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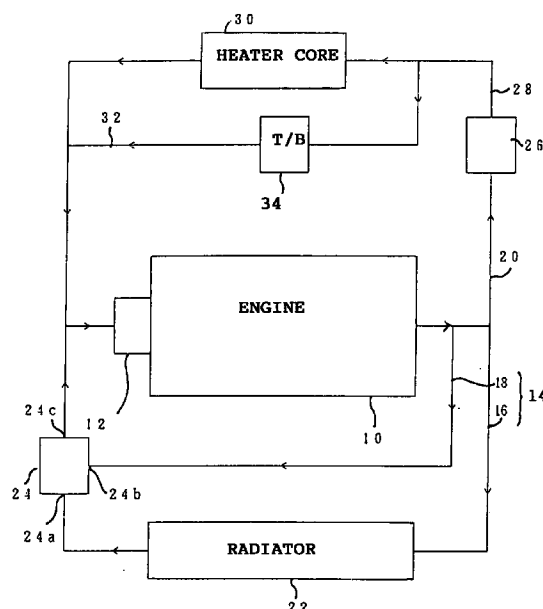
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(54) Engine cooling apparatus

(57) An engine cooling apparatus includes a main cooling water passage (14) in which a cooling water is circulated from an outlet of and to an inlet of a water jacket in an engine (10) to cool the engine. A water pump (12) supplies the cooling water to the engine through the main cooling water passage. A heater passage (28) interconnects a heater core (30) and the main cooling water passage to circulate the cooling water. A throttle body passage (32) interconnects a throttle body (34) and the main cooling water passage to circulate the cooling water. A water valve (26) opens the heater passage when an operation starting requirement of a heater of a vehicle compartment is met, which allows the cooling water from the main cooling water passage to flow into the heater core through the heater passage. In this apparatus, the throttle body passage (32) is connected to the heater passage (28) in such a manner that the cooling water from the main cooling water passage (14) is supplied to the throttle body (34) through the throttle body passage only when the heater passage is opened by the water valve (26).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention generally relates to a cooling system of an internal combustion engine, and more particularly to an engine cooling apparatus including a main cooling water passage in which a cooling water is circulated from an outlet of and to an inlet of a water jacket in the engine, and including a throttle body passage in which a heated cooling water from the outlet of the water jacket is supplied to a throttle body, in order to prevent the icing of a throttle valve in the throttle body.

(2) Description of the Related Art

A throttle valve provided in an intake pipe of an internal combustion engine on an automotive vehicle may be frozen with a moisture in a throttle body when a humid air enters the intake pipe in a cold weather in winter. This phenomenon is called the icing of the throttle valve.

The above icing of the throttle valve is harmful for an effective operation of the engine since it makes it difficult to smoothly control an air-fuel ratio of an intake air into the engine by using the throttle valve. Japanese Laid-Open Patent Application No. 5-222932 discloses an engine cooling device for heating a throttle body with a heated cooling water supplied from the engine. In this engine cooling device, a heated cooling water from the outlet of the water jacket in the engine during operation is partially brought to the vicinity of the throttle body. The throttle body is heated by the heated cooling water to prevent the icing of the throttle valve in the throttle body which may occur under a cold-weather condition.

In the engine cooling device disclosed in the above publication, the heated cooling water from the outlet of the water jacket in the engine during operation is circulated to the throttle body, and the throttle valve in the throttle body is kept at a certain temperature above a freezing point by the heated cooling water. Thus, the icing of the throttle valve is prevented even when a humid air is taken into the intake pipe in a cold weather.

However, the above-mentioned engine cooling device includes a throttle body passage in which the heated cooling water from the outlet of the water jacket in the engine is brought to the vicinity of the throttle body. An inlet of the throttle body passage is connected directly to an outlet of the water jacket in the main cooling water passage to circulate the cooling water to the throttle body. In this engine cooling device, the inlet of the throttle body passage communicates with the outlet of the water jacket in the engine.

Thus, when the engine is operated, the heated cooling water from the main cooling water passage is always brought into the throttle body passage, and the heated cooling water is always supplied to the throttle body through the throttle body passage.

In a warm weather in summer, the above icing of the throttle valve hardly occurs to the engine cooling device. If a heated cooling water from the engine during the operation is supplied to the throttle body under a warm-weather condition, the intake air flowing into the throttle valve is heated by the heated cooling water. This is harmful for an effective operation of the engine, and the output efficiency of the engine may deteriorate due to an excessive heating of the intake air.

Accordingly, the above-mentioned engine cooling device serves to prevent the icing of the throttle valve under a cold-weather condition, but, there is a problem that, in a warm weather, the engine cooling system may harm an effective operation of the engine.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an engine cooling apparatus in which the above-described problems are eliminated.

Another object of the present invention is to provide an engine cooling apparatus in which the icing of the throttle valve is reliably prevented by circulating the heated cooling water to the throttle body only when it is under a cold-weather condition.

The above-mentioned objects of the present invention are achieved by an engine cooling apparatus which includes: a main cooling water passage in which a cooling water is circulated from an outlet of and to an inlet of a water jacket in an engine to cool the engine; a water pump which supplies the cooling water to the engine through the main cooling water passage; a heater passage which interconnects a heater core and the main cooling water passage to circulate the cooling water; a throttle body passage which interconnects a throttle body and the main cooling water passage to circulate the cooling water; and a water valve which opens the heater passage when an operation starting requirement of a heater of a vehicle compartment is met, thereby allowing the cooling water from the main cooling water passage to flow into the heater core through the heater passage, wherein the throttle body passage is connected to the heater passage in such a manner that the cooling water from the main cooling water passage is supplied to the throttle body through the throttle body passage only when the heater passage is opened by the water valve.

