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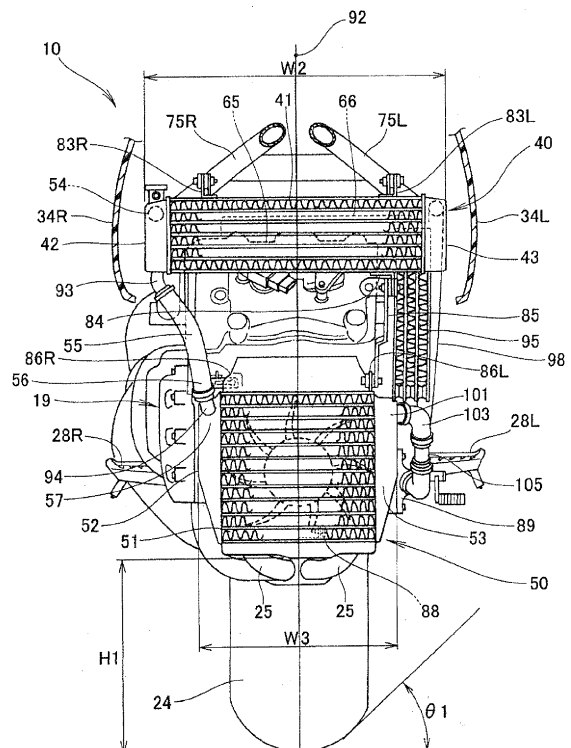
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• **Takei, Hayato****Saitama 351-0193 (JP)**(54) **Saddle-ride type vehicle**

(57) An object is to provide a saddle-ride type vehicle that can ensure a bank angle while enlarging a radiator.

A vehicle 10 includes an upper radiator 40 disposed above a front wheel and in front of an engine 19 and a lower radiator 50 disposed behind the upper radiator 40 and between the front wheel and the engine 19. An upper return pipe 98 adapted to return cooling water to the engine 19 extends toward the rear of the vehicle from an upper downstream tank 43 and a lower return pipe 103 extends toward the rear of the vehicle from an upper portion 101 of a lower downstream tank 53.

FIG. 3



Description

[Technical Field]

[0001] The present invention relates to a saddle-ride type vehicle equipped with a radiator in front of an engine.

[Background Art]

[0002] A radiator is attached to a water-cooled engine mounted on a saddle-ride type vehicle. It is known that the radiator is disposed in the front portion of a vehicle into which the airflow resulting from the running vehicle is likely to move (see e.g. Patent Document 1 Japanese Patent Laid-Open No. 2005-271636 (Figs. 1 and 2)).

[0003] As shown in Fig. 1 of Patent Document 1, an engine E is mounted on a main frame 1 of a saddle-ride type vehicle. (A parenthetic symbol denotes a symbol described in Patent Document 1. The same holds true for the following.) A radiator 2 is disposed in front of and above the engine E.

[0004] The radiator 2 is disposed on each of the right and left sides in a vehicle-width direction as shown in Fig. 2 in Patent Document 1.

[0005] A cooling water inlet pipe 18 extends upward from a cooling water jacket outlet 20 of the engine shown by an imaginary line. The cooling water inlet pipe 18 is bifurcated into two inlet branch pipes 17. The inlet branch pipes 17 are each connected to an inlet side cooling water tank 6 of the radiator 2. Additionally, an outlet pipe 21 extends from each of the outlet side cooling water tanks 7. The two outlet branch pipes 21 are converged into a cooling water outlet pipe 22 in a lower portion of the vehicle. The cooling water outlet pipe 22 is connected to a cooling water jacket inlet of the engine via a water pump.

[0006] Incidentally, an increase in the radiation area of the radiator 2 is required depending on the specifications of the engine in some cases.

[0007] In order to increase the radiation area, the vehicle-widthwise dimension of the radiator 2 may be increased. Such a case will have an influence on a bank angle. Alternatively, to increase the radiation area, if the radiator 2 is extended downward, the cooling water output pipe 22 disposed below the radiator 2 comes close to the ground surface. Since the ground height has a limit, also there is a limit to extend the radiator 2 downward.

[0008] In short, the structure of Patent Document 1 has difficulty in enlarging the radiator 2. Thus, a structure substituting for the structure of Patent Document 1 is required.

[Summary of the Invention]

[0009] It is an object of the present invention to provide a saddle-ride type vehicle that can ensure a bank angle while enlarging a radiator.

[0010] The invention is **characterized in that** in a sad-

dle-ride type vehicle equipped with radiators in front of an engine, the vehicle includes an upper radiator disposed above a front wheel and in front of the engine and a lower radiator disposed behind the upper radiator and between the front wheel and the engine; the upper radiator includes an upper radiator core extending in a vehicle-width direction, an upper upstream tank connected to one of the left and right, in the vehicle-width direction, of the upper radiator core and adapted to store water supplied to the upper radiator core, and an upper downstream tank connected to the other of the left and right, in the vehicle-width direction, of the upper radiator core and adapted to store water cooled by the upper radiator core; the lower radiator includes a lower radiator core extending in the vehicle-width direction, a lower upstream tank connected to one of the left and right, in the vehicle-width direction, of the lower radiator core and adapted to store water supplied to the lower radiator core, and a lower downstream tank connected to the other of the left and right, in the vehicle-width direction, of the lower radiator core and adapted to store water cooled by the lower radiator core; an upper return pipe adapted to return the cooling water to the engine extends toward the rear of the vehicle from the upper downstream tank and a lower return pipe extends toward the rear of the vehicle from an upper portion of the lower downstream tank; and the upper return pipe and the lower return pipe converge on the upstream side of a water pump while being arranged to extend along the engine.

[0011] The invention may also be **characterized in that** an inlet of the upper return pipe is connected to an upper rear surface of the upper downstream tank; and an oil cooler adapted to cool engine oil circulating inside the engine is disposed on the other of the left and right in the vehicle-width direction, and as viewed from the side of the vehicle, is disposed below the upper return pipe while extending along a rear surface of the upper radiator.

[0012] The invention may also be **characterized in that** the saddle-ride type vehicle includes, on one of the left and right in the vehicle-width direction, an upper supply pipe extending from the engine to the upper upstream tank and adapted to supply the water to the upper stream tank and a lower supply pipe extending from a lower portion of the upper upstream tank to the lower upstream tank and adapted to supply the water to the lower upstream tank.

[0013] The invention may also be **characterized in that** the saddle-ride type vehicle includes a body frame supporting the engine, the body frame includes a head pipe, left and right main frames extending toward the rearward downside of the vehicle from the head pipe and disposed right and left, and a seat rail extending toward the rear of the vehicle from a rear portion of the main frames, the upper radiator is disposed, as viewed from the side of the vehicle, below and adjacently to the main frames, and the upper return pipe extends in an extending direction of the main frames at a position below the main

frames, further extending below the vehicle along a front surface of the crankcase of the engine, and is connected to a confluence portion with the lower return pipe.

[0014] The invention may also be **characterized in that** the main frames are truss frames formed by welding a plurality of pipes, and the upper return pipe has a diameter generally equal to a diameter of the pipe and is disposed to overlap the main frames in the back and forth direction of the vehicle.

[0015] The invention may also be **characterized in that** the lower radiator 50 is disposed behind the front wheel 13 and below a cylinder 65 of the engine 19 tilting toward the front of the vehicle,

the lower radiator core 51 is provided at a rear portion thereof with an air-cooling fan 115 for forced-cooling the water, and

an exhaust pipe 25 extending toward the downside of the vehicle from a lower surface of the cylinder 65 passes the back of the air-cooling fan 115 and extends toward the rear of the vehicle as viewed from the side of the vehicle.

[0016] The invention may also be **characterized in that** the lower radiator is disposed below a cylinder of the engine tilting toward the rear of the front wheel and toward the front of the vehicle, the lower radiator core is provided at a rear portion thereof with an air-cooling fan for forced-cooling the water, and an exhaust pipe extending toward the downside of the vehicle from a lower surface of the cylinder, passes the back of the air-cooling fan and extends toward the rear of the vehicle as viewed from the side of the vehicle.

