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N. L. DERBY

1,794,448

HEATING SYSTEM

Filed Feb. 8, 1928

Fig. 1

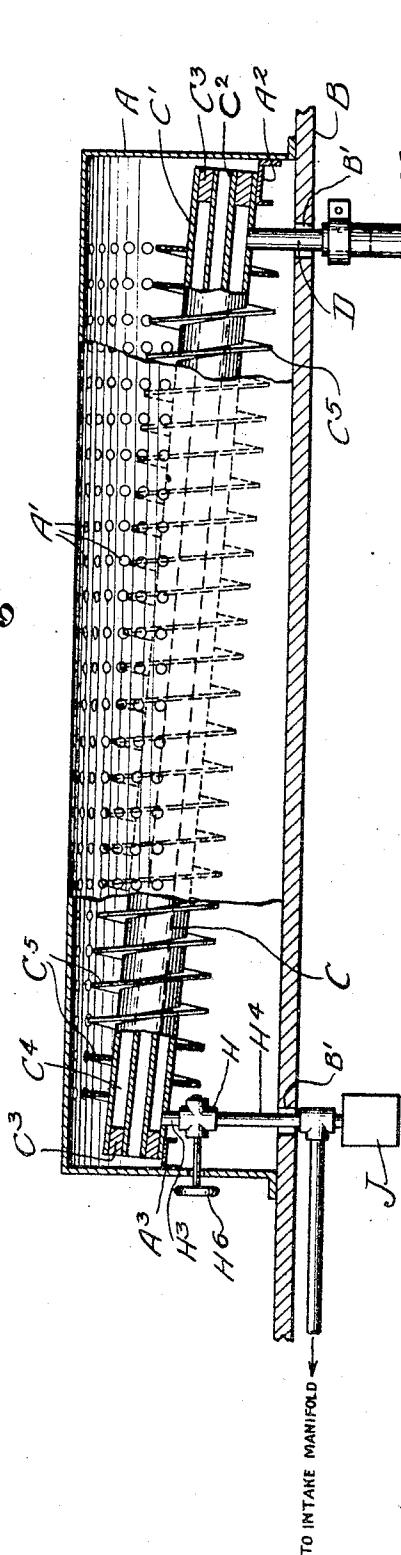


Fig. 3

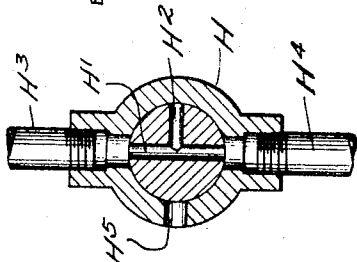
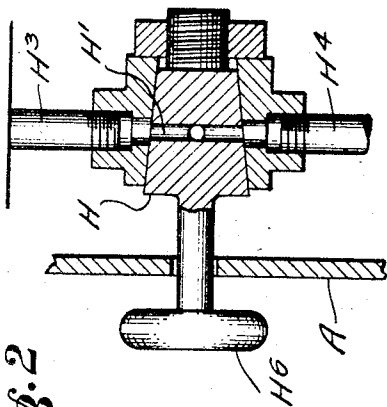
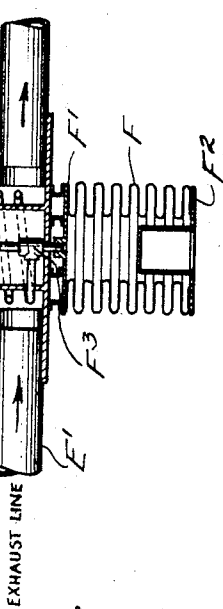


Fig. 2



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HEATING SYSTEM

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The general object of my present invention is to provide an improved heating system for vehicles having an internal combustion engine as a source of motive power. More specifically, the object of my invention is to provide a heating system operating under a pressure normally below atmospheric and provided with means for automatically regulating the amount of fluid in circulation in accordance with the fluid pressure in the system.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, and the advantages possessed by it reference should be had to the accompanying drawing and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawing:

Fig. 1 is an elevation partly in section of a preferred embodiment of my invention;

Fig. 2 is a section through the control valve shown in Fig. 1; and

Fig. 3 is a section through the valve ports of Fig. 2.

In the drawing and particularly in Fig. 1, I have illustrated a preferred embodiment of my invention in which A is a radiator casing having a multiplicity of perforations A' therein for the circulation of air. The casing is transversely mounted on and secured to the flooring B of an automobile or like vehicle in any suitable manner. Openings B' are formed in the flooring for the entrance of fresh air to the radiator unit.

A radiator unit C is mounted in the casing A and comprises a tube C' supported in an inclined position by casing brackets A² and A³. A concentric tube C² is arranged within the tube C'. An annular plug C³ is mounted in each end of the tube C' and provides a gas-tight annular space C⁴ between the tubes C' and C². A continuous radiating fin C⁵ is secured circumferentially of the tube C' and extends substantially the length thereof. A vertical pipe D passing down through one of the openings B' in the vehicle flooring

connects the lower end of the radiator unit to a heating unit utilizing as a source of heat the exhaust gases from the vehicle engine.

