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Crain

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[54] **AUXILIARY ENGINE COOLING APPARATUS**

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[52] **U.S. Cl.** **123/41.01,** 62/314, 165/137, 62/304

[51] **Int. Cl.** **F01p 9/04**

[58] **Field of Search** 62/314, 304; 123/41.01; 165/137

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Assistant Examiner—S. J. Richter
Attorney—Spensley et al.

[57] **ABSTRACT**

An improved auxiliary cooling apparatus for vehicle engines. A segregated source of water or suitable fluid is activated after the engine temperature has exceed a predetermined level. The water is emitted upon the radiator of the engine in a manner which is substantially independent of vehicle velocity. A spray member is disposed at a suitable interval from the radiator and at the upper portion thereof. A radial spray is directed downwardly. The initial portion of the spray upon being emitted from the spray member is shielded by a deflection screen. The spray is shielded from the wind velocity until it passes the boundary of the deflector after which it will be directed to substantially all portions of the radiator.

10 Claims, 5 Drawing Figures

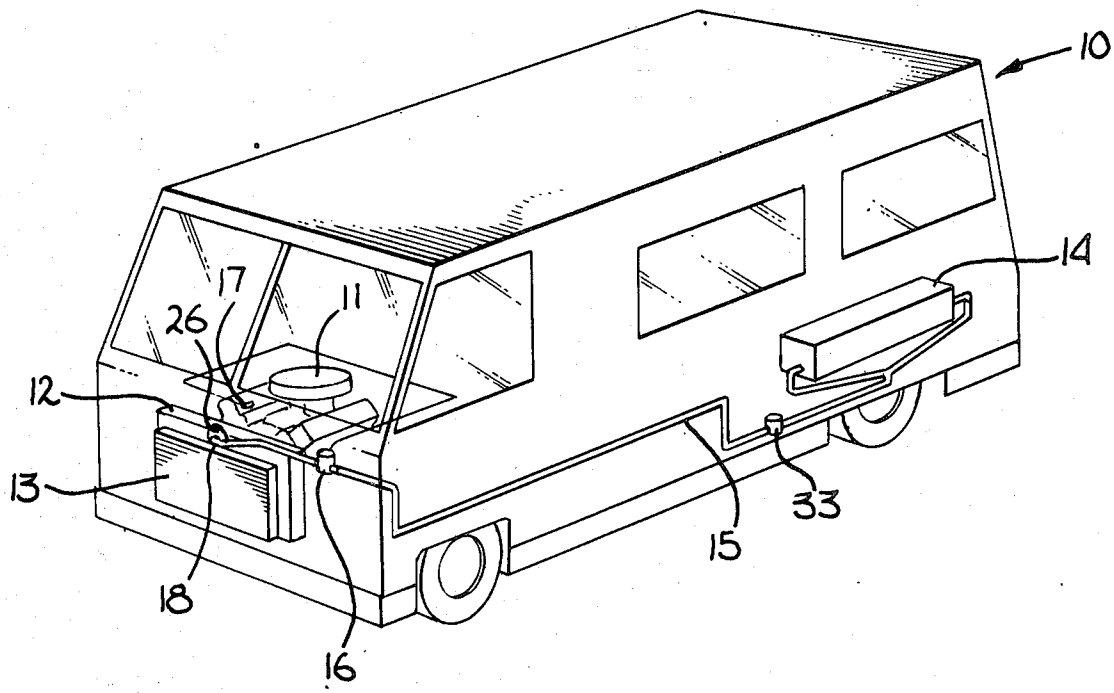
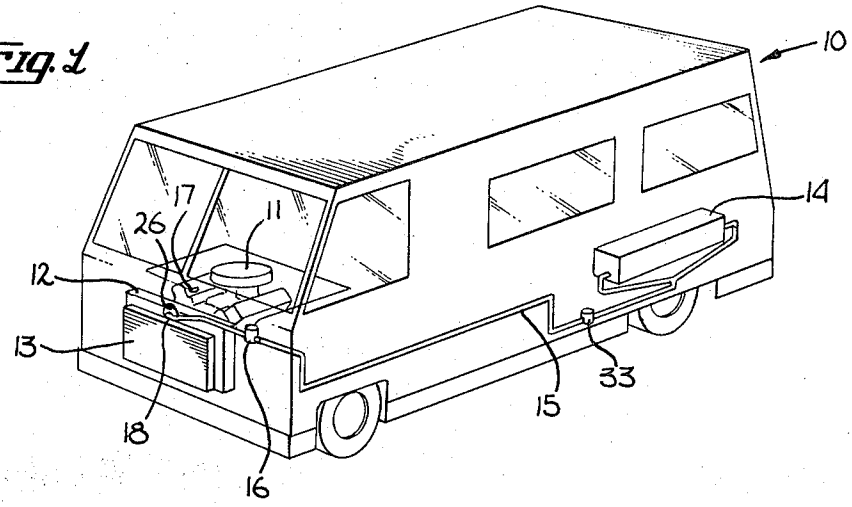


