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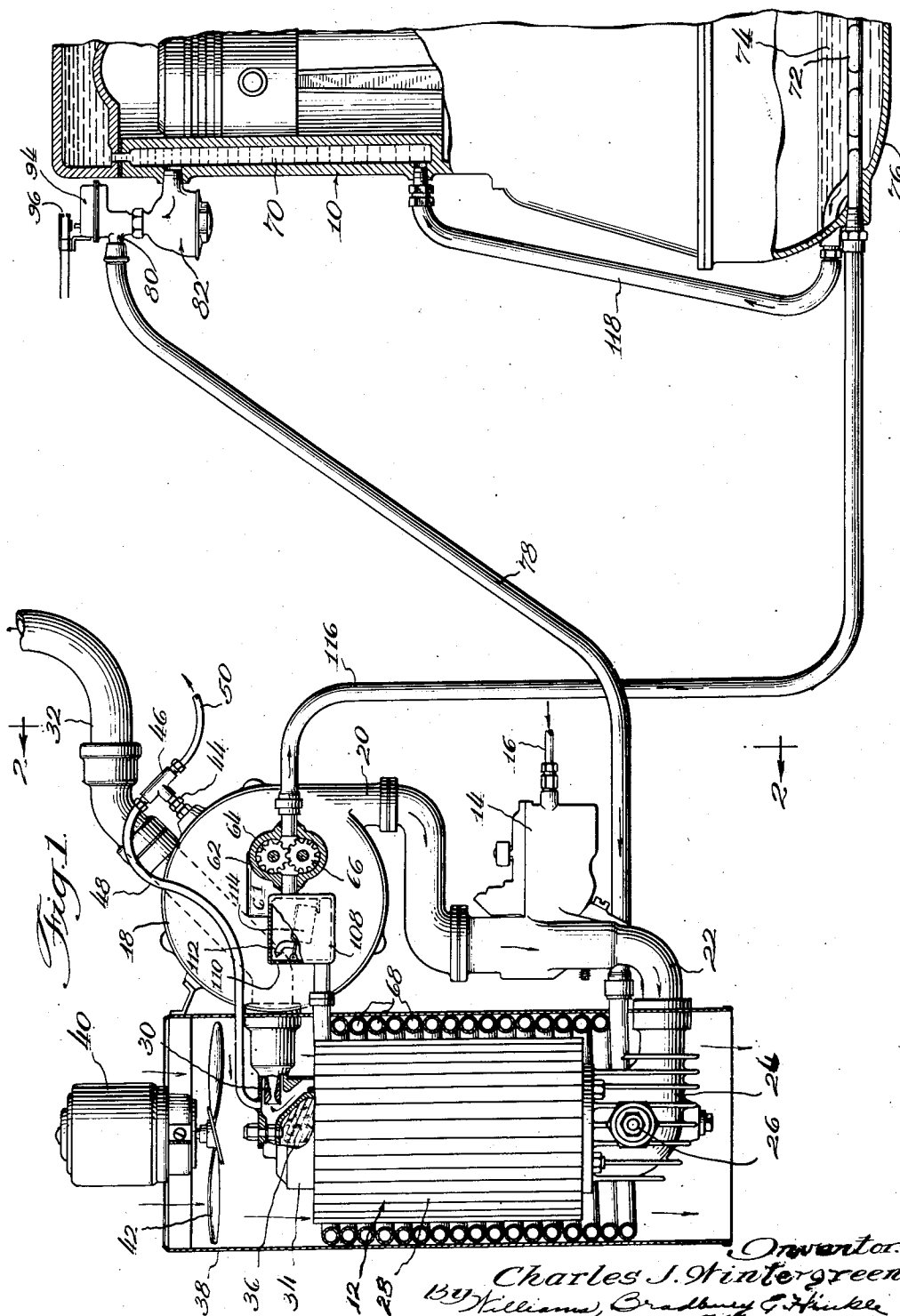
C. J. WINTERGREEN

