

Dec. 16, 1941.

J. E. ESHBAUGH

2,266,314

RADIATOR SEALING CAP

Filed Aug. 17, 1940

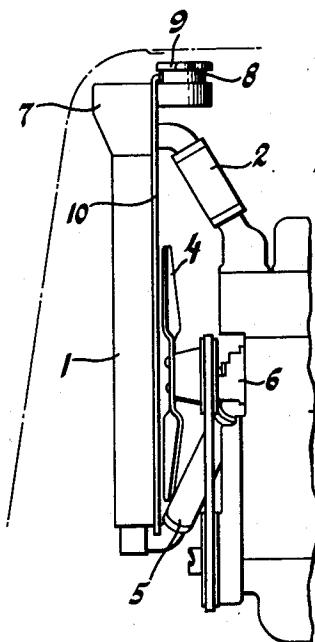
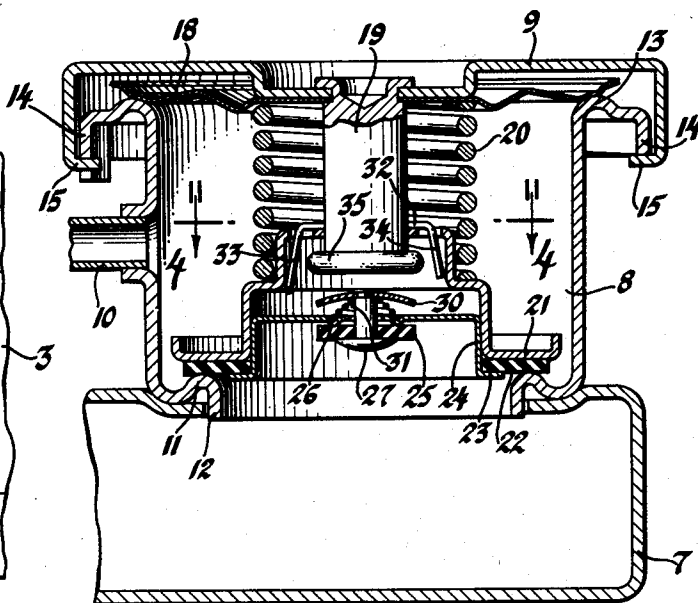


Fig. 1



The ig. 2

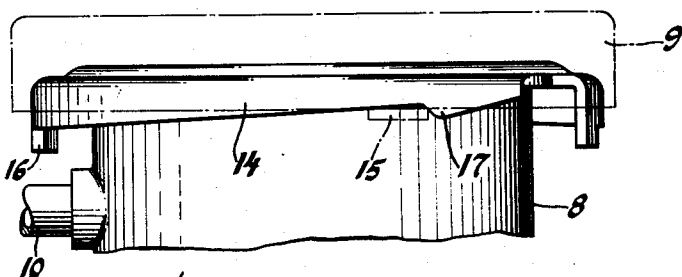


Fig. 3

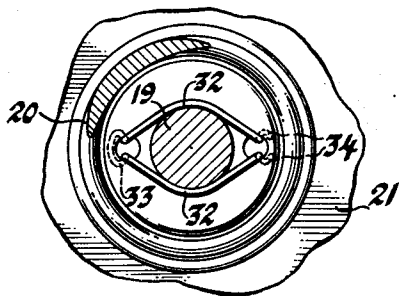


Fig. 4

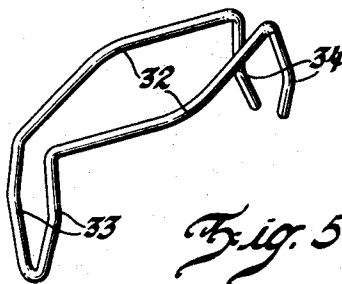


Fig. 5

Inventor

Jesse E. Eshbaugh

34

By *Blackmore, Jones & Hunt*
Attorneys

Attorneys

UNITED STATES PATENT OFFICE

2,266,314

RADIATOR SEALING CAP

Jesse E. Eshbaugh, Flint, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application August 17, 1940, Serial No. 352,990