Fig. 1



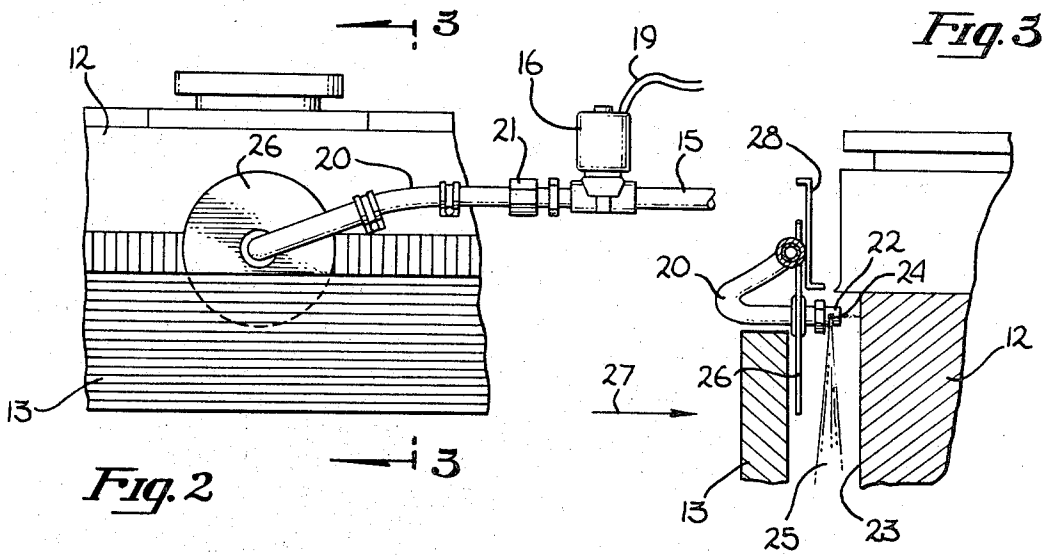


Fig. 2

Fig. 3

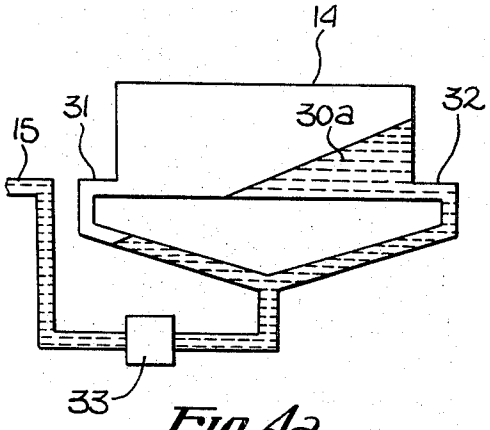


Fig. 4a

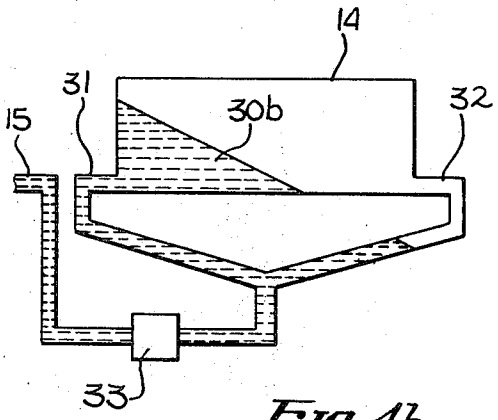


Fig. 4b

AUXILIARY ENGINE COOLING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is generally related to vehicle cooling systems and, more particularly, to those systems used to supplement the internal engine cooling system of the vehicle.

2. Prior Art

The increased use of vehicles employing engines having high horsepower ratings and also utilizing load producing options have placed an increased stress on the need for auxiliary systems to supplement the cooling of the engines. In addition to the options which are supplied or built into the vehicle such as air conditioning units, the load produced on an engine by pulling trailers, boats or other recreational vehicles places large cooling demands on the engine which cannot be met by the internal cooling system of the engine. There are many devices disclosed by the prior art for providing an auxiliary cooling system. The most common types of systems disclosed by the prior art have a water supply under pressure which can be manually activated. Upon activation, a pressure feed or an external pump moves the cooling fluid, typically being water, to a spray nozzle which is intended to dispose the cooling fluid upon the radiator surface.

The basic device described by the prior art has various options which have served to expand the capability yet still leaves major deficiencies. One of the optional features which can be provided is a temperature sensing switch which allows the auxiliary cooling apparatus to be activated automatically upon detecting a predetermined temperature level of the vehicle engine. In a like manner, after the engine temperature has decreased below the detected temperature, the system would be deactivated. Other options include pressurizing the auxiliary cooling source to eliminate the necessity of a pump or other external moving equipment.

