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(54) Title: PROCESS FOR MANUFACTURING A HOLLOW BODY AND THE MANUFACTURED BODY

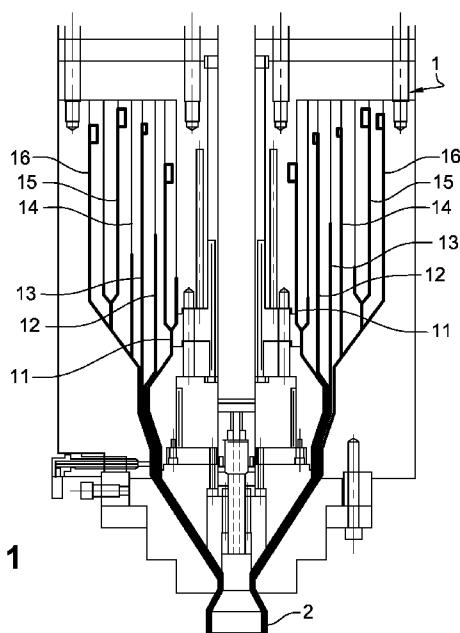


Fig. 1

(57) Abstract: It is proposed a process for manufacturing a diesel tank or filler pipe by means of an extrusion-blow moulding machine suitable for manufacturing a gasoline tank or filler pipe. The extrusion-blow moulding machine is equipped with a coextrusion head comprising at least one extruder being configured to provide during a first period of time a first material that is a barrier to liquids and/or gases, such that during the first period of time the coextrusion head (1) produces a first multilayer parison from which the gasoline tank or filler pipe can be manufactured. The extruder is such that it is further configured to provide during a second period of time a second material distinct from the first material, such that during the second period of time the coextrusion head produces a second multilayer parison from which the diesel tank or filler pipe can be manufactured.



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PROCESS FOR MANUFACTURING A HOLLOW BODY AND THE MANUFACTURED BODYFIELD OF THE INVENTION

The present invention relates to a process for manufacturing hollow bodies, and particularly fuel tanks and filler pipes for motor vehicles. More precisely, it relates to the manufacture of a thermoplastic diesel tank or filler pipe.

5 PRIOR ART

For clarity reason, the problems of the prior art are described hereafter only for the particular case of the production of diesel tanks and gasoline tanks for motor vehicles. It is to note that similar problems are encountered in the case of the production of diesel filler pipes and gasoline filler pipes for motor vehicles.

10 Thermoplastic fuel tanks are widely used in motor vehicles. Diesel vehicles are equipped with diesel tanks and gasoline (i.e. petrol) vehicles are equipped with gasoline tanks. A hybrid vehicle may be equipped either with a diesel tank or a gasoline tank.

15 Generally, the wall of a diesel tank is composed of a single thermoplastic layer. It is known to manufacture a diesel tank by means of an extrusion-blow moulding machine equipped with an extrusion head. The extrusion head is configured to extrude (i.e. provide) a monolayer thermoplastic parison. The extruded parison is then blown-moulded in a mould to form the wall of the diesel tank.

20 Generally, the wall of a gasoline tank is composed of a multilayer structure comprising at least one thermoplastic layer and at least one additional layer which, advantageously, may be formed from a material that is a barrier to liquids (particularly hydrocarbons) and/or gases. Preferably, the nature and the thickness of the barrier layer are chosen so as to minimize the permeability of the liquids and/or gases in contact with the wall of the gasoline tank. Preferably, this layer
25 is based on a barrier material, i.e. a fuel-impermeable resin such as, for example, EVOH (a partially hydrolysed ethylene/vinyl acetate copolymer). Alternatively, the tank may be subjected to a surface treatment (fluorination or sulphonation) for the purpose of making it impermeable to the fuel. It is known to manufacture
30 a gasoline tank by means of an extrusion-blow moulding machine equipped with a coextrusion head. The coextrusion head comprises a plurality of extruders (or channels), each of them being configured to extrude only one type of material. The coextrusion head co-extrudes in a synchronised manner the different layers

of material in order to produce a multilayer parison. The multilayer parison is then blown-moulded in a mould to form the wall of the gasoline tank.

In the prior art approach for manufacturing diesel tanks and gasoline tanks it is necessary to use two distinct extrusion-blow moulding machines; one
5 machine equipped with an extrusion head (for manufacturing monolayer plastic diesel tanks) and another machine equipped with a coextrusion head (for manufacturing multilayer plastic gasoline tanks).