2,354,345

HEATING APPARATUS

Filed Nov. 6, 1942

3 Sheets-Sheet 1



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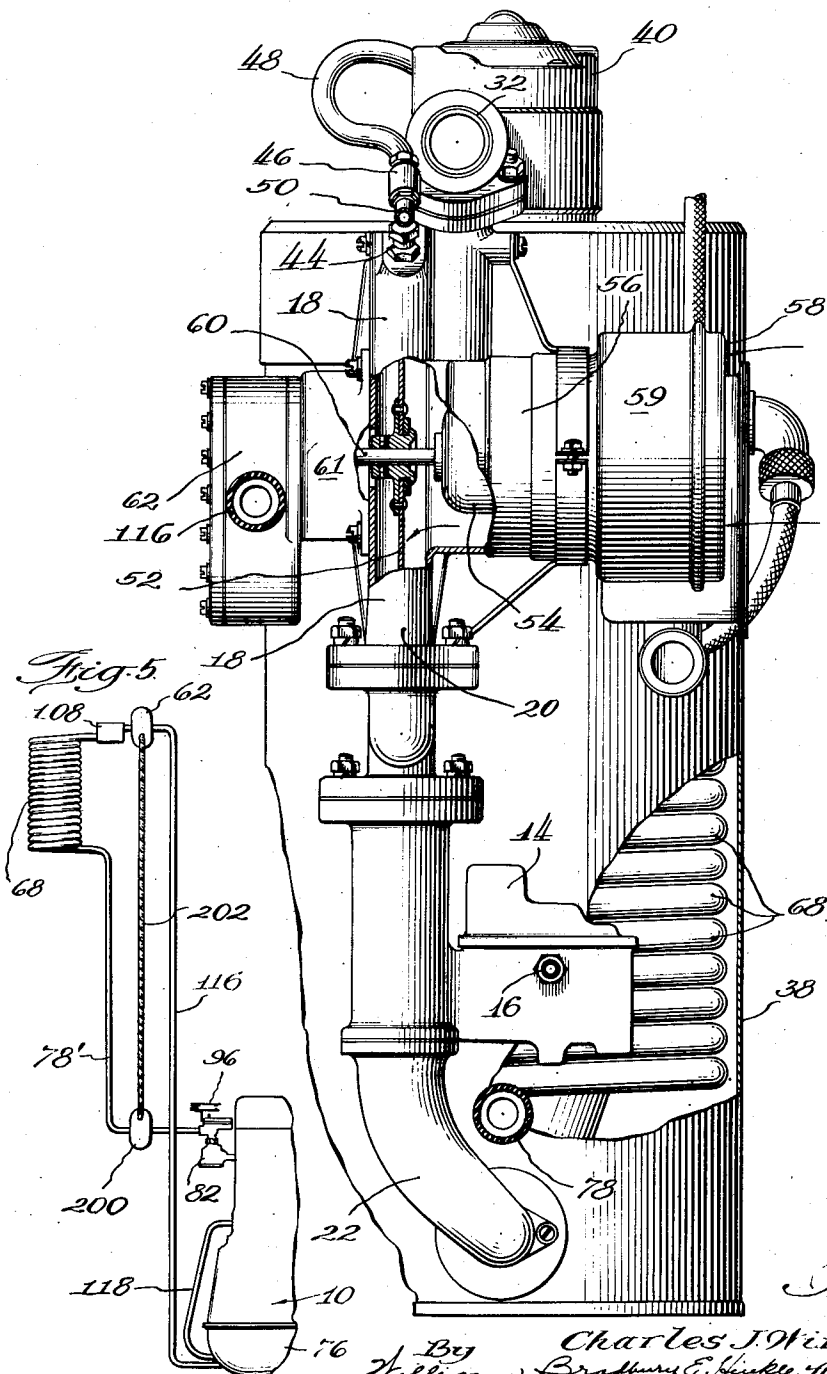
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Fig. 2.



