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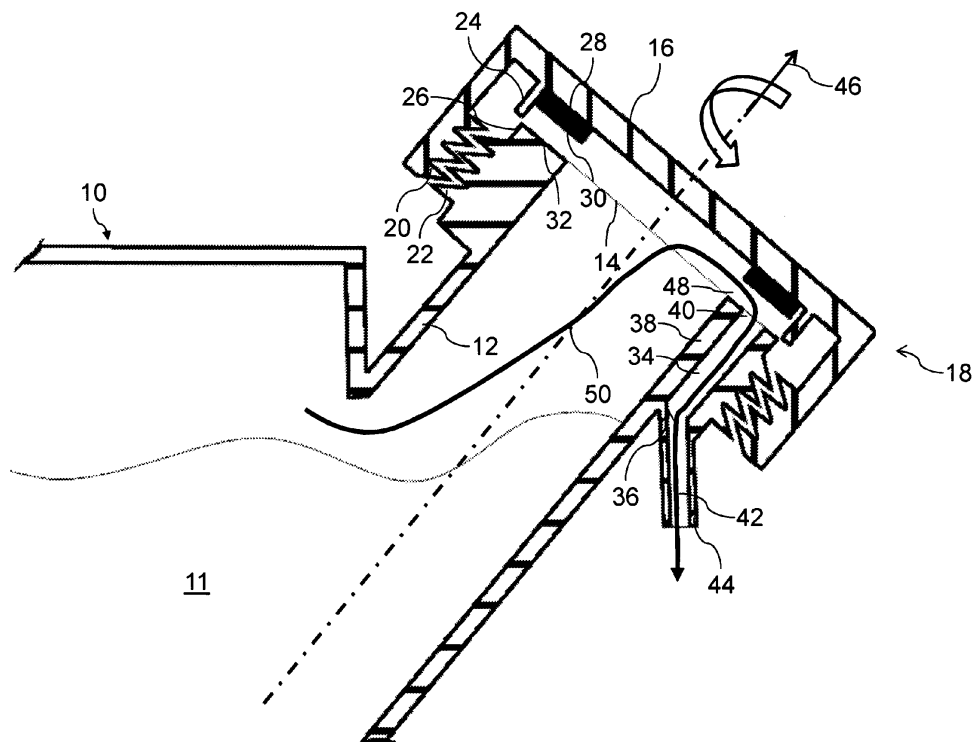
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(71) Applicant: **MANN+HUMMEL GmbH****71638 Ludwigsburg (DE)****(54) Closure device for sealing a filler aperture of a reservoir**

(57) The present invention relates to a closure device (18) for sealing a filler aperture (14) of a reservoir (10), especially for the use on a radiator of an internal combustion engine in particular of a motor vehicle. The closure device (18) comprises a filling socket (12) and a cupulate cap (16) secured to the socket (12) by interlocking means (20, 22), which are interlocked by a rotating and/or plug-in movement of the cap (16) on the socket (12). The cap (16) is provided with sealing means (28),

which seals the filler aperture (14) in the state of closing. A drainage channel (36) for pressure equalization is connected with the filler aperture (14) when removing the cap (16). The cap (16) presses in the state of closing the sealing means (28) against the end face (32) of the filling socket (12) for sealing the filler aperture (14). When removing the cap (16) a gap (48) between the sealing means (28) and the end face (32) connects the filler aperture (14) with the drainage channel (36).

**Fig. 2**

Description

Technical Field

[0001] The present invention relates to a closure device for sealing a filler aperture of a reservoir, especially for the use on a radiator of an internal combustion engine in particular of a motor vehicle, comprising a filling socket and a cupulate cap secured to the socket by interlocking means, which are interlocked by a rotating and/or plug-in movement of the cap on the socket, and the cap is provided with sealing means, which seals the filler aperture in the state of closing, and a drainage channel for pressure equalization is connected with the filler aperture when removing the cap.

State of Technology

[0002] The GB 2 033 351 A discloses closure means for the filling aperture of a container, especially for use on the radiator of an internal combustion engine of a vehicle. The closure means comprises a filling socket and a cap secured to the socket by means of a screw-thread which, when screwed down, presses a sealing ring against the end face of a collar. The filling aperture is surrounded by the collar. The collar is coaxial with the filling socket. If a boiling and pressurised medium is present in the container and the cap is screwed off the filling socket, the medium passes through the continuously-increasing annular gap between the end-face of the collar and a bearing face of the sealing ring and finds its way into a collection chamber from which it can immediately escape by way of a drainage hose. Since the function of interlocking the cap and the socket and the function of sealing the aperture is separated, two different components namely the filling socket and the collar are necessary.

