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HEATING DEVICES, ESPECIALLY FOR MOTOR VEHICLES

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FIG. 2

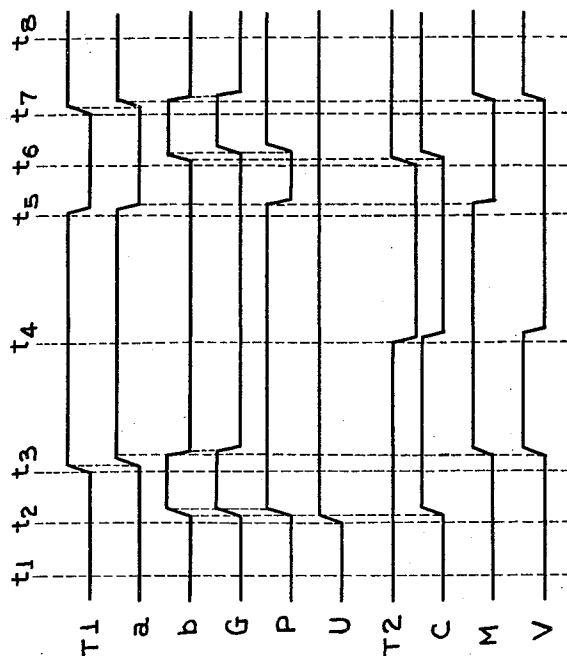


FIG. 1

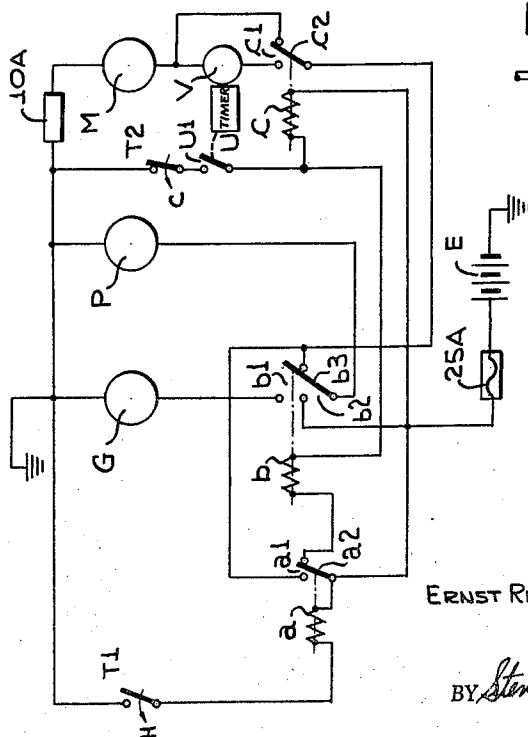
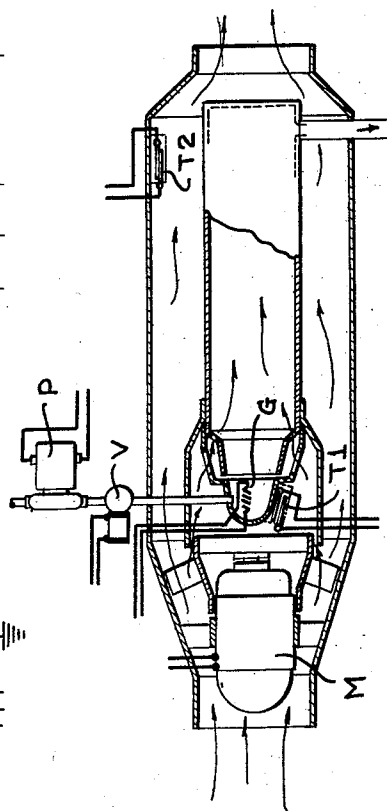


FIG. 3



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The present invention relates to improvements in or relating to heating devices, especially for motor vehicles, and driven by volatile fuels such as gasoline. The device is of the type which comprises a combustion chamber for combustion of the volatile fuel, an electrically driven pump for supplying the fuel, an electrically actuated electromagnetic valve for controlled delivery to the combustion chamber of the fuel supplied by the pump, an electrically heated glow body for igniting the fuel in the combustion chamber, a heating system around which the combustion products from the combustion of the fuel are passing for heating a heating medium, such as air, which is passed through the heating system, an electrically driven fan blower for propelling the heating medium, and two thermostatic switches, with one switch placed adjacent the glow body and actuable to a different contact position when the glow body has been heated sufficiently for volatilizing and igniting the fuel, and with the other switch positioned in the heating system and actuable to a different contact position when the heating medium has attained a predetermined maximum temperature, and with a current source for energizing the pump, the electromagnetic valve, the glow body and the fan blower.

