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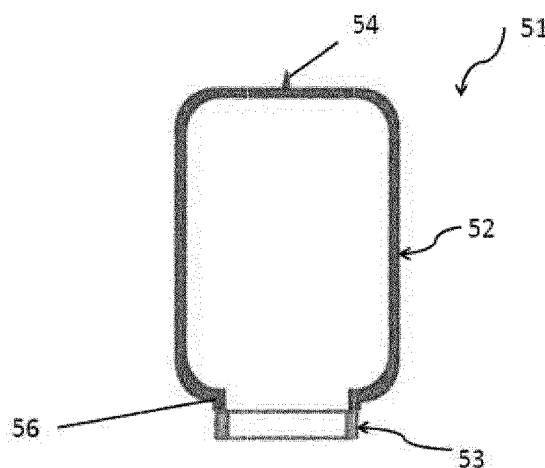


Fig. 5

(57) Abstract: The present invention relates to a plastic tank (21) comprising a blow-molded body (22) and two ends which define the internal closed volume of the tank. At least one of said two ends is formed by a blow-molded attachment part (25) extending from the blow-molded body and an injection molded part (23) attached outside in a leak tight manner to said blow-molded attachment part (25). The present invention further relates to a method for manufacturing such a tank.



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Plastic tank comprising a blow-molded body and method for manufacturing the same

The present invention relates to the technical field of plastic tank, particularly plastic tanks for motor vehicles. More specifically, it relates to a plastic tank comprising a blow-molded body and the method for manufacturing the same.

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Plastic tanks have many different applications. Among them, mention may be made to those used in the motor vehicle field such as fuel tanks for containing gasoline or diesel, additive tanks for containing urea, other precursors of ammonia, or ammonia solutions for use in SCR (Selective Catalytic Reduction) systems, tanks for storing engine coolant, fluid for the hydraulic brake control system, screen-wash or headlight-wash liquid and the like.

Plastic tanks for vehicles have to meet safety and environmental regulations. Generally the wall thickness of such tanks is one of the key factors. It is known to produce plastic tanks for vehicles by using an extrusion blow-molding process. Generally, an extrusion blow-molding process consists in blowing a plastic parison (or preform) (in one piece or several sheets) in a mold. Generally, the mold comprises two half molds. Each half mold has a cavity against which the parison is pressed during blow-molding operation. Generally, a cavity is characterised by an opening height and a depth.

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It has been found through simulation that when the depth of the cavity is greater than the opening height, the parison would be heavily stretched during the blow molding process, leading to a very high thickness discrepancies between the parting line (where the two half molds come into contact with each other) area and the end areas of the tank (a big thickness may be obtained in the parting line area while the thickness in the top area and/or the bottom area of the tank is still too small). This might result in defaults of thickness of the tank or make the tank impossible to blow (no compromise can be reached between over-thickness in the centre of the tank and under-thickness at its ends) or at least lead to a significant weight increase / internal volume reduction in order to meet the minimum thickness requirement in some special areas (such as a Mason Jar thread, which is generally located in the top area in the case of a fuel tank or in the bottom area in the case of a SCR tank).

In the event that the depth of the cavity is smaller than the opening height, good wall thickness is generally obtained when the depth of the cavity is smaller than the opening

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height. However, when some special elements (such as a Mason Jar thread) are designed to be located in an area through which the parting line of the tank passes, there would be a problem, such as increased leakage risk.

- 5 Hence, the object of the present invention is to make a blow-moldable tank with improved quality.

To this end, the present invention provides a plastic tank comprising a blow-molded body and two ends which define the internal closed volume of the tank, wherein at least
10 one of said two ends is formed by a blow-molded attachment part extending from the blow-molded body and an injection molded part attached in a leak tight manner from outside to said blow-molded attachment part.

The fact that the tank is formed by a blow-molded body and at least one injection
15 molded part attached thereto from outside which define jointly the internal closed volume of the tank (i.e. the injection molded part forms a portion of the wall of the tank) allows to manufacture the tank through a combination of extrusion blow-molding and injection molding processes, which are user-friendly and easy to perform. In other words, the at least one injection molded part covers an opening made in the blow-molded body from
20 outside in a leak tight manner so as to define together an internal closed volume of the tank. In the case of very tall or very long tanks, it allows to reduce the total height or length of the portion (thus the depth of the cavity of the blowing mold for producing the tank) to be blow-molded (just the blow-molded body as compared to the whole tank in classic process), making the tank blow-moldable without thickness problem, and/or
25 allows to manufacture separately some specific areas requiring minimum thickness in the injection molded part, facilitating the manufacturing of the tank and optimizing its thickness. In other words, it is not necessary any more to result in an over-thickness in the parting line area of the tank in order to meet the minimum thickness requirement in the end areas of the tank. This leads to a material saving, thus weight, volume and cost
30 saving. In the case of tanks comprising one or more special element (such as a Mason Jar thread) located in the area passed by the parting line, it allows to manufacture the special element separately through injection molding, reducing the leakage risk in this area.

35 The term "tank" is understood to mean a leak-tight chamber intended for the storage of any fluid, such as a fuel, a fuel additive (such as those required for reducing the combustion temperature of the particles retained on the particulate filters of diesel

engines for example), an exhaust gas additive (such as urea, other precursors of ammonia, or ammonia solution in SCR (Selective Catalytic Reduction) systems), an engine coolant, a fluid for the hydraulic brake control system, a screen-wash or headlight-wash liquid, for example.

