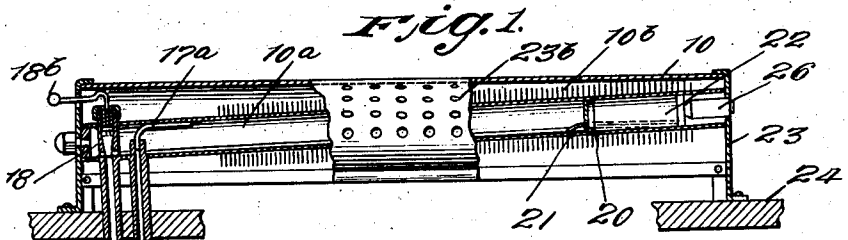
Jan. 21, 1936. S. VERNET 2,028,260

CAR HEATER

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Fig. 1.



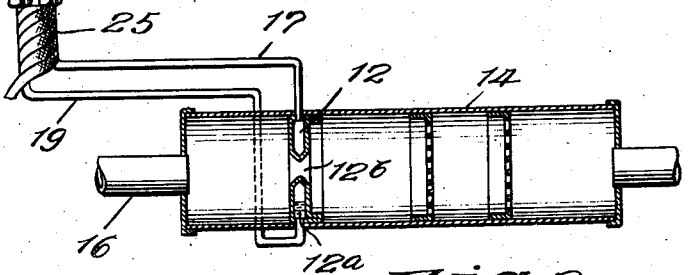
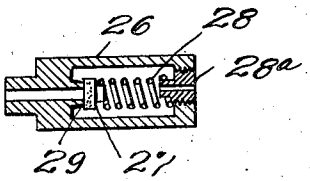


Fig. 2.



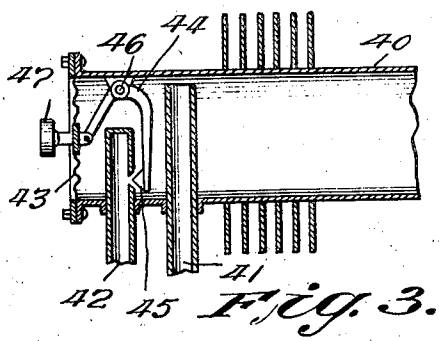


Fig. 3.

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Fig. 4.

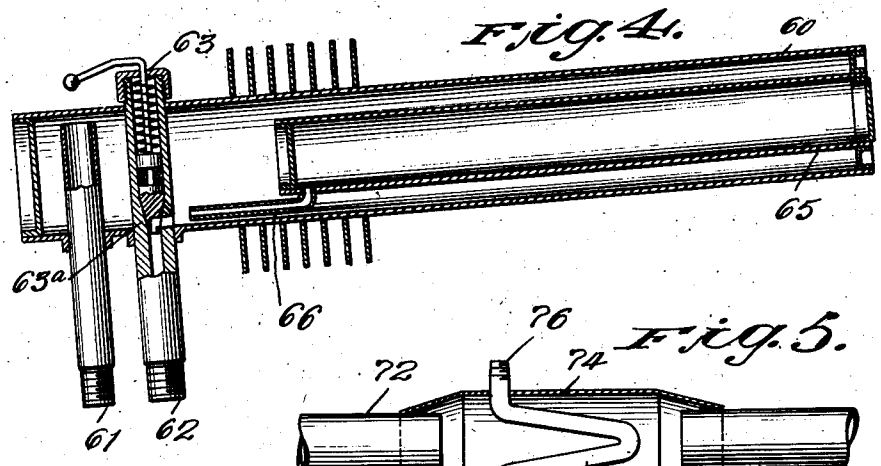


Fig. 5.

Fig. 6.