According to the present invention, the circulation of the cooling water to the throttle body is effectively associated with the operation of the heater of the vehicle compartment. Therefore, when the operation starting requirement of the heater is not met under a warm-weather condition (the heater is OFF), it is possible to safely avoid an excessive heating of the intake air flowing into the throttle valve in the throttle body. When the operation starting requirement of the heater is met under a cold-weather condition (the heater is ON), it is possible to reliably prevent the icing of the throttle valve in the throttle body.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will be more apparent from the following detailed description when read in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram of an engine cooling apparatus in a first embodiment of the present invention;
 FIG. 2 is a block diagram of an engine cooling apparatus in a second embodiment of the present invention;
 FIG. 3 is a block diagram of an engine cooling apparatus in a third embodiment of the present invention;
 FIG. 4 is a block diagram of an engine cooling apparatus in a fourth embodiment of the present invention;
 FIG. 5 is a block diagram of an engine cooling apparatus in a fifth embodiment of the present invention; and
 FIG. 6 is a block diagram of an engine cooling apparatus in a sixth embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A description will now be given of various preferred embodiments of the present invention with reference to the accompanying drawings.

FIG. 1 shows an engine cooling apparatus in a first embodiment of the present invention. In FIG. 1, an internal combustion engine 10 includes a water jacket (not shown) in which a cooling water is passed through the engine 10 to hold a temperature of the engine 10 below a predetermined reference temperature during operation of the engine 10.

A water pump 12 is connected to an inlet of the water jacket in the engine 10. The water pump 12 is driven by an output torque of the engine 10 to discharge the cooling water into the water jacket in the engine 10. Therefore, when the engine 10 is operated, the water pump 12 discharges the cooling water under a pressure into the water jacket in the engine 10.

A radiator passage 16, a thermostat bypass passage 18, and a bypass passage 20 are connected to an outlet of the water jacket in the engine 10. The radiator passage 16 and the thermostat bypass passage 18 constitute a main cooling passage 14 of the engine 10 in which the cooling water is circulated to and from the water jacket in the engine 10.

The radiator passage 16 is a cooling water path that brings a heated cooling water from the outlet of the water jacket in the engine 10 into an inlet of a radiator 22, and brings a cooled cooling water from an outlet of the radiator 22 into a first inlet 24a of a thermostat unit 24. The radiator 22 serves to cool the cooling water heated by the engine 10 by using an external air entering the radiator 22.

The thermostat bypass passage 18 is a cooling water path that brings the cooling water from the outlet of the water jacket in the engine 10 into a second inlet 24b of the thermostat unit 24, and brings the cooling water from the thermostat unit 24 into an inlet of the water pump 12. The thermostat bypass passage 18 is separate from the radiator passage 16, and it does not pass through the radiator 22.

The thermostat unit 24 has an outlet 24c which is connected to the inlet of the water pump 12. The thermostat unit 24 is a switching device that is responsive to a temperature of the incoming cooling water. The thermostat unit 24 outputs the cooling water from the outlet 24c at a controlled ratio in accordance with the temperature of the incoming cooling water, the controlled ratio indicated by a ratio of a first quantity of the cooling water from the first inlet 24a to a second quantity of the cooling water from the second inlet 24b.

When the temperature of the incoming cooling water is high, the thermostat unit 24 outputs the cooling water from the outlet 24c at a greater controlled ratio. When the temperature of the incoming cooling water is low, the thermostat unit 24 outputs the cooling water from the outlet 24c at a smaller controlled ratio.

Accordingly, when the cooling water from the outlet of the water jacket in the engine 10 is at a low temperature, the cooling water is circulated via the thermostat unit 24 to the inlet of the water jacket in the engine 10 by the water pump 12 primarily through the thermostat bypass passage 18. Most of the cooling water being circulated is not cooled by the radiator 22.

On the other hand, when the cooling water from the outlet of the water jacket in the engine 10 is at a high temperature, the cooling water is circulated via the thermostat unit 24 to the inlet of the water jacket in the engine 10 by the water pump 12 primarily through the radiator passage 16. Thus, most of the cooling water being circulated is cooled by the radiator 22 and such a cooling water is supplied to the inlet of the water jacket in the engine 10.

Upon a cold start of the engine 10, most of the cooling water is passed through the thermostat bypass passage 18, not the radiator passage 16. Thus, the engine cooling apparatus can realize an early warming-up of the engine 10 after the cold start of the engine 10.

After the warming-up of the engine 10 is completed, the temperature of the cooling water flowing into the thermostat unit 24 is high. Most of the cooling water is passed through the radiator passage 16, not the thermostat bypass passage 18. Therefore, the engine cooling apparatus can ensure a high cooling capability that is enough to cool the engine during the operation.

The bypass passage 20 is a cooling water path that brings the cooling water from the outlet of the water jacket in the engine 10 to a heater passage 28 in which a water valve 26 is included. The heater passage 28 brings the cooling water from the water valve 26 into an inlet of a heater core 30, and brings the cooling water

from an outlet of the heater core 30 into the inlet of the water pump 12.

The heater core 30 serves as a heat source for supplying heat to a heater of a vehicle compartment. The water valve 26 is a valve device that is responsive to an operating condition of a manual or automatic air conditioner which is also provided in the vehicle compartment. More specifically, the water valve 26 is switched ON to open the heater passage 28 only when an operation starting requirement of the above heater is met.

When the operation starting requirement of the heater is not met, the water valve 26 remains OFF to close the heater passage 28 and the flow of the cooling water from the engine 10 into the heater core 30 is shut off. When the operation starting requirement of the heater is met, the water valve 26 is switched ON to open the heater passage 28 and the heated cooling water from the outlet of the water jacket in the engine 10 is brought into the heater core 30 through heater passage 28. A heat energy of the heated cooling water is transferred to the heater core 30.

The engine cooling apparatus in the first embodiment, shown in FIG. 1, includes a throttle body passage 32 having an inlet which is connected to an intermediate portion between the heater core 30 and the water valve 26 in the heater passage 28. The water valve 26 is provided at the inlet of the heater core 30 in the heater passage 28. The throttle body passage 32 has an outlet which is connected to the inlet of the water jacket in the engine 10 in the main cooling water passage 14. The outlet of the throttle body passage 32 is located downward from the outlet of the heater core 30 in the heater passage 28.

