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(54) **LOSS SAFETY DEVICE FOR A TANK CAP**

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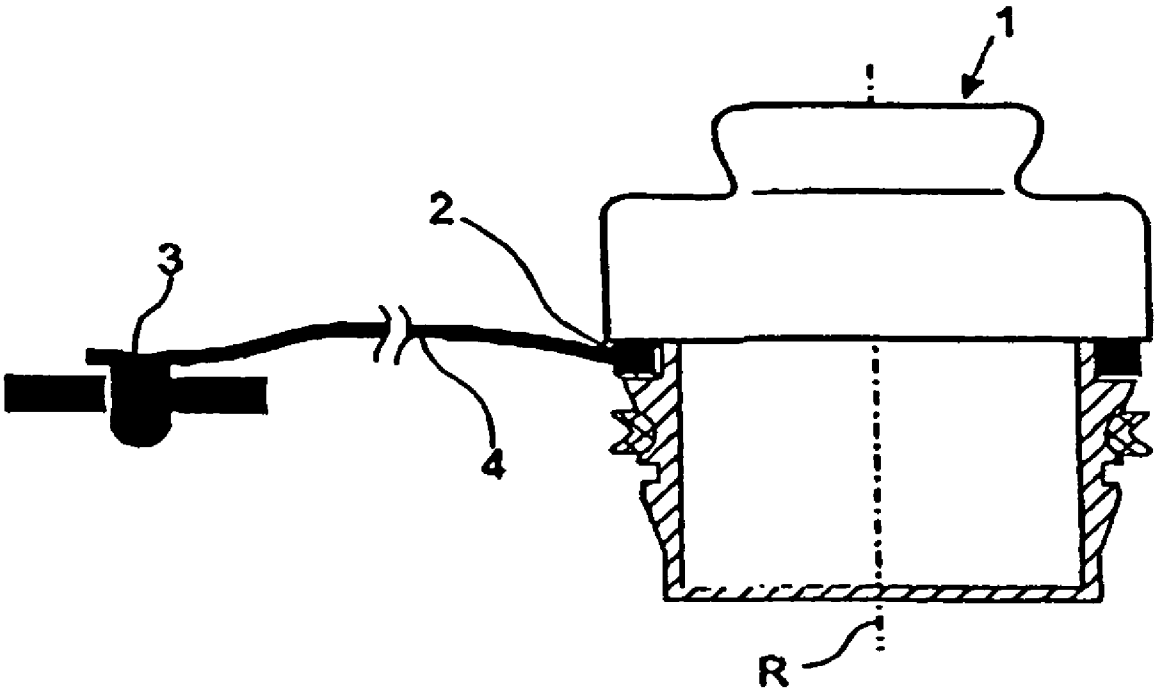
(57) **ABSTRACT**

The present invention relates to a loss safety device for a tank cap of a vehicle, especially for a fuel tank, with a first end section attached over a first connecting element at the tank cap, with a second end section attached on a vehicle over a second connecting element, and a band section provided between the first and second end sections. The second connecting element is formed by a pin and at least an anchoring extension. The first connecting element is connected with the tank cap rotatably around an axis of rotation R of the tank cap, being formed of an annular eyelet and of an anchor, connected with said band section and annular eyelet, and said annular eyelet features a recess in its inner section, as well as an insertion groove, connecting said recess with the outer side of said annular eyelet, and said anchor may be inserted into said insertion groove.



