Oct. 30, 1962 R. B. EDELMANN ETAL 3,061,138

RADIATOR CAP

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Fig. 3

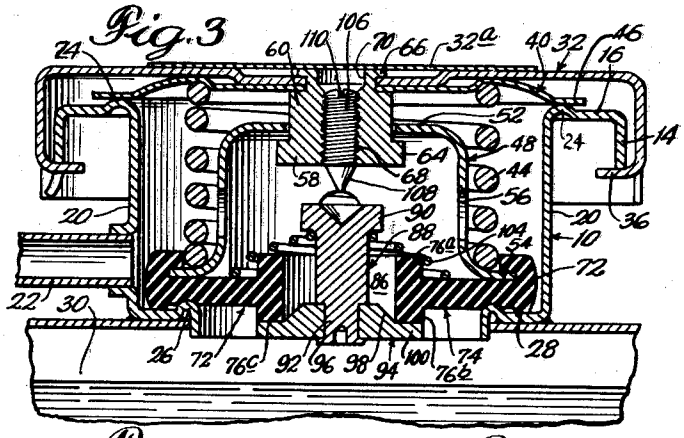


Fig. 4

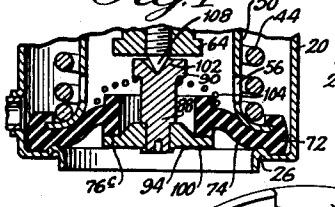


Fig. 5

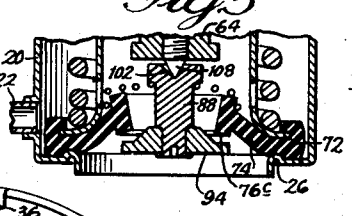


Fig. 2

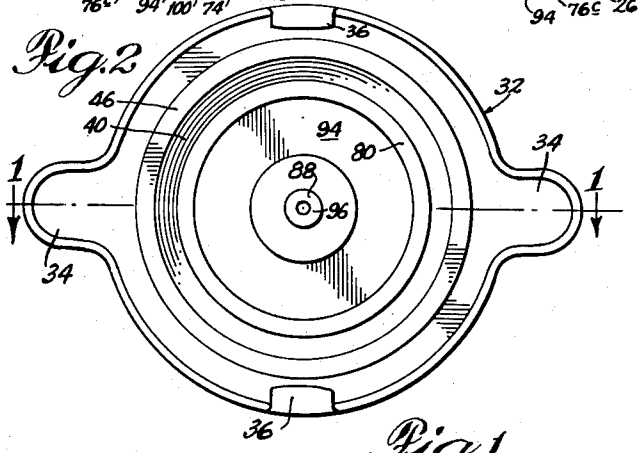


Fig. 1

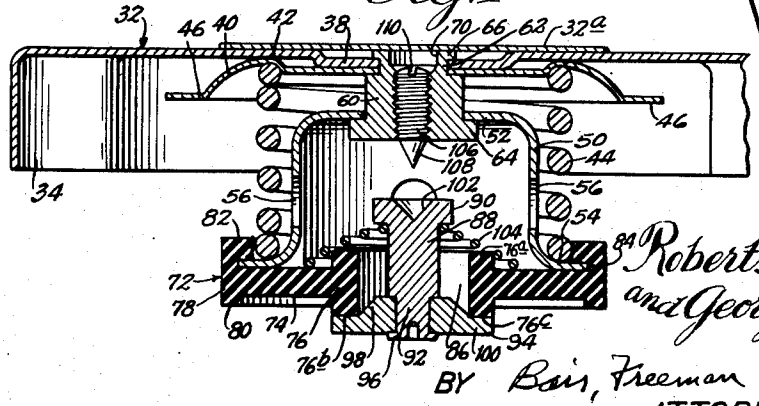
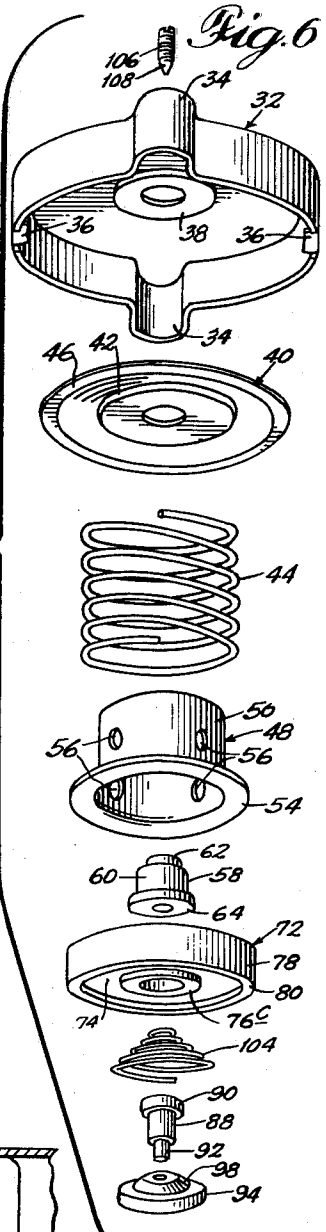


