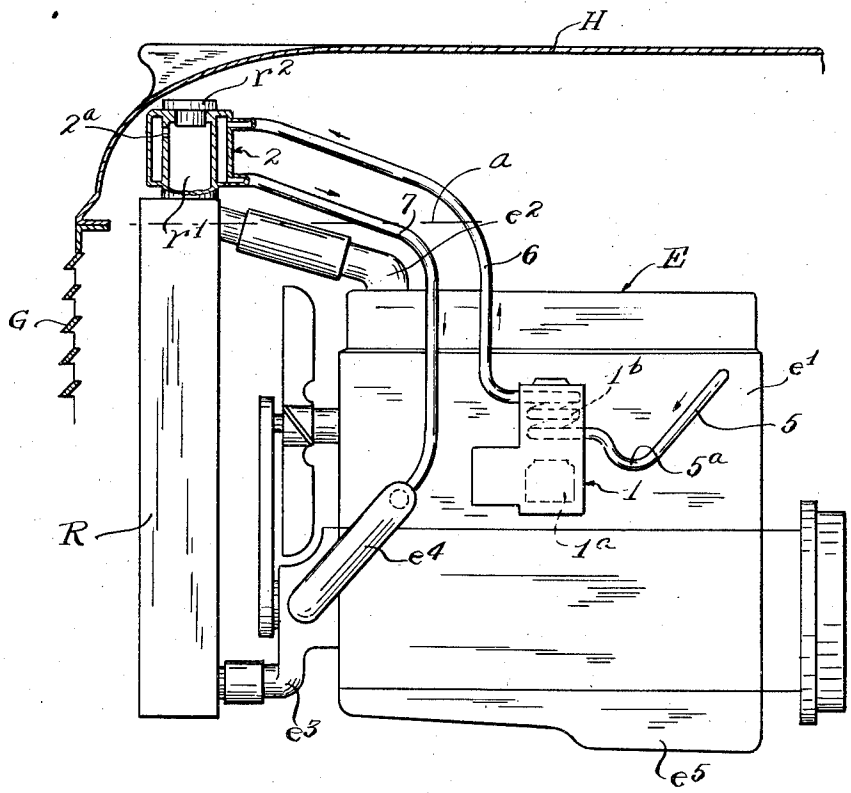
May 7, 1946. M. RESEK 2,399,941

HEATING SYSTEM OF THE CIRCULATING LIQUID CLASS

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FIG. 1.



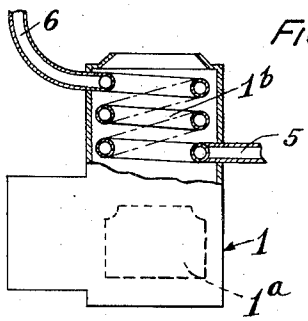


FIG. 4.

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HEATING SYSTEM OF THE CIRCULATING LIQUID CLASS

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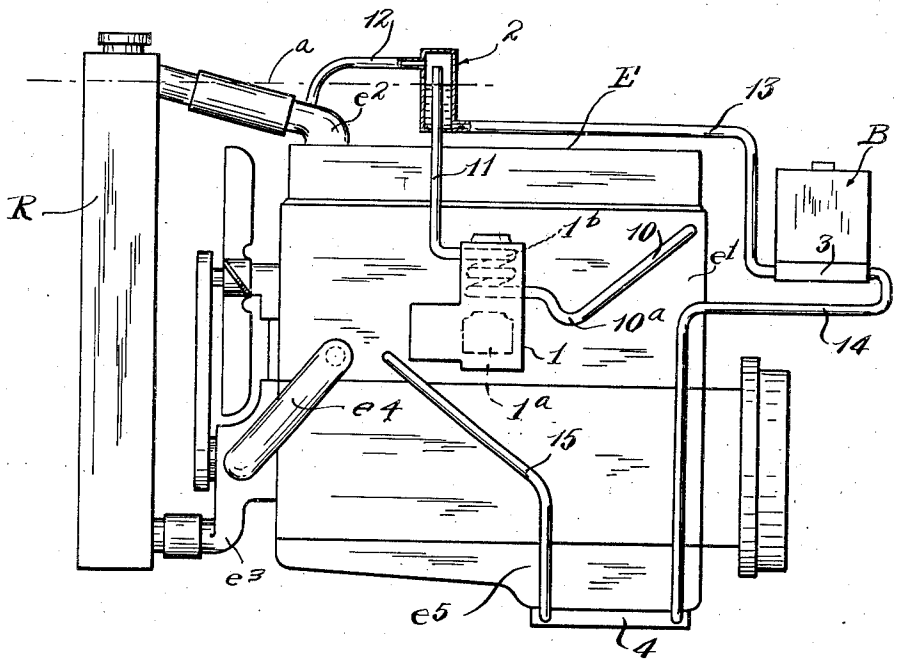