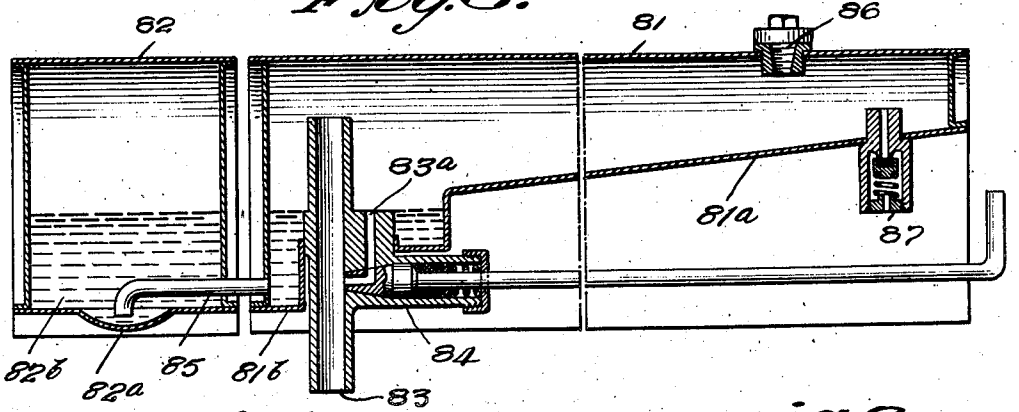


Fig. 7.

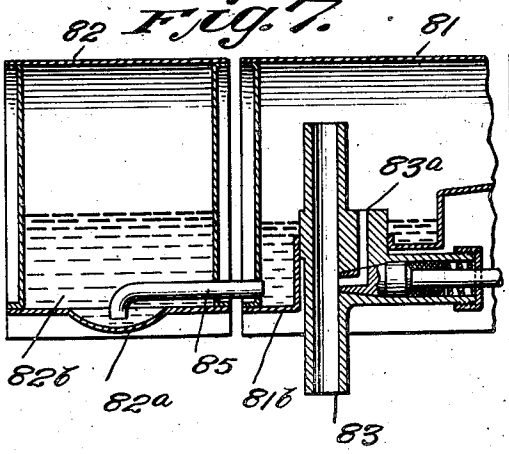
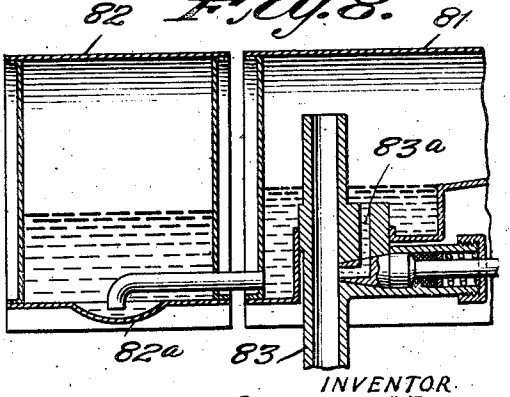


Fig. 8.



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Fig. 10.

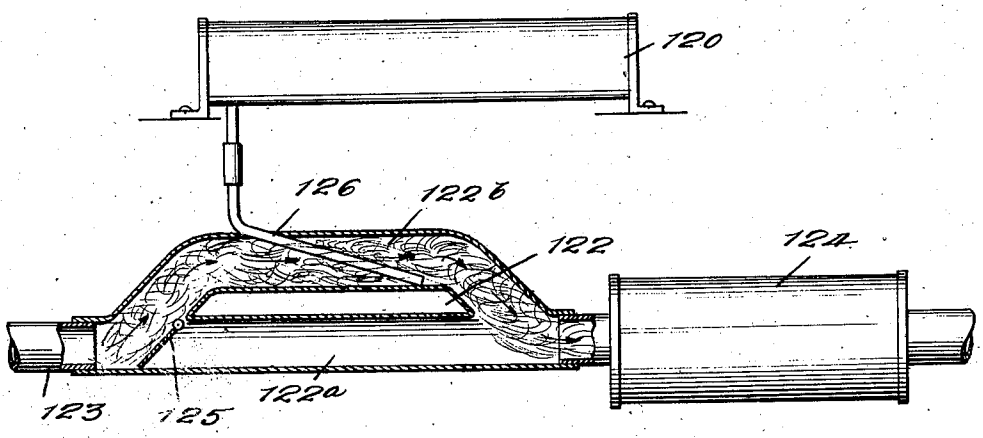


Fig. 11.

