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LIQUID REPLENISHING SYSTEM

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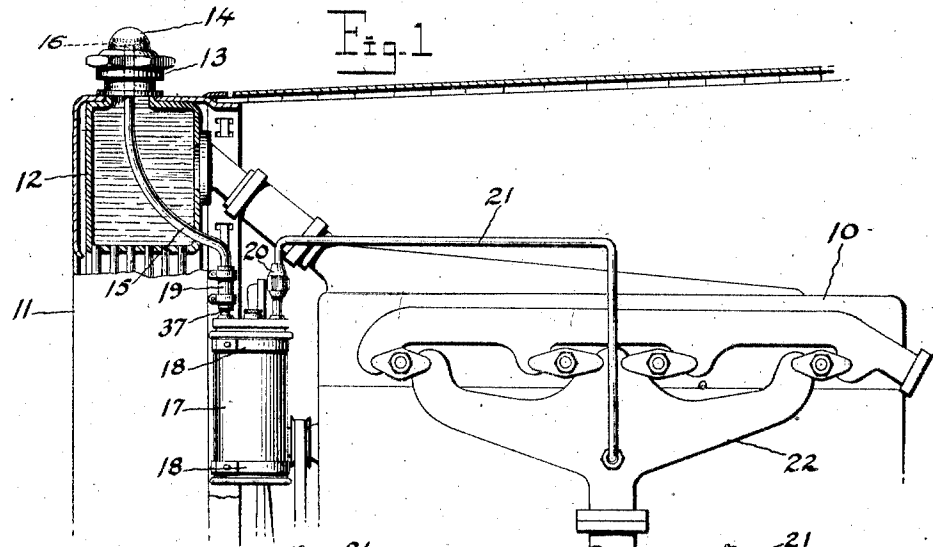
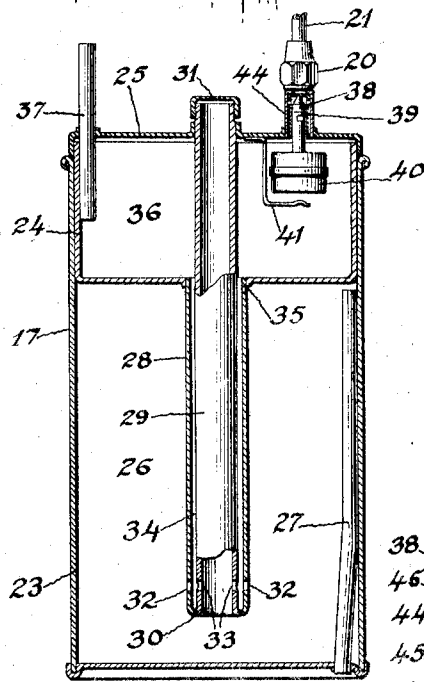


Fig. 2

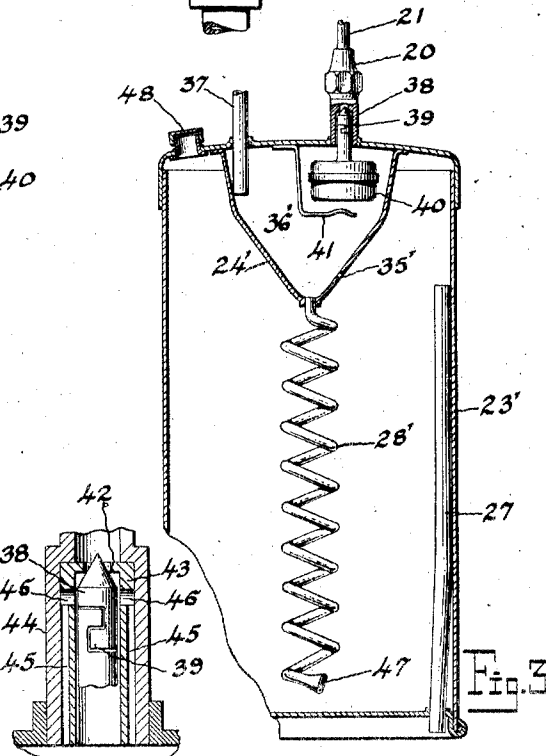


Fig. 3

Fig. 4

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LIQUID-REPLENISHING SYSTEM.

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The invention relates to liquid replenishing systems adapted for use in maintaining the desired level of cooling liquid in the radiators of internal combustion engines or in like relationships, and is more especially concerned with a system applicable to motor vehicles and adapted to supply liquid from a reserve tank to the usual motor vehicle radiator.

10 The principal object of the invention is to provide a liquid supply system including a connection from the radiator to a source of sub-atmospheric pressure, such, for example, as the engine intake, a single conduit 15 serving both as means for exhausting air from the radiator and for supplying liquid thereto.

