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CLOSURE DEVICES  
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Fig. 1.

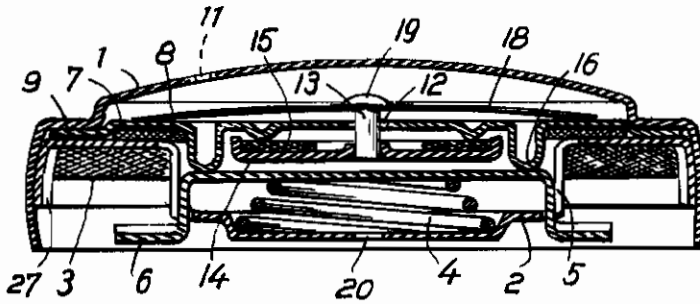


Fig. 2.

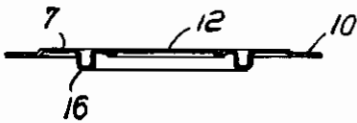


Fig. 4.

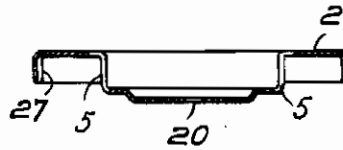


Fig. 3.

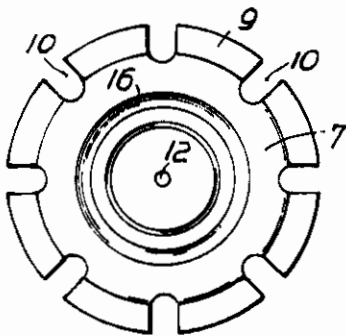
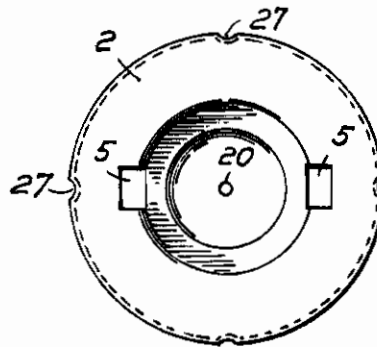


Fig. 5.



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Fig. 6.

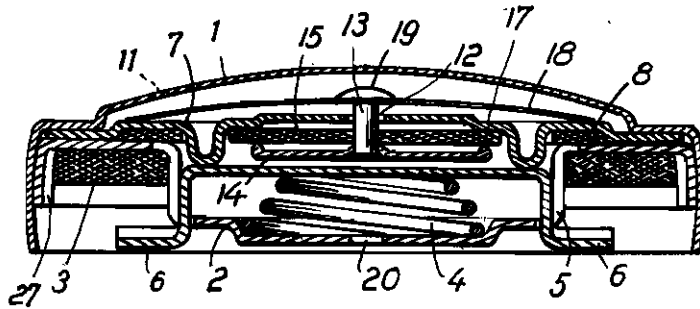


Fig. 7.

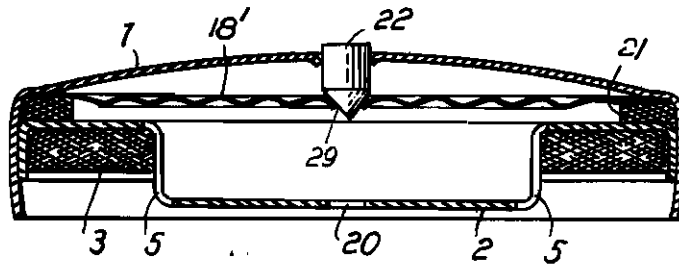
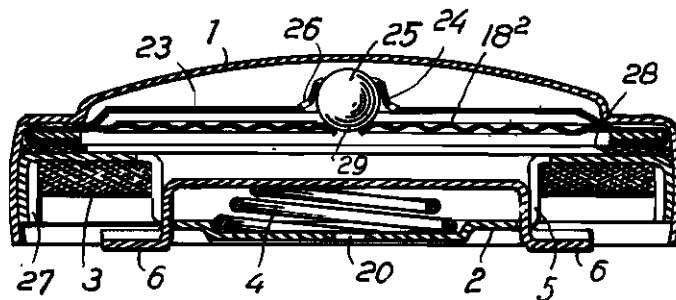


Fig. 8.



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## CLOSURE DEVICES

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Application filed June 14, 1940

The invention relates to a closure device which is intended particularly but not exclusively for fuel tanks, cooling water vessels and so forth on power vehicles and is provided with a pressure-equalizing member which is automatically opened when a reduction in pressure occurs in the closed vessel and establishes an equalization of pressure with the atmosphere. According to the invention the pressure equalizing member consists of a spring diaphragm, leaf spring or the like having on the outside and inside a large pressure surface for actuating the air valve controlled by it and of which the entire area is exposed to the outer atmospheric pressure and to the internal pressure in the container. Since the entire area of the diaphragm is exposed to the pressure it responds to every slight variation in pressure.

The new closure at the same time prevents with certainty an unintentional escape of the contents of the vessel while on the other hand it makes an absolutely odourless closure.

Various constructional embodiments of the invention are illustrated by way of example in the accompanying drawings, in which

Fig. 1 shows in vertical section a tank closure with a resilient metal diaphragm,

Figs. 2 and 3 show in section and plan respectively the intermediate plate which is used in the tank closure,

Figs. 4 and 5 show the spring casing in section and plan respectively, and

Figs. 6-8 show three other constructional forms of the closure in section.

