Glass expansion chamber connected to cooling system by a tube going down to bottom of chamber, characterized by a pressure relief valve fitted between the aforementioned system and the expansion chamber, with a valve allowing air to enter from the outside if pressure drops in system fitted to expansion chamber stopper.

5 Claims, 4 Drawing Figures
COOLING SYSTEM EXPANSION CHAMBERS

This invention refers to cooling system expansion chambers for internal combustion engines and concerns improvements to these expansion chambers.

Known expansion chambers for automobile engine cooling systems are best made in the form of a glass recipient. So we have an inexpensive product whose transparency allows the cooling liquid level to be checked. However, these glass expansion chambers have the disadvantage of being fragile when hot, especially in hot atmosphere conditions when the recipient is filled with a liquid at 100°–115°C under safety-valve working pressure, ruptures can occur.

It has been established that the most common cause of rupturing is the presence of liquid at high temperatures in the recipient. This liquid is rapidly heated by bubbling through steam coming from radiator in a tube that goes down to the bottom of the recipient, when the over-pressure in system causes air and steam to be released by safety valve and thus a steam flow through delivery tube.

From the technical point of view we can mention U.S. Pat. Nos. 3,083,701 and 3,193,041.

The improvements forming the object of the invention consist, in an expansion chamber, in connecting the chamber to the cooling system by a tube going down to the bottom of the chamber, a pressure limiting valve being fitted between the said system and the expansion chamber. A valve allowing air to come in from the outside if a pressure-drop occurs in system is fitted in chamber stopper.

It should be noted that the improvements consist also, as a preferred alternative solution, in fitting the connecting pipe from the radiator, the valve and the immersed tube of expansion chamber to the three ends of Y-adaptor in the expansion chamber above liquid level, and relate particularly to the best mode of execution of this patent in which high and low pressure valves are connected with a by-pass tube under the stopper but above maximum liquid level at the top part of tube that goes down to bottom of chamber.

In this design variation the low-pressure valve is fitted inside the high-pressure valve, the two valves being connected directly by the by-pass tube to the tube going down to the bottom of the expansion chamber.

In annexed drawing:

FIG. 1 shows the general arrangement forming the object of the patent,

FIG. 2 shows a preferred solution,

FIG. 3 shows, as an example, curves for pressure and temperature rises in cooling system,

FIG. 4 shows a sectional view of position of the two concentric valves in the chamber stopper when solution in FIG. 2 is used.

Referring to FIG. 1, expansion chamber 1 is connected to a radiator by a tube 2 that goes down to the bottom of the chamber and has a relief valve 3 located independently on the tube 2 between the radiator and the chamber. A valve 4 is located in the expansion chamber stopper and allows air to enter from the outside when a pressure drop occurs in the system.

In the preferred mode of execution shown in FIG. 2, relief valve 3 and low-pressure valve 4 are fitted as a combined assembly to stopper or plug 5 at the top of expansion chamber, the relief valve being connected to the top part of tube going down to bottom of chamber with a by-pass tube 6 under stopper 5.

Thus, when the pressure and temperature rise so causing the steam to flow and the valve to open, the steam escapes directly from the latter without going through the expansion chamber, in which the liquid temperature does not rise. In other words, the present apparatus operates by allowing excess steam to be vented to the atmosphere without requiring the steam to pass through the liquid in the expansion chamber which would cause the liquid to boil and adversely affect the expansion chamber.

Under normal running conditions, when the escape valve is closed, the expansion chamber works normally, receiving or supplying liquid to the circuit according to its heating or cooling conditions, with an air inlet valve, low-pressure valve, working at the top of the recipient.

In FIG. 3 is a comparison of the temperature and pressure conditions over a period of time for an expansion chamber without having the present design and for an expansion chamber according to the present invention. Solid line a represents the pressure rise over a period of time in the expansion chamber and dashed line b illustrates the corresponding temperature rise for an expansion chamber that is not equipped according to the present invention. When the expansion chamber is equipped with the present invention the pressure in the chamber is constant at the valve opening pressure d as shown by the solid line and the temperature remains at a constant value c shown by the dashed line.

If we go back to FIG. 4, we can see that expansion chamber 1 is fitted with a stopper 5 with the tube 2 going through it to the bottom of the chamber and of which the top part, which is fitted with a bend, is connected to the radiator, the by-pass tube 6 branching off of tube 2 and emerging through a well in stopper 5.

The bell-shaped relief valve 3 caps tube-end 6 and rests on a circular gasket at the bottom of the well in stopper, under the action of the spring 7 of which the top end presses against cover 8 which is fixed to stopper 5 and has openings 9 for steam outlet or air inlet in case of pressure drop.

The low-pressure valve 4 is fitted inside the relief valve 3, and in the form of construction represented as an example the valve steam forms one piece with disc 10, with a spring 11 one end of which presses on disc 10 and the other on valve bottom 3 so ensuring that valve 4 closes under normal working conditions.

Working conditions for valves 3 and 4 are the same as for those described for FIG. 2 but with the following particularities:

The low-pressure valve is adjusted so that the opening point be sufficiently high to allow the liquid to be drawn firstly into the cooling system under the effect of the expansion of the gaseous volume contained in the expansion chamber, air being introduced into the circuit through the valve only when high pressure drops occur.

This arrangement allows a compact unit to be made as well as a gain in size and cost price of the expansion chamber stopper. The appropriate valve working pressures combined with a sufficient volume of the expansion chamber devoid of any direct opening in its top part ensure efficient working, even under extreme conditions, without the risk of losing liquid from the relief valve or the air inlet valve in the cooling system.
In the preferred construction, tube 2 and its by-pass 6 will be made in the form of a Y shaped tube in a single part from moulded rubber of which the two branches will be fitted to the corresponding metal tube outlets, which form one piece with the stopper 5.

I claim:

1. An apparatus for use in a cooling system comprising
   an expansion chamber for receiving cooling liquid ejected from the cooling system having a plug at the top to seal the chamber and connected to the cooling system by a tube which extends down to the bottom of said chamber;
   a pressure relief valve located on the connecting tube whereby excess steam generated in said cooling system is vented to the atmosphere; and
   a low-pressure valve located on said plug for said expansion chamber whereby air is allowed to enter said chamber from the outside when the pressure drops in the system.

2. An apparatus according to claim 1 wherein said pressure relief valve is located on said plug of said expansion chamber and wherein said valve is connected to the top part of said tube extending down to the bottom of said chamber by a by-pass tube which is located beneath said plug.

3. An apparatus according to claim 2 wherein said relief valve and said low-pressure valve are fitted concentrically one inside the other and the two valves are connected to the tube extending down to the bottom of the chamber by said by-pass tube.

4. An apparatus according to claim 3 wherein said relief valve comprises a bell-shaped member secured to the top of said plug and positioned over said by-pass tube, said relief valve further comprising a cover means fitting in a sealing arrangement over the end of said by-pass tube and a spring between the under side of said bell-shaped member and said cover means to maintain said cover means in spring fitted engagement over the end of said by-pass tube; and said low-pressure valve comprises an opening in the top of said cover means of the relief valve and a spring operated closure means for said opening whereby the valve is normally closed and only opens in response to low pressure under said cover means.

5. An apparatus according to claim 2 wherein said by-pass tube and said tube extending down to the bottom of said chamber consist of a rubber Y-shaped tubular part.

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