In the construction shown the heating unit comprises an inverted T-shaped casing E inserted in and forming a part of the engine exhaust pipe E'. A cover plate E² prevents the escape of gases through the top of the casing E. A hollow cylindrical casing E³ is mounted on the bottom plate of the casing E and spaced from the top and sides thereof. Removably secured to the underside of the bottom plate is a hollow longitudinally expansible and collapsible element F, preferably in the form of a metallic bellows or an air tight water-proof textile fabric bellows reinforced by a coiled spring. In Fig. 1 the element is shown as a seamless metallic bellows having top and bottom plates F' and F², respectively. The top plate F' is provided with a central threaded opening to which a T F³ mounted in the casing E³ is connected by a nipple. A vertical pipe G has its lower end connected to the T and its upper end to a nipple G' secured in the casing cover plate E². The T and nipple are also connected by a coiled pipe G² used as the heating element and extending around the casing E³. The nipple G' is connected to the pipe D by a flexible conduit preferably in the form of a rubber hose G³.

The upper end of the radiator unit is provided with a control valve H connected to the space C⁴ through a pipe H³. The control valve is of the plug type and the valve plug is provided with passages H' and H² perpendicular to each other and adapted to be rotated into different positions to cut off communication with the radiator element or to connect the pipe H³ leading from the radiator unit, either to a pipe H⁴ passing through an opening B' and leading to a source of suction such as the suction intake manifold of the vehicle engine or to a port H⁵ leading to the atmosphere. The valve is operated by a handwheel H⁶ projecting through an end wall of the radiator casing A. A drip pan J is connected to the bottom of the pipe H⁴ to catch any liquid passing down through that pipe.

In the preferred mode of operation of the apparatus described, the bellows element F is filled with a vaporizable liquid while the system presumably contains air or other gas. The handwheel H^a is rotated to connect the enclosed space C⁴ with the engine suction intake manifold to exhaust the air and gases therefrom. When most of the gases have been exhausted, the handwheel is rotated one eighth of a turn to cut off communication with the engine manifold. The pressure in the space C⁴ is then considerably below atmospheric and as the pressure in the heating system drops beyond a certain point, the pressure of the surrounding atmosphere on the bellows F causes this element to partially collapse, thereby forcing some of the liquid therein into the coil G², where it is heated by the engine exhaust gases contacting therewith and vaporized. The vapor generated passes upwardly through the conduit G³ into the space C⁴ between the tubes C¹ and C². The vapor in the space C⁴ loses part of its heat to the air circulating through the casing A and condenses. The condensate flows by gravity to the lower end of the radiator unit and passes down through the conduits G³ and G⁴ to the bellows and heating coil, where it is again vaporized.

The vapor pressure in the system gradually rises until the pressure is almost atmospheric. As the pressure approaches this point the bellows F correspondingly expands thereby increasing its liquid holding capacity and withdrawing an increasing amount of returning condensate from circulation. The decrease in the amount of circulating fluid causes the fluid pressure in the heating system to drop. The drop in pressure causes the bellows F to partially collapse and thus increase the amount of circulating fluid. The amount of heat radiating surface due to the particular construction of the radiating fin C⁵ and the inner tube C² is sufficient to prevent the temperature within the radiator unit from ever rising beyond a predetermined point and prevents the pressure therein from increasing beyond atmospheric. It is thus seen that in the normal operation of my heating system, the air having been initially exhausted from the radiator unit, that the heating cycle comprises a collapsing of the bellows F, an increase in the amount of fluid circulating in the system, and an increase in the fluid pressure in the system which causes the bellows to again expand. The increased capacity of the bellows decreases the amount of circulating fluid and thereby causes a drop of pressure in the system until an equilibrium point is reached where the amount of vapor being condensed in the radiator unit is just equal to the amount of vapor being generated in the heating coil.

When it is desired to render the system inoperative for heating service the valve H is

turned to connect the space C⁴ with the atmosphere and allow the system to be filled with air. The valve is then closed and the air trapped in the system prevents the circulation of vapor as the system becomes air bound. The pressure in the system is sufficient to prevent the bellows from collapsing and any heat in the radiator unit is quickly dissipated by the radiating fins and tube surfaces. The heating system can be restored to service by connecting the space C⁴ to the engine suction manifold to exhaust the air therefrom, thus creating an unbalanced force on the outer walls of the bellows element F.

The vaporizable liquid in use is one having a relatively high boiling point at atmospheric pressure, preferably about 300° F. and a boiling temperature of about 225° F. when subjected to the amount of vacuum normally obtained by connecting the tube space to the engine manifold. A light lubricating oil having these requisites is most desirable. The temperature of the exhaust gases passing through the pipe E¹ and around the heating coil G² ranges from 275° F. to 350° F. depending upon the engine operating conditions. With these conditions the temperature in the radiator unit will be approximately 225° F. and the pressure below atmospheric.

