Dec. 31, 1940. H. J. DE N. McCOLLUM 2,226,612

AUTOMOBILE HEATER

Filed April 6, 1938 2 Sheets-Sheet 1

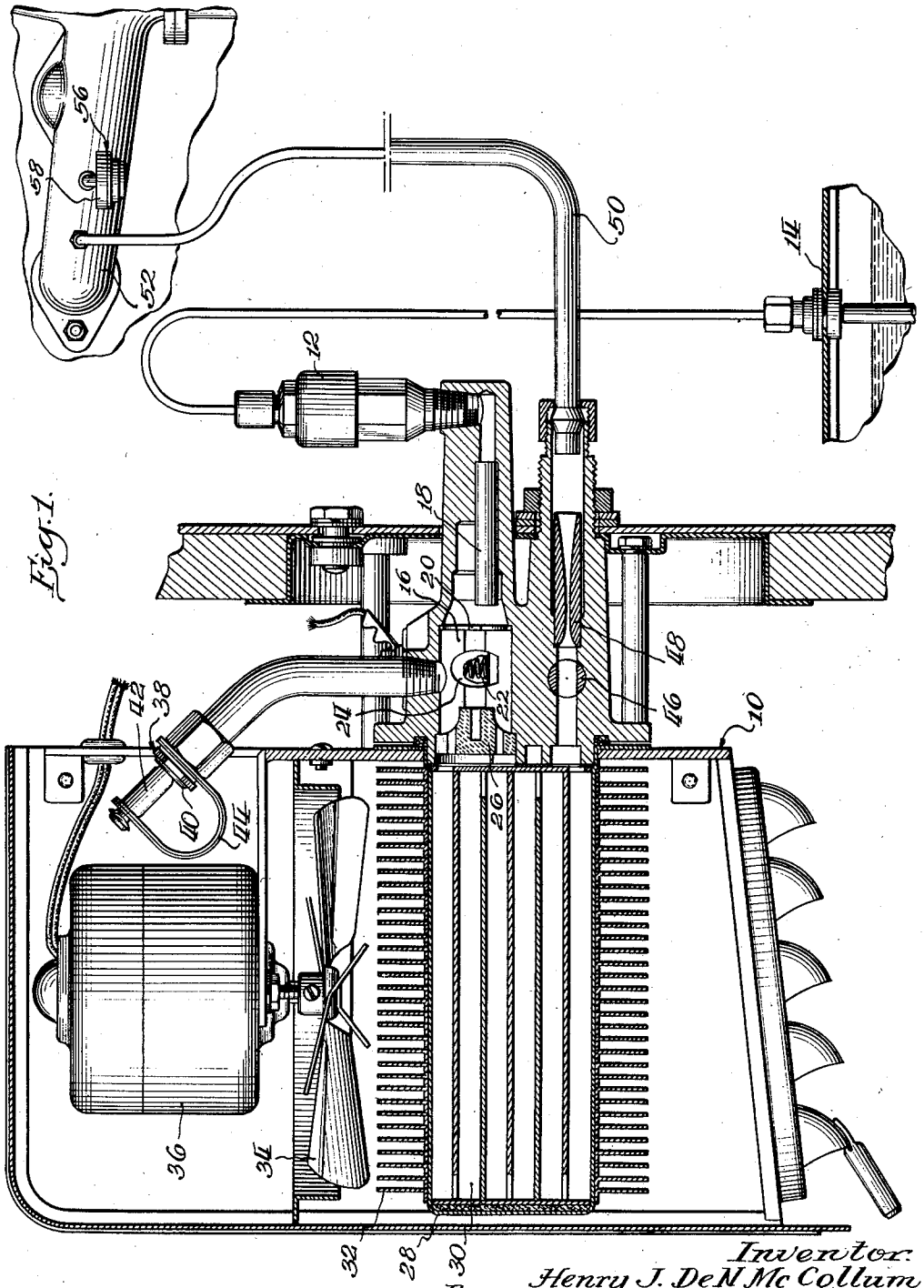


Fig. 1.