Fig. 6



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Fig. 8

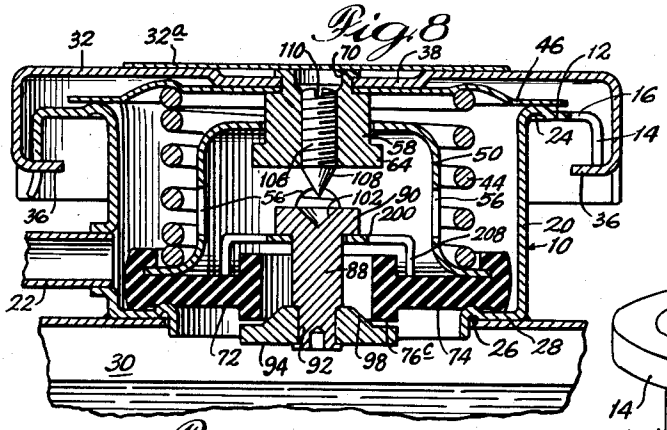


Fig. 13

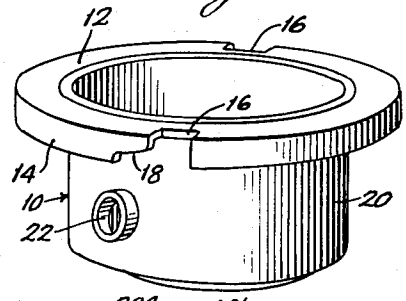


Fig. 9

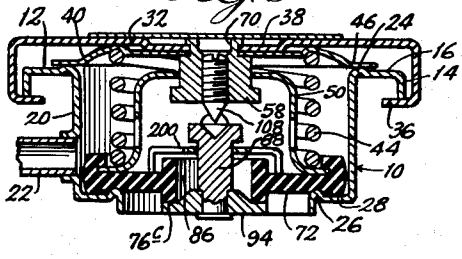


Fig. 12

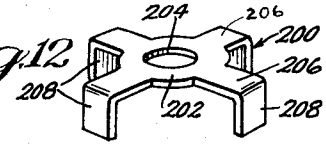


Fig. 10

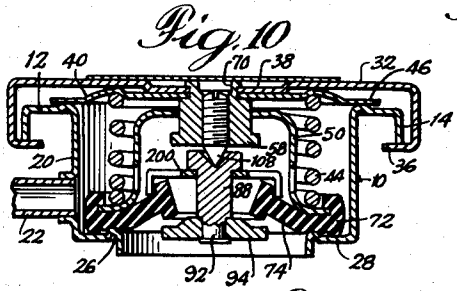


Fig. 11

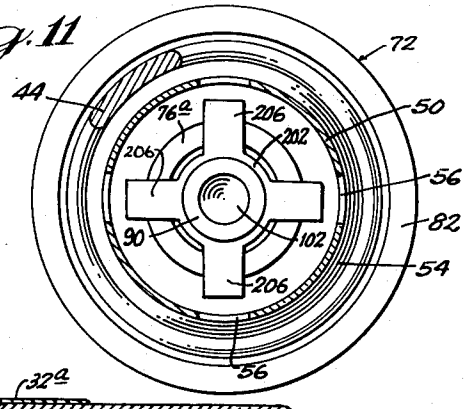
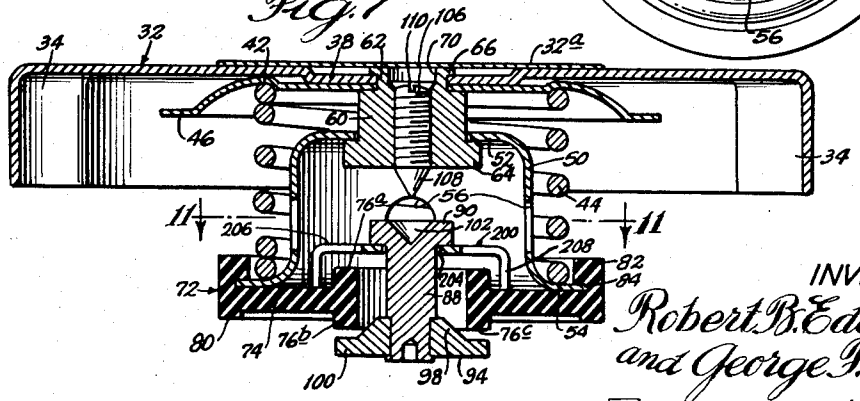


