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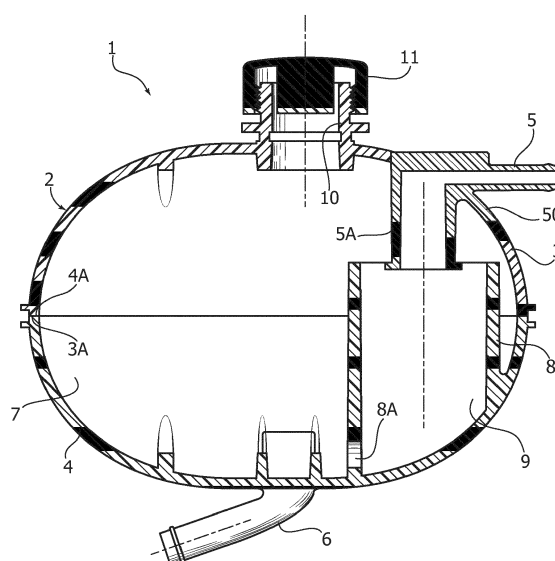
Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **A SUPPLEMENTARY TANK FOR AN AUXILIARY SYSTEM ASSOCIATED WITH AN INTERNAL COMBUSTION ENGINE OF A MOTOR-VEHICLE**

(57) A supplementary tank (1) for an auxiliary system associated with an internal combustion engine of a motor-vehicle, having a containing volume (7) for the coolant of an engine cooling system, or two separate containing volumes (7, 70), one for the coolant and the other for a urea solution in a catalytic reduction system of the exhaust gases of the engine, wherein said supplementary tank (1) has a body (2) comprising an upper half-shell (3) and a lower half-shell (4), both made of plastic, rigidly connected to each other along respective perimetral coupling edges (3A, 4A) and defining the aforesaid containing volume (7) or the aforesaid containing volumes (7, 70) between them, wherein said containing volume (7) or each of said containing volumes (7, 70) is provided with a filling inlet (10, 100) for filling the fluid within the containing volume, and at least one upper connection element (5) and one lower connection element (6) for connecting ducts to said auxiliary system, and wherein said containing volume (7) of the coolant is associated with a stilling well (8), extending upwards within said containing volume (7) of the coolant starting from a bottom wall of said body (1), said supplementary tank being characterized in that said upper half-shell (3) and said lower half-shell (4) are rigidly connected to each other by means of adhesive material, and in that said stilling well (8) protrudes upwards beyond a theoretical plane containing the perimetral coupling

edge (4A) of the lower half-shell and in that said stilling well (8) is formed in a single piece with said lower half-shell (4).

FIG. 1



Description

Field of the invention

[0001] The present invention relates to a supplementary tank for an auxiliary system associated with an internal combustion engine of a motor-vehicle, having at least one volume for containing a coolant of an engine cooling system. Application of the invention to tanks including more than one containing volume is also not excluded, such as a first volume for said coolant, and a second volume for a urea solution for a system for catalytic reduction of the exhaust gases of the engine.

[0002] The invention particularly relates to a supplementary tank of a known type having a body comprising an upper half-shell and a lower half-shell, both of plastic material, rigidly connected to each other along respective perimetral coupling edges and defining the aforesaid containing volume, and wherein said containing volume is provided with a filling inlet for charging said fluid within the containing volume, and at least one upper connection element and one lower connection element for connecting ducts to said auxiliary system; a stilling well is also associated with said containing volume, extending upwards within said containing volume, starting from a bottom wall of said body.

Prior art

[0003] In known supplementary tanks of the type indicated above, the upper half-shell and the lower half-shell forming the body of the tank are rigidly connected to each other by means of hot welding of the plastic material forming the two half-shells. To this end, a tool is used in the form of a blade, which is preliminarily heated and then brought into contact with the coupling edges of the two half-shells to bring the thermoplastic material to the temperature required to perform the welding operation obtained by pressing the two half-shells against each other.

[0004] The disadvantage of this known technique lies in the fact that it is imperative to design each of the two half-shells so that they do not have portions protruding above the plane containing the perimetral coupling edge, otherwise it would not be possible to bring the hot blade used for welding into contact with the perimetral coupling edge. This puts a limit on the functionality of the supplementary tank, since the aforesaid stilling well within the containing volume of the coolant should instead extend upwards as much as possible. To overcome this disadvantage, the stilling well could be produced from two separate elements formed in one-piece with the two half-shells, in positions that define the entire body of the well when the two half-shells are welded together. This mode of operation is relatively complicated and, furthermore, does not enable, at the end of the welding process, the good quality of the weld to be checked also at the coupled edges of the two elements forming the well.

[0005] A further drawback of the prior art described

above lies in the fact that the two half-shells cannot be made with different materials, nor is it possible to provide inserts of different materials and/or colors. It would, however, be preferable to make the aforesaid connections with different color materials, for example, to characterize - in a simple and immediate manner - different tanks intended to be used on different engines, so as to facilitate the work of the operators in assembly lines of the motor-vehicles.

[0006] Finally, the prior art described above also involves the risk that the relatively high temperature reached during welding results in unwanted modifications of the thermoplastic material, which makes controlling the process more problematic and costly.

Object of the invention

[0007] The aim of the present invention is to provide a supplementary tank of the type indicated above that is able to overcome the above-mentioned drawbacks.

Summary of the invention

[0008] In order to achieve the aforesaid object, the present invention relates to a supplementary tank for an auxiliary system associated with an internal combustion engine of a motor-vehicle, having at least one volume for containing a coolant of an engine cooling system, wherein said supplementary tank has a body comprising an upper half-shell and a lower half-shell, both made of plastic, rigidly connected to each other along respective perimetral coupling edges and defining the said containing volume,

wherein said containing volume is provided with a filling inlet for charging the fluid within the containing volume, and at least one upper connection element and one lower connection element for connecting pipes from said auxiliary system, and

wherein said containing volume is provided with a stilling well, extending upwards within said containing volume starting from a bottom wall of said body,

said supplementary tank being characterized in that said upper half-shell and said lower half-shell are rigidly connected to each other by means of adhesive material, in that said stilling well protrudes upwards beyond a general theoretical plane containing the perimetral coupling edge of the lower half-shell, and in that said stilling well is formed in a single piece with said lower half-shell.

[0009] According to a further preferred characteristic of the invention, the perimetral coupling edges of the upper half-shell and the lower half-shell have mutual engagement surfaces including a perimetral rib and a perimetral groove, respectively, or vice versa. The said perimetral rib has a cross-sectional profile selected from a trapezoidal profile, a triangular profile, a rounded profile, and a square profile.