More and more production sites are requested to manufacture both diesel and gasoline tanks. For example, production sites that have been originally
10 organised to manufacture gasoline tanks are now requested to also manufacture diesel tanks.

The major drawback of using two distinct machines is that it is expensive and cumbersome. Not only the cost of the machines themselves is expensive, but also the cost related to the manufacturing and maintenance operations. In certain
15 situation, the installation of two distinct machines at the same production site is not possible due to lack of space.

In view of the above-mentioned disadvantages, there is a need for a method that allows one production site to simply and efficiently manufacture different types of fuel tanks (or filler pipes), particularly diesel and gasoline tanks (or filler
20 pipes), without the need of using distinct extrusion-blow moulding machines.

SUMMARY OF THE INVENTION

It is, therefore, one aspect of the present invention to provide for a process for manufacturing a diesel tank or filler pipe by means of an extrusion-blow moulding machine suitable for manufacturing a gasoline tank or filler pipe, the
25 extrusion-blow moulding machine being equipped with a coextrusion head comprising at least one extruder being configured to provide during a first period of time a first material that is a barrier to liquids and/or gases, such that during said first period of time the coextrusion head produces a first multilayer parison from which the gasoline tank or filler pipe can be manufactured.

According to one aspect of the present invention, the extruder is further configured to provide during a second period of time a second material distinct from the first material, such that during said second period of time the coextrusion head produces a second multilayer parison from which the diesel tank or filler pipe can be manufactured.

Thus, it is proposed to manufacture a diesel tank or filler pipe by means of
35 an extrusion-blow moulding machine that is usually used for manufacturing a

gasoline tank or filler pipe. In other words, the approach of the present invention consists in using the same extrusion-blow moulding machine for manufacturing alternately (i.e. at different periods of time) diesel tanks (or filler pipes) and gasoline tanks (or filler pipes).

5 Preferably, the diesel tanks (or filler pipes) and gasoline tanks (or filler pipes) according to the invention are made of plastic.

 The term "plastic" is understood to mean any material comprising at least one synthetic polymer resin.

 The extrusion-blow moulding machine used in the process according to the
10 invention comprises a coextrusion head. The coextrusion head is adapted to produce a multilayer parison.

 The term "parison" is understood to mean a molten thermoplastic preform (that is generally extruded and has a cylindrical shape and/or that is in the form of cylindrical parison halves and/or sheets) (generally extruded), which is
15 intended to form the wall of the tank after moulding, i.e. after an operation which consists in forming the parison, which is in the melt state, into the required shapes and dimensions using a mould in order to obtain a tank.

 In a particular embodiment, the parison may be made up of two separate pieces, which may be two sheets, for example. Advantageously, these pieces can
20 result from cutting one and the same extruded tubular parison as described in the document EP 1 110 697. According to this particular embodiment, once a single parison has been extruded, this parison is cut over its entire length, along two diametrically opposed lines, to obtain two separate portions (sheets).

 According to the present invention, the coextrusion head is configured to
25 produce alternately (i.e. at different periods of time) a first multilayer parison adapted to be blow-moulded in order to form the wall of a gasoline tank (or filler pipe), and a second multilayer parison adapted to be blow-moulded in order to form the wall of a diesel tank (or filler pipe).

 Thus, unlike the known diesel tank (as described above in relation to the
30 prior art), the wall of the diesel tank according to the present invention is composed of a thermoplastic multilayer structure.

 Advantageously, the multilayer structure of the diesel tank (or filler pipe) according to the invention is composed of material that is distinct from (i.e. that is not) material that is a barrier to liquids and/or gases. In other words, the
35 multilayer structure of the diesel tank (or filler pipe) according to the present invention does not comprise any barrier layer. The material cost of the diesel

tank according to the present invention is effectively reduced.

Unlike a gasoline tank/filler pipe, a diesel tank/filler pipe doesn't require any barrier layer. The idea behind the present invention is to modify the operating mode of the extruder that is usually in charge of extruding the barrier layer. More precisely, in the present invention it is advantageously proposed to control such extruder in a manner such that:

- during a first period of time, it extrudes a barrier layer (also called hereafter first material); and
- during a second period of time, it extrudes a material that is not a barrier layer (also called hereafter second material), and vice-versa.

