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(54) CENTRIFUGAL PUMP CASING

(57) A centrifugal pump casing (110) is disclosed, the centrifugal pump casing (110) comprises
- at least one inlet (112) through which a fluid is admittable into the centrifugal pump casing (110);
- at least one flange (114) via which the centrifugal pump casing (110) is mountable relative to an impeller (116) insertable into the centrifugal pump casing (110);
- at least one funnel (118) in which the impeller (116) is rotatable for pumping the fluid, wherein the inlet (112), the funnel (118) and the flange (114) are formed as one piece from at least one plastic material;
- at least two metal inlays (120) at least partially over-molded by the plastic material of the inlet (112), the funnel (118) and the flange (114).

Further disclosed is a method of manufacturing a centrifugal pump casing (110).

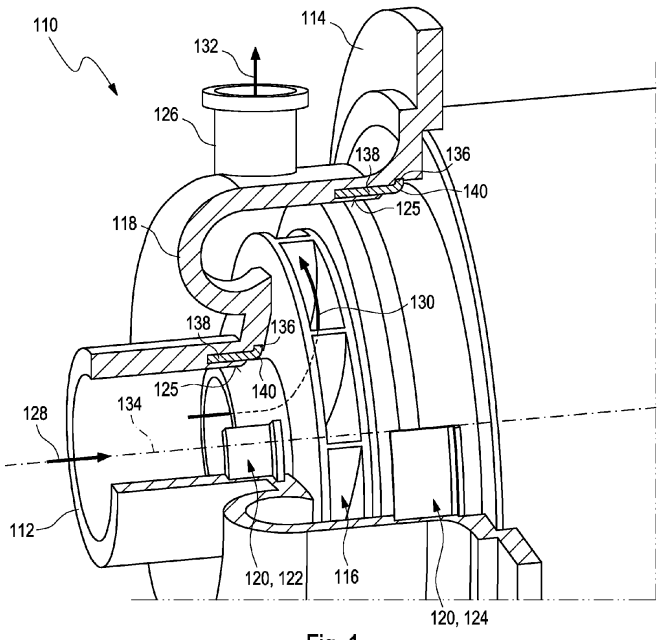

Fig. 1

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Description

Technical Field

[0001] The invention relates to a centrifugal pump casing. The devices according to the present invention may generally be applied in the field of fluid pumping, such as for pumping water or other fluids, for example in thermal management applications. Specifically, the invention may be applied in automotive thermal management, such as in the field of thermal management of vehicles, e.g. in the cooling and/or heating of cars and trucks. Additionally or alternatively, the invention may be applied in the field of thermally managing arbitrary electric and electronic applications. Other applications however, such as in for example in gardening tools, are also feasible.

Background art

[0002] For managing and/or controlling fluid flow, e.g. in thermal management systems or manifolds, centrifugal pumps are used. Typically, centrifugal pumps comprise a centrifugal pump casing that receives the fluid being pumped by an impeller and usually comprises a curved funnel, increasing in area as it approaches a discharge port. As the fluid travels along the centrifugal pump casing it is joined by more and more fluid exiting the impeller. However, due to the increasing area, e.g. cross sectional area, of the pump casing, ideally the velocity of the fluid is maintained. As the liquid exits the impeller, it generally has high kinetic energy and the centrifugal pump casing directs this flow through to the discharge port.

[0003] In order to function properly, the impeller and the centrifugal pump casing have to be aligned within tight tolerances. Due to the tight tolerances, at least a flange part of the centrifugal pump casing typically is made of a metal material, wherein sealing rings, typically O-rings, are used for sealing purposes, keeping the fluid within the centrifugal pump casing and generally preventing the fluid from reaching the motor driving the rotation of the impeller.

[0004] DE 102014213154 A1 describes a flange connection between a metal component and a plastic component, wherein the plastic component has a component opening enclosed by an opening rim of plastic, wherein the metal component has a flange of metal, the flange having a plastic frame injection-molded thereon, which is welded to the opening edge in such a way that a weld zone closed around the component opening is formed between the frame and the opening edge, wherein a permanent tightness of the flange connection is aimed for from at least one seal running closed along the flange, which is in contact with the metal of the flange.