[0003] It is an object of the invention to provide a closure device for easy sealing a filler aperture of a reservoir, which can be built easy with a minimum of components and which allows a safe removing of the cap especially if a boiling and pressurised medium is present in the reservoir.

Disclosure of Invention

[0004] The object is achieved by that the cap presses in the state of closing the sealing means against the end face of the filling socket for sealing the filler aperture and when removing the cap a gap between the sealing means and the end face connects the filler aperture with the drainage channel.

[0005] Favourably, the filling socket combines both the interlocking function and the sealing function. This reduces the number of components. A separate collar as part of the sealing means is not necessary. When removing the cap any boiling and pressurised medium, in particular coolant and hot steam, can pass to the drainage channel.

The medium is drained off with the drainage channel away from the cap. In this way it is prevented that hot medium can hurt a person which removes the cap. Any pressurised hot medium is automatically directed away from the hand of the person when removing the cap. The drainage channel can lead off the reservoir so that no medium escaping from the interior of the reservoir soils the exterior of the reservoir. The drainage channel can lead to a collecting area to prevent that medium can get to surroundings.

[0006] According to a favourable embodiment of the invention, an intake section of the drainage channel can be integrated in a wall of the filling socket and can have an intake opening to the end face, which can be sealed in the state of closing by the sealing means. So the intake section of the drainage channel is space-saving combined with the filling socket. The filling socket and a drainage channel easy can be formed together. In particular the filling socket, the drainage channel and the reservoir can easy be molded in one piece of plastic. The intake opening and the filler aperture can be opened and closed simultaneously with only one sealing means. This reduces the number of components. It also simplifies the manufacturing process.

[0007] According to another favourable embodiment of the invention, a covering ring for an annular opening between the end face of the cap and the outer circumferential side of the filling socket can comprise a ring sealing and an intake section of the drainage channel can be placed in the covering ring and can have an intake opening that is axially arranged between the end face of the socket and the ring sealing of the covering ring. Since the drainage channel is attached to the cap the inventive closure device can be combined easy with a conventional reservoir without modifying an existing filling socket. The covering ring prevents that medium which passes the gap between the cap and the filler socket can escape through the annular opening to surroundings. The medium can be collected in a space which is bounded by the outer circumferential side of the filling socket, the inner circumferential side of the cap and the covering ring. The medium can leave this space through the drainage channel.

[0008] Particularly, the covering ring can be attached to the cap by way of a plug-in joint or a ring-shaped snap joint. In this way the covering ring easy can be fixed to the cap. So an usual cap can be retrofitted with a covering ring. The covering ring also can be attached removable to the cap.

[0009] According to a further favorable embodiment of the invention, an outlet section of the drainage channel can have a connector for an outlet pipe. The outlet pipe can lead far away from the cap for further reducing the risk of injury due to escaping hot medium or steam.

[0010] Advantageously, the sealing means can comprise a sealing ring or a sealing plate. A sealing ring or a sealing plate can be mounted easily in the cap.

[0011] Particularly, the interlocking means can com-

prise a plug-in joint, a screw-thread or a bayonet joint. The parts of a plug-in joint can easily be combined and separated. A screw-thread has a high stability in axial direction. A bayonet joint can easily be connected and separated and has a high stability in axial direction.

Brief Description of Drawings

[0012] The present invention together with the above-mentioned and other objects and advantages may best be understood from the following detailed description of the embodiments, but not restricted to the embodiments, wherein is shown schematically

- Figure 1 a sectional view of an expansion tank of a radiator of an internal combustion engine in the area of closing means for a filling aperture in the state of closing with a drainage channel according to a first embodiment;
- Figure 2 the expansion tank according to figure 1 where the closing means is in the state of opening;
- Figure 3 the expansion tank in the area of the closing means according to figures 1 and 2 where an outlet section of the drainage channel is connected to an outlet pipe;
- Figure 4 a sectional view of an expansion tank in the area of closing means according to a second embodiment in the state of closing where a covering ring comprises a drainage channel and is attached to the cap;
- Figure 5 the expansion tank according to figure 4 whereby the closing means is in the state of opening.

[0013] In the drawings, equal or similar elements are referred to by equal reference numerals. The drawings are merely schematic representations, not intended to portray specific parameters of the invention. Moreover, the drawings are intended to depict only typical embodiments of the invention and therefore should not be considered as limiting the scope of the invention.

Embodiment(s) of Invention

[0014] Figures 1 to 3 depict a detail of an expansion tank 10 of a radiator of an internal combustion engine of a motor vehicle according to a first embodiment. The expansion tank 10 is made of plastic. The expansion tank 10 contains coolant 11.