Fig. 7



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Fig. 16

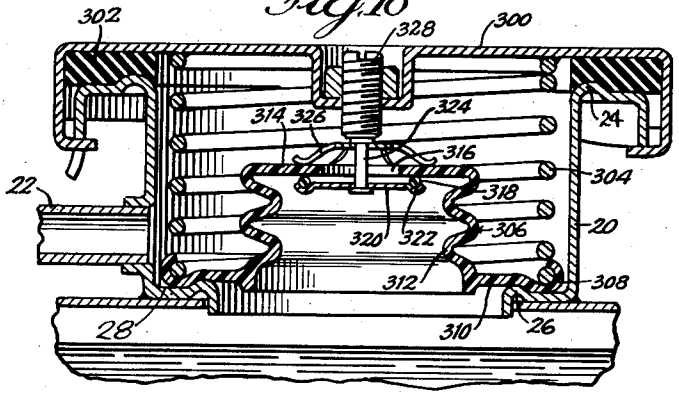


Fig. 17

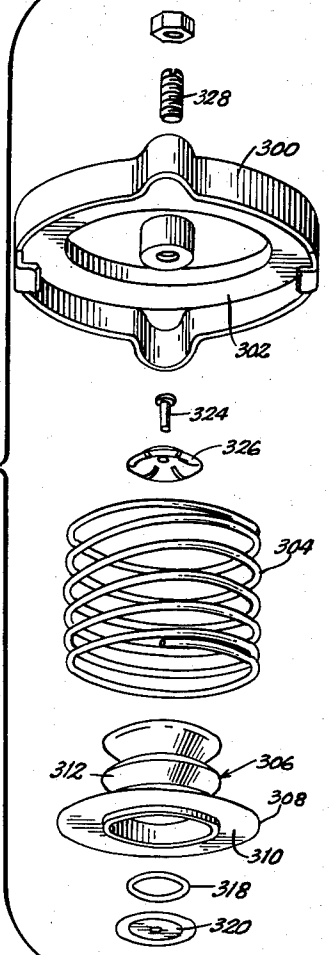


Fig. 15

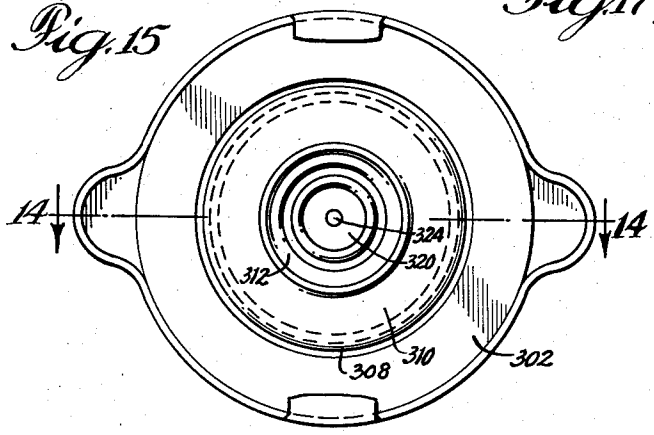
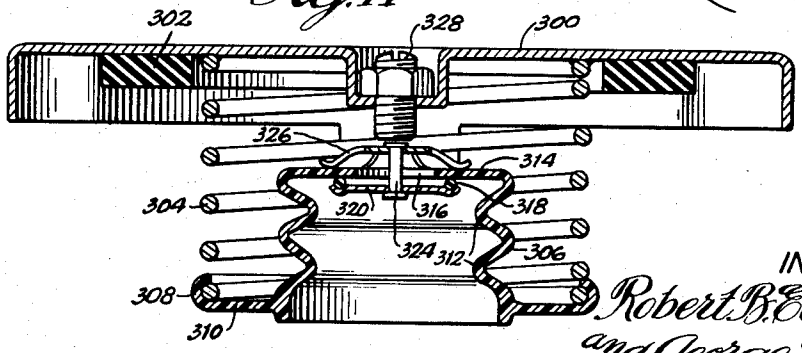


Fig. 14



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United States Patent Office 3,061,138 Patented Oct. 30, 1962

3,061,138
RADIATOR CAP

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Filed Jan. 3, 1957, Ser. No. 632,326
9 Claims. (Cl. 220—44)

This invention relates to a radiator cap for automotive vehicles and the like, and more particularly to a pressure-relief type radiator cap that includes means for selectively setting the pressure at which the cap is intended to operate.

One problem incident to manufacture of present day radiator caps resides in the fact that there exist three different pressure systems for modern automotive vehicles. That is, cooling systems for automotive vehicles are designed to develop pressures therein, greater than atmospheric pressure, in varying amounts. At present, the three most popular systems operate at pressures of 4 p.s.i., 7 p.s.i., and 14 p.s.i. gauge.

Now, existing radiator caps generally use coil springs or the like to seat a valve member on the lower valve seat surrounding the well of a radiator spout, and when the pressure in the radiator is operative to overcome the bias of the seating spring, then the valve unseats to permit relief of the excess pressure. Of course, in order to provide caps for all three systems, a radiator cap manufacturer would have to stock the necessary different parts and springs therefor.

Thus, one object of this invention is to provide a radiator cap wherein the same parts are utilized regardless of the pressure system to which the cap is to be attached, and which cap is provided with means for selectively adjusting the cap so as to produce a cap which will operate substantially at the pressure intended for it.

It should also be noted that automotive vehicle manufacturers differ as to whether the cooling system, when at atmospheric pressure, should be normally open, and vented, or normally closed. Both systems are presently in use. And so, a radiator cap manufacturer must again be prepared to produce caps for either system.

Thus, another object of this invention is to provide radiator caps for either normally open or normally closed systems, which are provided with selectively adjustable means for selecting the pressure at which the cap is to be operated.

The radiator cap of the instant invention is designed to make provision for relieving vacuums in the radiator, which vacuums occur after the radiator has been initially heated to drive off a portion of the vapor therein, and after the radiator has been subsequently cooled. Accordingly, it is another object of this invention to provide a radiator cap of the type herein disclosed having valve means for relieving vacuums that may be created within the radiator.

It should be generally noted that the valve seats in radiator spouts are often damaged; for example, by being dented or scratched when the mouth of a pouring spout member is introduced into the spout of the radiator. Howsoever the damage is caused, such damage to the well seats frequently cause existing radiator caps to leak. Existing radiator caps, while often including a resilient sealing disc-member to be seated against the lowermost seat of a radiator spout, generally include a rigid backing member which supports the resilient sealing member. If the dent, or scratch, on the valve seat is large enough, then the resilient sealing member just does not have a chance to seal said damaged portion of the valve seat, because the rigid backing member therebehind is seated on the remainder of the seat and there is then no structure available to force the resilient sealing member into sealing relation with the damaged portion of the seat.

Thus, still another object of this invention is to provide a resilient member which seats against the lower seat of the spout of a radiator and is so arranged and constructed as to effect full sealing engagement with the lower seat of the radiator spout, regardless of the condition of said seat, be it scratched or dented.

A further difficulty encountered with existing radiator caps lies in the fact that after the automotive vehicle's radiator has been heated, the fluid within the radiator is at a high enough temperature to scald a person. When present day caps are rotated a ¼ turn to be released from locking position, prior to being removed from the radiator spout, the arrangement of parts is such that the lower valve seat in the radiator spout still receives the lower valve member carried by the radiator cap in sealing relation thereto, so that the pressurized fluid in the radiator does not bleed past the lower seat. Then, when the radiator cap is removed from the radiator spout, there is a sudden discharge of hot fluids from the spout, and such may cause scalding of the person removing the radiator cap.

