April 18, 1939. R. H. MAUTSCH 2,155,278

VEHICLE HEATING APPARATUS

Filed June 21, 1935

Fig. 1

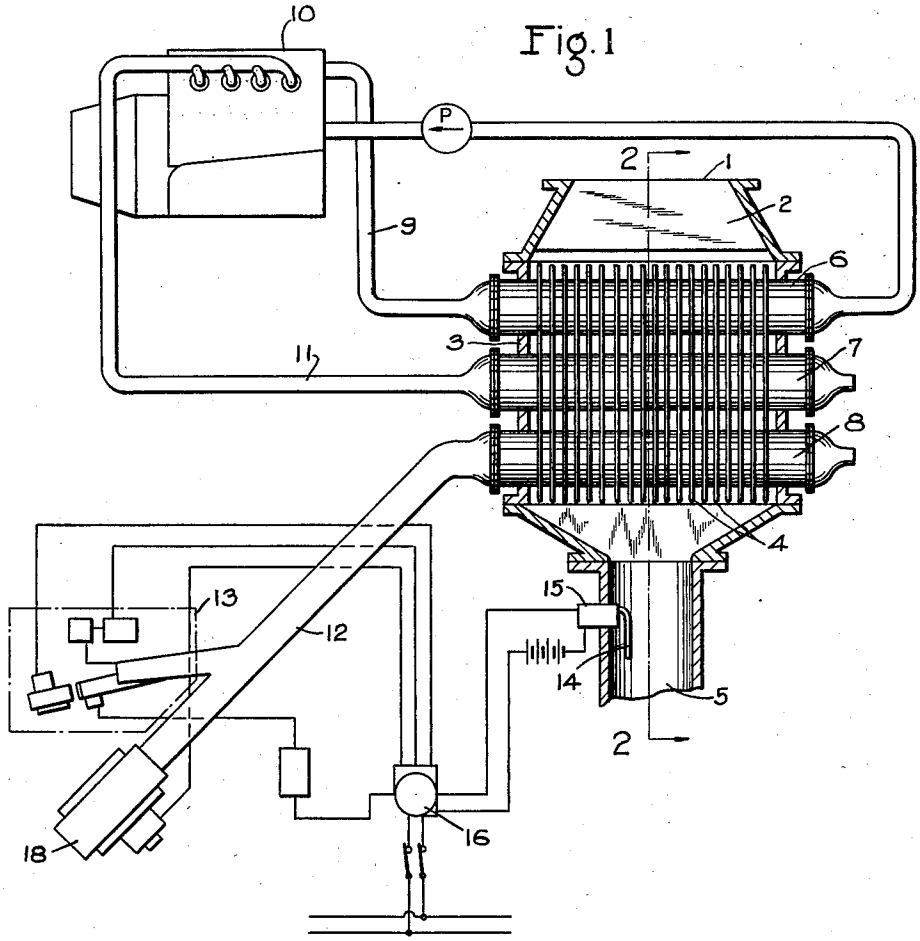
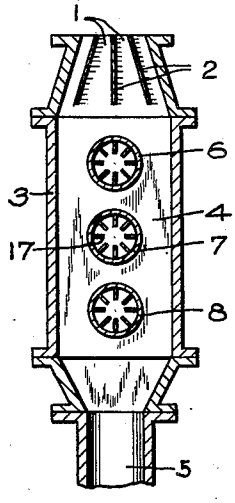


Fig. 2



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VEHICLE HEATING APPARATUS

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9 Claims. (Cl. 237—12.4)

This invention relates to vehicles of the type propelled by internal combustion engines, and more particularly to apparatus for heating the space within such vehicles.

Numerous devices have been proposed for utilizing the heat of engine exhaust gases for heating vehicles propelled by internal combustion engines. These devices have the common fault of providing irregular heating varying in intensity with the rate of operation of the engine and only attaining their normal operation after a sufficiently long period of continuous running of the engine. This disadvantage is particularly marked in the heating of railway motor vehicles in service on line where stops are frequent.

The principal object of the invention is to provide an improved apparatus for heating vehicles of the above type, in which apparatus the above described disadvantage is obviated.

This object is attained by associating with the engine exhaust gas heating device an auxiliary source of heat, constituted by a burner such as a heavy oil burner of the type employed in central heating adapted to operate to provide additional heat for the vehicle when that obtained from the engine exhaust heating device is inadequate. The intermittent periods of operation of the burner, providing the installation with the additional heat momentarily required, are with advantage controlled by a thermostat which automatically renders the burner operative or inoperative according to requirements, assuring the regularity of the heating.

