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(54) A PRESSURIZED FLUID CARTRIDGE

(57) A pressurized fluid cartridge comprising:
i) a bottom (21), a lateral wall (22) and an upper wall (23) opposite the bottom (21);
ii) a safety means (3) that opposes the leak of fluid from the cartridge (1) after perforation of a predetermined perforable part (231) afforded in the upper wall (23).

The safety means (3) comprises:
*) a fluid dynamic seal means (4) which in a fluid dynamic seal configuration contacts the upper wall (23) along an imaginary closed line which surrounds said predetermined perforable part (231);
*) a flexible strip (5) which pushes said seal means (4) towards the upper wall (23).

The strip (5) defines:
- a housing cup (50) in which the fluid dynamic seal means (4) is at least partially housed;
- at least a first and a second arm (51, 52) which, from an intermediate zone (53) of the strip (5) in which said cup (50) is afforded, extend towards the lateral wall (22), said cup (50) being made of the same material and in a single body with the first and the second arm (51, 52).

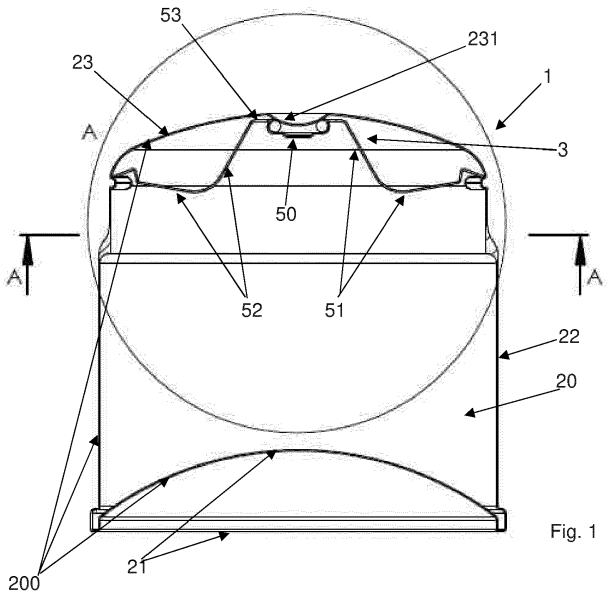

Fig. 1

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Description

[0001] The present invention relates to a pressurized fluid cartridge. This is a container of combustible fluid used for example for the operation of camping stoves or welding guns also called welding lamps.

[0002] Such cartridges are typically single-use. They comprise a metal casing inside which the pressurized combustible fluid is present. These cartridges have a bottom, a lateral wall and an upper wall. A perforable zone is present at the centre of the upper wall. A dispenser which is equipped with a needle that pierces the cartridge allowing the fluid to flow out can be connected to the cartridge.

[0003] Safety systems are known which prevent the unwanted leak of the fluid; for example, if the still not perfectly empty cartridge is disconnected from the dispenser. In this case there is a sheet supporting an annular gasket. The sheet comprises four teeth between which the annular gasket is mounted. Appropriately, this sheet is fixed to two ends in a perimeter groove obtained along the lateral wall of the cartridge. The annular gasket is placed in the middle of this support sheet. In a fluid dynamic seal configuration, the annular gasket exerts a seal along a closed line that surrounds a zone in which the dispenser needle is expected to pierce the cartridge. When the needle pierces the cartridge, the needle will press on the support of the annular gasket moving it away from the upper wall. In this way, the fluid present in the cartridge is allowed to reach the hole made by the needle and therefore dispensing is allowed.

[0004] In this context, the technical task underlying the present invention is to propose a cartridge which allows the components to be optimized, allowing at the same time both high operational safety and competitive costs.

[0005] The stated technical task and specified objects are substantially achieved by a cartridge comprising the technical features set forth in one or more of the appended claims.

[0006] Further features and advantages of the present invention will become more apparent from the illustrative and thus non-limiting description of a preferred but not exclusive embodiment of a cartridge as illustrated in the appended drawings, in which:

- figure 1 shows a longitudinal section view of a cartridge according to the present invention;
- figure 2 shows a view according to the section A-A of figure 1;
- figure 3 is an enlargement of the detail A of figure 1;
- figure 4 shows a component of the cartridge of figure 1;
- figure 5 shows a component of the cartridge alternative to the one shown in figures 1- 4;
- figure 6 shows a section view according to the plane A-A of figure 5.

[0007] In the accompanying figures, the reference number 1 indicates a pressurized fluid cartridge (it is typically a gas; it could possibly also be in the liquid state inside the cartridge due to compression; when it is dispensed by the cartridge it is typically in gaseous form). This pressurized fluid is typically a fuel, for example it comprises butane and/or propane. The cartridge 1 comprises an outer casing 200 which defines a tank for the fluid. Appropriately, the cartridge 1 or rather the casing 200 comprises a bottom 21, a lateral wall 22 and an upper wall 23 opposite the bottom 21. Appropriately, the cartridge 1 comprises a safety means 3 that opposes (in particular limits/prevents the) the leak of the fluid from the cartridge 1 after perforation of a predetermined perforable part 231 afforded in the upper wall 23.

[0008] Therefore, it limits/prevents the leak of the fluid from the cartridge through a hole made by a dispenser for drawing the fluid. For example, the means 3 limits/prevents the leak of fluid from a cartridge which, by mistake or for any other reason, is decoupled from the dispenser (even if it is not completely exhausted). During coupling with the dispenser there are no unwanted leaks of fluid from the cartridge 1 as the dispenser is equipped with a seal element. The safety means 3 in a dispensing configuration allows the fluid to flow out from the cartridge. In fact, in this configuration it is the dispenser which, by means of a needle for piercing the cartridge, interacts with the safety means 3 allowing the fluid to flow out. The safety means 3, however, tends to spontaneously evolve towards a safety configuration in which it prevents/limits the leak of the fluid from the cartridge (appropriately when the dispenser is removed). The safety means 3 allows/prevents/limits the leak of the fluid from a hole made by the needle (in particular it allows the fluid to flow out when there is a correct coupling with the dispenser, while on the other hand it prevents/limits the leak of the fluid when the dispenser is decoupled).

