May 19, 1931. L. P. BARLOW 1,806,382

VAPOR COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

Filed June 27, 1927 2 Sheets-Sheet 1

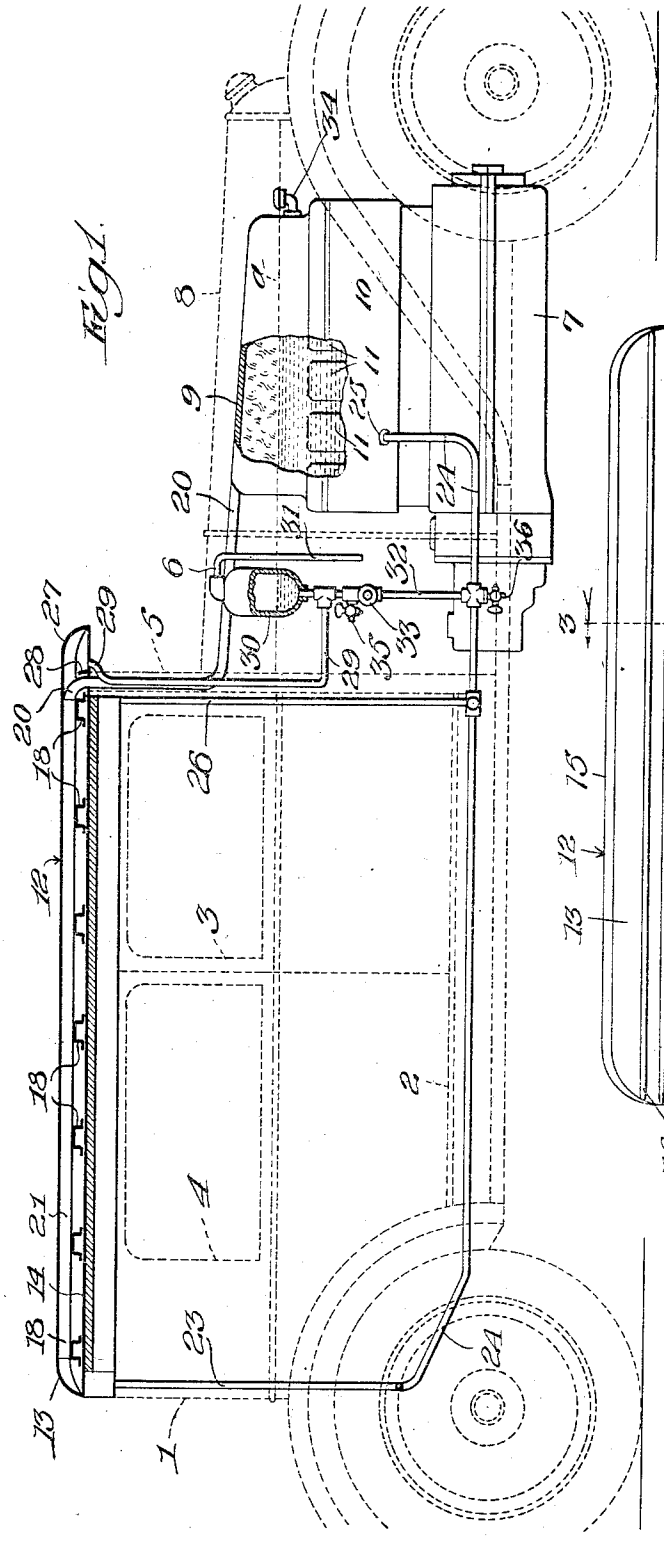

Fig. 1.

