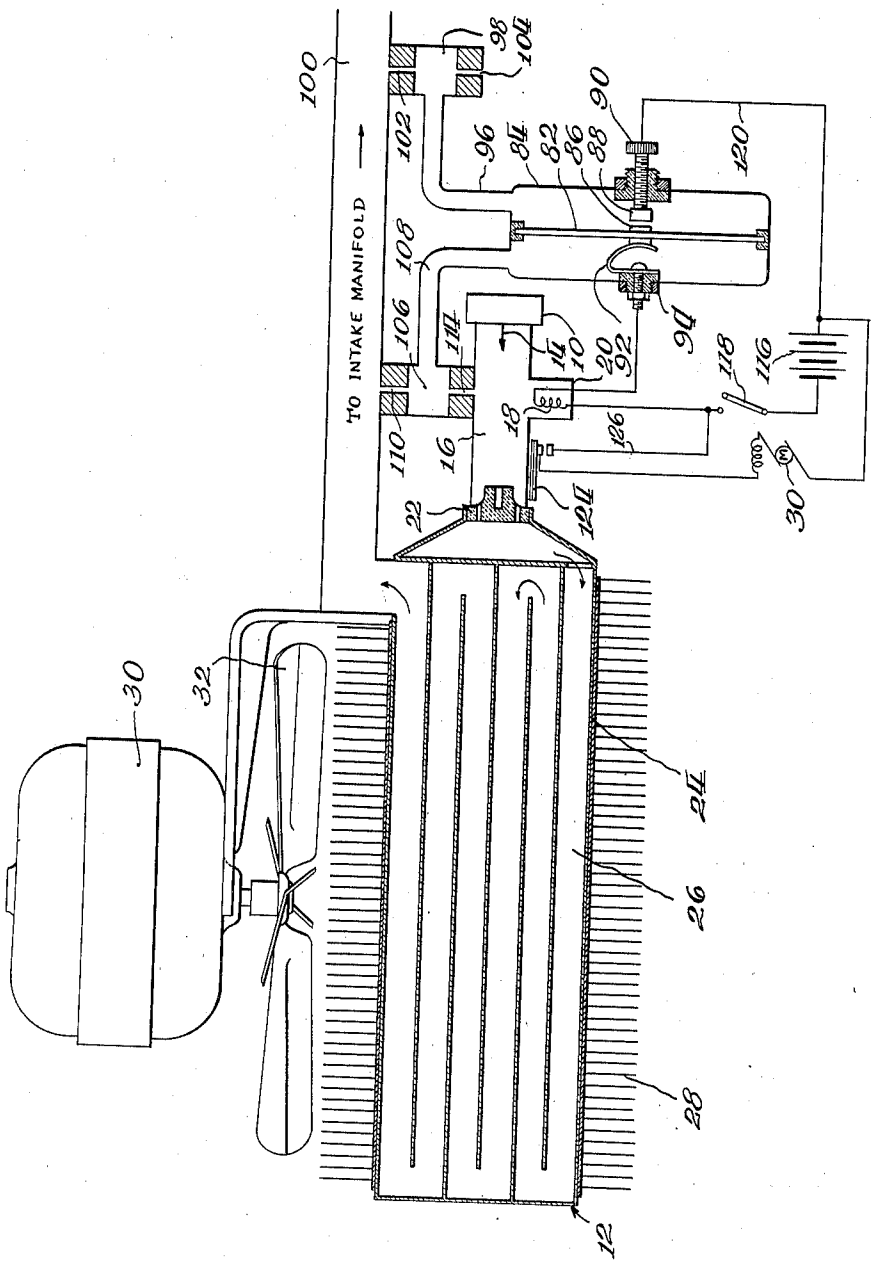
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AUTOMOBILE HEATER

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Inventor:
Henry J. DeN McCollum
By
Williams, Bradbury, McCaleb & Hinkle.
Attys.

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AUTOMOBILE HEATER

Henry J. De N. McCollum, Evanston, Ill.

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5 Claims. (Cl. 237—12.3)

The invention relates generally to automobile heaters and the present application is a division of a co-pending application, Serial No. 61,213 filed January 28, 1936.

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 heater is so installed in an automobile as to employ the vacuums created by internal combustion engine for a source of power to provide the fluid pressure differential needed to produce and move 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, 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 will fall below the degree necessary to maintain the factors of combustion required for a continuous operation of the heat generator. Consequently, it is necessary to provide for a reignition of the combustible mixture in the generator so that the operation of a 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 the 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 reestablishing the flame, should the flame be accidentally extinguished.

