May 16, 1939. F. D. TAYLOR 2,158,388

SURGE TANK

Filed Jan. 20, 1938

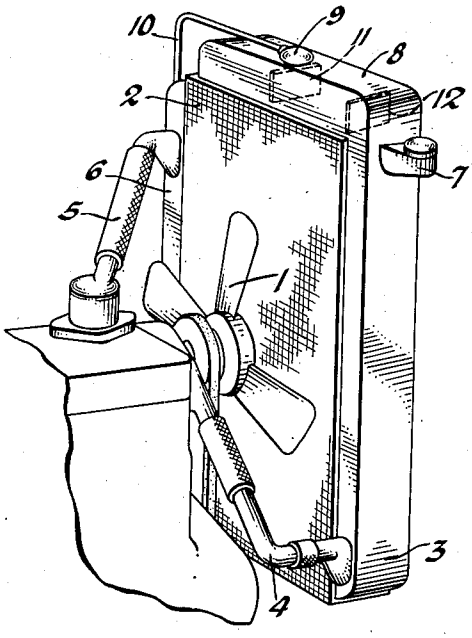

Fig. 1

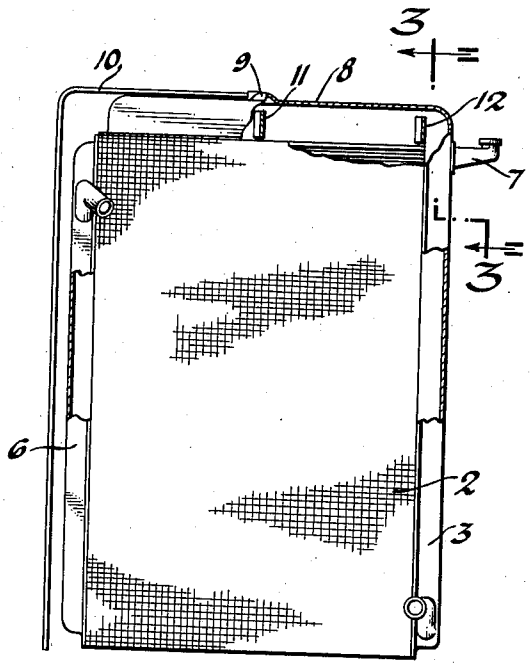

Fig. 2

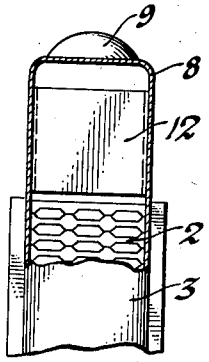

Fig. 3

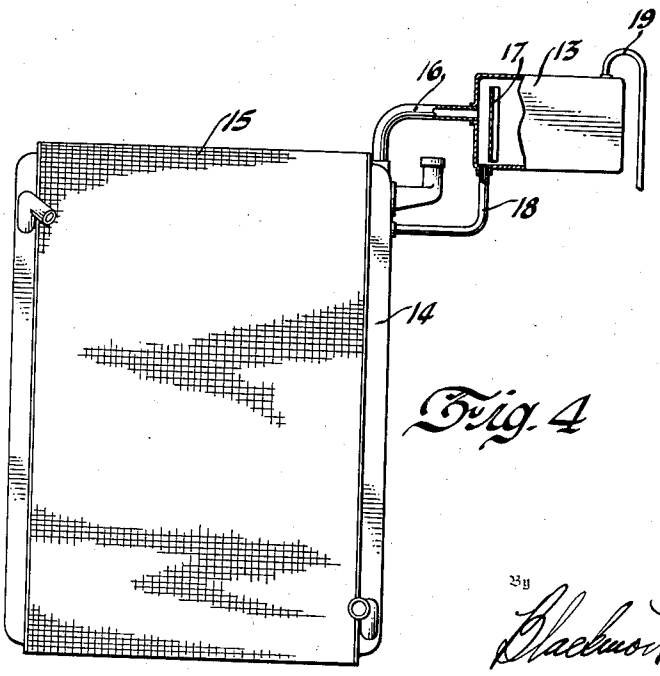

Fig. 4

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SURGE TANK

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4 Claims. (Cl. 257—125)