[0010] A further characteristic of the tank according to the invention lies in the fact that the perimetral coupling

edges of the upper half-shell and the lower half-shell are also rigidly connected to each other by mechanical coupling, for example, with the aid of a plurality of elastic teeth each protruding from one of said half-shells and engaged within corresponding coupling seats of the other half-shell.

[0011] Thanks to the aforesaid characteristics, the supplementary tank according to the invention has a series of important advantages. Firstly, the tank is produced with a stilling well that can be as long as possible, so as to ensure the best operating efficiency, without causing any problems or disadvantages in the manufacturing process of the tank. A further advantage of the invention lies in the fact that the two half-shells forming the tank can be made of different materials and/or colors. In one embodiment, the body of the tank includes, in addition to the aforesaid upper half-shell and the aforesaid lower half-shell, additional body portions joined by adhesive material to at least one of said half-shells. In this embodiment, the aforesaid additional body portions can be produced using the same material or a different material, and either using the same color or a different color compared to the material and color of the two half-shells. For example, the aforesaid upper connection element of the tank can be produced as a separate body portion, in a different and contrasting color with respect to the color of the upper half-shell of the tank. This characteristic can be used, for example, in an industrial production to distinguish tanks intended to be associated with different types of engines, by adopting a predetermined color for the upper connection element of the tank for each type of engine.

[0012] Another important advantage of the invention lies in the fact that the perimetral coupling edges for coupling the upper half-shell with the lower half-shell can have portions lying in different planes, inclined or spaced apart, without this having any drawbacks in the manufacturing process (unlike in the case of half-shells welded by applying a hot blade).

Description of the preferred embodiments

[0013] Further characteristics and advantages of the invention will become apparent from the description that follows with reference to the attached drawings, provided purely by way of non-limiting example, wherein:

- Figure 1 is a cross-sectional view of a first embodiment of a supplementary tank according to the present invention;
- Figures 2 and 3 are further cross-sectional views of the tank of Figure 1, according to different cross-sectional planes compared to Figure 1,
- Figures 4 and 5 are perspective views of the upper half-shell and the lower half-shell forming the supplementary tank of Figure 1,
- Figures 6 and 7 show, in cross-section, the coupling edges of the upper half-shell and the lower half-shell

of the supplementary tank of Figure 1, according to two different variants,

- Figures 8A, 8B, and 8C are schematic representations relative to further variations of the cross-sectional profile of the coupling edges of the upper half-shell and the lower half-shell,
- Figure 9 is a perspective view- on an enlarged scale- of an elastic tooth and the corresponding coupling seat arranged on the two half-shells of the tank of Figure 1,
- Figure 10 is a perspective view of a second embodiment of the tank according to the invention, and
- Figure 11 is a cross-sectional view of the tank of Figure 10.

[0014] In Figures 1 to 3, the reference numeral 1 indicates, in its entirety, a first embodiment of a tank according to the invention, which in the example shown is an supplementary tank for the cooling system of an internal combustion engine of a motor-vehicle. The tank comprises a plastic body 2 including an upper half-shell 3 and a lower half-shell 4.

[0015] In the present description, the terms "upper" and "lower" are understood to refer to the position of the tank in the condition of use.

[0016] According to the prior art, the tank 1 includes an upper connection element 5 and a lower connection element 6 for coupling of connecting pipes from the cooling system of the motor-vehicle, according to the conventional technique well-known to those skilled in the art. Furthermore, within the containing volume 7 defined between the two half-shells 3, 4, a stilling well 8 is arranged, formed by a cylindrical wall extending upwards from the bottom wall of the lower half-shell 4, so as to define a reduced containing volume 9 of the coolant, which is in communication with the connection 5 by means of a duct portion 5A protruding vertically downwards from the wall of the upper half-shell 3 and partially inserted within the upper part of the stilling well 8. The cylindrical wall forming the stilling well has an opening 8A, adjacent to the bottom wall of the lower half-shell 4, which causes the containing volume 9 of the well 8 to communicate with the main containing volume 7 of the tank 1.

[0017] A filling inlet 10 is also formed in one piece in the upper half-shell 3 for charging the fluid within the tank 1, having a threaded external surface for engaging the threaded inner surface of a closure lid 11.

[0018] As best seen in Figure 2, in the bottom wall of the lower half-shell 4, a lower connection element 12 is formed in a single piece for engaging a pipe (not shown) connecting the tank 1 to the engine cooling system of the motor-vehicle, according to the conventional technique well-known to those skilled in the art.

[0019] With reference in particular to Figure 3, within the containing volume 7, a spacer column is arranged, defined by two column portions 13, 14 formed in a single piece with the upper half-shell 3 and the lower half-shell 4, respectively (see also Figures 4, 5). In the example

illustrated in Figure 4, the upper half-shell 3 also includes two brackets 15 for connecting the supplementary tank 1 to a supporting structure belonging to the motor-vehicle structure.

[0020] In the supplementary tank according to the invention, the two half-shells 3 and 4 are rigidly connected to each other along their perimetral coupling edges 3A and 4A by means of adhesive material M (see figures). This allows, if required, the use of different materials for the half-shells 3, 4. For example, the upper half-shell 3 can be made of polypropylene, while the lower half-shell 4 can be made of polyamide. Furthermore, the connection 5, or any other connection provided on the tank 1 can be formed of a separate body portion 50, made of a different material with respect to the material chosen for the upper half-shell 3, if required and/or having a different coloring. In the illustrated example, the connection 5 is formed of a separate body portion 50 joined to the upper half-shell 3 by means of adhesive material. The portion 50 can be made, for example, of polyphenylsulphide. This characteristic allows arrangement of tanks of the type illustrated, with differently colored connections 5 to indicate the destination for different types of engines. In this way, the work of the operators in the assembly line of motor-vehicles is made easier.

[0021] As can be seen in Figures 1 to 3, the stilling well 8 is obtained in a single piece with the lower half-shell 4, and yet it extends upwards beyond the theoretical plane containing the perimetral coupling edge 4A of the lower half-shell 4. In this way, the stilling well 8 is able to optimally perform its function and, at the same time, does not give rise to any inconvenience or complication during the manufacturing process, unlike conventional solutions in which the two half-shells 3, 4 are rigidly connected to each other by welding with a hot blade.

[0022] According to a further preferred characteristic of the invention, the perimetral coupling edges 3A, 4A of the half-shells 3, 4 have reciprocal engagement surfaces including, respectively, a rib 15 received within a groove 16. In the illustrated example, the groove 15 is formed on the perimetral coupling edge 4A of the lower half-shell 4 and the rib 16 is formed on the perimetral coupling edge of the upper half-shell 3. However, an inverse configuration could be adopted, with the rib formed on the upper half-shell and the groove formed on the lower half-shell.

