United States Patent [19]

Fernberg et al.

[11] **3,921,849**

[45] **Nov. 25, 1975**

[54] **SEALING CAPS**

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[22] Filed: **Dec. 3, 1973**

[21] Appl. No.: **420,833**

[52] **U.S. Cl.** **220/295;** 220/308; 220/302; 220/373; 220/378

[51] **Int. Cl.²** **B65D 53/00;** B65D 51/16

[58] **Field of Search** ..... 220/24 GT, 60 R, 46 R, 220/44 R, 44 A, 44 C, 295, 302, 308, 323, 378, 303, 367, 373, 374; 215/317, 343

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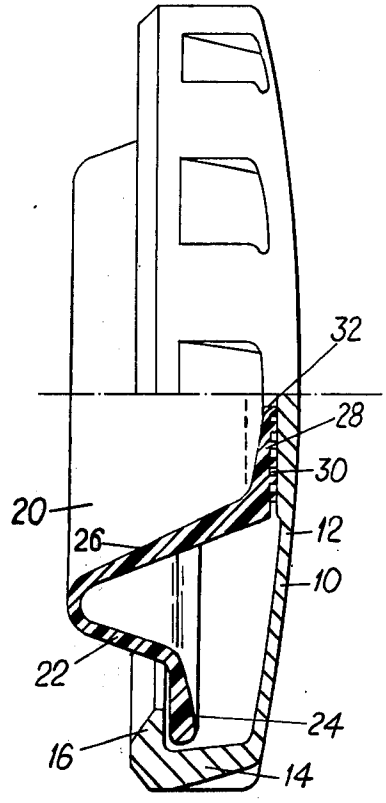
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[57] **ABSTRACT**

A one-piece plastics diaphragm for a petrol cap, and which replaces the conventional assembly of spring, backing plate, and sealing ring, the diaphragm having at its edge an annular wall which is spaced from the body of the cap, and a further wall which has an axial extent, the further wall being deformed by the pressure between the annular wall and the filler neck during manual application so that the two walls of the diaphragm seal tightly against the inner surface and the rim of the neck, the sealing engagement being maintained merely by the fastening engagement between the cap body and the filler neck.

1 Claim, 3 Drawing Figures



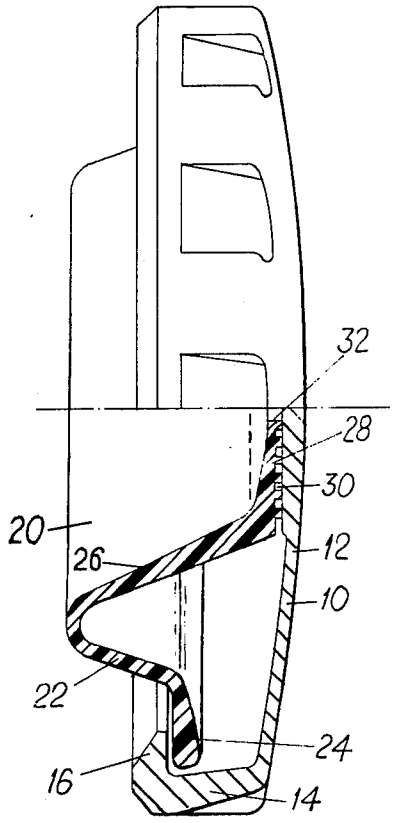


Fig. 1.

Fig. 2.

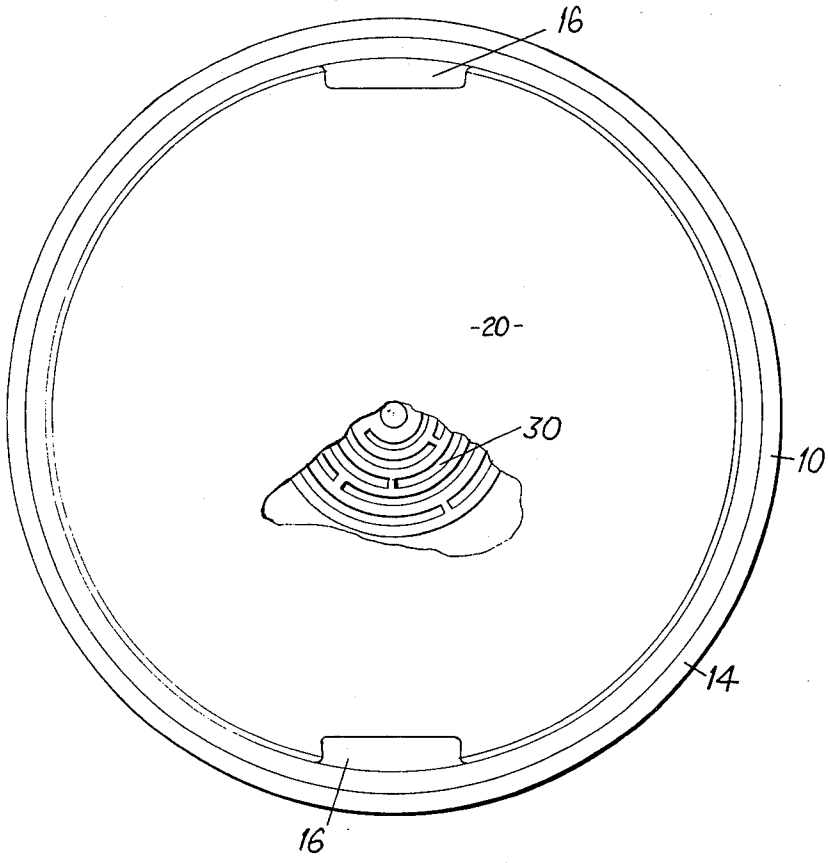
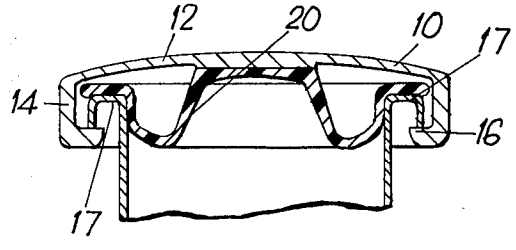