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

Another object of the invention is to provide a heater and control therefor of the class described, which is relatively simple in construction and may be economically manufactured, installed, operated and maintained.

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

Referring now to the embodiment of the invention illustrated diagrammatically in the single view of the accompanying drawing, the heater construction, which is more particularly described in said copending application, comprises generally, a carbureting device **10** which supplies to the heater **12**, as indicated by the arrow **14**, 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 to the heater is fed into the combustion chamber **16** in a suitable manner and the mixture is ignited by an electrical heating element **18** located in a recess **20** in the side of the chamber. A refractory ceramic plug **22** is disposed at the outlet of the combustion chamber to maintain an ignition heat since it 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, the hot gases pass through a radiator **24** comprising a circuitous tube **26** to which heat radiating fins **28** are thermally connected. Over these fins air is circulated by a motor **30** and fan **32** whereby heat is transferred from the hot gases of combustion to the passenger compartment of the automobile for the comfort of the passengers.

The outlet of the circuitous tube **26** is connected to the intake manifold of an internal combustion engine and in this way the fluid pressure differential necessary for the operation of the heater is supplied whereby the combustible mixture is drawn from the carbureting device **10** into the combustion chamber **16** where it is ignited and the hot gases of combustion thereby created are then drawn through the radiator **24** in heat transfer relationship. Finally, the gases are disposed of in the intake manifold where any excess of fuel not already burnt or utilized may be employed in the operation of the engine itself.

Referring now to the operation and control of the embodiment illustrated in the accompanying drawing, it will be appreciated as already mentioned that upon occasion the intake manifold vacuum may be so small that the rate of flow of combustible mixture into the combustion

chamber 16 will not be sufficiently rapid to support the flame. It will, therefore, be necessary, upon occasion, to reignite the flame. For this purpose, an automatic means is provided for reconnecting the igniter 18 to the source of current during the time that the vacuum is too low for the continued operation of the heater. The particular embodiment illustrated employs a vacuum control switch which is automatically closed upon the lowering of the intake manifold beyond a predetermined value, and although shown in use with a high resistance heating element such as the igniter 18 illustrated, the switch is also useable in connection with a spark plug type of igniter.

In the embodiment illustrated, the switch is controlled by a flexible diaphragm 82 mounted in a suitable casing 84 and carrying a contact point 86 which is cooperable with a contact point 88 carried at the end of an adjustable screw 90. The contact 86 is connected by a flexible conductor 92 in a binding post 94, insulated from the casing 84. The right hand side of the casing 84, as viewed in the drawing, is connected by pipe 96 with a chamber 98. The chamber 98 communicates with a tube 100 through a restricted passageway 102 and with the atmosphere through a similar restricted passageway 104. The left hand side of the casing 84 communicates with a chamber 106 through a connecting tube 108. The chamber 106 communicates with the intake manifold through a restricted passageway 110 and communicates with a combustion chamber 16 of the heater through a restricted passageway 114. The passageway 114 is of slightly greater diameter than the passageway 104.

The igniter element 18 has one end connected to the binding post 94 and its other end connected to the battery 116 through a manually operated switch 118. The adjustable contact 88 is connected by a conductor 120 to the battery 116, completing the igniter circuit. The fan motor 30 has one terminal thereof connected with the conductor 120 and the other terminal thereof connected to a thermostat switch 124. The main switch 118, when closed, is adapted to complete the circuit to the fan motor 30 (providing the thermostatic switch 124 is closed) through a conductor 126. Upon closing the switch 118, the circuit through the igniter 18 will be completed, since the switch contacts 86 and 88 operated by the diaphragm 82 will normally be closed. When, however, combustion commences in the combustion chamber 16, the switch contacts 86 and 88 will be separated because of the differential in pressure upon the opposite sides of the diaphragm resulting from the starting of a flame in the combustion chamber.

Prior to the ignition of the flame, the degree of vacuum present upon opposite sides of the diaphragm 82 will differ because of the difference in the diameters of the passageways 104 and 114. Since the passageway 104 is the smaller, the degree of vacuum produced in the chamber 98 (and hence in the right hand side of the casing 84) will be higher than the vacuum in the chamber 106, because the tendency to high vacuum in the chamber 106 will be more completely relieved by virtue of the fact that the passageway 114 is of relatively large diameter. As a result, the diaphragm 82 will be flexed to the right, closing the contacts 86 and 88.