Constituted by a heat exchanger inserted in the exhaust pipe of the engine on the one hand, and in a conduit for the air or other fluid to be heated on the other, the heating device according to the invention includes in the same envelope or casing a passage for the hot gases from the engine and a parallel passage for the hot gases from the burner. A third passage is with advantage provided for the hot water of the engine cooling system, so as to utilize substantially all the heat of the combustion of the engine for heating purposes. Preferably these passages are arranged in the exchanger in such a manner that the fluid to be heated first encounters the hot water passage, then the passage for the hot exhaust gases, and finally the hot gas passage of the burner which is at the highest temperature when the burner is working. The thermostat controlling the burner is located at a suitable position in the outflow conduit for the heated fluid leaving the exchanger.

In the accompanying drawing which represents schematically by way of example one embodiment of the invention,

Fig. 1 is a view of the heating installation for motor vehicles as a whole, showing the heat exchanger in longitudinal section, and

Fig. 2 is a transverse section of the interchanger taken on the line 2—2 of Fig. 1.

The heating installation illustrated in the drawing is of the hot air type. The air entering the mouth 1, in which there are disposed guiding or distributing vanes 2, flows through the space between said vanes, and then travels along between spaced and parallel vanes 4 in the casing 3 and leaves through the outlet pipe 5 which distributes the heated air in the vehicle to be heated. The vanes 4 extend from one side of the casing to the opposite side and from end to end, as shown in Fig. 2 and form a plurality of parallel paths for the flow of air, while the vanes 2 are disposed at right angles to vanes 4 and so arranged as to substantially equally distribute the air entering mouth 1 over the adjacent ends of the space containing vanes 4.

Three spaced conduits 6, 7 and 8 extend parallel to one another through the casing 3 and through suitable openings in the vanes 4, with which they are in thermal contact. The conduit 6 located nearest the mouth 1, is connected to the water circulation conduit 9 of the engine 10 driving the vehicle, whereas the conduit 7 is interposed in the exhaust pipe 11 of the engine. A pipe 12 connects the conduit 8 to a heavy oil burner included as a whole in the dot and dash line indicated by the reference numeral 13. The burner 13 is adapted to discharge the mixture of combustion gases into the pipe 12, and a fan 18 is provided to blow fresh air into said pipe to mix with said gases and thereby reduce their temperature to a suitable degree before reaching the conduit 8. The operation of the burner 13 is controlled by a thermostat 14, located in the hot air outlet pipe 5, through the intermediary of an electric relay 15 and a suitable electroresponsive mechanism 16.

If the heating installation is adapted for a motor railway vehicle for instance it will be no longer necessary as at present to run the engine idle for some time before the departure of the vehicle in order to heat the latter. Heating is effected very rapidly and with only a small amount of combustible by means of the burner 13. As soon as the working temperature of the system is attained the thermostat 14 renders the burner inoperative. It does not render it operative again when the engine is running, until

the heating by the cooling water and exhaust gases of the engine is insufficient to maintain the working temperature of the installation; for example when the engine is running at slow speed, when the motor vehicle as at rest, on descending gradients, etc.

The grouping of the three conduits 6, 7, 8 in the casing 3 of the heat exchanger permits the attainment with very little loss, of very high output and a rational utilization of heat from the three sources, viz. cooling water, exhaust gases and burner gases by the progressive heating of the air successively encountering the heat exchanging elements at increasing temperatures. The cross-sectional area of the conduits 6, 7, 8 may be relatively large compared to that of the inlet pipes 9, 11 and 12 so as to reduce the rate of flow of the heating medium through said conduits and thereby permit the maximum amount of heat to be withdrawn therefrom. In order to further increase the exchange of heat from the heated medium in conduits 6, 7 and 8 to the space surrounding said conduits, vanes or guides 17 may be provided within said conduits.

It will be evident that the scope of the invention will not be exceeded by effecting modifications to the installation described hereinbefore, either, for example, by dispensing with the cooling water conduit 6, or by adding another source of heat, or by employing a different medium for supplying heat to conduit 8 other than the oil burner 13, and as will be evident, any suitable type of heat exchanger may be utilized.

While one illustrative embodiment of the invention has been described in detail, it is not my intention to limit its scope to that embodiment or otherwise than by the scope of the appended claims.

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

1. In a heating system, in combination, a water cooled internal combustion engine, a casing having an air inlet and an air outlet through which air is adapted to flow to become heated, a conduit extending through said casing in the path of air flow through said casing and connected at one end to the exhaust of said engine whereby the exhaust gases from the engine are adapted to flow through said conduit and thereby heat said conduit and the air flowing through said casing, another conduit extending through said casing, and connected into the water cooling circuit of said engine whereby water heated by the engine flows through the conduit for heating the air flowing through said casing, a third conduit extending through said casing, means operative to supply a heated medium to said third conduit for heating the air flowing through said casing, and temperature responsive means controlled by the heat of the air discharged from said casing and operative to effect operation of said means upon a deficiency of heat in the discharged air, said conduits being arranged one behind the other between said inlet and outlet with the water heated conduit nearest the said inlet and the conduit heated by the exhaust gases from said engine between the other two conduits.