[0023] Figures 6 and 7 have two possible configurations, corresponding to two different variants, of the rib 15 and of the groove 16. In both cases, the rib and the groove have a trapezoidal profile cross-section.

[0024] In a concrete embodiment example, the dimensions shown in Figure 6 were as follows:

h1 = about 5 mm;
h2 = about 5.7 mm;
s1 = 0.1-0.9 mm
s = 0.4 mm
f = 8 mm
a = 2 mm;

b = 2.5 mm.

[0025] The variant of Figure 7 differs from Figure 6 due to the arrangement of a height space h_3 between the two facing edges 3A, 4A on the inner side of the rib. In a concrete embodiment example, the dimensions shown in Figure 7 were as follows:

h1 = about 5 mm;
h2 = about 5.7 mm;
h2 = about 2.3 mm;
s1 = 0.1-0.9 mm
f = about 8 mm;
a = 2 mm;
b = 2.5 mm.

[0026] The present invention extends to any commercially available adhesive, suitable for applications of the type discussed here. By way of example, a usable adhesive material is the Loctite AA3038 product of the Henkel Company.

[0027] Instead of the trapezoidal shape of the rib 15 and of the groove 16 illustrated in the variants of Figures 6 and 7, it is possible to adopt a triangular shape, a rounded shape or a square shape, as shown schematically in Figures 8A, 8B and 8C.

[0028] According to a further important characteristic of the present invention, the two half-shells 3, 4 are rigidly connected to each other by mechanical connection, as well as through adhesive material. This mechanical connection is achieved by the engagement of a plurality of elastic teeth 30 arranged on one of the perimetral coupling edges of the half-shells 3, 4 within corresponding coupling seats 40 provided in the perimetral coupling edge of the other half-shell. Figure 9 shows, by way of example, the detail of an elastic tooth 30 protruding from the perimetral coupling edge 3A of the upper half-shell 3 in a decoupled position with respect to the corresponding coupling seat 40 provided in the perimetral coupling edge 4A of the lower half-shell 4. Figure 9 shows only the portions of the perimetral coupling edges of the two half-shells in which the elastic tooth 30 and the coupling seat 40 are arranged. Of course, each elastic tooth 30 can be provided in either of the two half-shells 3, 4, resulting in the provision of the coupling seat 40 in the other half-shell.

[0029] Another important advantage of the tank according to the invention lies in the fact that it can have half-shells 3, 4 with perimetral coupling edges including portions contained in different planes, for example, inclined or spaced apart, without this having any drawbacks in the manufacturing process, as occurs in the case of the tank according to the prior art in which the two half-shells are connected together by means of hot-blade welding. An example of a tank of this type is illustrated in Figures 10 and 11 with reference to a second embodiment. In the case of this embodiment, the body of the tank comprising the two half-shells 3, 4 also defines, in

addition to the containing volume 7 for the coolant of an engine cooling system, another containing volume 70, separate from the volume 7, which in the example shown is intended to contain a urea solution for a catalytic reduction system of exhaust gases of the engine.

[0030] In Figures 10 and 11, the parts common or corresponding to those of Figures 1-9 are indicated by the same reference numbers.

[0031] In the case of the embodiment of Figure 11, the stilling well extends for the entire height of the containing volume 7, from the bottom wall of the lower half-shell up to the upper wall, coaxially to the filling inlet 10. To contain the urea solution, the auxiliary volume 70 has a separate filling inlet 100 and an outlet connection 60 associated with it. All of the variants illustrated above with reference to the embodiment of Figure 1 can, of course, also be adopted in the case of the embodiment of Figures 10 and 11.

[0032] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely with respect to those described and illustrated purely by way of example, without departing from the scope of the present invention.

Claims

1. A supplementary tank (1) for an auxiliary system associated with an internal combustion engine of a motor-vehicle, having at least one containing volume (7) for a coolant of an engine cooling system, wherein said supplementary tank (1) has a body (2) comprising an upper half-shell (3) and a lower half-shell (4), both made of plastic, rigidly connected to each other along respective perimetral coupling edges (3A, 4A) and defining the aforesaid containing volume (7) between them, wherein said containing volume (7) is provided with a filling inlet (10) for charging the fluid within the containing volume, and at least one upper connection element (5) and one lower connection element (6) for connecting pipes from said auxiliary system, and wherein said containing volume (7) is provided with a stilling well (8), extending upwardly within said containing volume (7) starting from a bottom wall of said body (1), said supplementary tank being **characterized in that** said upper half-shell (3) and said lower half-shell (4) are rigidly connected to each other by means of adhesive material (M), and **in that** said stilling well (8) protrudes upwards beyond a general theoretical plane containing the perimetral coupling edge (4A) of the lower half-shell and **in that** said stilling well (8) is formed in a single piece with said lower half-shell (4).
2. A supplementary tank according to claim 1, **characterized in that** said body (1) defines two separate containing volumes (7, 70), a first volume for said coolant, and a second volume for a urea solution for a system for catalytic reduction of the exhaust gases of the engine, said second containing volume (70) being provided with a filling inlet (100) for charging the fluid within the second containing volume (70), and at least one lower connection element (60).
3. A supplementary tank according to claim 1, **characterized in that** the perimetral coupling edges (3A, 4A) of the upper half-shell (3) and of the lower half-shell (4) have reciprocal engagement surfaces including a perimetral rib (15) received in a perimetral groove (16).
4. A supplementary tank according to claim 3, **characterized in that** the aforesaid perimetral rib (15) and the aforesaid perimetral groove (16) have a cross-sectional profile chosen among a trapezoidal profile, a triangular profile, a rounded profile, and a square profile.
5. A supplementary tank according to claim 1, **characterized in that** the perimetral coupling edges (3A, 4A) of the two half-shells (3, 4) have portions lying on different planes, inclined or vertically spaced apart from each other.
6. A supplementary tank according to claim 1, **characterized in that** the aforesaid body (1) includes additional body portions (50) joined by means of adhesive to at least one of said half-shells (3, 4).
7. A supplementary tank according to claim 6, **characterized in that** said half-shells (3, 4) and said additional body portions (50) are made of the same or different materials and/or of the same or different colors.
8. A supplementary tank according to claim 6, **characterized in that** said upper connection element (5) is part of a separate body portion joined by means of adhesive material to said upper half-shell (3), and has a color contrasting with the color of said upper half-shell (3), said color being predetermined depending on the type of engine with which the additional tank should be associated, so that in an industrial production, the same color of said connection indicates the destination of the tank to a specific type of engine.
9. A supplementary tank according to claim 1, **characterized in that** the said half-shells (3, 4) are rigidly connected to each other, by mechanical coupling as well as by means of adhesive material.
10. A supplementary tank according to claim 8, **characterized in that** said mechanical coupling includes a

plurality of elastic teeth (30) each arranged along the perimetral coupling edge (3A, 4A) of one of the two half-shells (3, 4) and engaging within a corresponding coupling seat (40) provided along the perimetral coupling edge (3A, 4A) of the other half-shell.

