Oct. 21, 1941. W. T. DOWNS 2,259,950

REFRIGERATING SYSTEM

Filed Nov. 12, 1937 2 Sheets-Sheet 1

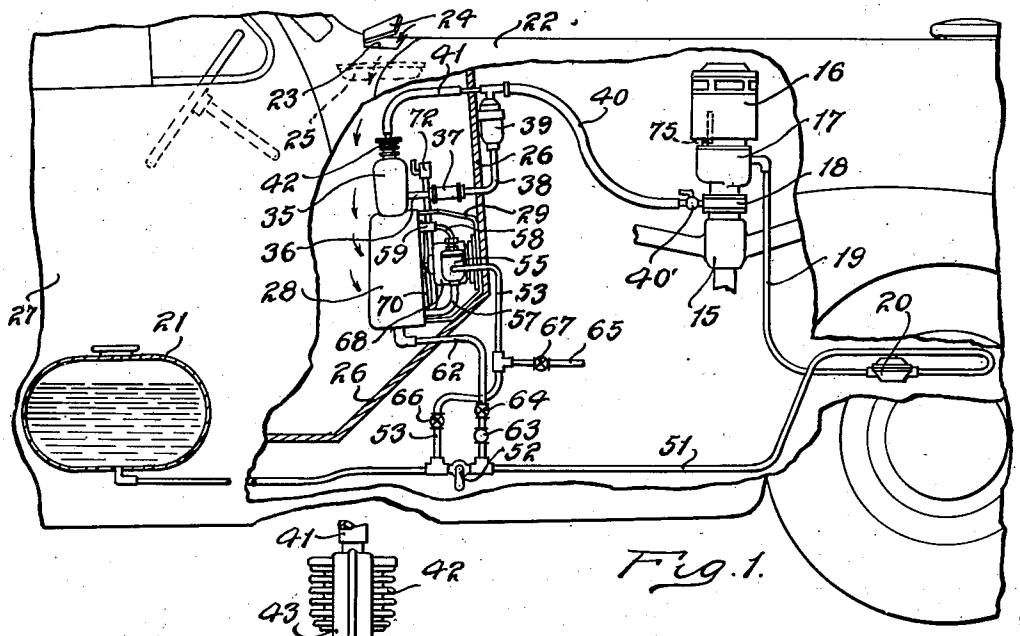


Fig. 1.