FIG. 2

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HEATING SYSTEM OF THE CIRCULATING LIQUID CLASS

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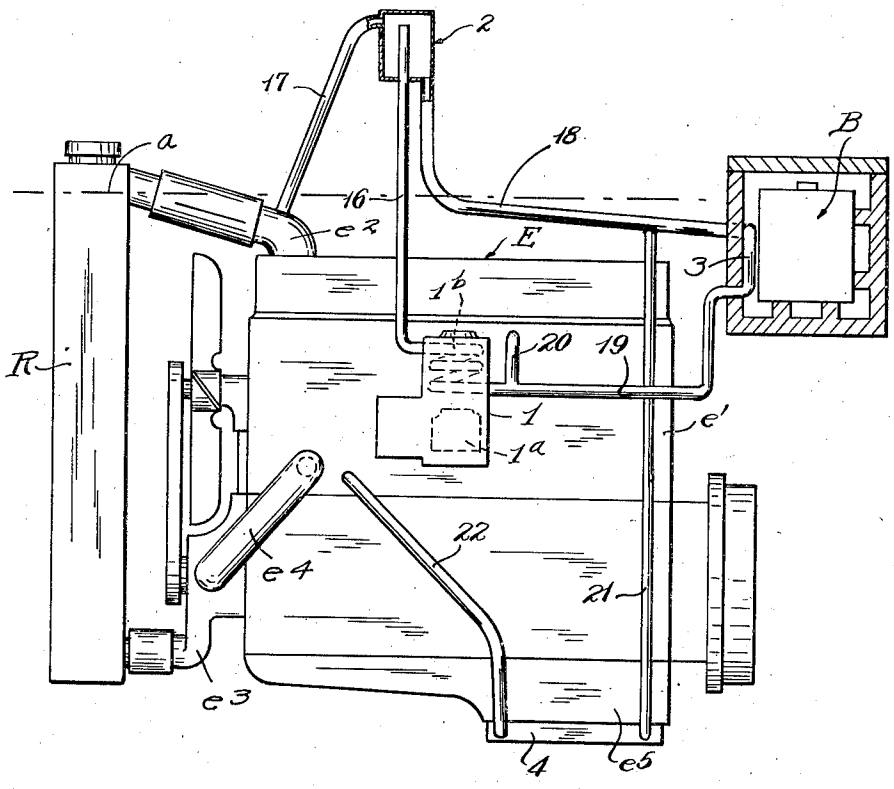


FIG. 3

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Patented May 7, 1946 2,399,941

UNITED STATES PATENT OFFICE

2,399,941

HEATING SYSTEM OF THE CIRCULATING LIQUID CLASS

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Application January 15, 1945, Serial No. 572,918

7 Claims. (Cl. 123—142.5)

This invention resides in improvements in heating systems of the circulating liquid class, and its primary object is to provide a system of this class in which the heater may be located at any desired elevation relative to the heat dissipating or delivery unit or units, thus especially adapting the system to the heating of an internal combustion engine (as will hereinafter more fully appear) for the purpose of facilitating the starting of the engine during cold weather, and for protecting the engine and its appurtenances from damage by exposure to extremely low temperatures between operations.

Heretofore, in the use of systems of the above mentioned class for engine heating purposes, it was necessary, because of the common thermosiphon circulation method employed in such systems, to locate the heater so low with respect to the engine that it made the installation of the heater, in the restricted space available for its accommodation, extremely difficult and access to the heater equally inconvenient. Usually the heater had to be reached from underneath the vehicle on which it was installed, for inspection and servicing. Furthermore, because of the proximity of the heater to the ground, it was necessary to provide means for sealing the heater casing when the vehicle was in use and the system was not in operation in order to protect the enclosed parts from water and mud.

In more limited terms, the object of the invention is to provide a heating system of the liquid circulating class in which the liquid is lifted by vapor action from the heater to a separator that forms the highest part of the system, where the vapors are removed, and from which the highly heated liquid flows by gravity to one or more heat dissipating or delivery units that may be located above, below, or in the plane of the heater, and from which unit or units—which, in the case of a plurality, may be arranged either in series or parallel, so to speak—the liquid is caused to return to the heater by displacement. The term "heat dissipating or delivery unit" is intended to embrace the coolant space or water jacket of the engine.

