 oppositely to each other while being provided at their tip end portions with engaging projection portions 128a, 128a projecting to such sides as to approach each other, and with a pair of connection walls 129 and 130 rising from an outside surface of the upper cover member 83 oppositely to each other while connecting between the hooks 128, 128. Further, the upper cover member 83 is provided with a rectangular tetragonal through-hole 131 surrounded by the hooks 128, 128 and the connection walls 129 and 130.

[0051] A plurality of flexible elongate component parts stacked on each other and pressed into the gap between both the hooks 128, 128 are clamped between the engaging projection portions 128a, 128a of the hooks 128, 128 and the connection walls 129 and 130. In this embodiment, a cable 133 which is the flexible elongate component part on the inner side to be received by the connection walls 129 and 130 and a tube 134 which is the flexible elongate component part on the outer side and the outside surface of which is in contact with the engaging projection portions 128a, 128a are clamped between the engaging projection portions 128a, 128a and the connection walls 129 and 130.

[0052] The cable 133 has a soft vinyl film, and is in connection with the temperature sensor 73, whereas the tube 134 formed of a hard elastic material is connected to the head cover 38 so as to conduct a breather gas.

[0053] In addition, the hook 128 is comprised of a base plate portion 128b having a base end portion in continuity with the upper cover member 83 over the entire length thereof, and a plurality of, for example, two branch plate portions 128c, 128c in continuity with the base plate portion 128b at a plurality of, for example, two locations spaced from each other along the longitudinal direction of the cable 133 and the tube 134 and having the engaging projection portion 128a projecting at a tip end portion thereof; besides, a reinforcement wall 132 for receiving the cable 133 between the connection walls 129 and 130 is provided between the branch plate portions 128c, 128c over the range between the hooks 128, 128.

[0054] An exhaust pipe 118 is connected to a lower side surface of the cylinder head 37 which is not covered with the shroud 82, with its upstream end connected to the exhaust port 48, and the downstream end of the exhaust pipe 118 is connected to an exhaust muffler 119 disposed on the right side of the rear wheel WR.

[0055] Paying attention to Figs. 3 and 4, a transmission case 136 extended to the left side of the rear wheel WR as viewed from a rider directed to the forward side of the running direction of the motorcycle is connected to the crankcase 35. The transmission case 136 is comprised of a case main body 137 connected integrally to the case member 35b of the crankcase 35 and extended rearwards, a left-side cover 138 fastened to the case main body 137 from the left side so as to form a first transmission chamber 140 between itself and the case main body 137, and a right-side cover 139 fastened to a right rear portion of the case main body 137 so as to form a second transmission chamber 141 between itself and the case main body 137.

[0056] A support arm portion 142 is projected on a front portion of the case main body 137 of the transmission case 136 so as to be disposed on a lateral side of the cylinder block 36 of the engine E, and the support arm portion 142 is oscillatably supported to the vehicle body frame 25 through the link mechanism 33.

[0057] An axle 143 for the rear wheel WR is rotatably supported to a rear portion of the case main body 137 of the transmission case 136 and the right-side cover 139. As shown in Fig. 1, a rear cushion 144 is provided between a rear portion of the case main body 137 and the upper frame portion 29a of the rear frame pipe 29 of the vehicle body frame 25.

[0058] The non-stage transmission M is of the type of a V belt contained in the first transmission chamber 140, and a speed reduction gear train 145 is provided between the non-stage transmission M and the axle 143.

[0059] The non-stage transmission M comprises a drive-side transmission pulley 146 connected to an end portion of the crankshaft 44 on the outside of the second ball bearing 46, a driven-side transmission pulley 149 mounted, via a centrifugal clutch 148, to a driven shaft 147 rotatably supported to a rear portion of the case main body 137 and the right-side cover 139 while having

an axis parallel to the crankshaft 44, and an endless V belt 150 wrapped around both of the transmission pulleys 146 and 149.

[0060] The drive-side transmission pulley 146 is comprised of a fixed pulley half 146a fixed to the crankshaft 44, and a movable pulley half 146b axially slidably mounted to the crankshaft 44. A V-shaped annular groove 151 is formed between both of the pulley halves 146a and 146b, and the V belt 150 is inserted in the annular groove 151. In addition, a ramp plate 152 is attached to the crankshaft 44 on the back side of the movable pulley half 146a, and a plurality of weight rollers 153 are contained in a floating condition between the movable pulley half 146a and the ramp plate 152. When the revolution number of the crankshaft 44 increases, the weight rollers 153 receiving a centrifugal force are moved outwards in the radial direction of the crankshaft 44 to thereby bring the movable pulley half 146a closer to the fixed pulley half 146b. As a result, the radius of contact of the V belt 150 with the pulley halves 146a and 146b is enlarged.

[0061] On the other hand, the driven-side transmission pulley 149 comprises a support tube 154 connected to the driven shaft 147 through the centrifugal clutch 148 and rotatably supported to the driven shaft 147, a fixed pulley half 149a formed as one body with the support tube 154, and a movable pulley half 149b supported to the support tube 154 so as to be capable of approaching and parting away from the fixed pulley half 149a and spring-biased in the direction of approaching the fixed pulley half 149a, and the V belt 150 is inserted in a V-shaped annular groove 155 formed between both of the pulley halves 149a and 149b. In the fixed pulley half 149a, as the radius of contact of the V belt 150 with the drive-side transmission pulley 146 increases, the movable pulley half 149b is axially moved so that the radius of contact of the V belt 150 with the driven-side transmission pulley 149 decreases, whereby non-stage speed change according to the rotation of the crankshaft 44 between the crankshaft 44 and the driven shaft 147 is achieved.

[0062] A kick shaft 156 is rotatably supported to the left-side cover 138 of the transmission case 136, and a kick pedal 157 (see Fig. 1) is provided at the outer end of the kick shaft 156. A kick type starter 158 in which the power of the kick shaft 156 according to a stepping-in operation on the kick pedal 157 can be transmitted to the crankshaft 44 is provided between the kick shaft 156 and the crankshaft 44, on the inner surface side of the left-side cover 138.

[0063] The speed reduction gear train 94 is provided between the driven shaft 147 and the axle 143, and is contained in the second transmission chamber 141. The rotational power of the driven shaft 147 in the non-stage transmission M is subjected to speed reduction by the speed reduction gear train 94, before being transmitted to the axle 143 of the rear wheel WR.

[0064] Meanwhile, a luggage box 160 capable of stor-

ing a helmet and the like therein is supported between front portions of both the rear frame pipes 29 and 30 of the vehicle body frame 25, in the manner of being disposed on the upper side of the engine E, and a fuel tank 161 is supported between rear portions of both the rear frame pipes 29 and 30.

[0065] A secondary-air air cleaner 162 for cleaning secondary air to be supplied into the exhaust port 48 of the engine E is supported to a front portion of the upper frame portion 29b of the left-side rear frame pipe 29 of both the rear frame pipes 29 and 30. The downstream end of an intake tube 163 is connected to an intake port of the secondary-air air cleaner 162, and the upstream end of the intake tube 163 is inserted in a rear end portion of the upper frame portion 30b of the right-side rear frame pipe 30 of both the rear frame pipes 29 and 30.

[0066] A secondary air control valve 164 provided between the engine E and the secondary-air air cleaner 162 is supported by a stay 165 which is mounted to an upper portion of the rise frame portion 29a of the left-side rear frame pipe 29.

[0067] A connection pipe portion 166 communicated to the inside of the rise frame portion 29a of the left-side rear frame pipe 29 is provided at a lower portion of the rise frame portion 29a, and a duct 167 for conducting cooling air from the inside of the non-stage transmission M of the power unit P is connected to the connection pipe portion 166.