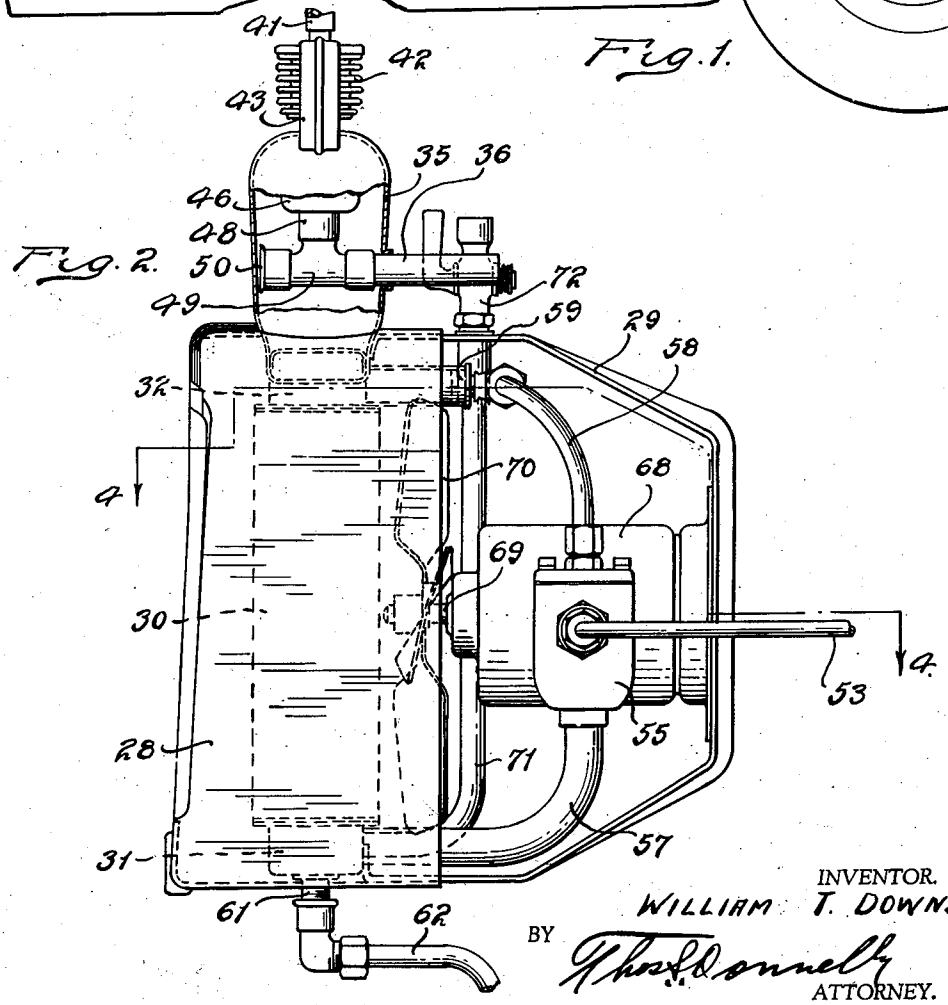


Fig. 2.

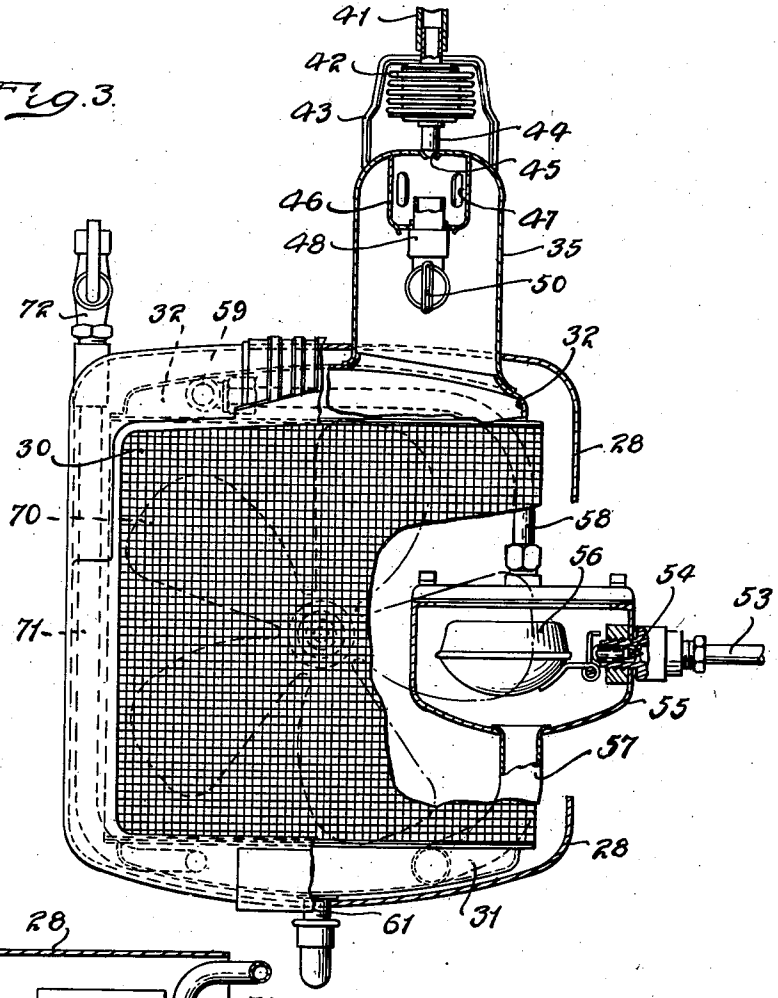
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Fig. 3.



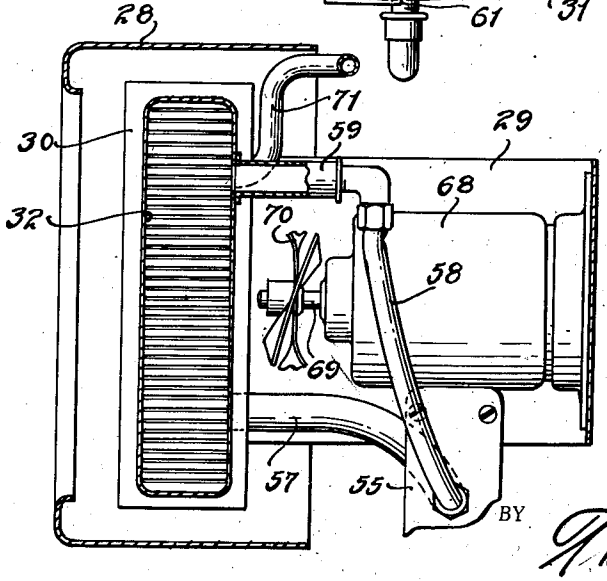


Fig. 4.