In the operation of a motor vehicle loss of engine cooling liquid often results from what is commonly referred to as surging. Surging is most likely to occur immediately after a sudden and complete stop from a hard run, especially if the weather and general operating conditions are unfavorable to system cooling. The explanation is that intense jacket heat causes steam formation and the expansion pushes the liquid through the jacket outlet. The impulse may be only momentary but then more liquid moving into the hot zone boils and the resultant additional expansion gives another push and the repetition of this action may be likened to a series of short explosions augmenting one another to send the liquid and steam mixture forward in sudden successive spurts raising the liquid level in the radiator. Usually the rise will be in intermittent stages interrupted by drops since some of the steam condenses into surrounding liquid with a consequent contraction of volume and some separates from the liquid on reaching the surface, but the net result of the successive rise and fall is a higher level which may reach the overflow vent with a portion of the liquid displaced by steam, spilling from the system.

To prevent loss by expellation it has been proposed heretofore to enlarge the vented radiator header but this is only partially successful unless the tank is of unusual capacity, such as to make it impractical for use. It has also been proposed to restrict or baffle the overflow pipe but this is found not to stop liquid loss because the head of liquid in the tank resists free entrance thereto of additional liquid so that pressure is built up and when sufficient to overcome the resistance lifts the head of liquid violently and with explosive speed blows some of it through the overflow.

The present invention also contemplates the use of a liquid storage reservoir but among other things it differs in that the surging mixture of liquid and steam enters freely at the top of the tank with the heavy liquid dropping to the floor and the pressure being relieved by freeing the lighter vapors through a vent near the roof of the tank thus clearing the path for the next vomition and further in that the trapped liquid trickles slowly back by gravity from the bottom of the tank to the system without interference to succeeding spouts of pressure fluid mixture.

In a preferred embodiment of the invention the vented expansion tank to store liquid until disturbances causing expulsion have subsided is located above the normal liquid filling level of the radiator and is provided with a baffle plate over which the liquid and steam mixture on a system level lifting impulse can spill freely and be retained for subsequent gravity return through a small drain pipe so as to keep clear the passage between the vent pipe and circulating system and eliminate resistance to succeeding impulses.

For a better understanding of the invention reference may be made to the accompanying drawing wherein Figure 1 is a perspective view showing an engine cooling circulating system with the invention applied thereto; Figure 2 is a view partly in section of a cooling radiator embodying the expansion tank; Figure 3 is a sectional view taken on line 3—3 of Figure 2 and Figure 4 shows an alternative arrangement.

In the drawing the numeral 1 indicates an engine driven fan for drawing air through the radiator core 2 and the fan shaft also operates a pump for circulating liquid through the engine cooling system. The flow of liquid is from the cold or outlet header 3 of the core through a conduit 4 to the engine jacket and then out of the engine jacket through the conduit 5 to the inlet or hot header 6 for return across the cooling core to the outlet header. The radiator core shown in the drawing is of the cross flow type with the flow tubes extending horizontally between the side mounted inlet and outlet tanks. A filling spout 7 sealed by a removable cap, is mounted near the upper end of the outlet header 3 and its height determines the maximum level to which the cooling system may be filled. Above this level is located the expansion tank 8 which is in open communication with the outlet header 3 and extends across the top of the radiator core 2 so as to form a compact assembly with the radiator unit. In the top wall of the tank and in spaced relation to the connection between the outlet tank 3 and expansion tank 8 is a domed formation 9 to which is connected the usual overflow pipe 10 by which the system is vented to atmosphere.