The devices disclosed by the prior art all exhibit several basic deficiencies which are substantially overcome by the present invention. The typical application for an auxiliary cooling system arises where the condenser of an air conditioning unit is placed ahead of the engine radiator, the interval between the condenser and the radiator leaving little room for the addition of an auxiliary spray head. The devices disclosed by the prior art have taken substantially no care in the design of the spray head and therefore requiring that the installation of the spray head be approximately at the center of the radiator in order to provide the intended cooling. Since the air conditioning condenser substantially restricts the available space, the devices disclosed by the prior art cannot be properly mounted and therefore disposition of the cooling fluid is poor at best.

Another deficiency in the devices disclosed by the prior art concerns the auxiliary water source. A moving vehicle presents certain obstacles to a delivery system which is not generally experienced during normal operation because the delivery system must be operational during travel. As the vehicle moves, the water in the auxiliary tank will tend to move from side to side from the basic inertial effect of the moving vehicle and coolant. As the water moves from front to back or side to side, air bubbles can form in the lead line and air-lock the system where an external pump is used to move the cooling water from the auxiliary tank to the spray location.

The present invention substantially overcomes the deficiencies existing in the devices disclosed by the prior art. To compensate for the lack of usable area in the engine compartment, the spray head used with the present invention has been designed to allow it to be disposed substantially adjacent the upper region of the vehicle radiator and still provide for the disposition of the cooling spray to substantially all portions of the radiator surface. In addition, the auxiliary water source is provided with multiple outlets to eliminate any problems due to movement of the cooling fluid within the tank.