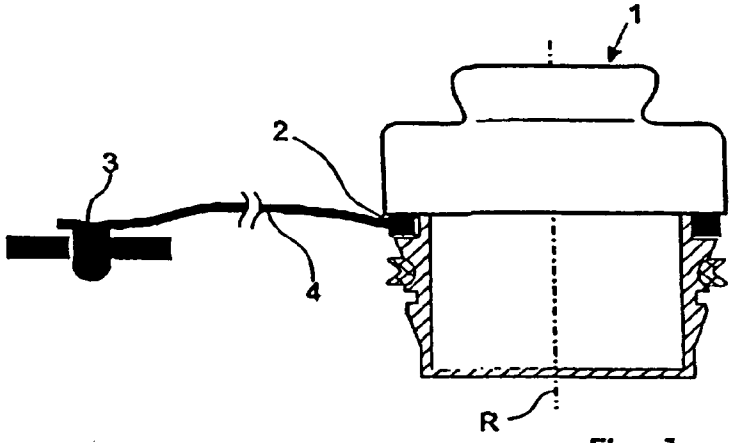


Fig. 1

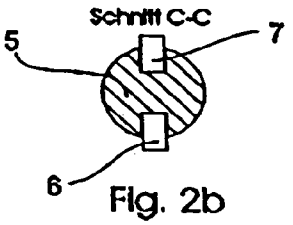


Fig. 2b

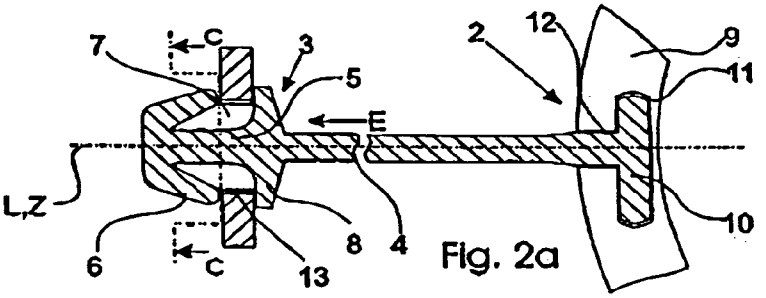


Fig. 2a

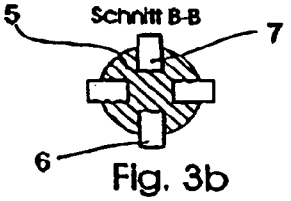


Fig. 3b

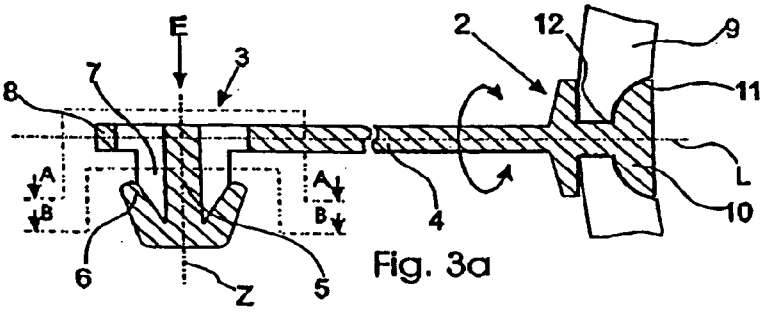


Fig. 3a

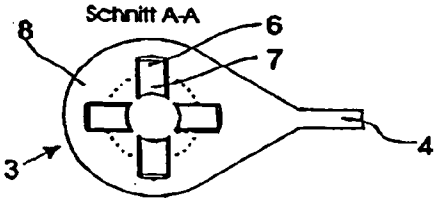


Fig. 3c

LOSS SAFETY DEVICE FOR A TANK CAP

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application is related to and claims priority under the Paris Convention from German Utility Model Application No. 20 2004 001 485.8, filed 30 January, 2004.

FIELD OF THE INVENTION

[0002] The present invention relates to loss safety devices and, in particular, to a loss safety device for a tank cap.

BACKGROUND OF THE INVENTION

[0003] The present invention relates to a loss safety device for a vehicle cap, in particular a cap for a fuel tank. Tank caps have been used for a considerable length of time. Fuel tank caps for a variety of vehicles feature a band or cord-like device, where a first end section of the device is connected with the tank cap and a second end section is connected with the vehicle. When the cap is removed from the filler neck of the fuel tank, the cap cannot be removed from the vehicle.

[0004] The loss safety device typically must meet many requirements, both during the many years of vehicle operation, as well as during the manufacturing phase. For example, the cost must be reasonable and the quality of the device must be high.