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Fig. 2.

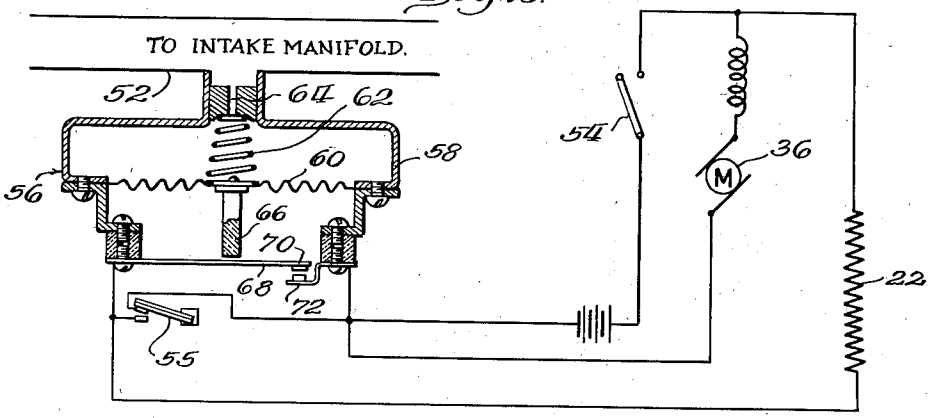


Fig. 4.

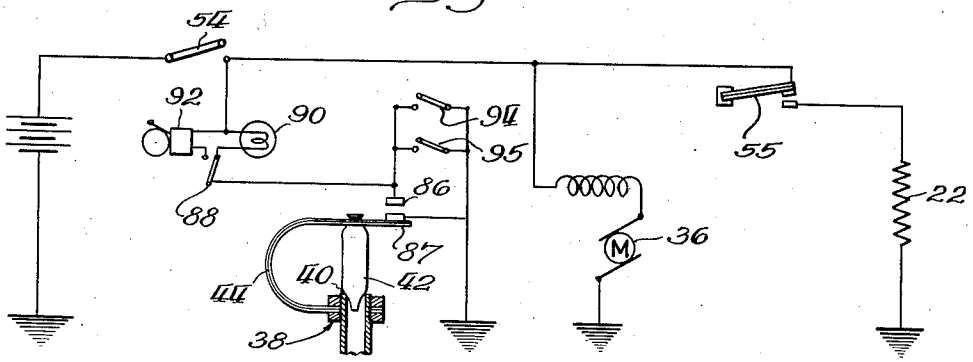
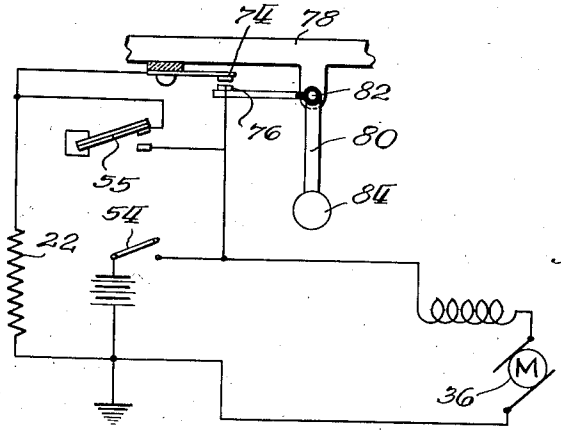


Fig. 3.



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UNITED STATES PATENT OFFICE

2,226,612

AUTOMOBILE HEATER

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Application April 6, 1938, Serial No. 200,315

7 Claims. (Cl. 237—12.3)

The invention relates generally to automobile heaters and the present application is a continuation in part of a copending application, Serial No. 61,213 filed January 28, 1936, which has matured into Patent No. 2,191,173.

