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(54) **Engine lubricating device**

(57) In a lubricating device for an engine which includes an oil pump disposed in a crankcase and feeding oil in response to the rotation of a crankshaft, the oil pump can be assembled separately from the crankcase, which is effective in improving assembling and maintenance work of the oil pump.

A holder 34 rotatably supporting a crankshaft 20 is attached to a surface 108 of a crankcase 26, and constitutes a pump housing 90 for an oil pump 82 together with a cover 91 fastened to the holder 34.

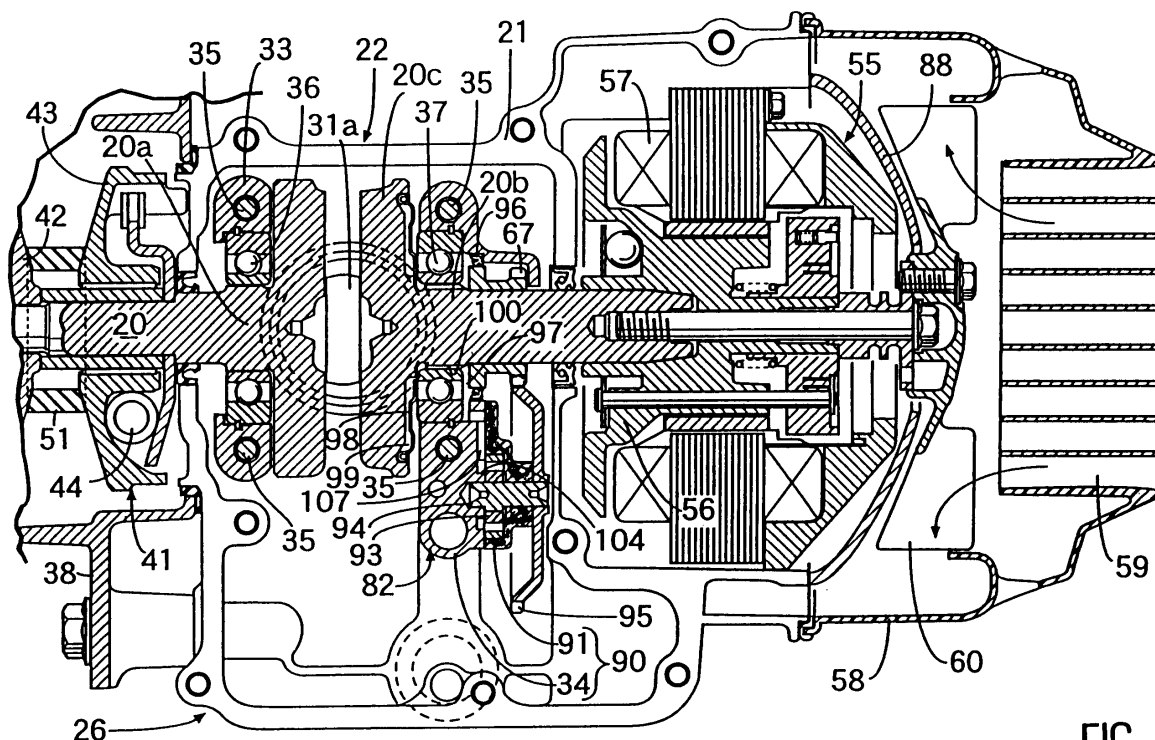


FIG. 3

Description

[0001] The present invention relates to an engine lubricating device including an oil pump which is housed in a crankcase and discharges oil in response to the rotation of a crankshaft.

[0002] Such a lubricating device has been known in Japanese Utility Model Laid-Open No. Sho 61-63492.

[0003] In the foregoing lubricating device, a pump housing of an oil pump is constituted by a crankcase and a cover attached to the crankcase. When assembling the oil pump into an engine, components constituting the oil pump, such as a rotor, also have to be incorporated in the crankcase. Therefore, such an oil pump is likely to be difficult to assemble and maintain.

[0004] The invention has been contemplated in order to overcome the foregoing problems of the related art, and provide an engine lubricating device in which an oil pump is assembled separately from a crankcase, and facilitates assembling and maintenance.

[0005] In order to accomplish the foregoing purpose, claim 1 defines an engine lubricating device wherein: an oil pump is housed in a crankcase and discharges oil in response to the rotation of a crankshaft; a holder for rotatably supporting the crankshaft is attached on a surface of the crankcase where the holder is attached; and a pump housing for the pump is constituted by the holder and a cover fastened to the holder.

[0006] According to this feature, the oil pump is assembled on the holder which is attached to the crankcase, i.e. the holder is attached to the crankcase with the oil pump assembled thereon. This structure is effective in facilitating assembly and maintenance of the oil pump.

[0007] According to claim 2, the engine lubricating device of claim 1 features the following: a discharge path is formed on the holder, communicates with a discharge port of the oil pump at a first end thereof and opens at a second end thereof on a surface of the holder attached to the crankcase; and a discharge side oil path is formed on the crankcase, opens on the surface of the crankcase at a first end thereof, communicates with the second end of the discharge path, and introduces oil to a cylinder head. This structure enables the oil path to extend from the oil pump to the cylinder head simply by attaching the holder to the crankcase. In other words, the oil path can be formed easily.