In the accompanying drawings, which form a part hereof, Fig. 1 represents a side elevation of an internal combustion engine equipped with one form of my invention, the view being in the nature of a diagram and including the radiator that forms a part of the cooling system, and a portion of the hood and grill of the motor vehicle on which the engine is installed; Fig. 2 is a similar view showing a form of the invention in which heat dissipating or delivery units of the system are arranged in heat exchanging relation to the battery and to the oil pan of the engine, respectively, the system additionally being in circuit with the coolant space of the engine, as in the form above; Fig. 3 is a view similar to Fig. 2 showing a further modification of the heating system, and Fig. 4 is a side elevational view, partly in section, of the heater.

In each of the views, the engine is designated, generally, by the reference letter E, and the coolant space—that is, the water jacket of the cylinder block and head—is designated e'. Said space is in circuit with the radiator R through the usual connections e^2 and e^3, the former leading from the top of the coolant space to the corresponding part of the radiator, while the second mentioned connections lead from the bottom of the radiator and include the usual pump which draws the coolant from the radiator and delivers it to the lower portion of the coolant space e', the connections between the pump and said space, in the present instance, being represented by the pipe e^4. The oil pan of the engine is designated e^5.

Fragments of the hood and grill of the vehicle are included in Fig. 1 where they are designated H and G, respectively.

My improved heating system, in all forms shown, includes a heater 1, incorporating a heating means or combustion device 1^a, and a heat exchanger or circulating element or coil 1^b. The system also includes, as an essential part thereof, a separator 2, which forms the highest part of the system.

In the embodiments of the invention illustrated in Figs. 2 and 3, heat dissipating or delivery units 3 and 4 are also included, the former being arranged in proximity to the electric battery B for the purpose of delivering heat thereto, and the latter in heating relation to the oil pan e^5 of the engine. The battery B provides the source of current for the starting and ignition circuits of the engine, and the lighting and other circuits of the vehicle.

In the form of the invention illustrated in Fig. 1, which will now be described, the filling spout r' of the radiator R is made sufficiently long to serve as the inner wall of an annular vessel that constitutes the separator 2, the filling spout being provided with the usual cap r^2. A vent opening 2^a establishes communication between the upper portion or vapor space of the separator 2 and the interior of the spout r'.

A conduit 5 leads from the top of the coolant space e' of the engine to the inlet of the heat exchanger 1^b (Fig. 4), and a conduit 6 extends from the outlet of said exchanger to the top portion or vapor space of the separator 2. A conduit 7 establishes communication between the bottom part or liquid space of the separator and the lower portion of the coolant space e', incidentally through the end of the aforesaid pipe e^4 adjacent its connection with the cylinder block. The conduit 5 preferably includes a trap 5^a.

In considering the operation of the above described form of the invention, it will be assumed that liquid stands in the system at approximately the level indicated in Fig. 1 (as well as in each of the other views) by the dot-and-dash line a, and that the heater or combustion device 1^a is in operation. When the liquid in the exchanger 1^b is heated sufficiently to partially vaporize it or cause it to boil, the resultant bubbles will rise through the conduit 6 and carry liquid upwardly and discharge it into the separator. Here, air or other gases, and probably some of the coolant vapors, will escape through the vent opening 2^a into the radiator R, which, in accordance with present preferred practice, may be sealed in order to prevent the loss of volatile coolant. When the radiator is sealed, the cooling system of the engine is under pressure, and the pressure therein is equalized with that in the heating system through the vent opening 2^a. This prevents a superior pressure being built up in one system that would force coolant liquid through the vent opening into the other system. Coolant vapors generated in the heat exchanger 1^b will usually condense in the separator and join the liquid in the bottom portion or liquid space thereof. However, any coolant vapors escaping through the vent opening will condense in the cooling system of the engine and will not be lost. It will be seen, therefore, that boiling of the coolant in the heat exchanger results in no loss of coolant.

The highly heated liquid, elevated to the separator by vapor action, gravitates from the separator through the conduit 7 to the bottom of the coolant space of the engine to take the place of that flowing out through the conduit 5. In this way, a circulation of liquid is set up through the coolant space independently of the radiator and its connections with the engine, and in a very brief period of time the temperature of the engine will be raised to such an extent that starting will be made easy. Between operations of the engine, the latter may be kept warm by maintaining the system in operation. When the engine is in use and the system is inactive, the latter has no effect upon the normal functioning of the standard cooling system. The purposes of the trap 5^a, it may be explained, is to avoid upward displacement of liquid through the conduit 5 by vapor pressure in the exchanger 1^b, and insure upward flow exclusively through the conduit 6.