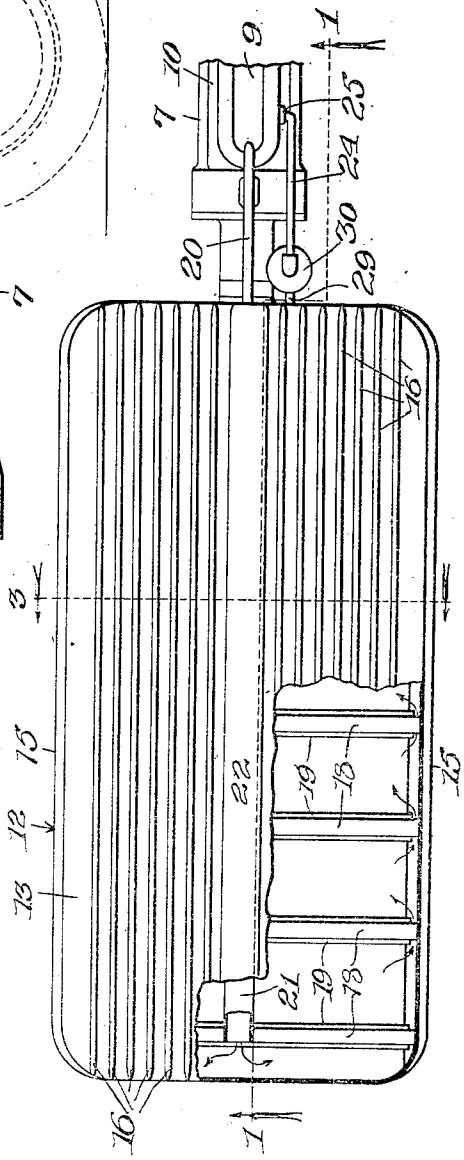

Fig. 2.

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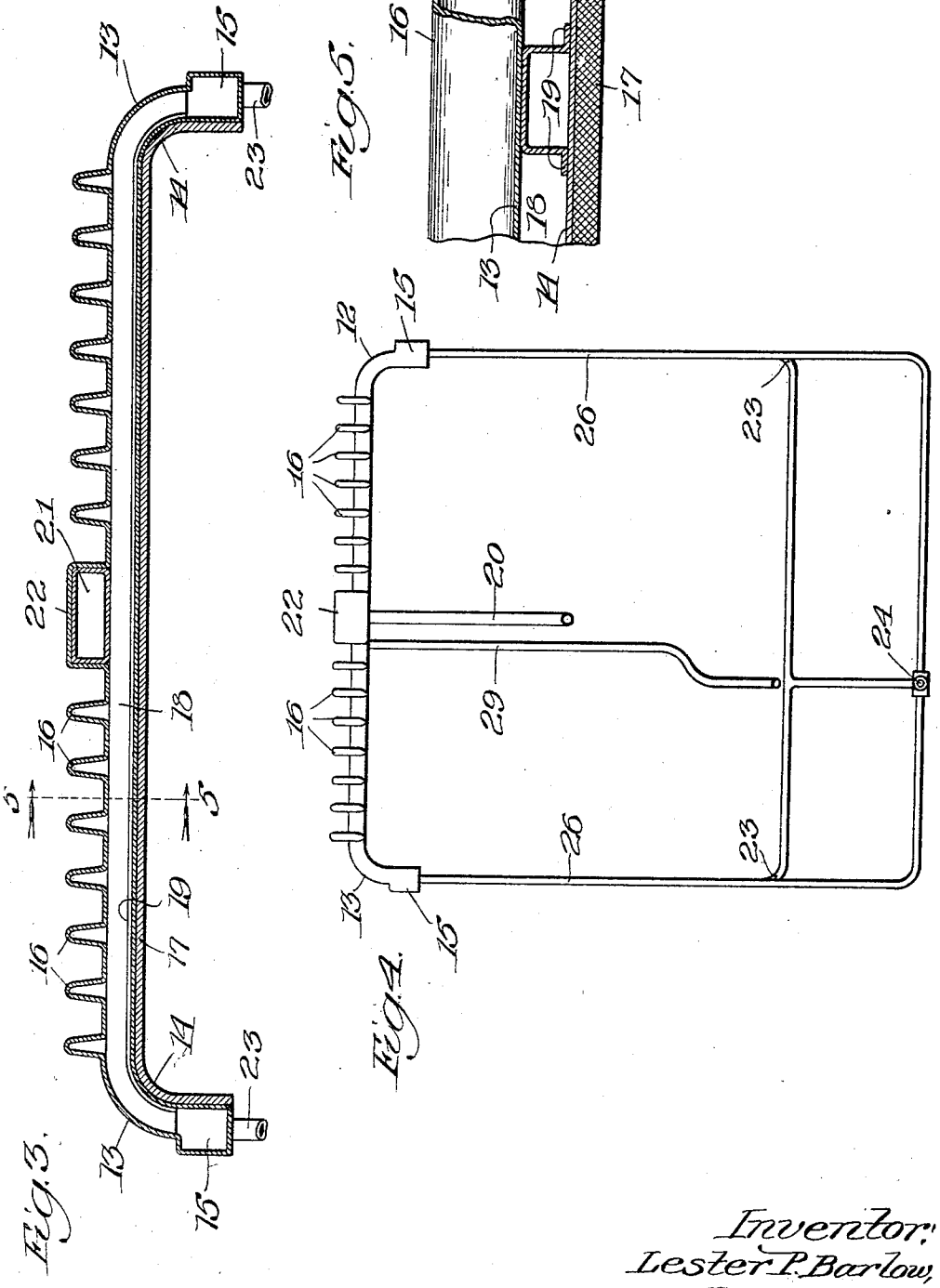

