

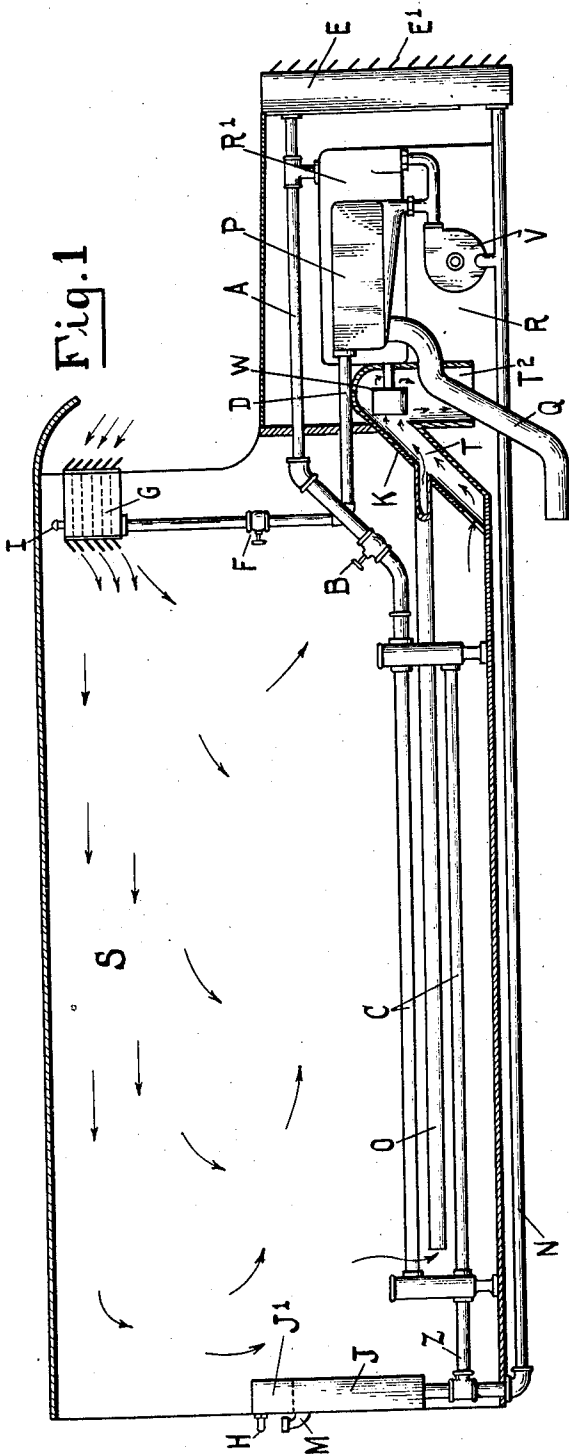
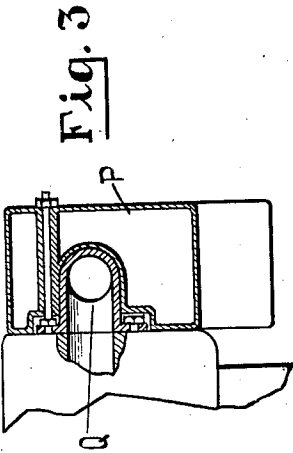
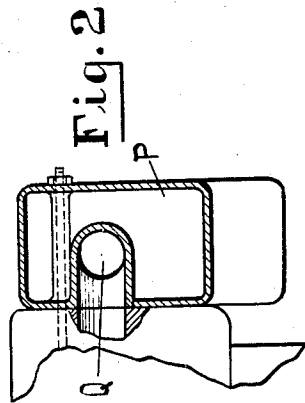
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BUS HEATING AND VENTILATING SYSTEM

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BUS HEATING AND VENTILATING SYSTEM

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8 Claims. (Cl. 237—12.3)

For a detailed description of the present form of my invention, reference may be had to the following specification and to the accompanying drawing, wherein

Fig. 1 is a side elevation partly in section illustrating my system;

Figs. 2 and 3 show boiler details.