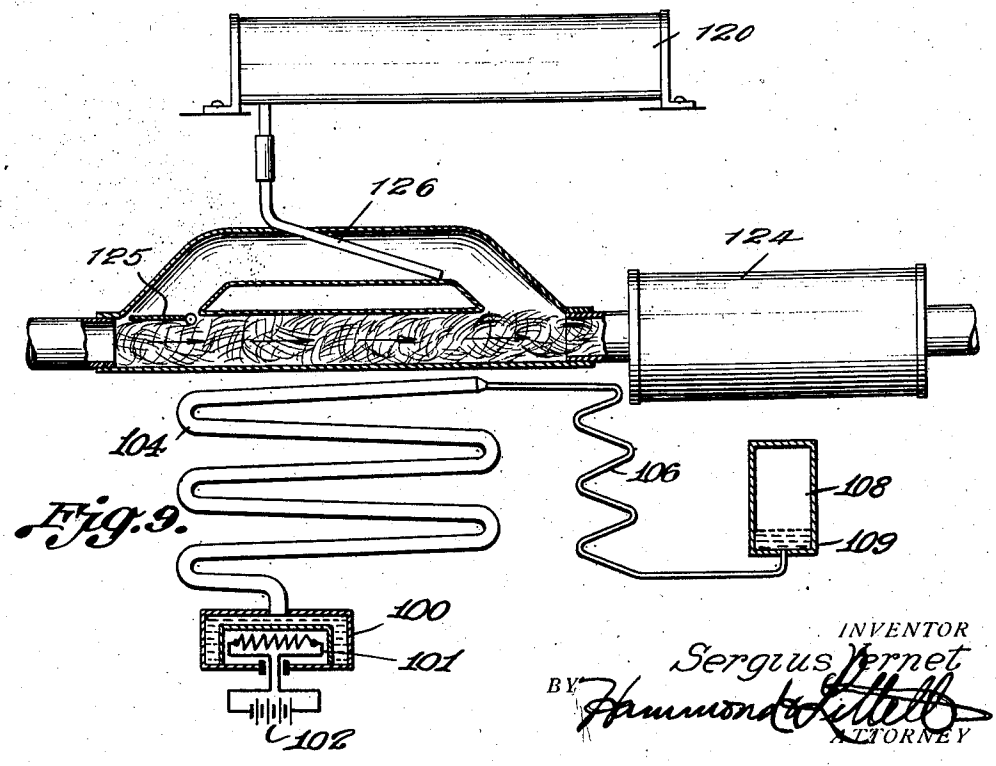


Fig. 9.

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UNITED STATES PATENT OFFICE

2,028,260

CAR HEATER

Sergius Vernet, Brooklyn, N. Y., assignor to Foster-Vernay Corporation, Pittsburgh, Pa., a corporation of New York

Application August 8, 1928, Serial No. 298,242
Renewed September 20, 1935

8 Claims. (Cl. 237—12.3)

This invention relates to improvements in vapor heaters, and particularly to a heater which is indirectly operated by the heat of the exhaust gases of the internal combustion engine of an automotive vehicle, the heater being automatically controlled to prevent the generation of too high a pressure when the exhaust gases raise the temperature in the heater to a relatively high point.

One object of this invention is to provide a vapor heating system including automatic means for withdrawing from the system a portion of the fluid when too great a pressure is generated in the system. A further object of this invention is to provide a heating system which will be readily controlled and which will automatically prevent some of the fluid from returning to the vaporizer if the pressure exceeds a predetermined amount.

It is a still further object of this invention to provide an automatic vapor heating system for motor vehicles in which a heat absorbing device may be desirably placed within an exhaust pipe of a motor vehicle, and in which the heating radiator such as a condenser is placed within the motor vehicle body, and is under automatic control to prevent undue pressures, and to permit extremely rapid heating.

Another object of this invention is to provide a closed heating system comprising a radiator condenser, a vaporizer and conducting means operatively connecting the radiator condenser and the vaporizer for the flow of vaporized heating medium from the vaporizer to the radiator condenser and the return of condensate from the radiator condenser to the vaporizer, the system being under automatic control effective as the pressure increases for withholding condensate from circulation back to the vaporizer from the radiator condenser.

Other objects and advantages of this invention will appear from the following detailed description thereof in conjunction with the attached drawings which illustrate preferred forms of embodiment of my invention, and in which

Fig. 1 is a side elevation, partly in section, of the radiator and vaporizer showing the details of construction.

Fig. 2 is a vertical section showing the relief valve of Fig. 1.

Fig. 3 is a vertical section of a part of the radiator element showing a modified form of automatic control.

Fig. 4 is a vertical section of a still further modified form of radiator element.

Fig. 5 is a side elevation, partly in section, of a vaporizer or boiler.