Fig. 3.



SEALING CAPS

This invention concerns petrol cap assemblies.

Cap assemblies are applied to filler necks of petrol tanks on automobiles. They are applied by manual, axially inward pressure against a spring action, then a small clockwise turn causes a fastening engagement to occur between means provided on the cap, and co-operating means on or in the vicinity of the neck. At the end of the small turn it is arranged for the spring to urge the cap to its fastened condition and maintain a seal in the cap to operate against the rim of the filler neck.

It is necessary for the cap to be removable from the neck by a short anticlockwise turn which means, in effect, that the seal cannot hold itself on the neck by frictionally gripping the outer or inner surfaces of the neck, but must rely on simply abutting the circular or annular rim i.e., the edge or edge face of the neck.

One automobile firm specify that the seal, to be safe, must withstand a head of 300 cms of petrol, which can happen when the automobile is inverted in an accident. In the cap assemblies in which a vent is provided through the cap, they specify further that the loss rate of petrol through the vent must be less than 6 ccs in 5 minutes, and not more than 5 ccs in any one minute.

Known caps have achieved the seal by an annular corrugated spring positioned between the body of the cap and a backing plate which is held in the cap. A flexible sealing ring is mounted on the other side of the backing plate. The cap assembly therefore has to carry a central turret about which is mounted a spring, a backing plate and a sealing ring. These components have to be manufactured separately and assembled.

The present invention is particularly concerned with replacing the assembly of the spring, sealing ring and backing plate in conventional caps.

According to this invention a petrol cap assembly comprises a cap body and a one-piece plastics diaphragm, the diaphragm being substantially continuous and comprising a first wall which extends a substantial distance in the direction of the axis of the body, and a second annular wall which extends radially outwards at the edge of the diaphragm and in the relaxed condition lies spaced axially from the cap body; the arrangement being such that when the cap is progressively pressed onto the filler neck of a petrol tank the second wall abuts with increasing pressure the rim of the neck, and causes the diaphragm to deform in such a manner as to force the first wall to form a continuous seal against the interior of the neck, that seal between the two walls of the diaphragm and the two surfaces of the neck, being maintained only by a fastening means operative between the cap head and the filler neck.

One cap assembly having a diaphragm constructed in accordance with this invention is particularly described below with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation of the assembly, the lower half being shown in radial section, the diaphragm being shown in its relaxed condition, that is to say before application to a filler neck;

FIG. 2 is an underneath plan except that a central portion is broken away and shows a modification described below; and,

FIG. 3 is an axial section to a reduced scale, through the cap assembly when applied to a filler neck of a petrol tank.

The filler cap assembly comprises a main body **10** made up of a dished central wall **12,** an axially extending peripheral wall **14** having gripping serrations, and two diametrically opposed lugs **16** projecting inwards. The only other component of the assembly is a sealing diaphragm **20.**

The diaphragm **20** is a one-piece plastics moulding which is continuous, meaning that it has no substantial openings or apertures over its surface, although there can be, for example, a small vent or a fastening aperture, described in more detail below in relation to modifications.

The diaphragm has the same form, viewed in radial section, around its entire periphery. This is seen best in the lower half of FIG. **1.** There is a frusto-conical "first" wall **22** which is divergent in the direction towards the cap. It joins to an annular "second" wall **24** which lies at the outer edge of the diaphragm. The first wall **22** joins through a smooth crest to a "third" wall **26** which is also frusto-conical but is convergent towards the cap body, and is twice as long. The third wall joins to a "fourth" wall **28** which is generally planar and abuts the undersurface of the dished central wall **12** of the cap body **10.**

In radially outward sequence, the fourth wall **28** increases in thickness, the third wall **26** diminishes, the crest and the first wall **22** are uniform, being the thinnest part of the diaphragm, then the second wall increases and terminates in a rounded bulge. The first wall **22** has substantially the same inclination to the axis as the third wall **26,** but twice the axial extent, hence the second wall **24** lies spaced a considerable distance from the wall **12** of the cap.