[0068] The vehicle body frame 25 is covered with a vehicle body cover 168 made of a synthetic resin. The vehicle body cover 168 comprises a leg shield 169 for covering the front side of the legs of the driver, a step floor 170 connected to a lower portion of the leg shield 169 so that the feet of the rider are put thereon, and a side cover 171 being in continuity with the step floor 170 so as to cover a rear portion of the vehicle body from both lateral sides.

[0069] A seat 172 is provided on the side cover 171 so as to be capable of opening/closing the luggage box 160 and the fuel tank 161 from the upper side.

[0070] Next, the functions of this embodiment will be described. The oil pump 66 for pumping up the oil from the oil reservoir portion 65 in the crankcase 35 of the engine main body 34 is mounted to the crankcase 35, the oil supply passage 67 for conducting the oil for lubricating the valve-operating mechanism 52 is provided in the crankcase 35, the cylinder block 36, the cylinder head 37 and the head cover 38 in communication with the oil pump 66, and the temperature sensor 73 is attached to the engine main body 34 with its detection element portion 73a fronting to the oil supply passage 67.

[0071] Meanwhile, the oil supply passage 67 for conducting the oil discharged from the oil pump 66 for lubricating the valve-operating mechanism 67 is filled up with the oil irrespectively of the operating conditions and the posture of the engine, as far as the engine is being operated. Since the detection element portion 73a of the temperature sensor 73 is disposed fronting to the oil

supply passage 67 as above-mentioned, the engine temperature can always be detected accurately and speedily while minimizing the influence of the changes in the operating conditions and the posture of the engine E, and no complicated structure is needed for detecting the oil temperature by the temperature sensor 73.

[0072] Moreover, since the oil supply passage 67 in the cylinder head 37 is disposed at a position nearer to the intake port 47 than to the exhaust port 48, the engine temperature can be detected accurately and speedily while minimizing the influence of the heat radiation from an outside surface portion of the engine main body 34.

[0073] In addition, since the cylinder block 36 and the cylinder head 37 are provided with the cooling fins 36a ... and 37a ... for air cooling so as to constitute the engine E of the forced air-cooled type and the temperature sensor 73 is mounted to the head cover 38 not provided with the air cooling fins, the engine temperature can be accurately detected without any interference by the cooling fins 36a ... and 37a ..., and the structure for mounting the temperature sensor 73 is made simple.

[0074] Besides, since the auto-by starter 111 controlled by applying an electric current based on the value detected by the temperature sensor 73 is mounted to the carburetor 108 connected to the intake port 47, so as to open and close the starting fuel-air mixture passage 113 provided in the carburetor 108, it is possible to optimize the fuel-air mixture supplied to the engine E at the time of starting, based on the engine temperature accurately detected by the temperature sensor 73, and to enhance the warming-up performance of the engine E.

[0075] Furthermore, the cylinder block 36 and the cylinder head 37 are covered with the shroud 82 forming the communication passage 81 for flow of air for the forced air cooling between itself and the cylinder block 36 and the cylinder head 37, and the temperature sensor 73 is mounted to the head cover 38 so as not to be influenced by the forcedly blown cooling airflow, whereby an accurate engine temperature can be detected notwithstanding the forced air-cooled engine.

[0076] The flat mount surface 97 with the intake port 47 opened therein is provided at the upper side surface of the cylinder head 37, and the inlet pipe 98 is fastened to the mount surface 97 with the insulator 99 interposed therebetween. The upper cover member 83 of the shroud 82 is provided with the opening portion 105 for fitting and positioning of the insulator 99.

[0077] Therefore, the insulator 99 is positionedly held by the shroud 82 by being fitted to the opening portion 105, and in addition, the insulator 99 functions to guide the bolts 104 ... to be screwed into the screw holes 103 ... provided in the mount surface 97 of the cylinder head 37, so that the screwing and fastening of the bolts 104 ... into the screw holes 103 ... is facilitated, and assembleability can be enhanced.

[0078] In addition, since the air discharge port 106 is formed between the inside surface of a part of the open-

ing portion 105 provided in the upper cover member 83 made of a synthetic resin and the side surface of a part of the insulator 99, the inlet pipe 98 is heated by a warm airflow discharged from the air discharge port 106 and the warming-up performance can be thereby enhanced. Moreover, the mold portion for molding the opening portion 105 at the time of molding the upper cover member 83 can be comparatively enlarged in size so as to include a portion corresponding to the air discharge port 106 and can be enhanced in strength, whereby it is possible to contribute to enhancement of the useful life of the mold.

[0079] Further, since the thickness T of the insulator is set to be larger than the spacing between the mount surface 97 and the shroud 82, it is possible, by fitting the insulator 99 into the opening portion 105 in the manner of pressing the insulator 99 against the mount surface 97, to prevent the insulator 99 from dropping from the shroud 82 at the time of assembly and to further enhance the assembleability.

[0080] The shroud 82 comprises the upper-lower pair of the upper and lower cover members 83 and 84 connected to each other so as to cooperate with each other in covering the cylinder block 36 and the cylinder head 37, and the fitting hole 120 for fitting therein the plug cap 121 connected to the spark plug 51 mounted to the right side surface of the cylinder head 37 is formed between the mating surfaces 86 of both of the cover members 83 and 84. Moreover, the upper cover member 83 is provided with the eaves 122 for covering from the upper side the fitting portion, for fitting into the fitting hole 120, of the plug cap 121 which assumes such a posture as to extend at least a part of the high-tension cord 123 connected to the plug cap 121 forwards from the plug cap 121, and the plug cap 121 biased to one of the directions around the spark plug 51 by a springy force exerted from the high-tension cord 123 is brought into contact with and engaged with the anti-turning positioning portion 122a formed in the eaves 122 so as to receive the plug cap 121 against the springy force.

[0081] Therefore, at least a part of the high-tension cord 123 is extended forwards from the plug cap 121. Therefore, even where the spacing between the plug cap 121 and the rear frame pipe 30, of the vehicle body frame 25, which is disposed on the outside of the plug cap 121 is small, it is possible to increase the degree of freedom in laying out the high-tension cord 123 while avoiding interference with the vehicle body frame 25. Besides, even where the high-tension cord 123 is to be laid out in a curved state, it is possible to set the radius of curvature to be comparatively large, thereby enhancing the useful life of the high-tension cord 123.

[0082] In addition, since the plug cap 121 is brought into contact with and engaged with the anti-turning positioning portion 122a formed in the eaves 122 by the springy force exerted from the high-tension cord 123, it is possible to prevent the plug cap 121 from turning around the axis of the spark plug 51 during operation of

the engine, to thereby prevent vibration of the high-tension cord 123, and to effectively prevent the high-tension cord 123 from making contact with other component parts.

[0083] Moreover, since the fitting portion of the plug cap 121 for fitting in the fitting hole 120 is covered with the eaves 122 from the upper side, muddy water or the like dropping after colliding against a member on the upper side of the engine main body 34, for example, the luggage box 160 can be prevented from adhering to connection portions of the high-tension cord 123 and the plug cap 121.

[0084] Besides, since the clamp 124 for holding the high-tension cord 123 is mounted to the clamp mount seat 125 formed in the upper cover member 83 in continuity with the eaves 122, it is possible to hold the high-tension cord 123 in the vicinity of the plug cap 121, to thereby effectively prevent the vibration of the high-tension cord 123, and to increase the strength of the eaves 122 by the clamp mount seat 125.