Amended claims in accordance with Rule 137(2) EPC.

1. A supplementary tank (1) for an auxiliary system associated with an internal combustion engine of a motor-vehicle, having at least one containing volume (7) for a coolant of an engine cooling system, wherein said supplementary tank (1) has a body (2) comprising an upper half-shell (3) and a lower half-shell (4), both made of plastic, rigidly connected to each other along respective perimetral coupling edges (3A, 4A) and defining the aforesaid containing volume (7) between them, wherein said containing volume (7) is provided with a filling inlet (10) for charging the fluid within the containing volume, and at least one upper connection element (5) and one lower connection element (6) for connecting pipes from said auxiliary system, and wherein said containing volume (7) is provided with a stilling well (8), extending upwardly within said containing volume (7) starting from a bottom wall of said body (1), said supplementary tank being **characterized in that** said upper half-shell (3) and said lower half-shell (4) are rigidly connected to each other by means of adhesive material (M), and **in that** said stilling well (8) protrudes upwards beyond a general theoretical plane containing the perimetral coupling edge (4A) of the lower half-shell and **in that** said stilling well (8) is formed in a single piece with said lower half-shell (4), **characterized in that** said upper connection element (5) is part of a separate body portion joined by means of adhesive material to said upper half-shell (3), and has a color contrasting with the color of said upper half-shell (3), said color being predetermined depending on the type of engine with which the additional tank should be associated, so that in an industrial production, the same color of said connection indicates the destination of the tank to a specific type of engine.
2. A supplementary tank according to claim 1, **characterized in that** said body (1) defines two separate containing volumes (7, 70), a first volume for said coolant, and a second volume for a urea solution for a system for catalytic reduction of the exhaust gases of the engine, said second containing volume (70) being provided with a filling inlet (100) for charging the fluid within the second containing volume (70), and at least one lower connection element (60).

3. A supplementary tank according to claim 1, **characterized in that** the perimetral coupling edges (3A, 4A) of the upper half-shell (3) and of the lower half-shell (4) have reciprocal engagement surfaces including a perimetral rib (15) received in a perimetral groove (16).
4. A supplementary tank according to claim 3, **characterized in that** the aforesaid perimetral rib (15) and the aforesaid perimetral groove (16) have a cross-sectional profile chosen among a trapezoidal profile, a triangular profile, a rounded profile, and a square profile.
5. A supplementary tank according to claim 1, **characterized in that** the perimetral coupling edges (3A, 4A) of the two half-shells (3, 4) have portions lying on different planes, inclined or vertically spaced apart from each other.
6. A supplementary tank according to claim 1, **characterized in that** the said half-shells (3, 4) are rigidly connected to each other, by mechanical coupling as well as by means of adhesive material.
7. A supplementary tank according to claim 8, **characterized in that** said mechanical coupling includes a plurality of elastic teeth (30) each arranged along the perimetral coupling edge (3A, 4A) of one of the two half-shells (3, 4) and engaging within a corresponding coupling seat (40) provided along the perimetral coupling edge (3A, 4A) of the other half-shell.