Thus, the extruder according to the present invention can operate according to two distinct operating modes.

In a preferred embodiment, the first material that is a barrier to liquids and/or gases is EVOH copolymer.

The term "thermoplastic" is understood to mean 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). Examples of such copolymers are, non-limitingly, random copolymers, linear block copolymers, non-linear block copolymers, and graft copolymers.

Any type of thermoplastic polymer or copolymer, the melting point of which is below the decomposition temperature, is suitable. Synthetic thermoplastics having a melting range spread over at least 10 degrees Celsius are particularly suitable. Examples of such materials include those that exhibit polydispersity of their molecular weight.

In particular, polyolefins, thermoplastic polyesters, polyketones, polyamides and copolymers thereof may be used. A blend of polymers or copolymers may also be used, as may a blend of polymer materials with inorganic, organic and/or natural fillers such as, for example, but non-limitingly, carbon, clays, salts and other inorganic derivatives, natural fibres or polymeric fibres. It is also possible to use multilayer structures consisting of stacked layers bonded together, comprising at least one of the polymers or copolymers described above.

In a particular embodiment, the second material (extruded by the extruder during the second period of time) is high density polyethylene (HDPE).

In another particular embodiment, the second material (extruded by the

extruder during the second period of time) is a mixture of high density polyethylene (HDPE) and adhesive.

For example, the second material can consist of a mixture of about 50-80% by weight of HDPE and of about 20-50% by weight of adhesive. In a particular
5 embodiment, the second material consists of a mixture of about 70% by weight of HDPE and of about 30% by weight of adhesive.

The adhesive most often used is generally a polymer adhesive in the form of a functionalized polyolefin. The term "functionalized polyolefin" is understood to mean any polyolefin comprising, in addition to the units derived
10 from olefins, functional monomeric units. These may be incorporated either into the main chain of the polyolefin or into its side chains. They may also be incorporated directly into the backbone of these main and side chains, for example by the copolymerization of one or more functional monomers with the
15 olefin monomer or monomers, or else they may result from the grafting of one or more functional monomers onto the said chains, after the polyolefin has been manufactured. Several functionalized polyolefins may also be used as a blend.

The functional monomeric units of the functionalized polyolefin may be chosen from carboxylic acids, dicarboxylic acids and the anhydrides corresponding to these diacids. These monomeric units generally come from the
20 copolymerization or from the grafting of at least one unsaturated monomer possessing the same functional groups. Examples of monomers than can be used are, non-limitingly, acrylic acid, methacrylic acid, maleic acid, fumaric acid, itaconic acid, maleic anhydride, fumaric anhydride and itaconic anhydride. Preferably, the functional monomeric units come from the copolymerization or
25 from the grafting of maleic anhydride.

Advantageously, before the start of the period of time during which the extruder provides the first material (that is a barrier to liquids and/or gases), respectively the second material (that is not a barrier to liquids and/or gases), said extruder is purged in order to remove from it the second material,
30 respectively the first material.

Thus, it is proposed to purge the extruder each time a change of material has to be performed. In other words, a step of purging is performed before each transition between a barrier material (i.e. first material) and a thermoplastic based material free of barrier material (i.e. second material), or vice-versa. This purge
35 is aiming at evacuating out of the extruder the remaining barrier material, respectively the thermoplastic based material, in order to allow the extruder to

provide pure thermoplastic based material (i.e. devoid of barrier material), respectively pure barrier material (devoid of thermoplastic based material).

In a particular embodiment, blow-moulding operations continue during the step of purging, such that the manufacture of tanks (or filler pipes) continues. In
5 this particular embodiment the manufacturing chain is not stopped.

In another embodiment, during the step of purging no blow-moulding operation is performed. Once the purged material (i.e. material evacuated out of the extruder) is extruded by the extruder, this purged material is collected and take away from the manufacturing chain. This purged material may be, for
10 example, stored, destroyed or recycled (particularly if the purged material is HDPE).

In the particular case of a gasoline tank, it is important that the barrier layer is not mixed with another material that could damage its impermeability properties. Advantageously, the step of purging according to the present
15 invention permits to avoid rupturing, damaging, or compromising the requisite fuel barrier properties and structural integrity of the fuel tank.