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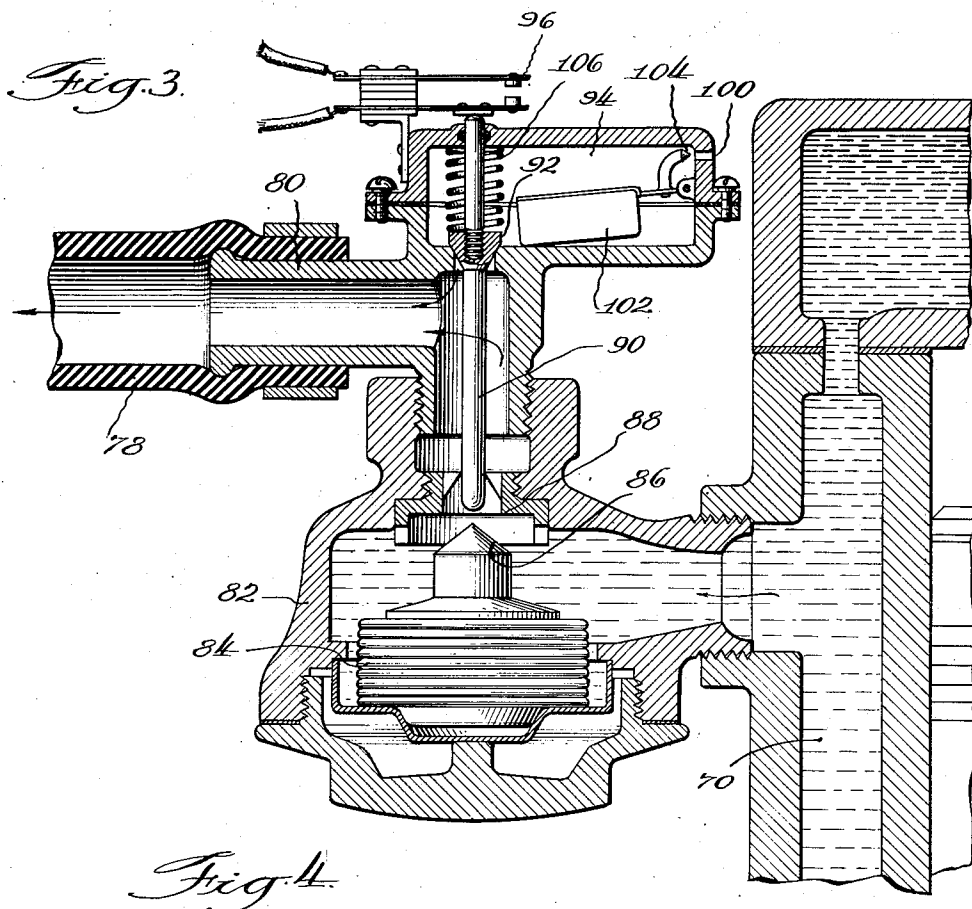
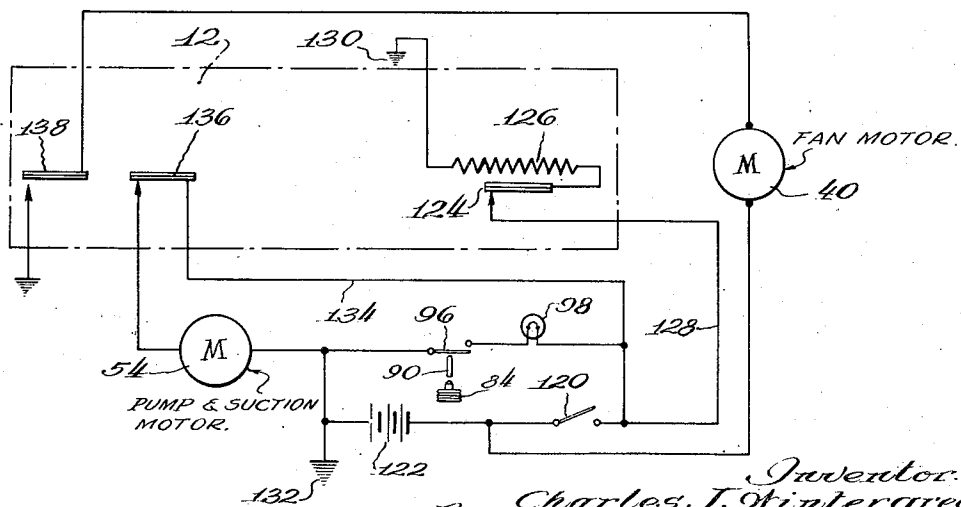
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HEATING APPARATUS

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,354,345

HEATING APPARATUS

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Application November 6, 1942, Serial No. 464,719

18 Claims. (Cl. 237—2)

My invention relates to heating apparatus and more particularly to heating apparatus especially adapted for, but not limited to, use on trucks and buses.

When the conventional truck or bus is left for an appreciable period of time on the streets or in an unheated garage in cold weather, the gasoline engine becomes thoroughly chilled and the lubricating oil in the engine crank case and engine lubricating system becomes thick and viscous. It is difficult to start such an engine because the thick and viscous oil resists movement of the various movable parts of the engine and the low temperature of the cylinder walls and pistons increases the condensation of fuel thereon and reduces the combustibility of the mixture in the engine cylinders. After the engine starts, lubricating oil does not properly lubricate the various moving parts of the engine until the engine attains normal operating temperature and prior to this time the combustion in the engine cylinders is inefficient and highly productive of carbon formation. This carbon formation is particularly disadvantageous in that it forms deposits on the cylinder heads which produce premature firing or knocking of the engine and otherwise impairs engine operation.

An object of my invention is to provide a new and improved heating system which overcomes the foregoing disadvantages by permitting the operator to preheat the automobile engine to a substantial degree before starting this engine.

Another object of my invention is to provide a new and improved heating system which is effective both to preheat the automobile engine and to heat the cab or passenger compartment of the truck or bus to any desired extent.

Another object of my invention is to provide a new and improved heating system wherein the preheating of the engine will be automatically discontinued when the engine attains normal operating temperature.