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The tank may be made from any suitable plastic material. Thermoplastics give good results within the context of the invention, especially due to the advantages of weight, mechanical strength and chemical resistance and easier processing. The term "thermoplastic" denotes any thermoplastic polymer, including thermoplastic elastomers, and blends thereof. The term "polymer" is understood to mean both homopolymers and copolymers (especially binary or ternary copolymers). Non-limiting examples of such copolymers are: random copolymers, alternating copolymers, block copolymers and graft copolymers. Polyvinyl halides and polyolefins are generally preferred. One polymer often employed is polyethylene. Excellent results have been obtained with high-density polyethylene (HDPE). The impermeability of this plastic to volatile hydrocarbons may be improved by surface treatment (fluorination, sulphonation, etc.) and/or by the use of a barrier layer (for example, based on polyamide (PA) or on a polyvinyl alcohol homopolymer (PVOH) or else ethylene/vinyl alcohol copolymer (EVOH)).

Preferably, the tank has multilayer structures that include at least one layer based on HDPE and at least one layer based on EVOH, the expression "based on" meaning "mainly composed of", it being understood that these layers may comprise other polymers and/or additives in a minor amount (by weight). Preferably, the expression "based on a material" means "including more than 50% by weight of the material", more preferably "including more than 80% by weight of the material".

The term "internal closed volume of the tank" is understood to mean the working volume of the tank for the storage of liquid and/or gas (eg. vapor). In some embodiments, the internal closed volume of the tank can be defined by a single storage compartment (i.e. storage volume). In some other embodiments, the internal closed volume of the tank can be defined by two or more storage compartments in fluid communication with each other.

The tank can further comprise one or more following features, taken alone or together:

- The at least one injection molded part is welded to the blow-molded attachment part. It is appreciated that other connecting means, such as gluing, bonding, screwing and the like, can also be used to attach the injection molded part(s) to

the blow-molded attachment part.

- The plastic tank is a fuel tank or a urea tank for motor vehicle. It is appreciated that the tank can be any other tank, such as a tank for storing an exhaust gas additive, an engine coolant, a fluid for the hydraulic brake control system, a screen-wash or headlight-wash liquid, for example. Those skilled in the art would know what material to choose for the tank according to the content intended to be stored therein.
- The two ends comprise a first end and a second end, the first end being formed by the blow-molded attachment part extending from the blow-molded body and the injection molded part attached in a leak tight manner to said blow-molded attachment part. According to a variant, the second end is formed by the blow-molded attachment part extending from the blow-molded body and the injection molded part attached in a leak tight manner to said blow-molded attachment part. According to another variant, both the first and second ends of the tank are formed by the blow-molded attachment part extending from the blow-molded body and the injection molded part attached in a leak tight manner to said blow-molded attachment part. In the case of tanks vertically used (i.e. with its longest axis in the vertical direction), the first and second ends refer to the upper and lower ends of the tank in normal operation position, respectively. In the case of tanks horizontally used (i.e. with its longest axis in the horizontal direction), the first and second ends refer to the left and right ends of the tank in normal operation position, respectively. It should be appreciated that tanks can be used in any other position, such as an inclined position, depending on the specific application.
- The injection molded part comprises at least one component, such as nipples, valves and other elements of the venting system. This is particularly advantageous in the case of functional components since their integration can require a specific shape and/or thickness of the receiving area on the tank to ensure their proper function. Such a specific shape and/or thickness can be subject to defaults in case of blow-molding if the receiving area is located at the end of the tank. As the functional components are integrated on an injection molded part, the quality of their receiving area may be improved. According to another embodiment, the injection molded part is a threaded connection element, preferably configured to be connected to a pump module. An advantageous example of the treaded connection element is a Mason Jar thread, which is typically located on the top side in the case of a fuel tank or on the bottom side in the case of a SCR tank and is a critical area of the tank shell that requires minimum thickness to resist to the stress generated by the closing lock nut and ensure good tightness of the tank.

- The injection molded part comprises a storage volume. This storage volume forms a portion of said internal volume of the tank. This is particularly advantageous because it makes it possible to manufacture a tank with multiple pockets (volume for containing a fluid) through a combination of extrusion blow molding and injection molding. According to an example, a tank with two pockets is provided, wherein one pocket is blow molded, the other is injection molded and attached (eg. welded) to an end of the blow molded pocket. According to another example, a tank with three pockets is provided, wherein the pocket in the middle is blow molded, the other two pockets are injection molded and attached (eg. welded) to both ends of the blow molded pocket. With this flexible solution, some specific shapes which are difficult to manufacture through blow molding may be obtained by injection molding, thus it is possible to produce tanks of high complexity at a low cost.
- According to some embodiments, the tank comprises a parting line plan (the plan comprising the parting line) and the first end and the second end are in a direction perpendicular to the parting line plan. Preferably, the blow-molded body is elongated, so that a height of the blow-molded body measured in a direction perpendicular to the parting line plane of the plastic tank is greater than a width measured in a direction parallel to the parting line plane. This facilitates the manufacturing of the tank and optimizes its thickness, as explained above.
- According to some other embodiments, the first end and the second end are in a direction parallel to the parting line plan.
- The blow-molded body and the injection molded part attached thereto define jointly the internal closed volume of the tank. In other words, the injection molded part forms a portion of the wall of the tank, more precisely a wall of the internal closed volume of the tank.

The present invention also relates to a method for manufacturing a plastic tank as described above, comprising the following steps:

- blow molding a plastic material parison or a preform in a mold to produce the blow-molded body;
- removing the body from the mold;
- cutting off a portion of the body at at least one of its ends to form the blow-molded attachment part;
- attaching the at least one injection molded part to the blow-molded attachment part from outside in a leak tight manner.

Preferably, the blow-molded body is closed when removed from the mold.