The object of the present invention is to provide a device which is reliable and takes very little current, these characteristics being very important in connection with automatic heating devices which at least partially take their power from a battery, for example a car battery. During the winter there is a great need for attaining in a reliable and cheap way an automatic heating of the interior of a car and/or of the motor and the present invention concerns especially a device for this purpose. It is known earlier to attain an automatic starting of a heating device for a car for example by means of a time relay, but these known arrangements have either been difficult to fabricate and too complicated to use or have taken too much current from the battery and have therefore not come into common use.

The device according to the present invention, which is designed with due regard to the said desirable features, is especially characterized by the fact that the electromagnetic valve and the fan blower are dimensioned in such a way that they, when they by means of one or both of the thermostatic switches directly or indirectly and possibly by means of further elements (for example a timer) are connected to the current source, operate in such a way that there is attained as well opening of the electromagnetic valve and starting of the non-rotating fan blower, when the electromagnetic valve and the fan blower are connected in series to the current source without any further elements of substantial resistance connected in the circuit as also continued opening of the electromagnetic valve when the fan blower after the start has attained normal speed by the said connection of the electromagnetic valve and the fan blower to the current source.

The dimensioning is further preferably such that the electromagnetic valve is not being opened when the electromagnetic valve in series with the fan blower and with the lastnamed rotating with substantially normal speed is connected to the current source without any further elements of substantial resistance connected in the circuit.

A detailed description of the present invention is given

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in connection with the attached drawing, where FIGURE 1 is a schematic circuit diagram for the device; FIGURE 2 is a time diagram for the functioning of the different units in the device and FIGURE 3 is a diagrammatic view of the combustion chamber with the various components.

In a combustion chamber for burning a volatile fuel, for instance gasoline, there is positioned an electrically heated resistive member formed into a body G—a glow spiral—which is a resistance heating means and has a terminal connected to ground and the other terminal connected to a stationary contact in a switch *b1*. For delivery of fuel there is provided an electrically driven pump P, with one terminal connected to ground and the other terminal connected to a moving contact in a switch *b2—b3*. When the moving contact is in its left position the contact *b3* is open and the contacts *b1* and *b2* are closed, so that the glow body G as well as the pump P via a fuse 25A are connected to the positive pole of a battery E which has its negative pole connected to ground. When the moving contact is in its right position (as seen in FIGURE 1) the contacts *b1* and *b2* are open and the contact *b3* is closed, so that the pump P is connected to a stationary contact in a switch *a1*. For a controlled delivery to the combustion chamber of the fuel supplied by the pump P there is an electrically operated electromagnetic valve V which has one terminal connected to a stationary contact in a switch *c1* and has the remaining terminal connected to ground via an electrically driven fan blower M which is used for propelling a heating medium, for instance air, with one terminal of the fan blower connected to ground. The remaining terminal of the fan blower M is also connected to a stationary contact in a switch *c2*, and the moving contact in the switch *c1* is at the same time a moving contact in the switch *c1* and is connected to the stationary contact in the switch *b3*. When the said moving contact is in its left position the fan blower M and the electromagnetic valve V are series connected, and when the said moving contact is in its right position (the position shown in FIGURE 1) only the fan blower M is connected between ground and the stationary contact in the switch *a1*. There are also two thermostatic switches, with one of these, T1, positioned adjacent the glow body G and provided for closing a first circuit, which goes from ground to the positive pole of the battery E, when the glow body G has attained sufficient high temperature for volatilizing and igniting the fuel, and with the other thermostatic switch, T2, provided in a heating system the heating medium, for instance air, going through the heating system, with said second thermostatic switch used for breaking a second circuit from ground to the stationary contact in a switch *u1* when the heating medium has attained a predetermined maximum temperature. The switch *u1* is an element in a timer U and has a moving contact connected to a terminal of a winding of a relay *c* and to a terminal of a winding of a relay *b*. The switches *b1*, *b2* and *b3* are elements of the said relay *b*. The switches *c1* and *c2* are elements of the said relay *c*. The switch *a1* and a switch *a2*, which has a stationary contact connected to the remaining terminal of the winding of the relay *b* and also has a moving contact which also is an element of a switch *a1*, are elements of a relay *a*, with the winding of the said relay *a* connected between a moving contact in the thermostatic switch T1 and the common moving contact for the switches *a1* and *a2*.