Another object of my invention is to provide a new and improved heating system which will accomplish the foregoing purposes with a minimum number of parts and at a minimum expense.

Another object of my invention is to provide a new and improved heating system which requires no more attention on the part of the operator than conventional passenger compartment heaters now in use.

Other objects and advantages will become apparent as the description proceeds.

In the drawings:

Fig. 1 is a somewhat diagrammatic view of a heating system embodying a preferred form of my invention;

Fig. 2 is a vertical, sectional view taken substantially in the plane of the arrows 2—2 of Fig. 1, but showing certain parts broken away to expose structural details;

Fig. 3 is a vertical, sectional view through the thermostatic flow control mechanism;

Fig. 4 is a view illustrating a wiring diagram; and

Fig. 5 is a diagrammatic view of a modified form of my invention.

In Fig. 1, I have indicated a conventional gasoline engine 10 of the kind commonly used in trucks and buses and an internal combustion heater 12 for heating the cab or passenger compartment of the truck or bus. The heater 12 is ordinarily, but not necessarily, separated from the engine 10 by the partition which separates the engine compartment from the operator's cab or passenger compartment of the truck or bus.

The internal combustion heater 12 may be of any usual or suitable type and is illustrated as having a carburetor 14 which receives fuel through a pipe 16 connected to the main fuel tank of the truck or bus or to any other suitable source of fuel supply. A blower 18 furnishes air under pressure to the carburetor 14 by way of a pipe 20 and the combustible mixture formed by the carburetor 14 flows through a second pipe 22 to the heater combustion chamber 24, where it is ignited by an electrical igniter 26.

The hot products of combustion formed in the combustion chamber 24 flow through a cylindrical casing or heat exchanger 28 and are discharged through an outlet 30 into an exhaust pipe 32 which may lead directly to atmosphere or which may connect with atmosphere through the exhaust system of the engine 10. A silencer 34, filled with glass wool or stainless steel wool, or other suitable sound absorbing material 36, may be located in the heat exchanger 28 to provide a quietly operating heater.

The heater 12 is located in a cylindrical casing 38 having an electric motor 40 supported at the upper end thereof and driving a fan 42 for circulating air through the casing 38 and over the heater 12. The heat exchanger 28 and combustion chamber 24 are provided with fins, as clearly shown in Fig. 1, to facilitate the transfer of heat from the hot gases of combustion to the ventilating air circulated by the fan 42. The upper and lower ends of the casing 38 are ordinarily in open communication with the cab or

passenger compartment and any desirable or suitable arrangement of louvers or other mechanism may be provided to control the circulation of the ventilating air.

The combustible mixture supplied to the heater by the carburetor 14 is ordinarily burned in combustion chamber 24 and gives up most of its heat to the ventilating air before reaching the outlet 30. Under some conditions, all of the combustible mixture may not burn prior to reaching the outlet 30 and I have illustrated the blower 18 as having a second outlet 44 supplying limited quantities of air to a T 46. A pipe 48 connects one end of this T with the heater outlet, whereby sufficient additional air is mixed with unburned fuel adjacent the heater outlet to prevent this fuel from thereafter burning or exploding. A second pipe 50 connects the other end of the T 46 with the fuel tank which supplies both the engine 10 and the heater 12 and in the particular embodiment shown pressure transmitted to the fuel tank from the blower 18 by way of pipe 50 serves to feed fuel from this tank to the engine and the heater, although any other means may be provided for supplying fuel to the engine heater.

Referring particularly to Fig. 2, it will be seen that the blower 18 has an impeller 52 driven by an electric motor 54 located in a housing 56. The housing 56 is generally tubular and serves as an air inlet for the blower 18. Air entering the open end 58 of a filter 59 attached to this housing passes over and cools the electric motor 54 before entering the blower 18. The motor shaft 60, which drives the impeller 52, extends into a gear reduction box 61 to which the casing 62 of a gear pump is attached, and drives the gears 64 and 66 located therein at a reduced speed.

The engine 10 is preheated by a coil 68 which is interposed between the heater 12 and casing 38 and which is in communication with the engine water jacket 70 and also with a heating coil 72 located in a body of oil 74 in the engine crank case 76. A pipe 78 connects the lower end of the heating coil 68 with the water outlet 80 of a thermostat 82 which controls communication between this outlet and the upper part of the engine water jacket 70. The thermostat 82 has a Sylphon or bellows 84 shown in the contracted position assumed when the water in the engine water jacket is cold. In this position the valve member 86 is spaced from its seat 88 and water may flow freely from the upper part of the engine water jacket into the pipe 78 and heating coil 68.