One of the objects of the instant invention is to provide a radiator cap which is so designed and constructed that when the radiator cap is rotated a ¼ turn from its locking position on the radiator's spout, then there is unseating of the sealing member from the spout's lower valve seat, which permits bleeding of fluid past the lower spout seat, so that there will be relieving of the radiator pressure instantly upon the unlocking of the radiator cap, and thereafter when the radiator cap is removed from the spout there will be no sudden discharge of scalding fluids from the radiator.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

A preferred embodiment of the invention is shown in the accompanying drawings, in which:

FIGURE 1 is a vertical axial cross-section view of one form of radiator cap embodying the invention, and is taken on line 1—1 of FIGURE 2;

FIGURE 2 is a bottom plan view of the radiator cap of FIGURE 1;

FIGURE 3 shows the radiator cap of FIGURE 1 secured to the mouth of a radiator spout of an automotive vehicle;

FIGURE 4 is a fragmentary cross-section view showing the position of the diaphragm parts at a radiator pressure when the valve stem first abuts the stop means carried by the radiator cap;

FIGURE 5 is similar to FIGURE 4, but showing what occurs at a pressure slightly higher than the pressure achieved in FIGURE 4;

FIGURE 6 is an exploded view of the parts of the radiator cap of FIGURES 1–5;

FIGURE 7 is similar to FIGURE 1 and shows a modified form of radiator cap;

FIGURE 8 is similar to FIGURE 3, showing the cap of FIGURE 7 mounted on the mouth of a radiator spout;

FIGURE 9 shows the position of the parts at a radiator pressure slightly higher than in FIGURE 8 and slightly higher than atmospheric pressure;

FIGURE 10 is similar to FIGURE 5 and shows the diaphragm member unseated from the valve member at a radiator pressure higher than in FIGURE 9;

FIGURE 11 is a cross-section view taken on line 11—11 of FIGURE 7;

FIGURE 12 is a perspective view of the spider carried

by the valve stem in the form of invention of FIGURES 7–11;

FIGURE 13 is a perspective view of a radiator spout to which the radiator cap of this invention is to attach;

FIGURE 14 is a vertical axial cross-section view, similar to FIGURE 1, showing still another modified form of radiator cap embodying this invention, said FIGURE 14 being taken substantially on line 14—14 of FIGURE 15;

FIGURE 15 is a bottom plan view of the radiator cap of FIGURE 14;

FIGURE 16 shows a radiator cap of FIGURE 14 secured to the mouth of the radiator spout of an automotive vehicle; and

FIGURE 17 shows an exploded view of the parts of the radiator cap of FIGURES 14–16.

Referring now to the drawings, attention is first called to FIGURE 13 wherein is shown the spout portion 10 of a radiator for an automotive vehicle. The spout 10 includes an upper laterally extending flange 12 which terminates in a downturned flange 14. The flanges 12 and 14 are formed with oppositely arranged notches 16, each of said notches being adjacent a cam surface 18 formed on the edge of the downwardly turned flange 14. The spout 10 also includes a cylindrical wall portion 20 through which a relief tube 22 vents to the interior of the spout, which is known as the spout well. The construction of FIGURE 13 is more fully shown in cross-section in FIGURE 3, and it will be seen that portions of the spout 10 are shaped to define an upper annular valve seat 24 and a lower annular valve seat 26, spaced respectively above and below the point where the relief tube 22 vents through the cylindrical wall 20 of the spout. Surrounding the lower annular valve seat 26 there is formed a depressed portion which defines an annular gutter 28. The spout 10 is shown in FIGURE 3 being appropriately attached to a radiator, generally indicated at 30. The foregoing construction of a radiator spout is well known in the art.

Now referring to the closure cap for the radiator spout, said closure cap includes a cap member generally indicated at 32. The cap member is a stamping of sheet metal which is shaped to define a pair of opposed protruding ears or flanges 34, and a pair of inwardly turned tongues 36. Again, this construction of the cap member 32 is well known in the art.

The cap member is also shaped to define a central dished portion 38. Positioned against the central dished portion 38 is the central portion of an annular metal diaphragm 40, which diaphragm is shaped to define an annular detent or groove 42 for receiving and centering the upper end of a coil spring 44. The outwardly extending portion of the metal diaphragm 40 is bent, or pre-formed, to define a valve member 46 which is adapted to seat against the valve seat 24 of the radiator spout.

There is also provided a bell-shaped, or inverted cup-shaped, member 48 having upright side walls 50, an in-turned upper flange 52, and an out-turned lower flange 54. The upright side walls 50 are apertured at 56 to provide communication between the interior of the bell member 48 with the space surrounding the bell member 48.

There is a central annular stud, or rivet, 58 which defines an elongated shank or stem 60, a reduced stem portion 62, and an enlarged shoulder 64. The stud 58 is arranged to retain the members thus far described in assembled condition. The stud 58 is of such dimension that the stem 60 slidably extends through the aperture defined by the in-turned flange 52 of the bell member 48, but the shoulder 64 is of such size that the flange 52 abuts thereagainst. The reduced stem portion 62 is adapted to extend through centrally aligned apertures in the cap member 32 and diaphragm 40, and is arranged to be upset to form a rivet head 66 which is disposed within the recess defined by the dished portion 38 of the cap member. The stud 58 thus operates to assemble the cap member 32, the diaphragm 40, the bell-shaped member 48, and the spring 44 which is positioned between the out-turned flange 54 of the bell member 48 and the flexible diaphragm 40. The stud, or rivet, 58 is centrally bored and the lower bore portion is threaded at 68 and the upper bore portion is counterbored at 70, said counterboring operating to reduce the thickness of the wall of the rivet, so as to ease the upsetting of the adjacent material which forms the rivet head 66.

The closure cap is also provided with a diaphragm subassembly which is attached to the outwardly extending flange 54 of the bell member 48. This diaphragm subassembly includes an annular flexible diaphragm member 72 which is formed of a resilient compressible material, such as rubber or the like. The annular diaphragm member 72 is shaped to define a central portion 74 which is generally disc-shaped, an inner annular portion 76 having axially extending portions 76*a* and 76*b* extending respectively above and below the plane of the central annular portion 74, and an outer annular portion 78. The outer annular portion 78 defines a centering rib 80 extending below the plane of the central portion 74. The outer annular portion 78 also defines an inwardly turned flange 82 spaced above the plane of the central portion 74 to define an inwardly opening circular groove 84 arranged to receive the out-turned flange 54 of the bell member 48.