More particularly, the present invention relates to the operation and control of the independent heat generator, illustrated and described in said copending application, when the generator is so installed as to employ the vacuums created by an internal combustion engine as a source of power to provide the fluid pressure differential needed for the production and movement of a stream of hot gases through the radiator of the generator.

In view of the fact that the degree of vacuum developed in the intake manifold of the internal combustion engine of an automobile approaches zero from time to time, depending upon the speed and the load to which the engine is subjected under operating conditions, such as when the automobile is being accelerated or driven up a hill, it is appreciated that now and then the vacuum developed in the intake manifold may fall below the degree necessary to maintain the factors of combustion needed for the continued operation of a heat generator. Consequently, it is necessary to assure reignition of the combustible mixture in the generator so that the operation of the heater may be resumed when the vacuum factors are again favorable. Moreover, other contingencies arise when the combustion has ceased for a while and these have to be coordinated with reignition to return the heater to proper and full operation.

One of the objects of the invention is to provide for the reignition of the extinguished flame of an internal combustion heater when the factors are again favorable therefor and to coordinate therewith the other functions necessary to return the heater to full operation.

Another object of the invention is to provide a liquid fuel burning heater with improved means for maintaining a flame and for reigniting the heater, should the flame be accidentally extinguished.

Another object of the invention is to provide an improved safety means for extinguishing the flame of a heater whenever the heat generated becomes excessive, and for automatically re-establishing the flame after the excessive heat has been moderated sufficiently for the heater to be returned to operation.

Another object of the invention is to provide an improved means for reigniting and returning the heater to full operation automatically without attention when the factors preventing its operation are removed either after a short or a long delay.

Another object of the invention is to provide a means for reigniting and returning the heater to full operation after an interruption which is controlled directly by the factors which cause the interruption.

Another object of the invention is to provide a means for reigniting and returning a heater of the class described to full operation in response to certain functions of the automobile which in turn are related to those factors involved in the interruption of the operation of the heater.

Another object of the invention is to provide a safety device for internal combustion heaters of the class described which will warn the operator of any unusual conditions arising or developing in the operation of the device which might become injurious to the heater as an operating unit.

Another object of the invention is to provide a heater of the class described which may be easily started and restarted from time to time without attention from the operator of the vehicle, and which is relatively simple in construction and may be economically manufactured.

These being among the objects of the invention, other and further objects will become apparent from the drawings herein, the description relating thereto and the appended claims.

In the drawings:

Fig. 1 is a central vertical sectional view of the heater, showing also the fuel supply; and

Figs. 2, 3 and 4 are diagrammatic views illustrating various modified forms of control circuits for energizing the igniter whenever the intake manifold vacuum drops below the value necessary to maintain combustion in the chamber.

Referring now to the drawings in further detail, and particularly to Fig. 1, the heater construction, as more particularly described in said co-pending application, comprises generally, a carbureting device 12 supplied with gasoline preferably from the float bowl 14 of the usual engine carburetor. Suitable means are provided to control the flow of gasoline to the heater 10 and also the amount of air mixed therewith in order to supply to the heater several combustible mixtures of different degrees of richness to take care of the various heater requirements encountered under starting and running conditions.

The combustible mixture supplied by the carbureting device is fed into the combustion cham-

ber 16 through a tube 18 and a perforated baffle plate 20 by means of which preheat and turbulence are effected to thoroughly vaporize the mixture entering the combustion chamber. The mixture is ignited by an electrical heating element 22 located in a recess 24 in the side of the chamber, and, in event the flame ever becomes extinguished for a brief time, the mixture is reignited by refractory ceramic plug 26 at the outlet of the combustion chamber which acquires a sufficiently high temperature for such purpose by being directly exposed to the flame during the normal operation of the heater.

From the combustion chamber 16 the hot gases pass through a radiator 28 comprising a circuitous tube 30 to which heat radiating fins 32 are thermally connected. Over these fins air is circulated by the fan 34 as driven by the motor 36, in a manner whereby heat is transferred from the hot gases to the passenger compartment of the automobile for the comfort of the passengers.