A throttle body (T/B) 34 which includes a throttle valve (not shown) is provided in an intake passage (not shown) of the engine 10 to control a flow of an intake air into the engine 10. In the first embodiment, as shown in FIG. 1, the throttle body (T/B) 34 is included in the throttle body passage 32 at an intermediate portion thereof.

In the first embodiment, the throttle body passage 32 is a cooling water path which brings the cooling water from the outlet of the water jacket in the engine 10 into the throttle body 34.

As described above, in the case of the conventional apparatus, the icing of the throttle valve in the throttle body 34 may take place when a humid air enters the intake passage of the engine 10 under a cold-weather condition. However, in the above-described first embodiment, the water valve 26 opens the heater passage 28 when the operation starting requirement of the heater of the vehicle compartment is met, and the heated cooling water from the outlet of the water valve 26 is circulated to the throttle body 34 through the throttle body passage 32. Thus, in a cold weather, it is possible to stably prevent the icing of the throttle valve in the throttle body 34 by the heated cooling water.

In addition, as described above, in the case of the conventional apparatus, the intake air flowing into the throttle valve may be excessively heated by the heated

cooling water supplied from the outlet of the water jacket in the engine 10 to the throttle body 34 under a warm-weather condition, which will harm an effective operation of the engine 10. However, in the above-described first embodiment, the water valve 26 closes the heater passage 28 when the operation starting requirement of the heater of the vehicle compartment is not met, and the heated cooling water from the outlet of the water jacket in the engine 10 is not circulated to the throttle body 34 through the throttle body passage 32. Thus, in a warm weather, it is possible to avoid the excessive heating of the intake air flowing into the throttle valve.

Next, a description will be given of examples of the operation starting requirement of the heater of the vehicle compartment regarding the engine cooling apparatus of the present invention. Whether the water valve 26 opens or closes the heater passage 28 is determined depending on whether this requirement is met or not, as described above.

For example, if a manual-type air conditioner is mounted on the vehicle, whether the operation starting requirement of the heater of the vehicle compartment is met depends on whether a vehicle operator switches ON the heater of the vehicle compartment. If an automatic-type air conditioner is mounted on the vehicle, whether the operation starting requirement is met depends on whether a difference in temperature between the inside of the vehicle and the outside thereof is greater than a predetermined reference temperature.

When the ambient temperature of the vehicle is below a freezing point of water (under such a condition the icing of the throttle valve may take place), the operation starting requirement of the heater of the vehicle compartment is always met, regardless of whether the manual-type air conditioner or the automatic-type air conditioner is mounted on the vehicle. When the temperature of the vehicle compartment is high enough (e.g., under a warm-weather condition in summer), the operation starting requirement of the heater of the vehicle compartment is hardly met.

Accordingly, the engine cooling apparatus in the above first embodiment circulates the heated cooling water to the throttle body 34 through the throttle body passage 23 when the ambient temperature of the vehicle is below the freezing point of water. Thus, it is possible to reliably prevent the icing of the throttle valve under a cold-weather condition. The engine cooling apparatus in the first embodiment does not circulates the heated cooling water to the throttle body 34 through the throttle body passage 23 when the temperature of the vehicle compartment is high enough. Thus, it is possible to safely avoid the excessive heating of the intake air flowing into the throttle valve in the throttle body 34 under a warm-weather condition.

FIG. 2 shows an engine cooling apparatus in a second embodiment of the present invention. In FIG. 2, the elements which are the same as corresponding elements in FIG. 1 are designated by the same reference numerals, and a description thereof will be omitted.

In the second embodiment, the water valve 26 is provided at an outlet of the heater core 30 in the heater passage 28, and an outlet of the throttle body (T/B) 34 in the throttle body passage 32 is connected to an inlet of the water valve 26 in the heater passage 28.

More specifically, in the second embodiment, an inlet of the throttle body 34 in the throttle body passage 32 and an inlet of the heater core 30 in the heater passage 28 are connected in parallel to the main cooling water passage 14 at the outlet of the water jacket in the engine 10. The inlet of the throttle body 34 in the throttle body passage 32 is located upstream from the inlet of the heater core 30 in the bypass passage 20.

The bypass passage 20 extending from the outlet of the water jacket in the engine 10 communicates with the heater passage 28 as well as the throttle body passage 32.

As previously described, in the first embodiment in FIG.1, the circulation of the cooling water through the heater passage 28 and further through the throttle body passage 32 is controlled by using the water valve 26 which is provided at the outlet of the water jacket in the engine 10. The location of the water valve 34 relative to the throttle body 34 is upstream along the throttle body passage 32. The engine cooling apparatus of the present invention is not limited to the construction of the first embodiment.

In the second embodiment in FIG.2, the circulation of the cooling water through the throttle body passage 32 and the circulation of the cooling water through the heater passage 28 are controlled by using the water valve 26 which is provided at the inlet of the water jacket in the engine 10. The location of the water valve 26 relative to the throttle body 34 is downstream along the throttle body passage 32.

The engine cooling apparatus in the second embodiment can achieve the same functions that are achieved by the engine cooling apparatus in the first embodiment. The above is true regardless of whether the water valve 26 is provided at the inlet of the water jacket in the engine 10 or at the outlet thereof.

Similarly to the first embodiment, in the second embodiment, only when the operation starting requirement of the heater of the vehicle compartment is met, the water valve 26 is switched ON to open the heater passage 28. This allows the cooling water from the outlet of the water jacket in the engine 10 to be supplied to the throttle body 34 through the throttle body passage 32. When the operation starting requirement of the heater is not met, the water valve 26 is OFF to close the heater passage 28. The cooling water from the outlet of the water jacket in the engine 10 is not supplied to the throttle body 34.