The inner annular portion 76 of the diaphragm member 72 surrounds a central opening 86 within which is positioned a valve stem 88 having an outwardly extending flange, or shoulder, 90 at the upper end thereof and a reduced stem portion 92 at its lower end. A valve member 94 is mounted on the reduced stem portion 92, and the terminus of said reduced stem 92 is upset to form a rivet head 96 which clamps the stem 88 of the valve member 94 together as a unit.

The valve member 94 has a frusto conical portion 98 which cooperates with the inner annular portion 76 of the diaphragm member to center the valve member 94 with respect thereto. The valve member 94 also defines a portion 100, located outwardly of the frusto conical portion 98, which is adapted to seat against a valve seat 76*c*, which is the under surface of diaphragm portion 76*b*. The upper terminal end of the valve stem 88 is recessed conically at 102.

In the form of the invention shown in FIGURES 1–6, there is provided a conical coil spring 104, the upper end of which is arranged to engage the shoulder 90 of the valve stem 88, and the lower, larger end of which is adapted to fit over the upstanding diaphragm portion 76*a*, and to seat against the upper surface of the central portion 74 of the diaphragm member. The spring has a spring constant which is so selected and designed as to cause the valve member 94 to seat and seal against valve seat 76*c* of the diaphragm member when the opposite sides of the valve member 94 are exposed to equal pressures.

There is a screw-type stop member, abutment or stop means, 106 threaded in bore 68 of stud 58. Said screw-type stop member 106 is shaped to define a conical lower end 108 which is arranged to cooperate with the conical recess 102 in stem 88. The apex angle of the conical tip 108 is less than the apex angle of the recess 102, so as to obviate binding of said parts and to permit of proper adjustment between the parts. The upper end of screw member 106 is slotted, or socketed, at 110 to receive the bit of an adjusting instrument, such as a screw driver or the like.

In the modified form of FIGURES 7–12, the great majority of parts shown are identical with the parts shown and described in the form of FIGURES 1–6. The difference in construction in FIGURES 7–12 lies in the fact that the conical spring 104 of FIGURES 1–6 has been omitted. In its place, there is provided an annular spider generally indicated at 200 and which is best seen in FIGURE 12. The spider member 200 includes a central disc

portion 202 which is apertured at 204 to provide for a sliding fit on the stem 88. Extending outwardly from the central disc portion 202 are a plurality of arms 206 which are flanged downwardly to define support fingers 208. The reach of arms 206 is such that the support fingers are located outwardly of diaphragm portion 76, and thus seat against the upper surface of the central diaphragm portion 74. In normal position, at atmospheric pressure in the radiator, the parts are as shown in FIGURE 7 with the valve member 94 unseated from the valve seat 76c defined on the diaphragm member 72.

In the form of the device shown in FIGURES 14–17 there is shown a cap member 300 having a compressible annular sealing gasket 302 secured to the underside thereof. A coil spring 304 is brazed, welded, or otherwise appropriately attached to the under side of cap 300, and is located inwardly of the sealing gasket 302. A pre-formed annular diaphragm member, of rubber or other appropriate resilient material, is provided at 306. Said diaphragm member 306 is shaped to define an outer annular portion 308 which is arranged to grip the lowermost coil of the spring 304, so as to provide for assembly of the resilient diaphragm member 306 with the cap 300. The central portion of the resilient member 306 defines an outer, horizontally arranged portion 310 which is adapted to seat against the lower valve seat 26 of the radiator spout. An inner portion of the central portion of the resilient diaphragm member 306 is generally vertically disposed and is bellows-shaped, as at 312. The annular diaphragm member 306 also defines an inner portion 314 which surrounds a central aperture 316, and the underside of said inner portion 314 serves as a valve seat against which a valve member 318, in the form of an O ring, or the like, may be seated.

The valve member 318 is supported on a disc-shaped rigid plate 320 which is grooved at 322 to receive the O ring 318. A central stem 324, connected to the plate member 320, extends upwardly through the central opening 316 in the diaphragm member 306, and carries thereon a plurality of spring fingers 326 which engage and cooperate with the upper side of the annular diaphragm 306 to normally force the valve member 318 into sealing engagement with the underside of diaphragm portion 314. The cap 300 carries thereon an adjustable abutment means in the form of a screw member 328 which is threaded to the cap.

In the forms of the device herein disclosed in FIGURES 1–12, the upper annular diaphragm 40 is so designed and arranged that when it is seated against the upper valve seat 24 in full sealing relation thereto, as shown in FIGURES 3 and 8, then it requires an abnormally high pressure exerted against the underside of diaphragm 40 to effect movement of said diaphragm off the valve seat 24 to permit relief of such abnormally high pressure. Said diaphragm 40 is preferably selected to open at pressures in the range of 20 p.s.i. gauge.

The coil spring 44 operates to normally bias the parts to the position shown in FIGURE 1. When the portions of the cap including the annular diaphragm member 72 are inserted into the well of the radiator spout, the parts have been so selected and designed that when the valve portion 46 of diaphragm 40 engages the upper valve seat 24, so that the weight of closure cap 10 is supported thereby, then the diaphragm member 74 is not in sealing relation with the lower valve seat 26. This is important because when the closure cap of this invention is being removed from a radiator spout, said cap will be moved into a position, prior to complete removal of the closure cap from the radiator spout, at which the pressure within the radiator is vented past the lower valve seat 26 of the radiator spout. Then, if there happens to be some excess pressure in the radiator, such pressure will be vented before the closure cap is fully removed from the spout, and this will obviate any sudden release of pressurized fluids from the radiator spout upon removal of the closure cap therefrom. Accordingly, this is a safety feature which obviates the discharge of scalding fluid from the radiator upon removal of the closure cap from the radiator spout.