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UNITED STATES PATENT OFFICE

2,259,950

REFRIGERATING SYSTEM

William T. Downs, Detroit, Mich.

Application November 12, 1937, Serial No. 174,145

14 Claims. (Cl. 62—169)

My invention relates to a new and useful improvement in a cooling mechanism which may be used for cooling currents of air passed over, through or around the mechanism and the invention is admirably adapted for use as an air cooler for automobiles and similar vehicles having a closed body in which the passengers sit and having in connection with the closed body an internal combustion engine.

It is an object of the present invention to provide a cooling mechanism of this class which will be simple in structure, economical of manufacture, durable, highly efficient in use, easily and quickly installed and requiring a minimum of disturbance to the usual apparatus of an internal combustion engine in its installation and operation.

Another object of the invention is the provision of a cooling mechanism of this class which may be operated in connection with an internal combustion engine without requiring any additional material for its operation other than the fuel used for operating the engine.

Another object of the invention is the provision of a cooling mechanism of this class in which the suction naturally produced by the engine during its operation is utilized for rarefying and vaporizing the combustible liquid resulting in a lowering of its temperature so that the cooled liquid may be utilized as a cooling agent.

Another object of the invention is the provision of a method of cooling air consisting in subjecting a high volatile liquid in a container to a rarefying action and while in said rarefied state bringing into contact therewith, air, humidifying the air with said liquid and while the liquid is in a lowered state of temperature, directing a blast of air to be cooled in proximity to and into contact with said container for purposes of cooling the air.

Another object of the invention is the provision of a method of and an apparatus for cooling a current of air whereby a container is placed in the path of the current of air to be cooled and a vaporizable fluid conducted into the container and a partial vacuum maintained in the container for vaporizing and rarefying the fluid for the purposes of lowering the temperature of the container.

Other objects will appear hereinafter.

The invention consists in the combination and arrangement of parts hereinafter described and claimed.

The invention will be best understood by a reference to the accompanying drawings which form a part of this specification, and in which,

Fig. 1 is a side, elevational view of the invention illustrating its mounting.

Fig. 2 is a side elevational view of the invention considerably enlarged over the structure shown in Fig. 1, with parts broken away and parts shown in section.

Fig. 3 is a front elevational view with parts broken away and parts shown in section.

Fig. 4 is a fragmentary, sectional view taken on line 4—4 of Fig. 2.

The invention is, as illustrated in Fig. 1, adapted for use with a vehicle having an internal combustion engine provided with an intake manifold 15 communicating with which is a carburetor involving an air cleaner and inlet chamber 16 and a float chamber 17 connected in communication with the manifold 15 through the adaptor 18. Leading into the float chamber 17 is the fuel delivery pipe 19 through which the fuel is directed by the pump 20 which is connected by the pipe 51 to the fuel tank 21.

In the construction of automobiles, the internal combustion engine is generally placed beneath a hood 22 rearwardly of which is a cowl in which is formed an opening 23 closed by the swingable closure 24. A drip pan 25 is positioned beneath the opening 23 for the purposes of catching rain which might pass through the opening 23. This opening 23 communicates with the interior of the vehicle body 27 rearwardly of the dash 26.

Mounted on the inner face of the dash 26 is a bracket 29 which serves to support a cooling reservoir 30 which is formed of the multiple air and water tube type similar to the type which is used in vehicle radiators such as the honeycomb type and the fin and tube type radiators. Communicating with this reservoir 30 at the top is an upper chamber 32 and communicating with the bottom thereof is a lower chamber 31. This honey-comb reservoir is positioned within an embracing frame 28 to which the bracket 29 is attached. Mounted in communication with the upper chamber 32 and projecting upwardly therefrom is an inverted bell-shaped housing 35 extending inwardly of which is a pipe 36 which is connected by the flexible connection 37 to the pipe 38 communicating throught the check valve 39 with the pipe 40 which is connected through an opening formed in the adapter 18 in communication with the intake manifold 15. A valve 40' is interposed in the pipe 40 so that this communication with the intake manifold may be