My invention relates to means for heating and ventilating passenger vehicles, particularly busses propelled by a hydro-carbon gas engine of the usual type. It has been heretofore proposed to utilize for heating busses the cooling water of the engine from which the heat is ordinarily abstracted by the radiator at the front of the car. By diverting this water to a radiator in the body of the bus the heat therefrom may be partly or wholly abstracted by the latter radiator for heating the bus body. This system, however, is frequently inadequate, and it is the purpose of my invention to reinforce it, which I do by putting the aforesaid cooling water in communication with a boiler which is heated by the exhaust gases from the engine. In this boiler steam is generated which rises into a steam radiator located in the front upper corner of the bus body, said radiator having its air passages open both to the external atmosphere and to the interior of the bus. Thereby fresh air is introduced into the body at that point which is also heated if desired, the condensed steam or vapor resulting from the temperature exchange at the radiator being returned to the boiler. To provide space for this incoming fresh air I arrange for also removing the foul air. To this end I provide a suitable chamber through which an air current into the atmosphere is maintained by a small blower on the engine shaft. Into this chamber there is an opening along the lower edge of the footboard through which the air from the bus body is drawn by suction. I also lead an air duct forward from the dead-air space at the rear end of the body to this point of air-exit at the edge of the foot board. This arrangement affords adequate ventilation and keeps the foot board cool and at the same time enables the body to receive supplementary steam heat from the steam radiator if necessary. In order to make possible the aforesaid combination of the exhaust boiler with the cooling-water system, I remove from the engine-radiator the usual top overflow and venting outlet, also the filling cap and lead a pipe from the top of the said radiator, first to the water-radiator in the body of the bus, and thence to a closed water tank occupying an elevated position at the rear of the body. In this

tank there is a filling tube at an elevation that will maintain the required water-level both in the aforesaid boiler and in the cooling-water system. The bottom of the tank is connected with a return pipe leading to the opposite side of the water-circulating pump. Above the filling tube is provided a vacant space in the tank which acts as an expansion chamber for the water system which is no longer an overflow system, such as has been heretofore customary in automobiles, but is a closed or sealed circulating system wherein the generated pressure acts against the back pressure of the air in said expansion chamber and also against the steam pressure in the boiler, which now forms part of the water-pipe system. Thereby if the steam is generated faster than it is condensed in the radiator pressure accumulates and when it exceeds a predetermined amount, it forces water out of the boiler and back into the pipe-system, at the same time, by reason of a suitable safety valve causing the water in that system to compress the air in the expansion chamber to a predetermined point. But the water having been forced out of the boiler the production of steam therein ceases, or is reduced, resulting in a consequent reduction of pressure, and the joint system thus becomes a self regulating unit, since either an excess or a deficient pressure will tend to correct itself. That is, the safety valve operates to maintain an approximately constant normal condition.

Referring to the drawing, S represents the body of a bus, R is the engine, of which the water jacket is indicated at R'. The engine radiator is shown at E, being provided with shutters E' which are under the control of the driver by means that are well known. V is the usual circulating pump for the cooling water. A boiler P is formed around the usual manifold of the exhaust pipe Q. In an engine already built, its existing manifold may be replaced by a casting P as shown in Fig. 2 comprising a water-chamber surrounding the ducts which carry the exhaust gases, or, as shown in Fig. 3, the chamber P is made separate and applied outside an existing manifold. In any case the intent is to have the water heated by the hot exhaust gases from the engine, so as to produce steam or vapor to be delivered to the radiator G. The usual filling cap and overflow pipe are omitted from the engine radiator E, and its water cavity sealed. From the top of the radiator E a pipe A provided with a stop-cock B leads back into the body of the bus and there supplies a hot-water radiator C