2. In a heating system for a vehicle, in combination, a heater casing through which air is adapted to pass from an inlet to an outlet to become heated, a plurality of spaced heat conveying conduits extending through said casing, a plurality of vanes disposed in said casing crosswise of said conduits and engaging opposite side walls of said casing, said vanes being substantially equally spaced one from the other and from the other side walls of said casing thereby forming a plurality of parallel passageways extending in the direction of air flow through said casing, and a plurality of vanes radially disposed in the inlet to said casing and extending crosswise of the first mentioned vanes and from one side to the opposite side of said inlet and cooperative with the first mentioned vanes to distribute the air entering said inlet to the parallel passageways in said casing.

3. In a heating system for a vehicle, in combination, a heater casing through which air is adapted to pass from an inlet to an outlet to become heated, a plurality of spaced heat conveying conduits extending through said casing, a plurality of partition walls disposed in said casing crosswise of said conduits and parallel to the direction of air flow through said casing and in thermal contact with said conduits, said partition walls being equally spaced one from the other and from the opposite side walls of said casing, a plurality of spaced vanes disposed in the inlet to said casing crosswise of said partition walls and extending from one side of the inlet to the opposite side, and a plurality of spaced vanes within said conduits in thermal contact with the inner wall of said conduits.

4. In a heating system, in combination, a casing having an inlet and an outlet through which air is adapted to enter and leave said casing, a plurality of partition walls disposed in said casing, said partition walls being substantially equally spaced one from the other and from two opposite walls of said casing and extending in the direction of air flow through said casing and from one side of the casing to the opposite side, a conduit extending through said casing and said partition walls, means for supplying a heated medium to said conduit, said inlet being of smaller cross-sectional area than said casing, and a plurality of radially disposed vanes in said inlet disposed crosswise of said partition walls and extending from one side to the opposite side of said inlet.

5. In a heating system, in combination, a casing having an inlet and an outlet through which air is adapted to enter and leave said casing, said outlet being of smaller cross-sectional area than said casing, a plurality of partition walls disposed in said casing, said partition walls being substantially equally spaced one from the other and from two opposite walls of said casing and extending in the direction of air flow through said casing and from one side of the casing to the opposite side, a conduit extending through said casing and said partition walls, means for supplying a heated medium to said conduit, said inlet being of smaller cross-sectional area than said casing, and a plurality of radially disposed vanes in said inlet disposed crosswise of said partition walls and extending from one side to the opposite side of said inlet.

6. In a heating system, in combination, means in which waste heat is generated and having a flow medium which is heated by said waste heat, a heat exchanger comprising a casing having an air inlet and an air outlet, a conduit in said casing through which said medium flows, and disposed in the path of flow of air through said casing to thereby heat the air passing through the casing by the unregulated flow of heated medium through said conduit, an auxiliary means providing a

source of heated medium, a second conduit in said casing disposed in the path of flow of air through said casing and through which heated medium from said auxiliary source flows, and temperature responsive means subjected to the flow of air through said casing for controlling the operation of said auxiliary means to maintain the temperature of air flowing through said casing against a deficiency of heat in the medium heated by waste heat.

7. In combination, a heat exchanger comprising a casing through which fluid is adapted to flow from an inlet to an outlet to become heated, a plurality of spaced conduits disposed in said casing in the path of fluid flow so that the fluid contacts first one of said conduits and then another of said conduits, means for supplying to the conduit closest to the inlet of said casing a heat carrying medium of relatively low temperature, means for supplying to a conduit intermediate the end conduits of said plurality a heat carrying medium of a higher temperature, and means for supplying to the conduit closest to the outlet a heat carrying medium having a temperature higher than in the conduits on the inlet side thereof.

8. In combination, a heat exchanger comprising a casing, through which fluid is adapted to flow from an inlet to an outlet to become heated, a plurality of spaced conduits disposed in said casing in the path of fluid flow so that the fluid contacts first one of said conduits and then another of said conduits, and means for supplying to each of said conduits a heat carrying medium, the temperature of the heat carrying mediums supplied to said conduits progressively increasing in the direction of fluid flow through said casing.

9. In combination, a heat exchanger comprising a casing, through which fluid is adapted to flow from an inlet to an outlet to become heated, a plurality of spaced conduits disposed in said casing in the path of fluid flow so that the fluid contacts first one of said conduits and then another of said conduits, means for supplying to the conduit closest to the inlet of said casing a heat carrying medium of relatively low temperature, means for supplying to a conduit intermediate the end conduits of said plurality a heat carrying medium of a higher temperature, means for supplying to the conduit closest to the outlet a heat carrying medium having a temperature higher than in the conduits on the inlet side thereof, and means controlled by the temperature of fluid at said outlet for controlling the operation of the means for supplying heated medium to the last mentioned conduit and operative automatically to effect the operation thereof for maintaining the temperature of fluid at said outlet substantially constant.

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