opened and closed at will. The construction is such that when the internal combustion engine is set into operation, a suction will be set up through the pipe 40 communicating with the pipe 36 and a partial vacuum developed in the container or reservoir 30. This pipe 36 is in communication with a T-fitting 49 positioned in the housing 35. Connected to the pipe 40 and in communication therewith is a pipe 41 which communicates with the bellows 42 projecting outwardly from the lower end of which is a valve-forming stem 44 adapted for engaging in and closing the opening 45 formed in the upper end of the housing 35. A U-shaped bracket 43 serves to support this bellows 42 in position. This construction is such that when the engine is operating and the suction is established through the pipe 40 and its connections with the interior of the housing 35, a vacuum will also be established in the bellows 42. If the vacuum is increased sufficiently, the bellows 42 will be drawn into collapsed position so as to raise the valve-forming stem 44 out of the opening 45 and thus permit entry of air into the interior of the housing 35. This opening 45 communicates with the interior of a vapor housing 46 mounted in the housing 35 and communicating therewith through the opening 47. Projecting upwardly from the T-fitting 49 is a pipe 48 which extends into and opens interiorly of the vapor housing 46. The end of the T-fitting 49 is provided with a reduced portion to form the slit-like opening 50 which communicates with the interior of the housing 35.

Interposed in the fuel delivery pipe 51 is a valve 52, which may be manually opened and closed. Communicating with the pipe 51, between the tank 21 and the valve 52, is a delivery pipe 53 in which is interposed the manually operable valve 66. This pipe 53 communicates through the valve and fitting 54 with the float chamber 55 in which is mounted a float 56 to control the opening and closing of the valve 54. An outlet pipe 57 communicates with the float chamber 55 through the bottom thereof. This pipe 57 leads into and terminates in the lower reservoir chamber 31. A pipe 58 communicating with the float chamber 55 extends upwardly and communicates with the pipe 59 which opens at its inner end into the interior of the upper chamber 32. Thus, the float chamber is connected both to the top and the bottom of the honey-comb reservoir or container.

Projecting outwardly from the bottom of the lower chamber 31 is a nipple 61 to which is connected the outlet pipe 62. This pipe 62 leads through the manually operable valve 64 and the check valve 63 to the pipe 61 at the opposite side of the valve 52.

The construction is such that when the internal combustion engine is set into operation the fuel delivery pump 20 will be operated and the liquid fuel will be delivered from the tank 21 through the pipe 53 into the float chamber 55, the valves 66 and 64 being opened and the valve 52 being closed. From the float chamber the liquid fuel will pass through the pipe 57 into the honey-comb container. At the same time, the fuel vapors will be drawn off in response to the suction of the engine through the pipes 36, 37, 38, check valve 39 and pipe 40 to pass into the intake manifold 15. The suction of the engine will establish a partial vacuum in the housing 35 to maintain this withdrawal of the fuel vapors. The pipe 48 has been extended into the shielding housing 46 in order to prevent drawing out of the housing 35 any solid liquid material so that a vaporized fuel alone is thus conducted into the intake manifold.

A pipe 71 communicates at its lower end with the lower chamber 31 and at its upper end through the manually operable valve 72 with the atmosphere so that when the vacuum is established in the housing 35, air will be drawn into the honey-comb container at the bottom and pass upwardly through the liquid fuel container in this reservoir, thus, aerating the fuel vapor and at the same time humidifying the air led into the liquid fuel. The valve 72 is present to regulate the amount of air which is permitted to pass through the pipe 71. In this manner, the desirable mixture of fuel and air for combustion purposes will be delivered through the pipe 40 to the intake manifold 15. When the vacuum in the housing 35 reaches a predetermined degree, the bellows 42 will be collapsed and the valve-forming stem 44 will be lifted to uncover the opening 45 and allow additional air to be bled into the shielding housing 46.

When the vacuum is established, the liquid fuel container within the honey-comb reservoir is rarefied and it is well known that leading off the vapors through a vacuum process will effect a lowering of the temperature of the liquid. Experience has shown that by leading air into the liquid and humidifying this air with the liquid, a further lowering of the temperature of the liquid is effected. Experience has also shown that when the additional air is bled in an additional lowering of the temperature is accomplished and very suddenly. This is possibly due to the sudden expansion of the air bled into the vacuum and to the sudden further humidifying of the air so led in. When the stem 44 raises off of the opening 45 to permit air to enter the housing 35, the entry of the additional air will, of course, relieve the partial vacuum and when the vacuum has been lowered to the predetermined amount, the valve stem 44 will again move onto its seat to close the opening 45. Experience has shown that the liquid, in the ordinary operation of an internal combustion engine, may be lowered below the temperature of fifty degrees Fahrenheit.