When the water in the water jacket attains normal operating temperature, bellows 84 expands, causing valve member 86 to contact its seat 88 and thereby cut off communication between pipe 78 and the engine water jacket. At the same time the valve member 86 raises pin 90 to open valve 92 controlling communication between float chamber 94 and pipe 78. Raising of pin 90 closes switch 96 and lights colored lamp 98 (Fig. 4) located on the instrument board of the truck or bus.

Float chamber 94 has an air inlet 100 which is normally open, as shown in Fig. 3. If any liquid should find its way into float chamber 94, it would raise float 102, causing valve 104 to close air inlet 100 and thus prevent the escape of liquid through this air inlet. When the water in the water jacket 70 again cools down, bellows 84 contracts and valve 92 is returned to closed position by spring 106. The return of valve 92 per-

mits switch 96 to open and cuts off the supply of current to the dash indicating light 98.

The upper end of the heating coil 68 is connected to a second float chamber 108 which also communicates with the inlet side of the gear pump casing 62. The float chamber has an air inlet 110 which is closed by a valve 112 when there is sufficient liquid in the chamber 108 to raise the float 114. A pipe 116 connects the discharge side of the gear pump casing 62 with the coil 72 in the engine crank case and a second pipe 118 connects this coil 72 with the lower part of the engine water jacket 70.

Referring to the wiring diagram of Fig. 4, it will be seen that I have illustrated therein a manual control switch 120 for initiating operation of the heating system. This control switch 120 controls a first circuit whereby the battery 122 is connected to thermostatic switch 124 and the heating element 126 of the igniter 26 by way of wire 128. The hot wire 126 of the igniter is grounded to the vehicle frame, as indicated at 130, and the battery 122 is similarly grounded, as indicated at 132. The battery may be the battery which supplies current for the vehicle lights and starting motor, or may be a separate battery, as desired.

The manual control switch 120 also controls a second circuit comprising the wire 134, thermostatic overheat switch 136 and motor 54 which operates the impeller 52 of the blower 18 and the gear wheels 64 and 66 of the gear pump. The manual control switch 120 also controls the circuit including the switch 96 and indicating light 98. The thermostatic switch 124 serves to disconnect the hot wire igniter from the battery when the heater attains normal operating temperature and is normally located in close juxtaposition to combustion chamber 24 or heat exchanger 28. The other heat switch 136 is so positioned that it will open if the heater should become overheated for any reason, such as the failure of the fan motor.

I have illustrated a fourth circuit in the wiring diagram of Fig. 4 and this fourth circuit connects the fan motor 40 and thermostatic fan control switch 138 with the battery 122. This circuit is effective only while the heater is at operating temperature and prevents a cold blast of air being directed into the cab or passenger compartment of the heater when the heater is first started and before this heater has attained operating temperature.

The embodiment of Figs. 1 to 3, inclusive, is designed for utilization in buses or trucks wherein the heater 12 may be so positioned that the top of the coil 68 is below the highest point in the engine cooling system so that liquid in the cooling system will flow toward the highest point toward the top of the coil 68. When the heater and automobile engine are at rest and the latter is cold, or relatively cool, thermostatic valve 82 will be in the position shown in Fig. 3 and the lower end of the coil 68 will be in open communication with the upper end of the water jacket 70. Switch 96 will be open and the light 98 extinguished. Float 102 would normally be in the lower position shown in Fig. 3, whereas float 114 would be in the raised position and valve 112 would prevent escape of liquid through opening 110. Thermostatic switches 124 and 136 would be closed and thermostatic switch 138 would be open, as shown in Fig. 4.

If the operator closes control switch 120, the hot wire 126 of the electrical igniter 26 will be raised

to ignition temperature and motor 54 will begin to operate and force a combustible mixture into the combustion chamber 24 which will be fired by the hot wire 126. Operation of the motor 54 will also cause the gears 64 and 66 of the gear pump to rotate and create a flow of liquid through coil 66, pipe 116, coil 72 in the engine crank case, pipe 118, water jacket 70 and pipe 78 back to the lower end of the coil 68.

After the heater has been in operation for a short space of time, such as one or two minutes, it will have attained normal operating temperature, whereupon thermostatic switch 124 will open to break the igniter circuit and thermostatic switch 138 will close to initiate fan operation. This will produce a discharge of heated air from the lower end of the heater casing and this air will start to warm up the cab or passenger compartment of the vehicle. At the same time the liquid in the coil 68 will be heated and the circulation of this heated liquid will raise the temperature of the oil in the engine crank case and of the liquid in the engine water jacket. The vehicle may be provided with the usual indicator for indicating the temperature of the liquid in the engine water jacket and when this liquid has attained the desired temperature, the operator will start the engine 10 in the usual manner.