[0085] Further, the engine main body 34 is disposed between the rear frame pipes 29 and 30, with the cylinder head 37 corresponding to lower portions of the rise frame portions 29a and 30a provided at front portions of the rear frame pipes 29 and 30 and inclined rearwardly upwards, in side view, and is vertically swingably supported to the vehicle body frame 25. Of the high-tension cord 123 having one end connected to the ignition coil 126 supported by the rear frame pipe 30 on the rear side of the cylinder head 37, the other end portion is bent back in a roughly U shape from the front side of the plug cap 121 engaged with the anti-turning positioning portion 122a to the rear side of the plug cap 121, and is connected to the plug cap 121.

[0086] With such an arrangement, the high-tension cord 123 can be easily laid while avoiding interference with the vehicle body frame 25, whereby flexural durability of the high-tension cord 123 can be securely enhanced.

[0087] In addition, the upper cover member 83 of the shroud 82 is integrally provided with the pair of hooks 128, 128 rising from an outside surface of the upper cover member 83 oppositely to each other while having at their tip end portions the engaging projection portions 128a, 128a projecting to such sides as to approach each other, and with the pair of connection walls 129 and 130 rising from an outside surface of the upper cover member 83 oppositely to each other while connecting between both of the hooks 128, 128. The upper cover member 83 is provided also with the rectangular tetragonal through-hole 131 surrounded by the hooks 128, 128 and the connection walls 129 and 130.

[0088] The cable 133 and the tube 134 stacked on each other and pressed into the gap between both of the books 128, 128 are clamped between the engaging projection portions 128a, 128a of the hooks 128, 128 and both the connection walls 129 and 130.

[0089] Therefore, the pair of hooks 128, 128 and the

pair of connection walls 129 and 130 can be integrally molded by a simple mold structure not using a slide mold, at the time of molding the upper cover member 83 made of a synthetic resin. Also, it is possible to stably support the cable 133 and the tube 134 by both the hooks 128, 128 and both the connection walls 129 and 140 without using other component parts than the upper cover member 83 possessed by the motorcycle, and to stably support the cable 133 and the tube 134 onto the flat surface of the upper cover member 83 while contriving reductions in the number of component parts and the number of assembling steps.

[0090] Moreover, the through-hole 131 is covered with the cable 133 and the tube 134 which are stacked on each other, so that the inside of the upper cover member 83, i.e., the inside of the shroud 82 cannot be seen through the through-hole 131 in the condition where the cable 133 and the tube 134 are supported.

[0091] Namely, the through-hole 131 is covered with the cable 133 and the tube 134 which are stacked on each other, so that the cable 133 and the tube 134 can be supported to the shroud 82, while stably maintaining the cooling performance of the forced air-cooled type engine E by preventing the cooling airflow from leaking out of the shroud 82. Also, it is possible to prevent the cooling airflow from leaking through the through-hole 131, so that it is possible to prevent dusts from being ejected to the outer surface side of the shroud 82, and to thereby prevent the appearance from being impaired.

[0092] Meanwhile, the cable 133 has a soft vinyl film and is connected to the temperature sensor 73, whereas the tube 134 is formed of a hard elastic material for conducting the breather gas and is connected to the head cover 38. The vinyl film at the outside surface of the cable 133 is put in sufficiently close contact with both the connection walls 129 and 130, and the engaging projection portions 128a, 128a at the tip end portions of both the hooks 128, 128 are securely engaged with the outside surface of the tube 134, whereby the cable 133 and the tube 134 can be supported more securely.

[0093] Moreover, the hook 128 is comprised of the base plate portion 128b which has the base end portion in continuity with the upper cover member 83 over the entire length thereof, and the plurality of, for example, two branch plate portions 128c, 128c which are in continuity with the base plate portion 128b at the plurality of, for example, two locations spaced along the longitudinal direction of the cable 133 and the tube 134 and are provided with the engaging projection portions 128a at the tip end portions thereof. Further, the reinforcement wall 132 for receiving the cable 133 between both of the connection walls 129 and 130 is provided between the branch plate portions 128c, 128c over the range between both of the books 128, 128.

[0094] Therefore, with the cable 133 on the inner side received also by the reinforcement wall 132, it is possible to more stably support the cable 133 and the tube 134, and to increase the strength of the hooks 128, 128

by the reinforcement wall 132.

[0095] While the embodiment of the present invention has been described above, the present invention is not limited to the above-described embodiment, and a variety of design modifications are possible without departure from the scope of the invention as set forth in the claims.

[0096] As described above, according to the invention as set forth in claim 1, at least a part of the high-tension cord is extended forwards from the plug cap. Therefore, even where the spacing between the plug cap and the frame member disposed on the outside of the plug cap is small, it is possible to increase the degree of freedom in laying out the high-tension cord while avoiding interference with the vehicle body frame, and even where the high-tension cord is to be laid in a curved state, it is possible to set the radius of curvature to be comparatively large and thereby to enhance the life of the high-tension cord. In addition, since the plug cap is springily brought into contact with and engaged with the anti-turning positioning portion, it is possible to prevent the plug cap from turning around the axis of the spark plug during operation of the engine, to thereby prevent vibration of the high-tension cord, and to effectively prevent the high-tension cord from making contact with other component parts. Moreover, since the fitting portion of the plug cap for fitting in the fitting hole is covered with the eaves from the upper side, muddy water or the like dripping after impinging on members on the upper side of the engine main body can be prevented from adhering to connection portions of the high-tension cord and the plug cap.

[0097] In addition, according to the invention as set forth in claim 2, the high-tension cord is held by the clamp in the vicinity of the plug cap, whereby the vibration of the high-tension cord can be prevented more effectively, and the strength of the eaves can be increased by the clamp mount seat.

[0098] Furthermore, according to the invention as set forth in claim 3, the high-tension cord can be easily laid while avoiding interference with the vehicle body frame, whereby flexural durability of the high-tension cord can be enhanced more securely.

Object; In a forced air-cooled type engine for motorcycle in which an engine main body comprising as a part of component elements thereof a cylinder head having a cylinder axis set substantially horizontally and a spark plug mounted at least one of left and right side surfaces is vertically swingably supported to a vehicle body frame and the cylinder head is covered with a shroud for forming a communication passage for flow of air for forced air cooling between itself and the cylinder head, to increase the degree of freedom in laying out a high-tension cord and to enable enhancement of flexural durability of the high-tension cord.

Means of Solution: An ignition coil 126 disposed on the rear side of the cylinder head is supported by one of a left-right pair of rear frame members 29 and 30 pos-

sessed by the vehicle body frame 25, and an other end portion of the high-tension cord 123 having one end connected to the ignition coil 126 is bent back in a roughly U shape from the front side of a plug cap 121 connected to the spark plug to the rear side of the plug cap 121 and is connected to the plug cap 121. 5