In order to prevent the possibility of overheating, a safety valve 38 is provided which is thermostatically controlled and is operable to admit a large volume of atmospheric air to the combustion chamber to cool the latter and to extinguish the flames therein whenever the thermal units in the heater exceed an amount deemed safe, such as might be the case should the electric motor cease operation for any reason.

The safety valve comprises an outwardly facing valve seat 40 with a valve member 42 held tightly thereagainst by a thermal responsive bimetal element 44 biased to seat the valve 42 when cold and to unseat the valve when the heat is excessive.

The flow of gases through the heater is restricted and regulated at the outlet of the radiator by means of a valve 46 operable at will and an orifice or passageway 48 having the shape of a Venturi tube. The action of the valve 46 is to start and stop the heater and the action of the Venturi passageway 48, which is interposed in the conduit 50 connecting the heater with the intake manifold 52, is such that the flow of gases therethrough is restricted to that required for the most efficient operation of the heater.

This action of the Venturi passageway 48 is as follows: Since the pressure in the venturi can never be greater than atmospheric pressure, and the dimensions of the restricting orifice are such that with a given degree of vacuum beyond the orifice, the vacuum at the throat of the venturi in the nozzle will be of a maximum value, any excess of vacuum in the intake manifold above a predetermined degree will have a diminishing import as regards further increases in the flow of the gases through the throat of the tube. As a result, the rate of flow through the tube approaches a constancy whenever the vacuum in the intake manifold is equivalent to or exceeds a predetermined pressure differential.

In this way excessive degrees of vacuum developed in the intake manifold are controlled, but, on the other hand, when the vacuum drops to a degree so slight as to be insufficient to sustain continued operation of the heater, either over a short or long period of time, means must be provided to return the heater to operation when the vacuum conditions are again favorable.

In the several views of the drawings, the heater 10 and motor 36 are controlled manually by a master switch 54. The circuits connected therewith are such that the motor runs continuously whenever the master switch is closed and a thermostat switch 55 provided in the igniter 22 circuit is connected in series with the master switch to disconnect the igniter when the temperature of the heater is such that combustion can be maintained under favorable vacuum conditions without further assistance from the igniter.

For the purpose of returning the heater to full operation after the flame has been extinguished, and to provide for the proper operation of the heater under the many conditions to which its operation is subjected, automatic means for reconnecting the igniter to the source of current during the continuation of conditions unfavorable for the heater are provided so that the combustible mixture will be again ignited when the rate of flow thereof and other pertinent conditions are favorable for the resumption of the operation of the heater.

In accomplishing this, a means which is responsive to some factor that will serve as an index to those conditions either favorable or unfavorable to the heater operation, may be employed to control reignition of the heater and such a means may be provided as illustrated, wherein a vacuum controlled switch 56 is automatically actuated upon a lessening of the vacuum to a degree critical to the continued operation of the heater.

Referring now to Fig. 2, the vacuum switch 56 comprises a casing 58 having one side formed by a diaphragm 60, with the central portion of the diaphragm normally pressed outwardly by a compression coil spring 62. The interior of the casing is normally in communication with the intake manifold 52 through a restricted passageway 64 and upon the opposite side, the diaphragm is provided with an insulating stem 66 projecting therefrom and adapted to engage the switch member 68 which carries a contact point 70 cooperable with a fixed contact point 72.

With this construction, the spring 62 will operate to close the contacts 70 and 72 and cause current to flow through the igniter 22 whenever the intake manifold vacuum is unusually low. Thus the igniter 22 will become heated to reignite the flame, should the flame have become extinguished because of the lowness of the vacuum. The thermostatic switch 55 which is connected in parallel with the vacuum switch 56 is provided to short-circuit the vacuum-controlled switch contacts whenever the combustion chamber is cold. The thermostatic switch 55 is exposed to the heat of the radiator as already mentioned and in event the vacuum-operated switch fails to accomplish its purpose, the continued running of the motor 36 will rapidly cool the radiator 28 to the point where the thermostatic switch 55 will come into operation and remain in operation regardless of the intake vacuum exerted upon the heater until such time as the igniter 22 has functioned properly and the heat in the radiator has been raised again to a point where the thermostatic switch breaks.