[0005] Document DE 200 18 750 U1 features a tank cap with a first connecting element, rotably assembled around the axis of rotation of the tank cap, being formed of an annular eyelet and an anchor, connected with a band section and an annular eyelet. The anchor is introduced into an inner recess of the annular eyelet, exiting from the inner section of the annular eyelet through an insertion groove. Nevertheless, there is a problem, in that during insertion of the anchor into the annular eyelet recess, errors may be committed by a technician, as the anchor may be introduced in different positions into the annular eyelet. As a consequence, faulty alignment of the second connecting element may result. Since tank caps are normally irreversibly assembled by means of insertion and spring catches, such a failure may not be uncorrectable and the tank cap must be discarded.

[0006] As to the material of the connector, especially the material of the second connecting element discussed above, one problem can arise in that transporting the element from the supplier to the vehicle manufacturer may effect the material. This is especially applicable in the case of plastics which, during long airplane transportation routes, may be exposed to conditions of extreme cold, which could negatively influence material properties.

[0007] It is therefore an object of the present invention to provide a loss safety device for a tank cap of a vehicle, which overcomes the handicaps mentioned above.

SUMMARY OF THE INVENTION

[0008] Generally and briefly, and in one embodiment of the invention, a loss safety device for a tank cap of a vehicle, especially for a fuel tank, has a first end section attached over a first connecting element at the tank cap. A second end section is attached on a vehicle over a second connecting element. A band section is provided between the first and second end sections. The second connecting element is formed by a pin and at least an anchoring extension. The first connecting element is connected with the tank cap rotatably around an axis of rotation R of the tank cap, being formed of an annular eyelet and of an anchor, connected with said band section and annular eyelet, and said annular eyelet features a recess in its inner section, as well as an insertion groove, connecting said recess with the outer side of the annular eyelet, and said anchor may be inserted into the insertion groove.

[0009] While the foregoing sets forth general features of a particular embodiment, further embodiments and features will be apparent from the Detailed Description, the drawings and the claims. Consequently, the invention is not limited to what this Summary briefly describes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] **FIG. 1** illustrates a tank cap with a loss safety device attached thereto, according to one embodiment of the invention;

[0011] **FIG. 2***a* is a version of a loss safety device according to the present invention, wherein the anchor of the first connecting element may be introduced into the annular eyelet only in one angular position, while the second connecting element features two anchoring extensions, and the pin longitudinal axis coincides with the longitudinal axis of the band section;

[0012] **FIG. 2***b* is the cross section taken along line C-C through the second connecting element according to the invention, in **FIG. 2***a;*

[0013] **FIG. 3***a* is an embodiment of a loss safety device, where the anchor of the first connecting element may be introduced randomly into the annular eyelet, whilst the second connecting element features four anchoring extensions, with the pin longitudinal axis projected in rectangular direction on the longitudinal axis of the band segment;

[0014] **FIG. 3***b* is the cross section taken along line B-B through the second connecting element in **FIG. 3***a*; and

[0015] **FIG. 3***c* is the cross section taken along line A-A through the second connecting element in **FIG. 3***a*, according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0016] This task is being solved according to the invention in that said anchor of the first connecting element is designed in such a fashion that relatively to the longitudinal axis of said band section, it can be introduced precisely in an angular or random position into said annular eyelet. This insures that during anchor insertion into said annular eyelet, faulty assembly and consequent faulty alignment of the second connecting element may be prevented.

[0017] The task is additionally solved due to the fact that the pin features, on its outer section, at least one admission groove and the anchoring extension surpasses said pin in a direction perpendicular to its longitudinal axis, being flexibly united with said pin and can be pressed into said admission groove. As a result, notwithstanding the surpassing section of said anchoring extension, with accurate insertion of said second connecting element, eventually in a perforation existing on vehicle for this purpose, the anchor

diameter offers reduced clearance inside the perforation, being insured a firm seat, offering a good quality impression. Also vibrations acting upon the second connecting elements are effectively absorbed. Additionally, this offers the possibility to provide a one-piece version, insuring a strong rupturing force.

[0018] To provide an adequate disposition of anchoring extension and admission groove, the latter preferably extends in the axial direction of said pin. Due to this condition, also positioning and a constructive disposition of a tool, required for production, eventually during an injection molding process will be considerably easier.