Claims

- 10
1. A forced air-cooled type engine for motorcycle, comprising an engine main body (34) comprising, as a part of component elements thereof, a cylinder head (37) having a cylinder axis (C) set substantially horizontally and a spark plug (51) mounted at least at one of left and right side surfaces thereof, said engine main body (34) being vertically swingably supported to a vehicle body frame (25), and at least said cylinder head (37) of said engine main body (34) being covered with a shroud (82) forming a communication passage (81) for communication of air for forced air cooling between itself and said cylinder head (37), wherein an ignition coil (126) disposed on the rear side of said cylinder head (37) is supported to one of a left-right pair of rear frames (29, 30) possessed by said vehicle body frame (25), and an other end portion of a high-tension cord (123) having one end connected to said ignition coil (126) is bent back in a roughly U shape from the front side of a plug cap (121) connected to said spark plug (51) to the rear side of said plug cap (121) and is connected to said plug cap (121). 15 20 25 30
 2. A forced air-cooled type engine for motorcycle as set forth in claim 1, wherein said shroud (82) comprises an upper-lower pair of upper and lower cover members (83, 84) connected to each other so as to cooperate with each other in covering said cylinder head (37), a fitting hole (120) for fitting of said plug cap (121) therein is formed between mating surfaces (86) of both said cover members (83, 84), said cover member (83) is integrally provided with an eaves (122) for covering from the upper side a fitting portion of said plug cap (121) for fitting in said fitting hole (120), and said plug cap (121) biased to one of directions around the axis of said spark plug (51) by a springy force exerted from said high-tension cord (123) is brought into contact with and engaged with an anti-turning positioning portion (122a) formed in said eaves (122) so as to receive said plug cap (121) against said springy force. 35 40 45 50
 3. A forced air-cooled type engine for motorcycle as set forth in claim 2, wherein a clamp (124) for holding said high-tension cord (123) is mounted to a clamp mount seat (125) formed in said upper cover member (83) in connection with said eaves (122). 55