which serves to heat the atmosphere within the body. From radiator C a connecting pipe Z leads to a water tank J at the rear of the body, the upper part of this tank being sealed to form an air chamber J¹. Thus, instead of allowing surplus water to overflow at the engine radiator, in the customary way, any expansion of the water in the system serves to compress the air in the top of the tank J to an extent limited by a safety-valve H. Also instead of filling the water-cooling system through the cap on top of the engine radiator as is usual, I fill the system through the tank J by means of a tube M which is placed at such an elevation as will give a proper water-level in the entire system including boiler P. From tank J a return pipe N leads back to the intake of the circulating pump V which also receives the water from the bottom of radiator E in the usual manner. From the pump V the water-flow passes to the water-jacket R¹ of the engine and then has two routes open to it. One route is the usual one through radiator E and the other route is through pipe A (assuming cock B to be open) to body water-radiator C and return pipe N. The system as thus far described provides for the hot-water heating of the bus. If heat is desired the driver merely opens cock B and part of the water heated in jacket R¹ goes to body radiator C and part to engine radiator E. If more heat is desired the driver closes shutters E¹ on the engine radiator and then practically all of the heat in the water is dissipated in the body radiator C. Such a system is, however, of only limited capacity, as a means of heating the bus and leads to overheating of the engine if the bus body is adequately heated since the atmosphere surrounding the body-radiator C is warm, in contrast to the cold outside air that acts on the engine radiator E. That is to say, the body-heating effect of radiator C tends to cut down its own capacity as a water-cooling agency for the engine, while if radiator E is also in action its effect is to cut down the heating capacity of radiator C. Therefore it is necessary to provide a supplementary source of heat for the bus-body which will be independent of the mutual limiting effects of water-radiators E and C and the cooling of the engine which is the primary function of these radiators and can not be subordinated to the other function of heating the bus body. I overcome this defect in the aforesaid method, wherein the same body of water is expected to cool the engine and heat the bus, by means of the aforesaid boiler P. This boiler is made self draining, its lower right hand corner being connected to the outlet of the circulating pump V. At its upper left-hand corner it is connected to a pipe D which leads to a steam or vapor radiator G located in the upper forward corner of the bus body compartment. The air passages through steam radiator G are open to the outside atmosphere on one side just under the hood of the roof, and to the interior of the bus on the other side. On both sides are shown shutters for controlling the air flow. The pipe D leading to this radiator is controlled by a stop-cock F and the radiator has the usual air outlet valve I on its steam chamber. In practice, the steam or vapor passes from the boiler P to the radiator G, and is condensed during the temperature transfer of the radiator heat to the inflowing air, the condensed vapors flowing back through the pipe D to the boiler. Obviously, by closing the valve F, the circulation in both directions is arrested, whereupon the heating functions of the radiator will cease.

The arrangement is such that I utilize this supplementary heating agency as a means for ventilating the car by introducing fresh air from the outside. It will be manifest that the water utilized in boiler P is taken from the supply of engine-cooling and bus-heating water in the aforesaid system, also that the level of the water in the boiler is under the same control, heretofore described, as in that part of my system. But the water in the boiler is also under the opposing control of the steam pressure in pipe D and radiator G. As this steam pressure rises it overcomes the hydrostatic and air-chamber pressures in tank J and forces down the water level in the boiler below the level in the pipe-system. But as the water is forced out of boiler P its steaming capacity is reduced. Consequently the boiler becomes self-regulating. It tends to maintain a balance between the water-covered area of the boiler and the steam pressure thereby produced. Any excess of steam pressure above the predetermined point serves to reduce itself by cutting down the pressure-producing capacity of the boiler itself. It will now be understood why I have removed the usual overflow features of engine radiator E. Otherwise the steam pressure in the boiler would merely force the water to spill out of the system at the overflow point in radiator E. I prevent this by sealing the water-cooling system and at the same time provide the self-regulating feature I have described. The sealed water-pipe system is also desirable since it retains all the non-freezing substance used in the system which is rapidly lost by evaporation in the usual non-sealed system. K is the foot-board for the driver, which, as is well known, tends to become overheated by the proximity of the exhaust pipe. Beneath this foot-board I form a chamber T, by means of a secondary partition, which chamber communicates on one side with a vertical chamber T² which is open at its bottom and contains near its top a blower W on the engine shaft. This blower acts to force air down compartment T² to its lower end which is open to the atmosphere. Chamber T communicates at the lower edge of the foot-board, with the interior of the bus-body and also with one end of a duct O which takes air from the back end of the bus where the air ordinarily tends to be pocketed and stagnant. The effect of blower W in driving the air down chamber T² is to suck into that chamber and expel therefrom the dead and foul air from the body while it also maintains the foot-board cool and draws in any engine gases and odors that might otherwise work into the bus. Since chamber T² terminates near the end of exhaust pipe Q it has a further effect of diverting exhaust gases from entering the bus. The general route of the incoming fresh, and, in cold weather, steam-heated, air is indicated by arrows in the body of the bus. Since the ventilation of a public vehicle of this kind is now considered of equal importance with its heating and is required by law, it will be realized that the utilization of my supplementary heating agency to effect the ventilation, as above described, is a feature of distinct value. At the same time it constantly provides an adequate amount of heat without resort to a separate stove or burner which introduces an additional piece of apparatus which it is desirable to avoid. While designating my device as a bus heater and illustrating it by its application to a bus, I intend it to be used on gas-propelled rail cars, or on any analogous vehicle for which its capacity may be adequate.