The extruder (that is usually in charge of extruding the barrier layer) can be purged with any suitable resin or material.

In a particular embodiment, the extruder can be purged with HDPE or
20 LDPE (low density polyethylene).

In a preferred embodiment, the extruder can be purged with a mixture of HDPE and adhesive. Advantageously, the composition of the mixture of HDPE and adhesive can be made such that its viscosity is close to that of the barrier layer (for example, EVOH). This results in a faster purging of the extruder.

Advantageously, the coextrusion head comprises at least one another
25 extruder that is usually in charge of extruding adhesive.

Generally, for a gasoline tank (or filler pipe), the barrier layer (for example EVOH) is surrounded on each side by an adhesive layer.

In a first advantageous embodiment, during said second period of time and
30 when the second material (that is to be extruded during the second period of time by the extruder that is usually in charge of extruding the barrier layer) is HDPE, said another extruder is configured to provide HDPE.

Thus, it is proposed to replace the adhesive layer by a HDPE layer. By this way, the multilayer parison from which the diesel tank/filler pipe according to
35 the present invention is manufactured can be made of thermoplastic layers only (i.e. no barrier layer and no adhesive layer). As a result, pure plastic diesel

tank/filler pipe can be manufactured. The fact to replace the adhesive layer by a HDPE layer allows reducing the material cost of the diesel tank/filler pipe.

In a second advantageous embodiment, during said second period of time and when the second material (that is to be extruded during the second period of time by the extruder that is usually in charge of extruding the barrier layer) is a mixture of HDPE and adhesive, said another extruder is configured to provide an amount of adhesive that is lower than the amount of adhesive provided during said first period of time.

For example, the amount of adhesive extruded during the second period of time (i.e. period for manufacturing diesel tank/filler pipe) can be reduced up to 80% as compared to the amount of adhesive extruded during the first period of time (i.e. period for manufacturing gasoline tank/filler pipe). This allows reducing the material cost of the diesel tank/filler pipe.

In a particular embodiment, the coextrusion head comprises at least one additional extruder in charge of extruding HDPE and at least one additional extruder in charge of extruding recycled plastic (also called regrind).

In another embodiment, the coextrusion head can comprise other additional extruders, for example at least one extruder in charge of extruding a mat of fibres.

The term "recycled plastic" is understood to mean a plastic obtained by grinding up scrap obtained from various steps in the manufacture of fuel tanks according to the invention, or by grinding up spent fuel tanks at the end of their life.

According to another aspect of the present invention, there is provided a diesel tank or filler pipe comprising an inner layer comprising HDPE, at least one layer comprising HDPE, at least one layer comprising recycled plastic and an outer layer comprising HDPE.

According to yet another aspect of the present invention, there is provided a diesel tank or filler pipe comprising an inner layer comprising HDPE, at least one layer comprising a mixture of HDPE and adhesive, at least one layer comprising recycled plastic and an outer layer comprising HDPE.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated, in a non limitative way, by the accompanying Figures 1 to 4.

Figures 1 and 2 illustrate schematically a particular embodiment of a coextrusion head of an extrusion-blow moulding machine to which the present

invention may be applied;

Figure 3 illustrates a manufacturing sequence of gasoline and diesel tanks, in accordance with a first particular embodiment of the invention; and

Figure 4 illustrates a manufacturing sequence of gasoline and diesel tanks, in accordance with a second particular embodiment of the invention.

DESCRIPTION OF THE INVENTION

For clarity reason, the invention is described hereafter only for the particular case of the production of diesel tanks and gasoline tanks for motor vehicles. It is to note that the invention can be applied in the same manner to the case of the production of diesel filler pipes and gasoline filler pipes for motor vehicles.

The same reference numerals are used to indicate the same elements (or functionally-similar elements) throughout the separate Figures 1 to 4.

Figure 1 is a cross sectional view of a coextrusion head 1 according to a particular embodiment of the present invention. The coextrusion head 1 is a part of an extrusion-blow moulding machine (not shown). The coextrusion head 1 is in charge of producing a multilayer parison 2.

In this particular embodiment, the coextrusion head 1 comprises six extruders 11, 12, 13, 14, 15 and 16. In another embodiment, the coextrusion head can comprise more than or less than six extruders. Each extruder is in charge of extruding a layer of material.