Fig. 3 illustrates a control for the same purpose as that intended with the embodiment illustrated in Fig. 2, and comprises a pair of contacts 74 and 76, the former contact being secured to a suitable part 78 of an automobile, but being insulated therefrom, and the contact 76 being attached to one arm of a bell crank 80 which is pivotally supported by pin 82 upon the automobile part 78 for movement about a horizontal axis that is disposed perpendicular to the line of movement of the automobile. For this purpose, downwardly extending arm of the bell crank is provided with a weight 84. The contacts 74 and 76 are connected

in a circuit which is in all respects similar to that shown in Fig. 2 and similar reference characters have therefore been applied to the corresponding parts.

When the automobile is rapidly accelerated, or is being driven up a hill, the weight 84 acting as an inertia or gravity pendulum, will swing clockwise and close the contacts 74 and 76, maintaining these contacts closed until the objective of the vehicle is attained. Thus, during the interval that the vacuum in the intake manifold is very low, due to the extra load temporarily imposed upon the engine, the igniter will be supplied with current to aid in maintaining the flame in the combustion chamber. The pendulum 80 will ordinarily be provided with a suitable dashpot arrangement so that the igniter will be connected to the battery for a short interval after the objective of the vehicle has been attained. In this way the reignition of the heater is controlled by a function of the automobile which serves as an index of the operation of the motor upon which the operation of the heater is predicated, this particular adaptation being very desirable when it might otherwise be difficult or impractical to control the reignition switch in direct relationship with the degree of vacuum existing in the intake manifold.

Referring to Fig. 4, an embodiment is illustrated wherein the thermostatically operated safety valve 38 described in Fig. 1 as a means to extinguish the flame whenever the radiator becomes excessively hot, may also be utilized as a further control to complete a circuit to a suitable signal for warning the operator of the vehicle that the fan motor has stopped or that some other condition dangerous to the operation of the heater has developed.

In the embodiment illustrated, a fixed contact 86 is provided for the thermostatic switch 87 and is connected to a two-way switch 88 which is adapted to connect either a signal light 90 or an audible signal 92 in the circuit which includes the thermostatically operated switch 87. Thus, upon overheating of the thermostatic element, either the warning lamp will be illuminated or the audible signal will be sounded, so that the operator may be apprised of the unusual condition existing with the heater.

Moreover, the embodiment illustrated in Fig. 4, includes a pair of switches 94 and 95 connected in circuit to bridge the contacts of the thermostatic switch 87. It will be apparent that closure of either of the switches 94 or 95 will result in giving a warning signal. The switches 94 and 95 are preferably connected so that they will be closed by some normal operation performed by the driver of the vehicle incidental to parking the vehicle; for example, the switch 94 might be controlled in such manner that when the usual ignition switch of the vehicle is open, the switch 94 will be closed. The switch 95 might be operated by the front door of the vehicle, the operating conditions being so arranged that when the door is opened, the switch 95 will be closed. Or, the switch 95 might be positioned beneath the driver's seat and so arranged that it would be opened by the weight of the driver upon the driver's seat and closed by a spring pressure when the driver left the seat. Any other suitable arrangement can be provided for closing either the switch 94 or the switch 95 as, for example, one of these switches could be closed whenever the parking brake is applied.

In this way, means are provided for the reignition of an extinguished flame of an internal combustion heater when the factors which caused the extinguishment of the flame are again favorable for the resumption and continued operation of the heater. The reignition is accomplished automatically without the attention of the operator, and proper operation of the heater is assured. Moreover, a heater of the class described, and controls therefor, are provided which are relatively simple in construction and may be economically manufactured, installed and used.