FIG. 1

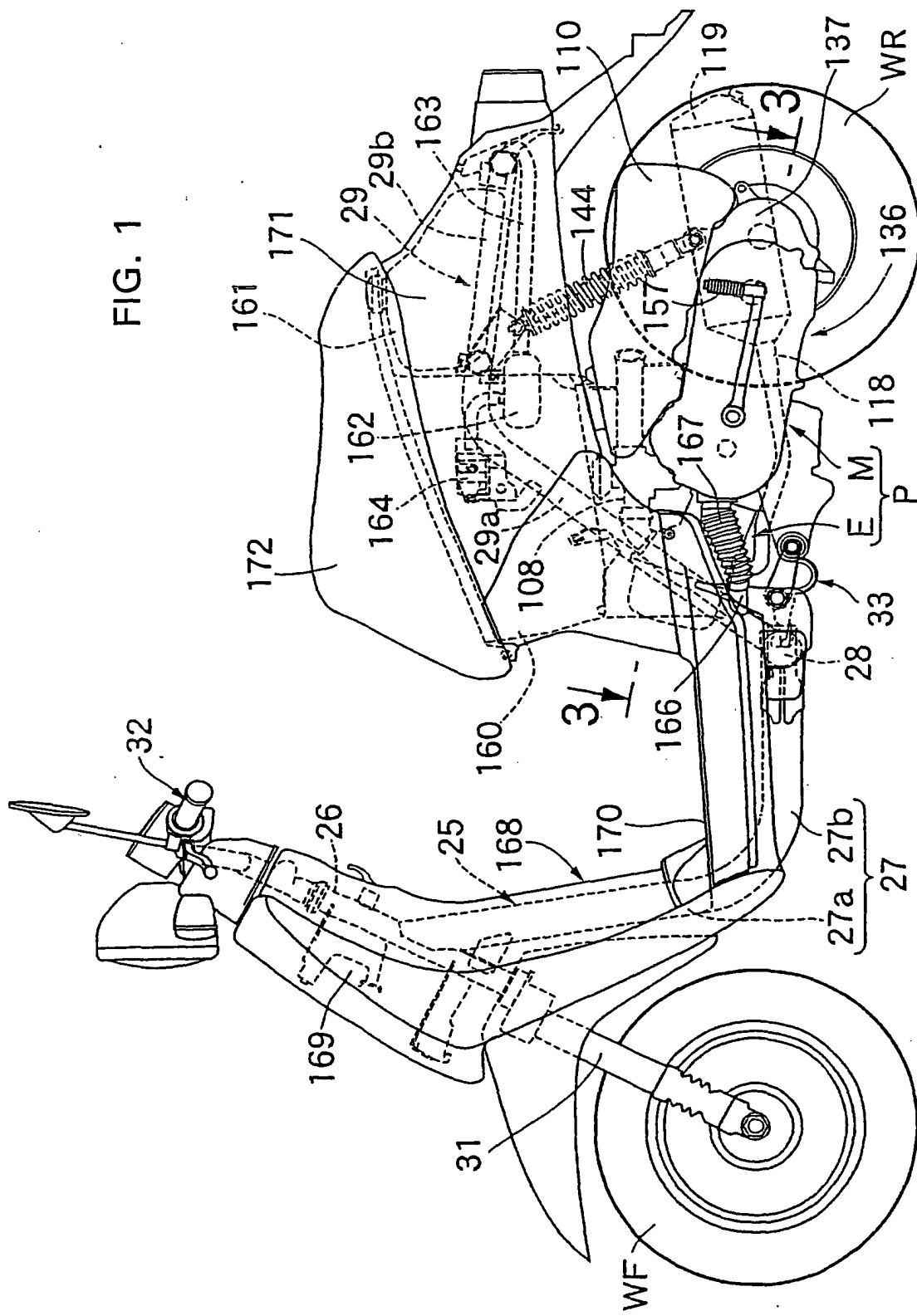


FIG. 2

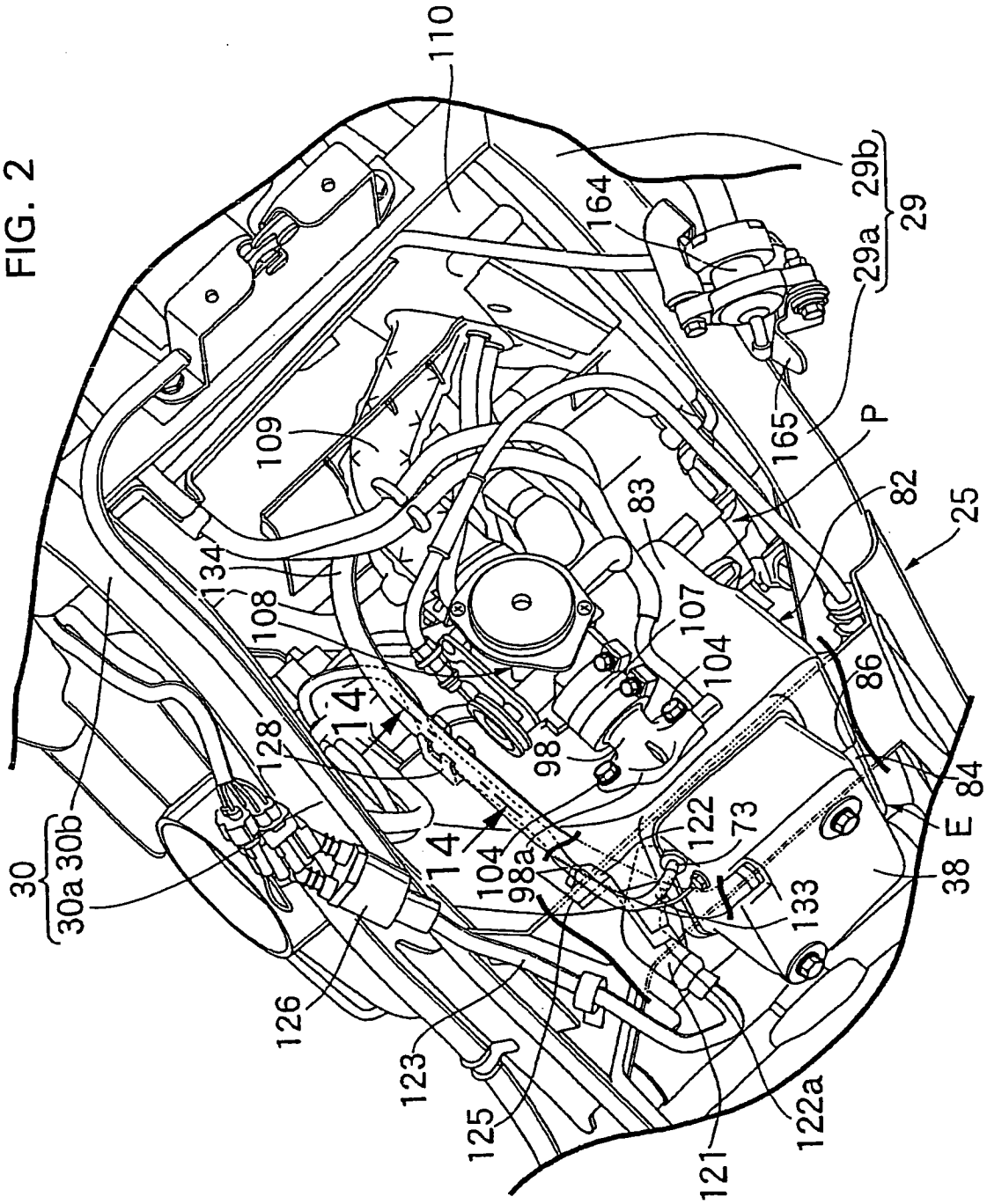


FIG. 3

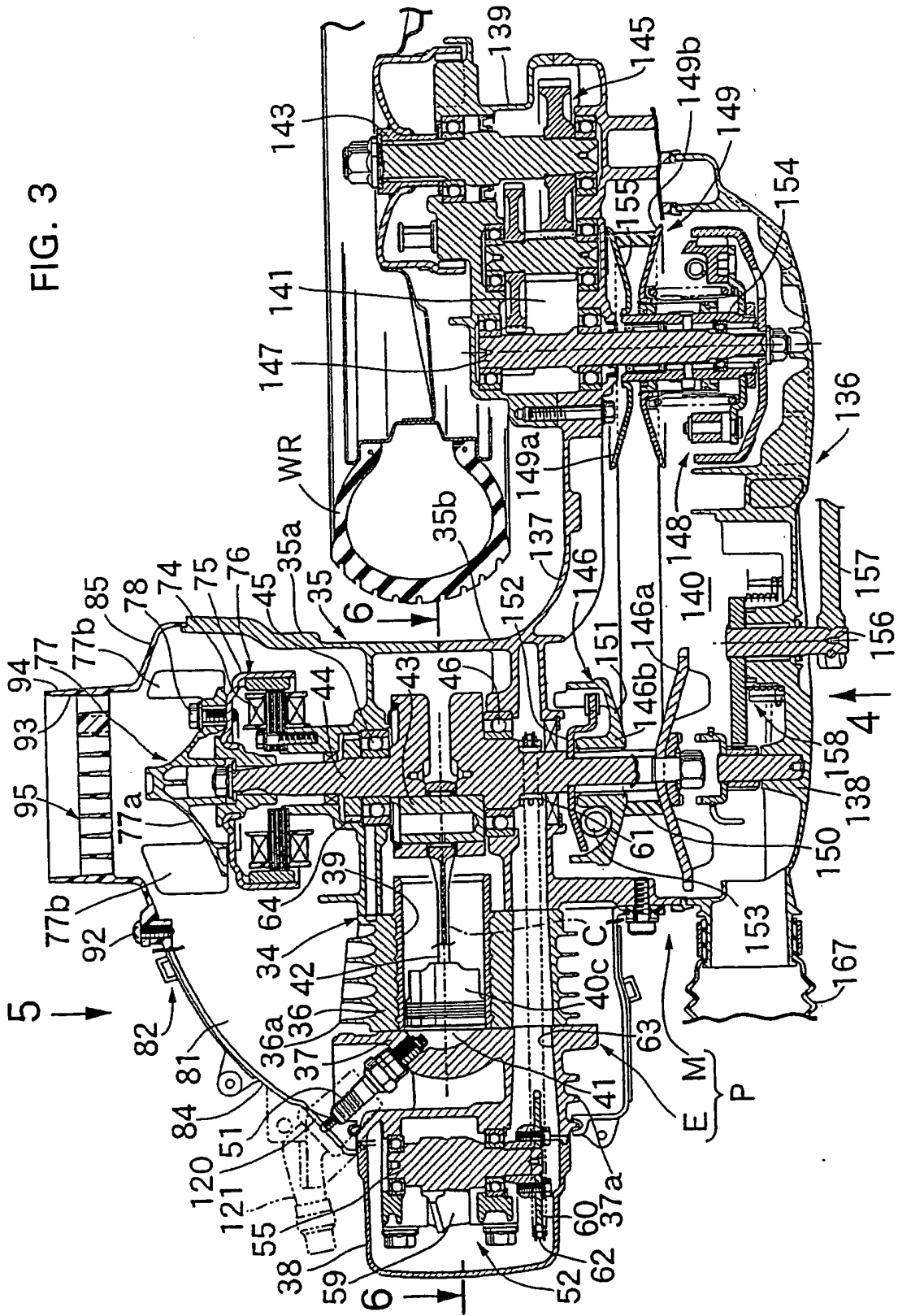


FIG. 4

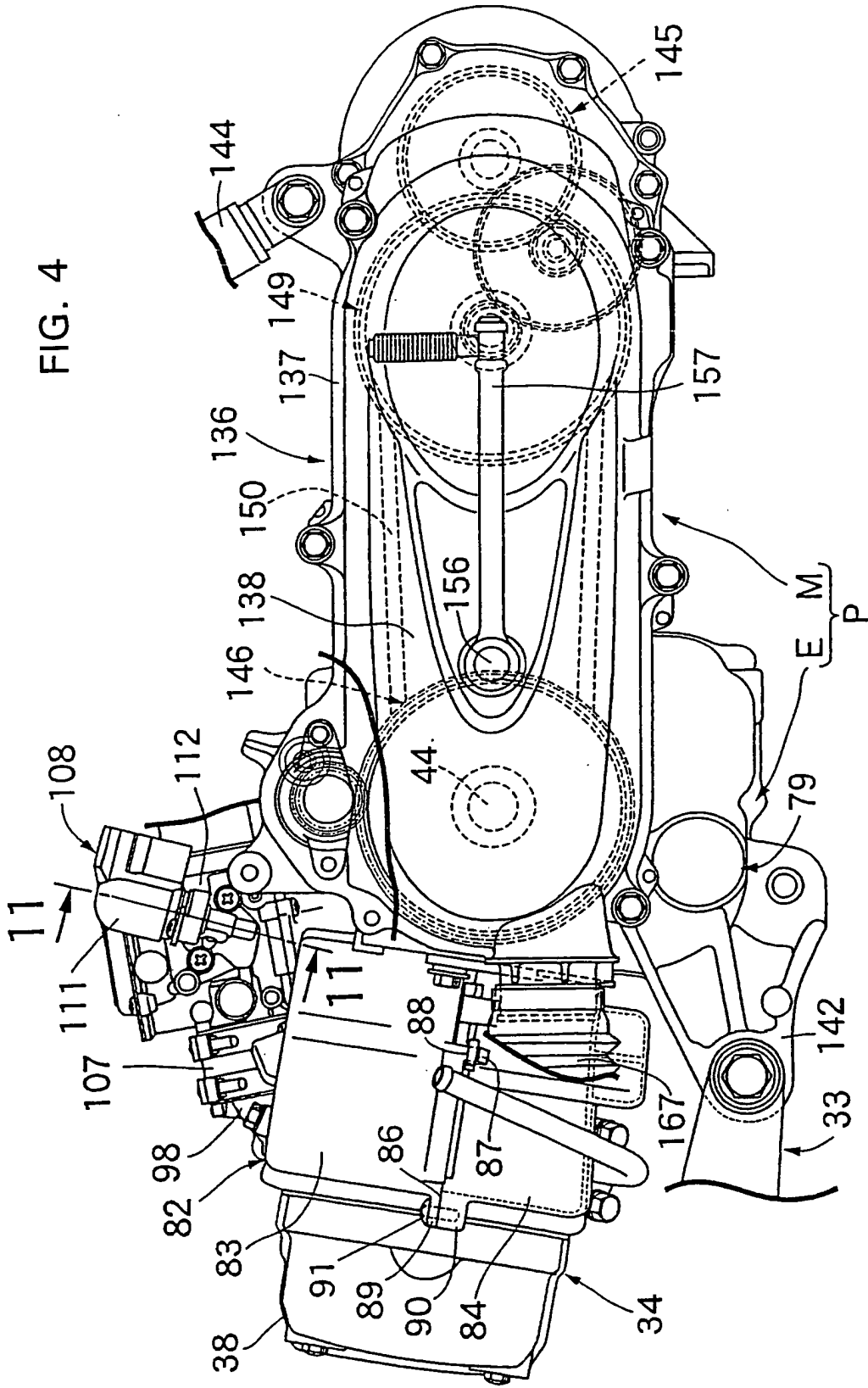