The present invention further relates to a method for manufacturing a plastic tank as described above, comprising the following steps:

- blow molding a plastic material parison or a preform in a mold to produce the blow-
5 molded body with the blow-molded attachment part around an opening;
- removing the body from the mold;
- attaching the at least one injection molded part to the blow-molded attachment part from outside in a leak tight manner.

10 Preferably, the step of attaching is performed through welding. It is appreciated that this step may also be performed through any other suitable means, such as gluing, bonding, screwing and the like.

The present invention will be better understood when read with reference to the
15 accompanying figures, given only in illustrative purpose. In the drawings:

- figure 1 is a schematic side cross-sectional view of a tank according to a first embodiment;
- figure 2 is a schematic side cross-sectional view of a tank according to a second embodiment;
- 20 - figure 3 is a schematic side cross-sectional view of a tank according to a third embodiment;
- figure 4 is a schematic side cross-sectional view of a tank according to a fourth embodiment;
- figure 5 is a schematic side cross-sectional view of a tank according to a fifth
25 embodiment;
- figure 6 is a schematic view illustrating a step of a method for manufacturing a tank according to an embodiment;
- figure 7 is a schematic view illustrating a further step of the method shown on figure 6;
- 30 - figure 8 is a schematic view illustrating the mains steps of a method for manufacturing the tank of figure 1;
- figure 9 is a schematic view illustrating the mains steps of a method for manufacturing the tank of figure 2;
- figure 10 is a schematic view illustrating a system for manufacturing the tank of figure
35 5; and
- figure 11 is a schematic view illustrating the mains steps of a method for manufacturing the tank of figure 5.

Figure 1 shows a plastic tank 11 according to a first embodiment. In this embodiment, the tank 11 is a SCR tank for motor vehicles. It comprises an elongated blow-molded body 12 and two ends. It is noted that the term "elongated" is understood here to mean the fact that the height (or length) H of the body 12 is greater than its width W. In this embodiment, the height H is measured in the direction perpendicular to the parting line plane 14 of the tank 11 and the width W measured in the direction parallel to the parting line plane 14 of the tank 11. The body 12 and the two ends define together the internal closed volume of the tank 11. As shown in figure 1 illustrating an example of vertical use of the tank, the upper end 15 of the tank is formed by a part of the body 12 and the lower end of the tank 11 is formed by a blow-molded attachment part 16 extending from the body 12 and an injection molded part 13 welded in a leak tight manner from outside to the blow-molded attachment part 16. In other words, the injection molded part 13 covers an opening made in the body 12 from outside in a leak tight manner so as to define together an internal closed volume of the tank. It will be appreciated that the injection molded part 13 can be attached to the blow-molded attachment part 16 through other means, such as gluing, bonding, screwing, as long as it ensures good tightness between the two parts.

In this embodiment, the injection molded part 13 is a Mason Jar thread to be connected to a pump. The Mason Jar thread is a critical area of the tank shell that requires minimum thickness to resist to the stress generated by the closing lock nut and ensure good tightness of the tank. In the case of a very tall (or very long) tank, if the Mason Jar thread were formed during the blow molding process, the minimum thickness requirement could not be met as the parison is heavily stretched in that area or this requirement could be met at the cost of over-thickness in the centre of the tank (thus overweight and cost increasing of the tank).

The body 12 and the injection molded part 13 may be made of any suitable plastic, in particular, thermoplastic material, such as HDPE. The material of the injection molded part 13 should be compatible with that of the blow-molded attachment part 16 such that the two parts can be connected to each other in a leak tight manner through welding for example.

Figure 2 shows a tank 21 according to a second embodiment in an example of vertical use. In this embodiment, the tank 21 is a fuel tank for motor vehicles. This embodiment is similar to the first one with differences in that the lower end 26 of the tank 21 is formed

by a part of the blow-molded body 22 and the upper end of the tank 21 is formed by a blow-molded attachment part 25 extending from the blow-molded body 22 and an injection molded part 23 welded in a leak tight manner from outside to the blow-molded attachment part 25.

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One or more components, such as nipples, valves and other elements of the venting system, may be integrated in the injection molded part 23. These components can be integrally molded with the part 23 or can be attached thereto through welding, for example.

10 Figure 3 shows a tank 31 according to a third embodiment in an example of vertical use. The tank 31 comprises a blow-molded body 32 and two ends. The body 32 and the two ends define together the internal closed volume of the tank 31. As shown in figure 3, the upper end of the tank 31 is formed by a blow-molded attachment part 35 extending from the body 32 and an injection molded part 33 welded in a leak tight manner from
15 outside to the blow-molded attachment part 35. Likewise, the lower end of the tank 31 is formed by a blow-molded attachment part 36 extending from the body 32 and an injection molded part 33' welded in a leak tight manner from outside to the blow-molded attachment part 36. The reference numeral 38 designates a functional component (a valve in this example) integrated in the injection molded part 33. It should be appreciated
20 that the number, type and the position of the component shown in figure 3 is just exemplary.

Figure 4 shows a tank 41 according to a fourth embodiment in an example of vertical use. In this embodiment, similarly to the second one, the tank 41 is a fuel tank for motor
25 vehicles. The tank 41 comprises a blow-molded body 42 and two ends. In the exemplary vertical use position, the upper end of the tank 41 is formed by a blow-molded attachment part 45 extending from the body 42 and an injection molded part 43 welded in a leak tight manner from outside to the blow-molded attachment part 45. In this embodiment, the injection molded part 43 per se comprises a storage volume, which forms a portion of
30 said internal volume of the tank. According to a variant, the lower end of the tank is formed by a blow-molded attachment part extending from the body and an injection molded part which is welded in a leak tight manner from outside to the blow-molded attachment part and comprises a storage volume. According to another variant, both ends of the tank are formed by such an injection molded part. This solution is particularly advantageous
35 because it makes it possible to manufacture a tank with multiple pockets (volume for containing a fluid) though a combination of extrusion blow molding and injection molding. With this flexible solution, some specific shapes which are difficult to manufacture through

blow molding may be obtained by injection molding, thus it is possible to produce multiple-pocket tanks of high complexity at a low cost.