Consequently, although several embodiments of the invention have been shown and described herein, it will be apparent to those skilled in the are that various and further uses, modifications and changes may be made without departing from the spirit and substance of the invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. In a heater for automobiles, the combination of a combustion chamber, an electrical igniter for said combustion chamber, means for connecting said combustion chamber to the intake manifold of the automobile engine thereby to draw combustible mixture into said combustion chamber, and means responsive to a condition indicative of the degree of intake manifold vacuum to connect said igniter to a source of currents under the condition when the degree of vacuum within the intake manifold is insufficient to cause the flow of combustible mixture into said chamber at a sufficiently rapid rate to support combustion.

2. In a heater for an automobile vehicle, having a passenger compartment and an internal combustion engine, the combination of a combustion chamber, means to supply a mixture of liquid fuel and air to said combustion chamber, a radiator for receiving the products of combustion from said chamber, a connection from said radiator to the intake manifold of the automobile engine to draw the charge of combustible mixture into said combustion chamber and the products of combustion through said radiator, an electrically operated igniter in said combustion chamber, a source of electricity for said igniter, and means for connecting said igniter to said source whenever the degree of vacuum in said intake manifold falls below the minimum required to cause flow of the combustible mixture into said chamber at a sufficiently rapid rate to support a flame therein, and to disconnect said igniter from said source when the degree of vacuum exceeds said minimum value.

3. In a heater for automobiles having internal combustion engines, the combination of a combustion chamber, means for supplying the combustible mixture of liquid fuel and air to said chamber, a heat radiator located within the passenger compartment of the automobile and connected to receive the product of combustion from said chamber, means connecting said radiator to the intake manifold of the engine whereby the product of combustion will be drawn through said radiator and the combustible mixture drawn into said chamber, an igniter located in said combustion chamber, a battery for supplying current to said igniter, and a switch controlled by a degree of vacuum in the intake manifold of the engine and operable to close a circuit connecting said battery with said igniter whenever the pressure in the intake manifold rises to substantially atmospheric pressure and to open said circuit

when the vacuum in the intake manifold is sufficient to cause normal operation of the heater.

4. In an internal combustion heater of the class described dependent upon the intake manifold vacuum of an internal combustion engine for its operation, the combination of a manually operable switch for conditioning the heater for operation, a thermostatically controlled switch connected in series with said manually operable switch normally closed when the heater is cool, and a vacuum operated switch connected in a series with said manually operated switch and in parallel with said thermostatic switch, said vacuum operated switch being normally closed whenever the pressure in the intake manifold of the engine approaches atmospheric pressure to a degree critical to the operation of the heater.

5. A heater for automotive vehicles, the combination of a combustible mixture of liquid fuel and air to said chamber, a radiator located within the passenger compartment of the vehicle and receiving the product of combustion of said chamber, means connecting said radiator to the intake manifold of the vehicle engine, thereby to draw said combustible mixture into said combustion chamber and to withdraw the products of combustion from said radiator, an igniter in said chamber, and means responsive to the degree of acceleration of movement of the vehicle for supplying electric current to said igniter.

6. A heater for automotive vehicles, the combination of a combustion chamber, means for supplying a combustible mixture of fuel and air to said chamber, a radiator located within the passenger compartment of the vehicle and receiving the product of combustion of said chamber, means connecting said radiator to the intake manifold of the vehicle engine, thereby to draw said combustible mixture into said combustion chamber and to withdraw the products of combustion from said radiator, an igniter in said chamber, and means responsive to the degree of longitudinal tilt of the vehicle for supplying electric current to said igniter.

7. In an internal combustion heater of the class described dependent upon the intake manifold suction of an internal combustion engine for its operation, a radiator, means for supplying hot gases of combustion to said radiator for heat exchange purposes whenever the manifold suction is sufficient to support combustion, and means responsive to said manifold suction for inducing combustion after said suction has fallen below a predetermined value that is critical to the operation of the heater.

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