It will be noted that the reservoir 30 or the honey-combed container serves as a vacuum tank or chamber and it is believed obvious that this chamber, when placed at the proper elevation relatively to the carburetor, would permit the feeding of the fuel from the bottom thereof to the carburetor so that the pump 20 might be dispensed with. It will also be noted that this reservoir or honey-combed container 30 serves as an expansion chamber in which the combustible fluid is rarefied and the resultant cooling of the fluid due to the rarefication is taken advantage of for the purposes of cooling the current of air. It, therefore, is obvious that the fluid used for combustible purposes passes through this expansion chamber and the cooling resulting from the sudden expansion or rarefication of the fluid is effected at a location relatively to the current of air as to obtain a maximum efficiency in cooling effects. It will also be noted that the partial vacuum maintained in this expansion chamber or reservoir 30 is effected from the suction resulting from the reciprocations of the pistons of the engine.

The word "fluid" is used in some of the claims as this term is more comprehensive than the word "liquid" and it is believed obvious that the passage of the fuel through the reservoir 30 and

subjecting the same to a rarefication in the reservoir would result in a cooling of the material delivered whether the fuel were delivered to the reservoir in a liquid or a gaseous state. Particularly is this so where a partial vacuum is maintained in the reservoir 30, permitting or effecting a rapid expansion or rarefication of the fluid delivered.

Mounted on the bracket 29 is an electric motor 68 which is suitably connected to a source of electrical supply and provided with the necessary control switches and the like. Fixedly mounted on the shaft 59 of the motor 68 is a blade fan 70 arranged to blow the air which enters through the opening 23 through the air passages formed in the reservoir or container 30 in a manner similar to the blowing of the air through the water radiator of an automobile. In this manner the air is cooled and directed toward the interior of the body 27 in a cooled condition. There is thus provided a means for economically and effectively maintaining the air in the interior of the body 27 in a cooled condition. It is to be noted that no other material is necessary for operating this cooling mechanism other than the liquid fuel ordinarily used in operating the internal combustion engine. It will also be noted that this fuel is not wasted or consumed in any manner in the cooling operation but is directed in its entirety to the intake manifold 15.

The float chamber 17 is connected by a vent pipe 75 to the interior of the air chamber 16 so as to prevent an air lock in the fuel line.

When it is not desired to use the cooling system, even when it is connected in position, the valves 40', 64 and 66 may be manually closed and the valve 52 opened. The check valve 39 is to prevent any lighted gases passing through the pipe 38 into the housing 35. The check valve 63 prevents the back pressure from operating directly on the liquid in the container 30.

In Fig. 1 I have shown a pipe 65 leading from the pipe 53 and in which is positioned a manually operable valve 67. If desired, the pipe 65 may be connected to a tank other than the gasoline tank 21 such as a tank containing alcohol or the like. When the pipe 65 is so connected to a source of high volatile liquid in the operation of the device, the valve 67 would be opened as would likewise the valve 52; and the valves 64 and 66 would be closed.

In view of this disclosure it is, therefore, believed that I have provided a simple and effective method of cooling a current of air through the conducting of a vaporizable fluid into a container in which a partial vacuum is maintained for the purposes of rarefying the fluid and lowering the temperature thereof.

It is believed obvious that the device, when used with liquid fuel from the tank 21, is operated a continuous operation of the device in an efficient manner would be effected. The high volatile materials will be, of course, vaporized and drawn off the pipe 40 while the heavier tails would be removed through the pipe 62.

It is believed obvious that instead of the honeycombed type of container used a coil might be used for the same purposes as the "honey-comb container," the air being directed against and through the coils. Consequently, in the claims the phrase "honey-comb container" is considered to mean a type of container whereby the proper circulation of air around or through the container for cooling purposes may be effected.

While I have illustrated and described the preferred form of construction I do not wish to limit myself to the precise details of structure shown but desire to avail myself of such variations and modifications as may come within the scope of the appended claims.