[0005] DE 102016125250 B4 describes a method for the continuous manufacture of seals, in which a plurality of reinforcing inserts is produced by cutting individual sections from a flat material. Further, a compound is introduced into an extruder and the reinforcing inserts are fed to the extruder in a timed manner in order to be overmolded with the compound in the extruder. Furthermore, the reinforcing inserts are being fed and overmolded longitudinally one after the other and at a distance from one another as a result of the timing and a continuous strand of overmolded compound is ejected from the extruder, which strand includes and completely encloses the mutually spaced reinforcing inserts. A plurality of seals are produced by continuously severing the strand between adjacent reinforcing inserts in each case, wherein the severing is performed at such portions of the strand having the spacings between adjacent reinforcing inserts so that the reinforcing inserts remain completely enclosed by the compound, wherein the portions of the continuous strand having the spacings between the reinforcing inserts are marked, or alternatively the portions having the reinforcing inserts are marked.

[0006] Despite the advantages involved in using metal flange parts and seals, several technical challenges remain. Thus, as is typical in the automotive industry but also in many other fields, weight reduction is a constantly pursued objective. Further, known centrifugal pumps and their centrifugal pump casings typically require a lot of installation space and complex assembly processes are needed in order to ensure leak tightness of the devices.

Problem to be solved

[0007] It is therefore desirable to provide devices and methods, which address the above-mentioned shortcomings of known devices and methods. Specifically, a light centrifugal pump casing shall be proposed, which allows for a simple assembly and manufacturing of a centrifugal pump.

Summary

[0008] This problem is addressed by a centrifugal pump casing with the features of the independent claim. Advantageous embodiments which might be realized in an isolated fashion or in any arbitrary combinations are listed in the dependent claims as well as throughout the specification.

[0009] As used in the following, the terms "have", "comprise" or "include" or any arbitrary grammatical variations thereof are used in a non-exclusive way. Thus, these terms may both refer to a situation in which, besides the feature introduced by these terms, no further features are present in the entity described in this context and to a situation in which one or more further features are present. As an example, the expressions "A has B", "A comprises B" and "A includes B" may both refer to a situation in which, besides B, no other element is present in A (i.e. a situation in which A solely and exclusively consists of B) and to a situation in which, besides B, one or more further elements are present in entity A, such as

element C, elements C and D or even further elements.

[0010] Further, it shall be noted that the terms "at least one", "one or more" or similar expressions indicating that a feature or element may be present once or more than once typically will be used only once when introducing the respective feature or element. In the following, in most cases, when referring to the respective feature or element, the expressions "at least one" or "one or more" will not be repeated, non-withstanding the fact that the respective feature or element may be present once or more than once.

[0011] Further, as used in the following, the terms "preferably", "more preferably", "particularly", "more particularly", "specifically", "more specifically" or similar terms are used in conjunction with optional features, without restricting alternative possibilities. Thus, features introduced by these terms are optional features and are not intended to restrict the scope of the claims in any way. The invention may, as the skilled person will recognize, be performed by using alternative features. Similarly, features introduced by "in an embodiment of the invention" or similar expressions are intended to be optional features, without any restriction regarding alternative embodiments of the invention, without any restrictions regarding the scope of the invention and without any restriction regarding the possibility of combining the features introduced in such way with other optional or non-optional features of the invention.

[0012] In a first aspect of the present invention, a centrifugal pump casing is proposed. The centrifugal pump casing comprises at least one inlet through which a fluid is admittable into the centrifugal pump casing. The centrifugal pump casing further comprises at least one flange via which the centrifugal pump casing is mountable relative to an impeller insertable into the centrifugal pump casing. Furthermore, the centrifugal pump casing comprises at least one funnel in which the impeller is rotatable for pumping the fluid, wherein the inlet, the funnel and the flange are formed as one piece from at least one plastic material. In addition, the centrifugal pump casing comprises at least two metal inlays at least partially overmolded by the plastic material of the inlet, the funnel and the flange.

[0013] As an example, the centrifugal pump casing may be configured to be used and arranged in a vehicle, such as in a car and/or truck. In particular the centrifugal pump casing may be part of a thermal management manifold of the vehicle, such as of the car and/or truck.