In the embodiment of the invention illustrated in Fig. 2, as in the form above described, the upper portion of the coolant space e' of the engine communicates, through a conduit 10, with the inlet of the heat exchanger 1^b, said conduit including a trap 10^a. A conduit 11 leads from the outlet of the heat exchanger up through the bottom of the separator 2 and opens into the vapor space thereof, which space is vented, through a pipe 12 and connection e^2, to the cooling system of the engine.

A conduit 13 leads from the bottom of the separator 2 to the inlet of a heat dissipating or delivery unit 3 that is arranged in heating relation to the battery B. The parts are so arranged that the liquid gravitates to said unit and thence, through a conduit 14, to the inlet of the heat dissipating or delivery unit 4 disposed in heating relation to the oil pan e^5 of the engine. The outlet of the latter unit communicates, through a conduit 15, with the bottom portion of the coolant space e'.

The form of the invention illustrated in Fig. 3 differs only slightly from that last described. The outlet of the heat exchanger 1^b joins a conduit 16 that rises through the bottom of the separator 2 and opens into the vapor space thereof, which space is vented to the cooling system of the engine through a pipe 17. The hot liquid that is delivered by vapor action to the separator gravitates therefrom through a conduit 18 to the heat dissipating or delivery unit 3, associated with the battery B, and from said unit the liquid passes on through a conduit 19, to the heat exchanger 1^b. A branch 20 of the last mentioned conduit has connection with the top of the coolant space e'. Leading from the conduit 18, in advance of its connection with the unit 3, is a conduit 21 that has connection with the inlet of the heat dissipating or delivery unit 4 that is associated with the oil pan e^5 of the engine, and the outlet of said unit communicates, through a conduit 22, with the bottom of the coolant space e'.

It will be seen, therefore, that the principal difference between the two last described forms of the invention is: while in the former the heat dissipating or delivery units 3 and 4 are in series, they are, in the latter, in parallel, so to speak; and in the arrangement shown in Fig. 3 the liquid passes from the upper portion of the coolant space e' to the heat exchanger 1^b through the branch conduit 20 and the portion of the conduit 19 intermediate said branch and the heater.

From the description of the operation of the first form of the invention, the mode of operation of the other two forms will be readily understood.

Having thus described my invention, what I claim is:

1. In a heating system of the class set forth, a heat exchanger through which liquid is adapted to be circulated, the same being provided with an inlet and an outlet, a source of heat in operative relation to said exchanger, a separator located at a higher elevation than said heat exchanger and consisting of a vessel the top portion of which provides a vapor space and the portion therebelow a liquid space, liquid conducting means communicating at one end with the outlet of the exchanger and opening at its opposite end into the vapor space of the separator, said vapor space being provided with a vent, a heat dissipating unit below the plane of the separator, the same having a liquid passage provided with an inlet and an outlet, liquid conducting means leading from the liquid space of the separator to the inlet of the heat dissipating unit and so arranged that the liquid flows by gravity from the former to the latter, and other liquid conducting means leading from the outlet of said unit to the inlet of said heat exchanger.

2. In a heating system of the class set forth for

use with an internal combustion engine incorporating a coolant space and a liquid circulating cooling system including said space, a heat exchanger having a liquid passage provided with an inlet and an outlet, a source of heat in operative relation to said heat exchanger, a separator located at a higher elevation than said heat exchanger and adapted to occupy a plane above the maximum liquid level in the cooling system of the engine, said separator consisting of a vessel the upper portion of which provides a vapor space and the portion therebelow a liquid space, said vapor space being vented, a conduit communicating at one end with the outlet of the exchanger and opening at its opposite end into the vapor space of the separator, liquid conducting means leading from the liquid space of the separator and adapted for connection to the bottom portion of the coolant space of the engine, and other liquid conducting means adapted for connection to the upper portion of said coolant space and communicating with the inlet of the exchanger.

3. In a heating system of the class set forth for use with an internal combustion engine incorporating a coolant space and a liquid circulating cooling system including said space, a heat exchanger having a liquid passage provided with an inlet and an outlet, a source of heat in operative relation to said heat exchanger, a separator located at a higher elevation than said heat exchanger and adapted to occupy a plane above the maximum liquid level in the cooling system of the engine, said separator consisting of a vessel the upper portion of which provides a vapor space and the portion therebelow a liquid space, means through which the vapor space of the separator is vented to the cooling system of the engine, a heat dissipating unit for the oil pan of the engine, the same having a liquid passage provided with an inlet and an outlet, a conduit communicating at one end with the outlet of the exchanger and opening at its opposite end into the vapor space of the separator, a conduit leading from the liquid space of the separator to the inlet of said heat dissipating unit, a conduit leading from the outlet of said unit and adapted for connection to the bottom portion of the coolant space of the engine, and another conduit adapted for connection to the top portion of said space and leading to the inlet of the heat exchanger.