Figure 5 shows a tank 51 according to a fifth embodiment in an example of vertical use. This embodiment is similar to the first one with differences in that the end of the tank formed by the blow-molded attachment part 56 extending from the body 52 and the injection molded part 53 (here a Mason Jar thread) attached from outside to the blow-molded attachment part 56 is in the direction parallel to the parting line plane 54 of the tank. If the Mason Jar thread were formed during the process for blow molding the tank, it would be passed by the parting line plane 54, resulting in increased leakage risk. According to a variant, both ends in the direction parallel to the parting line plane 54 of the tank are formed by a blow-molded part and an injection molded part attached to the former from outside.

The fact that the tank is formed by a blow-molded body and an injection molded part attached thereto from outside which define jointly the internal closed volume of the tank (i.e. the injection molded part forms a portion of the wall of the tank) allows to manufacture the tank through a combination of extrusion blow-molding and injection molding processes, which are user-friendly and easy to perform. In the case of very tall or very long tanks, it allows to reduce the total height or length of the portion (thus the depth of the cavity of the blowing mold for producing the tank) to be blow-molded (just the blow-molded body as compared to the whole tank in classic process), making the tank blow-moldable without thickness problem, and/or allows to manufacture separately some specific areas requiring minimum thickness in the injection molded part, thereby facilitating the manufacturing of the tank and optimizing its thickness (In other words, it's not necessary any more to result in an over-thickness in the parting line area of the tank in order to meet the minimum thickness requirement in the end areas of the tank. This leads to a material saving, thus weight and cost saving.). In the case of tanks comprising one or more special element (such as a Mason Jar thread) located in the area passed by the parting line, it allows to manufacture the special element separately through injection molding, reducing the leakage risk in this area

Now description will be made to the manufacturing process of the tanks 11, 21 and 51 described above with reference to figures 6 to 11.

The process for manufacturing the tank 11 of figure 1 mainly comprises the following steps (see figures 6, 7 and 8):

- placing a plastic material parison (or a preform) 10 between a first half-mold 1 and a second half-mold 2 and closing the mold (figure 6);
- blow molding the parison (or the preform) 10 in the mold to produce a blow-molded body 12 (figure 7), preferably, a closed blow-molded body;
- 5 - removing the body 12 from the mold and cooling the body (step A of figure 8);
- cutting off a portion of the body 12 at its lower end to form the blow-molded attachment part 16 around an opening 17 (in other words, the blow-molded attachment part 16 is the edge of the opening 17, see step B of figure 8);
- attaching the injection molded part 13 to the blow-molded attachment part 16 from
10 outside in a leak tight manner (step C of figure 8).

Similarly, the process for manufacturing the tank 21 of figure 2 mainly comprises the following steps (see figures 6, 7 and 9):

- placing a plastic material parison (or a preform) 10 between the a half-mold 1 and
15 a second half-mold 2 and closing the mold (figure 6);
- blow molding the parison (or the preform) 10 in the mold to produce a body 22 (figure 7) , preferably, a closed blow-molded body;
- removing the body 22 from the mold and cooling the body (step A of figure 9);
- cutting off a portion of the body 22 at its upper end to form the blow-molded
20 attachment part 25 around an opening 27 (in other words, the blow-molded attachment part 25 is the edge of the opening 27, see step B of figure 9);
- attaching the injection molded part 23 (may comprise one or more components integrated therein beforehand) to the blow-molded attachment part 25 from outside in a leak tight manner (step C of figure 9).

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Those skilled in the art may easily figure out the process for manufacturing the tanks as shown in figures 3 to 5 in view of the foregoing.

Preferably, the tank 51 of figure 5 is manufactured through another process, mainly
30 comprising the following steps (see figures 10 and 11):

- placing a plastic material parison (or a preform) 10 between a first half-mold 3 and a second half-mold 4 and closing the mold (figure 10);
- blow molding the parison (or the preform) 10 in the mold to produce the blow-molded body 52 with the blow-molded attachment part 56 around an opening (this may be
35 realised with the help of a moving part 5 (for example of cylindrical shape, see figure 10) at bottom side to pinch properly the parison or the preform);
- removing the body 52 from the mold and cooling the body (step A of figure 11);

- removing flashes 57 (excess material) from the body 52;
- attaching the injection molded part 53 to the blow-molded attachment part 56 from outside in a leak tight manner.

5 Preferably, in the above processes, the step of attaching is performed through welding.

The drawings and the above description describe non-limitative particular embodiments of a tank or process for manufacturing a tank. Some conventional aspects have been simplified or omitted in teaching the principles. Those skilled in the art should
10 know that the variations from these embodiments fall into the scope of the present invention. It should be appreciated that the above features can be combined in various ways to form a plurality of variations. Thus, the present invention is not limited to the above particular embodiments, but defined by the following claims and their equivalents.