[0017] The invention may also be **characterized in that** an outlet of the lower supply pipe is connected to a front surface of the lower upstream tank.

[0018] In the invention according to claim 1 as filed, the vehicle has the two radiators one above the other.

[0019] The vehicle-widthwise dimension of the lower radiator can easily be reduced compared with that of the upper radiator. Thus, the bank angle can easily be ensured.

[0020] The lower return pipe is not extended downward from the lower downstream tank of the lower radiator but extended rearward from the upper portion of the lower downstream tank of the lower radiator. The lower radiator can be extended downward. While ensuring the ground height, an increase in radiation area can easily be achieved.

[0021] Thus, a saddle-ride type vehicle can be provided that can ensure the bank angle while enlarging the radiator.

[0022] Additionally, the upper return pipe extending from the upper downstream tank and the lower return pipe extending from the lower downstream tank converge on the upstream side of the water pump. The water cooled by the upper radiator is supplied to the engine not via the lower radiator. The cooling water maintaining a low-temperature state flows into the water jacket of the engine. In short, the cooling efficiency of the engine can

be improved.

[0023] In the invention according to claim 2 as filed, the oil cooler is disposed along the rear surface of the upper radiator and below the upper return pipe as viewed from the side of the vehicle.

[0024] Since the oil cooler is disposed along the rear surface of the upper radiator and below the upper return pipe, while effectively utilizing the space defined in rear of the upper radiator and below the upper return pipe, the oil cooler can satisfactorily be disposed in the limited space.

[0025] Additionally, the oil cooler is disposed closer to the upper portion of the vehicle. If the oil cooler is disposed closer to the lower portion of the vehicle, ensuring of the bank angle can be influenced. In the present invention, the oil cooler is disposed closer to the upper portion of the vehicle; therefore, the bank angle can further easily be ensured.

[0026] In the invention according to claim 3 as filed, the upper supply pipe is installed to extend from the engine to the upper upstream tank and the lower supply pipe is installed to extend from the lower portion of the upper upstream tank to the lower upstream tank.

[0027] The lower supply pipe is installed to extend from the lower portion of the upper upstream tank to the lower upstream tank. Therefore, the lower supply pipe can be reduced in length compared with the case where the lower supply pipe is branched from the upper supply pipe. Since the length of the pipe is short, the weight saving and cost reduction of the vehicle can be achieved.

[0028] In the invention according to claim 4 as filed, the upper return pipe is extended along the extending direction of the main frame at a position below the main frame as viewed from the side of the vehicle.

[0029] If the upper return pipe is extended along the main frame, the upper return pipe and the main frame are arranged in rows as viewed from the side of the vehicle. The upper return pipe and the main frame are arranged in rows; therefore, external appearance is enhanced.

[0030] In the invention according to claim 5 as filed, the upper return pipe is disposed to overlap the main frame in the back and forth direction of the vehicle.

[0031] Since the upper return pipe is disposed to overlap the main frame in the back and forth direction of the vehicle, the upper return pipe can be prevented from projecting toward the side of the vehicle.

[0032] In the invention according to claim 6 as filed, the exhaust pipe passes the back of the air-cooling fan and is extended toward the rear of the vehicle as viewed from the side of the vehicle.

[0033] Since the exhaust pipe passes the back of the air-cooling fan, the air supplied by the air-cooling fan strikes the exhaust pipe. As a result, the cooling of the exhaust pipe can be promoted.

[0034] In the invention according to claim 7 as filed, the outlet of the lower supply pipe is connected to the front surface of the lower upstream tank.

[0035] The lower upstream tank is disposed on one of the left and right in the vehicle-width direction. That is to say, the front surface of the lower upstream tank is opened toward the front of the vehicle; therefore, the outlet of the lower supply pipe can easily be connected to the front surface of the lower upstream tank.

[Brief Description of the Drawings]

[0036]

Fig. 1 is a left lateral view of a saddle-ride type vehicle according to the present invention.

Fig. 2 is a left lateral view of a front portion of the vehicle.

Fig. 3 is a cross-sectional view taken along line 3 to 3 in Fig. 1.

Fig. 4 is an enlarged view of a 4-portion in Fig. 2.

Fig. 5 is system diagrams of cooling water.

Fig. 6 is a cross-sectional view taken along line 6 to 6 in Fig. 4.

Fig. 7 shows a modified example of Fig. 2.

[Detailed Description of preferred embodiments]

[0037] Embodiments of the present invention will hereinafter be described with reference to the accompanying drawings. It is to be noted that the drawings shall be viewed in the direction of reference symbols. The front, rear or back, left and right, and upside and downside used in the following description are determined based on an occupant sitting on an occupant seat.

[0038] A saddle-ride type vehicle according to the present invention is described with reference to the drawings.

[0039] As shown in Fig. 1, a saddle-ride type vehicle 10 is a motorcycle which includes a front fork 12 steerably supported by a head pipe 11; a front wheel 13 rotatably supported by a lower end of the front fork 12; a steering handlebar 14 connected to an upper end of the front fork 12; main frames 15L (symbol L is a suffix indicating left and the same holds true for the following), 15R (symbol R is a suffix indicating right and the same holds true for the following) extending toward the leftward-rear and rightward-rear of a vehicle body from the head pipe 11; a middle frame 17 connected to rear portions of the main frames 15L, R, extending generally vertically and having a pivot shaft 16 at its lower portion; a seat rail 18 extending toward the rear of the vehicle body from the upper end of the middle frame 17; a V-type engine 19 (detailed later) supported by the lower portions of the main frames 15L, 15R; a fuel tank 21 disposed above the engine 19 and supported by the upper portions of the main frames 15L, 15R and the upper portion of the seat rail 18; a seat 22 disposed vehicle-body-rearward of the fuel tank 21 and supported by the seat rail 18; a rear swing arm 23 locked at its front end by the pivot shaft 16, extending in the back and forth direction of the vehicle body and vertically

swinging around the pivot shaft 16; a rear wheel 24 rotatably attached to the rear end of the rear swing arm 23; and a muffler 26 attached to the rear end of an exhaust pipe 25 extending toward the rear of the vehicle body from an exhaust port of the engine 19.

[0040] A body frame 27 is composed of the head pipe 11, the main frames 15L, R, the middle frame 17 and the seat rail 18. Steps 28L, R on which feet of a rider sitting on a rider seat of the seat 22 are put are installed at the lower end of the middle frame 17. The middle frame 17 and the seat frame 18 are connected by a connection frame 29. A pillion step 32 on which a foot of a pillion passenger sitting on a pillion passenger seat of the seat 22 is installed on a stay 31 extending from the connection frame 29.

[0041] The front of the head pipe 11 is covered by a front cowl 33 and the side of the head pipe 11 and the sides of the front portions of the main frames 15L, R are covered by middle cowls 34L, R. Additionally, the side of the rear portion of the seat rail 18 and the side of the rear portion of the connection frame 29 are covered by a side cover 35.

[0042] A front fender 36 covering the upper portion of the front wheel 13 is attached to the front fork 12. A rear fender 37 is attached to the rear portion of the seat rail 18 so as to cover the rear wheel 24 from rear and above.

[0043] Additionally, the saddle-ride type vehicle 10 includes an upper radiator 40 (detailed later) disposed in front of the upper portion of the engine 19 to cool cooling water circulating in the engine 19; and a lower radiator 50 (detailed later) disposed in front of the lower portion of the engine 19 to cool cooling water circulating in the engine 19.

[0044] The configuration of the engine 19, the configuration of the main frame 15L and the arrangement of the upper radiator 40 and the lower radiator 50 are described with reference to Fig. 2.

[0045] As shown in Fig. 2, the engine 19 includes an oil pan 61; a crankcase 63 disposed above the oil pan 61 and rotatably housing a crankshaft 62 extending in a vehicle-width direction; a forward tilting cylinder 65 tilting forward with respect to a vertical line 64 passing through the center of the crankshaft 62 as viewed from the left lateral surface of the vehicle; and in association with the forward tilting cylinder 65, a rearward tilting cylinder 66 tilting rearward with reference to a central point P1 of the crankshaft 62.