FIG. 5

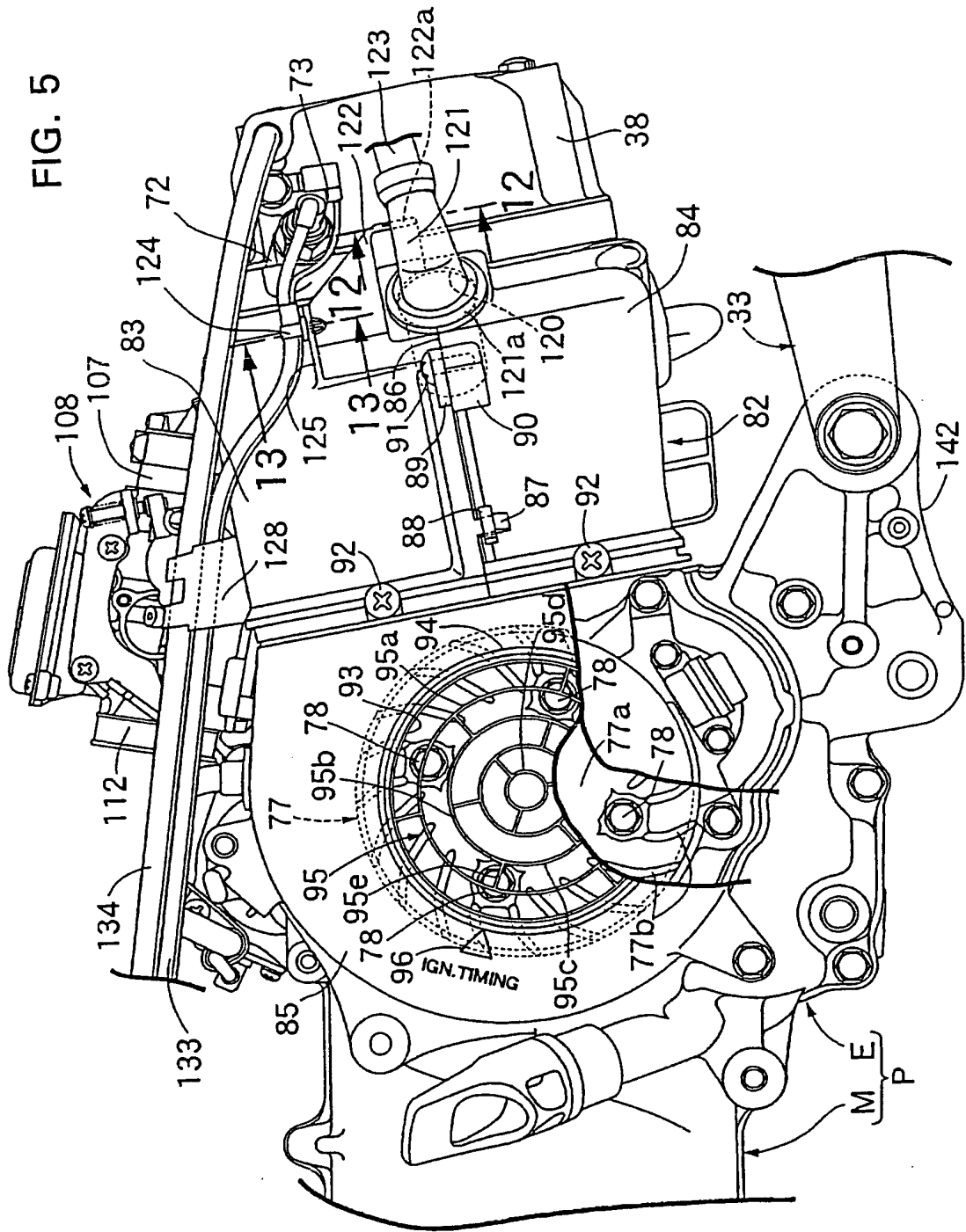


FIG. 6

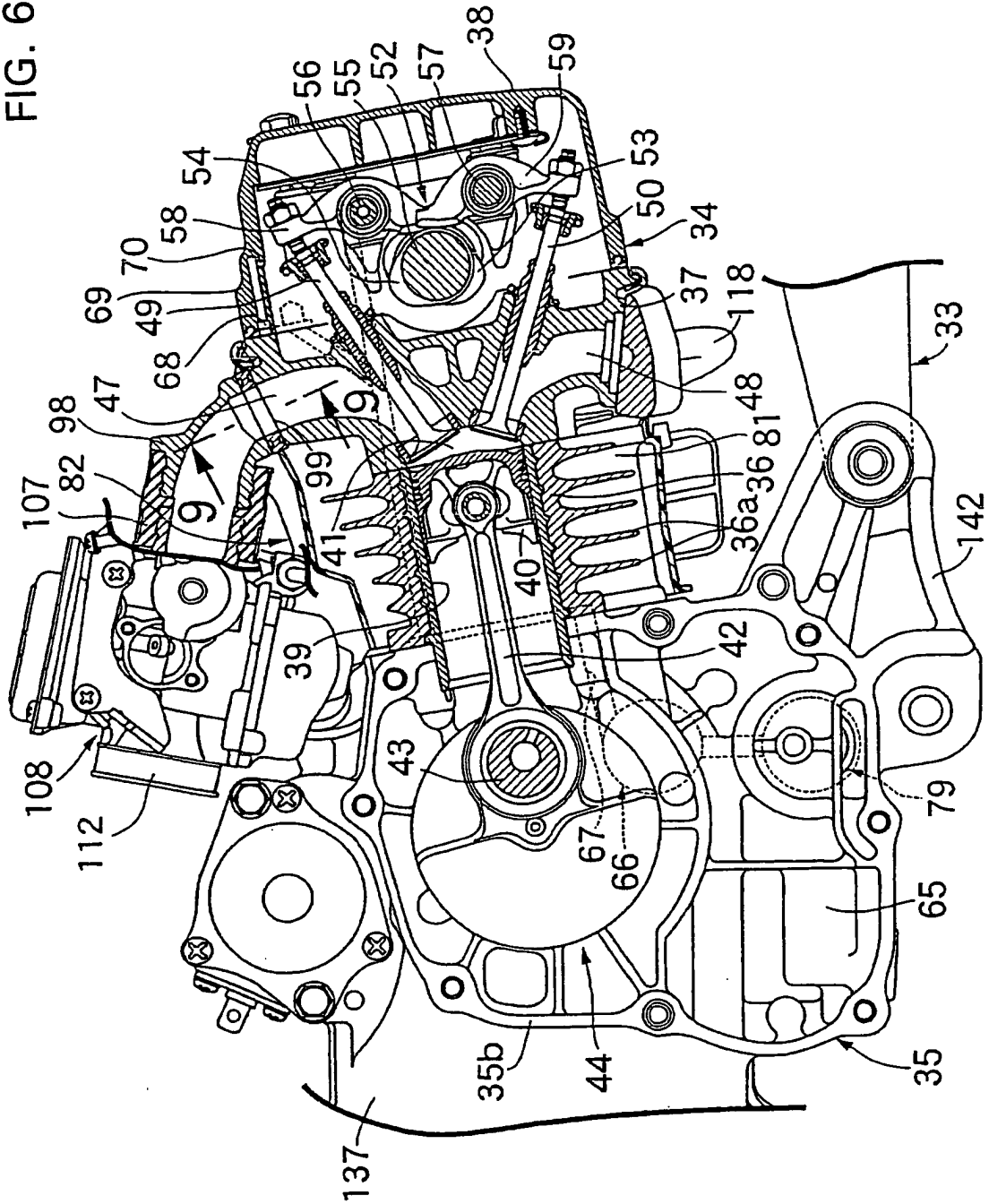


FIG. 7

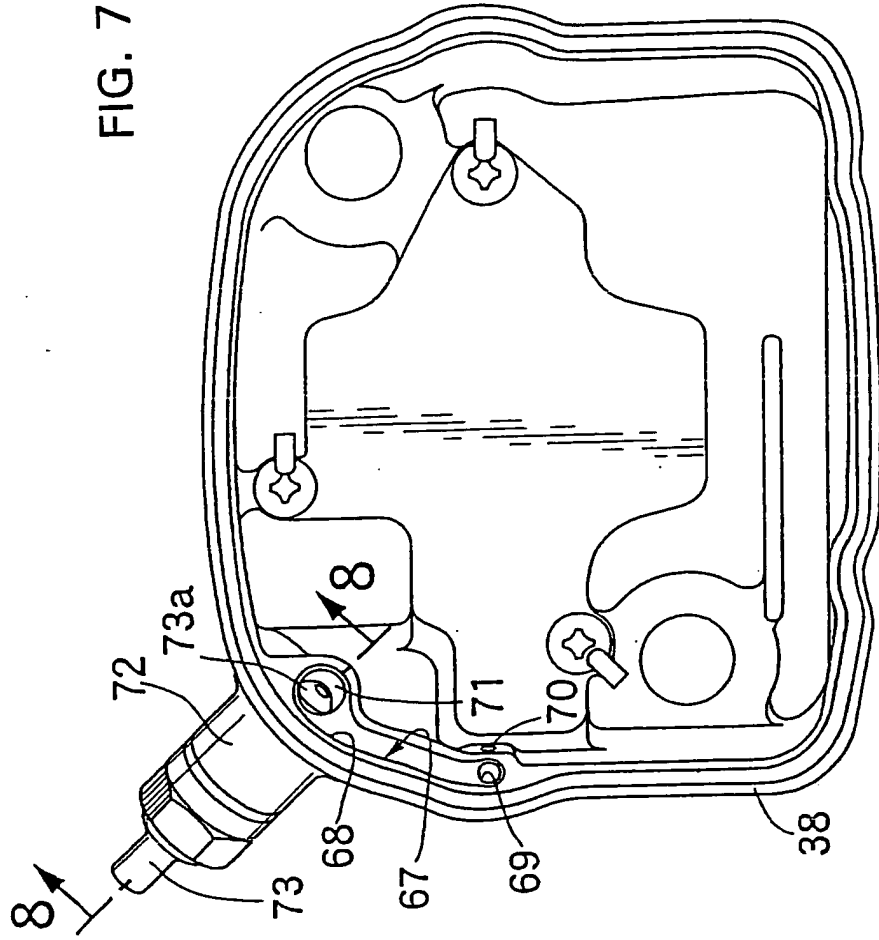


FIG. 8

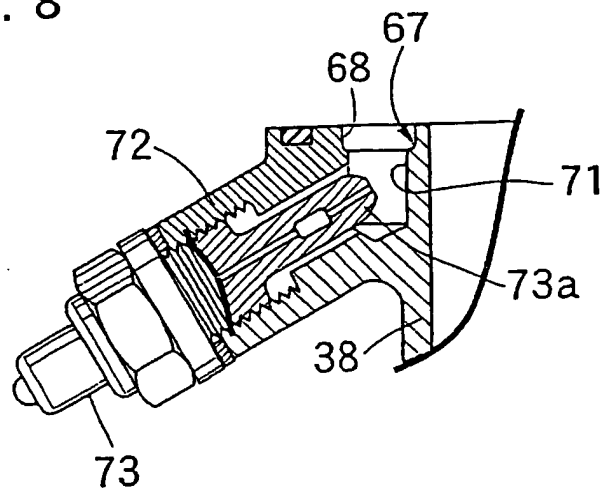


FIG. 9