CLAIMS

1. A plastic tank (11; 21; 31; 41; 51) comprising a blow-molded body (12; 22; 32; 42; 52) and two ends which define the internal closed volume of the tank, characterized in that at least one of said two ends is formed by a blow-molded attachment part (16; 25; 35; 36; 45; 56) extending from the blow-molded body (12; 22; 32; 42; 52) and an injection molded part (13; 23; 33, 33'; 43; 53) attached in a leak tight manner from outside to said blow-molded attachment part (16; 25; 35, 36; 45; 56).
2. Plastic tank (11; 21; 31; 41; 51) according to the preceding claim, wherein the at least one injection molded part (13; 23; 33, 33'; 43; 53) is welded to the blow-molded attachment part (16; 25; 35, 36; 45; 56).
3. Plastic tank (11; 21; 31; 41; 51) according to anyone of the preceding claims, wherein the plastic tank is a fuel tank or a urea tank for motor vehicles.
4. Plastic tank (21; 31; 41) according to anyone of the preceding claims, wherein said two ends comprise a first end and a second end, the first end being formed by the blow-molded attachment part (25; 35; 45) extending from the blow-molded body (22; 32; 42) and the injection molded part (23; 33; 43) attached in a leak tight manner to said blow-molded attachment part (25; 35; 45).
5. Plastic tank (21; 31; 41) according to anyone of the preceding claims, wherein the injection molded part (23; 33; 43) comprises at least one component, which is chosen from the group consisting of a nipple and a valve system.
6. Plastic tank (11; 31; 51) according to claim 4, wherein the second end is formed by the blow-molded attachment part (16; 36; 56) extending from the blow-molded body (12; 32; 52) and the injection molded part (13; 33'; 53) attached in a leak tight manner to said blow-molded attachment part (16; 36; 56).
7. Plastic tank (11; 31; 51) according to anyone of the preceding claims, wherein the injection molded part (13; 33'; 53) is a threaded connection element, which is configured to be connected to a pump module.
8. Plastic tank (41) according to anyone of the preceding claims, wherein the injection molded part (43) comprises a storage volume.

9. Plastic tank (11; 21; 31; 41) according to anyone of claims 4 to 8, wherein the tank comprises a parting line plan and wherein the first end and the second end are in a direction perpendicular to the parting line plan.

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10. Plastic tank (11; 21; 31; 41) according to the preceding claim, wherein the blow-molded body (12; 22; 32; 42) is elongated, so that a height (H) of the blow-molded body (12; 22; 32; 42) measured in a direction perpendicular to the parting line plane (14) of the plastic tank (11; 21; 31; 41) is greater than a width (W) measured in a direction parallel to the parting line plane (14).

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11. Plastic tank (51) according to anyone of claims 4 to 8, wherein the tank comprises a parting line plan and wherein the first end and the second end are in a direction parallel to the parting line plan.

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12. Plastic tank (11; 21; 31; 41, 51) according to anyone of preceding claims, wherein the blow-molded body (12; 22; 32; 42; 52) and the injection molded part (13; 23; 33, 33'; 43; 53) attached thereto define jointly the internal closed volume of the tank.

13. A method for manufacturing a plastic tank (11; 21; 31; 41; 51) according to anyone of preceding claims, comprising the following steps:

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- blow molding a plastic material parison or a preform (10) in a mold (1, 2; 3, 4) to produce the blow-molded body (12; 22; 32; 42; 52);

- removing the body (12; 22; 32; 42; 52) from the mold;

- cutting off a portion of the body at at least one of its ends to form the blow-molded attachment part (16; 25; 35, 36; 45; 56);

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- attaching, preferably welding, the at least one injection molded part (13; 23; 33, 33'; 43) to the blow-molded attachment part (16; 25; 35, 36; 45) from outside in a leak tight manner.

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14. Method for manufacturing a plastic tank (11; 21; 31; 41; 51) according to claim 13, wherein the blow-molded body is closed when removed from the mold.

15. A method for manufacturing a plastic tank (51) according to claim 11, comprising the following steps:

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- blow molding a plastic material parison or a preform (10) in a mold (3, 4) to produce the blow-molded body (52) with the blow-molded attachment part (56) around an opening;

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- removing the body (52) from the mold;
- attaching, preferably welding, the at least one injection molded part (53) to the blow-molded attachment part (56) from outside in a leak tight manner.