FIG.3 and FIG.4 respectively show an engine cooling apparatus in a third embodiment and an engine cooling apparatus in a fourth embodiment. In FIGS.3 and 4, the elements which are the same as corresponding elements in FIG.1 are designated by the same reference numerals, and a description thereof will be omitted.

In FIG.3, the water valve 26 is provided at an inlet of the heater core 30 in the heater passage 28, and an inlet of the throttle body 34 in the throttle body passage 32 is connected to an outlet of the heater core 30 in the heater passage 28. The heater passage 28 and the throttle body passage 32 are connected in series each other.

In FIG.4, an inlet of the throttle body 34 in the throttle body passage 32 is connected to an outlet of the heater core 30 in the heater passage 28, and the water valve 26 is provided at an outlet of the throttle body 34 in the throttle body passage 32. Similarly to the third embodiment, the heater passage 28 and the throttle body passage 32 are connected in series.

The difference between the third and fourth embodiments is whether the water valve 26 is provided at the inlet of the heater core 30 in the heater passage 28 or at the outlet thereof.

Similarly to the previously-described first and second embodiments, it is possible for the third and fourth embodiments to reliably prevent the icing of the throttle valve in the throttle body 34 under a cold-weather condition. At the same time, it is possible for the third and fourth embodiments to safely avoid the excessive heating of the intake air flowing into the throttle valve under a warm-weather condition.

FIG.5 and FIG.6 respectively show an engine cooling apparatus in a fifth embodiment and an engine cooling apparatus in a sixth embodiment. In FIGS.5 and 6, the elements which are the same as corresponding elements in FIG.1 are designated by the same reference numerals, and a description thereof will be omitted.

In FIG.5, the water valve 26 is provided at the inlet of the heater core 30 in the heater passage 28, and both the inlet and the outlet of the throttle body 34 in the throttle body passage 32 are connected to intermediate portions of the heater passage 28 between the outlet of the heater core 30 and the inlet of the water jacket in the engine 10. The outlet of the throttle body 34 in the throttle body passage 32 is located downstream along the heater passage 28 from the inlet of the throttle body 34 in the throttle body passage 32.

In FIG.6, the water valve 26 is provided at the outlet of the heater core 30 in the heater passage 28, and both the inlet and the outlet of the throttle body 34 in the throttle body passage 32 are connected to intermediate portions of the heater passage 28 between the outlet of the heater core 30 and the inlet of the water valve 26. The outlet of the throttle body 34 in the throttle body passage 32 is located downstream along the heater passage 28 from the inlet of the throttle body 34 in the throttle body passage 32.

The difference between the fifth and sixth embodiments is whether the water valve 26 is provided at the inlet of the heater core 30 in the heater passage 28 or at the outlet thereof.

In the previously-described first and second embodiments, a flowing resistance of the heater core 30 in the heater passage 28 is utilized to circulate the cooling water to the throttle body 34 through the throttle body

passage 32. If an appropriate flowing resistance of a corresponding element in the fifth and sixth embodiments is preset, the flowing resistance is utilized to circulate the cooling water to the throttle body 34 through the throttle body passage 32 in a similar manner.

Accordingly, it is possible for the above fifth and sixth embodiments of the present invention to reliably prevent the icing of the throttle valve in the throttle body 34 under a cold-weather condition. At the same time, it is possible for the above fifth and sixth embodiments of the present invention to safely avoid the excessive heating of the intake air flowing into the throttle valve under a warm-weather condition.

Provided that the circulating of the cooling water to the throttle body is effectively associated with the operation starting of the heater of the vehicle compartment, variations of the fifth and sixth embodiments of the present invention may be made. For example, the inlet and the outlet of the throttle body 34 in the throttle body passage 32 are connected to intermediate portions of the heater passage 28 at the inlet of the heater core 30, which is partially different from the connections of the inlet and outlet of the throttle body 34 to the intermediate portions of the heater passage 28 in the fifth and sixth embodiments described above.

According to the above-described embodiments, when the operation starting requirement of the heater of the vehicle compartment is not met under a warm-weather condition, it is possible to safely avoid the excessive heating of the intake air flowing into the throttle valve in the throttle body. When the operation starting requirement of the heater is met under a cold-weather condition, it is possible to reliably prevent the icing of the throttle valve in the throttle body.

The engine cooling apparatus of the present invention can ensure a reliable operation of the throttle valve under a cold-weather condition and can avoid deterioration of the output characteristic of the engine under a warm-weather condition.

Further, the present invention is not limited to the above-described embodiments, and variations and modifications may be made without departing from the scope of the present invention.

An engine cooling apparatus includes a main cooling water passage (14) in which a cooling water is circulated from an outlet of and to an inlet of a water jacket in an engine (10) to cool the engine. A water pump (12) supplies the cooling water to the engine through the main cooling water passage. A heater passage (28) interconnects a heater core (30) and the main cooling water passage to circulate the cooling water. A throttle body passage (32) interconnects a throttle body (34) and the main cooling water passage to circulate the cooling water. A water valve (26) opens the heater passage when an operation starting requirement of a heater of a vehicle compartment is met, which allows the cooling water from the main cooling water passage to flow into the heater core through the heater passage. In this apparatus, the throttle body passage (32) is connected to the

heater passage (28) in such a manner that the cooling water from the main cooling water passage (14) is supplied to the throttle body (34) through the throttle body passage only when the heater passage is opened by the water valve (26).

