Sept. 8, 1931. N. ECKLES 1,822,586

REFRIGERATING DEVICE

Filed April 19, 1930

Fig. 1.

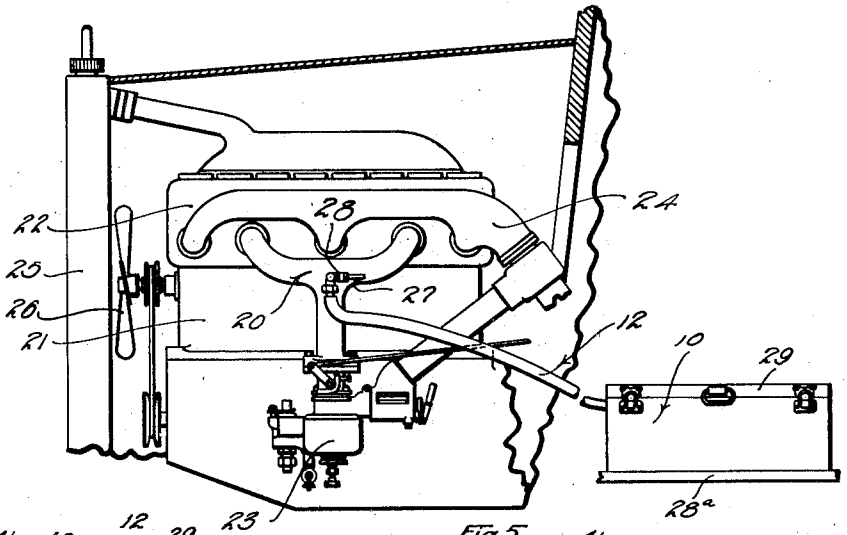


Fig. 2.

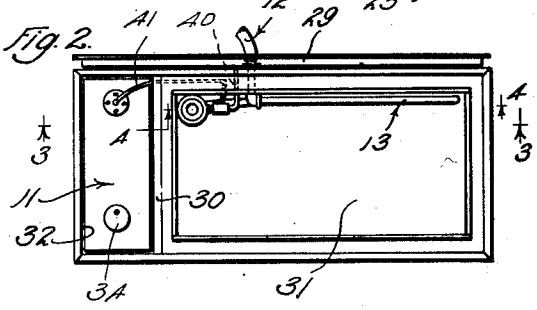


Fig. 5.

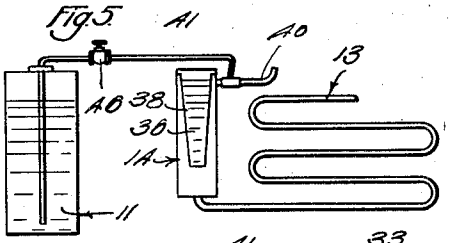


Fig. 6.

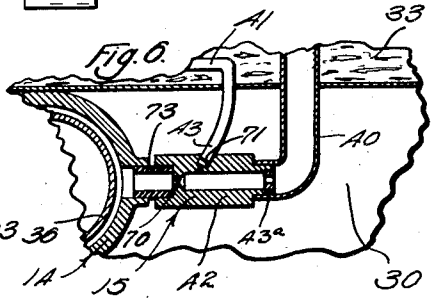


Fig. 3.

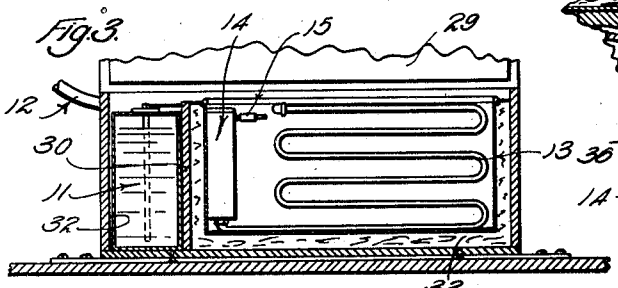
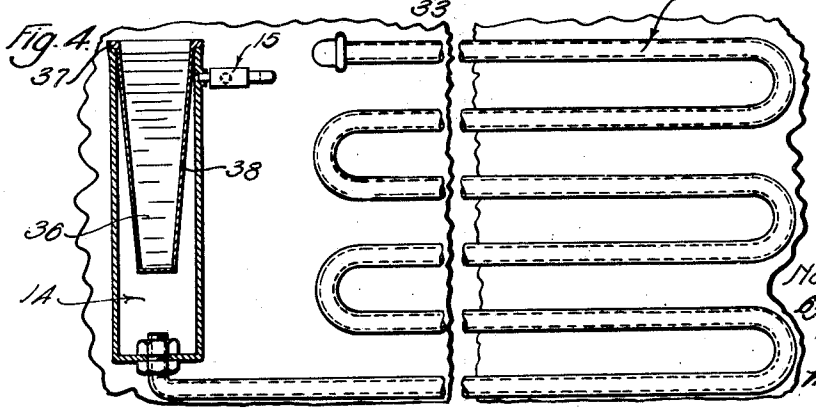


Fig. 4.