The parts of the radiator closure cap of this invention are so selected and arranged that when the cap is being connected to the radiator spout, the inwardly extending flanges 36 on cap member 32 first enter the notches 16 of the spout 10 and then, by roating the cap clockwise, said inwardly turned flange 36 rides down cam 18 and forces the upper diaphragm 40 into sealing relation with the upper valve seat 24, and also operates to force the resilient diaphargm member 72 into sealing relation with the lower spout seat 26. The diaphragm member 72 is of substantial thickness, and is of resilient and compressible material; and this is desirable because the diaphragm member 72, upon being forced into engagement with seat 26, compresses and deforms to flow into and over all scratches or slight dents which may exist in the valve seat 26, and thereby there is formed an excellent seal despite a damaged condition of said valve seat 26. As can be seen in FIGURE 3, the compression is such as to bulge the outermost lateral edge of the diaphragm member 72.

The centering rib 80 is useful in insuring that the diaphragm member is properly centered with respect to the valve seat 26. The spring member 44 is arranged and designed to provide sufficient force to effect the necessary compression and distortion of the flexible diaphragm member 72 against the valve seat 26. Furthermore, the spring 44 is selected and designed so as to permit unseating of the diaphragm member 72 from the valve seat 26 upon there being an abnormal pressure condition in the radiator, in the range of 20 p.s.i. gauge. It is possible for the radiator pressure to build up more rapidly than the normal venting operation of the cap is able to accommodate. Thus, when an abnorally high pressure of over 20 p.s.i. occurs in the radiator, the diaphragm member 72 will unseat from valve seat 26 in an attempt to relieve the pressure, and even the upper diaphragm 40 may be unseated from valve seat 24 to permit discharge of fluid under pressure past the cap member 32.

Considering the operation of the closure cap under normal conditions, when the pressure within radiator 80 is atmospheric, or slightly above atmospheric, then the parts will be as shown in FIGURE 3. As pressure within the radiator 30 increases, the central portion 74 of the diaphragm member 72 will flex upwardly as shown in FIGURE 4. It will be understood that the valve member 94 is seated against valve sat 76c of diaphragm member 72 and thus cooperates therewith to define a diaphragm which separates the pressure within radiator 30 from the space thereabove which is vented to the relief tube 22. Thus, the portion of the diaphragm member 72 which extends inwardly of the valve seat 26 operates as a flexible diaphragm which separates the region therebelow, a region of variable radiator pressure from the region thereabove, a region of constant reference pressure and which diaphragm displaces, or distorts, upwardly or downwardly in response to the pressure-differentials between the variable source of pressure within the radiator 30, and the constant source of pressure which communicates with the upper side of the diaphragm. This constant source of pressure in the vented system herein shown is atmospheric pressure, although another pressure source, or constant pressure could be applied to the upper surface of the diaphragm. The displacement of the movable diaphragm is a function of the pressure-differentials applied thereto.

In any event, as the pressure-differential increases above the first pre-selected pressure-differential at which the diaphragm flexes upwardly towards the position shown in FIGURE 4, and when the diaphragm reaches the position in FIGURE 4, then the stem 88 encounters the abutment at the tip of the stop means 106. Thus, further upward movement of the stem 88 and valve member 94

is terminated. Then, upon a further increase in the pressure-differential, the flexible diaphragm member **72** continues to flex upwardly, thus separating valve seat **76***c* from the valve member **94**, and opening a passage which communicates the pressure within the radiator to the region which is vented to the relief tube **22**. The latter position is best seen in FIGURE 5. After the excess pressure has been vented, of course the parts reseat as in FIGURE 4, and if the pressures fall within the radiator, the diaphragm flexes back towards the position in FIGURE 3. If there should be a vacuum condition developed within the radiator, such vacuum condition, or lowered pressure-differential, operates to move the valve member **94** downwardly away from the valve seat **76***c* and, again, the vacuum within the radiator is relieved by means of fluid entering the radiator through the vent relief tube **22**.

It will be understood that the instant closure cap may either be provided with a pre-selected, non-movable, abutment means for engaging the stem **88**, or with an adjustable abutment means. When the abutment means are pre-selected and non-movable, then said abutment means may be merely an integral portion of, or a downward extension of, the stud **58**, and said integral downward extension may be designed of such length as to engage and stop upward movement of the valve member at a predetermined pressure-differential. When adjustable abutment means are employed, then it may be adjusted in a factory so that the stem **88** engages the abutment means **106** only after a certain pressure-differential has been attained. With use of adjustable abutment means, one of the purposes of this invention is achieved by providing a closure cap wherein all of the parts of the same, but which may be adjusted at a factory to provide caps which operate to vent at different selected pressures, as desired by the automobile manufacturer. After the stop means **106** has been factory set, the cap **32** may have a removable cover plate, or name plate, **32***a* applied thereto which prevents unauthorized tampering with the adjustment.

With respect to the form of the invention shown in FIGURES 7–12, the valve **94** is normally unseated from valve seat **76***c*. This is the condition that exists when there is atmospheric pressure within the radiator to which the cap it attached. However, as the pressure within the radiator starts to build up, the slight initial pressure-differential is sufficient to lift the valve member **94** into engagement with the valve seat **76***c* of the diaphragm member **72**, and thereafter the device operates precisely as described and disclosed in FIGURES 1–6.

In the device of FIGURES 14–17, the thickness of the flexible material of the diaphragm member **306** is not as great as in the other two forms described. The arrangement of the coil spring **304** is such that the lower end of coil spring **304** seats the diaphragm member within the gutter **28** of the radiator spout, and the horizontal portion **310** of the diaphragm member **306** is thus caused to wrap itself around the valve seat **26** so as to effect proper sealing therewith. The operation of this form of device is substantially similar to the operations of the other devices disclosed. Upon increase in pressure-differentials, the bellows unit **312** expands upwardly until, at a pre-selected pressure-differential, the uppermost end of stem **324** abuts the stop means **328**, and thereafter further pressure-differential will unseat the portion **314** of diaphragm member **306** from the valve member **318**, thus providing venting of the radiator to the vent tube **22**. Upon relief being attained, the parts return to the normal sealed position. The valve member **318** is normally in sealing relation with the diaphragm member **306** by reason of the resilient arms **326**. The cap of FIGURES 14–17 does not show a pressure-relief diaphragm which seats on the upper spout seat **24**, but rather uses a gasket to obtain such sealing. However, if desired, a diaphragm similar to diaphragm **40** may be supplied in this latter form of invention. The spring member **304** is designed and arranged to unseat in the neighborhood of 20 p.s.i. gauge so as to permit relief at abnormally high pressures.