SUMMARY OF THE INVENTION

The present invention comprises an auxiliary engine cooling system which is used to provide an auxiliary source of water to the vehicle engine radiator upon detecting excessive engine temperatures. The present invention utilizes a segregated water source to provide the cooling fluid necessary for carrying out the function of the present invention. A temperature controller is used to detect excessive engine temperature and initiate the operation of the present invention. To obtain proper cooling characteristics, it is essential that the temperature controller operate in a manner which is similar to a magnetic hystersis loop. This property permits restoration of a significant operating margin to the vehicle after it has reached an unsafe engine temperature. When the temperature of the engine reaches a predetermined point which requires auxiliary cooling, the auxiliary cooling system will be operated until there is a significant temperature differential. This is typically selected as a drop of 15° F. Although a 15° F interval is desirable, the scope of the present invention encompasses other suitable temperature intervals. The temperature differential provides a margin to operate above the lower limit of the temperature controller and thereby overcome loading caused by increased loads without the need for immediate action of the present invention. Failure to use such a temperature controller would cause excessive water usage, higher operating temperatures and allow no margin to overcome relatively small temperature increases without the necessity of spray action.

Upon detecting the proper engine temperature, water is caused to flow from the auxiliary water storage tank to the spraying apparatus. The spray apparatus substantially improves the operability, results and ease of installation when comparing same to the devices disclosed by the prior art. The nozzle of the spray apparatus is disposed at a predetermined interval from the radiator of the engine and is placed substantially near the upper region of the radiator. The nozzle directs a radial spray downwardly rather than directly at the radiator itself. A deflection member is placed in advance of the spray nozzle to eliminate the deflection of the spray as it immediately leaves the nozzle. In the absense of such a deflector, wind velocities would immediately deflect the spray toward the radiator thereby substantially limiting the area of the radiator which is contacted by the auxiliary cooling fluid. When water is emitted from the spray nozzle in conjunction with the deflecting member, the radially moving droplets of auxiliary cooling fluid will have the opportunity to be dispersed outwardly and downwardly from the nozzle without being

deflected by the air stream. By the time the droplets have passed the boundaries of the deflector, they will take a substantially ballistic path and contact greater areas of the radiator surface than have heretofore been achieved by the devices disclosed in the prior art.

It is therefore an object of the present invention to provide an improved auxiliary engine cooling apparatus.

It is another object of the present invention to provide an auxiliary cooling apparatus which can cool substantially all portions of the radiator surface of the subject vehicle.

It is still another object of the present invention to provide an improved auxiliary engine cooling apparatus which provides greater efficiency of operation by utilizing preset temperature margins.

It is yet another object of the present invention to provide an improved auxiliary engine cooling apparatus which is simple to install and easy to fabricate.

The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objectives and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawing in which a presently preferred embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for the purpose of illustration and description only, and is not intended as a definition of the limits of the invention.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a recreational vehicle equipped with an auxiliary engine cooling system in accordance with the present invention.

FIG. 2 is a front elevation view of the placement of the spray head and deflection member in accordance with the present invention.

FIG. 3 is a partial cross-sectional view of the vehicle radiator, air conditioning condenser and spray head assembly taken through line 3—3 of FIG. 2.

FIG. 4*a* and FIG. 4*b* are schematic views of the auxiliary water storage tank in accordance with the present invention.

DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENT

An understanding of the present invention can be best gained by reference to FIG. 1 wherein a perspective view of a recreational vehicle using the present invention is shown, the vehicle being generally designated by the reference numeral **10**. Recreational vehicle **10** typically represents camper units or other similar vehicles which are in frequent use at the present time. Although camper unit **10** is used for the purpose of example, it is only representative of a class of vehicles or factors which will impose extraordinary loads upon the vehicle engine thereby causing overheating problems. Typical of the factors which could produce the stated deleterious results are air conditioning units or other vehicle options which are driven by the vehicle engine. In addition to the particular vehicle or load factors imposed on the engine, the present invention eliminates the overheating problems caused by pulling trailers or other loads which are external to the vehicle.