When the cap assembly is applied to a filler neck, the second wall **24** first abuts the rim of the neck. Increased manual pressure on the body of the cap when the lugs **16** coincide with openings, not shown, in the outwardly turned rim **17** on the neck, presses the second wall **24** towards the wall **12.** The wall **24** remains planar and does not stretch, the increasing pressure therefore causes the third wall **26** to bend radially outwards in the vicinity of the crest, and the first wall **22** simultaneously to turn anticlockwise, as viewed in the lower half of FIG. **2,** until the portion of the wall **22** adjacent to the second wall abuts the interior surface of the neck as shown in FIG. **3.** The body of the cap is then turned about its axis for the lugs **16** to engage under the rim **17.** After a short turning action the lugs **16** engage a portion of the rim, not shown, which slopes slightly upwards, but terminates at an axial abutment surface. The spring action of the diaphragm pressing downwards on the rim **17** thus urges the cap body upwards, and so urges the cap body to turn for the lugs **16** to abut the abutment surfaces. The cap rests with stability at this fastened condition, in which the diaphragm maintains its downward sealing pressure on the rim **17,** and maintains the deformed cylindrical portion of the wall **22** pressed tightly against the interior surface of the neck, as shown in FIG. **3.**

In this preferred diaphragm, there is provided a vent through which air can pass into and out of the petrol tank during use, but through which petrol cannot leak at more than the specified rate when the car is inverted in the event of an accident. The vent is in the form of

a labyrinthine groove **30** formed in that face of the fourth portion **28** of the diaphragm which abuts the undersurface of the dished portion **12** of the body of the cap. Its form is seen in detail in FIG. **2.** A small passage **32** seen in FIG. **1** opens between the interior of the tank, in use, and the groove. Air can pass readily freely around the rim of the diaphragm to reach the groove **30.**

A major advantage of the diaphragm shown is that it can operate effectively with a range of sizes and shapes of filler necks, the range being well beyond the limits of manufacturing tolerance. Moreover, it can maintain a good continuous seal even on a neck which is not circular because the action of the first and second walls gives good radial pressure against the filler neck, and can maintain the radial pressure against non-circular necks. That radial pressure is released by removal of the cap assembly from the filler neck.

It is to be noted that the pressure is also maintained between the second wall **24** and the rim **17,** without any portion of the diaphragm passing around the radially outer portions of the rim. Such a gripping action is not permissible on petrol tanks — unlike bottles for which it is known to provide resealable closures of plastic which grip the outer portion of the bottle rim to achieve their seal. The seal between the two walls of the diaphragm and the corresponding two surfaces of the neck in the present case is maintained completely by the interlocking of the cap body and the filler neck through the lugs **16.**

However, the present invention is not limited in any way to the lugs or any other fastening means. It is clear that the diaphragm which is the subject of the present invention can be incorporated into filler cap assemblies having alternative fastening means to that shown. Slight obvious modifications which might be necessary to the diaphragm, such as reshaping its outline, lie within the scope of the present invention.

In the cap assembly described above the diaphragm is retained within the cap body by the lugs **16.** If the diaphragm is incorporated into a cap assembly which has radially outwardly projecting lugs, or in cap bodies which have no radially inward projections at all, the diaphragm could have a central aperture through which a lug formed on the interior surface of the domed portion **12** could pass, and be swaged over to hold the diaphragm in place. Alternative obvious modifications are obviously possible, and are within the scope of this invention.

Almost any plastics material is suitable for making the diaphragm, provided it is sufficiently flexible and has a good memory. Preferred materials are polythene and polypropylene. The cap body can be of glass-filled polypropylene, metal, or any other suitable material which is not affected by petrol and is sufficiently rigid.

We claim:

1. A two piece petrol cap assembly for application to the filler neck of an automobile petrol tank, said cap assembly comprising a one-piece overcap body and a one-piece plastic diaphragm, said cap body and diaphragm having mutually cooperating means to permit them to be relatively rotatably coupled together as a unit, said cap body having means adapted to mutually cooperate with securing means on the neck of said petrol tank, said diaphragm being substantially continuous and presenting an annular wall which extends radially outwardly and includes the outer margin of said diaphragm, said diaphragm in its relaxed condition when coupled with said overcap being spaced axially from said cap body in the vicinity of said annular wall, said diaphragm having another wall radially inwardly of said annular wall which extends a substantial distance angularly inwardly relative to the axis of said cap body and capable of being moved radially outward to form a continuous seal against the interior surface of said neck upon mounting of said cap and diaphragm unit on the neck of the petrol tank as said cap is progressively pressed onto the rim of said filler neck of said tank, the seal between the two wall of the diaphragm and the inner surface and rim of the neck being continuously maintained by said securing means operative between said cap head and filler neck, said diaphragm further having means abutting the cap body, said means having a fine labyrinthine passage over its outer surface and a small passage opening through the diaphragm to a radially inner portion of the passage.

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