Some changes may be made in the construction and arrangement of the parts of our radiator cap without departing from the real spirit and purpose of our invention, and it is our intention to cover by our claims any modified forms of structure or use of mechanical equivalents which may reasonably be included within their scope.

We claim as our invention:

1. A closure cap for the radiator spout of an automotive vehicle, which spout defines at least one annular valve seat, said closure cap comprising means defining an annular flexible resilient diaphragm member positioned to have one side thereof responsive to variable radiator pressure within the radiator and the other side thereof responsive to a substantially constant reference pressure, a valve member carried by said annular diaphragm member and being movable with respect thereto, said valve member being arranged to seat and seal against said resilient annular diaphragm member and to have one side thereof exposed to said variable radiator pressure and to have the other side thereof exposed to said reference pressure, said valve member being selected and arranged to seat against said annular diaphragm member at a pressure-differential greater than a first predetermined pressure-differential between said radiator pressure and said reference pressure and to unseat from said annular diaphragm member at a pressure-differential less than said first predetermined pressure-differential, said valve member when seated against said diaphragm member cooperating therewith to define a diaphragm which separates the region of radiator pressure from the region of reference pressure, and which diaphragm flexes in response to pressure-differentials greater than said first predetermined pressure-differential, the degree of flexing of said diaphragm being a function of said pressure-differentials, stop means connected to said cap and spaced above said flexible diaphragm member for arresting movement of the valve member after a preselected upward displacement of the valve member carried by the flexing annular diaphragm member has occurred, so that further increase in the pressure-differential operates to separate the valve member and the annular diaphragm member and to establish communication between the region of radiator pressure and the region of reference pressure, resilient means carried by said closure cap for forcing said annular diaphragm member against an annular valve seat on the spout, said resilient means being selected and arranged to permit unseating of said annular diaphragm member from said annular seat at a radiator pressure in the range of 20 p.s.i. gauge, and diaphragm valve means carried by said cap for seating on a second annular seat on the spout and being selected and arranged to unseat at pressures in the order of at least 20 p.s.i. gauge.

2. A closure cap for the radiator spout of an automotive vehicle, said closure cap comprising means defining an annular flexible resilient diaphragm member positioned to have one side thereof responsive to variable radiator pressure and the other side thereof responsive to a substantially constant reference pressure, a valve member carried by said annular diaphragm member and being movable with respect thereto, said valve member being arranged to seat and seal against said resilient annular diaphragm member and to have one side thereof exposed to said variable radiator pressure and to have the other side thereof exposed to said reference pressure, said valve member being selected and arranged to seat against said annular diaphragm member at a pressure-differential greater than a first predetermined pressure-differential between said radiator pressure and said reference pressure and to unseat from said annular diaphragm member at a pressure-differential less than said first predetermined pressure-differential, said valve member when seated against said diaphragm member cooperating therewith to

define a diaphragm which separates the region of radiator pressure from the region of reference pressure, and which diaphragm flexes in response to pressure-differentials greater than said first predetermined pressure-differential, the degree of flexing of said diaphragm being a function of said pressure-differentials, stop means connected to said cap and spaced above said flexible diaphragm member for arresting movement of the valve member after a preselected upward displacement of the valve member carried by the flexing annular diaphragm member has occurred, so that further increase in the pressure-differential operates to separate the valve member and the annular diaphragm member and to establish communication between the region of radiator pressure and the region of reference pressure, said annular diaphragm member includes an outer annular portion adapted to seat against a valve seat formed in said radiator spout, an inner annular portion serving as a valve seat for said valve member, and an intermediate annular portion interconnecting said inner and outer annular portions and affording flexing thereof to permit axial movement of said inner annular portion relative to said outer annular portion, and said intermediate portion of said annular diaphragm member being bellows-shaped.

3. A closure cap for the radiator spout of an automotive vehicle, said closure cap comprising means defining an annular flexible resilient diaphragm member positioned to have one side thereof responsive to variable radiator pressure and the other side thereof responsive to a substantially constant reference pressure, a valve member carried by said annular diaphragm member and being movable with respect thereto, said valve member being arranged to seat and seal against said resilient annular diaphragm member and to have one side thereof exposed to said variable radiator pressure and to have the other side thereof exposed to said reference pressure, said valve member being selected and arranged to seat against said annular diaphragm member at a pressure-differential greater than a first predetermined pressure-differential between said radiator pressure and said reference pressure and to unseat from said annular diaphragm member at a pressure-differential less than said first predetermined pressure-differential, said valve member when seated against said diaphragm member cooperating therewith to define a diaphragm which separates the region of radiator pressure from the region of reference pressure, and which diaphragm flexes in response to pressure-differentials greater than said first predetermined pressure-differential, the degree of flexing of said diaphragm being a function of said pressure-differentials, stop means connected to said cap and spaced above said flexible diaphragm member for arresting movement of the valve member after a preselected upward displacement of the valve member carried by the flexing annular diaphragm member has occurred, so that further increase in the pressure-differential operates to separate the valve member and the annular diaphragm member and to establish communication between the region of radiator pressure and the region of reference pressure, said annular diaphragm member includes an outer annular portion adapted to seat against a valve seat formed in said radiator spout, an inner annular portion serving as a valve seat for said valve member, and an intermediate annular portion interconnecting said inner and outer annular portions and affording flexing thereof to permit axial movement of said inner annular portion relative to said outer annular portion, and said annular diaphragm member defining groove means therein for detachably connecting said diaphragm member onto an outwardly extending flange on a support member carried by said closure cap.