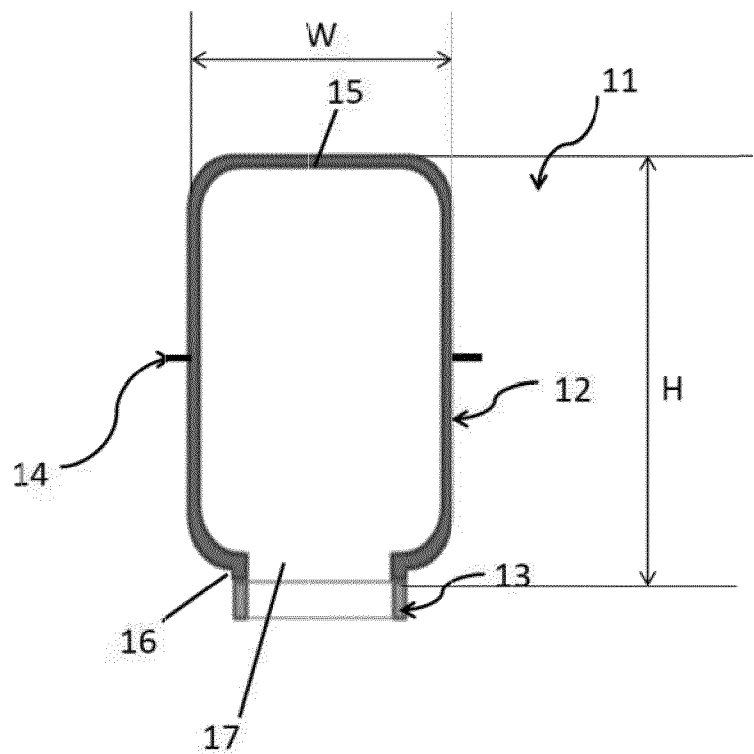


Fig. 1

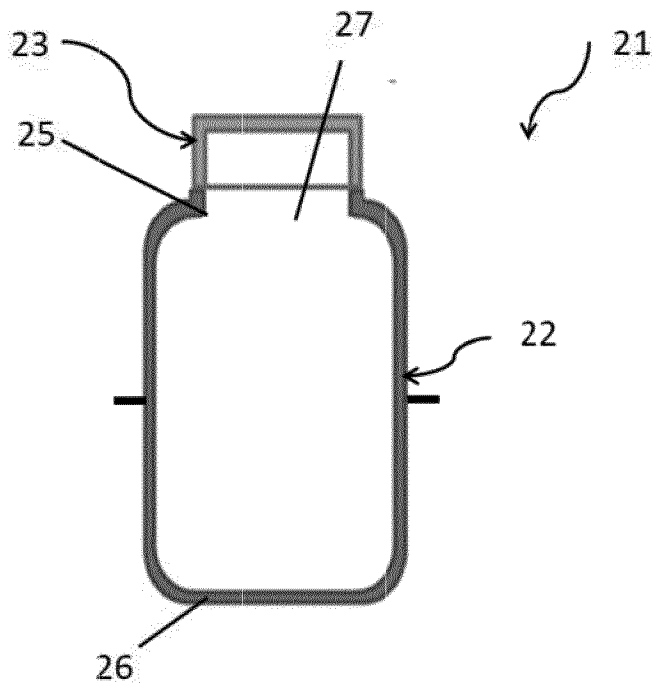


Fig. 2

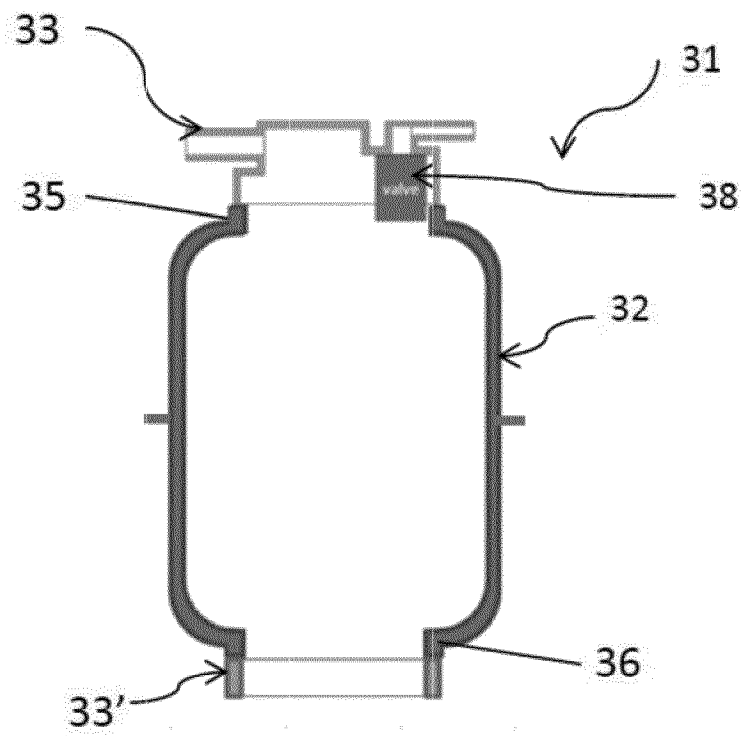


Fig. 3

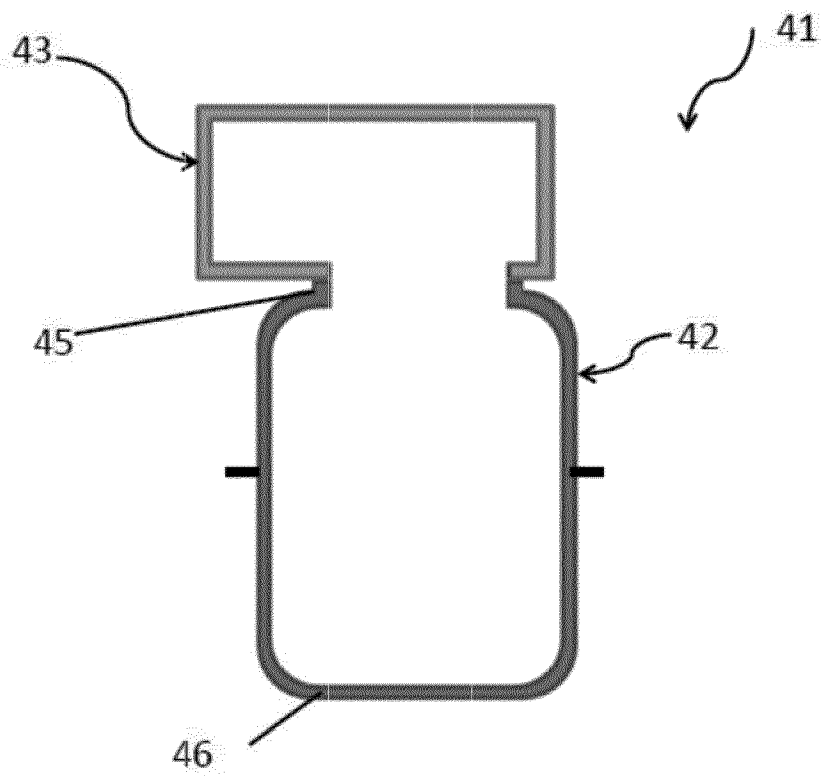


Fig. 4

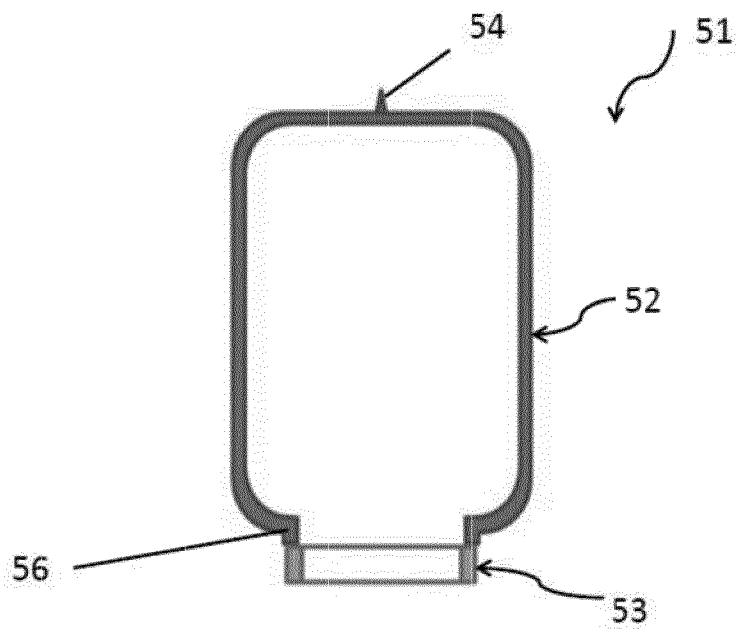


Fig. 5

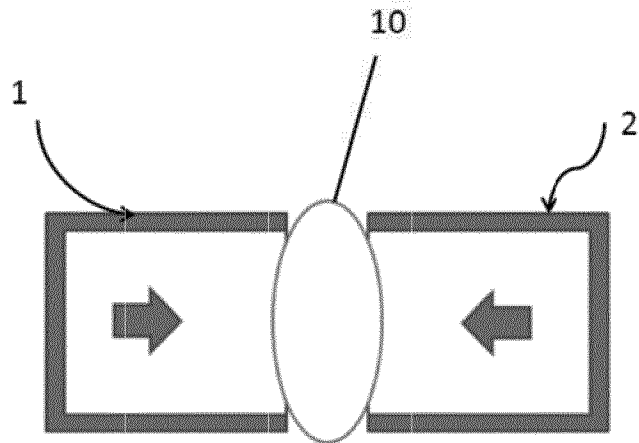


Fig. 6

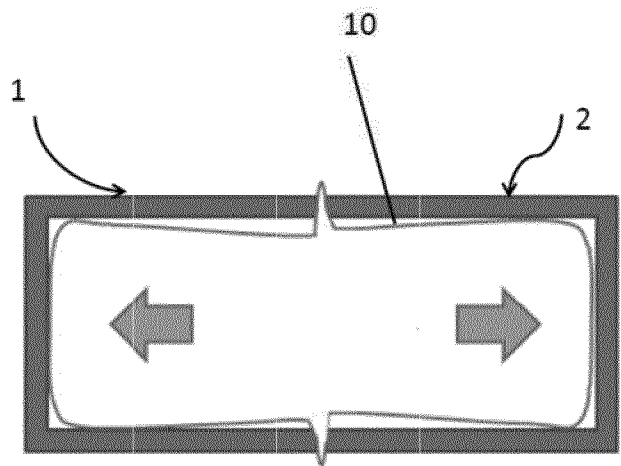


Fig. 7

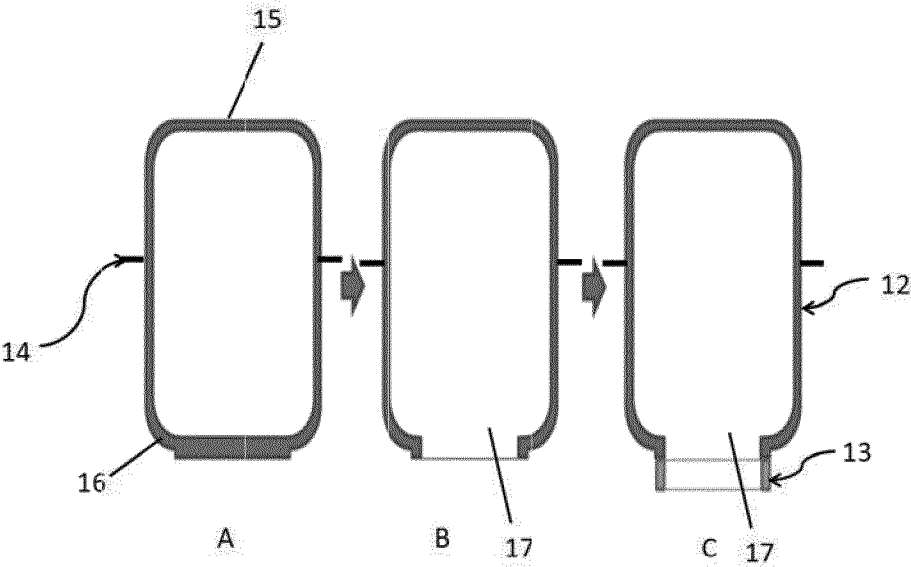


Fig. 8

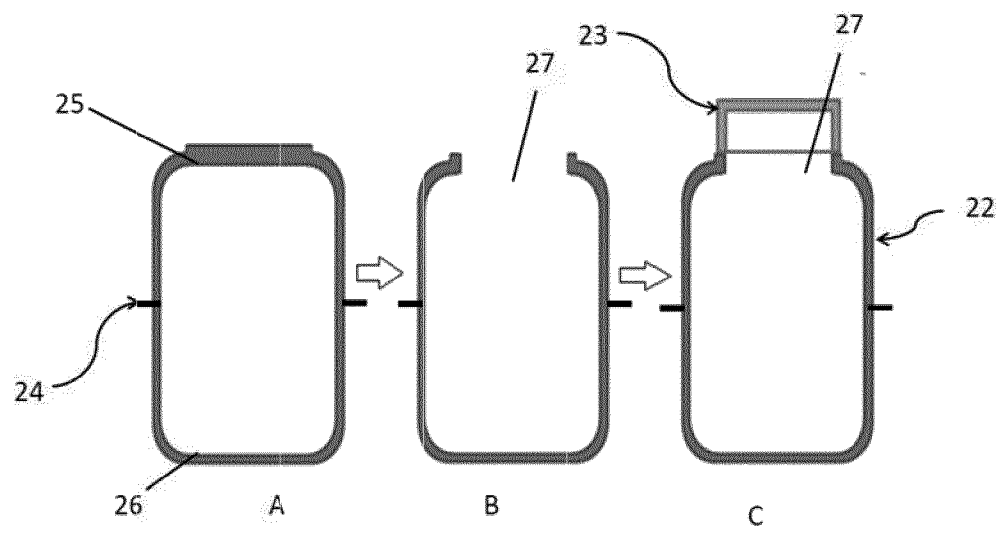