[0019] In order to be able to insure a sufficiently resistant and economical production process, it is foreseen that said pin and anchoring extension are produced in one piece. Ideally, the band section and the second connecting element are produced in one piece, so that the loss safety device consists of one only section, as least of the side of the second connecting element.

[0020] In another advantageous embodiment of the present invention, it is foreseen that the pin and anchoring extension are produced of similar material, especially of polyoxymethylene (POM) or of another plastic material. With an equally one-piece version of the second connecting element and of said band section, also these items are manufactured of the identical material, especially polyoxymethylene (POM) or of another plastic material.

[0021] Preferably, the plastic material features a Shore hardness rate between 40 and 80. This hardness is sufficiently flexible and even so its offers sufficient resistance. Additionally, the initially mentioned disadvantages, which may result during longer transportation routes at low temperatures, are thus being effectively avoided.

[0022] To increase anchorage resistance, it is advantageous to provide different anchoring extensions, and for each of these anchoring extensions an admission groove is foreseen in the pin. The number of anchoring extensions, in the case of a cylindrical pin, will be in accordance with the pin diameter. Normally, the number of anchoring extensions will be of two, three, four, five, six, seven or eight units. In an adequate fashion, the second connecting element will then be designed in such a fashion that said anchoring extensions and admission grooves will be uniformly disposed over the pin circumference, in order to render feasible a uniform power distribution. For this purpose, said anchoring extensions and admission grooves, in a specially advantageous form, are concentrically disposed in the direction of the pin central axis.

[0023] In order to render feasible a higher degree of protection against extraction of the loss safety device from its anchored position at the vehicle, the second connecting element is designed in such a fashion, that after introducing the second connecting element by means of a power, acting upon it against the insertion direction of the second connecting element, under the influence of progressive increase of the effective transversal surface, said anchoring extension of the second connecting element will be expanded and, therefore, by compounding a form-locking condition, will be opposed to a movement of the second connecting element contrary to the insertion direction.

[0024] In order to avoid that the second connecting element may be moved randomly in the insertion direction, for example into an empty space, located behind an admission perforation, the pin features an enlargement in its upper section, which restricts the mobility of the second connecting element in the insertion direction.

[0025] As occurs also with the second connecting element, at the first connecting element a one-piece configuration would be adequate. Nevertheless, this is rendered difficult due to the bipartite configuration of the first connecting element with an annular eyelet and anchor. Preferably, however, at least the anchor and band section are configured in one piece of identical material, especially of polyoxymethylene (POM) or another plastic material. For simplicity's sake, it can be foreseen that said anchor and annular eyelet are built of the same material, especially of polyoxymethylene (POM) or another plastic material. Also in this case, the material advantageously features a Shore hardness between 40 and 80.

[0026] An especially advantageous configuration results, evidently, with a loss safety device according to the present invention, which combines the advantages of the first connecting element with those of the second connecting element, in that the first and second connecting elements are configured according to the guidelines of the invention.

[0027] Considering now the drawings, **FIG. 1** features a tank cap **1** with a loss safety device attached thereto, in a schematic overall view. A first end section is attached with a first connecting element **2** at the tank cap **1**, being rotatably mounted around the axis of rotation R of said tank cap **1**, and therefore does not accompany the introduction or extraction of the tank cap **1**. A second connecting element **3** is attached at its second end, being attached in an admission perforation **13**, so that it may, for example, be located in the vehicle carriage. A band section **4** is provided between the first and second end section.

[0028] **FIG. 2***a* features, in detail, a possible configuration of said loss safety device. The first connecting element **2** features an anchor **10** and an annular eyelet **9**, said anchor **10** being introduced into a recess **11** of said annular eyelet **9**, and abandons said annular eyelet **9** through an insertion groove **12**. For anchoring action, said anchor **10** features two outwardly extending arms. These are of different length and recess **11** in said annular eyelet **9** is adjusted to these arms, so that said anchor may only be inserted into recess **11** in one exclusive angular position, relative to longitudinal axis I of band section **4**. The inner wall of annular eyelet **9** is not interrupted by recess **11**, so that anchor **10** may be firmly inserted into recess **11** of annular eyelet **9**, without being mobile in the direction of longitudinal axis L of said band section **4**.