Figs. 6, 7 and 8 are vertical sections of a modified form of radiator showing slightly different conditions within the pressure control.

Fig. 9 is a digrammatic view, partly in section, showing an electric heating element and pressure controlling mechanism.

Figs. 10 and 11 are side elevations of a vapor heating system, partly in section, in which the exhaust pipe is provided with a by-pass for the vaporizer or boiler and showing the on and off positions.

The principal parts of a vapor heating system are the radiating element 10 and the vaporizer 12 which is shown in Fig. 1 to be a hollow baffle plate in the muffler 14 on the usual exhaust gas pipe 16. A hollow chamber in the baffle 12 is adapted to be filled with a small quantity of a suitable liquid such as alcohol and water 12*a* which will be heated during operation of the motor vehicle engine and the vapor will pass through the inlet pipe 17 and through the extension 17*a* into the chamber 10*a* in the radiating element. This element may be provided with suitable fins 10*b* which are exposed to the cooler air of the vehicle body causing the vapor to condense and return through the discharge valve 18 and through the discharge conduit 19 back into the fluid chamber in the baffle 12 to be revaporized. In order to bring about a rapid heat exchange, it is desirable to provide the vaporizer or boiler 12 with a quantity of fluid sufficient to generate an amount of steam which will heat the radiating element 10 quickly. However, if all the fluid in the system is allowed to become vaporized, a very high pressure may be set up which is undesirable. To prevent excessive pressure, a pressure control 20 is provided for the element 10 including a receptacle having a forwardly extending nozzle 21 projecting into the main vapor chamber. As the pressure increases in the chamber 10*a*, some vapor will be forced through the nozzle 21 into the chamber 22 where, upon cooling, it will condense to form liquid. As long as the pressure is maintained in the chamber 10*a*, vapor will continue to pass through the nozzle 21 and the condensed liquid will be retained in the chamber 22 by the pressure of the vapor in the chamber 10*a*. This liquid is thus automatically kept out of the vaporization cycle as long as the pressure in the chamber 10*a* prevails, maintaining an automatic pressure regulation. When the pressure in the chamber 10*a* drops some of the liquid trapped

in the chamber 22 will return to the vaporizing element 12.

When it is desired, for the convenience of the user, to shut off the heater, a hand-controlled arm 18b is provided for the discharge valve 18 and by partially rotating this handle, the conduit therein will be closed. This will prevent the condensed liquid from returning to the heating element and obviously more vapor cannot be formed, and the heater will cease to function.

It is to be understood that the heating element 10, shown in Fig. 1, will be placed in a compartment desired to be heated in the motor vehicle. The device is preferably supported by a sheet metal frame 23 suitably perforated, as shown at 23b, to permit the circulation of air so as to bring about the necessary heat exchange. The device is shown mounted on the usual floor boards 24 of the vehicle. The conduits 17 and 19 may be wrapped with an appropriate wrapping 25 to prevent heat losses and to prevent external damage to these conduits. The baffle 12, to which the conduits 17 and 19 are attached, may be a substitute for the usual baffle in the muffler except that it will be hollow and of sufficient capacity to receive the fluid, and it will be provided with the usual central aperture 12b to allow the exhaust gases to pass therethrough. Although this baffle may be placed in the present-day muffler, it is contemplated to construct such a baffle and heating element while the muffler is being built and place it in the muffler in the first instance. In lieu of the baffle 12, it will be understood that a thimble or other vaporizer projected into the ordinary muffler may be used.

An air relief valve 26 shown in greater detail in Fig. 2 is provided to relieve the air with which the system is filled if in exceptional cases the pressure becomes excessive. It comprises a closure disc or valve 27 actuated by the spring 28 against the valve seat 29. A screw 28a operating against the spring 28 will increase the tension on the spring 28 as is well known in the art. By adjusting the screw 28a and the spring 28, the spring pressure may be adjusted so that if the gas pressure within the system becomes too great, gas such as air may escape through the valve to the atmosphere. By locating the valve 27 in the end of the heater remote from that at which the vapor enters, the incoming vapor forces the air toward the valve, so that when the pressure reaches that at which the valve is set to open only the air escapes therefrom, reducing the pressure and keeping the condensable vapor in the system. It is not intended to adjust the relief valves so as to allow all the air to escape from the system, but only to guard against the results of an excessive pressure being developed within the system by abnormal conditions.