FIG. 1

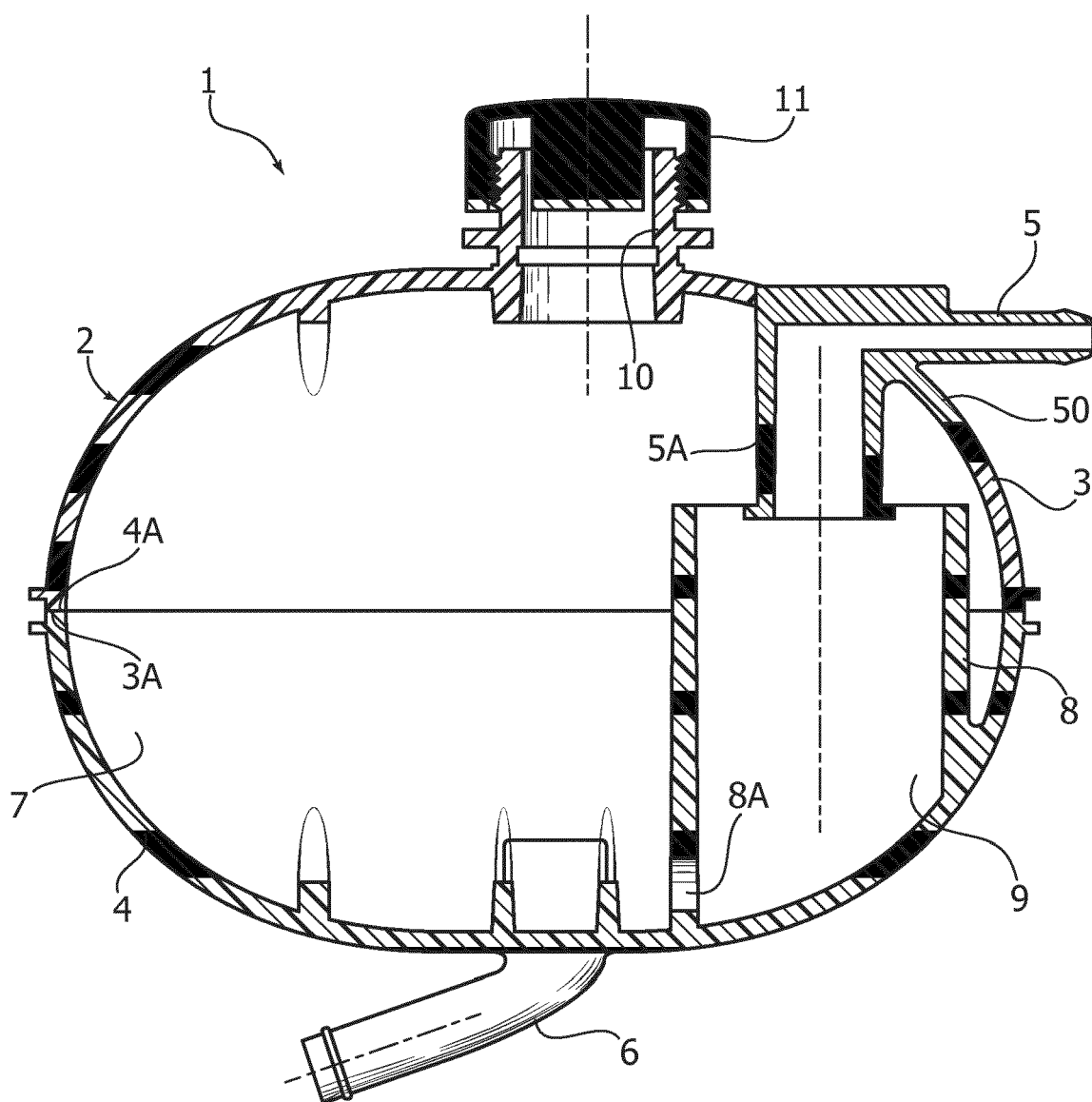


FIG. 2

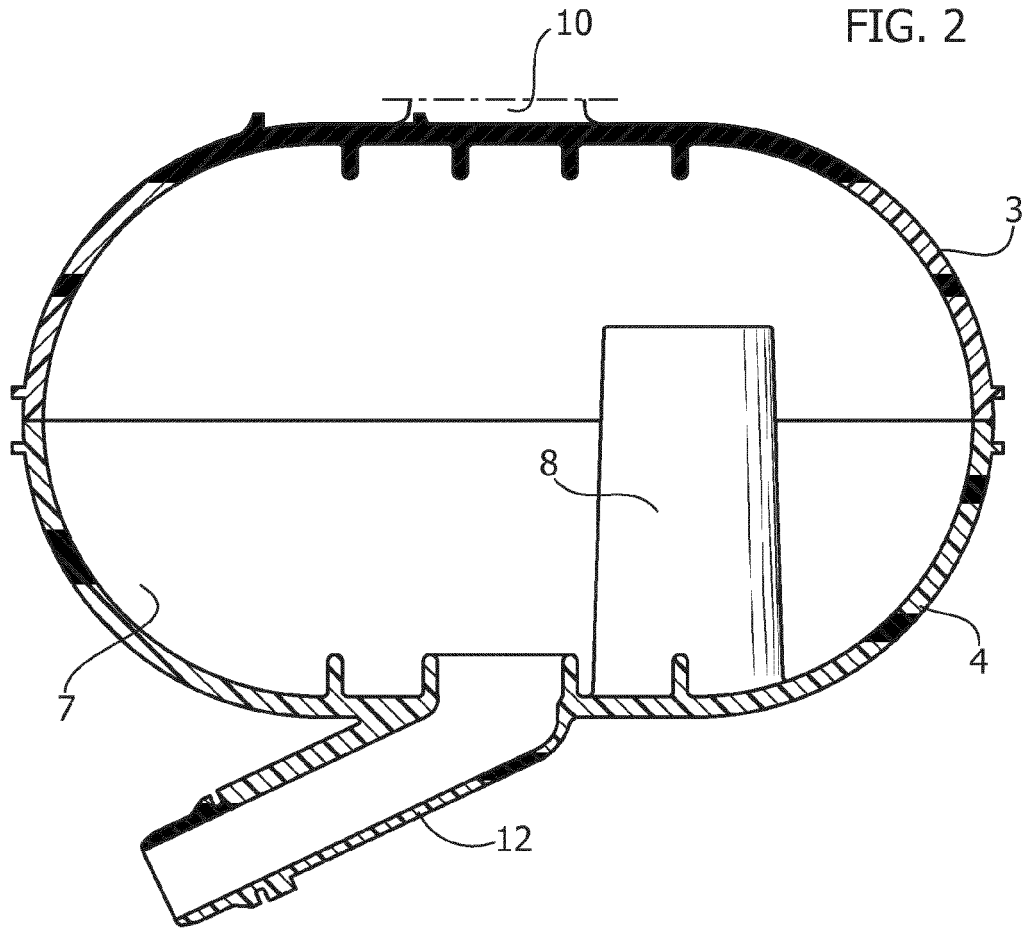


FIG. 3

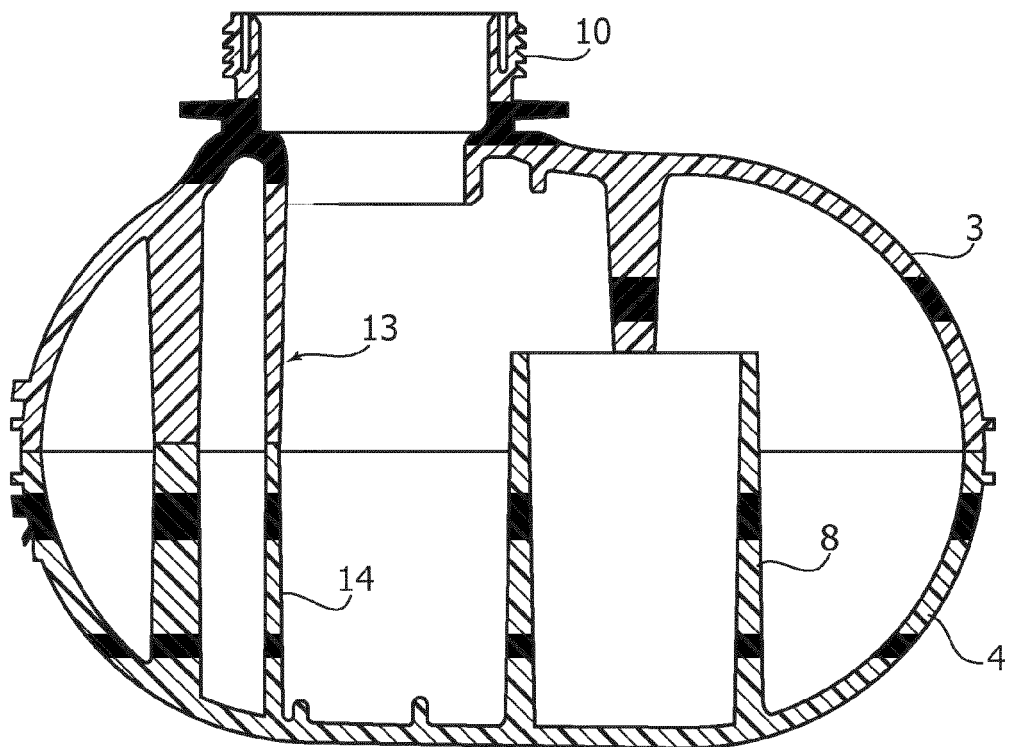


FIG. 4

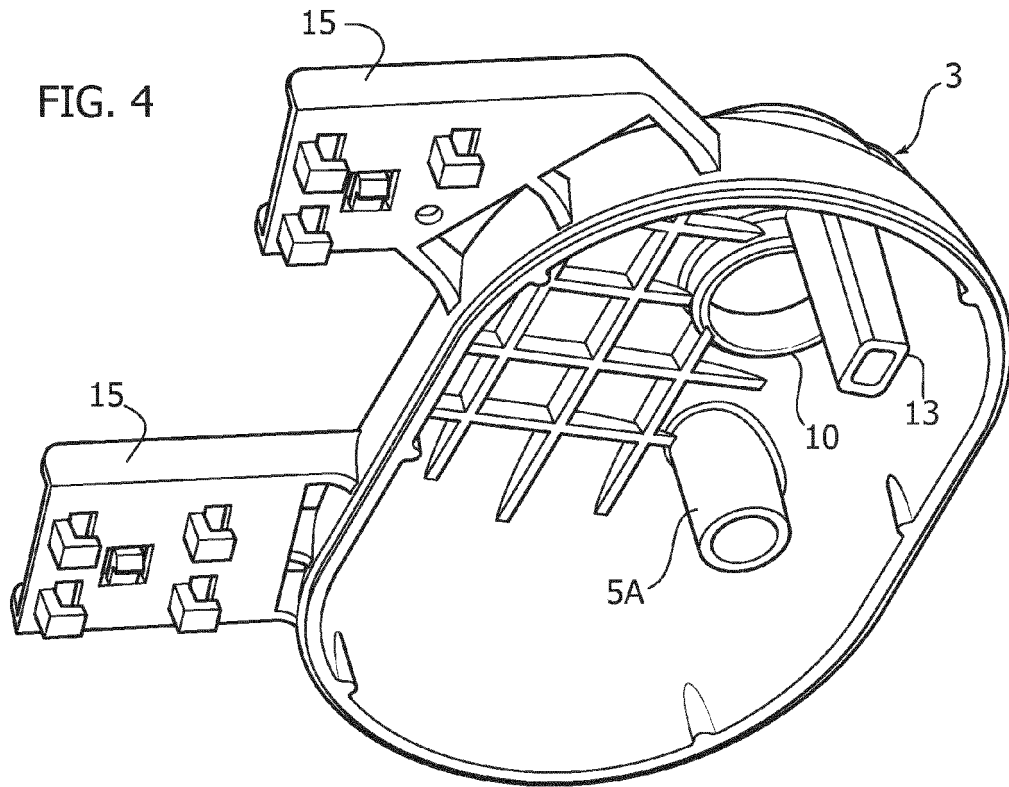


FIG. 5