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UNITED STATES PATENT OFFICE

NOBLE ECKLES, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-HALF TO JOHN W. BOUR, OF LOS ANGELES, CALIFORNIA

REFRIGERATING DEVICE

Application filed April 19, 1930. Serial No. 445,642.

This invention relates to a cooling or refrigerating device, and it is a general object of the invention to provide a simple, practical, and effective refrigerating device adapted to be operated by or in connection with an internal combustion engine.

It is an object of the invention to provide a cooling or refrigerating device adapted to be operated in connection with an internal combustion engine that utilizes the reduction of pressure or suction developed in the intake manifold of an internal combustion engine to cause the atomization and rapid evaporization of a refrigerant.

Another object of the invention is to provide a device of the character mentioned that may employ gasoline, or other volatile liquid, as the refrigerant.

Another object of the invention is to provide a device of the character mentioned which is related to an internal combustion engine so that the refrigerant after having evaporated is drawn into the intake manifold of the engine without interfering with the action or efficient operation of the engine.

It is another object of the invention to provide a refrigerating device of the character mentioned that is adapted to be carried on a motor vehicle, such as an automobile, driven by an internal combustion engine and that is adapted to be operated by the engine of the vehicle.

Another object of the invention is to provide a refrigerating device of the character mentioned that is simple and inexpensive of construction and requires little or no adjustment or regulation.

It is a further object of the invention to provide a device of the character mentioned that is particularly economical in operation as the refrigerant employed may be a volatile combustible liquid that may be burned or used to advantage in the internal combustion engine operating the device.

Other objects and features of my invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference will be had to the accompanying drawings, in which:

Fig. 1 is a side elevation of the engine of a typical automobile illustrating the device provided by this invention in connection therewith. Fig. 2 is an enlarged top or plan view of the principal parts of the device. Fig. 3 is a vertical detailed sectional view taken substantially as indicated by line 3—3 on Fig. 2. Fig. 4 is an enlarged vertical detailed sectional view taken substantially as indicated by line 4—4 on Fig. 2. Fig. 5 is a diagrammatic view of the principal parts of the device. Fig. 6 is an enlarged horizontal detailed sectional view of the atomizing or carbureting portion of the device.

The cooling or refrigerating device provided by the present invention is capable of use in various situations and in connection with various types of internal combustion engines, or other machines that are adapted to create a sufficient reduction of pressure or suction to provide for the movement of a volatile liquid and to create a low pressure in a chamber for rapidly evaporating the liquid. The device is particularly suited for use in connection with an internal combustion engine whose operation will not be materially affected by the injection of a small quantity of vaporized liquid, such as gasoline, into its intake manifold. Throughout the following detailed disclosure I will describe a form of the invention particularly suited for operation by an internal combustion engine of the type ordinarily operated on gasoline and will describe the device as operated by the internal combustion engine of an automobile. It is to be understood, however, that the invention is not to be construed as limited to the particular form and application disclosed herein but is to be taken as including any features or modifications that may fall within the scope of the claims.

In Fig. 1 of the drawings I have illustrated a typical internal combustion engine of a motor vehicle which includes, generally, a cylinder block 21, a cylinder head 22, a carburetor 23, an intake manifold 20 for receiving the atomized fuel from the carburetor 23 and for passing it into the cylinders of the

engine, an exhaust manifold 24, a radiator 25, a cooling fan 26, and various other parts common to engines of this class. The particular engine illustrated is provided with pipe or conduit 27 for connection with what is commonly termed a vacuum tank into which fuel is drawn from a supply tank to be discharged into the carburetor 23. The vacuum line 27 communicates with the intake manifold 20 through a suitable fitting 28.

The device provided by this invention may include, generally, a box or cabinet 10, a refrigerant container or reservoir 11 for carrying a supply of a volatile refrigerant, a pipe or suction line 12 for connection with the intake manifold 20 of the engine, a cooling coil 13 having one end connected with the suction line 12, a low pressure or reduced pressure chamber 14 connected with the other end of the coil, and means 15 for atomizing the refrigerant to be evaporated into the chamber 14 whereupon it is drawn through the coil 13 and line 12.