The retention of air in the system tends to retard condensate from being forced up the condensate return tube when vapor is being formed rapidly in the vaporizer. For if there were a vacuum in the system any sudden excess of pressure in the vaporizer over that in the radiator would result in vapor from the vaporizer rushing up the return tube and forcing the condensate back into the radiator, thus interfering with the system functioning smoothly. But with air in the system, to start with, at atmospheric pressure, a few drops of water suddenly vaporizing in the boiler will not cause such a tremendous difference in pressure between the boiler and the radiator, and accordingly there will not be the tendency for a sudden rush of steam trying to get up to the radiator to equalize this pressure. While the pressure may suddenly increase by a pound or two, this will only be a small percentage of the pressure already in the system, and as the percentage difference is so small, it will equalize by the steam flowing up through its normal path in the steam pipe and will not hold back or reverse the return flow of water in the water return line.

A modified form of automatic control comprising a discharge valve is shown in the radiating element 40 of Fig. 3 having the inlet pipe 41, the outlet pipe 42 and a flexible diaphragm 43 in the end of the heating element. A valve supporting member 44 having a cone-shaped plug valve 45 on the end thereof is pivoted at 46 to the casing of the heating element 40 and the other end of the valve supporting member 44 is fixed to the diaphragm 43. As the pressure increases in the heating element 40, the diaphragm 43 will be forced outward, thus forcing cone valve 45 into the valve seat in the discharge conduit 42 and shutting off the return of the condensed liquid. A manually controlled handle 47 may be provided to shut off the return of the condensed liquid at will, and any preferred form of locking mechanism may be provided to limit the rate of return of the liquid and thus the amount of heat generated.

The heating element 60, shown in Fig. 4 is provided with the inlet pipe 61 having a nipple extending nearly to the top of the cylinder and having an outlet conduit 62 with a hand-operated valve 63 near the bottom of the heating element so that the condensed liquid may return. The valve 63 is provided with the necessary spring pressed plug 63a operating on the valve seat to prevent leaks and as the handle of the valve is turned, communication is shut off through the valve. This heating element 60 is provided with a second substantially closed cylinder 65 within the outer cylinder 60 and one end is provided with an inlet pipe 66 substantially parallel and close to the bottom of the outer cylinder of the heating element. As the vapor is formed, the radiating element 60 will become warm, condensing the vapor and forming a liquid which will return through the valve and discharge pipe back to the vaporizer. However, if the pressure increases, the vapor which has entered the inner chamber and condensed therein will be held by the pressure on the remainder of the system which will prevent its return to the vaporizer. As the pressure is reduced, the liquid entrapped in the cylinder 65 will be relieved and will then return to the vaporizer. A slight incline is necessary in order that the liquid may flow by gravity from the cylinder 65 through the discharge conduit 62 and into the vaporizer.

In order to provide an adequate heating area for the vaporizer, the exhaust pipe 72, shown in Fig. 5, is cut and has a section removed therefrom, which section is covered by the enlarged cylinder 74 and in this cylinder 74 an irregularly shaped boiler 75 is fitted. The inlet pipe of the radiator condenser will be attached to the upper end 76 of the boiler 75 and the discharge conduit will be connected to the lower end 77 so that the vapor which is formed may pass directly into the radiator condenser. The volume occupied by the boiler 75 should be added to the volume of the normal exhaust pipe and the cylinder 74 should be slightly greater than these two sums so that there will be no increased

back pressure on the exhaust gases. It is also obvious that the heating element 75 may be S-shaped or of other form to have adequate area to satisfactorily and rapidly heat and vaporize the liquid contained therein.

The radiating element shown in Figs. 6, 7 and 8 comprises the radiator proper 81 and a secondary receptacle 82. The radiator 81 is provided with a sloping bottom 81a having a sump 81b in the bottom thereof. The inlet and outlet pipe 83 enters the radiator through this sump, having an outlet conduit 83a opening to receive liquid from the sump at a level considerably below the top of the main conduit of the pipe 83. A suitable valve 84, such as heretofore described, is provided to prevent the condensate which accumulates in the sump 81b from returning through the return conduit 83a and into the pipe 83. Substantially at the bottom of the sump 81b and connected into the auxiliary receptacle 82 is a short pipe 85 extending into a sump 82a in the bottom of the auxiliary receptacle. An inlet plug 86 is provided in the radiator 81 and an air relief valve 87 is also provided. This valve is the usual one-way valve provided with the usual spring-pressed plunger to prevent air pressure from leaking in.