Claims

1. An engine cooling apparatus which includes:
 - a main cooling water passage (14) in which a cooling water is circulated from an outlet of and to an inlet of a water jacket in an engine (10) to cool the engine;
 - pump means (12) for supplying the cooling water to the engine through said main cooling water passage;
 - a heater passage (28) which interconnects a heater core (30) and the main cooling water passage to circulate the cooling water;
 - a throttle body passage (32) which interconnects a throttle body (34) and the main cooling water passage to circulate the cooling water; and
 - valve means (26) for opening said heater passage when an operation starting requirement of a heater of a vehicle compartment is met, thereby allowing the cooling water from the main cooling water passage to flow into the heater core through the heater passage,
 - characterized in that said throttle body passage (32) is connected to said heater passage (28) in such a manner that the cooling water from the main cooling water passage (14) is supplied to the throttle body (34) through said throttle body passage only when said heater passage is opened by said valve means (26).
2. The engine cooling apparatus according to claim 1, characterized in that said valve means (26) is provided at an inlet of the heater core (30) in the heater passage (28), and an inlet of the throttle body (34) in said throttle body passage (32) is connected to an intermediate portion of the heater passage between the heater core and said valve means.
3. The engine cooling apparatus according to claim 1, characterized in that said valve means (26) is provided at an outlet of the heater core (30) in the heater passage (28), and an outlet of the throttle body (34) in said throttle body passage (32) is connected to an inlet of said valve means in the heater passage.
4. The engine cooling apparatus according to claim 1, characterized in that said valve means (26) is provided at an inlet of the heater core (30) in the heater passage (28), and an inlet of the throttle body (34) in said throttle body passage (32) is connected to an outlet of the heater core in the heater passage.

5. The engine cooling apparatus according to claim 1, characterized in that an inlet of the throttle body (34) in said throttle body passage (32) is connected to an outlet of the heater core (30) in the heater passage (28), and said valve means (26) is provided at an outlet of the throttle body (34) in said throttle body passage (32). 5
6. The engine cooling apparatus according to claim 1, characterized in that said valve means (26) is provided at an inlet of the heater core (30) in the heater passage (28), and both an inlet and an outlet of the throttle body (34) in the throttle body passage (32) are connected to intermediate portions of the heater passage between an outlet of the heater core and the inlet of the water jacket. 10 15
7. The engine cooling apparatus according to claim 1, characterized in that said valve means (26) is provided at an outlet of the heater core (30) in the heater passage (28), and both an inlet and an outlet of the throttle body (34) in said throttle body passage (32) are connected to intermediate portions of the heater passage between the outlet of the heater core and an inlet of the valve means. 20 25