Referring to the drawing, in all the forms of construction illustrated 1 denotes the cover which contains the spring case 2 and packing 3. The case 2 which receives the spring 4 is provided with oppositely situated apertures 5 (Figs. 4, 5, 7 and 8) through which passes the retaining member 6, which is preferably resilient, and of which the edges engage for example in bayonet fastening grooves provided on the inside of the edge of the opening in the container to be closed.

In the form shown in Figs. 1-6, there is disposed between the cover 1 and the spring case 2 an intermediate plate 7 which is provided with packing 8. The edge 9 of the plate 7 is clamped between the cover 1 and the spring case 2 and is provided with cut out portions 10 (Figs. 2 and 3) through which air which penetrates into the spring case, for example from below through grooves 21 or the like (Figs. 4 and 5), can reach the space below the cover. In some cases small air inlet openings 11 (Figs. 1 and 6) can be provided in the cover. The spring case 2 is likewise

provided with one or more openings 20 through which the air can reach the tank.

The intermediate plate 7 is provided with a central opening 12 through which passes the stem 13 of a plate valve 14 having a seating 15 which bears against a seating surface on the intermediate plate, for example against an annular ridge 16 (Figs. 1-3) or against a plane packing edge 17 (Fig. 6) of the intermediate plate 7.

Above the intermediate plate 7 is disposed the pre-tensioned metal diaphragm or metal spring 18 to which the plate valve 14 is connected by means of the valve stem 13 which is provided on top with a button 19. The pre-tensioned diaphragm can consist for example of a circular metal disc of spring steel.

The method of operation is as follows:—

When, owing to a fall in the level of the liquid in the container, the air becomes rarefied, the thin metal diaphragm or metal spring 18 of which the entire surface is exposed to the reduced pressure is bent inwards slightly. The valve 14 is thereby opened, so that air enters the container from the outside and pressure equalization takes place. Usually the air inlet is closed by the diaphragm or metal spring owing to its tension. On the occurrence of the least under-pressure in the container a slight bending, i. e. a so-called breathing, of the diaphragm or metal spring takes place, whereby the pressure equalization is effected. The outer air then presses on the large diaphragm or spring surface and its resiliency is so great that a tight closure of the valve is always ensured when pressure equalization occurs and the valve does not operate even with strong vibration, while on the other hand jamming of the valve is obviated and the latter is not sensitive in its action so that it operates only when pressure differences occur.

In the constructional form according to Fig. 7, the diaphragm 18<sup>1</sup> which consists for example of a corrugated metal disc is inserted between the cover 1 and the spring case 2, a packing 21 being interposed. In a central opening in the cover 1 is fixed a valve member 22 of which the lower, for example conical, end engages in an opening 23 in the diaphragm 18<sup>1</sup> and normally closes this opening. The remaining parts of the arrangement are similar to those in the forms previously described and the other parts such as the spring 4 and retaining clip 6 of Fig. 1 have been omitted from the drawing only for the sake of simplicity.

In the constructional form according to Fig. 8 of the drawing, the diaphragm 18<sup>2</sup>, which for example again consists of a corrugated metal disc,

is clamped in a diaphragm holding plate 23 the edge of which is clamped between the cover 1 and the spring case 2, a packing 28 being interposed. The diaphragm holding plate 23 is provided in the middle with an opening 24 having turned up edges which receives a valve ball 25 which can be fixed to the edges of the opening 24 by soldering or in another suitable manner. The valve ball 25 normally closes the opening 29 in the metal disc 18<sup>2</sup> so that no air can pass through. One or more air holes 26 are provided in the diaphragm holding plate 23.

The method of operation of the forms of construction according to Figs. 7 and 8 is similar to that of the constructions according to Figs. 1-6, but with the difference that the valve member 22 or 25 which closes the opening 29 is fixed and, when an under-pressure occurs in the tank, the metal disc or diaphragm 16<sup>1</sup>, 16<sup>2</sup> yields and is drawn by suction in the tank from the fixed point of the valve 22 or from the valve ball 25. The opening 29 is thereby freed for the pressure equalization to take place.

In the forms of construction according to Figs. 1-8 the access of air can take place underneath through grooves 27 arranged on the outside of

the spring case (Figs. 1, 4, 5 and 8) or from the top through one or more fine openings 11 (Figs. 1 and 6) in the cover 1. The diaphragm itself can likewise be provided with air holes.

If an excess pressure occurs in the container, the cover 1 can be lifted from its seating against the pressure of the spring 4. In order to protect the diaphragm against over-pressure in the tank, due to heat or the like, it is preferably fitted in a holding plate which does not allow unintended bending to take place.

The diaphragm 18, 18<sup>1</sup>, 18<sup>2</sup> together with the valve 14, 22, 25 and the packing 7, 21 are assembled in a casing to form a unit.

The nature of the diaphragm and valve construction and its arrangement may of course be different, and the remaining construction of the closure may be altered in accordance with requirements.

The new closure device can be used on all tanks and containers in which an equalization of pressure is necessary, in particular on fuel tanks, cooling water containers and so forth.

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