[0014] The term "centrifugal pump casing" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to a housing of a centrifugal pump configured for receiving an arbitrary fluid and an impeller for pumping the fluid.

[0015] Herein, the term "fluid" may specifically refer to an arbitrary liquid medium, such as for example comprising water. As an example, the fluid may be a cooling agent, configured for removing heat and/or for conducting heat to a heat sink. The fluid may specifically comprise at least one liquid selected from the group consisting of: water, oil, dielectric oil, refrigerant fluid, heat transfer fluid, insulating oil and glycol.

[0016] The term "inlet" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to an entrance into the centrifugal pump casing through which the fluid may enter into the centrifugal pump casing.

[0017] The term "flange" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to a part of the centrifugal pump casing via for mounting the centrifugal pump casing relative to the impeller, i.e. to an axis of rotation of the impeller. In particular, the flange may be a ring shaped disc via which the centrifugal pump casing may be fixed and/or mounted to an arbitrary fixing means, such as for example within a vehicle or other object in which the centrifugal pump is to be applied.

[0018] The term "funnel" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to a volute in which the impeller is rotatable, such as to, in conjunction with the funnel, pumping the fluid, thereby charging the fluid with kinetic energy.

[0019] The term "metal inlay" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to an arbitrary metal part having the shape of at least a partial circle and configured for being at least partially overmolded by another material, specifically by a plastic material. In particular, the metal inlay may be configured for providing at least one stabilizing bearing area of the impeller within the centrifugal pump casing.

[0020] The funnel may specifically comprise at least one outlet through which the fluid is dischargeable from the centrifugal pump casing. Herein, the term "outlet" is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to an exit from the centrifugal pump casing through which the fluid may leave the centrifugal pump casing.

[0021] At least one of the metal inlays may specifically be at least partially ring shaped, such as at least one partial ring. Thus, the metal inlays may for example be partial rings, such as half rings, e.g. two half rings to complete a circle. In particular, the metal inlays may be or

may comprise circular metal inlays, such as ring shaped circular metal inlays. Additionally or alternatively, at least one of the metal inlays may be or may comprise multiple partial rings that may be put together in such a way that they form a whole circle, i.e. with interruptions.

[0022] As an example, the metal inlays may have a rotationally symmetrical shape with respect to at least one axis. Specifically, the metal inlays may have a rotationally symmetrically shape with respect to the impeller's axis of rotation. Thus, for example, the metal inlays may be arranged within the plastic material of the inlet, the funnel and the flange.

[0023] At least one of the metal inlays, specifically all metal inlays, may have an L-shaped cross section. The term "L-shaped cross section" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to a cross section shaped like an "L" having an angle between the L's two extremities, such as between its horizontal and vertical part, in the range of from 45° to 135°. In particular, the L-shaped cross section may comprise an angle in the range of from 70° to 110° between its extremities. The horizontal part of the L-shaped cross section may specifically extend radially outward, e.g. away from the axis, specifically away from the impeller's axis of rotation. The vertical part of the L-shaped cross section may be arranged parallel to the axis, specifically parallel to the impeller's axis of rotation.

[0024] At least a part of one side of a bend of the L-shaped cross section of the metal inlays may be exposed and not covered by the plastic material of the inlet, the funnel and the flange. Thus, as an example, an outer side of the bend of the L-shaped cross section of the metal inlays may be exposed and not covered by the plastic material of the inlet, the funnel and the flange.

[0025] At least two of the metal inlays may have different diameters. In particular, the diameter, i.e. the double radius, of at least one partially ring shaped metal inlay, such as of at least one metal inlay shaped as a partial ring, may differ from the diameter of at least one other one of the at last partially ring shaped metal inlay.

[0026] The centrifugal pump casing may comprise exactly two metal inlays. Thus, in case the two metal inlays have different diameters, the diameter of the first of the fully or partially ring shaped metal inlay may differ from the diameter of the second of the fully or partially ring shaped metal inlay. As an example, the metal inlay arranged closer to the inlet may have a smaller diameter than the metal inlay arranged farther away from the inlet.