When the flame is ignited, however, the gases passing through the passageway 114 will be hot, but will be rapidly cooled upon entering the chamber 106. Due to the fact that the gases flowing through the passageway 114 are expanded by virtue of their high temperature, the rate of flow of gas (by weight) through the passageway 114 will be less than the rate of flow through the passageway 104. As a result, a higher vacuum will be built up and maintained in the chamber 106 than in the chamber 98. The diaphragm 82 will, under these circumstances, be flexed to the left, separating the contacts 86 and 88 and opening the circuit to the igniter 18. Since the igniter 18 draws a relatively large current, it is desirable that it be connected to the battery for as short an interval as is necessary to ignite the flame.

Should the flame in the combustion chamber become extinguished, the gases drawn through the passageway 114 will be at a low temperature, and as a result the rate of flow of gases (by weight) through the passageway 114 will exceed the rate of flow through the passageway 104, and as a result, the vacuum within the chamber 98 will become greater than the vacuum in the chamber 106, causing the diaphragm 82 again to flex to the right and complete the circuit to the igniter.

If desired, the right hand side of the diaphragm 82 may be opened to the atmosphere and a spring utilized to press the center portion of the diaphragm to the right and to maintain the contacts 86 and 88 closed. In this instance, the spring will apply just sufficient force to maintain the contacts closed when cold air is flowing through the passageway 114, but will not apply sufficient force to hold these contacts closed when the vacuum in the chamber 106 is increased upon the ignition of the flame in the combustion chamber.

Consequently, the embodiment shown and described provides a physical embodiment accomplishing the express and implied objects of the invention and although a single embodiment has been shown and described, it will be apparent to those skilled in the art 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 an automotive vehicle having 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, said last named means comprising a casing, a movable wall separating said casing into two compartments, a switch operated by said movable wall, a first chamber connected to one of said compartments and having a port communicating with the intake manifold and a port communicating with the atmosphere, and a second chamber connected to the other of said compartments and having a port communicating with said com-

bustion chamber and a port communicating with the intake manifold.

2. In a heater for an automotive vehicle having an internal combustion engine, the combination of a combustion chamber, means to supply a mixture of 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, said last named means comprising a casing, a movable wall separating said casing into two compartments, a switch operated by said movable wall, a chamber connected to one of said compartments and having a port communicating with the intake manifold and a port communicating with the atmosphere, a second chamber connected to the other of said compartments and having a port communicating with said combustion chamber and a port communicating with the intake manifold, said combustion chamber connecting port being slightly larger than the port communicating with the atmosphere, whereby the vacuum in said first chamber will be greater than the vacuum in said second chamber except when gases flowing through said combustion chamber connecting port are heated to a temperature resultant from normal combustion in the combustion chamber, said means comprising a pressure operated switch, and means responsive to the temperature of the gases leaving said combustion chamber to control the operation of said switch.

3. In a heater for an automotive 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, said last named means being critically responsive to the heat expansion of the hot gases of combustion in said combustion chamber as distinguished from unburnt combustible mixtures supplied thereto.

4. In an internal combustion heater for use with an internal combustion engine having an intake manifold, a combustion chamber, means to supply a combustible mixture of liquid fuel and air to the combustion chamber, means to connect the combustion chamber to the intake manifold, an electrically operated igniter in the combustion chamber to ignite the combustible mixture, a source of electricity for the igniter, and means for connecting the igniter to said source whenever the suction in the intake manifold falls below a certain required minimum and to disconnect the igniter from said source when said mixture becomes ignited, the last named means comprising a casing, a movable wall separating the casing into two compartments, a switch operated by the movable wall, said switch adapted to close a circuit between the igniter and said source, a chamber connected to one of said compartments and having a port communicating with the intake manifold and a port communicating with the atmosphere, and a second chamber connected to the other of said compartments and having a port communicating with the combustion chamber and another port communicating with the intake manifold.

5. In a heater of the class described which depends for its operation upon the suction in the intake manifold of an internal combustion engine, a combustion chamber, means to connect the combustion chamber to the intake manifold, means to supply a combustible fuel and air mixture to the combustion chamber under the influence of said suction, an igniter in the combustion chamber to ignite the combustible mixture passing therethrough, a source of electrical current supply, a switch adapted to complete a circuit between the igniter and said source to energize the igniter, and automatic control means to open and close said switch, said control means comprising a chamber vented to the combustion chamber and to the intake manifold, and a pressure sensitive element movable to open and close said switch under the influence of gas pressure in said chamber.

HENRY J. DE N. McCOLLUM.