[0046] The forward tilting cylinder 65 includes a forward tilting cylinder block 67 formed to extend in an anterosuperior direction from the crankcase 63; a forward tilting cylinder head 68 connected to the forward tilting cylinder block 67; and a forward tilting cylinder head cover 69 connected to the forward tilting cylinder head 68 to cover the forward tilting cylinder head 68. On the other hand, the rearward tilting cylinder 66 includes a rearward tilting cylinder block 71 formed to extend in a posterior-superior direction from the crankcase 63; a rearward tilting cylinder head 72 connected to the rearward tilting

cylinder block 71; and a rearward tilting cylinder head cover 73 connected to the rearward tilting cylinder head 72 to cover the rearward tilting cylinder head 72.

[0047] A description is next given of the configuration of the main frame 15L.

[0048] The main frame 15L includes an upper pipe 74L extending toward the rearward downside of the vehicle body from the upper portion of the head pipe 11 and connected to the middle frame 17; a lower pipe 75L extending toward the rearward downside of the vehicle body from the lower portion of the head pipe 11; a first pipe 76L extending obliquely with respect to the upper pipe 74L and the lower pipe 75L and connecting the front portion of the upper pipe 74L with the front end of the lower pipe 75L; a second pipe 77L extending generally vertically with respect to the upper pipe 74L and the lower pipe 75L and connecting the front portion of the upper pipe 74L with the intermediate portion of the lower pipe 75L; and a third pipe 78L extending obliquely with respect to the upper pipe 74L and the lower pipe 75L and connecting the rear portion of the upper pipe 74L with the intermediate portion of the lower pipe 75L. The main frame 15R has the same configuration as that of the main frame 15L; therefore, its description is omitted. That is to say, the main frames 15L, R are truss frames formed by welding a plurality of the pipes 74 to 78L, R.

[0049] The rearward tilting cylinder 66 is connected to the upper pipe 74L and the third pipe 78L. In addition, the forward tilting cylinder 65 is connected to the lower pipe 75L. In this way, the engine 19 is supported by the body frame 27.

[0050] The rearward tilting cylinder head 72 and the rearward tilting cylinder head cover 73 are disposed above the upper pipe 74L of the main frame 15L and below the fuel tank 21. Additionally, a frame member 79 disposed below the fuel tank 21 and extending toward the front of the vehicle body is attached to the upper end of the middle frame 17. In other words, an opening portion 81 is defined between the upper pipe 74L and the frame member 79. Heat of the rearward tilting cylinder 66 can be discharged from the opening portion 81 to the outside of the vehicle body.

[0051] Further, the frame member 79 can also serve as a foot-applying portion to which a foot can be applied when a rider knee-grips a knee-grip portion 82 of the fuel tank 21.

[0052] A description is next given of a cooling system attached to the engine 19.

[0053] The upper radiator 40 is disposed above the front wheel 13 and in front of the engine 19. The lower radiator 50 is disposed in rear of the upper radiator 40, between the front wheel 13 and the engine 19 and below the forward tilting cylinder 65 of the engine 19 tilting toward the front of the vehicle.

[0054] The upper radiator 40 is provided at an upper end thereof with an upper connecting member 83L extending toward the rearward upside of the vehicle body. The upper connecting member 83L is connected to the

lower pipe 75L. Additionally, the upper radiator 40 is provided at a lower end thereof with a lower connecting member 84 extending toward the rear of the vehicle body.

[0055] A radiator connecting member 85 extending toward the rearward downside of the vehicle body is connected to the lower connecting member 84. In addition, the radiator connecting member 85 is connected at a rear end thereof to the forward tilting cylinder head 68.

[0056] The lower radiator 50 has an upper end 86L connected to a lower end of the radiator connecting member 85. In addition, the lower radiator 50 has a lower end 87 connected to a front portion of the oil pan 61 via a stay 88 for the lower radiator. In short, the upper radiator 40 and the lower radiator 50 are supported by the main frame 15L.

[0057] Additionally, the upper radiator 40 is disposed below and adjacently to the lower pipe 75L of the main frame 15L as viewed from the left side of the vehicle.

[0058] Further, a water pump 89 adapted to supply water (coolant) to the upper radiator 40 and the lower radiator 50 is installed on a left lateral portion of the crankcase 63. Additionally, a reservoir tank 91 connected to a radiator cap of the upper radiator 40 is attached to a front end portion of the lower pipe 75L.

[0059] A configuration of the upper radiator 40 and the lower radiator 50 is described with reference to Fig. 3.

[0060] As shown in Fig. 3, the upper radiator 40 includes an upper radiator core 41 extending in a vehicle-width direction; an upper upstream tank 42 connected to the vehicle-widthwise right of the upper radiator core 41 and adapted to store water to be supplied to the upper radiator core 41; and an upper downstream tank 43 connected to the vehicle-widthwise left of the upper radiator core 41 and adapted to store water cooled by the upper radiator core 41.

[0061] The lower radiator 50 includes a lower radiator core 51 extending in a vehicle-width direction; a lower upstream tank 52 connected to the vehicle-widthwise right of the lower radiator core 51 and adapted to store water to be supplied to the lower radiator core 51; and a lower downstream tank 53 connected to the vehicle-widthwise left of the lower radiator core 51 and adapted to store water cooled by the lower radiator core 51.

[0062] On the vehicle-widthwise right, an upper supply pipe 54 adapted to supply water to the upper upstream tank 42 extends from the engine 19 to the upper upstream tank 42. A lower supply pipe 55 adapted to supply water to the lower upstream tank 52 has an inlet connected to an upper upstream connection pipe 93 installed in a lower portion of the upper upstream tank 42. In addition, the lower supply pipe 55 has an outlet 56 connected to a lower upstream connection pipe 94 installed on a front surface 57 of the lower upstream tank 52.

[0063] In short, the saddle-ride type vehicle (Fig. 1, reference symbol 10) includes, on the vehicle-widthwise right, the upper supply pipe 54 extending from the engine 19 to the upper upstream tank 42; and the lower supply pipe 55 extending from the lower portion of the upper

upstream tank 42 to the lower upstream tank 52.

[0064] The forward tilting cylinder 65 is installed so as to be offset rightward from a vehicle-widthwise centerline 92 as viewed from the front of the vehicle. The rearward tilting cylinder 66 is installed so as to be offset leftward from the vehicle-widthwise centerline 92.

[0065] An oil cooler 95 adapted to cool engine oil circulating in the engine 19 is disposed on the left side of the forward tilting cylinder 65.

[0066] Alternatively, the forward tilting cylinder 65 may be installed so as to be offset leftward from the vehicle-widthwise centerline 92 and the rearward tilting cylinder 66 may be installed so as to be offset rightward from the vehicle-widthwise centerline 92. In addition, the oil cooler 95 may be disposed on the right side of the front tilting cylinder 65.

[0067] Return pipes installed to return cooling water from the upper radiator 40 and the lower radiator 50 to the engine 19 are described with reference to Fig. 4.

[0068] As shown in Fig. 4, an upper downstream connection pipe 97 extends toward the rearward downside of the vehicle body from an upper rear surface 96 of the upper downstream tank 43. An inlet 99 of an upper return pipe 98 adapted to return cooling water to the engine 19 is connected to the upper downstream connection pipe 97.

[0069] A lower downstream connection pipe 102 extends toward the rear of the vehicle body from an upper portion 101 of the lower downstream tank 53. An inlet 104 of a lower return pipe 103 adapted to return cooling water to the engine 19 is connected to the lower downstream connection pipe 102.

[0070] While the upper return pipe 98 and the lower return pipe 103 are disposed along the left side of the engine 19, they meet at a confluence portion 105 on the upstream side of the water pump 89. The confluence portion 105 is composed of a short pipe 106 connected to the outlet of the lower return pipe 103 and a confluence pipe 107 joining the short pipe 106 and connected to the outlet of the upper return pipe 98.

[0071] The short pipe 106 of the confluence portion 105 and a main suction pipe 108 of the water pump 89 are connected by a suction side return pipe 109. A bypass pipe 112 connected to the inside of the water jacket of the engine 19 is connected to a sub-suction pipe 111 of the water pump 89.