A further object is to provide an improved reserve supply system applicable to cooling 20 systems and the like and adapted to condense vapors of water or other cooling liquids and return the condensate to the cooling system.

Other objects and advantages will appear 25 from the following description taken in connection with the accompanying drawings, in which—

Fig. 1 is a side elevation partly in section showing one embodiment of the invention applied to a conventional motor vehicle power plant;

Fig. 2 is a vertical sectional view of the reserve tank forming part of the system shown in Fig. 1;

35 Fig. 3 is a similar view showing a modified form of tank; and

Fig. 4 is an enlarged sectional view showing the valve of Fig. 2.

Referring to the drawings, 10 indicates an internal combustion engine provided with any usual or suitable form of cooling system employing a cooling liquid. The cooling system as shown includes a radiator 11 having an upper header 12 serving as a container for cooling liquid. The radiator is 45 provided with the usual filling opening at the upper portion thereof, which opening is closed by the cap 13. The cap is preferably provided with a transparent portion 14 50 through which the cooling liquid may be observed from the driver's station of the motor vehicle.

A pipe 15, which may be the usual overflow pipe provided in connection with radiators of the type shown, extends from a 55 point near the top of the header 12 to the

exterior of the header. If it be desired to maintain the level of liquid within the header during at least a portion of the time at a point within the transparent portion 14, 60 the pipe 15 may be extended as at 16 to a point within the said transparent portion.

In order to provide a reserve supply for the cooling liquid in the radiator, a reserve tank 17 is mounted in any convenient location 65 with reference to the engine power plant. The means for supporting this tank will be varied in accordance with the type of engine or the location of the tank. As shown, the tank is supported by brackets 18 70 adjacent to the rear of the radiator, which position renders it possible both to make the pipe connection to the radiator relatively short and to dispose such connection at an angle facilitating drainage. The form of 75 the tank may also be widely varied, although I prefer, for convenience in manufacture and assembly, the vertical cylindrical form illustrated. Suitable pipe fittings on the top of the tank, as at 19 and 20, afford means for 80 connecting the tank respectively to the pipe 15 and to the pipe 21, which latter extends to, and connects with the interior of, the engine intake manifold 22.

The reserve tank 17, as shown in detail 85 in Fig. 2, comprises a lower receptacle 23 which is open at the top and an upper receptacle 24 having a cover 25 suitably secured thereon. The receptacle 24 preferably fits into the open upper end of the receptacle 23, thus providing a cover for the latter. 90 The space 26 within the lower receptacle constitutes a reserve supply chamber which will ordinarily be filled with liquid of the same character as that utilized in the cooling system. An overflow pipe 27 limits the 95 height to which the chamber 26 may be filled and provides an exit to the atmosphere for the entire system.

A tube 28 is secured in an aperture in the bottom of the receptacle 24 and extends 100 downwardly to a point near the bottom of the chamber 26. A second tube 29, concentric with the first, is secured in the cover 25 and may be attached at its lower end to the outer tube 28, as at 30. The tube 29 should 105 extend above the cover 25 to provide a filling opening for the chamber 26, and may be closed as by the screw cap 31. Openings 32, 33 through the walls of the outer and inner tubes respectively permit flow of liquid 110 between the chamber 26 and the annular

space 34 between the two tubes. A vent 35 may also be provided in the wall of the tube 28 above the level of the upper end of the overflow pipe 27.

5 The interior of the receptacle 24 constitutes a suction chamber 36 which may be subjected to sub-atmospheric pressure by reason of the connection to the engine intake manifold through the pipe 21. This
10 chamber also communicates through a tube 37, fitting 19, and pipe 15 with the interior of the cooling liquid container or radiator, thereby enabling the same air pressure to be produced in the top of the radiator as exists
15 in the chamber 36. The communication of the chamber 36 with the engine intake is controlled by a valve 38 connected by a hooked or universal joint at 39 to the stem of a float 40 situated within the chamber
20 36. A bracket 41 serves to limit the downward movement of the float.

The valve, which may be of the ordinary needle valve type, is arranged to cooperate with a seat 42 formed preferably, as shown
25 in Fig. 4, in a sleeve member 43 suitably mounted in the pipe 44 leading from the receptacle 24 to the pipe fitting 20. The valve and the stem of the float fit loosely within the sleeve 43 to permit air to flow through
30 the passage within the sleeve. In order to modify the piston action of the valve, grooves 45 may be provided on the exterior of the sleeve, which grooves communicate by apertures 46 with the passage adjacent
35 to the valve seat. By suitably proportioning the air passages and the weight of the movable parts, the valve may be caused to close when the pressure in the intake passages is lowered to a predetermined extent
40 below that in the suction chamber.