In practice it is desirable to encase the cooling coil 13 and the reduced pressure chamber 14 in a heat insulated cabinet provided to contain the articles to be cooled or chilled. In the drawings I have illustrated a cabinet 10 carrying the reservoir 11, the coil 13, and the reduced pressure chamber 14. In the event that the device is to be operated by the engine of a motor vehicle or automobile, the cabinet 10 may be designed to be carried on a convenient part of the vehicle. For example, it may be designed to be mounted on a running board 28^a of the vehicle. The cabinet 10, illustrated, is a rectangular structure having a hinged top or cover 29. A transverse vertical partial partition 30 is provided in the interior of the cabinet 10 to divide it into a cooling compartment 31 for holding the articles or objects to be chilled, and a compartment 32 for carrying the reservoir 11. The cooling compartment 31 is preferably heat insulated by suitable insulating material 33 provided on the inner walls of the cabinet 10 and the partition 30. If desired, the cover 29 may also be provided with suitable heat insulating material. The cooling coil 13 and the reduced pressure chamber 14 are preferably mounted within the cooling compartment 31.

The supply reservoir 11 is provided to hold a supply of a volatile refrigerant liquid for use in the device. The reservoir 11 is arranged within the compartment 32 of the cabinet 10 and may be shaped to effectively fit into the compartment. The upper side or top of the reservoir 11 may be provided with a filling opening having a cap or closure 34.

The suction line 12 is connected with the intake manifold 20 of the engine and extends to the coil 13 to pass or draw a vaporized refrigerant from the coil and the chamber 14 into the manifold 20. The suction line 12 may be connected with the intake manifold 20 between the carburetor 23 and the valves of the engine in any suitable manner. In the case shown the line 12 is connected to the manifold 20 by the fitting 28 of the vacuum line 27. The line 12 extends from the intake manifold 20 to the cabinet 10 where it communicates with the cooling coil 13. In the particular form of the invention illustrated the section line 12 extends through an opening in a side of the cabinet 10 adjacent its upper edge to project into the compartment 31 where it is connected with the upper end of the cooling coil 13.

The cooling coil 13 is provided to pass the cold evaporated refrigerant from the reduced pressure chamber 14 to the suction line 12 and is mounted within the cooling compartment 13 so that the refrigerant passing through it absorbs heat from within the compartment. The cooling coil 13 may be vertically arranged against a side wall of the compartment 31. The coil 13 may be formed of a single length of tubing or pipe and may have its upper end connected with the suction line 12 and its lower end communicating with the reduced pressure chamber 14.

The reduced pressure chamber 14 is a closed or pressure tight container and is provided to receive the atomized volatile refrigerant from the atomizing means 15 and to initially pass or carry the refrigerant during its rapid evaporation before it passes into the cooling coil 13. The chamber 14 is arranged in the cooling compartment 13 of the cabinet 10. The chamber 14 may be mounted in a corner of the compartment 31 or against the side wall of the compartment on which the coil 13 is arranged. The chamber 14 may be a hollow cylindrical member and may be vertically arranged in the corner of the compartment 31. The receiving or lower end of the coil 13 communicates with the chamber 14. In the preferred form of the invention the receiving lower end of the coil 13 extends through an opening in the lower end of the chamber 14 to receive the vaporized refrigerant from the chamber.

If desired, means may be provided in connection with the device for chilling or freezing a liquid or for cooling a body of metal. A body of liquid or metal chilled or made cold during operation of the device will absorb heat from within the cooling compartment 31 in the event that the engine for operating the device is stopped so that articles in the cooling compartment will remain chilled for a period after the engine has stopped. In the drawings I have illustrated a liquid container 36 arranged in connection with the low pressure chamber 14 for holding a liquid to be chilled or frozen. The liquid container 36 may normally close the upper end or top of the chamber 14. The upper end of the chamber 14 may be beveled

outwardly and the container 36 may be correspondingly shaped to tightly seal against the upper walls of the chamber. The container 36 may have a radially projecting lip 37 at its upper end seating against the upper edge of the side walls of the chamber 14. The container 36 may depend downwardly from the lip 37 into the interior of the chamber 14. The side walls 38 of the container 36 may diverge or flare upwardly and outwardly so that liquid frozen in the container will not burst it and so that the frozen body may be readily removed from the container. If desired, the container 36 may be removably mounted on the chamber 14 so that the frozen liquid may be readily removed from within it.