[0015] The expansion tank 10 comprises a filling socket 12 with a filler aperture 14. The filling socket 12 is provided with a cupulate cap 16. The cap 16 is made of plastic. The filling socket 12 and the cap 16 are parts of a closure device 18 for sealing the filler aperture 14. The cap 16 is secured to the filling socket 12 by a screw-thread 20, 22. The cap 16 has an internal screw-thread

20 which can be engaged with an external screw-thread 22 on the filling socket 12.

[0016] At its bottom the cap 16 is provided with a cylindrical collar 24. In the state of closing of the closure device 18, which is shown in figures 1 and 3, the collar 24 is coaxial to the filling socket 12 and overlaps an end-section 26 of the filling socket 12. The radial inner circumferential of the collar 24 touches the radial outer circumferential of the end-section 26.

[0017] The cap 16 is provided with a sealing ring 28. The sealing ring 28 is arranged inside the collar 24 and coaxial to that. It lies flat on the inner surface of the bottom of the cap 16. In the state of closing a bearing face 30 of the sealing ring 28 is pressed in axial direction to the filling socket 12 on an end face 32 of the filling socket 12. The sealing ring 28 so seals the filler aperture 14 in the state of closing.

[0018] An intake section 34 of a drainage channel 36 is integrated in a thickening 38 of the filling socket 12. The thickening 38 also is provided with the external screw-thread 22. The drainage channel 36 has an intake opening 40 to the end face 32 of the filling socket 12. In the state of closing the intake opening 40 is sealed by the sealing ring 28 too.

[0019] An outlet section 42 of the drainage channel 36 leads out of the thickening 38 and away from the cap 16. The drainage channel 36 has a connector 44 for an outlet pipe 46 which is shown in figure 3. The outlet pipe 46 leads to a not shown collecting chamber where escaping coolant can be collected.

[0020] The expansion tank 10, the filling socket 12 and the drainage channel 36 are molded in one piece of plastic.

[0021] For opening the filler aperture 14 the cap 16 is screwed off the filling socket 12. The sealing ring 28 as a result is moved away from the end face 32 of the filling socket 12 in direction of an arrow 46 as shown in figure 2. A continuously-increasing gap 48 between the sealing ring 28 and the end face 32 then connects the filler aperture 14 with the intake opening 40 of the drainage channel 36. The drainage channel 36 for pressure equalization so is connected with the filler aperture 14 when removing the cap 16. Any hot and pressurized coolant and steam in the expansion tank 10 can escape through the gap 48 and the drainage channel 36 as sketched out by a bent arrow 50 and is led away from the cap 16.

[0022] In the starting phase of the removing of the cap 16 the collar 24 still overlaps the end section 26 of the filling socket 12. So it is prevented that hot and pressurized coolant and steam, which passes the gap 48, can leave the cap 16 through a space between the screw-threads 20 and 22.

[0023] In total the special closure device 18 prevents that hot and pressurized coolant and steam can escape near the cap 16 when opening the filler aperture 14. So the risk of injury by burning for a person who screws off the cap 16 is reduced.

[0024] Figures 4 and 5 depict a second embodiment

of an expansion tank 110. Those parts which are equal to those of the first embodiment according to figures 1 to 3 have the same reference numbers plus 100. Different to the first embodiment, the closure device 118 of the second embodiment comprises a covering ring 152, which is coaxial to the filling socket 112. The covering ring 152 covers an annular opening 154 between the end face of the cap 116 and the outer circumferential side of the filling socket 112.

[0025] The covering ring 152 has in its radial inner circumferential surface a groove with a ring sealing 156. The ring sealing 156 presses in radial direction to the filling socket 12 against the radial outer circumferential surface of the thickening 138 of the filling socket 112.

[0026] The intake opening 140 of the intake section 134 of the drainage channel 136 is axially arranged between the end face 132 of the filling socket 112 and the ring sealing 156 of the covering ring 162. The intake section 134 extends radial to the filling socket 112.

[0027] The covering ring 152 is attached to the cap 116 by way of a ring-shaped snap joint 158.

[0028] When the cap 116 is screwed off the filling socket 112, as shown in figure 5, the sealing ring 128 is moved away from the end face 132 of the filling socket 112 in direction of the arrow 146. The coolant and steam passes the continuously-increasing gap 148, leaves the cap 116 through a space between the screw-threads 120 and 122 and flows to the intake opening 140 of the drainage channel 136. Any hot and pressurized coolant and steam in the expansion tank 110 so can escape through the gap 148, the space between the screw-threads 120 and 122 and the drainage channel 136 as sketched out with a bent arrow 150 and is away from the cap 116. The covering ring 152 prevents that coolant and steam can get to surroundings directly through the annular opening 154.

[0029] The invention is not limited to an expansion tank 10; 110 of a radiator of an internal combustion engine of a motor vehicle. The invention can also be applied for other kinds of reservoirs especially for fluids which can be hot and/or under high pressure. The invention can further be applied to other kinds of internal combustion engines, particularly industrial engines.