[0009] The safety means 3 comprises a fluid dynamic seal means 4 which in a fluid dynamic seal configuration contacts the upper wall 23 along an imaginary closed line which surrounds said predetermined perforable part 231.

[0010] The lateral wall 22 connects the bottom 21 and the upper wall 23. The lateral wall 22 can be substantially cylindrical, for example, possibly with a tapering towards the upper wall 23. The bottom 21 and/or the lateral wall 22 and/or the upper wall 23 are appropriately metallic. Appropriately, the walls of the cartridge 1 have a thickness of less than 1 millimetre, preferably less than or equal to 0.5 millimetres.

[0011] The upper wall 23 is for example shaped like a dome. In a central zone of the upper wall 23 (or dome), the upper wall 23 (or dome) can advantageously define a recess which protrudes towards the inside of the cartridge 1 (i.e. towards the bottom 21). This central zone of the upper wall 23 is located on a top of the dome.

[0012] Appropriately the perforable part 231 (or better, the part intended for perforation typically using a dispenser) is part of said recess. The perforable part 231 is located in a central zone of the upper wall 23.

[0013] The cartridge 1 is intended to be perforated in said part 231 by an outer dispenser.

[0014] In this way the means 4 separates a compartment 20 containing the fluid from a zone 40 interposed between said seal means 4 and said perforable part 231. The fluid dynamic seal configuration coincides with the safety configuration illustrated above. In the dispensing configuration, the fluid dynamic seal means 4 is moved away from the upper wall 23. In this dispensing configuration, between the upper wall 23 and the fluid dynamic seal means 4 there is therefore a passage for the outflow of the fluid. If the cartridge 1 were perforated externally to this perforable part 231, the safety means 3 would not perform a safety action (but the connection between dispenser and cartridge 1 is such as to cause the perforation in this perforable part 231).

[0015] The safety means 3 comprises a flexible strip 5 which pushes the seal means 4 towards the upper wall 23. The strip 5 is therefore a spring. Preferably the strip 5 is symmetrical. In particular the strip 5 is symmetrical with respect to a plane. Appropriately the strip is symmetrical with respect to a plane that is orthogonal to an outer support plane on which the bottom 21 rests. The strip 5 does not come into contact with the bottom 21 either in the fluid dynamic seal configuration or in the fluid dispensing configuration.

[0016] The strip 5 defines a housing cup 50 in which the fluid dynamic seal means 4 is at least partially housed. For example, the cup 50 has a depth comprised between 2 and 6 millimetres. Appropriately the positioning of the fluid dynamic seal means 4 in the cup 50 facilitates the assembly thereof both in terms of speed and in terms of production flexibility (the assembly can be carried out during the implementation of the strip 5 or later).

[0017] The seal means 4 suitably comprises/is a gasket. The seal means 4 is housed in the cup 50, preferably not projecting out of the cup 50. The seal means 4 may be flush with an upper edge of the cup 50. The cup 50 defines an annular housing seat 71 on which the gasket rests. Appropriately the cup 50 comprises a closed bottom 72. It is intended to abut the dispenser needle which pierces the upper wall 23. Appropriately, the needle pierces the upper wall 23, passes through the gasket and contacts the bottom 72 of the cup 50, pushing it away from the upper wall 23. In this way the safety means 3 passes from the safety configuration to the dispensing configuration. It should be noted that the needle can pass through the gasket without damaging it since the gasket is advantageously annular. The housing seat 71 on which the gasket rests circumscribes a central recess 70 intended to abut the dispenser needle which allows the cartridge 1 to be pierced. However, this recess 70 could also be absent. The bottom 72 of the cup 50 could for example be flat or have a convexity which protrudes towards the upper wall 23 (solutions not shown). In both cases the bottom 72 is intended to abut the dispenser needle.

[0018] The seal means 4 comprises/is a ring having a constant cross section. It could possibly have a circular or polygonal cross section. In particular, this cross section is constant along the entire extension of the ring. For example, the seal means 4 comprises/is an O-ring (or an X-ring or a square or rectangular cross-sectional ring).

[0019] . Appropriately, the seal means 4 is made of a compressible material, e.g. rubber or elastomer.

[0020] The strip 5 comprises at least a first and a second arm 51, 52. The strip 5 comprises an intermediate zone 53 to the first and the second arm 51, 52 in which said cup 50 is afforded. From the intermediate zone 53 the first and second arm 51, 52 extend towards the casing 200, in particular towards the lateral wall 22. The first and the second arm 51, 52 both extend starting from the intermediate zone 53. Appropriately, the first and the second arm extend away from the intermediate zone 53 until coming into contact with the casing 200, in particular with the lateral wall 22.

[0021] The first and the second arm 51, 52 are symmetrical and extend according to opposite directions starting from the intermediate zone 53.

[0022] The cup 50 is made of the same material and is in a single body with the first and the second arm 51, 52. The first and the second arm 51, 52 and the cup 50 are thus a single monolith. Appropriately, the strip 5 is made of metallic material.

[0023] The strip 5 is preferably made of tinplate. Such material has optimal ductility. Appropriately, the strip 5 is made of the same material as the bottom 21, the lateral wall 22 and the upper wall 23. This minimizes the risk of corrosion. In an alternative, not preferred solution, the strip 5 could be made of plastic material.