In operation, as the heating medium is vaporized, it will pass through the inlet pipe 83 and into the radiator 81 giving up its heat. In cooling, the vaporized heating medium will be condensed and will run down the sloped bottom 81a into the sump 81b. Some of the heating medium will be forced by the pressure through the pipe 85 and into the auxiliary receptacle 82 where it will accumulate as shown at 82b. When sufficient condensate has accumulated in the sump 81b so as to overflow the top of the conduit 83a, which condition is shown in Fig. 8, the condensate will return through the conduit 83a and discharge by way of conduit 83 back to the vaporizer. Normally the liquid level in the radiator 81 is approximately as shown in Fig. 6, and as additional heating medium is condensed within the radiator 81, it will flow into the sump and overflow into conduit 83a. If the pressure in the system becomes excessive, however, the pressure in chamber 81 will be sufficiently larger than the back pressure in the auxiliary receptacle 82 to reduce the liquid level in the sump 81b by forcing liquid into the auxiliary receptacle 82. The liquid level being below the top of conduit 83a, the condensed heating medium is not returned to the vaporizer, and temporarily there will be an interruption of the cycle normally prevailing in the system according to which vaporized heating medium flows from the vaporizer to the radiator and condensed heating medium returns from the radiator to the vaporizer for revaporization. As the pressure is relieved, however, the back pressure in the secondary receptacle 82 will be sufficient to force liquid through the pipe 85 back into the sump 81b; and eventually, if the valve 84 is left open, liquid will overflow through the conduit 83a for return to the vaporizer. As pointed out in connection with preceding embodiments of the invention, the valve 84 may be closed to dam up the condensate in the sump 81b and stop circulation of heating medium, causing the boiler to run dry. It will be apparent that so long as the valve 84 is open, the operation is entirely automatic and depends upon the amount of liquid entrapped in the first place, and the subsequent increases in pressure. The valve 87 acts as a safety valve and permits the release of excess pressure, in case pressure is built up too rapidly. The plug 86 is provided for introducing the heating medium into the system.

In Fig. 9, an electrical heating element is shown and in this system the air is not expelled. It consists of the heating chamber 100 which is a fluid receptacle surrounding a resistance coil 101 energized in some suitable manner by a source of current 102. It will be clear, however, from the following description that suitable heat from the exhaust gases may be used in lieu of the coil 101. The vaporized liquid will be condensed in the primary radiating element 104 which is also provided with a smaller secondary rediating tube 106, the end of which is connected into the control chamber 108.

The operation is as follows: The vapor rises through the tube or radiating element 104 driving the air before it and, as the pressure increases, the air is driven through the tube 106. Should the pressure in the primary radiating element 104 become excessive, the vapor will travel down through the secondary radiating element 106 condensing into liquid and collecting in the chamber 108, as shown at 109. The greater the pressure the more condensed liquid will gather in the chamber 108 until the heating element 100 runs dry. The condensation in the primary radiating element 104 will then cause a drop in pressure, and this pressure in the radiating element 104 will be less than that in the regulating reservoir 108 and the liquid will thus be returned to the heating element 100. The relation of the amount of liquid to the total volume of the system including heating chamber 100, tube 104, tube 106, and chamber 108, and the comparative sizes of the regulating reservoir 108 and the volume of condensate within the primary coils 104 will control the operating pressure of the device, providing adequate heat but limiting the pressure to a safe range.

An important feature of this device is that it has no openings and no relief valves to leak or get out of order, and also allows a small diameter radiating tube to be used with its greatest efficiency without making it necessary to expel the air from the system.

A further modification in the location of the vaporizer is shown in Figs. 10 and 11 in which the radiator 120 is placed in the compartment to be warmed in the motor vehicle, and a by-pass 122 is placed in the exhaust pipe 123 before passing into the muffler 124. A valve 125 which may be manually controlled is provided near the engine end of the by-pass and it may be adjusted to deflect the gas from the direct passageway 122a to the portion 122b in which the vaporizer 126 is placed. In order to shut off the device, the valve 125 may be moved to shut off the by-pass and permit the regular flow through the direct opening into the muffler 124.