Referring now to FIG. **1**, vehicle **10** is shown with engine **11** having radiator **12** in the conventional position. In addition, vehicle **10** is shown supplied with an air conditioning unit as evidenced by air conditioning condenser **13**. Air conditioning condenser **13** is conventionally disposed in front of radiator unit **12**, the interval between radiator **12** and air conditioning condenser **13** being restricted.

Vehicle **10** is provided with auxiliary cooling storage unit **14** which is employed by the present invention. Coolant delivery tube **15** is coupled to auxiliary coolant storage unit **14** and delivers the coolant from storage unit **14** through solenoid control valve **16**. Solenoid control valve **16** is activated by temperature controller **17** which is used to detect the selected temperature differential of engine **11** and activates solenoid control valve **16** when the preselected temperature is surpassed and deactivates solenoid control valve **16** after the proper temperature drop has been achieved. The coolant supplied by delivery tube **15** is transferred by solenoid control valve **16** from delivery tube **15** to spray head assembly **18** which is disposed intermediate radiator **12** and air conditioning condenser **13**. Solenoid control valve **16** is a conventional electrically operated valve for controlling the passage of fluids.

Although the preferred embodiment of the present invention utilizes an automatic temperature controller which initiates action of solenoid control valve **16** automatically, it is obviously within the scope of the present invention to use manual activation of solenoid control valve **16**. Temperature controller **17** operates over a quasi-hysteresis loop to prevent unnecessary use of the auxiliary coolant as well as provide a margin of operation which will not require spray action. When the temperature of engine **11** reaches a predetermined unsafe temperature, operation of the present invention is initiated by activating solenoid control valve **16**. After the temperature of engine **11** has decreased by the preferred differential of 15° F, solenoid control valve **16** will be deactivated. The output of temperature controller **17** will not reactivate solenoid control valve **16** until the selected temperature is reached thereby providing for the operating margin described above.

Referring now to FIG. **2** and FIG. **3**, an understanding of the present invention auxiliary engine cooling apparatus can be best gained. Coolant delivered to delivery tube **15** is input to solenoid control valve **16** as mentioned above. Solenoid control valve **16** is activated and deactivated electrically by the output of temperature controller **17** via leads **19**. The output of solenoid control valve **16** is coupled to cooling line **20** by conventional coupling **21**, the output of coolant line **20** being coupled to spray head **22** as shown in FIG. **3**.

Referring to FIG. **3**, spray head **22** is disposed intermediate radiator **12** and air conditioning condenser **13** and is substantially in the vicinity of the uppermost portion of surface **23** of radiator **12**. As stated previously, one of the difficulties encountered by the devices disclosed in the prior art was the extreme difficulty encountered in mechanically mounting a spray head intermediate an air conditioning condenser and radiator unit. In the present invention, spray head **22** is to be mounted at the uppermost portion of raidator **12** and therefore does not encounter the stated difficulties. The typical interval between air conditioning condenser **13** and surface **23** of radiator **12** is approximately 1 to 1 ½ inches. The preferred embodiment of the present invention provides for mounting spray head **22** approximately intermediate air conditioning con-

denser 13 and surface 23 to maximize distribution of the auxiliary coolant.

Spray head 22 utilizes a substantially semi-circular nozzle orifice 24 for emitting the auxiliary coolant. Orifice 24 is spaced from radiator 12 by a distance within the range of ½ to 1. Auxiliary coolant is supplied at spray head 22 at a pressure of a least 15 psig. Coolant 25 is emitted from orifice 24 in a substantially sheet-like form. As mentioned previously, one of the difficulties with the devices disclosed in the prior art was the inability to deal with high air stream velocities. To eliminate this problem, deflection member 26 is disposed about coolant tube 20 intermediate spray head 22 and air conditioning condenser 13 and opposite radiator 12. Although the preferred embodiment of the present invention utilizes a circular, flat construction for deflection member 26, the scope of the present invention is broad enough to encompass similar structures.