[0024] Typically the strip 5 is a single body to which the fluid dynamic means 4 is assembled. Advantageously, the fluid-dynamic seal means 4 are assembled with the strip 5 and not in a single piece with the strip 5. Conveniently, the fluid-dynamic seal means 4 are assembled with the cup 50 and not in a single piece body with the cup 50.

[0025] The seal means 4, for example, may be connected by interference or by friction to the cup 50. The cup 50 can have straight side flanks or defining an undercut (e.g. for holding the seal means 4 better).

[0026] Appropriately, the strip 5 is elastic and pushes the seal means 4 against the upper wall 23. The strip 5 pushes the seal means 4 so that the safety means 3 spontaneously evolves from the dispensing configuration to the safety configuration. Appropriately the strip 5, on the other hand, opposes the passage from the safety configuration to the dispensing configuration. This passage is instead forced by the pressure exerted by the dispenser needle after having penetrated through the perforable part 231. In the dispensing configuration it is therefore the dispenser needle that keeps the seal means 4 away from the upper wall 23 (allowing the fluid to flow out). Appropriately the strip 5 is constrained to the casing 200 (in particular to the lateral wall 22) at a first and a second end 511, 521. For example, the strip 5 is me-

chanically constrained to the casing 200. As exemplified in Figure 3 the first and the second end 511, 521 are associated with one or more grooves afforded on the lateral wall 22 of the cartridge 1. In an alternative not preferred solution, which is not illustrated, the strip 5 could be connected to the casing 200 by welding or adhesive means.

[0027] The first arm 51 extends between said intermediate zone 53 and the first end 511.

[0028] The intermediate zone 53 appropriately comprises a platform 530 from which the cup 50 extends. The cup defines a concavity facing the upper wall 23. Appropriately, along the perimeter of the platform 530 one or more recesses 73 are afforded. Appropriately, the platform 530 is horizontal. The cup 50 extends fully below the platform 530 or however more below the platform 530 than above it. The platform 530 separates the first and the second arm 51, 52. In particular, the platform 530 is in contact on opposite sides both with the first and the second arm 51, 52.

[0029] The capsule 1 according to the present invention will be described below, with particular reference to the solution of figures 1-4.

[0030] The first arm 51 comprises a first slope 512 that extends from said intermediate zone 53, in particular it extends from the platform 530. In a particular non-limiting solution the first slope 512 extends in length for a dimension comprised between 15 and 20 millimetres. Appropriately, the first slope 512 extends in width for a dimension comprised between 15 and 25 millimetres, preferably between 18 and 22 millimetres. Appropriately, the thickness of the first slope 512 is less than 0.6 millimetres (advantageously this can be repeated for the entire strip 5).

[0031] Appropriately, the strip 5 comprises a width (evaluated orthogonally with respect to a predominant extension line) less than 25 millimetres. The use of a commercial O-ring also facilitates the containment of the width of the strip 5.

[0032] The first slope 512 and the intermediate zone 53 appropriately have a bending zone in common. It typically defines a bending edge.

[0033] The strip 5 comprises a first concavity 514 appropriately turned downwards. An edge of said first concavity 514 also defines the first end 511. The first concavity 514 is appropriately defined by two converging portions. One of such portions has a length comprised between 4 and 8 millimetres and the other has a length comprised between 1.5 and 4 millimetres. By way of example, such two converging portions define an interposed angle of width comprised between 60° and 100° in the fluid dynamic seal configuration.

[0034] The strip 5 comprises a first portion 513 interposed between the first slope 512 and the first concavity 514. The first portion 513 joins the first slope 512 and the first concavity 514 (therefore it is adjacent to both). The joining zone of the first portion 513 with the first concavity 514 is a bending zone of the strip 5. The first portion 513 is appropriately substantially rectilinear (at least in the fluid dynamic seal configuration). Despite this, at least in the fluid dynamic seal configuration (or more generally when it is inside the capsule 1), the first portion 513 is not horizontal. Such first portion 513 has a length comprised between 13 and 20 millimetres. Appropriately, the first portion 513 has a width comprised between 15 and 25 millimetres.

[0035] Along the linear extension of the first arm 51 the ratio between the length of the first slope 51 and the length of said first interposed portion 513 is comprised between 0.8 and 1.2.

[0036] The fact that the length of the first slope 512 is similar to that of the first portion 513 enables the strip 5 to be processed better without overloading specific zones.

[0037] The first portion 513 interposed in the seal configuration extends downwards starting from the first concavity 514.

[0038] The first arm 51 comprises at least a first and a second bend 61, 62.

[0039] The first concavity 514 comprises:

- the first bend 61 which is located at the top of the first concavity 514;
- the second bend 62 which is located at a connection zone with said first interposed portion 513.

[0040] The first and the second bend 61, 62 at least in the fluid dynamic seal configuration are located in two opposite half-spaces with respect to an imaginary plane 7 which passes through the first end 511 of the first arm 51 and orthogonal to an axis defining the extension in height of the cartridge 1. Such axis is orthogonal to an outer support plane on which the bottom 21 is placed. When the cartridge 1 is normally supported this axis is vertical.

[0041] Appropriately, the first arm 51 also comprises a third bend 63.

[0042] The third bend 63 corresponds to the bending zone interposed between the first interposed portion 513 and the first slope 512. Appropriately, the third bend 63 comprises a connection radius comprised between 1 and 8, for example between 4 and 8 millimetres, preferably comprised between 6 and 7 millimetres.