[0008] As defined in claim 3, the engine lubricating device of claim 2 further features the following: an oil intake side oil path is formed in the crankcase, communicates at a first end thereof with an oil filter, which is positioned under the crankcase and filters oil pumped up therefrom, and opens on the surface of the crankcase at a second end thereof; an intake path is formed on the holder, opens on the surface of the holder at a first end thereof for the purpose of communicating with the second end of the intake side oil path (117) and communicates with an intake port of the oil pump at the second

end thereof. Therefore, the oil path extends from the bottom of the crankcase to the oil pump simply by attaching the holder to the crankcase, which further facilitates the formation of the oil path.

[0009] The invention will be described with reference to one embodiment shown on the accompanying drawings.

[0010] Fig. 1 to Fig. 5 show the embodiment of the invention. Specifically, Fig. 1 is a side view of a rear part of a motorcycle, Fig. 2 is an enlarged sectional view taken along line 2-2 in Fig. 1, Fig. 3 is an enlarged sectional view taken along line 3-3 in Fig. 2, Fig. 4 is a sectional view taken along line 4-4 in Fig. 2, and Fig. 5 is a sectional view taken along line 5-5 in Fig. 2.

[0011] Referring to Fig. 1, a power unit P for driving a rear wheel WR is attached to the rear part of a body frame 11 of a scooter type motorcycle via a link 12 and is capable of swinging.

[0012] With reference to Fig. 2, the power unit P comprises an air-cooled four-cycle single cylinder engine 14 and an endless belt type continuously variable transmission 15 extending from a left side surface to the rear part of the body frame 11. The rear wheel WR is positioned behind the engine 14 and is attached to the right rear end of the continuously variable transmission 15 (called "the transmission 15" hereinafter). An upper rear surface of the transmission 15 is coupled to the rear end of the body frame 11 via a rear cushion 16. An air cleaner 17 is positioned on the transmission 15, and a muffler 18 is attached on the right side of the transmission 15. A retractable center stand 19 is attached to the underside of the engine 14.

[0013] Further referring to Fig. 3 to Fig. 5, the engine 14 includes a first engine block 22 and a second engine block 23 which are divided by a split plane 21 extending vertically along a crankshaft 20. The first engine block 22 constitutes a cylinder block 24 and a crankcase half 25. The crankcase half 25 and second engine block 23 constitute a crankcase 26 for housing the crankshaft 20. In other words, the crankcase 26 can be split by the plane including the rotation axis of the crankshaft 20.

[0014] A cylinder head 27 is coupled to the front end of the cylinder block 24, while a head cover 28 is coupled to the front end of the cylinder head 27. A piston 30 slidably fitted in the cylinder 29 of the cylinder block 24 is coupled to the crankshaft 20 via a connecting rod 31 and a crank pin 32.

[0015] Left and right holders 33 and 34 are attached to the crankcase half 25 of the first engine block 22 using two pairs of bolts 35, and left and right crank journals 20a and 20b of the crankshaft 20 are rotatably supported by the holders 33 and 34 via ball bearings 36 and 37.

[0016] The transmission 15 includes right and left casings 38 and 39 which are coupled. The front right surface of the right casing 38 is coupled to left side surfaces of the first and second engine blocks 22 and 23. Further, a speed reduction unit casing 40 is attached to the rear right surface of the right casing 38.

[0017] A driving pulley 41 is provided at the left end of the crankshaft 20 projecting into the right and left casings 38. and 39. The driving pulley 41 comprises an immovable pulley half 42 fixedly attached to the crankshaft 20 and a movable pulley half 43 which comes into contact with and out of contact from the immovable pulley half 42. The movable pulley half 43 is urged to approach the immovable pulley half 42 by a centrifugal weight 44 which moves radially as the crankshaft 20 rotates at an accelerated speed.

[0018] A driven pulley 46 is supported by an output shaft 45 positioned between the rear part of the right casing 38 and the speed reduction unit casing 40, and includes an immovable pulley half 47 relatively rotatably supported by the output shaft 45, and a movable pulley half 48 which comes into contact with and out of contact from the immovable pulley half 47. The movable pulley half 48 is urged toward the immovable pulley half 47 by a spring 49. A starting clutch 50 is provided between the immovable pulley half 47 and the output shaft 45. An endless V-belt 51 extends round the driving and driven pulleys 41 and 45.

[0019] An intermediate shaft 52 and an axle 53 are supported between the right casing 38 and the speed reduction unit casing 40, and are in parallel with the output shaft 45, so that a speed reducing gear train 54 is provided between the output shaft 45, intermediate shaft 52 and axle 53. The rear wheel WR is coupled to the right end of the axle 53 projecting rightward through the speed reduction unit casing 40.

[0020] Since the driving pulley 41 exerts a small centrifugal force on the centrifugal weight 44 in this transmission 15 during low speed rotation of the engine 14, a gap between the stationary pulley half 47 and the movable pulley half 48 is narrowed by the spring 49 of the driven pulley 46, and a transmission ratio is LOW. If the crankshaft 20 increases its rotating speed in this state, the centrifugal force acting on the centrifugal weight 44 is increased, and a gap between the immovable pulley half 42 and movable pulley half 43 of the driving pulley 41 is narrowed. As a result, the gap between the immovable pulley half 47 and movable pulley half 48 of the driven pulley 48 is widened, so that the transmission ratio continuously changes from LOW to TOP.

