Dec. 24, 1940. C. S. BAILEY 2,225,964

RADIATOR CAP

Filed Jan. 16, 1939

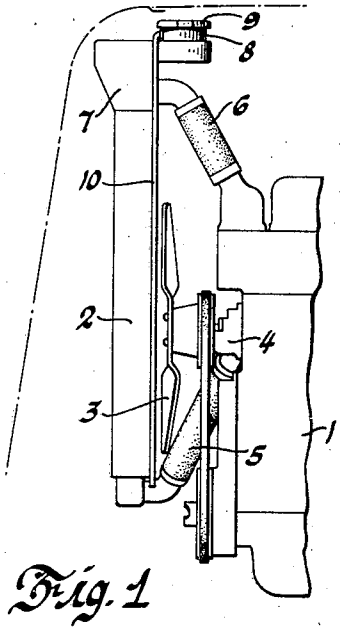


Fig. 1

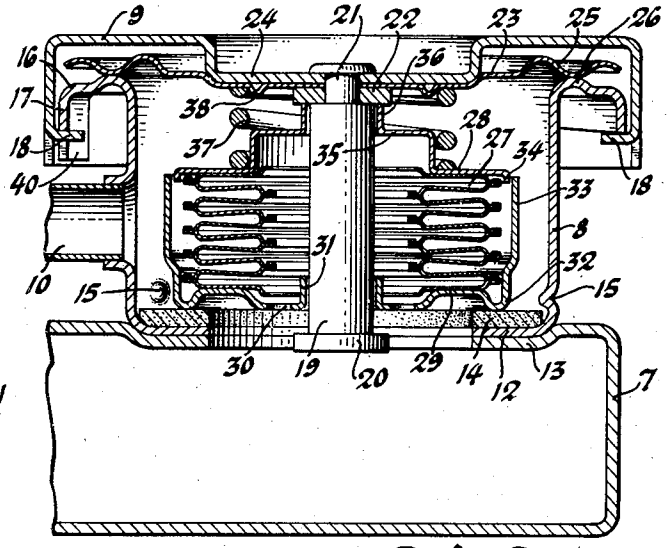


Fig. 2

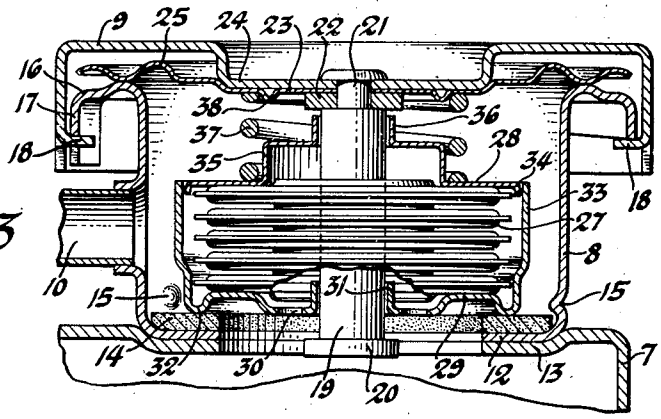


Fig. 3

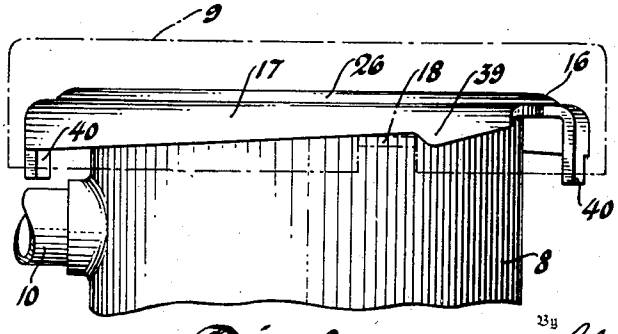


Fig. 4

Inventor
Charles S. Bailey
By Blackmore, Spencer & Flick
Attorneys

Patented Dec. 24, 1940

2,225,964

UNITED STATES PATENT OFFICE

2,225,964

RADIATOR CAP

Charles S. Bailey, Lockport, N. Y., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application January 16, 1939, Serial No. 251,053

11 Claims. (Cl. 220—44)

This invention relates to engine cooling systems and more particularly to an improved pressure valve cap assembly which can be fitted to the radiator filler spout for closing the system to atmosphere. The conventional automobile engine cooling system is designed primarily for operation at atmospheric pressure but the structure of the parts is such that they will withstand slight pressures and the operation of the system under a few pounds internal pressure improves cooling efficiency. For adverse operating conditions the usual filler cap can be replaced by the structure of the present invention which consists essentially of a special cap assembly incorporating pressure actuated valving to seal the system except for the relief of excess internal and external pressures. The improved cap structure, therefore, enables the ordinary open system to be converted easily into a closed system when warranted by operating conditions.