Figure 2 is a 3D view of the top of the coextrusion head 1. In the example illustrated in Figure 2, the coextrusion head 1 comprises six material feeding lines 21, 22, 23, 24, 25 and 26. Each feeding line is connected to one extruder of the coextrusion head 1. Each feeding line is in charge of distributing/pushing a material towards the extruder to which it is connected. In this example, the feeding line 21 is connected to the extruder 11, the feeding line 22 is connected to the extruder 12, the feeding line 23 is connected to the extruder 13, the feeding line 24 is connected to the extruder 14, the feeding line 25 is connected to the extruder 15, and the feeding line 26 is connected to the extruder 16.

According to a particular embodiment of the present invention, one side of the feeding line 23 can be connected to the extruder 13 and the other side of the feeding line 23 can be connected to the outlet port of a hopper (not shown). According to an advantageous embodiment, this hopper can comprise two inlet ports. For example, EVOH can entered in the hopper via the first inlet port and a mixture of HDPE and adhesive can entered in the hopper via the second inlet

port. Opening and closing of the inlet ports can be advantageously controlled such that EVOH and the mixture of HDPE and adhesive enter one at a time in the hopper.

Figure 3 illustrates a manufacturing sequence S1 of gasoline and diesel tanks, in accordance with a first particular embodiment of the invention.

During a period of time T1, the extrusion-blow moulding machine is, for example, configured to manufacture one or several gasoline tanks. In this example, during the period of time T1 the coextrusion head 1 is configured to produce a multilayer parison comprising six layers of material. More precisely, during the period of time T1 the coextrusion head 1 is configured such that:

- the extruder 11 extrudes (for example) HDPE;
- the extruder 12 extrudes (for example) adhesive;
- the extruder 13 extrudes (for example) EVOH;
- the extruder 14 extrudes (for example) adhesive;
- the extruder 15 extrudes (for example) recycled plastic; and
- the extruder 16 extrudes (for example) HDPE (with or without additive).

During this period of time T1, the multilayer parison produced by the coextrusion head 1 is blow-moulded in a mould (not shown) to form the wall of a gasoline tank. In this example, the wall of the gasoline tank is composed of six layers of material arranged in the following order: an inner layer comprising HDPE, a layer comprising adhesive, a layer comprising EVOH, a layer comprising adhesive, a layer comprising recycled plastic and an outer layer comprising HDPE.

Before the start of a period of time T3 during which the extrusion-blow moulding machine is, for example, configured to manufacture one or several diesel tanks, the coextrusion head 1 is purged during a period of time T2. In this example, the extruder 13 is purged with a mixture of HDPE and adhesive. In other words, the mixture of HDPE and adhesive is introduced in the extruder 13 so as to push out the EVOH remaining in the extruder 13. The duration of the period of time T2 is such that it allows the complete evacuation of the EVOH out of the extruder 13.

Once the step of purging is completed, the manufacture of diesel tanks can start. As mentioned above, during the period of time T3 the extrusion-blow moulding machine is, for example, configured to manufacture one or several diesel tanks. In this example, during the period of time T3 the coextrusion head 1

is configured to produce a multilayer parison comprising six layers of material. More precisely, during the period of time T3 the coextrusion head 1 is configured such that:

- the extruder 11 extrudes (for example) HDPE;
- 5 - the extruder 12 extrudes (for example) adhesive;
- the extruder 13 extrudes (for example) a mixture of HDPE and adhesive. Advantageously, this mixture is the same as the one used during the step of purging (i.e. period of time T2);
- the extruder 14 extrudes (for example) adhesive;
- 10 - the extruder 15 extrudes (for example) recycled plastic; and
- the extruder 16 extrudes (for example) HDPE (with or without additive).

Advantageously, the amount of adhesive extruded by the extruder 12 and/or the extruder 14 during this period of time T3 can be lower than the
15 amount of adhesive extruded by this extruder 12 and/or this extruder 14 during the period of time T1.

During this period of time T3, the multilayer parison produced by the coextrusion head 1 is blow-moulded in a mould (not shown) to form the wall of a diesel tank. In this example, the wall of the diesel tank is composed of six layers
20 of material arranged in the following order: an inner layer comprising HDPE, a layer comprising reduced adhesive, a layer comprising a mixture of HDPE and adhesive, a layer comprising reduced adhesive, a layer comprising recycled plastic and an outer layer comprising HDPE.