4. In a heating system of the class set forth for heating an internal combustion engine and an electric battery associated therewith, said engine incorporating a coolant space and a liquid circulating cooling system including said space, a heat exchanger having a liquid passage provided with an inlet and an outlet, a source of heat in operative relation to said heat exchanger, a separator located at a higher elevation than said heat exchanger and adapted to occupy a plane above the maximum liquid level in the cooling system of the engine, said separator consisting of a vessel the top portion of which provides a vapor space and the portion therebelow a liquid space, means through which the vapor space of the separator is vented, a conduit communicating at one end with the outlet of the exchanger and opening at its opposite end into the vapor space of the separator, a heat dissipating unit in heating relation to the battery, the same having a liquid passage provided with an inlet and an outlet, a conduit leading from the liquid space of the separator to the inlet of the heat dissipating unit and so arranged that liquid flows by gravity from the separator to said unit, a conduit leading from the outlet of said unit to the lower portion of the coolant space of the engine, and another conduit adapted for connection to the upper portion of said space and leading to the inlet of the heat exchanger.

5. In a heating system of the class set forth for heating an internal combustion engine and an electric battery associated therewith, said engine incorporating a coolant space and a liquid circulating cooling system including said space, a heat exchanger having a liquid passage provided with an inlet and an outlet, a source of heat in operative relation to said heat exchanger, a separator located at a higher elevation than said heat exchanger and adapted to occupy a plane above the maximum liquid level in the cooling system of the engine, said separator consisting of a vessel the top portion of which provides a vapor space and the portion therebelow a liquid space, means through which the vapor space of the separator is vented, a conduit communicating at one end with the outlet of the exchanger and opening at its opposite end into the vapor space of the separator, a heat dissipating unit in heating relation to the battery, the same having a liquid passage provided with an inlet and an outlet, a second heat dissipating unit for the oil pan of the engine, the same having a liquid passage provided with an inlet and an outlet, a conduit leading from the liquid space of the separator to the inlet of the first mentioned heat dissipating unit and so arranged that liquid will flow from the separator to the unit by gravity, a branch conduit leading from the last mentioned conduit to the inlet of the second heat dissipating unit, a conduit leading from the outlet of the second heat dissipating unit to the lower portion of the coolant space of the engine, a conduit leading from the outlet of the first mentioned heat dissipating unit to the inlet of the heat exchanger, and a branch conduit leading from the last mentioned conduit and adapted for connection to the upper portion of the coolant space of the engine.

6. In a heating system of the class set forth for heating an internal combustion engine and an electric battery associated therewith, said engine incorporating a coolant space and a liquid circulating cooling system including said space, a heat exchanger having a liquid passage provided with an inlet and an outlet, a source of heat in operative relation to said heat exchanger, a separator located at a higher elevation than said heat exchanger and adapted to occupy a plane above the maximum liquid level in the cooling system of the engine, said separator consisting of a vessel the top portion of which provides a vapor space and the portion therebelow a liquid space, means through which the vapor space of the separator is vented, a conduit communicating at one end with the outlet of the exchanger and opening at its opposite end into the vapor space of the separator, a heat dissipating unit in heating relation to said battery, a second heat dissipating unit in heating relation to the oil pan of the engine, and a system of conduits through which the separator, said heat dissipating units, the coolant space of the engine and the heat exchanger are adapted to be placed in circulation.

7. In a heating system of the class set forth, a heat exchanger having a liquid passage and provided with an inlet and an outlet therefor, a source of heat in heating relation to said heat exchanger, a vessel located at a higher elevation than said heat exchanger the upper portion of which provides a vapor space and the portion

therebelow a liquid space, means through which said vapor space is vented, a heat dissipating unit below the plane of said vessel, the same having a liquid passage, and liquid conducting means leading from the outlet of the heat exchanger upwardly to where it communicates with the interior of said vessel so as to permit liquid rising from the exchanger to enter said vessel, and further liquid conducting means communicating with the liquid space of said vessel and providing a circuit including the liquid passage of the heat dissipating unit and leading to the inlet of the heat exchanger.

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