7 Claims. (Cl. 277-45)

This invention relates to cooling systems for internal combustion engines used in automobiles and operated under varied conditions of load, speed and climate. Unless the cooling system is of unusually large capacity a hot running engine operating under adverse load and weather conditions will overheat and cause the cooling liquid to spill out through the overflow vent above the normal liquid level. With a reduced supply of cooling liquid overheating is aggravated and serious injury is likely if a convenient service station is not near at hand for a stop and replenishment. Closing the vent to atmosphere to enable the system to run under internal pressures within safe limits of bursting resistance gives the advantage of an increased liquid boiling point and greater heat transfer efficiency thus conserving the liquid supply and rendering small capacity systems more feasible and carefree in use.

For converting the ordinary open system having the overflow vent leading from the filler spout it is proposed to incorporate suitable valving in the spout closure cap assembly arranged to seal the circuit from the vent within given pressure limits and relieve pressures outside the selected range so as to avoid the imposition of bursting strain on the weaker parts of the system. Whether associated with the vent at the filler spout or elsewhere the structure to which the present improvement relates involves in a preferred, but not necessarily the only embodiment, a spring seated excess pressure relief valve having a hollow dome guided by and mounted on a central post with a closure wall for the open end of the dome incorporating a spring seated vacuum relief valve. Both valves being seated at the start of engine operation the circulating liquid expands in volume with the absorption of engine combustion heat and with the consequent rise in internal pressure affords increased heat dissipation efficiency of the system without increasing overall system capacity. To avoid excessive pressure build up the main valve seating spring should be selected to vent the system at a proper stage, for example, in the neighborhood of seven pounds per square inch is suitable where conventional radiator structure, pump packings and hose connections are employed. Later as the system cools down and the liquid content contracts in volume the secondary or vacuum relief valve opens inwardly to establish substantially atmospheric pressure within the system.

In considering the functioning of an engine cooling system it is important to bear in mind that cooling fluid expansion and contraction

throughout the system is not always at a uniform rate and that while liquid in some portion of the circuit may be giving up heat, liquid elsewhere in the circuit is absorbing heat and that, furthermore, hot spots in the engine jacket sometimes result in the formation of steam pockets and rapid fluctuations in pressure. Occasionally and for short intervals there may be rapid momentary surges of liquid from the jacket outlet to the top tank of the radiator. The surging liquid is retarded from escape through the vent by the pressure valve and in resisting the rapid fluctuations the valve is better able to function for this purpose and without noise if its sensitiveness to changes occurring at pressures approaching its spring seating force is modified through a check to its tendency to move to and from its seat. As a simple and effective check there may be provided a friction drag element carried by the valve for wiping engagement with the guide post and this preferably is in the nature of an inexpensive spring wire formed to hairpin shape to straddle the guide post with opposite ends turned laterally and projected through circumferentially spaced openings in the top of the hollow dome of the main valve and above the dome closure wall.

For a better explanation of the invention reference will be made to the accompanying drawing wherein Figure 1 is a side elevation of a portion of an engine and radiator circulating system; Figure 2 is an enlarged vertical sectional view of the filler spout assembly; Figure 3 is a side elevation of a portion of the filler spout; Figure 4 is a section on line 4-4 of Figure 2 and Figure 5 is a detail perspective view of the motion checking element for the valve.

In the drawing the engine cooling circuit includes the cooling radiator 1 having a hose connection 2 with the outlet from the cooling jacket of the engine 3. The engine driven fan 4 draws air through the radiator for extracting heat from the liquid within the system and the cooled liquid returns from the radiator 1 through the hose connection 5 to the engine jacket with an engine drive pump 6 in the return line for impelling flow through the circuit.

Associated with the top wall of the radiator inlet header 7 is a tubular filler spout 8 closed at its upper end by the removable cap 9 with an overflow or vent pipe 10 leading from the side wall of the filler spout downwardly beside the radiator assembly to a convenient point of discharge. At its lower edge the spout 8 has an inverted flange including a raised annular rib or

valve seat 11 and terminating in a dependent locating skirt 12 extending into the opening in the top wall of the header 7. At its outer end the spout 8 is flanged outwardly and provided with a raised annular rib 13 and a pair of dependent arcuate flanges 14 which serve as elements of a well known type of quick detachable bayonet connection in cooperation with a pair of inturned tabs 15 at the bottom of the peripheral skirt of the cap 9.