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FIG. 1

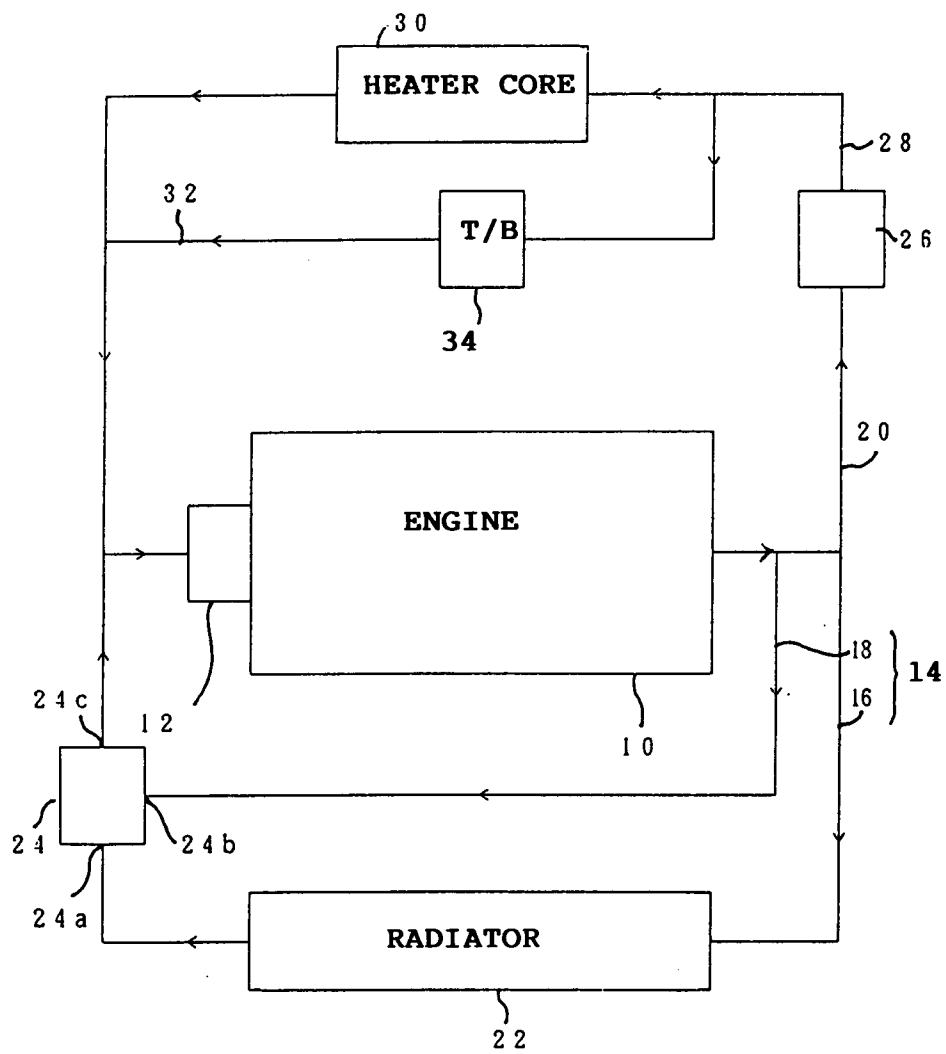


FIG. 2

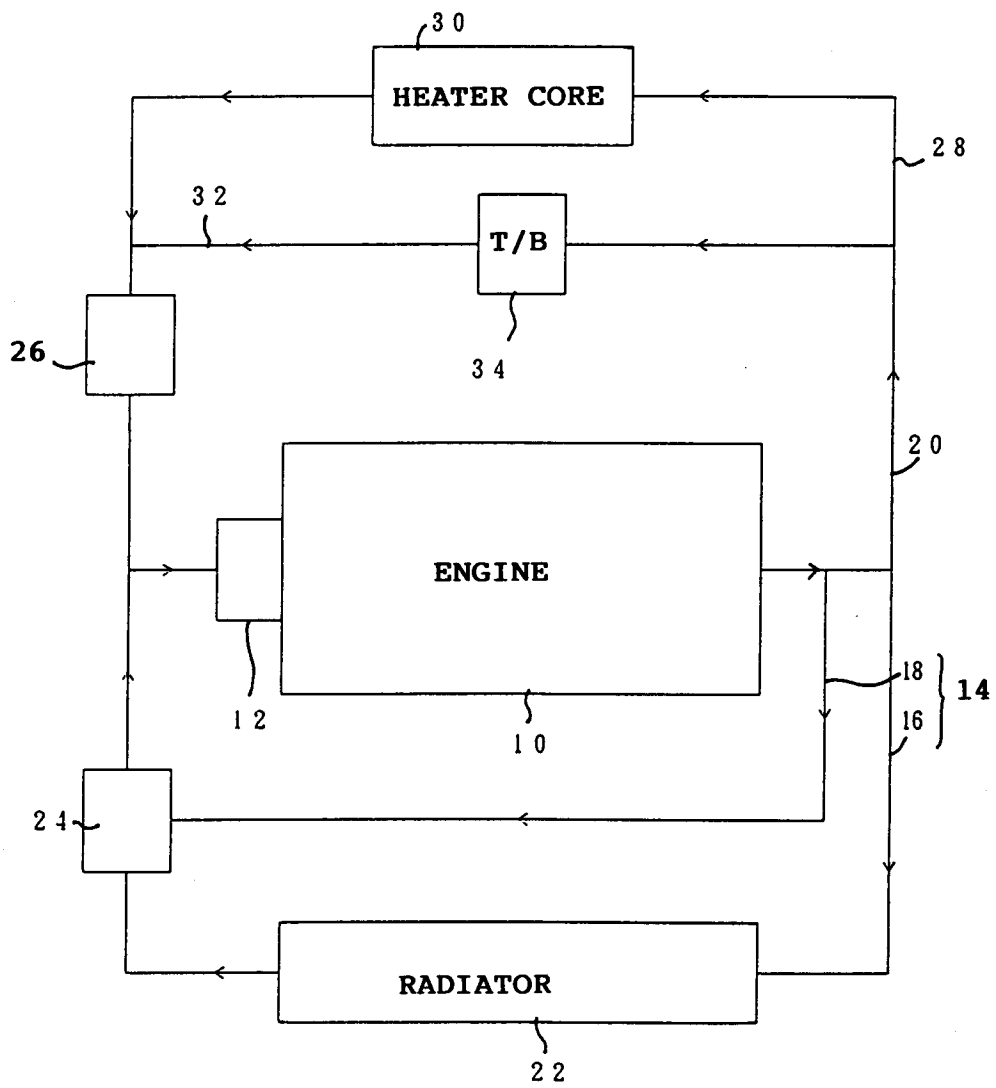


FIG. 3

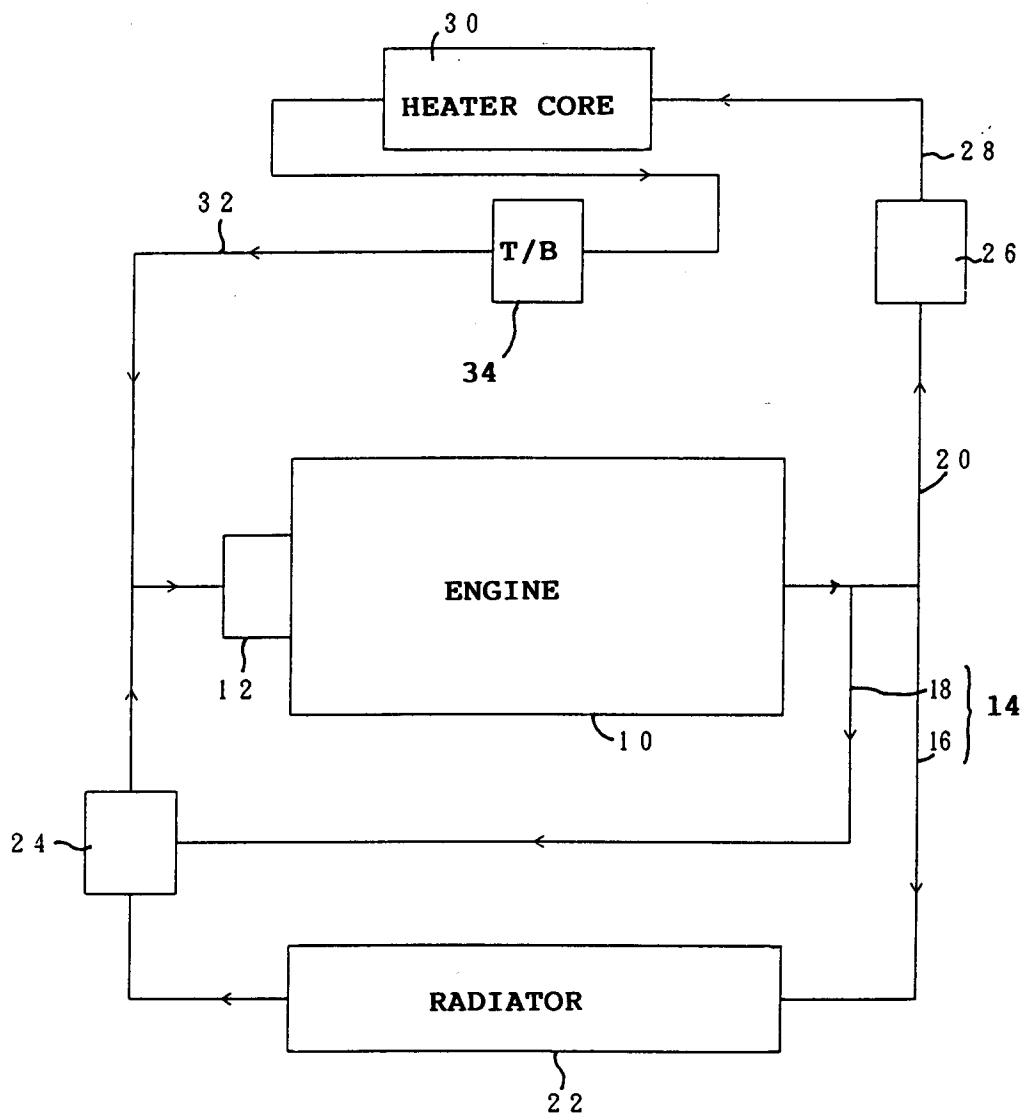


FIG. 4

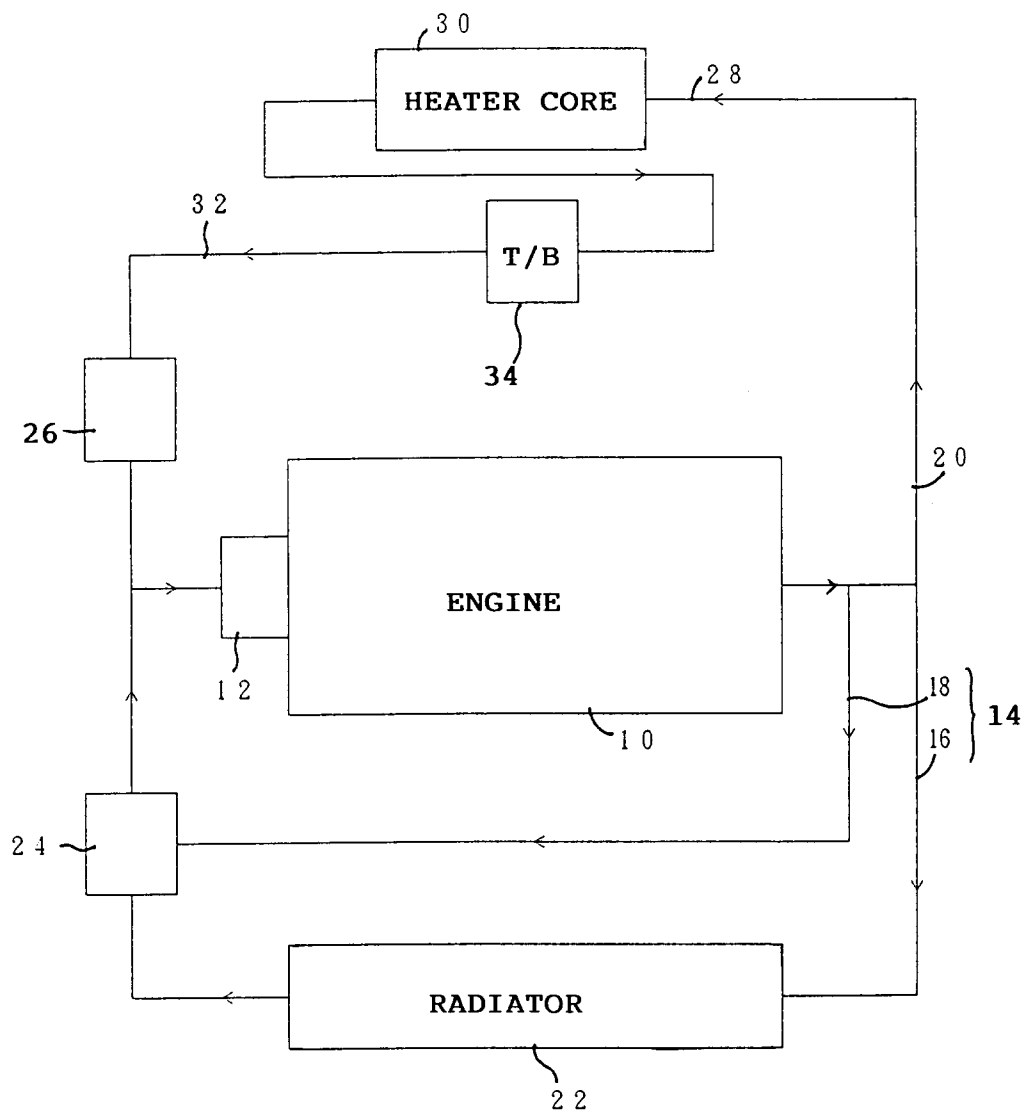