[0072] On the other hand, a supply pipe 113 extending from a discharge port of the water pump 89 is connected to the cylinder block 71 of the rearward tilting cylinder 66.

[0073] The upper return pipe 98 extends along the extending direction of the lower pipe 75L at a position below the lower pipe 75L of the main frame 15L, further extending along a front surface 114 of the crankcase 63 toward the downside of the vehicle, and is connected to the confluence portion 105.

[0074] Additionally, the lower radiator core (reference symbol 51 in Fig. 3) is provided at a rear portion thereof with an air-cooling fan 115 for forced-cooling water. The

exhaust pipe 25 extending toward the downside of the vehicle from the lower surface of the forward tilting cylinder 65 passes the back of the air-cooling fan 115 and extends toward the rear of the vehicle as viewed from the left of the vehicle.

[0075] The oil cooler 95 is disposed between the upper radiator 40 and the lower radiator 50 as viewed from the left of the vehicle. While extending along the rear surface 116 of the upper radiator 40, as viewed from the left of the vehicle, the oil cooler 95 is disposed below the upper downstream connection pipe 97 to which the upper return pipe 99 is connected. Incidentally, the oil cooler 95 may be located below the upper return pipe 99 by reducing the length of the upper downstream connection pipe 97.

[0076] A flow of water is described with reference to Fig. 5.

[0077] In Fig. 5, (a) shows the flow of water before warm-up and (b) shows after warm-up.

[0078] In (a), when the engine 19 is started up, water supplied to the water pump 89 flows as shown by arrow (1) and circulates inside the water jacket of the engine 19. In this case, a thermostat 117 is in a closed state.

[0079] If the warm-up operation of the engine 19 is finished, the thermostat 117 comes into an opened state in (b). Therefore, water flows into the upper radiator 40 and the lower radiator 50 as shown by arrow (2). High-temperature water flows into upper tubes 119 of the upper radiator core 41 and lower tubes 121 of the lower radiator core 51 and the airflow resulting from the running vehicle moves into upper fins 122 and lower fins 123. Such airflow strikes the outer surfaces of the upper tubes 119 and the lower tubes 121, which emits heat possessed by the high-temperature water to the atmosphere. Thus, water is cooled.

[0080] The positional relationship between the main frame 15L and the upper return pipe 98 is described with reference to Fig. 6.

[0081] As shown in Fig. 6, the upper return pipe 98 has a diameter D2 generally equal to a diameter D1 of the lower pipe 75L. In addition, the upper return pipe 98 is disposed to overlap the main frame 15L in the back and forth direction of the vehicle by a width-dimension W1. A harness 124 is disposed on the vehicle body-inside of the lower pipe 75L.

[0082] Incidentally, the body frame applied to the saddle-ride type vehicle 10 has other types in addition to the type shown in Fig. 2. An example of the other types is next described.

[0083] In Fig. 7, a detailed description of configurations common to those of Fig. 2 is omitted by diverting their reference symbols. A main modified point is that the upper pipe of the main frame and the middle frame are connected by pipes.

[0084] A main frame 125L of a body frame 27B includes an upper pipe 127L extending from the upper portion of a head pipe 11 toward the rearward downside of the vehicle body and connected to the a middle frame 126; a lower pipe 128L extending from the lower portion of the

head pipe 11 toward the rearward downside of the vehicle body; and a reinforcing pipe 129L obliquely connecting the rear end of the upper pipe 127L with the rear end of the lower pipe 128L. The middle frame 126 is provided with a pivot plate 131 having a pivot shaft 16.

[0085] Additionally, an intermediate portion of the upper pipe 127L and a front portion of the lower pipe 128L are connected by a first pipe 132L extending obliquely with respect to the upper pipe 127L and the lower pipe 128L. Further, the intermediate portion of the upper pipe 127L and an intermediate portion of the lower pipe 128L are connected by a second pipe 133L extending generally vertically with respect to the upper pipe 127L and the lower pipe 128L. The rear portion of the upper pipe 127L and the intermediate portion of the lower pipe 128L are connected by a third pipe 134L extending obliquely with respect to the upper pipe 127L and the lower pipe 128L. Additionally, the rear portion of the upper pipe 127L and a rear end of the lower pipe 128L are connected by a fourth pipe 135L extending generally vertically with respect to the upper pipe 127L and the lower pipe 128L. Further, the upper pipe 127L and the middle frame 126 are connected by a fifth pipe 136L. The main frame 125R has the same configuration as that of the main frame 125L; therefore, its description is omitted. In short, the main frames 125L, R are formed as truss frames. The truss frame is composed of a plurality of pipes; therefore, weight saving can be achieved easily.

[0086] A description is next given of the confluence portion between the return pipe adapted to return water to the engine 19 and the bypass pipe. In Fig. 2, the bypass pipe 112 is connected to the sub-suction pipe 111 of the water pump 89. However, in Fig. 7, a modification is made such that the bypass pipe is connected to the confluence portion. The details of the modification are next described.

[0087] As shown in Fig. 7, the upper return pipe 98 and the lower return pipe 103 are converged to the confluence portion 137. In addition, also the bypass pipe 138 is converged to the confluence portion 137.

[0088] Since the upper return pipe 98, the lower return pipe 103 and the bypass pipe 138 are converged to the confluence portion 137, a plurality of the pipes can collectively be connected at one place. Thus, pipe connecting work can be done efficiently. Additionally, the upper return pipe 98 and the bypass pipe 138 are arranged in rows so as to extend in a vertical direction; therefore, external appearance is improved.

[0089] The function and effect of the saddle-ride type vehicle 10 described above is listed below.

[0090] With the configuration shown in Fig. 3, the vehicle-widthwise dimension W3 of the lower radiator 50 can easily be reduced compared with the vehicle-widthwise dimension W2 of the upper radiator 40. Thus, a bank angle θ_1 can easily be ensured.

[0091] The lower return pipe 103 is not extended downward from the lower downstream tank 53 of the lower radiator 50 but is extended rearward from the upper por-

tion 101 of the lower downstream tank 53 of the lower radiator 50. The lower radiator 50 can be extended downward. While ensuring ground height H1, an increase in radiation area can easily be achieved. Thus, the saddle-ride type vehicle 10 can be provided that can ensure a bank angle θ while enlarging the radiators 40, 50.

[0092] Additionally, with the configuration shown in Fig. 5(b), the water cooled by the upper radiator 40 can be supplied to the engine 19 not via the lower radiator 50. Therefore, the cooling water maintaining a low-pressure state flows into the water jacket of the engine 19. In short, the cooling efficiency of the engine 19 can be improved.

[0093] With the configuration shown in Fig. 4, the oil cooler 95 is disposed along the rear surface 116 of the upper radiator 40 and below the upper downstream connection pipe 97 to which the upper return pipe 99 is connected. Therefore, while effectively utilizing a space behind the upper radiator 40 and below the upper downstream connection pipe 97, the oil cooler 95 can satisfactorily be disposed in the limited space.

[0094] Additionally, with the configuration shown in Fig. 3, the oil cooler 95 can be disposed closer to the upside of the vehicle. If the oil cooler 95 is disposed in the lower portion of the vehicle, ensuring of the bank angle θ_1 can be influenced. However, in the present invention, the oil cooler 95 is disposed closer to the upside of the vehicle; therefore, the bank angle θ can further easily be ensured.

[0095] With the configuration shown in Fig. 3, the lower supply pipe 55 is installed to extend from the lower portion of the upper upstream tank 42 to the lower upstream tank 52. Therefore, the lower supply pipe 55 can be reduced in length compared with the case where the lower supply pipe 55 is branched from the upper supply pipe 54. Since the length of the pipe is short, the weight saving and cost reduction of the vehicle can be achieved.

[0096] With the configuration shown in Fig. 4, the upper return pipe 98 is extended along the upper pipe 75L of the main frame 15L. Therefore, the upper return pipe 98 and the upper pipe 75L of the main frame 15L are arranged in rows. Since the upper return pipe 98 and the upper pipe 75L of the main frame 15L are arranged in rows as viewed from the side of the vehicle, external appearance is improved.