What I claim as new and desire to secure by Letters Patent is:

1. In a device for heating vehicles, the combination with an internal combustion engine and the water cooling system thereof, of a radiator adapted to be located within the vehicle and connected with said cooling system so as to be heated by a portion of the water thereof, a second radiator also adapted to be located within the vehicle, generator means heated by the exhaust manifold of the engine and also connected with said cooling system, so as to receive another portion of the water therefrom and to heat the same, and means for conveying the last mentioned heated portion of said water to said second radiator.

2. In a device for heating vehicles, the combination with an internal combustion engine and a sealed engine cooling system including an expansion chamber, of a radiator adapted to be located within the vehicle and connected with said cooling system so as to be heated by a portion of the water thereof, a second radiator also adapted to be located within the vehicle, a boiler also connected with said cooling system so as to receive another portion of the water therefrom, means for heating said boiler by the engine exhaust, and means for conveying heated water from said boiler to said second radiator.

3. In a device for heating vehicles, the combination with an internal combustion engine and the water cooling system thereof, said system having branches, a radiator adapted to be located within the vehicle and connected with one of said branches, an engine radiator connected with a second branch of said cooling system, a boiler connected with a third branch of the cooling system, means for heating said boiler by the engine exhaust, and a second radiator also adapted to be located within the vehicle, connected with said boiler so as to receive heated water therefrom.

4. In a device for heating vehicles, the combination with an internal combustion engine and the cooling system thereof, two spaced apart radiators connected with said cooling system, one radiator being adapted to be located within the vehicle, and the other exposed to the external atmosphere, a boiler heated by the exhaust of the engine and also connected with said cooling system, a third radiator also adapted to be placed within the vehicle and connected with said boiler, and means governed by pressure within said third radiator for controlling the operation of said boiler.

5. In a device for heating vehicles, the combination with an internal combustion engine and

the cooling system thereof, of two spaced apart radiators separately connected with said cooling system, one radiator being adapted to be located within the vehicle, the other exposed to the external atmosphere, a third radiator also adapted to be placed within the vehicle and located in the upper part of the space to be heated and having air passages therethrough open to the outside atmosphere, so that air entering to ventilate said space will be heated, and a boiler heated by the exhaust of the engine and also connected with said cooling system, said boiler being also connected with said third radiator.

6. In a device for heating vehicles, the combination with an internal combustion engine and the cooling system thereof, of a radiator adapted to be placed within the vehicle and connected with said cooling system, so as to be heated by a portion of the cooling fluid of said system, a second radiator also adapted to be placed within the vehicle, a boiler heated by the exhaust of the engine and also connected with said cooling system so as to receive another portion of the cooling fluid thereof, and means for conveying vapor from said boiler to said second radiator, said boiler having means whereby its water level is controlled independently of the water level in said cooling system.

7. In a bus heating apparatus, the combination of a sealed water circulating system provided with an expansion chamber, a closed boiler connected with said water circulating system, means for heating said boiler, a radiator adapted to be placed within the vehicle, and a single conduit connecting said radiator and said boiler, so that pressure created within said radiator acts to lower the level of the water in the boiler and thereby reduce its pressure producing capacity.

8. In a vehicle heating apparatus the combination with a vehicle, an internal combustion engine and the cooling system thereof, of a radiator adapted to be placed within the vehicle and connected with said cooling system so as to be heated by a portion of the cooling fluid thereof, a second radiator also adapted to be placed within the vehicle, a boiler positioned to be heated by the exhaust of the engine and also connected with said cooling system so as to receive another portion of the cooling fluid therefrom, means connecting said boiler with the second radiator, said last mentioned radiator being positioned to receive an incoming fresh air current, and suction means for expelling the internal air of the space to be heated adjacent the position of entry of said incoming air.

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