[0043] The first arm 51 also comprises a fourth bend 64. Appropriately, the fourth bend 64 corresponds to the bending zone interposed between the intermediate zone 53 and the first slope 512.

[0044] Appropriately in the solution exemplified in the appended figures the first arm 51 along the longitudinal extension comprises exactly four bends. The second arm 52 extends between the intermediate zone 53 and the second end 521.

[0045] Appropriately in the seal configuration the first and fourth bend 61, 64 lie in the first of the two half-spaces identified by the imaginary plane 7. In the seal configuration, the second and third bend 62, 63 lie in a zone

identified by the union of the imaginary plane 7 and the second of the two half-spaces identified by the plane 7.

[0046] The second arm 52 comprises:

- a second slope 522 that extends from said intermediate zone 53;
- a second concavity 524 appropriately turned downwards;
- a second portion 523 interposed between the second slope 522 and the second concavity 524.

[0047] What has been described with reference to the first arm 51 may also be repeated for the second arm 52.

[0048] In the fluid dynamic seal configuration extensions of the first and the second portion 513, 523 are converging (in particular they identify an upward concavity).

[0049] In a configuration in which the strip 5 is undeformed and extracted from a compartment 20 delimited by the combination of the bottom 21, the lateral wall 22 and the upper wall 23, the first and the second interposed portion 513, 523 are coplanar. This configuration is exemplified in figure 4. It is to be noted that in the preferred solution, in order to be able to extract the strip 5 from the casing 200 which defines the compartment 20 it is necessary to irreparably destroy the casing 200.

[0050] Appropriately, in the undeformed configuration (e.g. figure 4) the ratio between:

- an angle comprised between said intermediate zone 53 and said first slope 512;
  and
- an angle comprised between said first slope 512 and said first intermediate portion 513;

is comprised between 0.8 nm and 1.2.

[0051] Appropriately, the angle comprised between said first slope 512 and said first intermediate portion 513 is comprised between 100 and 130° in the fluid dynamic seal configuration.

[0052] Appropriately, the first and the second slope 512, 522 are rectilinear. Appropriately, extensions of the first and second slope 512 towards the upper wall 23 are converging.

[0053] In the solution exemplified in figures 5 and 6 the first arm 51, at the joining zone with the platform 530, comprises two U-bent portions 531, 532. They define a concavity turned the upper wall 23. Appropriately such two portions 531, 532 are opposing each other. Appropriately they are close to each other. Appropriately, one of the two portions 531, 532 extends less in height than the other. Such portion which extends less in height is the most distant one from the platform 530. A first flap 533 (appropriately rectilinear) extends from one of the two U-bent portions 531, 532. Appropriately, the first flap 533 extends from the portion that extends less in height.

[0054] Likewise, also the second arm 52, at the joining zone with the platform 530, comprises two U-bent portions. A second flap 534 (appropriately rectilinear) extends from one of them.

[0055] The strip 5 is symmetrical.

[0056] The strip 5 comprises a collar 535 which projects towards the upper wall 23 and surrounds the cup 50. Appropriately it delimits the perimeter of the cup 50.

[0057] Subject matter of the present invention is a method for making a capsule 1 having one or more of the characteristics described hereinabove.

[0058] The method comprises the step of arranging the flexible strip 5 provided with the first and the second arm 51, 52 and extending between a first and a second end 511, 521.

[0059] As mentioned above, the first arm 51 comprises: a first slope 512 which extends from said intermediate zone 53, a first concavity 514, a first portion 513 interposed between the first slope 512 and the first concavity 514.

[0060] The second arm 52 comprises a second slope 522 that extends from said intermediate zone 53, a second concavity 524, a second portion 523 interposed between the second slope 522 and the second concavity 524. In an undeformed configuration of the strip 5 the first and said second intermediate portions 513, 523 are coplanar. In particular they define a horizontal pedestal for the strip 5. This facilitates the movement of the strip 5. In the undeformed configuration the ratio between an angle comprised between said intermediate zone 53 and the first slope 512 and an angle comprised between said first slope 512 and said first interposed portion 513 is comprised between 0.8 and 1.2.

[0061] Appropriately, the method comprises the step of housing the strip 5 in a compartment 20 defined by the lateral wall 22 and by the upper wall 23. The method also comprises the step of introducing the pressurized fluid into the compartment 20.

[0062] The method then comprises the step of occluding the compartment 20 by connecting the bottom 21 to the lateral wall 22.

[0063] The present invention achieves important advantages.

[0064] First of all it enables the components of the cartridge to be optimized. This is important in order to reduce production costs.

[0065] In particular, the use of a gasket recessed into the strip enables the production costs of the safety system to be minimised. It further facilitates the use of a standard commercial gasket, e.g. an O-ring and does not require the use of an appropriately shaped gasket.

[0066] In the preferred solution, a careful study of the geometry of the strip 5 allows to implement measures aimed at optimizing an effective action for the purpose of optimizing the safety of the cartridge.

[0067] The invention as it is conceived is susceptible to numerous modifications and variants, all falling within the scope of the inventive concept characterised thereby. Furthermore, all the details can be replaced with other

technically equivalent elements. In practice, all the materials used, as well as the dimensions, can be any whatsoever, according to need.