An object of the invention is to provide a system closure comprising a few simple and easily manufactured parts which can be assembled at low cost for reliable and carefree operation.

A further object of the invention is to provide a cap having a dependent stud on which is slidably mounted a valve unit to seat on a portion of the spout inwardly of the system vent or overflow pipe when the cap is in fully closed position and which valve is unseated to relieve internal pressure through the vent either automatically, in the event of excessive pressure rise, or mechanically, through its mounting stud when the cap is shifted from its fully closed position to an intermediate position prior to complete removal.

Another object is to provide a valve unit wherein an outwardly opening valve and an inwardly opening valve are mounted on opposite ends of an expansible spring bellows which acts on both valves to hold them against spaced seats for sealing the system from the spout vent. With both valves seated by the same spring element the internal pressure at which it is desired to operate the system determines the strength of the spring but in order that the vacuum relief valve will open at a small drop below atmospheric pressure the full force of the main spring on the vacuum relief valve is opposed by a bucking spring selected for strength according to the pressure differential at which the valve is to be unseated.

The invention will be better understood upon reference to the accompanying drawing wherein Figure 1 is a side elevation illustrating the conventional cooling system for an automobile engine; Figure 2 is an enlarged sectional view of the filler spout and closure structure; Figure 3 is a view similar to Figure 2 with the vacuum relief valve unseated and Figure 4 is an elevation showing the upper portion of the filler spout.

In the conventional engine cooling system as seen in Figure 1 the heat generated within the engine 1 is absorbed by the water or other cooling liquid in the water jacket of the engine and is removed in the radiator 2 or transferred to air drawn through the radiator by an engine driven fan 3. Also driven from the engine is a water circulating pump 4 which draws water from the bottom of the radiator 2 through the hose connection 5 and sends it through the engine cooling jacket for return through the hose connection 6 to the top tank 7 of the radiator. The top tank of the radiator carries the filler spout 8 closed by a removable cap 9 and provided with an overflow or vent pipe 10.

As seen more particularly in Figure 2 the filler spout 8 is provided inwardly of the overflow 10 with an inturned flange 12 seated in a depressed portion 13 at the opening through the top wall of the tank 7. Resting on the flange 12 is a valve seat or fiber washer 14 which may be held against displacement by a series of dents 15 pressed in the side wall of the filler spout 8. At its outer end the spout is provided with an outturned flange 16 terminating in a downturned skirt 17, the lower edge of which forms camming abutment surfaces for a pair of oppositely disposed inturned fingers 18 on the removable closure cap 9.

The spout closure assembly includes a dependent stud or pin 19 having an enlarged head 20 at its lower end and a shouldered or reduced portion 21 at its upper end which projects through a valve seat or washer 22 and a spring diaphragm 23 on the underside of a central depression 24 of the cap and is secured thereto by peening over the upper end of the reduced portion 21. The spring diaphragm carries corrugations 25 at its rim to increase the flexibility thereof, one of the corrugations seating on a raised rib 26 in the spout flange 16 for sealing the outer end of the spout. Surrounding and slidably mounted on the dependent stud 19 above the enlarged head 20 is a valve unit comprising the spring bellows 27 and stamped metal valve elements 28 and 29 secured to opposite ends of the spring bellows 27. The bellows may be of the usual construction comprising a stack of spring disks having their inner and outer marginal portions joined to mating edges of the neighboring convolutions and affording a hol-

ing annular wall 31 affording a bearing guide surface engaging the pin 19. At the rim of the plate or valve element 29 is a depressed annular bead 32 which seats on the gasket 14 and projecting upwardly from the bead is an annular wall 33 which peripherally encloses the bellows and affords protection thereto when the assembly is separated from the spout. Optionally the incasing wall 33 may be formed wholly or in part as an extension of the dependent peripheral flange 34 of the upper valve element 28. Centrally of the element 28 is a dome-shaped portion 35 which slidably engages the pin 19 through an upstanding annular wall or extension 36, the upper edge of which seats on the washer 22 under influence of the expansive tendency of the spring bellows 27. The expansion of the bellows also tends to maintain the valve 29 seated on the washer 14 and yieldingly resists the relative movement of the valves toward one another. To buck the upward force of the bellows against opening of the valve 28, a coil spring 37 is interposed between the valve and the underside of the cap, one end surrounding and being located by the dome portion 35 and the other end being located by an annular rib 38 formed in the spring diaphragm 23.