The pipe 37 extends into the chamber 36 to a point below the float 40 so that when the valve 38 has been closed by the movement of the float in response to the rise of liquid in
45 the chamber 36, the lower end of the pipe 37 will be immersed in liquid. It will be noted that the communication between the chambers 26 and 36 through apertures 32, 33 and annular passage 34 is restricted so
50 that liquid will flow more or less slowly from the lower chamber to the upper one under the influence of suction in the latter. By this means a time element is introduced which permits the evacuation of chamber 36
55 and of the air space within the container 12 before liquid rises in the chamber 36 to such an extent as to interrupt the connection to the suction line.

In the modified form shown in Fig. 3, the
60 suction chamber 36' is formed within the walls of a conical receptacle 24' attached to the underside of the cover of the outer receptacle 23'. A tube 28' extends from the receptacle 24' to a point near the bottom of
65 the outer receptacle. The tube may be bent

or coiled, as shown, or the end may be flattened, as indicated at 47, or both expedients may be adopted to provide means for restricting the flow from the outer receptacle to the suction chamber. Other expedients
70 for reducing the rate of flow between the two chambers may, of course, be used if desired. A vent 35' may be provided, as in the form first described, at a point above the upper
75 end of the overflow pipe 27. With this form of tank a filling aperture is provided at 48 between the inner and outer receptacles.

The operation is as follows:

The radiator and reserve tank having been filled either through the filling opening at
80 13 alone or through that opening and the opening at 31 or 48, and the engine being set in operation, suction will be exerted thereby in the pipes 15 and 21 and the suction chamber 36 or 36', and air will flow from
85 the chamber and from the space in the radiator above the end of the overflow pipe. As a result of the partial vacuum thus produced, liquid will rise in the annular passage 34 or in the pipe 28', the rate of flow being slow
90 by reason of the restriction afforded by the form and size of pipe 28' or by the small openings at 32 and 33. With the means referred to last the flow inward is rendered even slower than flow outward by reason of
95 the arrangement of opposite openings which permit two streams to enter toward each other, thus interfering with the freedom of flow.

The suction valve is designed to close
100 whenever the pressure difference upon the two sides reaches the amount predetermined by the proportioning of the weight and dimensions of the valve 38 and the weight of the float. However, if such closing should
105 not take place earlier, it will at least occur when the liquid rises in the suction chamber to a height sufficient to lift the float, thus insuring that liquid shall not be drawn into the intake passages of the engine. In
110 either case, after the valve is closed, liquid will continue to rise in the chamber 36 and the radiator pipe 15 until equilibrium has been established, the vacuum produced being normally sufficient to cause some of
115 the liquid to be discharged into the radiator. If the liquid reaches such height as to lift the float, and if no vent is provided, conditions will remain stabilized until the level of liquid falls, as by discharge of gas or vapor
120 from the radiator as the latter becomes heated or by other conditions permitting rise of pressure in the suction chamber, whereupon the operation will be repeated as soon as the suction in the engine intake
125 is sufficiently low to permit the valve to open. If the frequency of operation under such conditions is insufficient normally to cause replenishing of the liquid in question, or if for any other reason it is desirable
130

to increase the frequency of operation, this result may be obtained by providing the vent 35 or 35', the size of the opening being such as to permit the air to enter as slowly as may be desired. The rate of entry of air may be reduced by locating the vent, as shown, so that it will be covered by liquid as soon as the latter flows into the suction chamber. The air admitted to the suction chamber through the vent relieves the vacuum and permits the liquid to fall within a relatively short time, thus insuring more frequent repetition of the cycles of operation. This will be of advantage not only for the purpose of quickly filling the radiator should a single cycle be insufficient to result in complete filling, but for the purpose of giving an indication of satisfactory working condition of the system, since the successive discharges are visible through the transparent radiator cap. In order to conserve the liquid, however, especially when non-freezing mixtures are in use, it is desirable to limit the frequency of operation to that required for replenishing the liquid lost from the radiator.

If it is desired to maintain a more or less permanent indication of the level of liquid in the radiator, the pipe 15 may be extended, as indicated on the drawing, to a point within the transparent cap. The normal level of liquid after the apparatus described has operated to completely fill the radiator, or after filling to such a point that expansion will cause rise of the liquid to the overflow level, will then lie within the cap and will give a very clear indication, readily visible from the driver's station in a motor vehicle, as to the functioning of the supply system, the occurrence of ebullition, etc.

Expansion of the liquid in the cooling system may take place to any extent necessary, overflow being permitted through the pipe 15 into the suction chamber and thence into the reserve tank and out through overflow pipe 27. It will be seen that any vapors discharged from the radiator will traverse the pipe 15, the annular passage 34, or the tube 28', and finally bubble up through the liquid in the reserve tank before being permitted to escape from the system. The apparatus therefore provides an efficient condenser for steam or other vapors, retaining the condensate and returning it to the cooling system, which feature is especially desirable when a volatile non-freezing solution is employed in the system.