[0021] A rotor 56 of a generator 55 is coupled to the right end of the crankshaft 20 projecting from the crankcase 26. The right end of the crankshaft 20 is positioned opposite to the transmission 15. A stator 57 of the generator 55 is supported by the first engine block 22, to which a generator cover 88 extending over the generator 55 is fastened.

[0022] A shroud 58 covers the cylinder block 24 of the engine 14, a part of the cylinder head 27 and the generator 55, and is provided with a louver 59 at a portion thereof outside the generator 55. A fan 60 is positioned between the louver 59 and the generator cover 88, and is coaxially coupled to the crankshaft 20. The fan 60 rotates together with the crankshaft 20 in order to suck the

air into the shroud 58 via the louver 59, so that cooling air flows through the shroud 58 as shown by arrows, thereby cooling not only a part of the cylinder head 27 but also the cylinder block 24 and the generator 55.

[0023] An intake valve 64 and an exhaust valve 65 are arranged on the cylinder head 27, are urged to be closed, and selectively connects or disconnects a combustion chamber 61, an intake port 62 and an exhaust port 63. The combustion chamber 61 is formed between the piston 30 slidably fitted to the cylinder 29 and the cylinder head 27. The intake and exhaust ports 62 and 63 are provided on the cylinder head 27, and are opened and closed by a valve system 66.

[0024] The valve system 66 comprises: a driving gear 67 which is housed in the right holder 34 supporting the crankshaft 20 and is fixedly attached to the crankshaft 20; a driven gear 68 rotatably supported by the right holder 34 and engaged with the driving gear 67; a cam 69 integral with the driven gear 68; a first intake side rocker arm 70 which is supported by the right holder 34 so as to swing round the axis parallel to the crankshaft 20 and is in slidable contact with the cam 69; a first exhaust side rocker arm 71 supported by the right holder 34 so as to swing round the axis parallel to the crankshaft 20 and is in slidable contact with the cam 69; a second intake side rocker arm 72 supported by the cylinder head 27, so as to swing round the axis parallel to the first intake side rocker arm 70, operate in synchronization with and be connected to the intake valve 64; a second exhaust side rocker arm 73 supported by the cylinder head 27 so as to swing round the axis parallel to the first exhaust side rocker arm 71, operate in synchronization with and be connected to the exhaust valve 65; a rod 74 connecting the first and second intake side rocker arms 70 and 72; and a rod 75 connecting the first and second exhaust side rocker arms 71 and 73.

[0025] In the crankcase half 25, an operation chamber 76 is arranged at the right side of the cylinder block 24, is in the shape of a triangle, and becomes narrow toward the cylinder head 27. The operation chamber 76 communicates with the crankcase 26, and houses the driven gear 68, parts of the first intake side rocker arm 70 and first exhaust side rocker arm 71, and cam 69 which constitute the valve system 66. The rods 74 and 75 are arranged in the shape of an X when viewed from a side, and are housed in cylindrical covers 78 and 79 provided between the crankcase half 25 and the cylinder head 27 in order to connect the operation chamber 76 to a valve chamber 77 which is formed between the cylinder head 27 and the head cover 28. The rods 74 and 75 are axially movable in the cylindrical covers 78 and 79.

[0026] An oil sump 80 is prepared at the bottom of the crankcase 26. Oil stored in the oil sump 80 is pumped up to an oil pump 82 via an oil filter 81, and is pressurized to parts to be lubricated in the engine 14.

[0027] Under the crankcase half 25 of the crankcase 26, a cylindrical filter chamber 83 is provided, which opens to the front side of the crankcase half 25, and

houses the oil filter 81 in the shape of a cup, and a holding spring 85 for pressing a seal 84 to an inner wall of the filter chamber 83. The seal 84 is attached to an open end of the oil filter 81. An open end of the filter chamber 83 is closed by a cap 86 screwed to the crankcase half 25.

[0028] The filter chamber 83 is divided into a non-filtering part inside the oil filter 81 and a filtering part 87 outside the oil filter 81. The oil sump 80 communicates with the non-filtering part

[0029] The cap 86 also functions as a drain bolt. When the oil filter 81 is removed by detaching the cap 86, oil in the oil sump 80 can be discharged outside via the filter chamber 83.

[0030] A pump housing 90 of the oil pump 82 is constituted by the right holder 34 and a cover 91 fastened to the right holder 34 using a plurality of bolts, e.g. two bolts 92. A rotor 93 is housed in the pump housing 90 and is coupled to a rotary shaft 94 which is rotatably supported by the pump housing 90. A driven gear 95 is fixedly attached to one end of the rotary shaft 94 projecting from the pump housing 90. The driven gear 95 is engaged with the driving gear 67 fixedly attached to the crankshaft 20. In other words, the oil pump 82 operates in synchronization with the rotation of the crankshaft 20.

[0031] An outer race of the ball bearing 37 for supporting the right crank journal 20b of the crankshaft 20 is fitted to the right holder 34. Further, an oil seal 96 is attached to the right holder 34, and is in sliding contact with the driving gear 67 which is fixed to the crankshaft 20 outside the right crank journal 20b. An annular oil chamber 97 is formed between the outer surface of the ball bearing 37 and the driving gear 67. In the crankshaft 20, an annular side plate 98 is attached on the outer surface of a crank web 20c near the right crank journal 20b in order to surround the right crank journal 20b. An annular and flat oil sump 99 is formed between the side plate 98 and the crank web 20c. Further, a plurality of oil grooves 100 are formed on the outer surface of the right crank journal 20b, thereby enabling the oil chamber 97 and the oil sump 99 to communicate with each other.