[0097] With the configuration shown in Fig. 6, the upper return pipe 98 is disposed to overlap the lower pipe 75L of the main frame 15L in the back and forth direction of the vehicle. Thus, the upper return pipe 98 can be prevented from projecting toward the side of the vehicle.

[0098] With the configuration shown in Fig. 4, the exhaust pipe 25 passes the back of the air-cooling fan 115. Therefore, the air supplied by the air-cooling fan 115 strikes the exhaust pipe 25. Consequently, the cooling of the exhaust pipe 25 can be promoted.

[0099] With the configuration shown in Fig. 3, the front wheel is disposed in front of the lower radiator 50. However, the lower upstream tank 52 is disposed on the right side in the vehicle-width direction. The front of the lower

upstream tank 52 is made open to the front of the vehicle. Therefore, the outlet 56 of the lower supply pipe 55 can easily be connected to the front surface 57 of the lower upstream tank 52.

[0100] Incidentally, in Fig. 3, the upper supply pipe 54 and the lower supply pipe 55 are arranged on the right in the vehicle-width direction and the upper return pipe 98 and the lower return pipe 103 are arranged on the left in the vehicle-width direction. However, the upper supply pipe 54 and the lower supply pipe 55 may be disposed on the left in the vehicle-width direction and the upper return pipe 98 and the lower return pipe 103 may be disposed on the right in the vehicle-width direction. In this case, the upstream tank and the downstream tank are naturally reversed right and left.

[0101] Incidentally, the saddle-ride type vehicle according to the present invention is applied to the motorcycle in the present embodiment. However, the saddle-ride type vehicle of the present invention can be applied to three-wheeled vehicles and four-wheeled vehicles which are capable of saddle-riding and to general vehicles without problem.

[0102] The saddle-ride type vehicle of the present invention is suitable for motorcycles equipped with a water-cooled engine.

[Description of Reference Symbols]

[0103]

10: Saddle-ride type vehicle,
11: Head pipe,
13: Front wheel,
15L, R: Main frame,
18: Seat rail,
19: Engine,
25: Exhaust pipe,
27: Body frame,
40: Upper radiator,
41: Upper radiator core,
42: Upper upstream tank,
43: Upper downstream tank,
50: Lower radiator,
51: Lower radiator core,
52: Lower upstream tank,
53: Lower downstream tank,
54: Upper supply pipe,
55: Lower supply pipe,
56: Outlet,
57: Front surface,
63: Crankcase,
65: Cylinder,
74 to 78L, R: A plurality of pipes,
89: Water pump,
95: Oil cooler,
96: Upper rear surface,
98: Upper return pipe,
99: Inlet,

101: Upper portion,
103: Lower return pipe,
105: Confluence portion,
114: Front surface,
115: Air-cooling fan,
116: Rear surface,
D1, D2: Diameter.

10 Claims

1. A saddle-ride type vehicle (10) equipped with radiators (40, 50) in front of an engine (19), **characterized in that**

the vehicle (10) includes an upper radiator (40) disposed above a front wheel (13) and in front of the engine (19) and a lower radiator (50) disposed behind the upper radiator (40) and between the front wheel (13) and the engine (19);

the upper radiator (40) includes an upper radiator core (41) extending in a vehicle-width direction, an upper upstream tank (42) connected to one of the left and right, in the vehicle-width direction, of the upper radiator core (41) and adapted to store water supplied to the upper radiator core (41), and an upper downstream tank (43) connected to the other of the left and right, in the vehicle-width direction, of the upper radiator core (41) and adapted to store water cooled by the upper radiator core (41);

the lower radiator (50) includes a lower radiator core (51) extending in the vehicle-width direction, a lower upstream tank (52) connected to one of the left and right, in the vehicle-width direction, of the lower radiator core (51) and adapted to store water supplied to the lower radiator core (51), and a lower downstream tank (53) connected to the other of the left and right, in the vehicle-width direction, of the lower radiator core (51) and adapted to store water cooled by the lower radiator core (51);

an upper return pipe (98) adapted to return the cooling water to the engine (19) extends toward the rear of the vehicle from the upper downstream tank (43) and a lower return pipe (103) extends toward the rear of the vehicle from an upper portion (101) of the lower downstream tank (53); and
the upper return pipe (98) and the lower return pipe (103) converge on the upstream side of a water pump (89) while being arranged to extend along the engine (19).

2. The saddle-ride type vehicle according to claim 1, **characterized in that** an inlet (99) of the upper return pipe (98) is connected to an upper rear surface (96) of the upper downstream tank (43); and
an oil cooler (95) adapted to cool engine oil circulating inside the engine (19) is disposed on the other of the left and right in the vehicle-width direction, and as viewed from the side of the vehicle, is disposed

below the upper return pipe (98) while extending along a rear surface (116) of the upper radiator (40).

3. The saddle-ride type vehicle according to claim 1 or 2,
characterized in that the saddle-ride type vehicle includes, on one of the left and right in the vehicle-width direction, an upper supply pipe (54) extending from the engine (19) to the upper upstream tank (42) and adapted to supply the water to the upper stream tank (42) and an lower supply pipe (55) extending from a lower portion of the upper upstream tank (42) to the lower upstream tank (52) and adapted to supply the water to the lower upstream tank (52).

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4. The saddle-ride type vehicle according to any one of claims 1 to 3, **characterized in that** the saddle-ride type vehicle includes a body frame (27) supporting the engine (19),
 the body frame (27) includes a head pipe (11), left and right main frames (15L, R) extending toward the rearward downside of the vehicle from the head pipe (11) and disposed right and left, and a seat rail (18) extending toward of the rear of the vehicle from a rear portion of the main frames (15L, R),
 the upper radiator (40) is disposed, as viewed from the side of the vehicle, below and adjacently to the main frames (15L, R), and
 the upper return pipe (98) extends in an extending direction of the main frames (15L, R) at a position below the main frames (15L, R), further extending toward the downside of the vehicle along a front surface (114) of the crankcase (63) of the engine (19), and is connected to a confluence portion (105) with the lower return pipe (103).

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5. The saddle-ride type vehicle according to claim 4, **characterized in that** the main frames (15L, R) are truss frames formed by welding a plurality of pipes (74 to 78L, R), and
 the upper return pipe (98) has a diameter (D2) generally equal to a diameter (D1) of the pipe (75L, R) and is disposed to overlap the main frames (15L, R) in the back and forth direction of the vehicle.

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6. The saddle-ride type vehicle according to any one of claims 1 to 5, **characterized in that** the lower radiator (50) is disposed behind the front wheel (13) and below a cylinder (65) of the engine (19) tilting toward the front of the vehicle,
 the lower radiator core (51) is provided at a rear portion thereof with an air-cooling fan (115) for forced-cooling the water, and
 an exhaust pipe (25) extending toward the downside of the vehicle from a lower surface of the cylinder (65) passes the back of the air-cooling fan (115) and extends toward the rear of the vehicle as viewed from

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the side of the vehicle.

7. The saddle-ride type vehicle according to any one of claims 3 to 6,
characterized in that an outlet (56) of the lower supply pipe (55) is connected to a front surface (57) of the lower upstream tank (52).