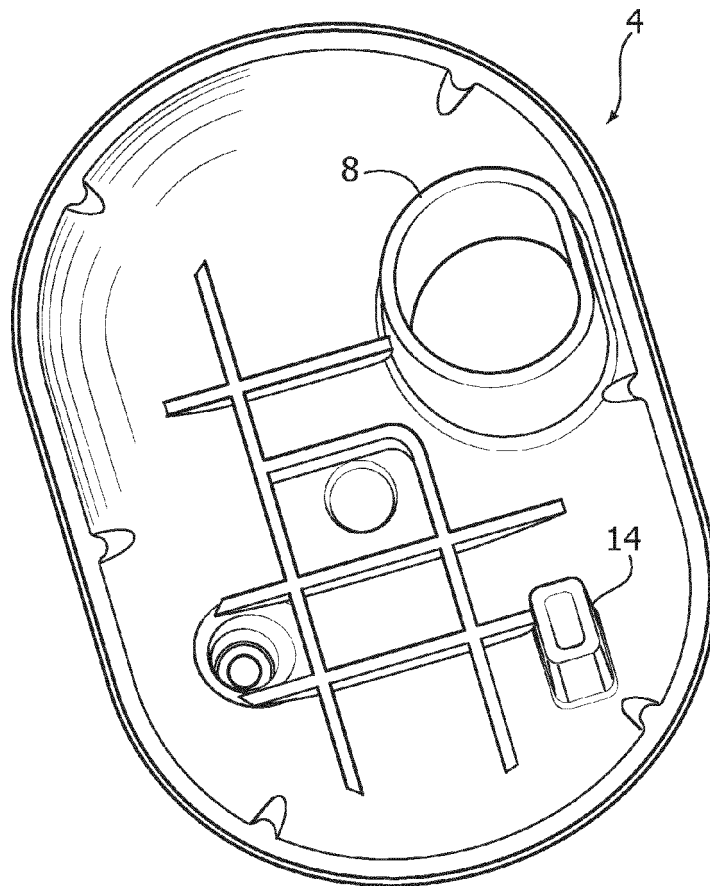


FIG. 6

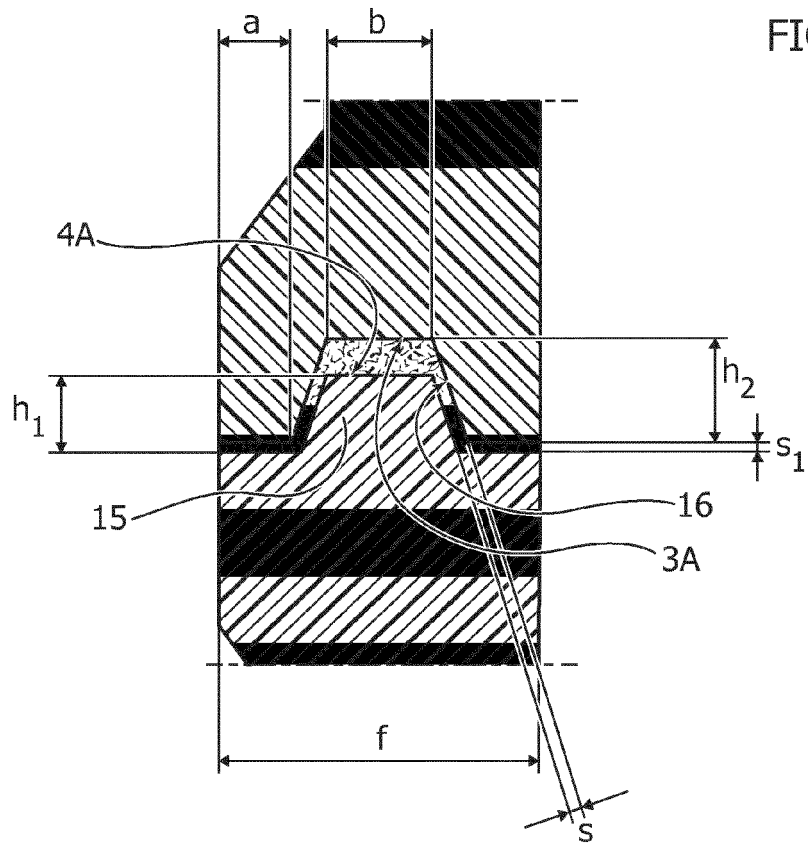


FIG. 7

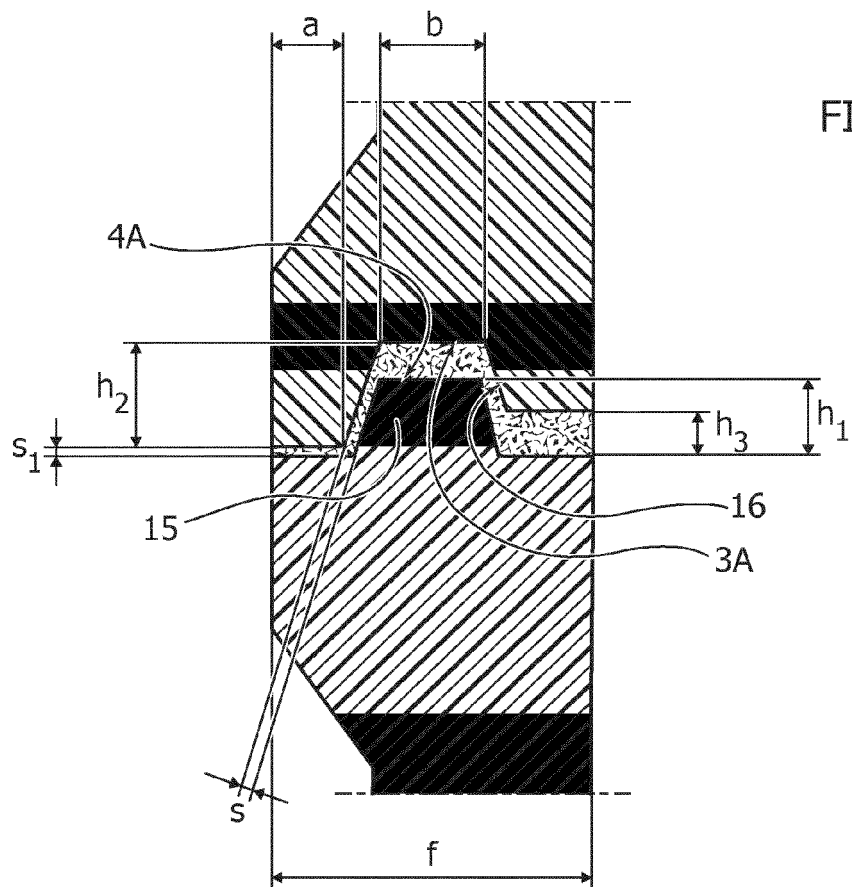


FIG. 8A

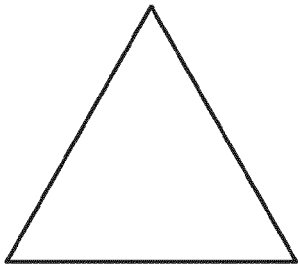


FIG. 8B