Claims

1. A pressurized fluid cartridge comprising:

i) a bottom (21), a side wall (22) and an upper wall (23) opposite the bottom (21);
ii) a safety means (3) that opposes the leak of fluid from the cartridge (1) after perforation of a predetermined perforable part (231) afforded in the upper wall (23);

said safety means (3) comprising:

*) a fluid dynamic seal means (4) which in a fluid dynamic seal configuration contacts the upper wall (23) along an imaginary closed line which surrounds said predetermined perforable part (231);
*) a flexible strip (5) which pushes said seal means (4) towards the upper wall (23), said strip (5) comprising:

- a housing cup (50) in which the fluid dynamic seal means (4) is at least partially housed;
- at least a first and a second arm (51, 52);
- an intermediate zone (53) to the first and the second arm (51, 52) in which said cup (50) is afforded and from which the first and the second arm (51, 52) extend towards the lateral arm (22), said cup (50) being made of the same material and in a single body with the first and the second arm (51, 52).

2. The cartridge according to claim 1, **characterized in that** the seal means (4) comprises/is an O-ring having a circular and constant cross section.

3. The cartridge according to claim 1 or 2, **characterized in that** said strip (5) is made of tin plate and is made of the same material as the bottom (21), the lateral wall (22) and the upper wall (23).

4. The cartridge according to any one of the preceding claims, **characterized in that** said strip (5) extends between a first and a second end (511, 521); the first arm (51) extends between said intermediate zone (53) and the first end (511);
said first arm (51) comprises:

- a first slope (512) that extends from said intermediate zone (53);
- a first concavity (514) turned downwards;
- a first portion (513) interposed between the first slope (512) and the first concavity (514).

5. The cartridge according to claim 4, **characterized in that** along the linear extension of the first arm (51) the ratio between the length of the first slope (51) and the length of said first interposed portion (513) is comprised between 0.8 and 1.2.

6. The cartridge according to claim 4 or 5, **characterized in that** said first concavity (514) comprises:

- a first bend (61) located at the top of the first concavity (514);
- a second bend (62) located at a connection zone with said first interposed portion (513);

said first and second bend (61, 62) being located in two opposite half-spaces with respect to an imaginary plane (7) which passes through the first end (511) of the first arm (51) and orthogonal to an axis defining the extension in height of the cartridge (1).

7. The cartridge according to any one of claims 1 to 5, **characterized in that** said first arm (51) comprises at least a first, a second, a third and a fourth bend (61, 62, 63, 64).

8. The cartridge according to any one of claims 4 to 6, **characterized in that** the second arm (52) extends between said intermediate zone (53) and the second end (521);
said second arm (52) comprises:

- a second slope (522) that extends from said intermediate zone (53);
- a second concavity (524) turned downwards;
- a second portion (523) interposed between the second slope (522) and the second concavity (524);

in a configuration in which the strip (5) is undeformed and extracted from a compartment (20) delimited by the combination of the bottom (21), the lateral wall (22) and the upper wall (23), the first and the second interposed portion (513, 523) are coplanar.

9. A method for realising a capsule according to any one of claims from 1 to 3, **characterized in that** it comprises the steps of:

i) arranging said flexible strip (5) provided with the first and the second arm (51, 52) and extending between a first and a second end (511, 521);

the first arm (51) comprising: a first slope (512) which extends from said intermediate

zone (53), a first concavity (514), a first portion (513) interposed between the first slope (512) and the first concavity (514);
the second arm (52) comprising: a second slope (522) which extends from said intermediate zone (53), a second concavity (524), a second portion (523) interposed between the second slope (522) and the second concavity (524);
in an undeformed configuration of the strip (5) said first and said second intermediate portion (513, 523) being coplanar;

ii) housing said strip (5) in a compartment (20) defined by the lateral wall (22) and by the upper wall (23);
iii) occluding said compartment (20) by connecting the bottom (21) to said lateral wall (22).

10. The method according to claim 9, **characterized in that** in said undeformed configuration the ratio between:

- an angle comprised between said intermediate zone (53) and said first slope (512);
and
- an angle comprised between said first slope (512) and said first interposed portion (513);

is comprised between 0.8 and 1.2.