In the middle of the tank 8 is a baffle plate 11 secured to the side walls of the tank in spaced relation to the top and bottom thereof and the purpose of this baffle primarily is to serve as a splash plate to resist violent side wash of liquid stored within the tank. A similar plate is shown at 12 immediately adjacent the connection between the side tank 3 and top tank 8 and this

baffle constitutes a divider or separator wall which holds back or dams ready return of liquid from the tank into the header 3. The spacing between the upper edge of the plate 12 and the top wall of the tank is such as to handle without material restriction all the liquid which may rise in the side tank 3 and spill over the top of the wall. The spacing between the lower edge of the wall 12 and the bottom of the expansion tank as best seen in Figure 3 is such as to afford a small bleed passageway which allows return flow in a relatively small stream so as not to block or plug any rising impulse of the liquid from the header 3. In this connection the middle wall 11 will also allow the liquid to spill over the top very freely but restricts return movement along the bottom of the tank.

It will be seen, therefore, that upon sudden surging of the liquid and steam mixture a free movement occurs into the expansion tank with the pressure fluid spilling over the top of the baffle plate or dam 12, the liquid falling by gravity to the bottom and the vapor separating out and moving on to the overflow pipe 10. Thus not only is pressure, by reason of the expansion of the liquid into steam relieved, but additionally the heavy body of liquid forced out of the circulating system, is trapped temporarily and held from blocking the outlet from the side tank 3. With the stored liquid out of the path of an oncoming surge, the impelling force spends itself quickly without liquid loss through the overflow, but the liquid is conserved for subsequent gravity return and restoration of system supply.

The same principle is embodied in the structure shown in Figure 4 where the expansion tank is constructed as a unit separate from the radiator assembly as shown at 13. Here again its location is above the normal liquid level in the system and it communicates with the top of the outlet header 14 of the radiator core 15 by means of a large capacity passageway 16 through which expelled liquid may flow freely into the expansion tank. A baffle wall 17 located at one end of the tank provides for the free flow of liquid over the top and for the restricted flow along the floor by gravity return to the system through the conduit 18. In this case the system is vented by means of the overflow pipe 19 located at the side of the storage tank 13 opposite to the position of the baffle plate 17. The action as will be readily understood is similar to that heretofore described.

I claim:

1. A cross flow radiator having inlet and outlet headers, a filling spout associated with one of the headers and by its position determining the maximum filling level, a tank extending across the top of the radiator and in open communication at the side with the outlet header, a baffle plate in said tank adjacent the outlet header allowing relatively free flow across the top thereof and restricting flow thereunder and vent means near the top of the tank beyond said baffle plate.

2. In an engine cooling liquid circulating system having an overflow vent, means to conserve the liquid supply by reducing liquid expulsion through the vent due to pressure surging incident to ebullition, including a storage tank forming the communicating connection between the system and the overflow vent and being located below the vent and above the normal system liquid level, said tank having an inlet above the bottom thereof for entrance of system contents forced from the system whereby the liquid separates by gravity from the vapors and is trapped temporarily for subsequent return to the system, clear of the path of open communication of the system with the vent for ejection of freed vapor under system pressure, and bleed back means for the return to the system of the previously expelled liquid.

3. For association with an engine cooling system subject to pressure surging of system contents in use, a tank located above the normal system liquid level for storing temporarily liquid expelled from the system, means at the top of the tank for the entrance of expelled system contents, a vent in the top of the tank to relieve system pressure through said entrance and above the liquid contents of the tank and bleed return means at the bottom of the tank for restoring the previously expelled liquid.

4. In an engine cooling system, a cross flow radiator core having a side tank constituting a vertical header therefor, a lateral extension on the side tank projecting horizontally across the top of the core above the system liquid level, system vent means leading from the top of said extension and a vertically disposed baffle wall in said extension affording a spillway over the top thereof for system contents leaving the side tank under pressure surges and a restricted drain back under bottom thereof for liquid trapped thereby within said lateral extension.

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