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Patented May 19, 1931 1,806,382

UNITED STATES PATENT OFFICE

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VAPOR COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

Application filed June 27, 1927. Serial No. 201,684.

This invention relates to vapor or steam cooling systems for internal combustion engines, such as are usually employed for driving automobiles, trucks, tractors, aeroplanes, etc.

Heretofore in these systems as designed for automobiles, the condenser for the steam or vapor generated in the cylinder jacket of the engine has been in the form of the customary automobile radiator with its upper and lower tanks and interposed core structure, either cellular or of the fin and tube type as the case may be, and with the radiator mounted in front of the engine in its upright or vertical position with a fan behind the radiator for drawing air therethrough and with a pump driven by the engine for supplying cooling liquids to the cylinder jacket.

One object of my invention is to provide a condenser which will function in a horizontal position above the engine and drain by gravity to the liquid intake of the cylinder jacket, and thus avoid the use of the water circulating pump and its connections to the drive shaft of the engine, as heretofore.

Another object of my invention is to have this condenser exposed to the external air in such way that it will function without the necessity of blowing air over or through it by a fan as heretofore, and thus avoid the use of a fan and its component parts, such as the drive belt, etc.

A further object of my invention is to provide a condenser which may be mounted on the body of the vehicle, and thus enable the engine to be retained in a relatively dust-proof hood and thus eliminate forcing any warm air or exhaust gases or fumes back into the passenger section of the vehicle body to the discomfort of the occupants, as heretofore.

A further object of my invention is to equip the condenser with a drain and vent system which will permit the condenser to be tilted with the vehicle body at extreme angles from the horizontal without flooding or impairing or stopping its function.

A still further object of my invention is to provide a condenser which may form the roof or top of the vehicle body, and thus serve a dual purpose.

The invention consists further in the matters hereinafter described and claimed.

In the accompanying drawings—

Fig. 1 shows the vapor cooling system of my invention applied to an automobile of the closed body type with the condenser forming the roof of the vehicle body;

Fig. 2 is a plan view of the condenser, part of the engine assembly also being shown;

Fig. 3 is an enlarged transverse vertical sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is a view looking at the front of the condenser removed from the body and showing the front and rear sets of drain pipes; and

Fig. 5 is an enlarged vertical sectional view taken on line 5—5 of Fig. 3 to show a detail of construction.

In Fig. 1, I have shown in dotted and full lines a conventional type of automobile having an enclosed two-door or coach body 1 having a floor 2, two front doors 3, rear side windows 4, windshield 5, and cowl 6, as in bodies of this general design. The engine 7 is mounted on the chassis in the usual manner forward of the cowl 6, and is covered by a hood 8 which extends back to the cowl 6, as shown.

The steam or vapor cooling system for the engine 7 includes a dome 9 on top of the cylinder block and opening directly into the liquid jacket 10 thereof about the cylinders 11, 11, as shown. The level for the liquids in the jacket stands in the lower portion of the dome above the cylinders at approximately *a*.

The condenser for the system is indicated by 12, and this, as shown in Fig. 1, is located above the engine 7 in a general horizontal plane. The condenser is made of relatively thin sheet metal, such as copper, brass, or the like, so as to readily radiate heat, and comprises upper and lower plates or walls 13, 14, which are suitably joined to provide a chamber between them which is co-extensive with the horizontal area of the condenser. When forming the top or roof of the vehicle body 1, as shown in Figs. 1 to 3, the condenser 12 is shaped accordingly and extends from front to rear and from side to side of the body, as

illustrated. At the opposite sides of the body, the condenser 12 is curved downward and is enlarged to provide drain channels 15, 15, which extend from front to rear of the body 1.