[0032] A needle bearing 103 is interposed between the outer surface of a crank pin 32 the big end 31a of the connecting rod 31. The crank pin 32 communicates with the oil chamber 97 via its hollow portion 101, and has a fuel injection hole 102 on the outer surface thereof, which communicates with the hollow portion 101.

[0033] The oil pump 82 has first and second discharge ports 104 and 105, and one intake port 106. An oil path 107 is formed on the right holder 34 in order to connect the first discharge port 104 with the oil chamber 97.

[0034] With the foregoing structure, oil is discharged via the first discharge port 104 of the oil pump 82 and is pressure-fed to the oil path 107, oil chamber 97, oil grooves 100, oil sump 99, hollow portion 101 of the crank pin 32, and fuel injection hole 102, thereby lubricating the ball bearing 37, outer surface of the crank pin

32, needle bearing 103, and big end 31a of the connecting rod 31.

[0035] The right holder 34 is attached to the surface 108 of the crankcase half 25 as described above, and has a discharge path 110 which communicates at a first end thereof with the second discharge port 105 of the oil pump 82. The discharge path 110 opens at a second end thereof on the surface 109 of the right holder 34 which is mounted on the surface 108 of the crankcase half 25. Further, a discharge side oil path 111 is formed on the crankcase half 25 of the crankcase 26 in order to introduce oil to the cylinder head 27, and opens on the surface 108 at first end in order to communicate with the second end of the discharge path 110.

[0036] The discharge side oil path 111 communicates with an oil path 112 provided on the cylinder block 24 and cylinder head 27. The oil path 112 communicates with a flat oil sump 114 formed between the head cover 28 and an oil holding plate 113 on the head cover 28. The oil holding plate 113 has fuel injection holes 115 and 115 for injecting fuel to the second inlet and exhaust side rocker arms 72 and 73 of the valve system 66.

[0037] Oil discharged via the second discharge port 105 of the oil pump 82 is injected to the rocker arms 72 and 73 via the oil discharging path 110, discharge side oil path 111, oil path 112 and oil sump 114.

[0038] Further, the right holder 34 has an intake path 116 which opens at a first end thereof on the surface 109 and communicates with the intake port 106. An intake side oil path 117 is formed on the crankcase half 25 of the crankcase 26, and communicates with the filtering chamber 87 of the oil filter 81 via one end thereof, and opens on the surface 108 via the other end thereof in order to communicate with one end of the intake path 116.

[0039] Oil filtered by the oil filter 81 is absorbed in to the intake port 106 of the oil pump 82 via the intake side oil path 117 and intake path 116.

[0040] The operation of the embodiment will be described hereinafter. The right holder 34 rotatably supporting the crankshaft 20 is attached on the surface 108 of the crankcase half 25 of the crankcase 26. The right holder 34 and the cover 91 fastened to the right holder 34 constitute the pump housing 90 for the oil pump 82. Therefore, the oil pump 82 can be assembled on the right holder 34 to be attached to the crankcase 26. In other words, the right holder 34 with the oil pump 82 assembled thereon is attached to the crankcase 26, which is effective in improving assembling and maintenance work of the oil pump 82.

[0041] The right holder 34 is provided with the discharge path 110 which communicates at the first end thereof with the second discharge port 105 of the oil pump 82 and opens on the surface 109 of the right holder 34 via the second end thereof. The discharge side oil path 111 is formed on the crankcase half 25, and opens on the surface 108 of the crankcase half 25 via first end thereof in order to communicate with the second end of

the discharge path 110, thereby feeding oil to the cylinder head 27. Therefore, the oil path can be easily formed between the oil pump 82 and the cylinder head 27 simply by attaching the right holder 34 on the crankcase 26.

[0042] The oil filter 81 is arranged in the crankcase 26 in order to filter oil pumped up from the oil sump 80 at the bottom of the crankcase 26. The intake side oil path 117 is provided in the crankcase half 25, communicates with the filter chamber 87 of the filter 81 and opens on the surface 108 at the first end thereof. The intake path 116 is provided on the right holder 34, opens on the surface 109 in order to communicate with the second end of the intake side oil path 117; and communicates with the intake port 106, at the second end thereof. Therefore, the oil path can be further easily formed between the bottom of the crankcase 26 and the oil pump 82 simply by attaching the right holder 34 to the crankcase 26.

[0043] Although the preferred embodiment has been shown and described, it should be understood that many changes and modifications may be made therein without departing from the scope of the claims.

[0044] As defined in claim 1, the oil pump can be assembled on the holder. The holder with the oil pump assembled thereon is attached to the crankcase, which is effective in improving assembling and maintenance work of the oil pump.

[0045] According to claim 2, the oil path can be easily formed between the oil pump and the cylinder head simply by attaching the holder to the crankcase.

[0046] In accordance with claim 3, the oil path can be further easily formed between the bottom of the crankcase and the oil pump simply by attaching the holder to the crankcase.