Before switching from the manufacture of diesel tanks to the manufacture
25 of gasoline tanks, the coextrusion head 1 is once again purged during a period of time T4. In this example, the extruder 13 is purged with EVOH. In other words, EVOH is introduced in the extruder 13 so as to push out the mixture of HDPE and adhesive remaining in the extruder 13. The duration of the period of time T4 is such that it allows the complete evacuation of the mixture of HDPE and
30 adhesive out of the extruder 13.

Then, during a period of time T5, the extrusion-blow moulding machine is, for example, once again configured to manufacture one or several gasoline tanks. During this period of time T5, the coextrusion head 1 operates in the same way as described above with reference to the period of time T1.

35 The duration of the periods of time T1, T2, T3, T4 and T5 can be different. For example, the duration of the period of time T1 can be such that it allows the

manufacture of 1000 gasoline tanks, the duration of the period of time T3 can be such that it allows the manufacture of 500 diesel tanks and the duration of the period of time T5 can be such that it allows the manufacture of 3000 gasoline tanks. For example, the duration of the period of time T2 can be around 2 hours and the duration of the period of time T4 can be more than 2 hours.

Figure 4 illustrates a manufacturing sequence S2 of gasoline and diesel tanks, in accordance with a second particular embodiment of the invention.

During a period of time T6, the extrusion-blow moulding machine is, for example, configured to manufacture one or several gasoline tanks. In this example, during the period of time T6 the coextrusion head 1 is configured to produce a multilayer parison comprising six layers of material. More precisely, during the period of time T6 the coextrusion head 1 is configured such that:

- the extruder 11 extrudes (for example) HDPE;
- the extruder 12 extrudes (for example) adhesive;
- the extruder 13 extrudes (for example) EVOH;
- the extruder 14 extrudes (for example) adhesive;
- the extruder 15 extrudes (for example) recycled plastic; and
- the extruder 16 extrudes (for example) HDPE (with or without additive).

During this period of time T6, the multilayer parison produced by the coextrusion head 1 is blow-moulded in a mould (not shown) to form the wall of a gasoline tank.

As illustrated in the example of Figure 4, the coextrusion head 1 is purged during a period of time T7. In this example, the extruders 12, 13 and 14 are purged with HDPE.

During a period of time T8 the coextrusion head 1 is configured such that:

- the extruder 11 extrudes (for example) HDPE;
- the extruder 12 extrudes (for example) HDPE;
- the extruder 13 extrudes (for example) HDPE;
- the extruder 14 extrudes (for example) HDPE;
- the extruder 15 extrudes (for example) recycled plastic; and
- the extruder 16 extrudes (for example) HDPE (with or without additive).

Advantageously, during this period of time T8 pure thermoplastic diesel tank (i.e. free of adhesive and free of EVOH) can be manufactured.

CLAIMS

1. – Process for manufacturing a diesel tank or filler pipe by means of an extrusion-blow moulding machine suitable for manufacturing a gasoline tank or filler pipe, the extrusion-blow moulding machine being equipped with a coextrusion head comprising at least one extruder being configured to provide during a first period of time a first material that is a barrier to liquids and/or gases, such that during said first period of time the coextrusion head produces a first multilayer parison from which the gasoline tank or filler pipe can be manufactured,

wherein the extruder is further configured to provide during a second period of time a second material distinct from the first material, such that during said second period of time the coextrusion head produces a second multilayer parison from which the diesel tank or filler pipe can be manufactured,

wherein the first material is a fuel-impermeable resin, and

wherein the second material is high density polyethylene or a mixture of high density polyethylene and adhesive.

2. - Process according to claim 1, wherein the first material is EVOH copolymer.

3. - Process according to claim 1 or 2, wherein before the start of the period of time during which the extruder provides the first material, respectively the second material, the extruder is purged in order to remove from it the second material, respectively the first material.

4. - Process according to any one of claims 1 to 3, wherein the coextrusion head comprises at least one another extruder being configured to provide adhesive.

5. - Process according to claim 4, wherein during said second period of time and when the second material is high density polyethylene (HDPE), said another extruder is configured to provide high density polyethylene (HDPE).

6. - Process according to claim 4, wherein during said second period of

time and when the second material is a mixture of high density polyethylene (HDPE) and adhesive, said another extruder is configured to provide an amount of adhesive that is lower than the amount of adhesive provided during said first period of time.