FIG. 1

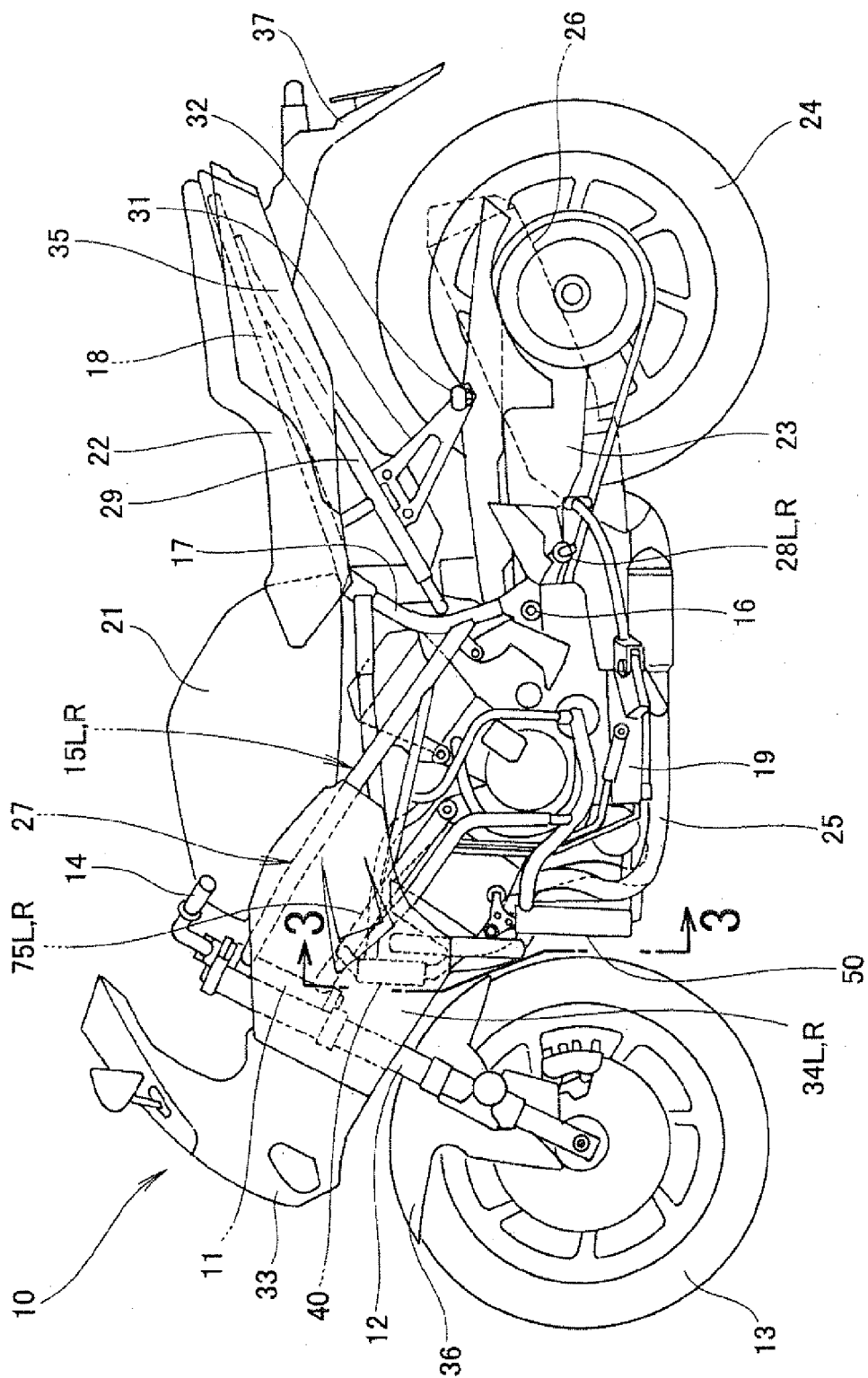


FIG. 2

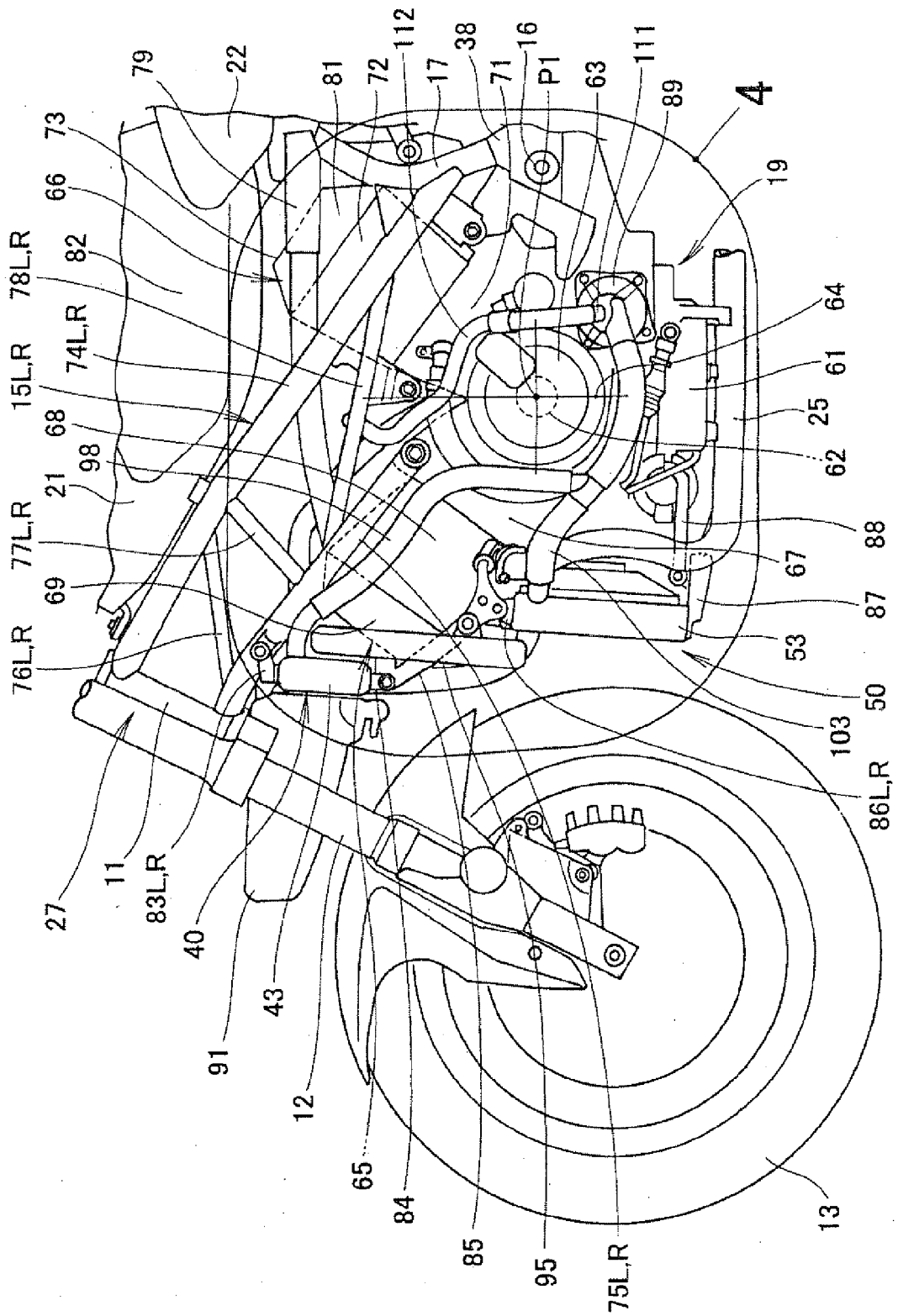


FIG. 3

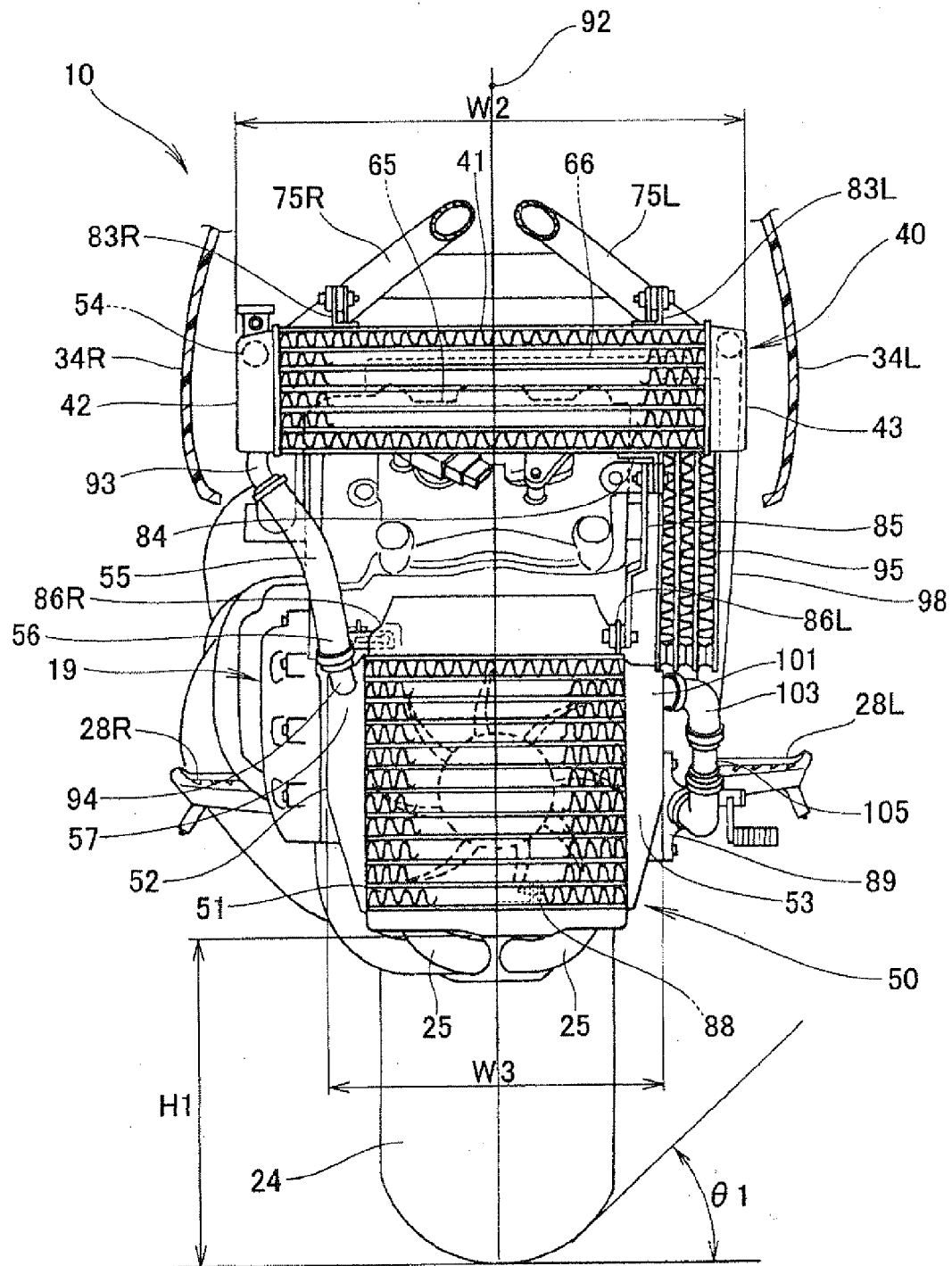


FIG. 4

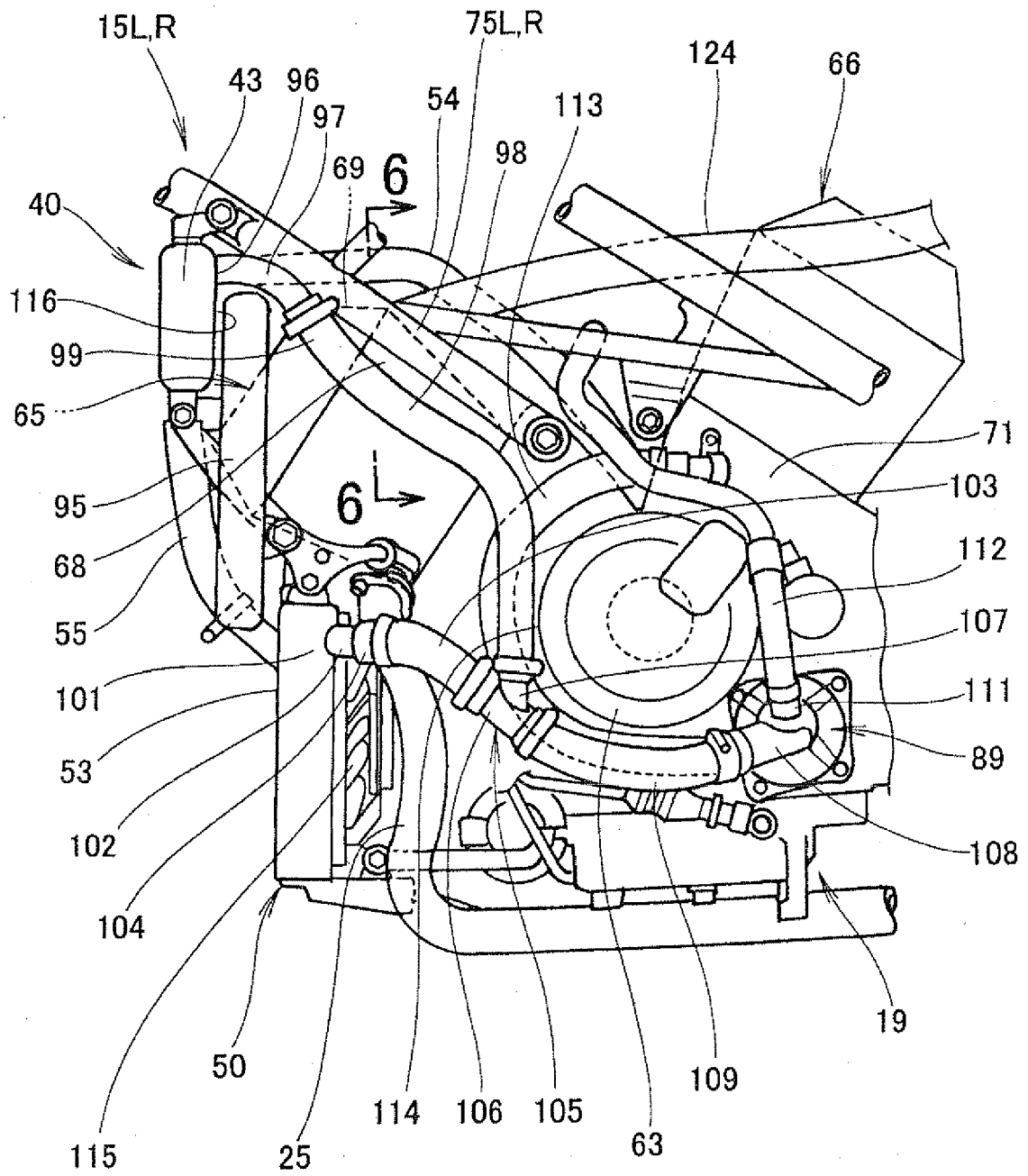


FIG. 5