The device which has been described in detail operates as follows: In the idle position all of the relay switches have the contacts in the positions shown in FIGURE 1, the glow body G is cold, the fan blower M and the pump P are not operating and the electromagnetic valve V is closed. In FIGURE 2 this condition is shown at the time

t_1 . When the timer U closes the switch $u1$ at the predetermined time t_2 the following operations take place. The relay b has its winding energized and then the glow body G is connected to the battery E by the switch $b1$ and the pump P is connected to the battery E by the switch $b2$. The relay c is also energized and thus the fan blower M and the electromagnetic valve V are connected in series by the switch $c1$. At the time t_3 the glow body G has been heated and the thermostatic switch T1 is then closed, relay a is energized and the relay b is de-energized, the glow body G is disconnected and the series-connected fan blower M and the electromagnetic valve V are via the switch $a1$ connected to the battery E and the fan blower M starts rotating and the electromagnetic valve V opens. The pump P continues to operate as it is now connected to the battery E via the switches $b3$ and $a1$. When the heating medium (the air) at the time t_4 has attained a predetermined maximum temperature the thermostatic switch T2 opens and the relay c is de-energized and the electromagnetic valve V closes cutting off the fuel supply to the combustion chamber. The fan blower M continues to operate as it is now connected to the battery E by the switches $c2$ and $a1$. At the time t_5 the thermostatic switch T1 has cooled down and opens and the relay a is thus de-energized and the fan blower M and the pump P will stop. At the time t_6 the temperature of the heating medium has decreased so much that the thermostatic switch T2 closes and thereby the relay b is energized and the glow body G and the pump P are connected to the battery, and the relay c is also energized and thus the fan blower M and the electromagnetic valve V are again connected in series. At the time t_7 the thermostatic switch T1 has again attained such a high temperature that it closes and the described sequence is repeated beginning from the time t_3 , and is repeated periodically as long as the timer U holds the switch $u1$ closed or until the battery E is manually disconnected.

From the above description of the operation it follows that the fan blower M when starting always is connected in series with the electromagnetic valve V, and the winding in the lastnamed electromagnetic valve is thus passed by the high current which the fan blower takes when starting and the valve will consequently operate very quickly and reliably. When the fan blower is in its normal operating condition it takes a much smaller current but the electromagnetic valve V is dimensioned in such a way that the normal operating current for the fan blower is sufficient for holding the valve opened once it has been opened. It is also clear that the units in the device are connected to the battery only during such time periods when it is necessary that they operate and therefore the energy taken from the battery is a minimum. If during the cooling down period the timer U closes its switch $u1$ when the fan blower M is still rotating and the electromagnetic valve V is closed the valve is not opened because the current is too small. This small current depends on

the counter E.M.F. set up by the still rotating fan blower M.

It is obvious to a person versed in the art that there are many modifications possible without departing from the spirit of invention. It is for instance possible to have the moving contact in the relay a consisting of the thermostatic switch T1, in other words the relay a is not absolutely necessary for the operation of the device. It would also be possible to substitute for the switches $c1$ and $c2$ a switch connected in parallel to the electromagnetic valve V. The embodiment shown in the drawing has however in practice been found to very effective and reliable.

I claim:

1. In a vehicle heating system, air heating means including a combustion chamber for combustion of a volatile fuel therein, electrically operable pump means for supplying the fuel to said combustion chamber, solenoid valve means for controlling delivery of the fuel to said combustion chamber supplied by said pump means, electric resistance heating means disposed adjacent said combustion chamber adapted to ignite said fuel, fan means arranged to deliver unheated air and heated air from said air heating means, a first thermostatic switch means adjacent said combustion chamber, a second thermostatic switch means remotely disposed from said first thermostatic switch means and adapted to respond to the temperature of said heated air, battery means having one end connected to ground and the other end adapted to be connected to said pump means, valve means, resistance heating means and fan means to supply electrical energy thereto, said fan means and valve means being serially connected with respect to each other, and switch means operatively controlled by one of said thermostatic switch means when unheated to energize both said fan means and valve means and when heated to energize only said blower, and further switch means separately controlled by the heating of the other of said thermostatic switch means to de-energize said electrical resistance heating means.

2. In a vehicle heating system according to claim 1 in which a timer means is interposed between said second thermostatic switch means and said switch means to control said heating system.

3. In a vehicle heating system according to claim 1 in which said further switch means is operatively controlled by both thermostatic means to energize said pump means and resistance heating means in one position and to energize said pump means in another position.

4. In a vehicle heating system according to claim 1 in which said fan means and valve means are connected in series relationship only when both said thermostatic switch means are in the closed position.

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