The atomizing means 15 may be in the nature of any suitable form of carburetor or atomizing device to break up or atomize the liquid refrigerant drawn from the supply reservoir 11 before or as it is passed into the low pressure chamber 14. In accordance with the preferred form of the invention the means 15 is in the nature of a simple atomizing device that does not require adjustment or regulation. The means 15 may include an air intake line 40 for passing air into the reduced pressure chamber 14, and a liquid supply line 41 for passing the liquid refrigerant from the reservoir 11 into the air intake line 40.

The air intake line 40 is provided to pass air into the reduced pressure chamber 40 and preferably discharges into the upper portion of the chamber. The line 40 may extend from the upper portion of the chamber 14 to the exterior of the cabinet 10. A choke tube 42 is provided in the line 40 to increase the velocity of the air passing through the line to draw the liquid through the supply line 41 and to break up the liquid as it is discharged from the nozzle 43. In the particular form of the invention illustrated, the choke tube 42 is provided at its outer end with an internal ring 43^a to reduce its passage at that point. An internal radial shoulder 70 is provided in the choke tube at a point adjacent the low pressure chamber 14 to greatly reduce the internal diameter of the inner end of the tube. The reducing ring 43^a and internal shoulder 70 provide a small reduced pressure chamber in the choke tube. The supply line 41 passes the liquid refrigerant from the supply reservoir 11 to the choke tube 42. The line 41 may extend from a point adjacent the bottom of the supply reservoir 11 to the tube 42. The end of the line 41 may discharge into an opening 71 in the wall of the choke tube 42. The inner end portion of the opening 71 is reduced to act as a nozzle for spraying or discharging the refrigerant into the choke tube. The opening 71 is preferably angularly disposed relative to the axis of the choke tube to discharge the liquid inwardly toward the restricting shoulder 70.

The choke 42 is connected with the low pressure chamber 14 by a heat insulating connection 73. The connection 73 may be a tubular part formed of rubber, bakelite, or the like. The connecting member 73 may have an end extending into the inner end of the choke tube 42 and its opposite end discharging through an opening 74 in the wall of the chamber 14. The connection 73 prevents the greatly chilled chamber 14 from contacting with and chilling the choke tube 42 so that the liquid will not freeze in the choke tube. The air drawn into the chamber 14 passes through the tube 42 at a high velocity to draw the liquid through the line 41 and to break it up or atomize it as it discharges from the opening 71. The volatile refrigerant passes from the line 40 into the chamber 14 in an atomized condition where it rapidly evaporates to cool or chill the surrounding parts. A valve 46 may be provided in the supply line 41 to provide for the regulation or adjustment of the mixture of liquid and air.

It is believed that the operation of the device provided by the present invention will be readily apparent from the foregoing detailed description. During operation of the internal combustion engine of the vehicle the suction or reduced pressure created in the engine operates to create a low pressure in the suction line 12, the coil 13, and low pressure chamber 14. The low pressure created in these parts causes air to be drawn through the air line 40 into the low pressure chamber 14. The air passing inwardly through the line 40 and choke tube 42 draws the liquid refrigerant through the line 41 from the supply reservoir 11. The liquid refrigerant discharged through the opening 71 into the choke tube 42 is discharged into the low pressure chamber 14 in an atomized state where it evaporates very rapidly to provide the reduced temperature for chilling the surrounding parts. The cold vaporized refrigerant passes from the chamber 14 through the coil 13 where it operates to absorb heat from within the compartment 31. The vaporized refrigerant passes from the coil 13 through the suction line 12 to the intake manifold 20. In the event that gasoline or other volatile liquids are employed in the device, their discharge into the intake manifold 20 does not materially affect the operation of the engine. The liquid in the container 36 is chilled during operation of the device and aids in keeping the cooling compartment 31 cold after operation of the device has stopped.

From the foregoing description it will be obvious that the cooling coil 13 is in fact a part or continuation of the reduced pressure chamber 14. In fact, the apparatus may be operated with but a single part forming a reduced pressure chamber, that is, it may

be operated with either the coil 13 or the chamber 14 without the other; therefore when I use the term "reduced pressure chamber," unless such term is otherwise modified or limited, I mean to include various elements that may be used in carrying out the invention. For instance, a chamber formed by either the coil 13 or the chamber 14, or both. In practice the shape, size, and construction of the reduced pressure chamber used in any particular case will depend upon the use to which the device is to be put.

Having described only a typical preferred form of my invention, I do not wish to limit myself to the specific details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims:

Having described my invention, I claim:

1. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a suction line communicating with the intake manifold, a chamber in communication with the suction line, and means for discharging an atomized volatile liquid into the chamber.