3. The engine lubricating device of claim 2, wherein: an intake side oil path (117) is formed in the crankcase (26), communicates at a first end thereof with an oil filter (81), which is positioned under the crankcase (26) and filters oil pumped up therefrom, and opens on the surface (108) of the crankcase (26) at a second end thereof; and an intake path (116) is formed on the holder (34), opens on the surface (109) of the holder (34) at a first end thereof for the purpose of communicating with the second end of the intake side oil path (117) and communicates with an intake port (106) of the oil pump (82) at a second end thereof.

Claims

1. An engine lubricating device wherein: an oil pump (82) is housed in a crankcase (26) and discharges oil in response to the rotation of a crankshaft (20); a holder (34) for rotatably supporting the crankshaft (20) is attached on a surface (108) of the crankcase (26) where the holder (34) is attached; and a pump housing (90) for the pump (82) is constituted by the holder (34) and a cover (91) fastened to the holder (34).
2. The engine lubricating device of claim 1, wherein: a discharge path (110) is formed on the holder (34), communicates with a discharge port (105) of the oil pump (82) at a first end thereof and opens at a second end thereof on a surface (109) of the holder (34) attached to the crankcase (26); and a discharge side oil path (111) is formed on the crankcase (26), opens on the surface (108) of the crankcase (26) at a first end thereof, communicates with the second end of the discharge path (110), and introduces oil to a cylinder head (27).