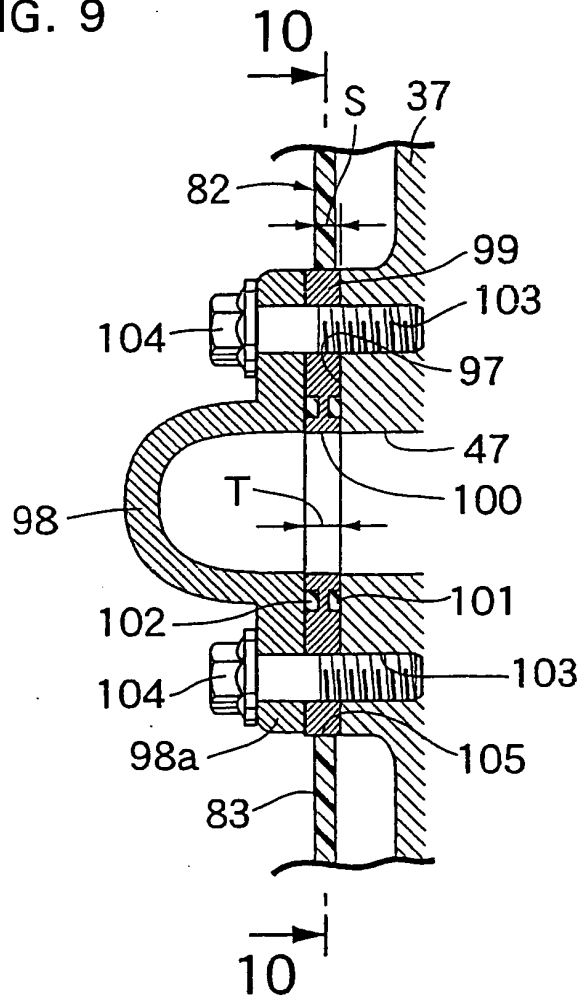


FIG. 10

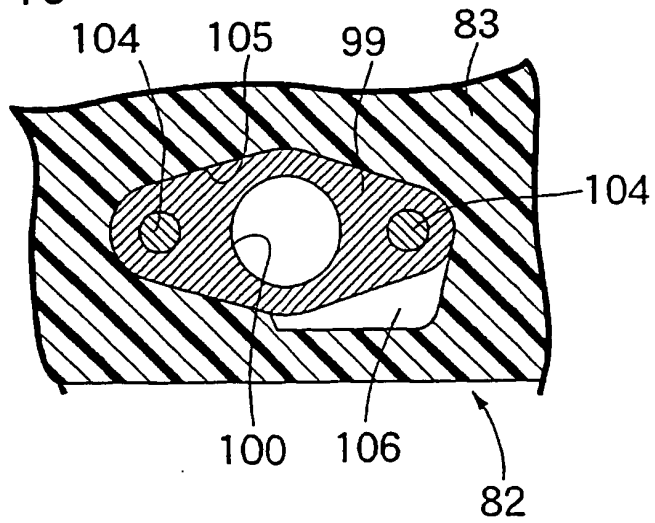


FIG. 11

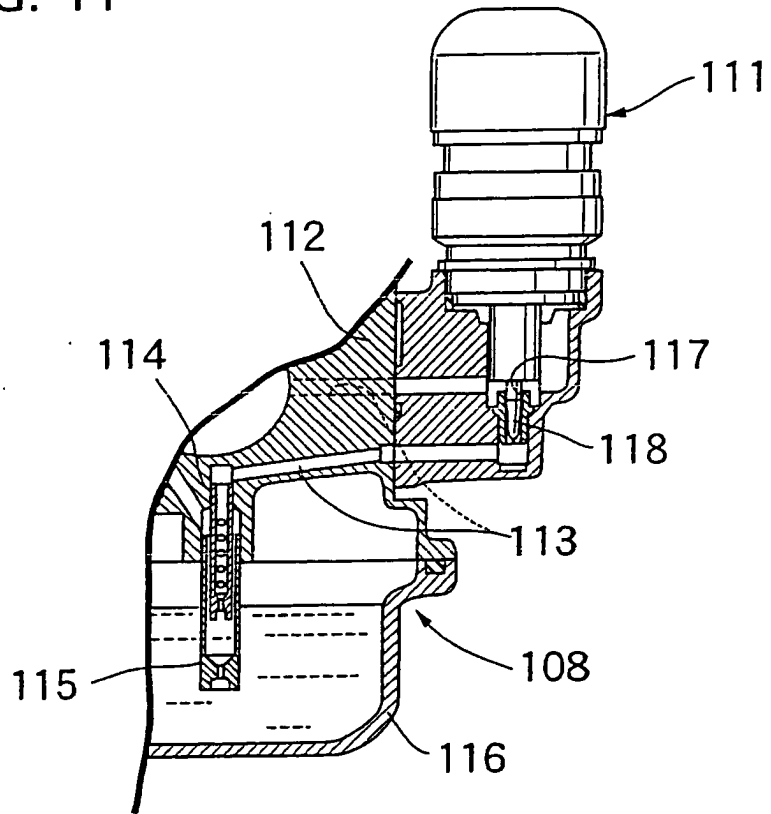


FIG. 12

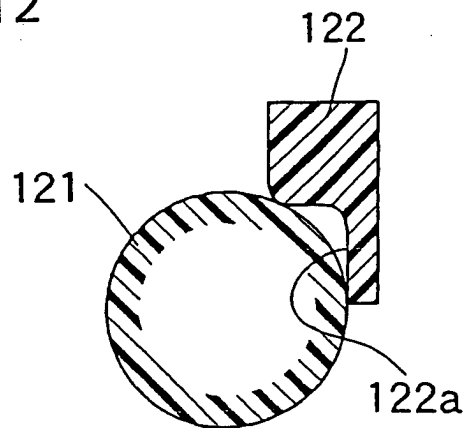


FIG. 13