5 7. – A diesel tank or filler pipe, wherein it comprises an inner layer comprising HDPE, at least one layer comprising HDPE, at least one layer comprising recycled plastic and an outer layer comprising HDPE.

 8. – A diesel tank or filler pipe, wherein it comprises an inner layer comprising HDPE, at least one layer comprising a mixture of HDPE and
10 adhesive, at least one layer comprising recycled plastic and an outer layer comprising HDPE.

1/3

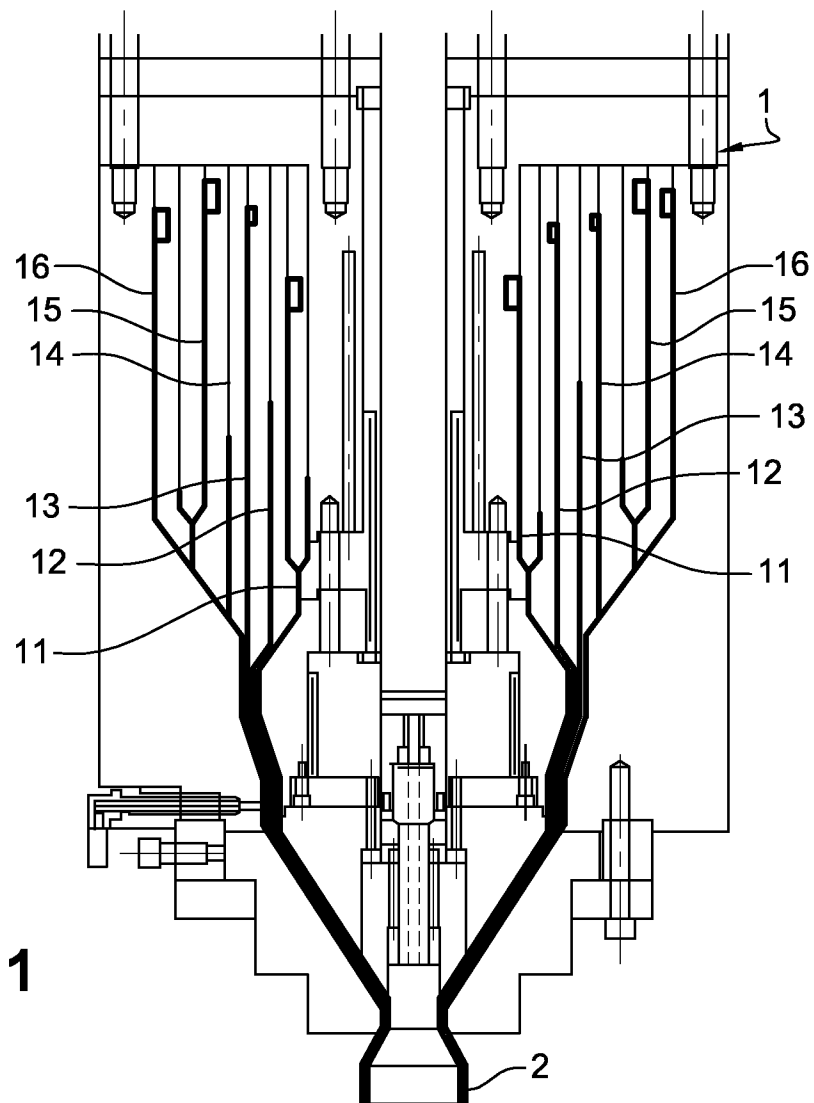


Fig. 1

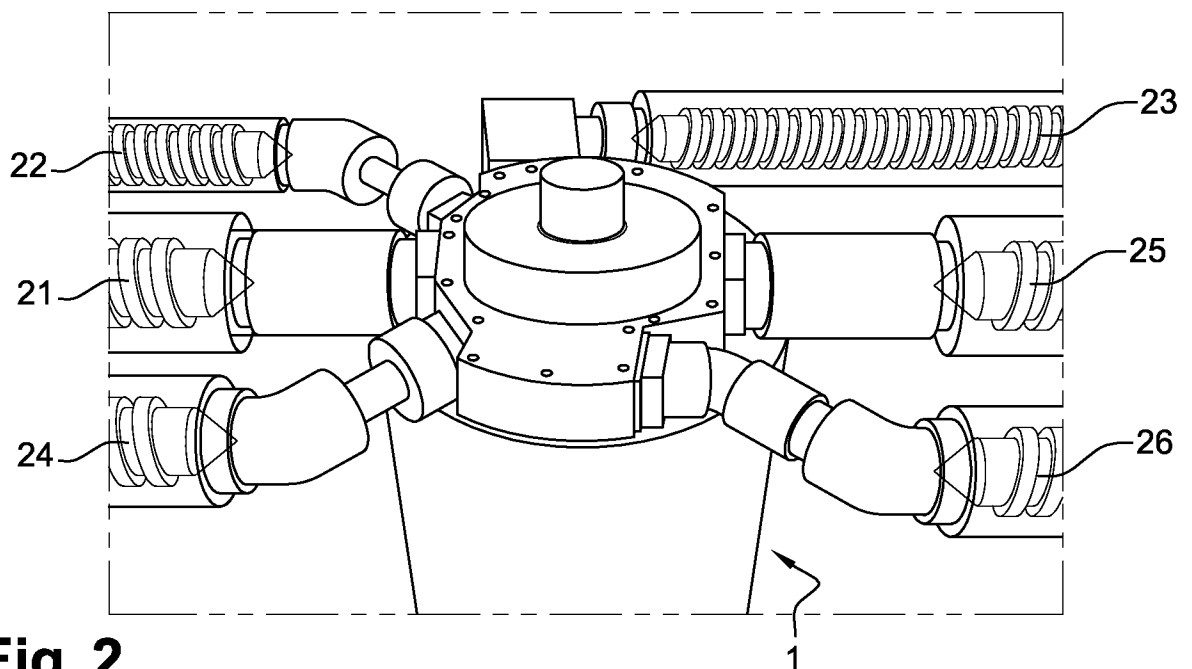
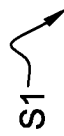


Fig. 2

S1

Extruder N°	GASOLINE TANK production	Step of purging	DIESEL TANK production	Step of purging	GASOLINE TANK production
16	HDPE (low MI) + MR	⇒	HDPE (low MI) + MR	⇒	HDPE (low MI) + MR
15	Regrind	⇒	Regrind	⇒	Regrind
14	Adhesive	→	Min Adhesive%	→	Adhesive
13	EVOH	⇒	HDPE (low MI) + ADHE	⇒	EVOH
12	Adhesive	⇒	Min Adhesive%	⇒	Adhesive
11	HDPE (low MI)	⇒	HDPE (low MI)	⇒	HDPE (low MI)

T1

T2

T3

T4

T5

Fig. 3

S2 ↗

Extruder N°	GASOLINE TANK production	Step of purging	DIESEL TANK production	Step of purging	GASOLINE TANK production
16	HDPE (low MI) + MB	⇒	HDPE (low MI) + MB	⇒	HDPE (low MI) + MB
15	Regrind	⇒	Regrind	⇒	Regrind