Deflection member 26 prevents the air stream represented by arrow 27 from deflecting the sheet-like spray of coolant 25 immediately after it exits from orifice 24. If air stream 27 was able to deflect coolant stream 25 immediately upon exiting orifice 24, only a small portion of surface 23 of radiator 12 would come in contact with coolant stream 25. Deflection member 26 shields coolant spray 25 for approximately 1 inch after it leaves orifice 24. At a distance of approximately 1 inch from orifice 24, spray stream 25 will break up into high velocity water droplets which will travel along conventional ballistic trajectories. The high velocity air stream represented by arrow 27 will not affect coolant stream 25 after it has broken up into the droplet form as it would have in the absence of deflection member 26. After coolant stream 25 passes the outer edge of deflection member 26, the force of air stream 27 will deflect stream 25 in a manner which will maximize the cooling effect since the high velocity water droplets will reach a much larger area of surface 23 of radiator 12. One of the objectives of the present invention was ease of installation. As can be seen from FIG. 2 and FIG. 3, spray head 22 is disposed at the top portion of surface 23 and therefore can be easily clamped to conventional existing brackets 28 present in substantially all vehicles.

As described previously, one of the problems encountered by the devices disclosed in the prior art was the possibility of producing an air-lock condition where external pumps were used to transfer auxiliary coolant from an auxiliary storage tank to the spraying apparatus. Referring now to FIG. 4*a* and FIG. 4*b*, a better understanding of the manner in which the present invention solves this problem can be best gained. FIG. 4*a* and FIG. 4*b* schematically depict auxiliary coolant storage tank 14 (FIG. 1) having an amount of coolant therein which is less than the total capacity of the tank 14. The alternative use shown in FIG. 4*a* and FIG. 4*b* illustrate motion of fluid contained within tank 14 in alternate positions, the body of fluid within tank 14 being generally designated by the reference numerals 30*a* (FIG. 4*a*) and 30*b* (FIG. 4*b*). As vehicle 10 moves in a normal manner, the coolant stored in tank 14 will move within the confines of tank 14 under the influence of conventional inertial effects. As can be schematically seen in FIG. 4*a* and FIG. 4*b*, coolant 30*a* and 30*b* will typically move from front to back of tank 14 during motion of vehicle 10. The present invention auxiliary engine cooling apparatus utilizes a feed system from tank 14 which substantially eliminates the potential problem of air-locking a pump.

The present invention utilizes a storage tank 14 having a multiple feed system. Referring to FIG. 4*a* and FIG. 4*b*, egress tubes 31 and 32 are coupled to tank 14 to provide an outlet for fluid 30*a* and 30*b* irrespective of the relative position of the coolant within tank 14. When coolant 30*a* is in the position shown in FIG. 4*a*, typically as a result of vehicle accelleration, coolant 30*a* will exit tank 14 at egress tube 32. This can be seen by the contiguous flow of coolant 30*a* from tank 14 to pump 33. When coolant 30*b* is in the position shown in FIG. 4*b*, the coolant will exit tank 14 at egress tube 31. This again is shown by the contiguous disposition of coolant 30*b* from tank 14 to pump 33. In either of the cases schematically depicted in FIG. 4*a* and FIG. 4*b*, pump 33 will have a constant source of coolant and therefore not be subject to the air-lock problem inherent in the devices disclosed by the prior art. Although the preferred embodiment of the present invention utilizes a pump for providing a pressure head of coolant at spray head 22, the scope of the present invention is broad enough to utilize a pressurized auxiliary storage unit.

The present invention constitutes an auxiliary engine cooling apparatus which is substantially improved over those devices disclosed in the prior art. By combining a coolant source which will provide a constant supply of coolant, such as water, the intermittent difficulties encountered by prior art devices would be eliminated. In addition, the ability to easily construct and install the spray head and the deflection member at an easily located position while allowing full coverage of the radiator surface constitutes a substantial improvement in operation, simplicity of installation and fabrication.