This engine will start relatively easily because the oil has been heated sufficiently to reduce its viscosity to a point where it provides proper lubrication and facilitates free movement of the various moving parts of the engine. The preheating of the cylinder walls facilitates combustion of the fuel and air mixture supplied to the engine cylinders and increases the efficiency of this combustion so that the engine fires properly as soon as the ignition is turned on and operates efficiently as soon as it has started. My invention thus eliminates the excessive wear on the engine parts which results when an engine is operated without proper lubrication and also eliminates the excessive formation of carbon and inefficient operation which usually takes place immediately after a cold engine has been started.

It is usually neither necessary nor desirable to preheat the engine to normal operating temperatures before starting this engine. After the engine is started, the temperature of the liquid in the water jacket therefore continues to increase until the thermostatic valve 82 closes to cut off communication between the upper part of the engine water jacket and the pipe 78 leading to the lower end of the heating coil 68. As the valve member 86 engages its seat 88, valve 92 is opened to provide communication between float chamber 94 and pipe 78 and as the gear pump continues to withdraw liquid from the upper end of the coil 68, air is drawn through air inlet 100 in float chamber 94 and passes into the upper end of pipe 78.

If the pipe 78 and piping of coil 68 are of such cross-section that air and water can not pass therein, the gear pump will be effective to remove all of the water therefrom. When the air drawn into the pipe 78 and coil 68 by operation of the gear pump reaches float chamber 108, float 114 will drop to the position shown in Fig. 1 and the port 110 will afford open communication between this float chamber and atmosphere. The gear pump is only required to circulate the liquid against relatively slight resistance and is not effective to pump air against a liquid head. As soon as the air reaches this gear pump, the effective pumping action of this pump ceases and air

is forced into the upper end of the pipe 116 only a short ways or not at all, so that flow in this pipe ceases and flow in pipe 78 and coil 68 also ceases, since the opposite ends thereof are both open to atmosphere. The coil 68, therefore, ceases to absorb heat from the heater 12 and all of the heat given off by this heater is available to heat the ventilating air supplied to the cab or passenger compartment of the vehicle. Even if the gear pump is not effective to withdraw all of the water from pipe 78 and coil 68, the very small amount remaining therein is of no importance, as it either collects in a part of the pipe 78 or vaporizes in the coil 68 and escapes to atmosphere through the vent opening 110.

When the valve 92 was opened to admit air to the upper end of pipe 78, switch 96 was closed and connected indicator light 98 with battery 122. The operator of the vehicle was thereby apprised of the closing of the thermostatic valve 82 and the fact that the heater was no longer functioning to raise the temperature of the engine oil and the liquid in the engine water jacket. In the usual installation, the heat created by the engine even while idling will be sufficient to maintain the liquid in the engine water jacket at a sufficiently high temperature to hold the thermostatic valve 82 in closed position, since in current practice the liquid in the engine water jacket is controlled by a thermostat interposed between this water jacket and the automobile radiator to maintain the liquid in the engine water jacket at a desirable operating temperature. The overheat switch 136 would normally remain closed and would only open if the fan 42 ceased to operate or if some other unusual condition should arise.

When the operation of the engine 10 is stopped, the engine cools down sufficiently to cause opening of the thermostatic valve 82, communication will again be established between the upper end of the pipe 78 and the engine water jacket 70. At the same time valve 92 will close and cut off communication between atmosphere and the upper end of pipe 78. Switch 96 will open and, if the heater is still operating, the opening of this switch will put out light 98. Water from the engine water jacket will flow into the upper end of pipe 78 and fill this pipe, coil 68 and float chamber 108, causing float 114 to rise, thereby closing port 110. If the heater is still operating, the gear pump will re-establish circulation through the coils 68 and 72 and engine water jacket 70. On the other hand, if the heater has been cut off, the in-flow of liquid from the engine water jacket into the upper end of pipe 78 will merely condition the heating system for a subsequent operation.

In Fig. 5, I have shown a modified form of my heating system which is designed for use in installations where the heating coil 68 is located above the highest part of the engine cooling system. In this form of my invention, a second gear pump 200 is located in pipe 78' at a level below the highest point in the engine cooling system and is effective to pump liquid through coil 68 and float chamber 108 to the inlet of gear pump casing 62. In Fig. 5, the two gear pumps are connected by a flexible drive shaft 202 which serves to drive the gear pump 200 from the shaft of either gear 64 or 66. Any other suitable method may be utilized for driving the pump 200 and this pump may be electrically or otherwise driven. Operation of the modification of Fig. 5 is the same as that of the previous embodiment.