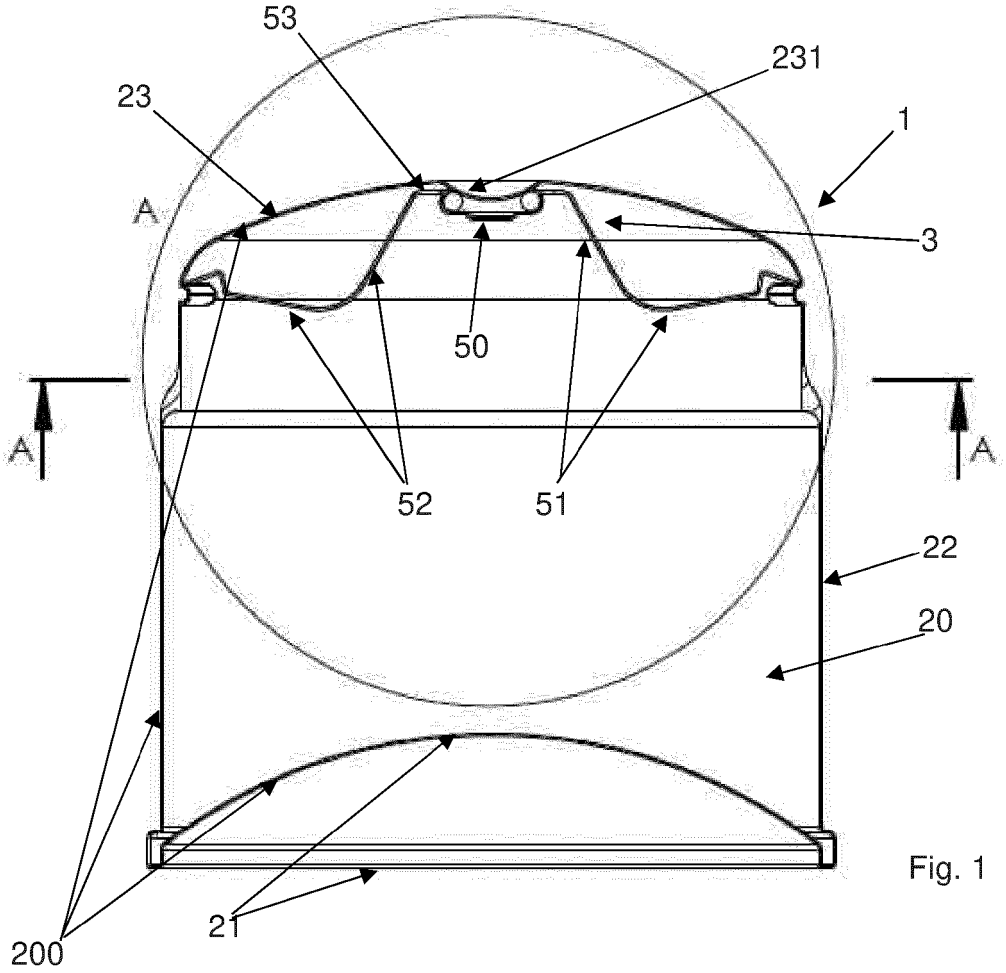

Fig. 1

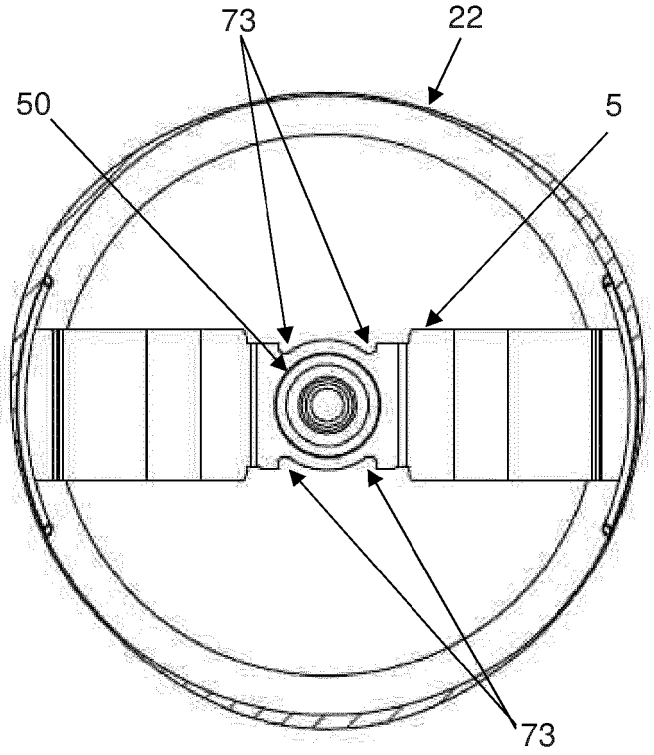

Fig. 2

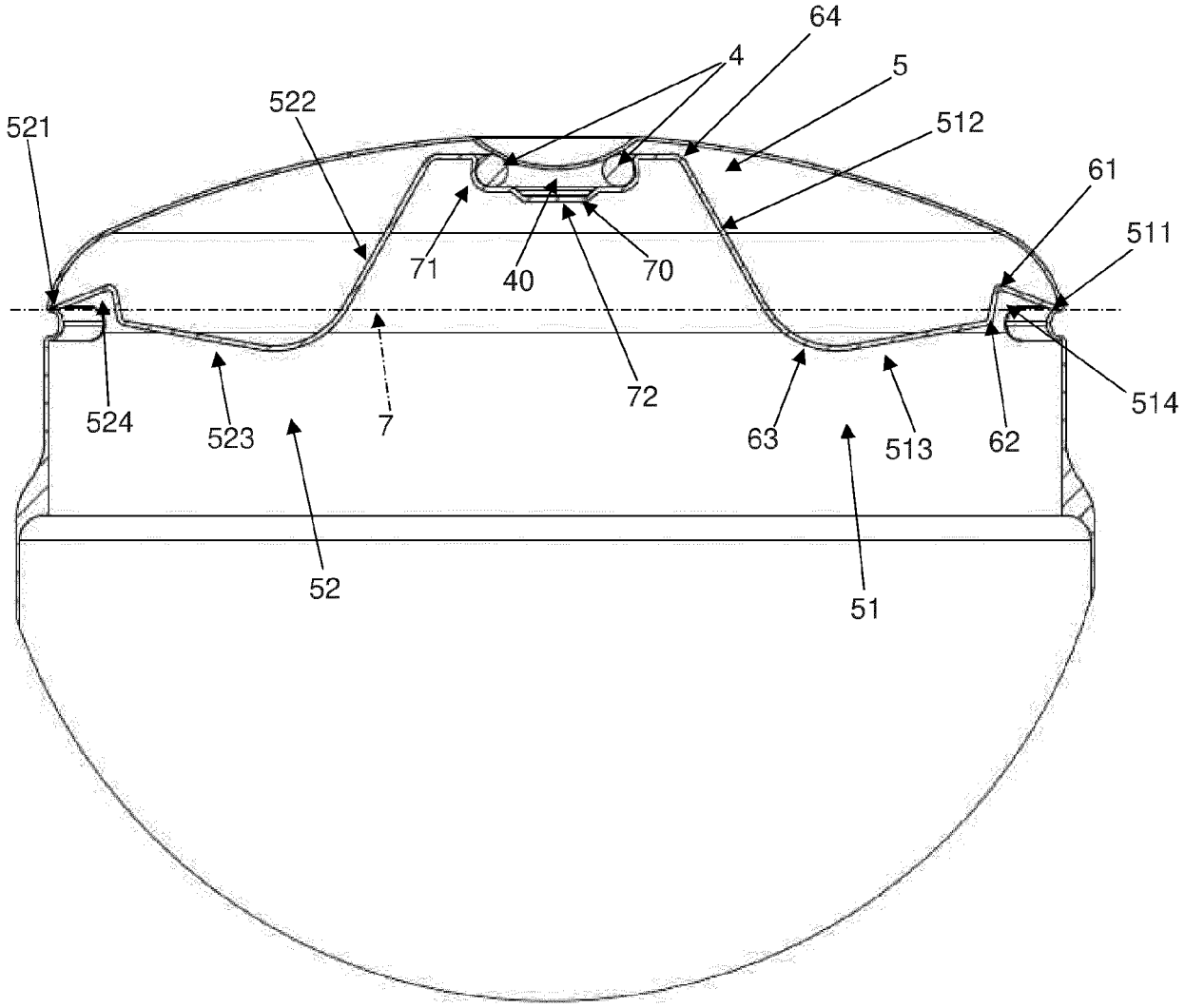

Fig. 3

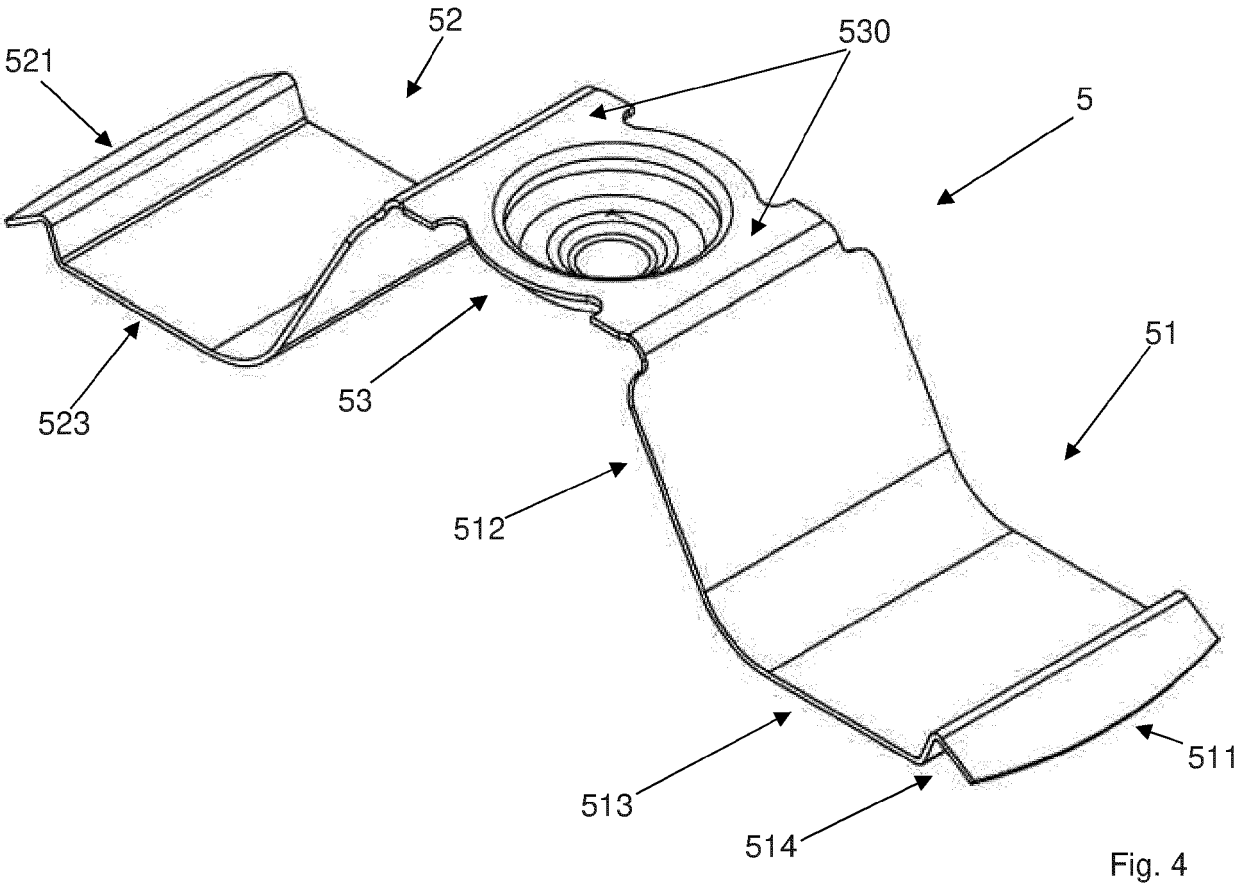

Fig. 4

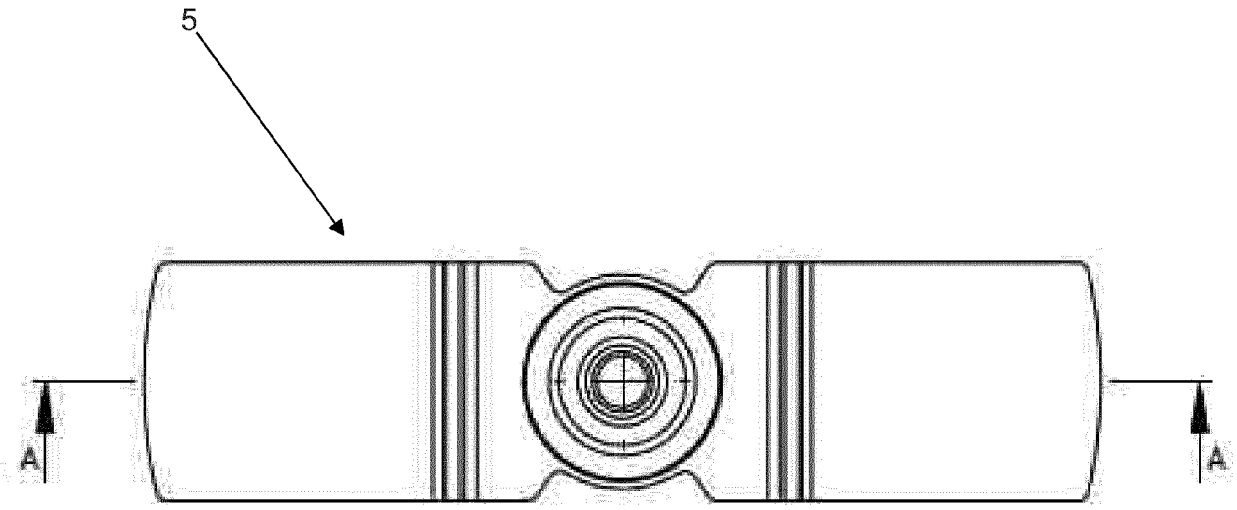

Fig. 5

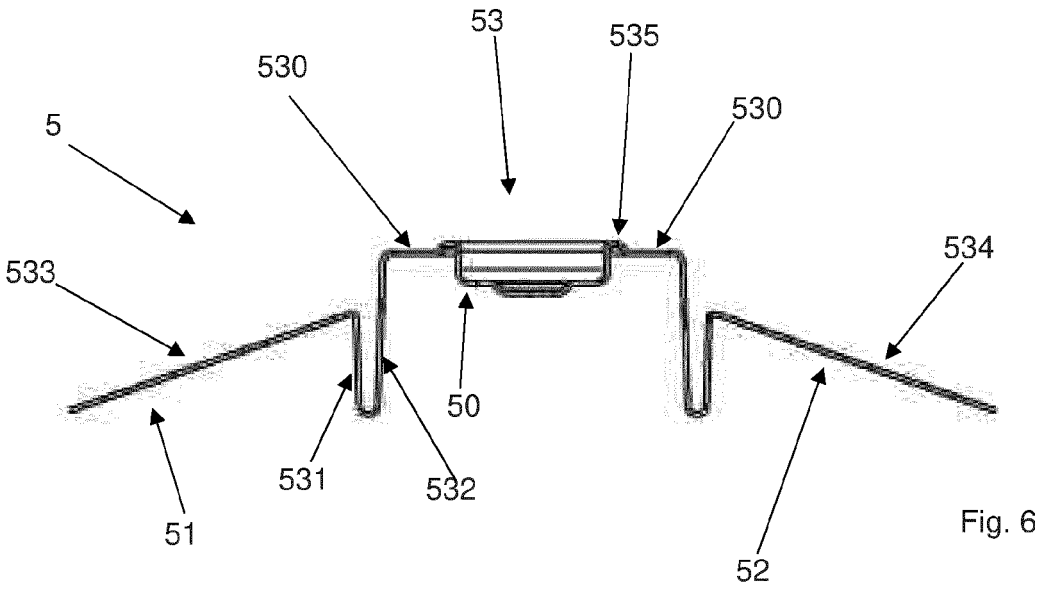

Fig. 6

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 0174

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	EP 1 406 041 A2 (GUILBERT EXPRESS SA [FR]) 7 April 2004 (2004-04-07) * paragraphs [0030] - [0036], [0082] - [0088]; figures 14,15 *	1,3-5, 7-10 2,6	INV. F17C1/00
X	WO 2019/002895 A1 (IGM TECHNIKI EMPORIKI EPE [GR]) 3 January 2019 (2019-01-03) * figures 1-5 *	1,4,5	