I claim:

1. An auxiliary engine cooling apparatus for use with a vehicle having an engine including a vertically mounted cooling radiator comprising:
   - *a.* an auxiliary coolant storage tank, said auxiliary coolant storage tank having means for storing a source of coolant;
   - *b.* a spray member disposed substantially adjacent the upper portion of the radiator;
   - *c.* deflection means for shielding said spray member from a high velocity air stream, said deflection means being coupled in cooperative relationship to said spray member opposite the radiator;
   - *d.* a solenoid control valve being coupled to said auxiliary coolant storage tank and said spray member, said solenoid control valve coupling said auxiliary coolant storage tank and said spray member upon being activated; and
   - *e.* temperature control means for activating said solenoid control valve, said temperature control means being adjacent the engine and connected to said solenoid control valve whereby said solenoid control valve is activated and deactivated over a predetermined engine temperature margin.

2. An auxiliary engine cooling apparatus as defined in claim 1 wherein said spray member includes a nozzle having a downwardly directed semicircular aperture therein being substantially parallel to the radiator whereby the coolant is downwardly dispersed in a radial spray.

3. An auxiliary engine cooling apparatus as defined in claim 2 wherein said semicircular aperture is sepa-

rated from said radiator by an interval in the range of ½ to 1 inch.

4. An auxiliary engine cooling apparatus as defined in claim **1** wherein said deflection means comprises a flat member being substantially parallel to the radiator and having a portion which extends vertically downwardly from said spray head and spaced from said spray head whereby the coolant emitted from said spray head is shielded.

5. An auxiliary engine cooling apparatus as defined in claim **4** wherein said portion extends downwardly approximately 1 inch from said spray head.

6. An auxiliary engine cooling apparatus as defined in claim **1** wherein the coupling between said solenoid control valve and said storage tank comprises a plurality of egress tubes, one end of each of said egress tubes being coupled to said storage tank, the other end of each of said egress tubes being coupled to each other forming a common connection, means for providing a pressure head of coolant at said spray head coupled to said egress tubes at the common connection thereof, and a delivery tube coupled to said means for providing a pressure head and said solenoid control valve.

7. An auxiliary engine cooling apparatus as defined in claim **1** wherein said temperature control means deactivates said solenoid control valve only after the engine temperature decreases 15° F.

8. An auxiliary engine cooling apparatus for use with a vehicle having an engine including a vertically mounted cooling radiator comprising:

a. an auxiliary water storage tank, said auxiliary water storage tank having means for storing a source of water;

b. a plurality of egress tubes, one end of each egress tube being coupled to said auxiliary water storage tank, the other end of each of said egress tubes being coupled to each other forming a common connection;

c. a spray member disposed substantially adjacent the upper portion of the radiator, said spray member including a nozzle having a downwardly directed semicircular aperture therein being substantially parallel to said radiator whereby the water is downwardly dispersed in a radial spray;

d. a deflection member coupled to cooperative relationship to said spray member opposite the radiator for shielding said spray member from a high velocity air stream, said deflection member comprising a substantially flat member substantially parallel to the radiator and having a portion which extends vertically downwardly from said spray head approximately 1 inch;

e. means for providing a pressure head of water at said spray head, said means for providing a pressure head coupled to the common connection of said plurality of egress tubes;

f. a solenoid control valve coupled to said means for providing a pressure head and to said spray member, said solenoid control valve coupling said means for providing a pressure head and said spray member to one another upon being activated; and

g. temperature control means for activating said solenoid control valve, said temperature control means being adjacent the engine and connected to said solenoid control valve whereby said solenoid control valve is activated and deactivated over a predetermined engine temperature margin.

9. An auxiliary engine cooling apparatus as defined in claim **8** wherein said semicircular aperture is separated from the radiator by an interval in the range of one-half inch to one inch.

10. An auxiliary engine cooling apparatus as defined in claim **8** wherein said temperature control means deactivates said solenoid control valve only after the engine temperature decreases 15° F.

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