4. A closure cap for the vented spout of a radiator for automotive vehicles or the like, which spout defines upper and lower annular seats respectively spaced above and below the vent for said spout; said closure cap comprising, in combination, a cap member formed for retaining association with said spout, a first diaphragm carried on the underside of said cap member and being of flexible material and being arranged for sealing engagement with said upper seat of the spout, a central annular stud clamping said cap member and said flexible diaphragm together, said annular stud defining an elongated shank portion extending below said flexible diaphragm and an outwardly extending shoulder at the lower end of said shank portion, an annular bell-shaped member slideably disposed on the shank portion of said stud and defining an apertured cylindrical side extending below said stud and an outwardly extending flange at the lower end thereof, a coil spring positioned between said flexible diaphragm and said outwardly extending flange of the bell-shaped member for normally biasing said members apart with said bell-shaped member seated against said shoulder on the shank portion of the stud, a second diaphragm of resilient, deformable material carried on said outwardly extending flange of the bell-shaped member and being arranged to have an outer annular portion thereof seat and seal against the lower annular seat of said radiator spout, said second diaphragm being annular and defining thereon a central annular valve seat on the lower side thereof, and the portion of said second diaphragm between said outer annular portion and central annular valve seat thereof being subject to flexing over a continuous range in response to pressure differentials applied thereto, an elongated valve stem arranged for upright longitudinal movement and located centrally of said central annular valve seat, said valve stem carrying a valve member at the lower end thereof for seating against said central annular valve seat on the second diaphragm, and a selectively adjustable stop member threaded in the central aperture of the annular stud and being spaced above said second diaphragm and disposed in the path of longitudinal movement of said valve stem.

5. A closure cap for the radiator spout of an automotive vehicle, which spout defines at least one annular valve seat, said closure cap comprising means defining an annular flexible resilient diaphragm member positioned to have one side thereof responsive to variable radiator pressure within the radiator and the other side thereof responsive to a substantially constant reference pressure, a valve member carried by said annular diaphragm member and being movable with respect thereto, said valve member being arranged to seat and seal against said resilient annular diaphragm member and to have one side thereof exposed to said variable radiator pressure and to have the other side thereof exposed to said reference pressure, said valve member being selected and arranged to seat against said annular diaphragm member at a pressure-differential greater than a first predetermined pressure-differential between said radiator pressure and said reference pressure and to unseat from said annular diaphragm member at a pressure-differential less than said first predetermined pressure-differential, said valve member when seated against said diaphragm member cooperating therewith to define a diaphragm which separates the region of radiator pressure from the region of reference pressure, and which diaphragm flexes in response to pressure-differentials greater than said first predetermined pressure-differential, the degree of flexing of said diaphragm being a function of said pressure-differentials, stop means connected to said cap and spaced above said flexible diaphragm member for arresting movement of the valve member after a preselected upward displacement of the valve member carried by the flexing annular diaphragm member has occurred, so that further increase in the pressure-differential operates to separate the valve member and the annular diaphragm member and to establish communication between the region of radiator pressure and the region of reference pressure, resilient means carried by said closure cap for forcing said annular diaphragm member against an annular valve seat on the spout, said resilient means being selected and arranged to permit un-

seating of said annular diaphragm member from said annular seat at excessive radiator pressures, and diaphragm valve means carried by said cap for seating on a second annular seat on the spout and being selected and arranged to unseat at pressures at least as high as said excessive radiator pressures.

6. A closure cap for the radiator spout of an automotive vehicle, which spout defines at least one annular valve seat, said closure cap comprising means defining an annular flexible resilient diaphragm member positioned to have one side thereof responsive to variable radiator pressure within the radiator and the other side thereof responsive to a substantially constant reference pressure, a valve member carried by said annular diaphragm member and being movable with respect thereto, said valve member being arranged to seat and seal against said resilient annular diaphragm member and to have one side thereof exposed to said variable radiator pressure and to have the other side thereof exposed to said reference pressure, said valve member being selected and arranged to seat against said annular diaphragm member at a pressure-differential greater than a first predetermined pressure-differential between said radiator pressure and said reference pressure and to unseat from said annular diaphragm member at a pressure-differential less than said first predetermined pressure-differential, said valve member when seated against said diaphragm member cooperating therewith to define a diaphragm which separates the region of radiator pressure from the region of reference pressure, and which diaphragm flexes in response to pressure-differentials greater than said first predetermined pressure-differential, the degree of flexing of said diaphragm being a function of said pressure-differentials, stop means connected to said cap and spaced above said flexible diaphragm member for arresting movement of the valve member after a preselected upward displacement of the valve member carried by the flexing annular diaphragm member has occurred, so that further increase in the pressure-differential operates to separate the valve member and the annular diaphragm member and to establish communication between the region of radiator pressure and the region of reference pressure, and spring means carried by said closure cap for spring pressing said annular diaphragm member against an annular valve seat on the spout to seal thereagainst, said spring means being selected and arranged to permit unseating of said annular diaphragm member from said annular seat at excessive radiator pressures.

7. A closure cap as set forth in claim 6 including spring means normally biasing said valve member into seating cooperation with said diaphragm member when the radiator pressure is at least as high as the reference pressure.

8. A closure cap as set forth in claim 6 wherein said valve member is selected and arranged so as to be unseated from said diaphragm member when said radiator pressure is no more than the reference pressure, but being arranged to seat against said diaphragm member upon slight initial pressure-differential being generated by the radiator.

9. A closure cap as set forth in claim 6 including annularly disposed centering means on the under side of said diaphragm member arranged for engaging cooperation with said annular valve seat against which said diaphragm is forced to effect centering and proper seating of said diaphragm member on said valve seat.

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