In general, the operating principle of this vapor heater comprises the evaporation of a small quantity of liquid, such as the combination of water and alcohol which will form a vapor in the closed system and which will subsequently be condensed in the radiator placed in a compartment to be warmed in a motor or other vehicle. Use is made of the high temperature of the exhaust gas pipe of the internal combustion engine and the sensible heat from the exhaust gases causes the liquid in the vaporizer to evaporate. By the use of such interme-

diate vapor heating, the disadvantages of an uncontrollable exhaust gas pipe, as well as the inherent disadvantages of transferring an odorous and undesirable gas, are obviated. The vaporizer may be placed in the muffler or in a bypass in the exhaust pipe or directly in the exhaust pipe itself, due consideration being given to the fact that the exhaust pipe must be suitably enlarged if the boiler is to be placed therein to prevent back pressure. Adequate heat is always provided when the vehicle engine is in operation although means are provided for shutting off the heat when the same is not desired, and for regulating the system to prevent over-heating of the passenger vehicle.

The radiator condenser, in general, comprises a small enclosure to receive the vapor and, in order to aid the heat transfer, it may be provided with fins. Various arrangements for returning the condensate have been illustrated, it being understood that if the condensate is prevented from returning to the vaporizer, that further heating is prevented. Inasmuch as all the liquid is adapted to be evaporated, continued heating will not increase the pressure but will merely superheat the vapor.

A further important feature in this device is that, by using a larger quantity of liquid than is safe with an uncontrolled heater, the heating is brought about with greater rapidity which is highly desirable in use, but some provision must be made to remove the excess liquid from the vaporization cycle as the pressure rises. To use sufficient liquid to bring about rapid heating would bring about a pressure far greater than is desirable. With the heating system disclosed in the drawings, a control is provided which may be embodied in a variety of different forms. In general, the control of the return of condensate to the vaporizer is made responsive to changes in pressure. It is sometimes desirable to provide means for removing part of the air pressure, as a limited amount of air will cause an extremely great pressure due to its expansion. The pressure relief valve is provided for this purpose and when the air is relieved, the vapor may be entirely withdrawn from the vaporizer which will bring about a greater rate of condensation in some parts of the radiating element than others. It is this condensation differential which causes a sufficient pressure drop to return the condensed vapor back to the heating element. The cycle continually controls the pressure and results in the heater being fully automatic. In other words, the amount of liquid in the system exceeds what is requisite to develop by its condensation a desired degree of heat at the radiator, so that when enough liquid has been vaporized to give the desired temperature at the radiator there will be a residuum or excess of liquid remaining, the full vaporization of which and its addition to the vapor already formed would result in undue heat and pressure. If the back flow of the condensate were unrestrained it would, if the heat at the vaporizer were sufficient, be all turned into vapor. But by my improved system the excess of liquid, over and above that necessary to produce the desired temperature by its condensation, is automatically trapped and withheld from circulation back from the radiator condenser, and only enough liquid is allowed to return to the vaporizing chamber to produce sufficient vapor to keep the radiator condenser at the desired temperature. The accumulating of the heating medium may take place in the radiator condenser proper as in the embodiment shown in Fig. 3, or in a segregated chamber or receptacle, whether within or without the radiator, as in Figs. 1, 4, 6, 7, 8 and 9. The invention deals broadly with a variation of the quantity of condensate returned, whereby control of the heater is effected; and as heating medium trapped as shown in Figs. 1, 4, etc. is withheld to the same purpose as heating medium trapped as shown in Fig. 3, the various embodiments have the common feature of a control automatically responsive to a plus or minus variation in the generated pressure for trapping and withholding respectively more or less condensate from circulation back from the radiator condenser.

While I have shown preferred forms of embodiment of the device, I am aware that other modifications may be made therein, and I therefore desire a broad interpretation of the device within the spirit and scope thereof, and within the spirit and scope of the claims appended hereto.

I claim:

1. In combination, a radiator condenser, a vaporizer, conducting means uniting the vaporizer and the radiator condenser as a closed system for the flow of vaporized heating medium from the vaporizer to the radiator condenser and the return of condensate from the radiator condenser to the vaporizer, and control means automatically responsive to a plus or minus variation in a physical characteristic imparted by the vaporizer to the heating medium in the radiator condenser for trapping and withholding respectively more or less condensate from circulation before flowing back from the radiator condenser, said control means including a receptacle communicating with the radiator condenser for receiving heating medium therefrom and returning heating medium thereto in response to variations in said physical characterisic.