The metal forming the top wall 13 of the condenser is folded or bent to provide a multiplicity of upstanding ribs 16, 16. These ribs run the full length of the condenser from front to rear of the body 1 and not only increase the heat radiating surface of the condenser but also strengthen it so that it may be strong enough to form the complete roof element of the vehicle body. The ribs 16, as shown in Fig. 3, are hollow; that is, they open downward directly into the chamber of the condenser, and thus vapor may flow up into and along the inside of the ribs so as to be better affected by the cooler external air which flows against the outer surfaces of the condenser and its ribs. The heat given off by the condenser will rise rapidly therefrom and thus create a flow of external air against the surface of the condenser, not only when the vehicle is standing still but also when in motion. At the latter time, this flow of air will be increased, due to the travel of the car. A heat insulating lining 17 covers the under side of the condenser and thus prevents heat from radiating downward into the vehicle body to inconvenience the occupants of the car by having the condenser form the roof thereof.

The condenser 12 will be supported by a suitable underlying framework (not shown) at the top of the body 1 and suitably joined thereto, as in body design. Arranged between the top and bottom plates 13, 14 of the condenser to support them are a number of ribs 18, 18, which extend crosswise of the condenser from one side channel 15 to the other, as shown in Figs. 3 and 4. The ribs 18 are preferably made of pressed metal and are channel shape in cross-section with base flanges 19, 19. The ribs 18 are suitably spaced apart and are disposed with their upper portions against the under side of the upper wall 13 of the condenser and with their base flanges against the lower wall 14 and suitably secured thereto. With the ends of the ribs 18 terminating short of the side channels 15, the sections of the condenser as divided by the ribs are in communication through said channels as well as through the hollow ribs 16 of the top wall 13.

A steam or vapor conveying pipe or conduit 20 leads from the dome 9 to the front end of the condenser 12 and there joins a pipe section 21 which extends along the center of the condenser to a point short of its rear end where it opens into the condenser to discharge steam into the same. The conduit section 21 may be made rectangular in cross-section, as shown in Fig. 3, and the top wall 13 of the condenser is shaped likewise, as at 22, to accommodate it. With the conduit section 21 extending along the center of the condenser, steam will be distributed into the condenser on opposite sides of the conduit when the system is in operation, as indicated by the arrows in Fig. 2.

The drain for the condenser 12 is at its front and rear ends, respectively. The rear drain includes two pipes 23, 23, which open into the channels 15, 15 at the opposite ends of the condenser. These pipes extend to a single pipe 24 which extends down back of the car and then under the floor 2 thereof to the liquid inlet 25 of the engine jacket 10. By so arranging the pipe 24, it does not interfere with the opening and closing of the doors of the car nor with the occupants entering and leaving the same.

The front drain also consists of two pipes 26, 26 which open into the side channels 15, 15 at the front of the condenser. These pipes extend to the pipe 24 and open into the same on the opposite sides thereof. The pipes 26, 26 extend down along the opposite sides of the body 1 before reaching the pipe 24.

The front end 27 of the condenser projects forward of the windshield 5, like a visor, and has an upright partition 28 to prevent condensate draining into the visor. The upper end of the partition 28 terminates at the hollow ribs 16 which cross it, and thus the visor 27 is in communication at all times with the rest of the condenser over the top of the partition. A pipe 29 leads from the visor 27 to a trap 30, which is located well below the visor 27 by being situated under the cowl 6. A pipe 31 has one end connected with the top of the trap 30 and its other end open to the atmosphere so as to vent the condenser 12 through the trap 30 to the atmosphere. The trap 30 serves as a condenser for steam vapors which enter the same from the condenser 12 and returns the condensate collected to the jacket 10 through a pipe 32 which connects the bottom of the trap with the pipe 24. The vent pipe 29 connects with the pipe 32 below the trap, so that any excess vapors carried over from the condenser 12 will be required to pass up through the water in the trap and be condensed. This will prevent and guard against any appreciable loss of liquids from the system through the vent, especially when the engine is under heavy duty. A check valve 33 in the pipe 32 opens under a certain head of liquid in the trap 30 to allow the condensate collected by the trap to return to the jacket 10 from time to time.

The operation of the system is as follows. When first starting the system, liquids are poured into the same through the filler neck 34, which is connected with the steam dome 9. The system is filled with liquids until the top of the neck is reached, this being at the level *a*. While filling the system, the liquids flow into the pipes 24 and 32 from the jacket inlet 25. The pipe 32 fills until blocked by

the check valve 33 in said pipe. The liquid level rises in the upright sections of pipes 23 at the rear of the vehicle body 1 until it reaches an elevation equal to the level *a* in the dome 9. After filling the system, the cap of the filler neck 34 is replaced.