What I claim as new is:

1. In combination with a vehicle having a body, an engine, an intake manifold, and a fuel tank for the reception of liquid fuel to be delivered to said intake manifold: a container; means for conducting fuel from said tank to said container; means for conducting fuel from adjacent the bottom of said container; a conduit communicating with said container adjacent the top thereof and communicating with said intake manifold for exhausting fuel vapors from said container; means for conducting air into said container adjacent the bottom thereof; and additional means for bleeding air into said container upon the development of a predetermined vacuum in said container.

2. In combination with a vehicle having a body, an engine intake manifold, and a fuel tank for the reception of liquid fuel to be delivered to said intake manifold: a container; means for conducting fuel from said tank to said container; means for conducting fuel from adjacent the bottom of said container; a conduit communicating with said container adjacent the top thereof and communicating with said intake manifold for exhausting fuel vapors from said container; means for conducting air into said container adjacent the bottom thereof; additional means for bleeding air into said container upon the development of a predetermined vacuum in said container; and means for regulating the level of liquid fuel in said container.

3. In combination with a vehicle having a body, an engine intake manifold, and a fuel tank for the reception of liquid fuel to be delivered to said intake manifold: a container; means for conducting fuel from said tank to said container; means for conducting fuel from adjacent the bottom of said container; a conduit communicating with said container adjacent the top thereof and communicating with said intake manifold for exhausting fuel vapors from said container; means for conducting air into said container adjacent the bottom thereof; additional means for bleeding air into said container upon the development of a predetermined vacuum in said container; means for regulating the level of liquid fuel in said container; and means for directing a current of air into the proximity of said container for cooling said current of air.

4. In combination with an internal combustion engine: an apparatus for cooling a current of air comprising a container mounted in the path of the air to be cooled and adapted for reception of a vaporizable liquid; a conduit for establishing communication between the upper part of said container and said engine for exhausting vapors from said container and lowering the temperature of the liquid in said container; means for bleeding air into said container below the liquid level during the exhausting operation, means for delivering liquid into said container, means for controlling the liquid level in said container; and means for bleeding air into the upper part of said container upon the developing of a predetermined vacuum in said container.

5. In combination with an internal combustion engine: an apparatus for cooling a current of air comprising a container mounted in the path of the air to be cooled and adapted for recep-

tion of a vaporizable liquid; a conduit for establishing communication between the upper part of said container and said engine for exhausting vapors from said container and lowering the temperature of the liquid in said container; means for bleeding air into said container below the liquid level during the exhausting operation; means for delivering liquid into said container; means for controlling the liquid level in said container; means for bleeding air into the upper part of said container upon the developing of a predetermined vacuum in said container; and means for conducting liquid from adjacent the bottom of said container.

6. In combination with a vehicle having an internal combustion engine, a manifold, and a container for supplying combustible fluid thereinto, an apparatus for cooling a current of air, comprising: a vessel positioned in the path of the air to be cooled and interposed between said engine and the source of fuel supply and adapted for the reception of the combustible fluid delivered to said engine prior to the delivery of the same to said engine; means for connecting said vessel in communication with the source of fuel supply; means for connecting said vessel in communication with the manifold of the engine for maintaining a partial vacuum in said vessel for effecting a vaporizing and cooling of the fluid passing therethrough; relief means for opening said vessel to communicate with the atmosphere upon the developing of a predetermined vacuum in said vessel; and means for directing a current of air into the proximity of said vessel for cooling the same.

7. In combination with a vehicle having an internal combustion engine, a manifold, and a container for supplying combustible fluid thereinto, an apparatus for cooling a current of air, comprising: a vessel positioned in the path of the air to be cooled and interposed between said engine and the source of fuel supply and adapted for the reception of the combustible fluid delivered to said engine prior to the delivery of the same to said engine; means for connecting said vessel in communication with the source of fuel supply; means for connecting said vessel in communication with the manifold of the engine for maintaining a partial vacuum in said vessel for effecting a vaporizing and cooling of the fluid passing therethrough; relief means for opening said vessel to communicate with the atmosphere upon the developing of a predetermined vacuum in said vessel; means for directing a current of air into the proximity of said vessel for cooling the same; and means for conducting liquid from adjacent the bottom of said vessel.

8. In combination with a vehicle having an internal combustion engine, a carburetor, an intake manifold and a source of liquid fuel supply, and means for delivering fuel from said source of fuel supply to said carburetor: a container adapted for the reception of fuel delivered from said source of fuel supply; means for connecting said container to said source of fuel supply; means for maintaining a predetermined level of liquid in said container for maintaining a chamber in said container above the liquid therein; means for communicating said chamber with the intake manifold between said carburetor and said intake manifold for maintaining a partial vacuum in said container and effecting an evaporation of the fuel in said container; and means for directing a current of air into the proximity of said container for cooling the same.