[0030] The invention also can be used for fluids different from coolant 11; 111.

[0031] The cap 16; 116 can be secured to the filling socket 12; 112 by interlocking means different from screw-threads 20, 22; 120, 122, preferable by interlocking means, which are interlocked by a rotating and/or plug-in movement of the cap relative to the socket, for example by a plug-in joint or a bayonet joint.

[0032] Instead with the sealing ring 28; 128, the cap 16; 116 can be provided with other sealing means, for example a sealing plate, which is suitable for sealing the filler aperture 14; 114 in the state of closing.

[0033] The expansion tank 10; 110 with the filling socket 12; 112 can be made of a material different from plastic. The expansion tank 10; 110 can be made of a material different from the material of the filling socket 12; 112.

Also the cap 16; 116 can be made of a material different from plastic.

[0034] With the first embodiment instead of only one intake opening 40 the drainage channel 36 can also have a number of intake openings to the end face 32 of the filling socket 12. The intake opening can also be formed as a slit which expands at least over a part of the circumference of the end face 32.

[0035] Instead of using the ring-shaped snap joint 158. In the second embodiment the covering ring 152 can be attached to the cap 116 in a different way. For example it can be attached to the cap 116 by means of a plug-in joint, a screw thread or a bayonet joint. It also can be mounted by welding or means of glue. The covering ring 152 can also be part of the cap 116.

Claims

1. Closure device (18; 118) for sealing a filler aperture (14; 114) of a reservoir (10; 110), especially for the use on a radiator of an internal combustion engine in particular of a motor vehicle, comprising a filling socket (12; 112) and a cupulate cap (16; 116) secured to the socket (12; 112) by interlocking means (20, 22; 120, 122), which are interlocked by a rotating and/or plug-in movement of the cap (16; 116) on the socket (12; 112), and the cap (16; 116) is provided with sealing means (28; 128), which seals the filler aperture (14; 114) in the state of closing, and a drainage channel (36; 136) for pressure equalization is connected with the filler aperture (14; 114) when removing the cap (16; 116), **characterized in that** the cap (16; 116) presses in the state of closing the sealing means (28; 128) against the end face (32; 132) of the filling socket (12; 112) for sealing the filler aperture (14; 114) and when removing the cap (16; 116) a gap (48; 148) between the sealing means (28; 128) and the end face (32; 132) connects the filler aperture (14; 114) with the drainage channel (36; 136).
2. Closure device according to claim 1, **characterized in that** an intake section (34) of the drainage channel (36) is integrated in a wall (38) of the filling socket (12) and has an intake opening (40) to the end face (32), which is sealed in the state of closing by the sealing means (28).
3. Closure device according to claim 1, **characterized in that** a covering ring (152) for an annular opening (154) between the end face of the cap (116) and the outer circumferential side of the filling socket (112) comprises a ring sealing (156) and an intake section (134) of the drainage channel (136) is placed in the covering ring (152) and has an intake opening (140) that is axially arranged between the end face of the socket (112) and the ring sealing (156) of the cover-

ing ring (152).

4. Closure device according to claim 3, **characterized in that** the covering ring (152) is attached to the cap (116) by way of a plug-in joint or a ring-shaped snap joint (158). 5
5. Closure device according to one of the previous claims, **characterized in that** an outlet section (42; 142) of the drainage channel (36; 136) has a connector (44; 144) for an outlet pipe (46). 10
6. Closure device according to one of the previous claims, **characterized in that** the sealing means comprises a sealing ring (28; 128) or a sealing plate. 15
7. Closure device according to one of the previous claims, **characterized in that** the interlocking means comprises a plug-in joint, a screw-thread (20, 22; 120, 122) or a bayonet joint. 20