FIG. 5

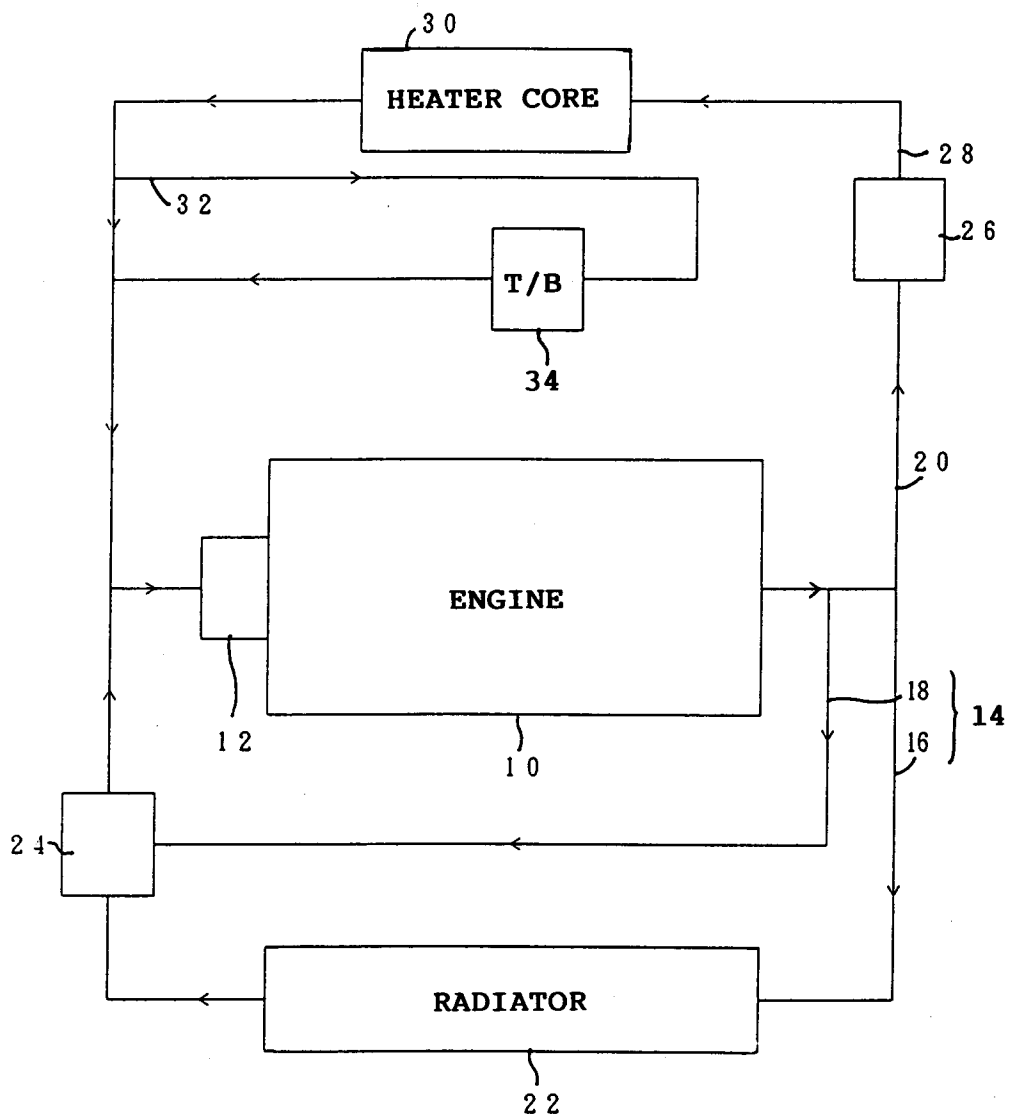
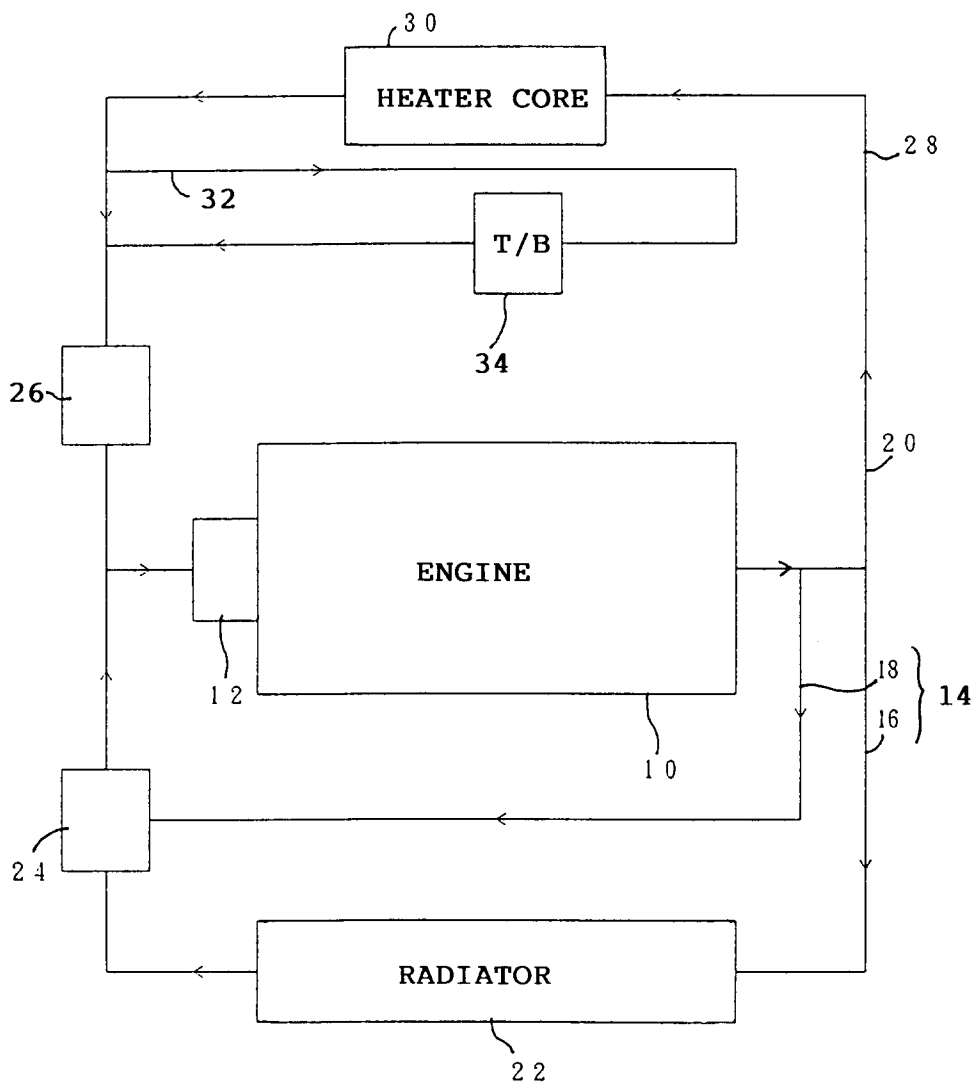


FIG. 6





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 6761

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.6)
X	DE-A-39 33 587 (BMW) * the whole document * -----	1-7	F01P3/20 F02M15/02
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F01P F02M
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 February 1996	Examiner Kooijman, F
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 (P04C01)