[0027] The funnel may be arranged between the inlet and the flange. Thus, the funnel, e.g. the volute, of the centrifugal pump casing may be arranged such that it is geometrically positioned between the inlet and the flange.

[0028] The plastic material may specifically comprise at least one material selected from the group consisting of glycol resistant plastic, oil resistant plastic, polypropylene (PP), polyamide (PA), polyamide 6 (PA6), polyketone (PK), polyamide 66 (PA66), polyoxymethylene (POM) and polyamide 9T (PA9T).

[0029] The plastic material, as a filler, may further comprise one or more of glass fibers (GF) and carbon fibers (CF). In particular, the filler of the plastic material may comprise GF in the range of from 5 %-weight to 60 %-weight of the plastic material. Specifically, the filler of the plastic material may comprise GF in the range of from 8 %-weight to 50 %-weight of the plastic material. More specifically, the filler of the plastic material may comprise GF in the range of from 10 %-weight to 30 %-weight of the plastic material. Additionally or alternatively, the filler of the plastic material may comprise CF in the range of from 5 %-weight to 60 %-weight of the plastic material. Specifically, the filler of the plastic material may comprise CF in the range of from 8 %-weight to 50 %-weight of the plastic material. More specifically, the filler of the plastic material may comprise CF in the range of from 10 %-weight to 25 %-weight of the plastic material.

[0030] At least one of the metal inlays, specifically all metal inlays, may for example comprise at least one metal material selected from the group consisting of copper, steel, specifically stainless steel, and aluminum.

[0031] In a further aspect of the present invention, a method of manufacturing a centrifugal pump casing as described herein is proposed. The method comprises the following steps. The steps may be performed in the given order. Still, a different order is possible. The method may comprise additional steps, which are not mentioned. It is further possible to perform one or more or all of the method steps repeatedly. Further, two of the method steps may be performed simultaneously or in a timely overlapping fashion.

[0032] The method comprises the following steps:

a) providing the at least two metal inlays;
b) generating the at least one inlet, the at least one flange and the at least one funnel by at least partially overmolding the at least two metal inlays in at least one overmolding process.

[0033] The method is configured for manufacturing the centrifugal pump casing as described herein. Thus, for possible definitions and options, reference may be made to the description of the centrifugal pump casing as provided above or as further outlined below.

[0034] The proposed devices and methods provide a large number of advantages over known devices and methods of similar kind. In particular, the devices and methods according to the present application may reduce the total weight of the centrifugal pump casing, thereby allowing for reducing emissions both during manufacturing and assembly as well as, in case of installation in a vehicle, during usage of the centrifugal pump casing.

[0035] Furthermore, the proposed devices and meth-

ods may reduce assembly and manufacturing complexity. Specifically, the proposed centrifugal pump casing may have a reduced number of components compared to known devices. This may specifically help reduce manufacturing costs and complexity of the assembly. For example, by a reduced number of interfaces and/or boundary surfaces, i.e. when assembling the components to form the centrifugal pump, compared to known devices and methods.

[0036] Further, due to using metal inlays, a shrinkage of the plastic components may be effectively reduced or even eliminated. In addition, in the proposed centrifugal pump casing, specifically by forming inlet, flange and funnel from one plastic material and integrating metal inlays by overmolding them with thee plastic material, different length expansion coefficients of plastic material and metal material may be compensated for and tight tolerances may be achieved.

[0037] Summarizing and without excluding further possible embodiments, the following embodiments may be envisaged:

Embodiment 1: A centrifugal pump casing comprising

- at least one inlet through which a fluid is admittable into the centrifugal pump casing;
- at least one flange via which the centrifugal pump casing is mountable relative to an impeller insertable into the centrifugal pump casing;
- at least one funnel in which the impeller is rotatable for pumping the fluid wherein the inlet, the funnel and the flange are formed as one piece from at least one plastic material;
- at least two metal inlays at least partially overmolded by the plastic material of the inlet, the funnel and the flange.

Embodiment 2: The centrifugal pump casing according to the preceding embodiment, wherein the funnel comprises at least one outlet through which the fluid is dischargeable from the centrifugal pump casing.