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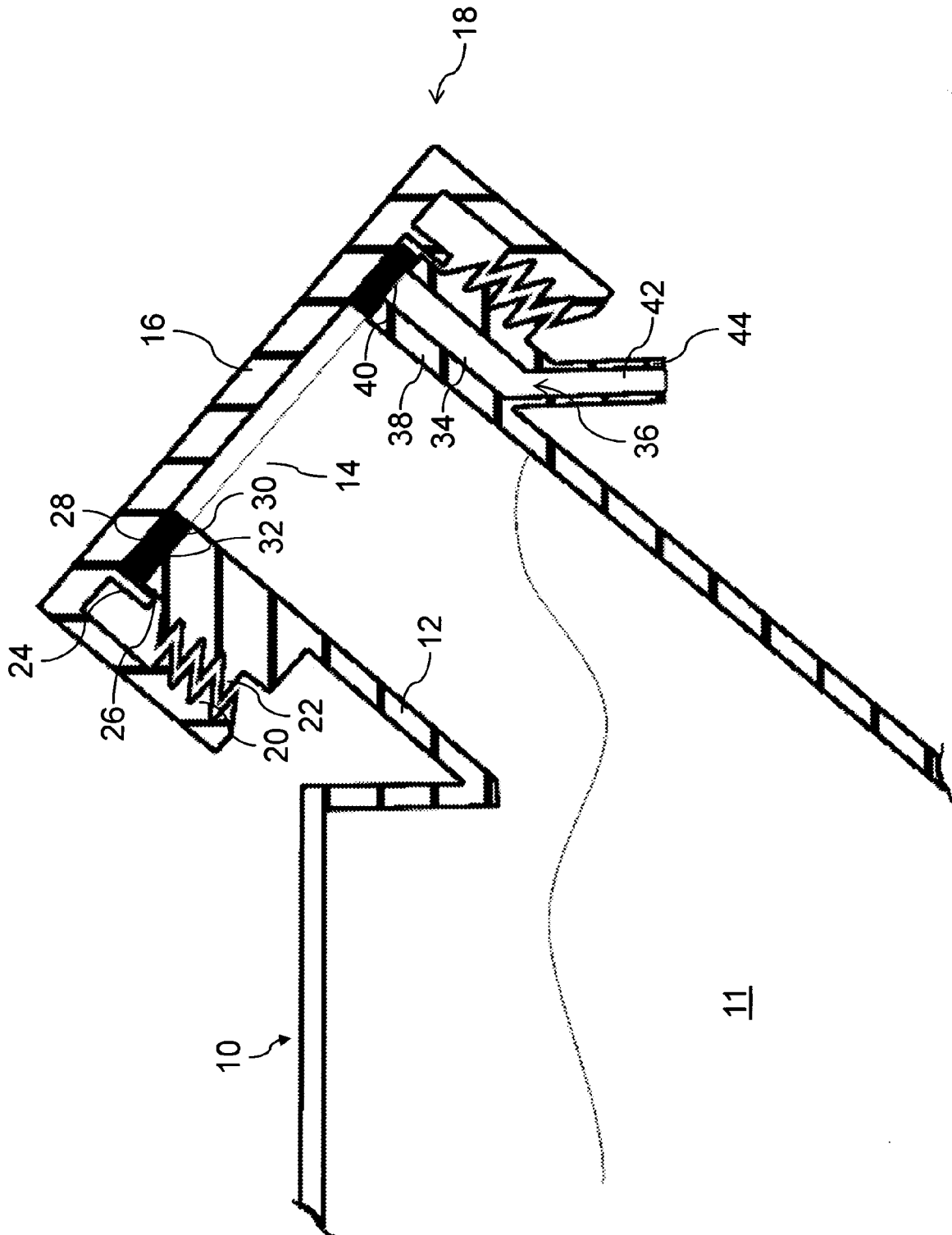