The tabs 15-15 are located diametrically opposite each other and are arranged to pass through openings in the outturned flange of the filler spout and upon partial rotation of the cap 9 ride on cam surfaces formed on the underside of the dependent flanges 14-14. The cam surfaces on the underside of each flange 14 tapers downwardly from the entrance opening to a final seating position adjacent a stop 16. A second and safety stop 17 is provided in the cam surface immediately adjacent the entrance opening and is so shaped as to permit the interengaging tab 15 to ride easily over it when the cap is applied to the spout and to afford a stop shoulder upon reverse rotation of the cap as the tab 15 rides up the inclined cam surface in the manner shown by the broken lines in Figure 3.

In the closed position of the parts as seen in Figure 2 the peripheral portion of a sealing diaphragm 18 seats on the annular ridge 13 of the spout 8. At its center the diaphragm is mounted on the underside of a spacer formation or central depression in the cap 9 through the dependent post 19 which is riveted or otherwise secured to the cap. Annular corrugations in the diaphragm help to impart the desired resiliency thereto and the centermost corrugation is conveniently utilized as a locating rib for the endmost coil of the valve seating spring 20. At its opposite end the spring engages the valve element 21 having a central dome slidably mounted on the lower end of the guide post or stud 19 and provided with a shouldered or offset tubular wall which seats and projects into the endmost coils of the spring 20 for the location thereof. On its underside the domed valve 21 carries an annular sealing gasket 22 which seats on the annular rib 11 of the filler spout and is secured to the valve by the outturned flange 23 of a cupped closure member 24 having a press fit connection within the hollow dome of the valve 21. The base of the cup extends across the dome and in connection with an inwardly opening valve 25 for an aperture therein seals the interior of the hollow dome from the cooling system. The secondary valve includes a gasket ring seating on a depressed annular rib 26 in the wall of the cup 24 and being mounted on a headed stud 27 which projects through the communicating passage to the opposite side of the closure cup 24 where a retainer washer 30 is fitted thereto and seats one end of a weak spiral coil spring 31 whose opposite end is seated in the depression afforded by the rib 26 whereby the spring serves to maintain the valve 25 seated.

For the purpose of checking the movement of the valve assembly on its guide post the top of the dome wall is provided with a pair of circumferentially spaced openings into which are fitted the laterally bent end portions of a hairpin member, preferably of phosphor bronze spring wire, and which straddles the guide post under tension for frictional sliding engagement therewith. The intermediate portions of the two legs of the hairpin are bowed apart centrally of the length of

the pin as at 32-32 to receive the post therebetween. Outwardly from the central bowed portion the two legs at each end converge toward the laterally bent extremities affording a narrow neck at the wire receiving openings of the domed valve 21. One set of laterally bent extremities 32-33, are interconnected and form the bight of the hairpin spring while the other pair of lateral feet 34-34 are unconnected and constitute the opposite ends of the spring wire. In each instance the cooperating legs are bowed outwardly at an intermediate point and afford inclined camming surfaces receding from the central enlargement toward the restricted neck at the point of bending and toward the tips of the laterally bent legs. These camming surfaces facilitate the assembly of the parts and the insertion of the legs through the dome openings and the enlargements afforded by the intermediate outwardly bowed portions together with the compression stress on the spring wire retains the hairpin spring in interlocking relation with the valve.

The openings in the top wall of the valve dome to receive the mounting legs of the friction drag hair pin being located beyond the closure wall 24 do not interfere with the sealing function of the valve but rather afford communicating ports through which air may be drawn in from the overflow vent for the relief of system subatmospheric pressure when the vacuum operated valve 25 is unseated. Normally the system is sealed from the vent but as previously pointed out internal pressure in excess of the force of the spring 20 unseats the main valve 21 and vents the system against abnormal pressures above the predetermined value. In the response of the valve to internal pressures the check spring modifies the action of the valve seating spring and introduces a lag in the movement of the valve thus reducing the tendency of the valve seating spring to yield to pressure fluctuations. Consequently, rapid pressure changes are less likely to stimulate excited valve quiver but the valve action is steady in response to substantially constant pressure.