Embodiment 3: The centrifugal pump casing according to any one of the preceding embodiments, wherein the metal inlays are circular metal inlays, specifically ring shaped circular metal inlays.

Embodiment 4: The centrifugal pump casing according to any one of the preceding embodiments, wherein the metal inlays have a rotationally symmetrical shape with respect to at least one axis, specifically with respect to the impeller's axis of rotation.

Embodiment 5: The centrifugal pump casing according to any one of the preceding embodiments, wherein at least one of the metal inlays, specifically all metal inlays, has an L-shaped cross section.

Embodiment 6: The centrifugal pump casing according to the two preceding embodiments, wherein the horizontal part of the L-shaped cross section extends radially outward, away from the axis, specifically away from the impeller's axis of rotation, wherein the vertical part of the L-shaped cross section is arranged parallel to the axis, specifically parallel to the impeller's axis of rotation.

Embodiment 7: The centrifugal pump casing according to any one of the two preceding embodiments, wherein at least a part of one side of a bend of the L-shaped cross section, specifically an outer side of the bend of the L-shaped cross section, of the metal inlays are exposed and not covered by the plastic material of the inlet, the funnel and the flange.

Embodiment 8: The centrifugal pump casing according to any one of the preceding embodiments, wherein at least two of the metal inlays have different diameters.

Embodiment 9: The centrifugal pump casing according to any one of the preceding embodiments, wherein the centrifugal pump casing comprises exactly two metal inlays.

Embodiment 10: The centrifugal pump casing according to the two preceding embodiments, wherein the metal inlay arranged closer to the inlet has a smaller diameter than the metal inlay arranged farther away from the inlet.

Embodiment 11: The centrifugal pump casing according to any one of the preceding embodiments, wherein the funnel is arranged between the inlet and the flange.

Embodiment 12: The centrifugal pump casing according to any one of the preceding embodiments, wherein the fluid comprises at least one liquid selected from the group consisting of water, oil, dielectric oil, refrigerant fluid, heat transfer fluid, insulating oil and glycol.

Embodiment 13: The centrifugal pump casing according to any one of the preceding embodiments, wherein the plastic material comprises at least one material selected from the group consisting of: glycol resistant plastic, oil resistant plastic, polypropylene (PP), polyamide (PA), polyamide 6 (PA6), polyketone (PK), polyamide 66 (PA66), polyoxymethylene (POM) and polyamide 9T (PA9T).

Embodiment 14: The centrifugal pump casing according to the preceding embodiment, wherein the plastic material, as a filler, comprises one or more of

glass fibers (GF) in the range of from 5 %-weight to 60 %-weight, specifically in the range of from 8 %-weight to 50 %-weight, more specifically in the range of from 10 %-weight to 30 %-weight, of the plastic material and
carbon fibers (CF) in the range of from 5 %-weight to 60 %-weight, specifically in the range of from 8 %-weight to 50 %-weight, more specifically in the range of from 10 %-weight to 25 %-weight, of the plastic material.

Embodiment 15: The centrifugal pump casing according to any one of the preceding embodiments, wherein at least one of the metal inlays, specifically all metal inlays, comprise at least one metal material selected from the group consisting of: copper, steel, specifically stainless steel, and aluminum.

Embodiment 16: A method of manufacturing a centrifugal pump casing according to any one of the preceding embodiments, comprising

a) providing the at least two metal inlays;
b) generating the at least one inlet, the at least one flange and the at least one funnel by at least partially overmolding the at least two metal inlays in at least one overmolding process.

Short description of the Figures

[0038] Further optional features and embodiments will be disclosed in more detail in the subsequent description of embodiments, preferably in conjunction with the dependent claims. Therein, the respective optional features may be realized in an isolated fashion as well as in any arbitrary feasible combination, as the skilled person will realize. The scope of the invention is not restricted by the preferred embodiments. The embodiments are schematically depicted in the Figures. Therein, identical reference numbers in these Figures refer to identical or functionally comparable elements.

[0039] In the Figures:

Figure 1 shows an embodiment of a centrifugal pump casing in a perspective view; and

Figure 2 shows a flow chart of a method for manufacturing a centrifugal pump casing.