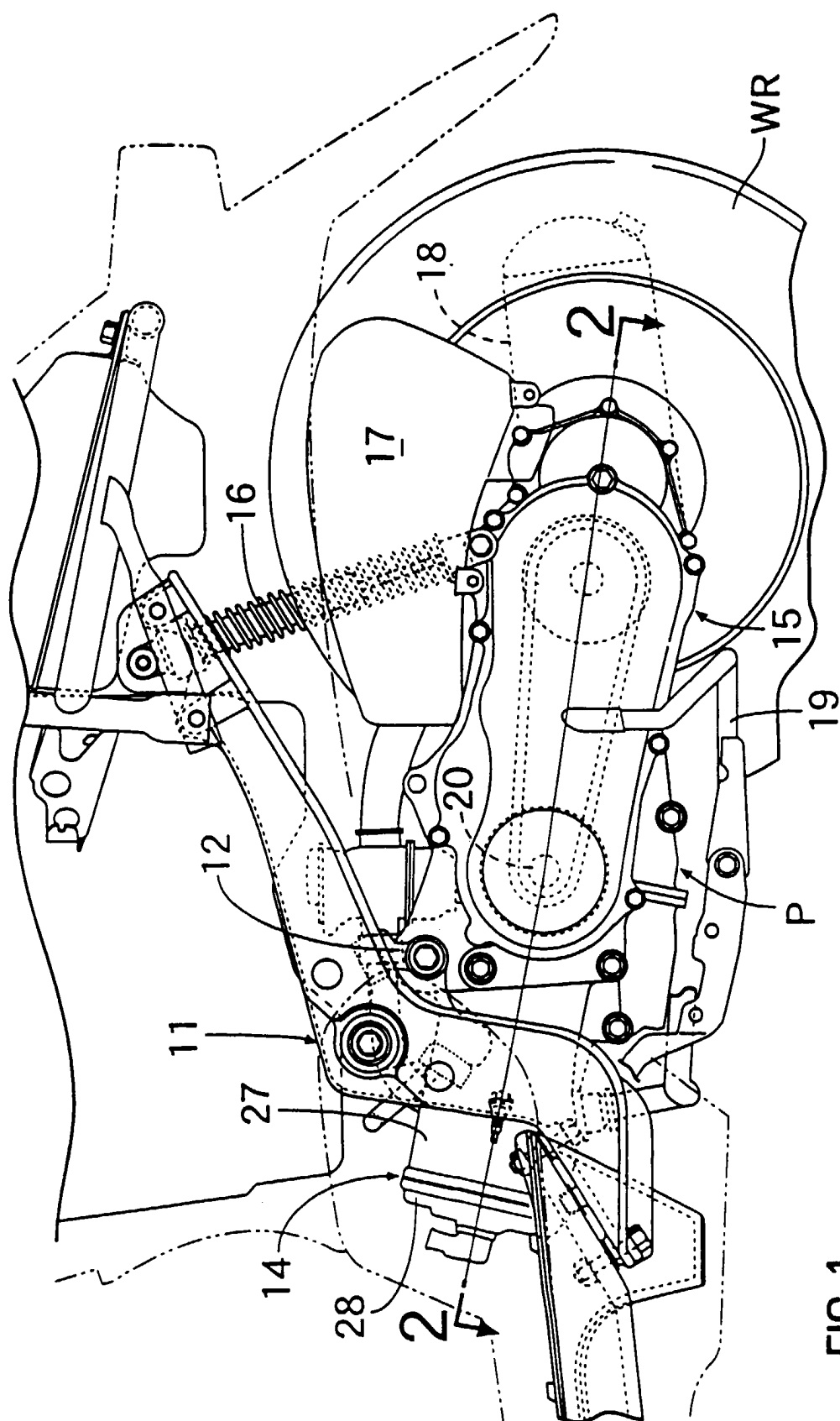


FIG. 1

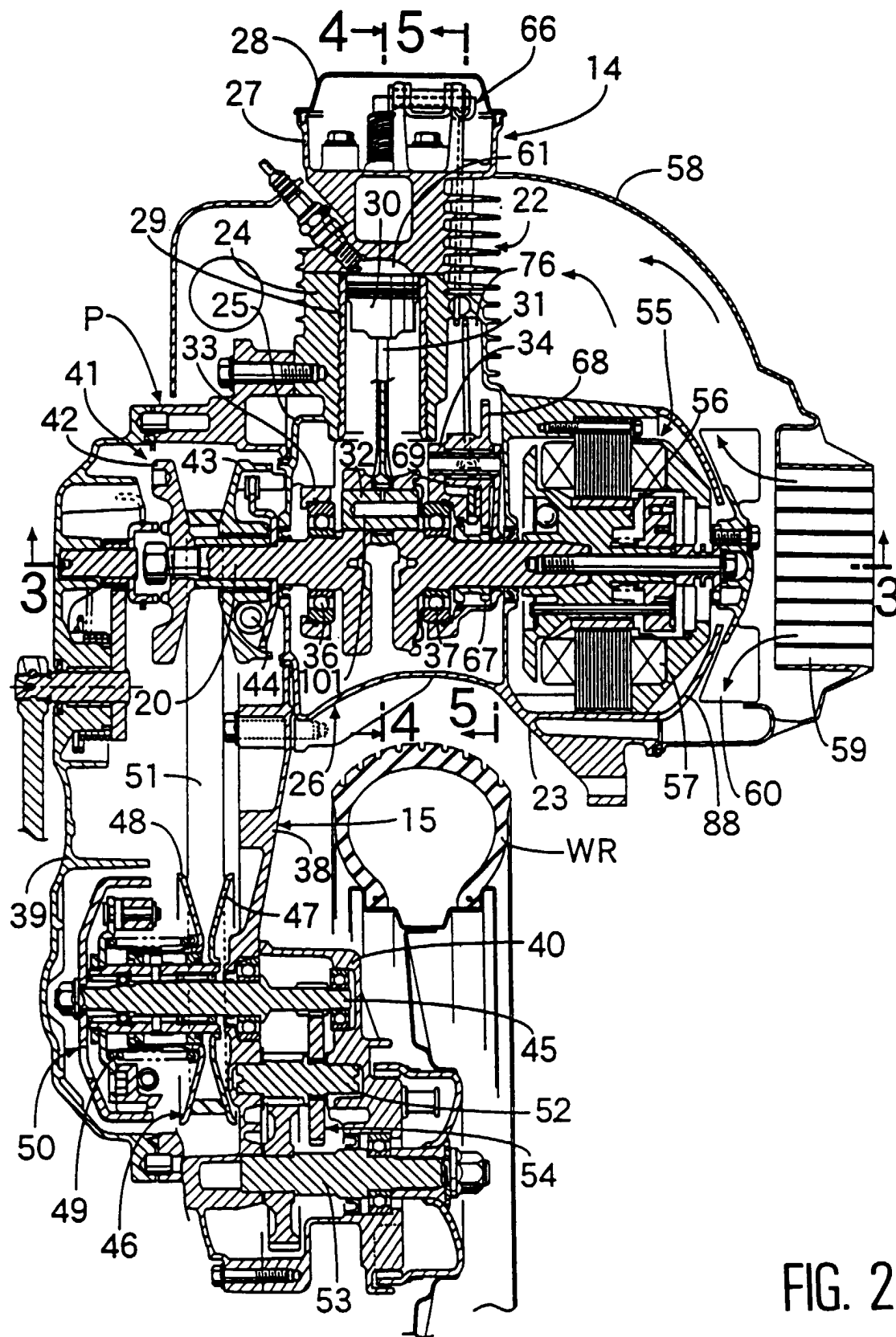


FIG. 2

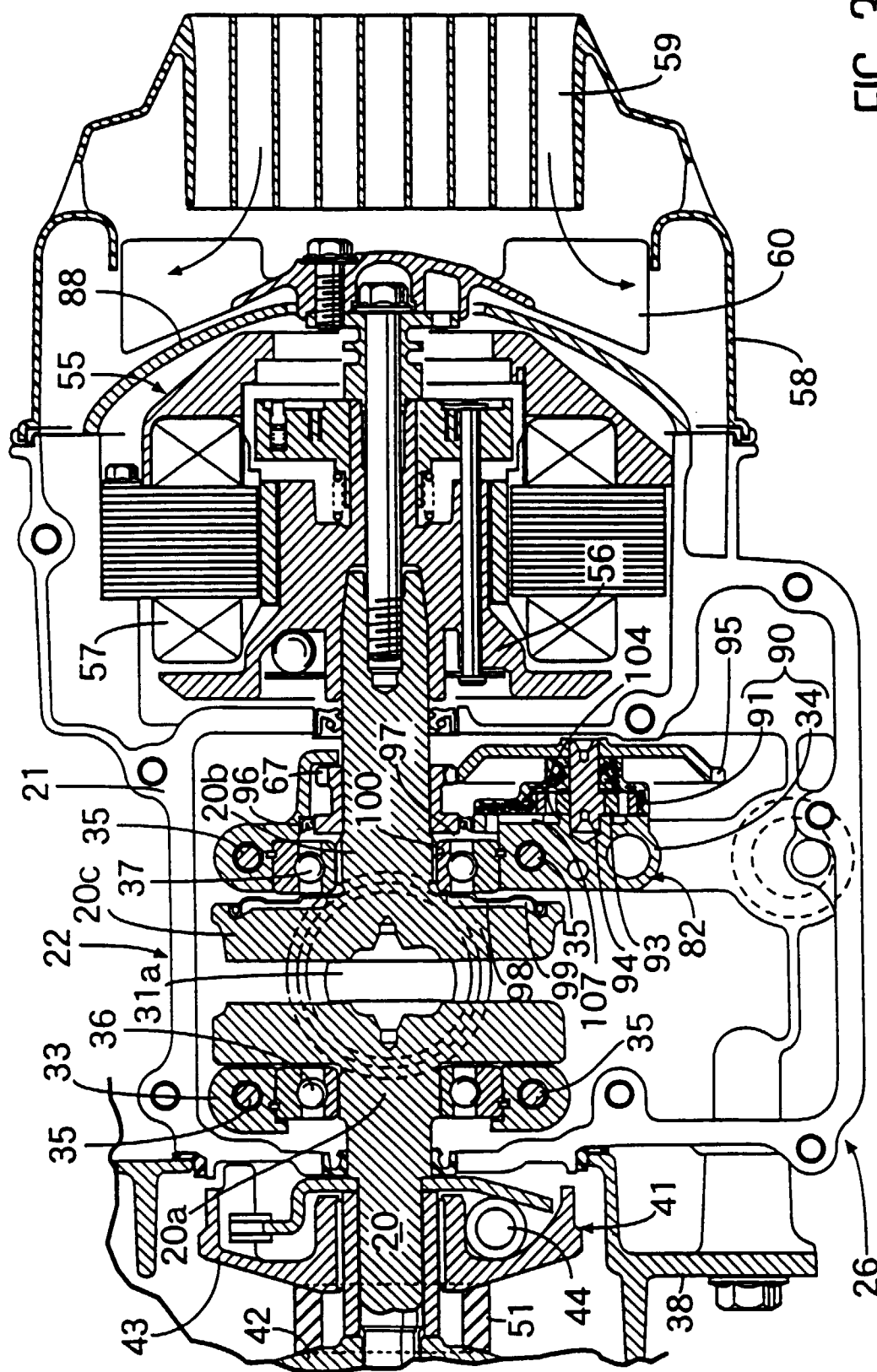


FIG. 3

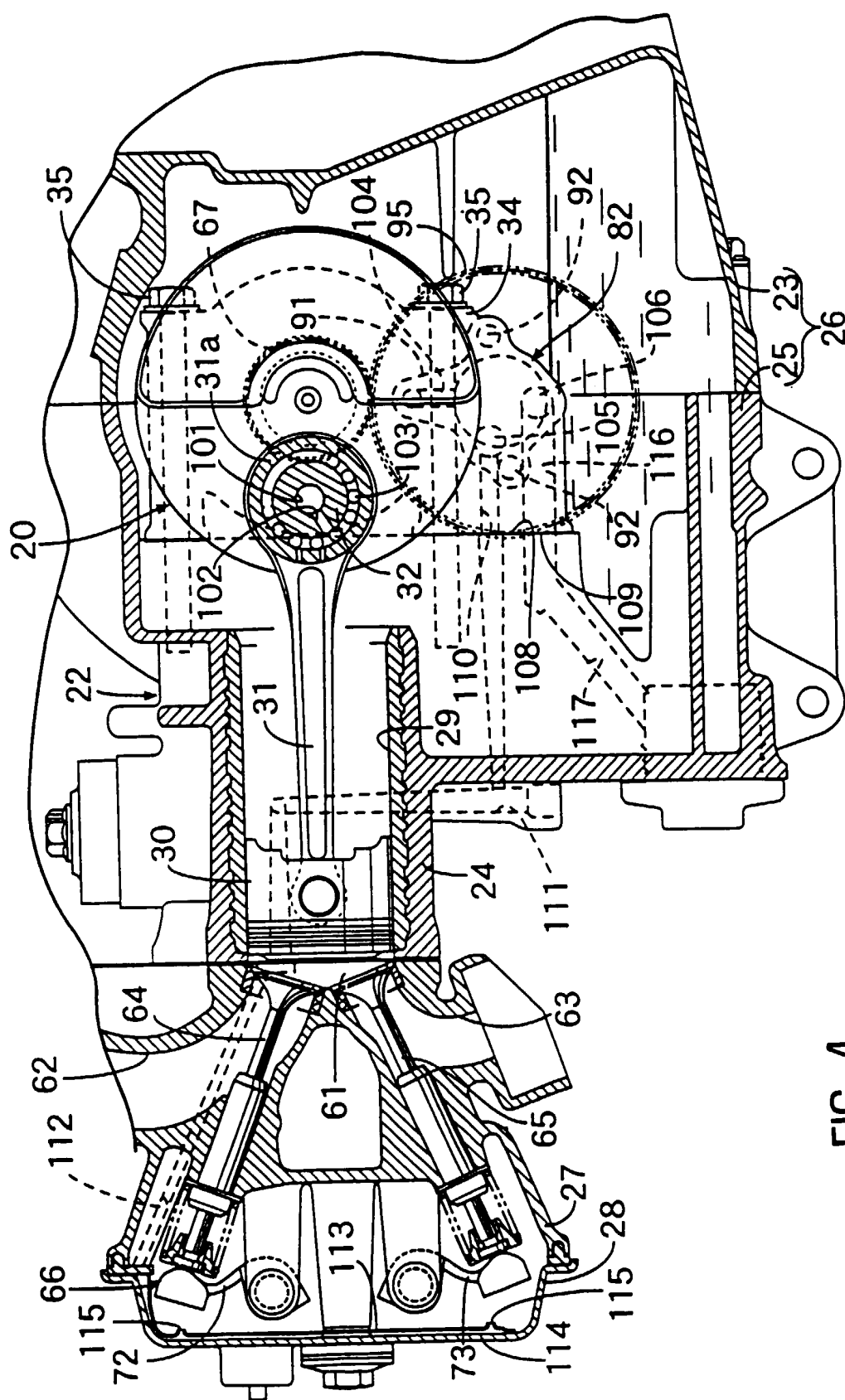
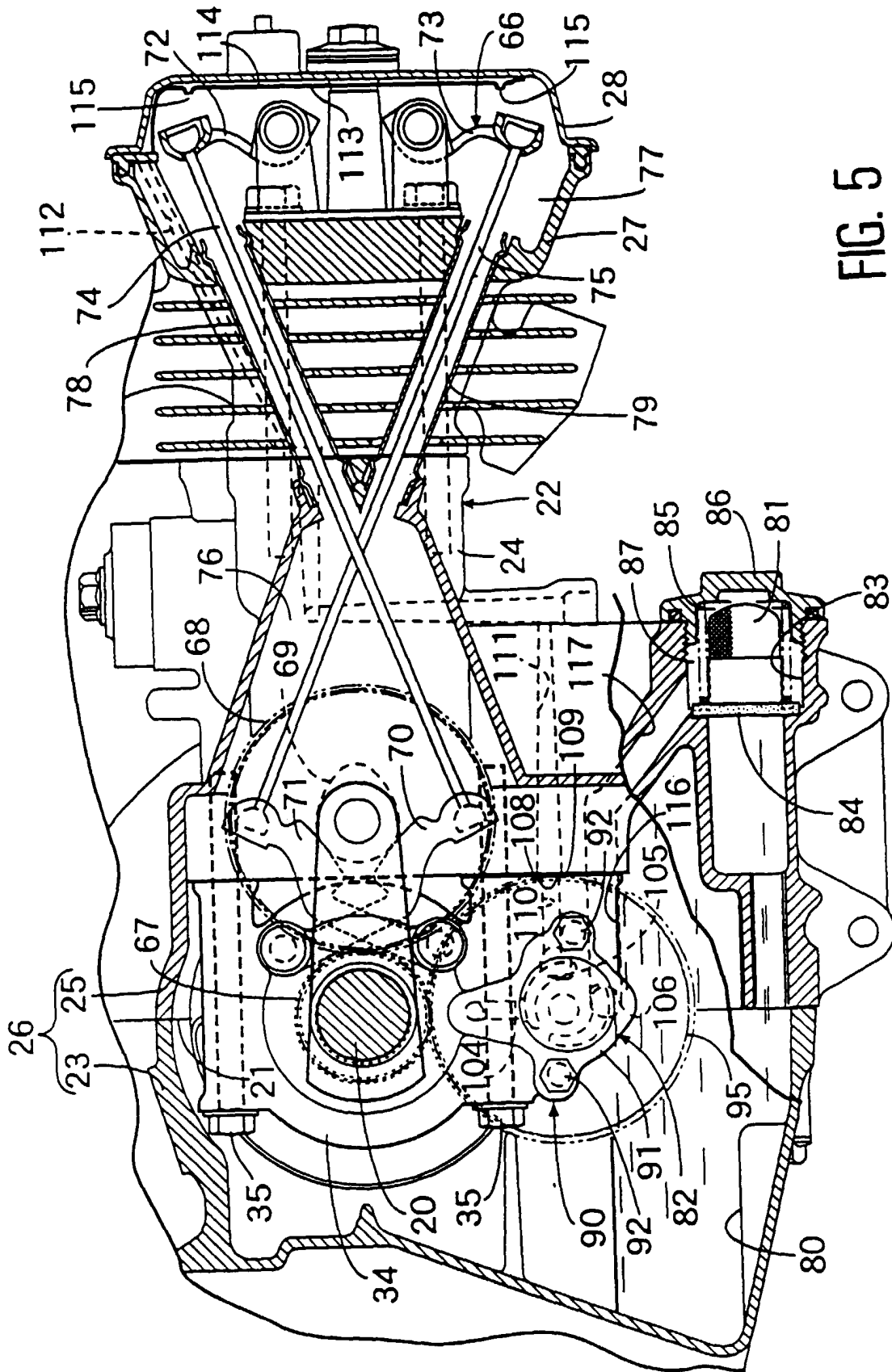


FIG. 4





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 00 40 2419

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 27 58 376 A (SCHWAEBISCHE HUETTENWERKE GMBH) 5 July 1979 (1979-07-05) * page 22, line 13 - page 24, line 3; figure 1 *	1	F01M1/02 F01M11/02
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20 November 2000	Examiner Mouton, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P4/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 40 2419

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