9. In combination with a vehicle having an internal combustion engine, a carburetor, an intake manifold and a source of liquid fuel supply, and means for delivering fuel from said source of fuel supply to said carburetor: a container adapted for the reception of fuel delivered from said source of fuel supply; means for connecting said container to said source of fuel supply; means for maintaining a predetermined level of liquid in said container for maintaining a chamber in said container above the liquid therein; means for communicating said chamber with the intake manifold between said carburetor and said intake manifold for maintaining a partial vacuum in said container and effecting an evaporation of the fuel in said container; means for directing a current of air into the proximity of said container for cooling the same; and means for conducting liquids from the bottom of said container.

10. In combination with a vehicle having an internal combustion engine, a carburetor, an intake manifold and a source of liquid fuel supply, and means for delivering fuel from said source of fuel supply to said carburetor: a container adapted for the reception of fuel delivered from said source of fuel supply; means for connecting said container to said source of fuel supply; means for maintaining a predetermined level of liquid in said container for maintaining a chamber in said container above the liquid therein; means for communicating said chamber with the intake manifold between said carburetor and said intake manifold for maintaining a partial vacuum in said container and effecting an evaporation of the fuel in said container; means for directing a current of air into the proximity of said container for cooling the same; means for conducting liquids from the bottom of said container; and relief means adapted for establishing communication between said chamber and the atmosphere upon the developing of a predetermined vacuum in said chamber.

11. In combination with a vehicle having an internal combustion engine, a carburetor, an intake manifold and a source of liquid fuel supply, and means for delivering fuel from said source of fuel supply to said carburetor: a container adapted for the reception of fuel delivered from said source of fuel supply; means for connecting said container to said source of fuel supply; means for maintaining a predetermined level of liquid in said container for maintaining a chamber in said container above the liquid therein; means for communicating said chamber with the intake manifold between said carburetor and said intake manifold for maintaining a partial vacuum in said container and effecting an evaporation of the fuel in said container; means for directing a current of air into the proximity of said container for cooling the same; means for conducting liquids from the bottom of said container; and means for bleeding air into the liquid in said container.

12. In combination with a vehicle having an internal combustion engine, a hood for enclosing the same, an intake manifold, and a container for supplying combustible fluid thereinto, an apparatus for cooling a current of air, comprising: a vessel positioned in the path of the air to be cooled and interposed between said engine and the source of fuel supply and adapted for the reception of combustible fluid delivered to said engine prior to the delivery of the same to the engine; means for connecting said vessel in com-

munication with the source of fuel supply; means for connecting said vessel with the intake manifold of the engine for maintaining a partial vacuum in said vessel for effecting an evaporation of the fuel passing thereinto; a conduit communicating with the atmosphere exterior of said hood for conducting air into said vessel; and means for directing a current of air to be cooled into the proximity of said vessel for cooling the same.

13. In combination with a vehicle having an internal combustion engine, a carburetor, an intake manifold and a source of liquid fuel supply, and means for delivering fuel from said source of fuel supply to said carburetor: a container adapted for the reception of fuel delivered from said source of fuel supply; means for connecting said container to said source of fuel supply; means for communicating said container with the intake manifold for maintaining a partial vacuum in said container and effecting an evaporation of the fuel in said container; means for directing a current of air into the proximity of said container for cooling the same; and means for conducting liquids from the bottom of said container to said carburetor.

14. A cooling system for an automobile comprising a container for liquid; a liquid supply means including means for maintaining a predetermined quantity of liquid in the container; a heat exchanger including a plurality of conduits, said heat exchanger being arranged adjacent said container; upper and lower headers communicating with each other through said conduits; a conduit connecting and affording communication between the lower header and the container below the normal liquid level in the latter; a second conduit connecting and affording communication between the upper header and the container above the normal level of the liquid in the latter; a fan for forcing air to be cooled over said heat exchanger; means for maintaining a vacuum above the normal liquid level in said container and said heat exchanger; and a valve controlled air tube communicating with the atmosphere at one end and with the lower header of the heat exchanger at the other; whereby evaporation in the heat exchanger may be promoted and the air forced across the heat exchanger may be cooled.

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