While I have described my invention as particularly adapted for use on trucks and buses, it is not limited to such use, but may be used on aircraft, motor boats, passenger automobiles, or any other type of automotive equipment. It is also capable of use in stationary installations where there is need for heating apparatus which will preheat an internal combustion engine and will heat an enclosed space in the vicinity of the engine. My novel heating apparatus is automatic in its operation except for the usual manual control switch and this switch is in all respects similar to the control switches on conventional heaters. The preheating of the internal combustion engine is automatically terminated as soon as this engine attains a suitable operating temperature, and the engine heating coil is emptied of water to prevent the heating coil from carrying away an appreciable quantity of heat after further heating of the engine becomes unnecessary.

While I have illustrated and described only two forms of my invention, it is to be understood that my invention is not limited to the particular details shown and described, but may assume numerous other forms and that my invention is to be construed as including all variations and modifications coming within the scope of the appended claims.

I claim:

1. Heating apparatus of the class described, comprising an internal combustion heater, means for supplying a combustible mixture thereto, a fan for directing ventilating air over said heater, a heating coil in heat transfer relation to said heater, means for connecting one end of said coil with a water jacket of an internal combustion engine, means for connecting the other end of said coil with said water jacket, means for circulating liquid from said water jacket through said coil to heat said water jacket, a thermostat controlling liquid flow through said coil, and means for substituting air for water in said coil when said water jacket has attained a predetermined temperature to render said coil ineffective further to heat water in said water jacket.

2. Heating apparatus of the class described, comprising an internal combustion heater, means for circulating ventilating air over said heater, a heating coil in heat transfer relation to said heater, means for connecting the ends of said coil with an engine water jacket, means for circulating liquid from said water jacket through said coil to heat said engine, and means for substituting air for water in said coil when said engine attains a predetermined temperature to thereby render said coil ineffective further to heat water in said water jacket.

3. Heating apparatus of the class described, comprising an internal combustion heater, a fan for circulating ventilating air over said heater, a heating coil in heat transfer relation to said heater, means for connecting the ends of said coil with an engine water jacket, means for circulating liquid from said water jacket through said coil to heat said engine, and means for substituting air for water in said coil when said engine attains a predetermined temperature to render said coil ineffective further to heat said water jacket, said last-named means comprising water and air valves controlled by a single thermostatic element.

4. Heating apparatus of the class described, comprising an internal combustion heater, means for supplying a combustible mixture to

said heater, a fan for directing ventilating air over said heater, a coil in heat transfer relation to said heater, means connecting opposite ends of said coil with a second coil located in an engine crank case, means for circulating liquid through said coils and connecting means, means for withdrawing water from said coil, and thermostatic means for admitting air to said heating coil to render said coil ineffective to heat said engine crank case.

5. Heating apparatus of the class described, comprising a heater, a fan for circulating ventilating air over said heater, a heating coil associated with said heater and in heat transfer relation thereto, means for circulating liquid through said coil, and thermostatically controlled means for cutting off the supply of liquid to said coil and circulating means, said thermostatically controlled means simultaneously functioning to admit air to said coil and circulating means to render said coil ineffective as a liquid heater.

6. Heating apparatus of the class described, comprising a heater of the internal combustion type, a fan for directing ventilating air over said heater, a coil surrounding said heater, a coil located in an engine crank case, said engine having a water jacket, means connecting said first-named coil with said second-named coil and said water jacket, means for circulating liquid through said coils and water jacket, means for supplying air to said first-named coil, and thermostatically controlled means for determining which of said fluids is supplied to said first-named coil.

7. Heating apparatus for heating the water jacket of an internal combustion engine and an enclosed space adjacent said engine, said system comprising a heater, a coil surrounding said heater, a fan for directing ventilating air over said heater, a float chamber communicating with the upper end of said coil, a float in said chamber, an air valve controlled by said float, a pump communicating with said float chamber, a pipe connecting said pump to the lower part of said water jacket, a second pipe connecting the lower end of said coil with the upper end of said water jacket, a thermostatic flow control valve in said second pipe, a second float chamber, a valve controlling communication between said float chamber and said second pipe, a float in said second float chamber, and an air valve controlled by said float.

8. Heating apparatus of the class described, comprising an internal combustion heater, means for supplying a combustible mixture thereto, a fan for directing ventilating air over said heater, a fluid conduit in heat transfer relation to said heater, means for connecting one end of said conduit with a water jacket of an internal combustion engine, means for connecting the other end of said conduit with said water jacket, means for circulating liquid from said water jacket through said conduit to heat said water jacket, a thermostat controlling liquid flow through said conduit, and means for admitting air to said conduit when said water jacket has attained a predetermined temperature, said circulating means functioning to withdraw liquid from said conduit and fill the same with air.