When the engine 7 is started, the liquids in the jacket 10 soon reach the boiling point, as no pump or other means is employed to disturb or circulate liquids through the jacket. When the liquids boil in the jacket, the steam collected in the dome 9 is conveyed therefrom to the condenser 12 through the conduits 20, 21. As the steam enters the condenser, it forces air out of the same through pipes 29, trap 30, and into the atmosphere through the vent pipe 31. As the steam condenses in the condenser 12, the condensate flows into the drain channels 15, 15 at the sides of the condenser and is returned to the jacket through the drain pipes at the end or ends of the condenser, depending on the angle of the body. If the car is standing or traveling with one side lower than another, the channel 15 at the lower side will be likely to receive more condensate than the other channel 15 on the opposite higher side. If both channels are at the same level, the drain will be through both, as the condenser is curved downward on opposite sides toward these channels and the drain will be to both sets of drain pipes. With the drains at both ends of the condenser, the latter will drain even if the body is at an angle extending up or down as when traveling up and down hills.

With the condenser on the roof of the car body and located above the engine, the condenser will drain to the engine by gravity. This makes it unnecessary to use pumps or equivalent means and their component parts for forcing the condensate from the condenser to the engine jacket. Moreover, with the condenser coextensive with the roof of the car body and exposed to the external air, the surface afforded the condenser is sufficient for efficient heat radiating purposes, and fans or blowers to blow air over the condenser are not required. With the condenser so located and the pump and fan eliminated, the engine may be located in a hood which will prevent dust and fumes from the exhaust and inlet conduits being blown back into the car body to the discomfort of the occupants of the car as heretofore.

To completely drain the system when desired, I equip the pipes 24 and 32 with drain cocks 35, 36.

The details of structure shown and described may be variously changed and modified without departing from the spirit and scope of my invention.

I claim as my invention:

1. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser, conduit means connecting the condenser to the jacket and its dome, respectively, for conveying steam from the dome to the condenser and for returning condensate from the condenser to the jacket, and a condensate collecting trap connected with the return conduit between its connections with the condenser and the jacket, said trap extending above and below the normal water level in the jacket and being constantly open to the atmosphere to vent the condenser thereto, said condenser being disposed in a substantially horizontal position at an elevation above the jacket so as to drain condensate thereto by gravity.

2. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming one of the members of the vehicle body, conduit means connecting the condenser to the jacket and its dome, respectively, for conveying steam from the dome to the condenser and for returning condensate from the condenser to the jacket, and a condensate collecting trap connected with the return conduit between its connections with the condenser and the jacket, said trap extending above and below the normal water level in the jacket and being constantly open to the atmosphere to vent the condenser thereto.

3. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser supported on the top of the vehicle in a substantially horizontal position and conforming to the general shape of the roof of the vehicle, conduit means connecting the condenser to the jacket and its dome, respectively, for conveying steam from the dome to the condenser and for returning condensate from the condenser to the jacket, and a condensate collecting trap connected with the return conduit between its connections with the condenser and the jacket, said trap extending above and below the normal water level in the jacket and being constantly open to the atmosphere to vent the condenser thereto.

4. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming the roof of the vehicle, conduit means connecting the condenser to the jacket and its dome, respectively, for conveying steam from the dome to the condenser and for returning condensate from the condenser to the jacket, and a condensate collecting trap connected with the return conduit between its connections with the condenser and the jacket, said trap extending above and below the normal water level in the jacket and being constantly open to the atmosphere to vent the condenser thereto.

5. In a motor vehicle, a vapor cooling sys-

tem for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming the roof of the vehicle and having draining channels at the opposite sides thereof, conduit means connecting the dome with the condenser for conveying steam thereto, conduit means connecting the draining channels with the jacket for conveying condensate from the condenser to the jacket, and a condensate collecting trap connected with the return conduit between its connections with the condenser and the jacket, said trap extending above and below the normal water level in the jacket and being constantly open to the atmosphere to vent the condenser thereto.

6. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming the roof of the vehicle, conduit means connecting the dome with the condenser for conveying steam thereto, two sets of draining conduits connecting the opposite ends of the condenser with the jacket for conveying condensate from either or both ends of the condenser to the jacket, and a condensate collecting trap connected to the drain conduits between the condenser and the jacket, said trap extending above and below the normal water level in the jacket and being constantly open to the atmosphere for venting the condenser thereto.

7. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming the roof of the vehicle and comprising upper and lower sheet metal walls connected to form a steam receiving space between them and coextensive with the roof of the vehicle, a conduit for conveying steam from the dome to the condenser, conduits for draining the condenser to the jacket, and an atmospheric vent for the condenser.

8. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming the roof of the vehicle and consisting of upper and lower connected sheet metal plates with draining channels at the opposite sides of the vehicle and extending the full length of the condenser, supporting ribs extending crosswise of the condenser between its plates and terminating at said channels, a conduit connecting the steam dome with the condenser for supplying steam thereto, conduits connecting said channels to the jacket for draining the condenser thereto, and an atmospheric vent for the condenser.

9. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming the roof of the vehicle and made of upper and lower sheet metal plates connected together, the upper plate being provided with a plurality of upwardly projecting heat radiating ribs, a conduit connecting the dome and the condenser for conveying steam thereto, conduits connecting the condenser with the jacket for draining condensate thereto, and an atmospheric vent for the condenser.

10. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming the roof of the vehicle and consisting of connected upper and lower sheet metal plates formed to provide draining channels at the opposite sides of the condenser, supporting members extending crosswise of the condenser between its plates and terminating short of said channels, the upper plate being folded to provide a plurality of upwardly extending hollow heat radiating ribs extending lengthwise of the vehicle, a conduit connecting the steam dome with the condenser for supplying steam thereto and extending into the condenser between the upper and lower plates and supported by said members, conduits connecting said channels with the jacket for draining condensate thereto, and an atmospheric vent for the condenser.

11. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming the roof of the vehicle and consisting of upper and lower connected sheet metal plates, a conduit connecting the dome with the condenser for supplying steam thereto, conduits connecting the opposite ends of the condenser with the jacket for draining condensate thereto, said draining conduits being so disposed as not to interfere with the opening or closing of the doors of the vehicle body, and an atmospheric vent for the condenser.

12. In a motor vehicle, a vapor cooling system for the vehicle engine, including the cylinder jacket with a steam dome above the same, a condenser forming the roof of the vehicle and consisting of connected upper and lower sheet metal plates spaced part to form a chamber, a conduit connecting the dome with the condenser for conveying steam thereto, a vent chamber in the condenser and partitioned from the rest of the same, drain pipes connecting the condenser from the vent chamber to the jacket for conveying condensate thereto, and a condensate collecting trap connected to the drain pipes and extending above and below the normal water level in the jacket, said trap being constantly open to the atmosphere for venting the condenser thereto.

13. In a vapor cooling system for internal combustion engines, the combination with a cylinder jacket, of a steam dome above the same, a surface condenser normally posi-

tioned in a horizontal plane above said dome, a conduit connecting the condenser at one end with the dome for receiving steam therefrom, conduits connecting the condenser at its opposite ends with the jacket for conveying condensate thereto, and a condensate collecting trap connected to said drain conduits between the condenser and the jacket, said trap extending above the normal level of the water in the jacket and being constantly open to the atmosphere for venting the condenser thereto.

14. A vapor cooling system, consisting of an internal combustion motor and a water jacket and a steam dome, a horizontal condenser connected at one end to the steam dome and a valveless air vent at the other end of the condenser connected to a liquid trap for trapping condensate passing through the vent tube, and drains at both ends of the condenser for conducting condensate back to the jacket.

15. A vapor cooling system, consisting of an internal combustion motor, a water jacket and a steam dome, a horizontal condenser connected at one end to the steam dome, and a valveless air vent at the other end of the condenser connected to a water trap and a non-returnable valve connected between the water trap and the jacket of the engine.

16. A vapor cooling system, including an internal combustion engine, a water jacket and a steam dome and a condenser, said condenser positioned horizontally at the upper part of a closed type automobile passenger body, and an inlet for steam at one end and a trap vent tube at the other end of the condenser leading to the atmosphere and drains from both ends of the condenser for conducting condensate therefrom back to the jacket and a heat insulating material adjacent to the lower side of the condenser.

In testimony whereof I affix my signature.

LESTER P. BARLOW.