Fig. 9

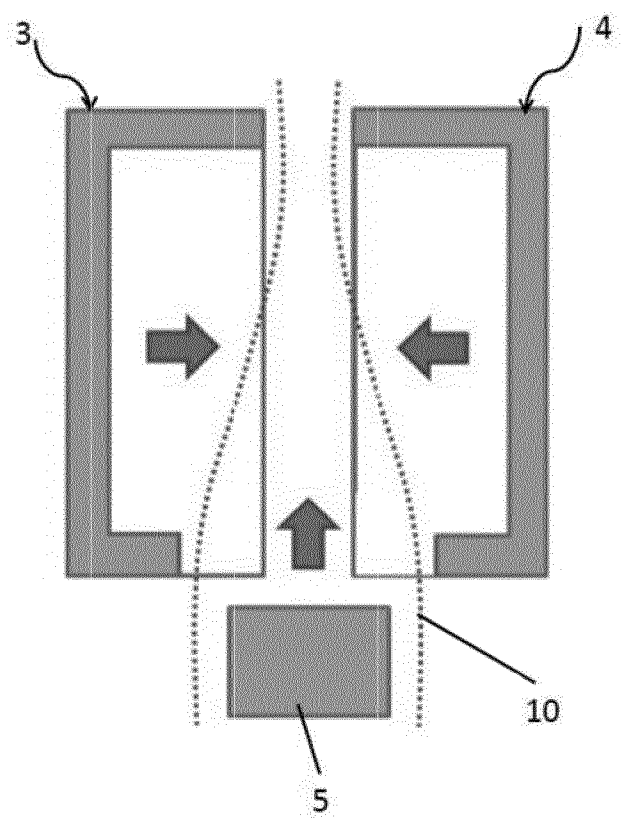


Fig. 10

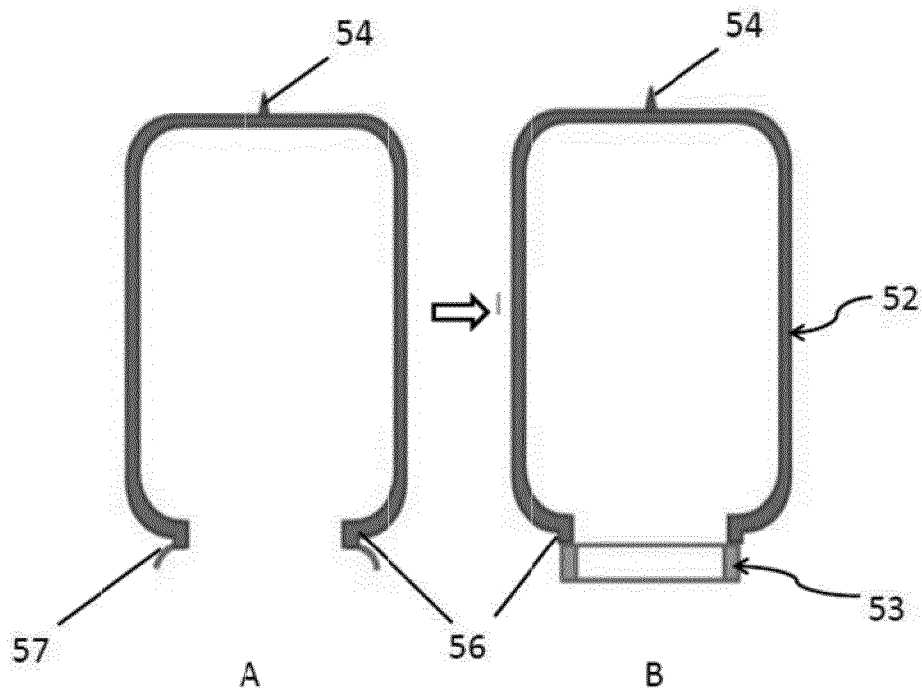


Fig. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/063730A. CLASSIFICATION OF SUBJECT MATTER
INV. B29D22/00 B60K15/03
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60K B29C B29L B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 337 702 A2 (INERGY AUTOMOTIVE SYSTEMS RES [BE]) 29 June 2011 (2011-06-29) claim 8, claim 1, claim 3 -----	1-15
A	WO 2010/006900 A1 (INERGY AUTOMOTIVE SYSTEMS RES [BE]; CRIEL BJORN [BE]; MUR JEAN-CLAUDE) 21 January 2010 (2010-01-21) -----	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search

7 July 2017

Date of mailing of the international search report

19/07/2017

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Tonelli, Enrico

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/063730

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