[0029] At its second end section, the loss safety device features a second connecting element **3**, which is being formed by a pin **5** and by two anchoring extensions **6**. Said anchoring extensions **6** surpass pin **5** in a direction perpendicular to longitudinal axis Z of said pin **5**. By inserting pin into an admission perforation **13**, said anchoring extensions **6** are pressed in insertion direction E into an admission groove **7**. Once the anchoring extensions **6** have transfixed said admission perforation **13**, in view of their flexibility, they resiliently return and prevent a renewed extraction of said second connecting element **3** from admission perforation **13** only by pulling band section **4** contrary to insertion direction E. On the contrary, said anchoring extensions **6**

will adjust in the rear section of the material composing said admission perforation **13**, being outwardly expanded.

[**0030**] In order to avoid also an additional displacement of the second connecting element **3** in the direction of introduction E and also to insure adequate attachment of the second connecting element **3** inside the admission perforation **13**, pin **5** features an enlargement **8** in its upper section. The minimum distance between said enlargement **8** and anchoring extension **6** is adequately chosen in such a way, that the mobility of the second connecting element **3** is largely restricted, without endangering upward resilience of said anchoring extensions **6**, after trespassing admission perforation **13**.

[**0031**] **FIG. 2***b* features cross section C-C, indicated in **FIG. 2***a*. It can be noticed that up to the points, at which pin **5** features the admission grooves **7**, the pin diameter is equivalent to that of a cylinder. Consequently, the second connecting element **3** may ideally be adjusted to the admission perforation diameter, largely avoiding radial mobility of the second connecting element **3** within said admission groove **13**. Evidently, the configuration of said pin is not restricted to a cylinder format. The invention may be accomplished also with three, four or multiple corners. This may, for example, be adequate when screwing of the second connecting element **3** inside a perforation should not be possible.

[**0032**] **FIG. 3***a* features another configuration of the loss safety device according to the present invention. Contrary to the embodiment shown in **FIG. 2***a*, in the present case, anchor **10** of the first connecting element **2** features a rotably symmetrical configuration towards longitudinal axis L of band section **4**. As a result, innumerous angular positions result, into which said anchor **10** may be introduced in recess **11** of annular eyelet **9**, and with this procedure, assembly errors are safely avoided, since alignment is no longer essential.

[**0033**] Additionally, the annular eyelet **9** inner wall is interrupted by a recess **11**, which offers advantages during production of injection molded tools, implying in cost reduction. Therefore, band section **4** features, at its point of transition to anchor **10**, an outwardly projecting stem, which prevents mobility of loss safety device to provide safe assembly, among other features. Longitudinal axis Z of pin **5** of the second connecting element **3** is aligned perpendicularly towards longitudinal axis L of band section **4**. This version may be especially advantageous when a reduced construction height of the second connecting element **3** and of the band section **4** should be required, since in the embodiment shown here, the second connecting element **3** and band section surpass only in an insignificant extension the material forming an admission groove **13** (see also **FIG. 1**).

[**0034**] In analog fashion to **FIG. 2***b*, **FIG. 3***b* shows a cross section B-B through pin **5**. Also here one may recognize that in spite of the duplication of said anchoring extensions **6**, contrary to version according to **FIG. 2***b*, the effective pin diameter may be preserved. Nevertheless, a large number of anchoring extensions **6** frequently offer advantages vis-à-vis the carrying capacity of said loss safety device. According to diameter and demands upon the carrying capacity, the production cost figures and simplicity of constructive configuration, several different versions are available to the specialist.

[**0035**] **FIG. 3***c* features an upper view of an alternate embodiment of an enlargement **8**, based on enlargement **8**, featured in **FIG. 2***c* and provided on the second connecting element **3**. Here, the band section extends perpendicularly to longitudinal axis L of pin **5**, in order to avoid unnecessarily high construction height.