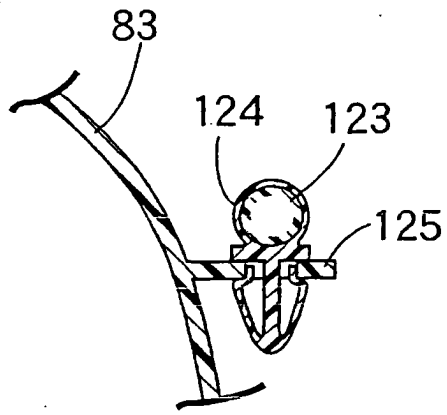


FIG. 14

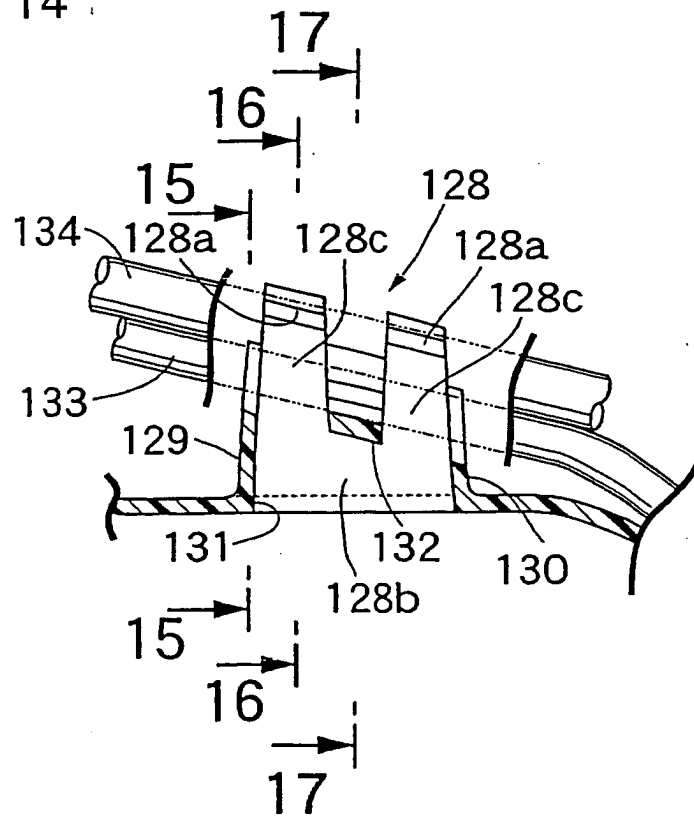


FIG. 15

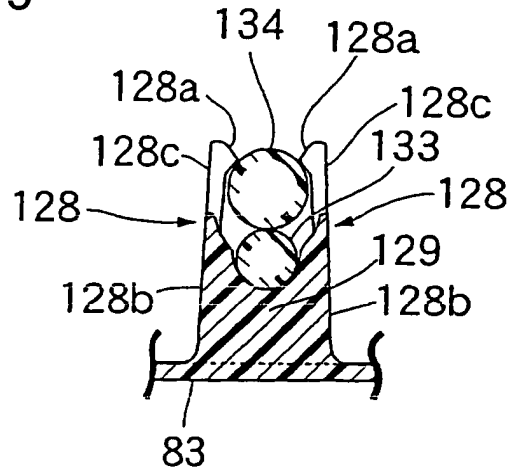


FIG. 16

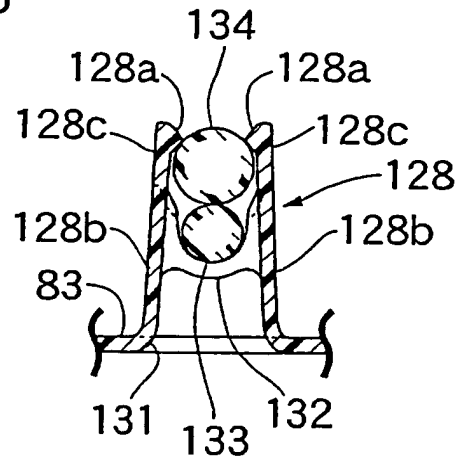


FIG. 17