With the parts arranged as shown in Figure 2 the system will be closed from the overflow vent 10 by the engagement of the two valves with their respective seats and the connection between the valves of the spring bellows. The bellows resists opening of the valve 29 as the pressure rises within the system due to heat expansion until a predetermined pressure is built up whereupon the valve 29 is lifted to relieve the excess pressure through the overflow pipe 10. As the system cools down the internal pressure drops and in the event of a sub-atmospheric pressure condition the valve 28 will be unseated under the combined forces of atmospheric pressure and the spring 37 allowing the passage of air between the skirt 36 and the dependent stud 19. This unseated position of the vacuum relief valve is illustrated in Figure 3 where it will be seen that the system is vented through the hollow bellows and overflow pipe.

In order to relieve internal pressure and avoid the likelihood of injury, the valve 29 may be unseated prior to complete removal of the closure cap assembly. For this purpose each camming portion of the dependent skirt 17, as shown in Figure 4, is provided with a safety stop 39 adjacent the entrance opening for the cooperating inturned abutment finger 18. Rotation of the cap between the fully closed position defined by the stop 40 at the bottom of the cam and the intermediate position defined by the safety stop 39, lifts the retainer head 20 into engagement with and unseats the valve 29. After a short interval of delay further rotation of the cap moves the abutment finger 18 beyond the safety stop 39 to an adjacent opening in the spout flange 16 for complete removal of the cap.

I claim:

1. For use with a vented filler spout having a valve seat at its inner end, a spout closure cap detachably engageable with the outer end of the spout, a dependent stud carried by the cap to project into the spout and provided with an enlarged head, a valve element slidable on the stud

2. A detachable closure device including a cap having a dependent pin, a pair of spaced valves slidably carried on said pin for engagement with valve seats, a spring bellows interposed between said valves and arranged to resist their relative movement toward one another and additional spring means acting on one of said valves in opposition to the spring force of said bellows.

3. In a closed pressure system, a pari of spaced valve seats, valves engaging said seats and movable toward one another for the relief of internal system pressure and vacuum, respectively, spring bellows interposed between said valves to seat the same and provide a hollow chamber for communication with the system and spring means acting on the vacuum relief valve in opposition to the bellows spring force.

4. For use with a vented filler spout having an internal valve seat, a detachable spout closure cap having a dependent stud, a valve unit slidably mounted on said stud and including a spring bellows and a pair of valve elements at opposite ends of the bellows to seat, respectively, on the spout seat and underside of the cap and means to retain said unit on the stud.

5. A radiator pressure cap having a dependent stud, a spring bellows surrounding the stud, a pair of valve elements secured to opposite ends of the spring bellows and slidably mounted on said stud for valve seating engagement, and a protective annular wall peripherally enclosing said spring bellows and forming a part of the valve assembly.

6. In a radiator pressure cap having a dependent stud, a valve assembly including a pair of spaced valve elements slidably mounted on the stud, a spring bellows interposed between said valve elements to afford a hollow chamber therebetween and spread the valve elements apart and a coil spring interposed between the cap and one of said valve elements for exerting thereon a spring force opposing that of the spring bellows.

7. In a device for valving a system vent, a pair of spaced valve seats, a pair of pressure responsive valves engaging said seats to close the vent and being arranged one to open outwardly of the system and only under excess system pressure and the other to open inwardly of the system and only under sub-atmospheric system pressure, and a spring bellows interposed between and secured at opposite ends to said valves, the interior of the bellows being open to the system.

8. In a closed pressure system having a vent to atmosphere, valve means automatically controlling the system vent and including a pair of valves spaced one beyond the other and arranged in parallel relation for operation in response to internal-external pressure differential, one to open outwardly of the system for the relief of excess system pressure and the other to open inwardly of the system for the relief of system vacuum, a flexible tubular wall having attaching portions secured to said valves and sealing the space therebetween and means affording open communication of said space with the system.

9. Automatic valving carried by a closure cap which is detachably engageable with a vented filler spout and characterized by an inwardly opening valve to seat on the cap, an outwardly open-

ing valve to seat on the spout and a spring bellows bearing at opposite ends on said valves to seat the same and affording a passageway communicating with the vented spout through the inwardly opening valve.

10. In a closed pressure system having a vented filler spout and a spout closure cap, pressure relief valving including an outwardly opening valve seating on the spout to close the system filler port, a spring bellows bearing at one end on said valve to seat the same and having its interior communicating at one end with the system and an inwardly opening valve mounted at the other end of the bellows to seat on the cap and close the interior of the bellows from the spout.

11. Automatic valving for a system vent including a valve arranged to open inwardly of the system in response to system pressure drop, an outwardly opening valve responsive to system pressure rise, a hollow tubular bellows interposed between and joined at opposite ends to said valves, a seat for one of the valves bounding a system port and a seat for the other valve serving to close a valve port communicating with the system through said hollow tubular bellows.

CHARLES S. BAILEY.