[**0036**] Contrary to version according to **FIGS. 2***a* and **2***b*, in **FIGS. 3***a*, **3***b* and **3***c* it can be seen that said admission grooves **7** extend from the upper portion through the pin enlargement, which is due to configuration and approximation of the injection molded tool to the later pin **5**. Whilst in **FIGS. 3***a*, **3***b* and **3***c*, the relevant portion of the tool is being applied from the upper section, in versions according to **FIGS. 2***a* and **2***b* it is being approximated from the lateral sections. In all cases shown here, the admission grooves **7** project in the axial direction of pin **5**. It should, nevertheless, be noted that also other forms, eventually radially projected grooves or simple recesses, may be envisioned and also claimed as part of the invention.

What is claimed is:

1. A loss safety device for a tank cap of a vehicle comprising:

a first end section attached over a first connecting element on the tank cap;

a second end section attached to the vehicle over a second connecting element on the tank cap;

and a band section, provided between the first and the second end section, the second connecting element being formed by a pin and by an anchoring extension;

wherein said pin features on its outside at least one admission groove, and the anchoring extension surpasses said pin in a direction perpendicular towards the pin central axis, being flexibly connected with the pin and may be forced into admission groove.

2. A loss safety device according to claim 1, wherein said admission groove extends in the radial direction of the pin.

3. A loss safety device according to claim 1, wherein the pin and anchoring extension are made in one piece.

4. A loss safety device according to claim 1, wherein the second connecting element and band section are built in one piece.

5. A loss safety device according to claim 1, wherein said pin and anchoring extension are of the same material.

6. A loss safety device according to claim 5, wherein said pin and anchoring extension are made of at least one of polyoxymethylene (POM) and another plastic material.

7. A loss safety device according to claim 1, wherein said second connecting element and band section are produced of the same material.

8. A loss safety device according to claim 7, wherein said material is at least one of polyoxymethylene (POM) and another plastic material.

9. A loss safety device, according to one of claims **6** or **8**, characterized in that the plastic material features a Shore hardness between 40 and 80.

10. A loss safety device according to claim 1, wherein several anchoring extensions are provided, and for each anchoring extension, an admission groove in the pin is provided.

11. A loss safety device according to claim 1, wherein several anchoring extensions are provided, and said anchor-

ing extensions and admission grooves are uniformly disposed over the circumference of said pin.

12. A loss safety device according to claim 1, characterized in that several anchoring extensions are provided, and said anchoring extensions and admission grooves are disposed concentrically to the pin central axis.

13. A loss safety device according to claim 1, characterized in that said second connecting element has a direction of introduction, and after introducing the second connecting element, and due to a power acting upon the second connecting element, contrary to its direction of introduction, an expansion takes place of the anchoring extension, by increasing the active cross-sectional area of the second connecting element, and consequently by composing a closing shape, it reacts to a movement of the second connecting element contrary to the direction of insertion.

14. A loss safety device according to claim 1, characterized in that said pin features an enlargement in its upper section, which restricts the mobility of the second connecting element in the direction of introduction (E).

15. A loss safety device for a tank cap, screwed into a connection of a vehicle fuel tank, with a first end section, attached to said tank cap over a first connecting element, a second end section, which over a second connecting element is attached to said vehicle, and a band section, foreseen between the first and second end section, the first connecting element being connected with said tank cap rotatably around the axis of rotation R of said tank cap), being composed of an annular eyelet and an anchor, united with said band section and annular eyelet, and said annular eyelet features in its internal area a recess, as well as an insertion groove, connecting the recess to the outer section of annular eyelet, and anchor may be introduced into said admission groove, characterized in that the anchor is configured in such a fashion that it may be introduced into said annular eyelet relatively to the band section longitudinal axis, precisely in an angular position or in an arbitrary angular position.

16. A loss safety device according to claim 15, characterized in that said anchor and band section are made in one piece, being composed of the identical material, especially of polyoxymethylene (POM) and of another plastic.

17. A loss safety device according to one of claims **15**, wherein said anchor and annular eyelet are produced of the same material, especially of polyoxymethylene (POM) or of another plastic material.

18. A loss safety device, according to one of claims **16** or **17**, characterized in that the plastic material features a shore hardness between 40 and 80.

19. A loss safety device according to one of claims **1**, combined with a loss safety device according to claim 15.

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