2. In combination, a radiator condenser, a vaporizer, conducting means uniting the vaporizer and the radiator condenser as a closed system for the flow of vaporized heating medium from the vaporizer to the radiator condenser and the return of condensate from the radiator condenser to the vaporizer, and means automatically responsive to increases and decreases in the pressure of the heating medium in the radiator condenser for trapping and withholding respectively more or less condensate from circulation before flowing back from the radiator condenser.

3. In combination, a radiator condenser, a vaporizer, conducting means uniting the vaporizer and the radiator condenser as a closed system for the flow of vaporized heating medium from the vaporizer to the radiator condenser and the return of condensate from the radiator condenser to the vaporizer, and control means automatically responsive to increases and decreases in the pressure of the heating medium in the radiator condenser for trapping and withholding respectively more or less condensate from returning from the radiator condenser, said control means including a receptacle communicating with the radiator condenser for receiving heating medium therefrom and returning heating medium thereto in response to variations in pressure in the radiator condenser.

4. In combination, a radiator condenser, a vaporizer, conducting means uniting the vaporizer and the radiator condenser as a closed system for the flow of vaporized heating medium

from the vaporizer to the radiator condenser and the return of condensate from the radiator condenser to the vaporizer, and control means automatically responsive to increases and decreases in the pressure of the heating medium in the radiator condenser for trapping and withholding respectively more or less condensate from returning from the radiator condenser, said control means including a receptacle containing entrapped non-condensing gas and communicating with the radiator condenser for receiving heating medium therefrom and returning heating medium thereto as the pressure in the radiator condenser is higher or lower than the pressure of said entrapped non-condensing gas.

5. In combination with the exhaust conduit of an internal combustion engine, a vapor generator for absorbing heat from the exhaust gases passing along said conduit, a radiator condenser, conducting means uniting the vapor generator and the radiator condenser in a hermetically sealed heating system, a heating medium in the system adapted to be converted into vapor by the vapor generator, condensed in the radiator condenser and returned to the vapor generator, and regulating means responsive to increases and decreases in the pressure in the system for trapping and withholding respectively more or less condensate from returning from the radiator condenser, said regulating means being operatively connected to the radiator condenser to receive heating medium therefrom and return heating medium thereto with increases and decreases in said pressure respectively.

6. In combination, a radiator condenser, a vaporizer, conducting means uniting the vaporizer and the radiator condenser as a closed system for the flow of vaporized heating medium from the vaporizer to the radiator condenser and the return of condensate from the radiator condenser to the vaporizer, and valve mechanism automatically responsive to the pressure of the heating medium in the radiator condenser for controlling the discharge of condensed heating medium from said radiator condenser for return to said vaporizer.

7. In combination with the exhaust conduit of an internal combustion engine, a vapor generator for absorbing heat from the exhaust gases passing along said conduit, a radiator condenser, conducting means uniting the vapor generator and the radiator condenser in a hermetically sealed heating system, a heating medium in the system adapted to be converted into vapor by the vapor generator, condensed in the radiator condenser and returned to the vapor generator, the quantity of such heating medium in the system being limited so as to be substantially entirely driven off from the vapor generator under normal running conditions, and means responsive to increases and decreases in the pressure in the system for regulating the amount of heating medium in active circulation in the system, said regulating means decreasing the quantity of condensate flowing back from the radiator condenser with increases in said pressure and increasing said quantity with decreases in said pressure by accumulating heating medium circulated to the radiator condenser and releasing the same for return respectively.

8. In combination, a radiator condenser, a vaporizer, conducting means uniting the vaporizer and the radiator condenser as a closed system for the flow of vaporized heating medium from the vaporizer to the radiator condenser and the return of condensate from the radiator condenser to the vaporizer, and control means responsive to the pressure of the heating medium in the radiator condenser for regulating the quantity of heating medium in active circulation in the system, said control means cooperating with the radiator condenser for storing varying quantities of the heating medium delivered to the radiator condenser by said conducting means and withholding it from return.

SERGIUS VERNET.