The heating system disclosed herein could be modified by eliminating the bellows F when the liquid in use has a boiling point so high that it will not boil at atmospheric pressure when subjected to the temperatures normally existing in the engine exhaust pipe. The liquid must, however, boil under the minus pressure obtained when the air is exhausted from the heating system. In such a construction, the lower end of the heating coil is sealed to hold the vaporizable liquid and the operation is the same as before except that the system is controlled exclusively by the variations in pressure therein causing vapor to be generated as the pressure drops sufficiently and keeping the liquid from boiling when the pressure in the system is approximately atmospheric.

My invention is characterized by its simplicity of control, low cost of construction and effectiveness in operation. The heating system may be incorporated in existing vehicles with little alteration in the construction thereof and by relatively unskilled labor. The use of a light lubricating oil as the circulating medium is also advantageous in that if some of the vapor is carried over into the engine when the space C⁴ is connected to the intake manifold, the vapor will aid rather than injure the engine.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus

disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features. For instance, openings H^2 and H^3 in valve H may be eliminated. When it is desired to trap air in the heating system the air will then be drawn from the engine intake manifold through pipe H^4 while the engine pistons are at rest.—And, also, valve H may be adjusted to allow free communication between the suction intake manifold and the radiator element while the heating system is in service. If the valve opening H^1 is made relatively small there is very little liability of vapor being sucked from the heating system into the engine when valve H is open and the engine is in operation.

Having now described my invention what I claim as new and desire to secure by Letters Patent, is:—

1. A heating system for vehicles having an internal combustion engine therein comprising in combination a heating element containing a vaporizable liquid, means for passing hot exhaust gases from said engine in contact with said heating element, a radiator element connected to said heating element, and means for automatically regulating the amount of fluid in circulation in said system in accordance with the fluid pressure in said system.

2. A vehicle heating system comprising in combination a heating element adapted to contain a vaporizable liquid, means for supplying heat to said heating element, a radiator element connected to said heating element, and means for automatically regulating the amount of fluid in circulation in said system in accordance with the fluid pressure in said system comprising a collapsible element containing a vaporizable liquid and having its outer walls subject to the pressure of the atmosphere.

3. A heating system for vehicles having an internal combustion engine therein comprising in combination a heating element containing a vaporizable liquid, means for passing hot exhaust gases from said engine in contact with said heating element, a radiator element having one end connected to said heating element and having its opposite end connected to the suction intake manifold of said engine, and means for closing communication between said radiator element and said suction intake manifold.

4. A heating system for vehicles having an internal combustion engine therein comprising in combination a heating element containing a vaporizable liquid, means for passing hot exhaust gases from said engine in contact with said heating element, a radiator element having one end connected to said heating element and having its opposite end connected

to the intake manifold of said engine, and a control valve for connecting said radiator element to said manifold or to atmosphere.

5. A heating system comprising a heating element adapted to contain a vaporizable liquid, a radiator element including a fluid holding space connected to said heating element, means for supplying heat to said heating element, suction means for exhausting said fluid holding space, and means for automatically passing a vaporizable liquid into said heating element in accordance with the pressure in said system.

6. A heating system for vehicles having an internal combustion engine therein comprising a heating coil, a collapsible element containing a vaporizable liquid connected to said heating coil, means for passing exhaust gases in contact with said coil, a radiator element comprising an enclosed space having its upper end connected to the intake manifold of the engine and its lower end connected to said heating coil, means for normally closing the connection to the engine manifold, said system being so arranged that the liquid holding capacity of said collapsible element automatically increases as the pressure in the system increases and vice versa.

7. A heating system for vehicles having an internal combustion engine therein comprising a heating coil, a collapsible element containing a vaporizable liquid connected to said heating coil, means for passing exhaust gases in contact with said coil, a radiator element mounted transversely of said vehicle and comprising an enclosed space, said space having its upper end connected to the intake manifold of the engine and its lower end connected to said heating coil, means for normally closing the connection to the engine manifold, said system being so arranged that said collapsible element automatically passes liquid into said heating coil when the pressure in the system drops below a predetermined value.

8. A vapor heating system for automotive vehicles comprising a chamber of variable liquid holding capacity, a heating element communicating with said chamber, and suction means connected to said heating element and chamber and arranged to create a pressure differential between the inner and outer walls of said chamber to vary the liquid holding capacity of said chamber.

9. A vapor heating system for a vehicle having an internal combustion engine therein comprising in combination a heating element, means for passing exhaust gases from said engine in contact with said heating element, a collapsible chamber containing a vaporizable liquid communicating with said heating element, a radiator element connected to said heating element and to the intake manifold of said engine; and means for cutting

off communication between said radiator element and said intake manifold.

10. In an automotive vehicle, the combination with a vapor heating system having a vaporizable liquid therein with a high boiling point at atmospheric pressure, of means connecting said heating system to the intake manifold of the vehicle engine for lowering the boiling point of said liquid.

Signed at Buffalo, in the county of Erie and State of New York, this 6th day of February, A. D. 1928.

NORMAN L. DERBY.

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