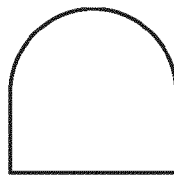


FIG. 8C

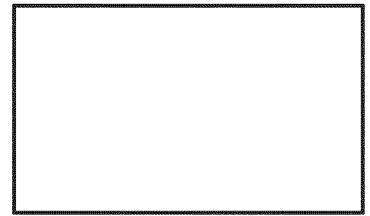


FIG. 9

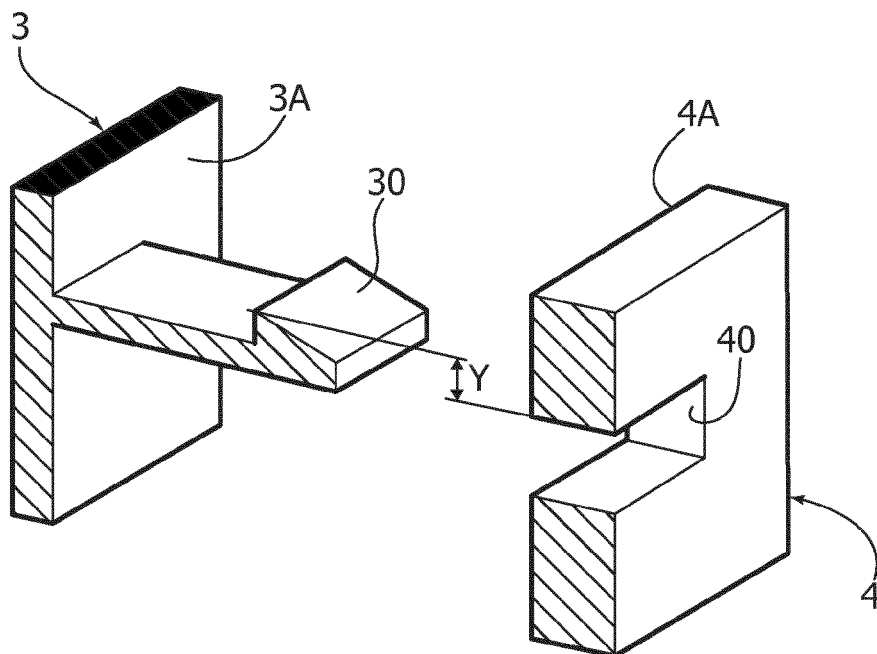


FIG. 10

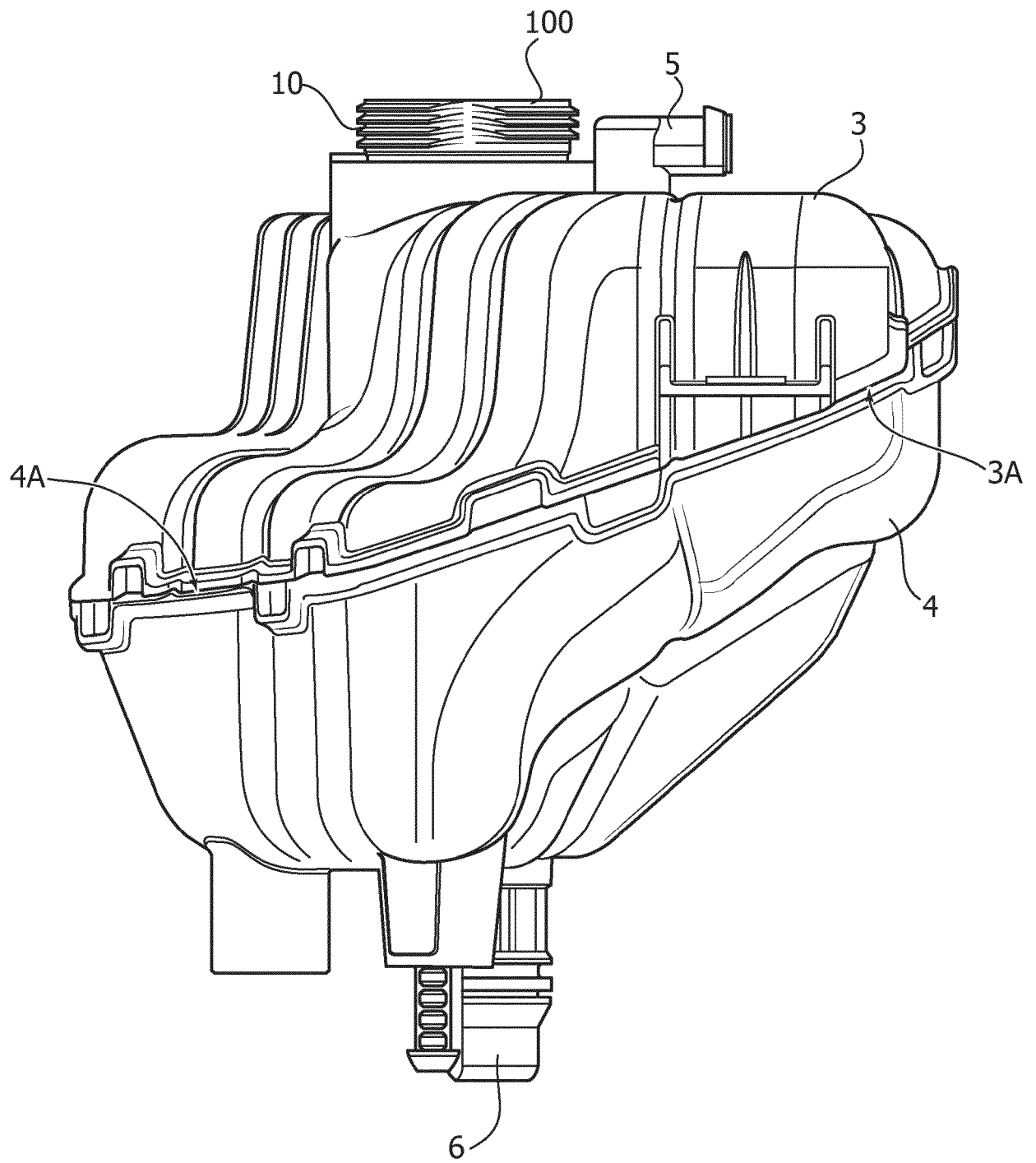