The weight and dimensions of the valve parts are so proportioned that the valve will close by air friction and remain closed when suction in the intake passage is relatively high, as when the throttle valve is nearly closed, thus preventing flow of air into the intake under idling conditions should the reserve tank become empty. Preferably the

proportions are such that the valve will remain closed during the greater part of the normal operation of the engine, particularly when a volatile mixture is being utilized as a cooling liquid, so that the loss of vapor by flow into the intake manifold may be reduced to a minimum. Variations in operating conditions, acceleration, etc., which will permit the valve to open for a short time will occur normally, however, with sufficient frequency to replenish easily the liquid in the radiator. I have found that, in ordinary summer weather, the radiator of a motor vehicle on which the system has been used will be completely filled before the vehicle has travelled as much as a mile.

It will be noted that the apparatus which I have devised may be easily and cheaply made and installed; that it involves very few working parts, the most of which are contained in the reserve tank; and that the structure may not only be easily applied to a motor vehicle power plant without requiring special skill or knowledge on the part of the workman, but may be readily modified to adapt it to various makes or types of motor vehicles or cooling systems. Any such modifications or other changes in mere details of construction I desire to be regarded as falling within the scope of the invention as defined in the appended claims.

I claim:

1. In apparatus of the class described, a container for liquid, a reserve tank, a single conduit connecting said container and tank, means for applying suction to withdraw gases from said container through said conduit thereby producing a partial vacuum in said container and means for interrupting application of suction and thereby causing liquid to flow through said conduit from said reserve tank to said container by reason of the partial vacuum in said container.

2. In apparatus of the class described, a container for cooling liquid, a reserve tank, a single conduit connecting said container and tank, a passage connecting said reserve tank to a source of sub-atmospheric pressure, and means for controlling flow through said passage whereby gases may be drawn through said conduit and thereafter liquid may flow therethrough from said reserve tank to said container.

3. In apparatus of the class described, a cooling liquid container, a reserve tank having a suction chamber, an open conduit between said chamber and said container, an engine intake conduit, a passage connecting said tank to said intake conduit, and means for closing said passage upon the occurrence of predetermined difference between the pressure in said intake conduit and that in said chamber.

4. In combination, a cooling liquid container, a suction chamber, a reserve tank

and a source of sub-atmospheric pressure, both connected to said chamber, and a permanently open conduit connecting said container to said chamber and constituting both an outlet and an inlet for flow of fluids to and from said container.

5. In combination, a cooling liquid container, a suction chamber connected thereto, a reserve tank, a source of sub-atmospheric pressure connected to said chamber, and means for supplying liquid from said tank to said chamber and from said chamber to said container under the influence of sub-atmospheric pressure, means being provided to retard the flow in said liquid supplying means from said tank to said chamber to permit evacuation of said container through the connection from the chamber to the container.

6. In a reserve tank for liquid supply systems, a main receptacle, an auxiliary receptacle within the upper portion of the main receptacle, and a connection between the interiors of said receptacles comprising a tube projecting from the bottom of the auxiliary receptacle and a filling tube for the main receptacle carried by said auxiliary receptacle.

7. In a reserve tank for liquid supply systems, a main receptacle, an auxiliary receptacle, forming a cover for the said main receptacle, a connection between the interiors of said receptacles comprising a tube projecting from the bottom of the auxiliary receptacle, and a filling tube for the main receptacle extending through the auxiliary receptacle and the first-mentioned tube.

8. In a liquid supply system, a supply chamber, a suction chamber, an airtight container, a conduit between said suction cham-

ber and said container through which gases may be withdrawn from said container, a connection between said supply chamber and said suction chamber, and means operative to interrupt the application of suction to said suction chamber after the level of liquid therein rises above the intake of said conduit thereby permitting liquid to be drawn through said conduit to said container by reason of the vacuum therein.

9. In a liquid supply system for engine radiators and the like, a suction chamber, passages for supplying liquid to and discharging it from said chamber, a suction connection between said chamber and the engine intake passages, and a valve for controlling said connection, said valve constructed and arranged to close in response either to rise of liquid level or to rise of suction beyond a predetermined limit.

10. The combination with an internal combustion engine having an intake passage and a radiator for cooling liquid of a reserve tank for cooling liquid the liquid in which is normally at a lower level than the level of liquid in said radiator, a suction chamber communicating with said tank, a single conduit connecting said chamber to the upper portion of said radiator through which gases may be withdrawn from the radiator and liquid may be introduced under the vacuum resulting from such withdrawal, a connection between said chamber and the engine intake passage and a valve controlling said last named connection and closing the same when the level of liquid in said chamber rises above the opening of the connection between the chamber and the radiator.

In testimony whereof I affix my signature.
JOHN M. LEA.