14	Adhesive	→	HDPE (low MI)	→	Adhesive
13	EVOH	⇒	HDPE (low MI)	⇒	EVOH
12	Adhesive	⇒	HDPE (low MI)	⇒	Adhesive
11	HDPE (low MI)	⇒	HDPE (low MI)	⇒	HDPE (low MI)
T6			T7		T8
			Stop BMM Change Materials purge Extruders 12,13,14		T9
					T10

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/055869

A. CLASSIFICATION OF SUBJECT MATTER

INV. B29C47/08 B29C47/00
ADD. B29C47/06 B29C49/04

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)
B29C

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	column 6, line 60 - column 7, line 31 column 7, line 66 - column 8, line 11 column 9, line 59 - column 10, line 47; claim 8; figures 1, 8c, 10, 12 column 10, line 48 - line 67	3
X	WO 2010/142593 A1 (INERGY AUTOMOTIVE SYSTEMS RES [BE]; MARTIN PHILIPPE [BE]; CRIEL BJORN) 16 December 2010 (2010-12-16) page 3, line 16 - page 3, line 34 page 4, line 10 - page 4, line 23 page 6, line 18 - page 7, line 2 page 8, line 8 - line 14 ----- -/-	1-8



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

16 June 2014

Date of mailing of the international search report

27/06/2014

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/055869

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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