The valving structure is retained on the supporting post 19 as a part of the cap assembly by the enlarged head 35 on the lower end of the post within the hollow dome space. The structure is such that when the cap 9 is to be removed from the spout its partial rotation results simultaneously with an outward movement of the cap, the retainer tabs 15 riding out on the tapered cams of the flanges 14. Outward movement of the cap takes up the clearance between the stud head 35 and the underside of the dome and thereafter lifts the valve within the cap and breaks the seal with the spout ridge 11. This breaking of the seal occurs prior to complete removal of the cap and enables the system to be completely vented through the overflow pipe 10, while rotation of the cap is stopped by the interengagement of the retainer tabs 15 with the shoulders 17. The seal between the diaphragm 18 and rib 13 at the outer end of the spout may be maintained or may be broken, depending upon the character of the diaphragm and the specifications of the manufacturer, but if the structure is such that the seal is broken in the safety stop position of the parts, the presence of pressure within the system will manifest itself by escape under the cap without, however, presenting the likelihood of injury from scalding fluid. As will be understood, depression of the cap and further

rotation enables the tabs 15 to pass the stops 17 for complete removal of the cap assembly.

When the cap assembly is removed from the spout, depression of the valve in the hands of a meddler will collapse the spring 20, but the spring is of such character that its coils will close solid on one another and limit the movement of the valve so that the head 35 of the supporting post will not push out and loosen the press fitted closure cup 24 or otherwise damage the assembly.

I claim:

1. In a device of the character described, a valve mounting post, a valve slidable thereon and having a pair of circumferentially spaced openings therein and a hairpin spring in frictional contact with and receiving the post therebetween and having its end portions bent laterally and projected through said openings, with the cooperating legs thereof bowed outwardly beyond said openings.

2. In a device of the character described, a valve mounting post, a valve slidable thereon and a pair of bowed springs frictionally engaging and straddling the post and having adjacent ends arranged to form narrow neck portions on opposite sides of the post axis to fit circumferentially spaced openings in the valve for the mounting thereof.

3. In a device of the character described, a guide member, a spring seated pressure relief valve member mounted on and guided by said guide member, a pair of interconnected, spreadable spring feet confined in an opening in one of the members and a projecting leg on one of said feet in frictional sliding engagement with the other member.

4. In a device of the character described, a stationary guide member, a pressure actuated valve member slidable thereon toward and from

its seat, a hair pin spring straddling one of the members in frictional sliding contact therewith upon relative movement of the members and having convergent restricted neck portions secured in interlocking connection with the other member.

5. The combination with a guide stem, and an outwardly opening valve having a hollow central dome closed by an inwardly opening valve and slidably mounted on said stem, of a hairpin spring frictionally embracing the stem and having laterally bent end portions projected through the central dome, said lateral end portions comprising opposed camming surfaces converging to a restricted neck at their passage through the dome.

6. In a closed cooling system, a filler spout having an internal seat, a spout closure cap having a dependent stud, a spring pressed valve slidable on said stud and engageable with said seat and having a pair of spaced openings on opposite sides of the stud axis, and a hairpin spring straddling the stud in frictional contact therewith and having opposite end portions bent laterally and projected through said spaced openings, said end portions being bowed outwardly for their retention within said openings.

7. In a closed system of the character described, an outwardly opening valve having a central hollow dome slidably mounted on a guide stem, means including an inwardly opening valve for closing the hollow dome, and a hairpin spring carried by the dome for frictional sliding engagement with the stem with opposite end portions bent laterally and projected through openings in the dome, each of said end portions including a pair of cooperating dependent spring legs bowed outwardly for self retention within said openings.

JESSE E. ESHBAUGH.