X	GR 2018 0100 278 A (IGM TECHNIKI EMPORIKI ETAIREIA PERIORISMENIS EFTHYNIS ME D T IGM EPE [] 13 February 2020 (2020-02-13) * figures 1-5 *	1,7	
A	EP 2 803 897 A2 (PROVIDUS S R L [IT]) 19 November 2014 (2014-11-19) * figures 1-10 *	1	
A	EP 3 088 791 A1 (RAVIOLO MARCO [IT]; POZZO ENRICO [IT]) 2 November 2016 (2016-11-02) * figures 1-4 *	1	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 2 913 578 A2 (EL GAZ S A [GR]) 2 September 2015 (2015-09-02) * figures 1-11 *	1	F17C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 September 2022	Nicol, Boris

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 17 0174

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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20-09-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1406041 A2	07-04-2004	AT 461397 T	15-04-2010
		DK 1406041 T3	28-06-2010
		EP 1406041 A2	07-04-2004
		ES 2342882 T3	16-07-2010
		FR 2845456 A1	09-04-2004
		PT 1406041 E	25-05-2010
WO 2019002895 A1	03-01-2019	GR 20170100293 A	20-03-2019
		WO 2019002895 A1	03-01-2019
GR 20180100278 A	13-02-2020	NONE	
EP 2803897 A2	19-11-2014	NONE	
EP 3088791 A1	02-11-2016	EP 3088791 A1	02-11-2016
		ES 2664448 T3	19-04-2018
EP 2913578 A2	02-09-2015	DK 2913578 T3	20-01-2020
		EP 2913578 A2	02-09-2015
		ES 2759361 T3	08-05-2020
		HU E046962 T2	30-03-2020
		PL 2913578 T3	30-04-2020
		PT 2913578 T	07-01-2020

EPO FORM P0459

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