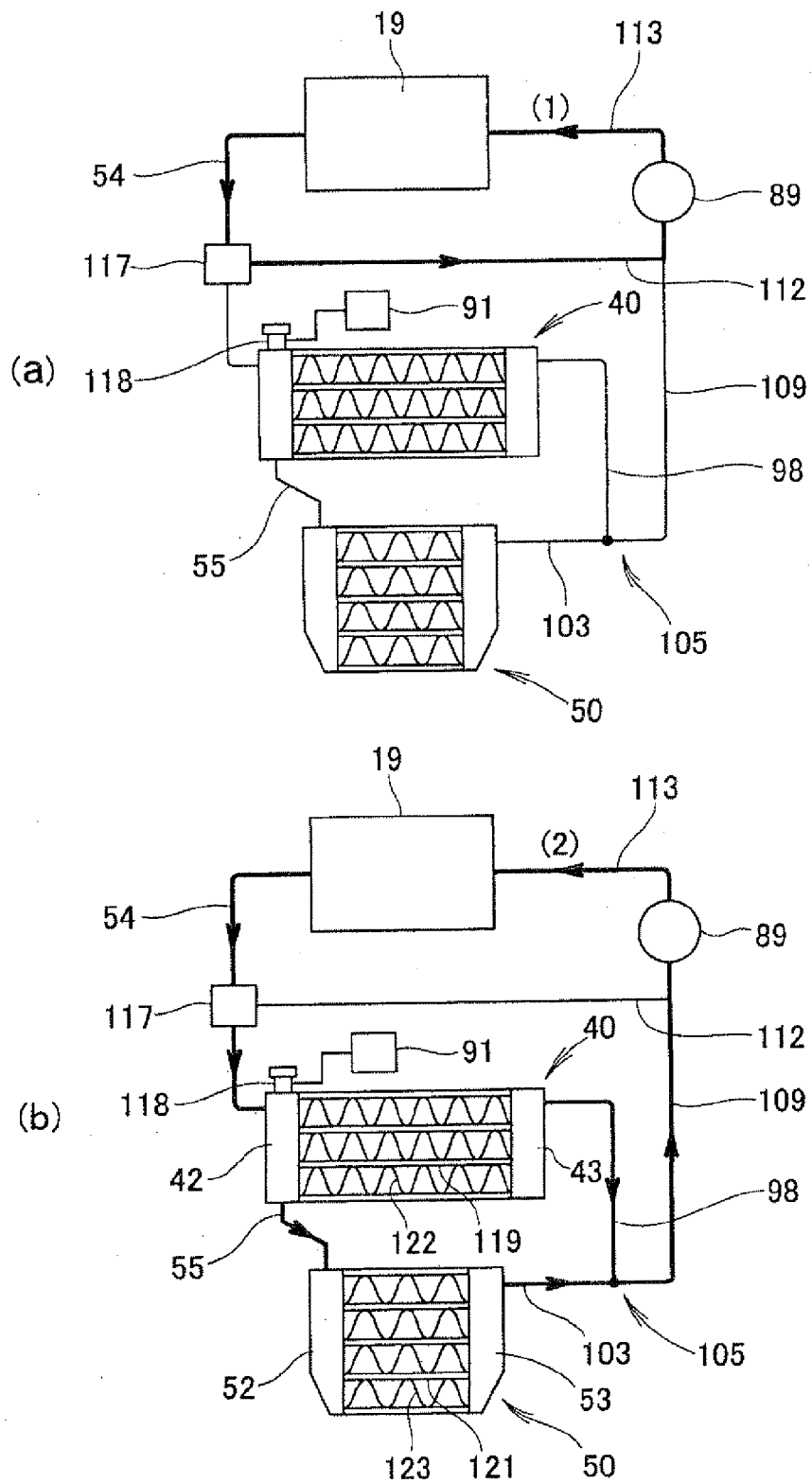


FIG. 6

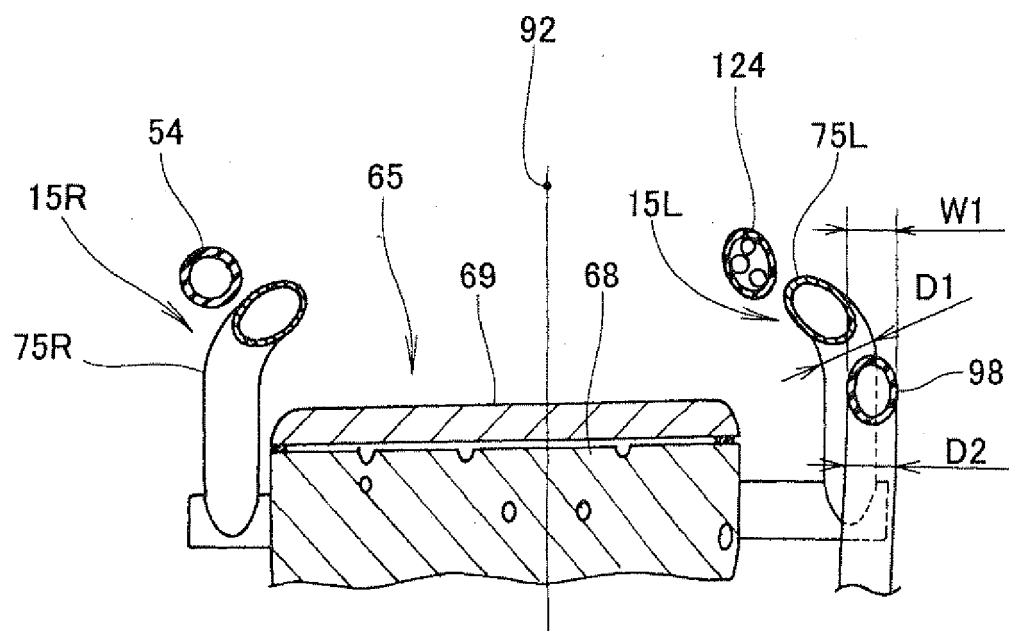
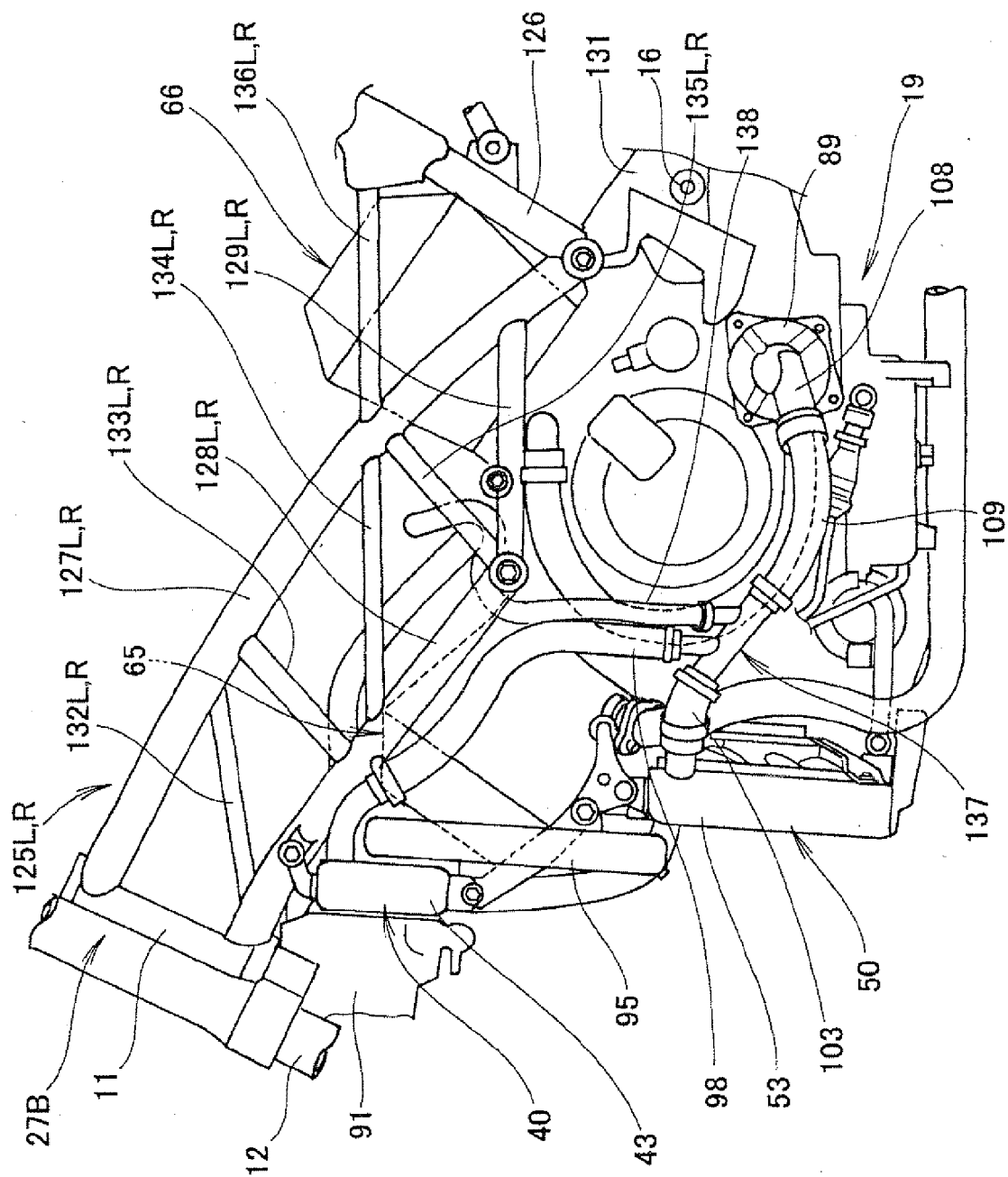


FIG. 7





EUROPEAN SEARCH REPORT

Application Number
EP 13 15 5880

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Place of search Munich		Date of completion of the search 10 July 2013	Examiner Luta, Dragos
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			

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