Fig. 1

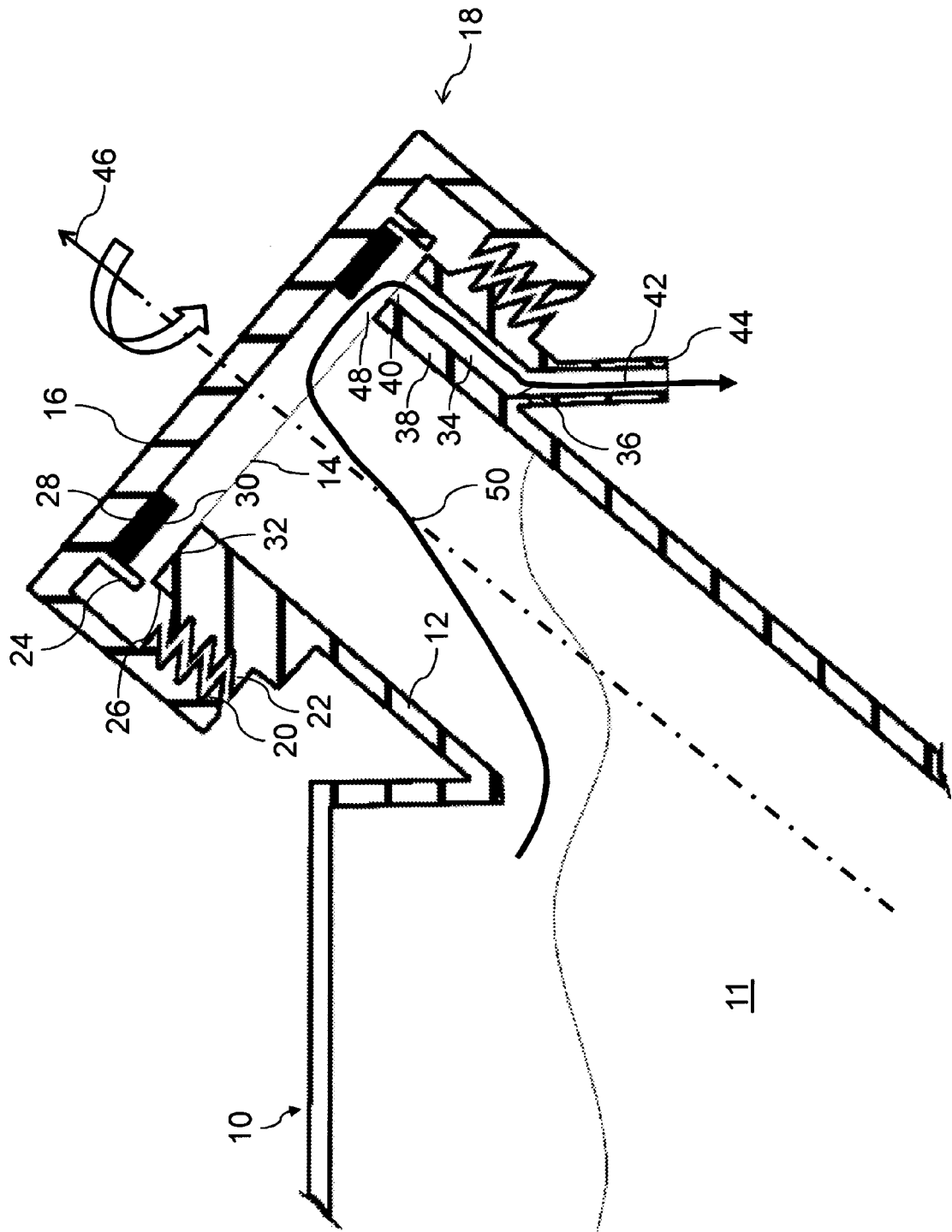


Fig. 2

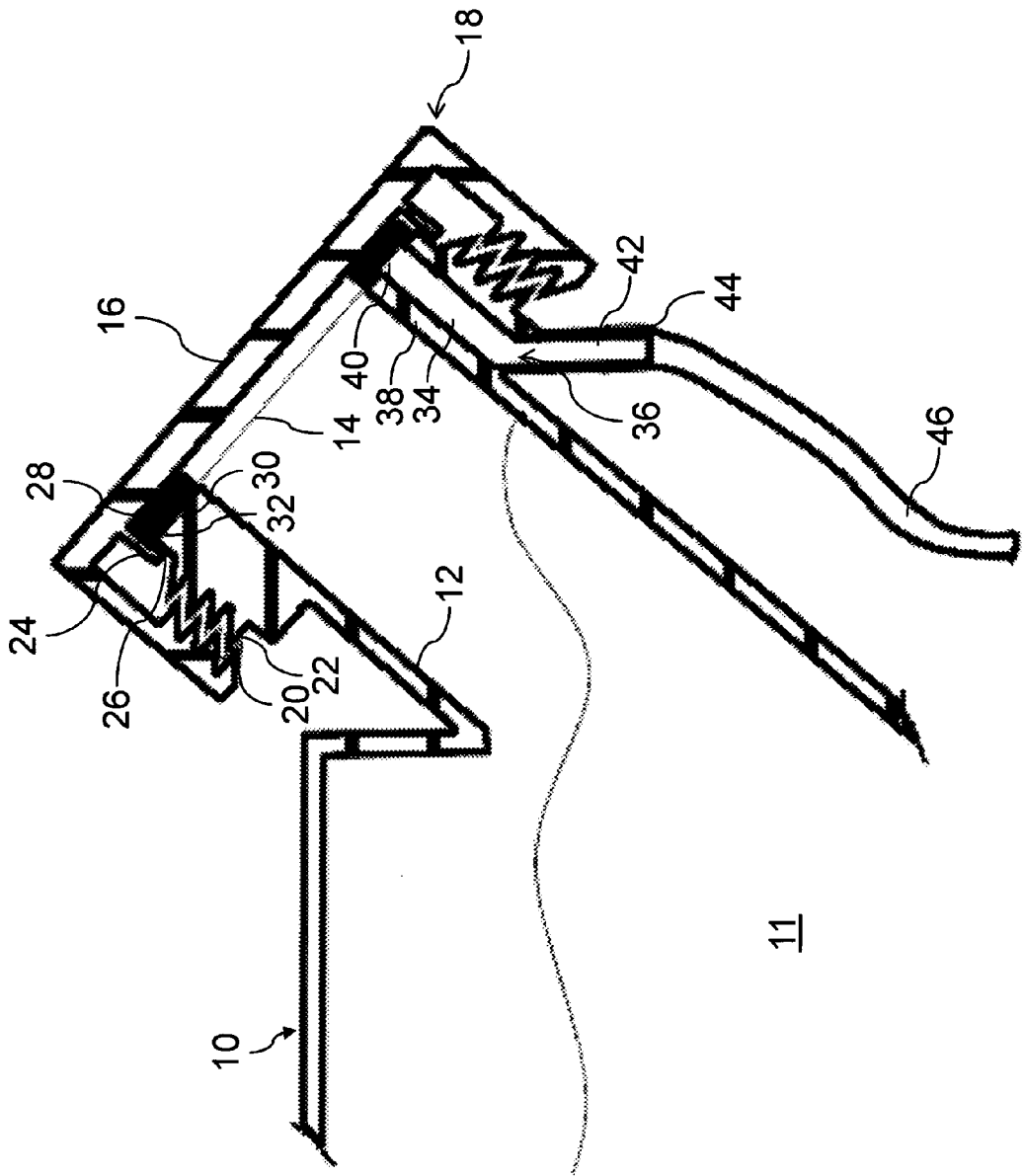


Fig. 3

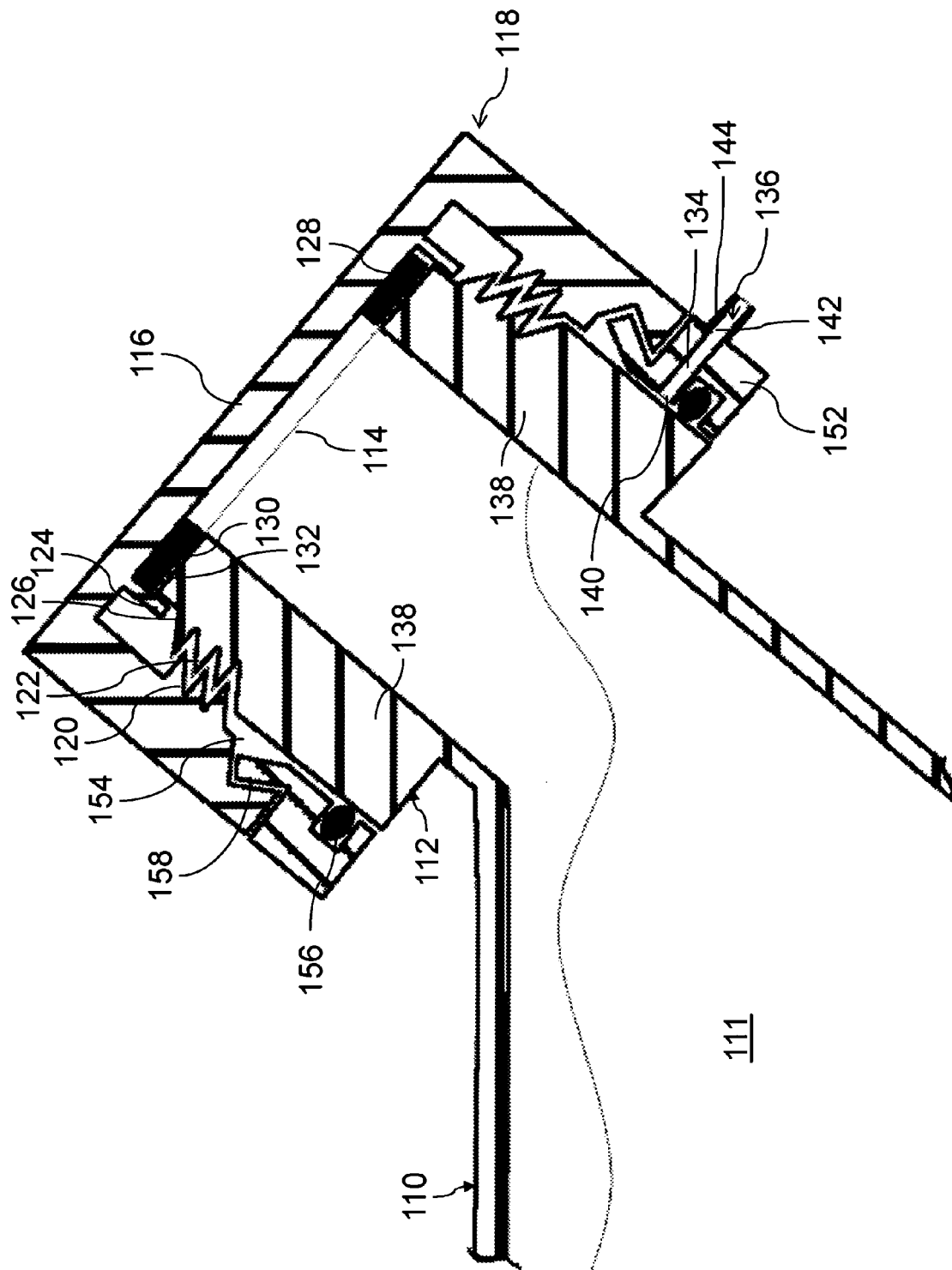


Fig. 4

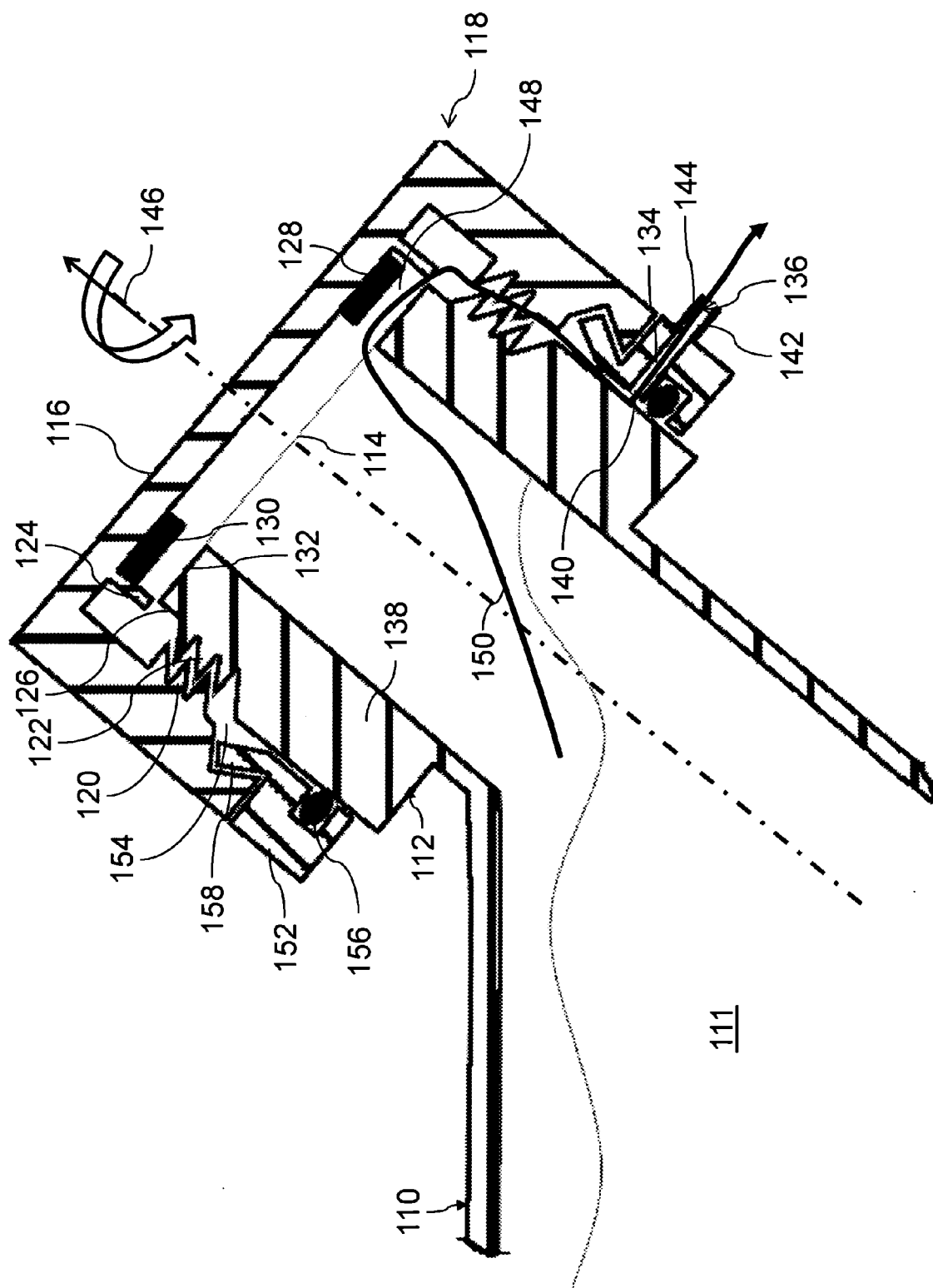


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 11 29 0359

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	US 3 077 927 A (WHITE THEODORE Z ET AL) 19 February 1963 (1963-02-19) * column 1, line 61 - column 2, line 34; figures *	1,6,7	INV. F01P11/02

X	DE 40 39 993 A1 (DAIMLER BENZ AG [DE]) 26 March 1992 (1992-03-26) * column 1, line 67 - column 2, line 34; figure *	1,2,5-7	

			TECHNICAL FIELDS SEARCHED (IPC)
			F01P
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 16 February 2012	Examiner Luta, Dragos
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 29 0359

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16-02-2012

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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