2. In combination with an internal combustion engine having an intake manifold, a refrigerating device including, a chamber in communication with the intake manifold, and means for supplying an atomized volatile liquid to the chamber.

3. In combination with an internal combustion engine having an intake manifold, a refrigerating device including, a chamber in communication with the intake manifold, and means for discharging an atomized volatile liquid into the chamber, including an air intake for the chamber, an atomizing device in the air intake, and a liquid supply line discharging at the atomizing device.

4. In combination with an internal combustion engine having an intake manifold, a refrigerating device including, a chamber in communication with the intake manifold, and means for discharging an atomized volatile liquid into the chamber including an air intake for the chamber, an atomizing device in the air intake, and means operable by the flow of air through the air intake for supplying a volatile liquid to the atomizing device.

5. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a suction line communicating with the intake manifold, a chamber in communication with the suction line, and means for discharging an atomized volatile liquid into the chamber including an air intake for the chamber and a carburetor in the air intake.

6. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a suction line communicating with the intake manifold, a chamber in communication with the suction line, and means for discharging an atomized volatile liquid into the chamber including an air intake for the chamber, an atomizing device at the air intake, and means for supplying liquid to the atomizing device.

7. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a suction line communicating with the intake manifold, a chamber in communication with the suction line, and means for discharging an atomized volatile liquid into the chamber including an air intake for the chamber, an atomizing device at the air intake, a reservoir, and a supply line from the reservoir discharging at the atomizing device.

8. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a coil communicating with the intake manifold of the engine, a chamber in communication with the coil, and means for passing an atomized volatile liquid into the chamber.

9. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a heat insulated cabinet, a coil in communication with the intake manifold in the cabinet, a chamber in communication with the coil in the cabinet, and means for passing an atomized volatile liquid into the chamber.

10. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a chamber in communication with the intake manifold of the engine, and means operable by the suction from the intake manifold for passing an atomized volatile liquid into the chamber including, an air intake for the chamber having a restricted portion, and a liquid supply line discharging at the restricted portion of the air intake.

11. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a chamber in communication with the intake manifold of the engine, and means operable by the suction from the intake manifold for passing an atomized volatile liquid into the chamber including, an air intake for the chamber having spaced restricted portions, a liquid reservoir, and a supply conduit extending from the reservoir and discharging into the air intake between the restricted portions.

12. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a chamber in communication with the intake manifold of the engine, and means operable by the suction from the intake manifold for passing an atomized volatile liquid into the chamber including, an air intake for the chamber having a restricted portion, a liquid

reservoir, and a supply conduit extending from the reservoir and discharging at the restricted portion of the air intake toward the chamber so that liquid is drawn from the reservoir.

13. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a chamber in communication with the intake manifold of the engine, and means operable by the suction from the intake manifold for passing an atomized volatile liquid into the chamber including, an air intake for the chamber, a restricted choke tube in the air intake, a liquid reservoir, and a conduit from the reservoir discharging in the choke tube toward the chamber.

14. In combination, a vehicle driven by an internal combustion engine, a refrigerator adapted to be driven by the engine of the vehicle including, a reduced pressure chamber in communication with the intake manifold of the engine, an air intake for the chamber, an atomizing device in the air intake, and means for supplying a volatile liquid to the atomizing device.

15. In combination, a vehicle driven by an internal combustion engine, a refrigerator adapted to be driven by the engine of the vehicle including, a reduced pressure chamber in communication with the intake manifold of the engine, an air intake for the chamber, an atomizing device in the air intake, and means operable by the flow of air through the air intake for supplying a volatile liquid to the atomizing device.

16. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a suction line communicating with the intake manifold, a reduced pressure chamber in communication with the suction line, a liquid container mounted in the chamber, and means for discharging an atomized volatile liquid into the chamber.

17. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a suction line communicating with the intake manifold, a reduced pressure chamber in communication with the suction line, a container adapted to hold a liquid for freezing removably mounted on the chamber, and means for discharging an atomized volatile liquid into the chamber.

18. A refrigerating device adapted to be operated by an internal combustion engine having an intake manifold including, a chamber in communication with the intake manifold of the engine, and means operable by the suction from the intake manifold for passing an atomized volatile liquid into the chamber including, an air intake for the chamber, a restricted choke tube in the air intake, a heat insulating tube connecting the choke tube and the chamber, a liquid reservoir, and a conduit from the reservoir discharging in the choke tube toward the chamber.

In witness that I claim the foregoing I have hereunto subscribed my name this 14th day of April, 1930.

NOBLE ECKLES.