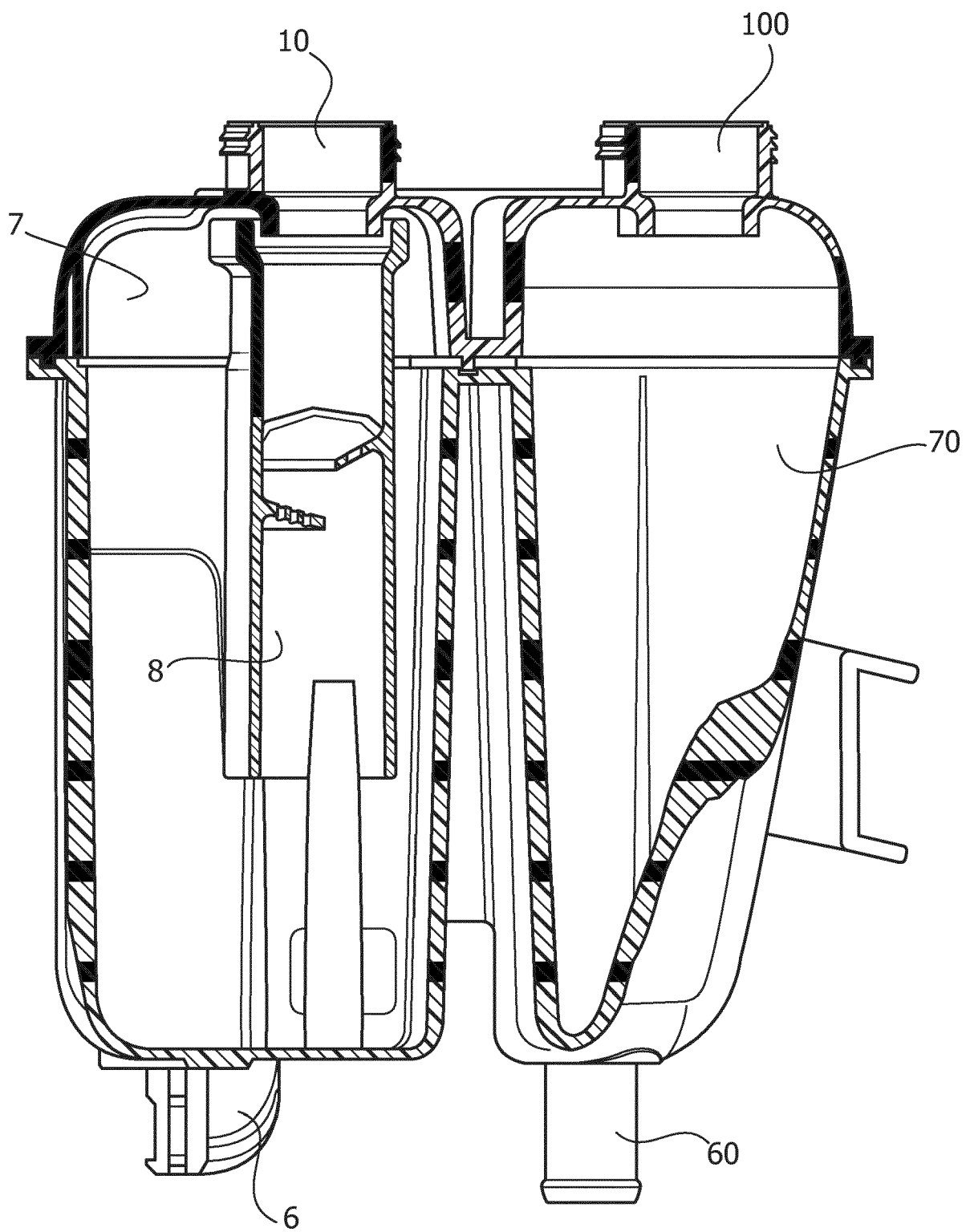


FIG. 11





EUROPEAN SEARCH REPORT

Application Number
EP 17 17 5831

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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