9. Heating apparatus of the class described, comprising an internal combustion heater, means for circulating ventilating air over said heater, a heating coil in heat transfer relation to said heater, means for connecting the ends of said

coil with an engine water jacket, means for circulating liquid from said water jacket through said coil to heat said engine, means for admitting air to said coil when said engine attains a predetermined temperature, said circulating means serving to withdraw liquid from said coil and fill the same with air, and means for permitting steam to escape from said coil.

10. Heating apparatus of the class described, comprising an internal combustion heater, a fan for circulating ventilating air over said heater, a heating coil in heat transfer relation to said heater, means for connecting the ends of said coil with an engine water jacket, means for circulating liquid from said water jacket through said coil to heat said engine, means for admitting air to said coil when said engine attains a predetermined temperature, said last-named means comprising water and air valves controlled by a single thermostatic element, said circulating means serving to withdraw water from said coil and fill the same with air, and means for preventing escape of liquid past said air valve.

11. Heating apparatus of the class described, comprising an internal combustion heater, means for supplying a combustible mixture to said heater, a fan for directing ventilating air over said heater, a coil in heat transfer relation to said heater, means connecting opposite ends of said coil with a second coil located in an engine crank case, a gear pump for circulating liquid through said coils and connecting means, and thermostatic means for admitting air to said heating coil, said gear pump serving to withdraw liquid from said first-named coil and fill the same with air.

12. Heating apparatus of the class described, comprising a heater, means for circulating ventilating air over said heater, a heating coil associated with said heater and in heat transfer relation thereto, means for circulating liquid through said coil, thermostatically controlled means for substituting air for liquid in said coil, and float controlled means for permitting escape of steam from said coil.

13. Heating apparatus for heating the water jacket of an internal combustion engine and an enclosed space adjacent said engine, said system comprising a heater, a coil surrounding said heater, a fan for directing ventilating air over said heater, a float chamber communicating with the upper end of said coil, a float in said chamber, an air valve controlled by said float, a pump communicating with said float chamber, a pipe connecting said pump to the lower part of said water jacket, a second pipe connecting the lower end of said coil with the upper end of said water jacket, a flow control valve in said second pipe, a second float chamber, a valve controlling communication between said float chamber and said second pipe, a thermostat controlling both of said valves, a float in said second float chamber, and an air valve controlled by said float.

14. Heating apparatus of the class described, comprising an internal combustion heater, means for circulating ventilating air over said heater, a blower for supplying a combustible mixture to said heater, a heating coil in heat transfer rela-

tion to said heater, means for connecting the ends of said coil with an engine water jacket, a pump for circulating liquid from said water jacket through said coil to heat said engine, means for substituting air for water in said coil when said engine attains a predetermined temperature to thereby render said coil ineffective further to heat said water in said water jacket, and a common motor, other than said engine, for driving said blower and pump.

15. Heating apparatus of the class described, comprising an internal combustion heater, means for circulating ventilating air over said heater, a heating coil surrounding said heater, means for connecting the ends of said coil with an engine water jacket, means for circulating liquid from said water jacket through said coil to heat said engine, and means for substituting air for water in said coil when said engine is at a predetermined temperature to render said coil ineffective further to heat water in said water jacket, said last-named means including an air inlet valve communicating with each end of said coil and a thermostat controlling liquid flow through said coil.

16. Heating apparatus of the class described, comprising an internal combustion heater, means for circulating ventilating air over said heater, a heating coil in heat transfer relation to said heater, means for connecting the ends of said coil with an engine water jacket, means for circulating liquid from said water jacket through said coil to heat said engine, thermostatic means for substituting air for water in said coil when said engine attains a predetermined temperature to thereby render said coil ineffective further to heat water in said water jacket, and a signal light controlled by said thermostatic means.

17. Heating apparatus of the class described, comprising an internal combustion heater, means for circulating ventilating air over said heater, a heating coil in heat transfer relation to said heater, means for connecting the ends of said coil with an engine water jacket, a pair of pumps for circulating liquid from said water jacket through said coil, a flexible drive shaft connecting said pumps, a separate motor for driving said pumps, and means for substituting air for water in said coil when said engine attains a predetermined temperature to thereby render said coil ineffective further to heat water in said water jacket.

18. Heating apparatus of the class described, comprising an internal combustion heater, means for circulating ventilating air over said heater, a heating coil surrounding said heater, piping connecting said coil with an engine water jacket, pumps in said piping and located on opposite sides of said coil for circulating liquid from said water jacket through said coil to heat said engine, driving means for said pumps, and thermostatically controlled means for substituting air for water in said coil when said engine attains a predetermined temperature to thereby render said coil ineffective further to heat water in said water jacket.

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