Detailed description of the embodiments

[0040] In Figure 1, an embodiment of a centrifugal pump casing 110 is illustrated in a perspective view. The centrifugal pump casing 110 comprises at least one inlet 112 through which a fluid is admittable into the centrifugal pump casing 110. The centrifugal pump casing 110 further comprises at least one flange 114 via which the centrifugal pump casing 110 is mountable relative to an impeller 116 insertable into the centrifugal pump casing 110. Furthermore, the centrifugal pump casing 110 comprises at least one funnel 118 in which the impeller 116 is rotatable for pumping the fluid, wherein the inlet 112, the funnel 118 and the flange 114 are formed as one piece from at least one plastic material. In addition, the centrifugal pump casing 110 comprises at least two metal inlays 120 at least partially overmolded by the plastic material of the inlet 112, the funnel 118 and the flange 114.

[0041] As an example, the metal inlays 120 may be circular, ring shaped metal inlays. Alternatively however, each metal inlay 120 may be or may comprise one or more partial rings, for example two half rings or four quarter rings. The metal inlays 120 may have different diameters. Thus, for example a first metal inlay 122, arranged closer to the inlet 112 may have a smaller diameter than a second metal inlay 124 arranged farther away from the inlet 112. The metal inlays 120 may specifically be configured for providing at least one stabilizing bearing area and/or bearing surface 125 for the impeller 116 within the centrifugal pump casing 110.

[0042] The funnel 118 may be arranged between the inlet 112 and the flange 114. The funnel 118 of the centrifugal pump casing110 may further comprise at least one outlet 126 through which the fluid may be dischargeable from the centrifugal pump casing 110.

[0043] Exemplarily, the function of a centrifugal pump including the centrifugal pump casing 110 may be described as follows: In the figure, the fluid entering the centrifugal pump casing 110 may be illustrated by a first arrow 128. The fluid that has entered the centrifugal pump casing 110, is then pumped by the impeller 116, in conjunction with the funnel 118, thereby changing the fluid's flow direction, as illustrated by a second arrow 130. Further, the fluid, when pumped by the impeller 116, travels along the funnel 118 and is joined by more and more fluid exiting the impeller 116, before exiting the funnel 118 through the funnel's outlet 126, as illustrated by the third arrow 132.

[0044] The impeller 116 may specifically be alignable within the centrifugal pump casing 110, specifically supported by the bearing surface 125, and may rotate around the axis 134. The metal inlays 120 may for example have a rotationally symmetrical shape with respect to the axis 134 and may have an L-shaped cross section, wherein the horizontal part 136 of the L-shaped cross section may extends radially outward, away from the axis 134, and wherein the vertical part 138 of the L-shaped cross section may be arranged parallel to the axis 134. In particular, at least a part of one side of a bend 140 of the L-shaped cross section, specifically an outer side of the bend 140 of the L-shaped cross section, of the metal inlays 120 may be exposed and not covered by the plastic material of the inlet 112, the funnel 118 and the flange 114.

[0045] Figure 2 illustrates a flow chart of a method of manufacturing a centrifugal pump casing 110. The method comprises the following steps:

a) (denoted by reference number 142) providing the at least two metal inlays 120;
b) (denoted by reference number 144) generating the at least one inlet 112, the at least one flange 114 and the at least one funnel 118 by at least partially overmolding the at least two metal inlays 120 in at least one over-molding process.

List of reference numbers

[0046]

110	centrifugal pump casing
112	inlet
114	flange
116	impeller
118	funnel
120	metal inlay
122	first metal inlay
124	second metal inlay
125	bearing surface
126	outlet
128	first arrow
130	second arrow
132	third arrow
134	axis
136	horizontal part of L-shaped cross section
138	vertical part of L-shaped cross section
140	bend
142	step a)
144	step b)

Claims

1. A centrifugal pump casing (110) comprising

- at least one inlet (112) through which a fluid is admittable into the centrifugal pump casing (110);
- at least one flange (114) via which the centrifugal pump casing (110) is mountable relative to an impeller (116) insertable into the centrifugal pump casing (110);
- at least one funnel (118) in which the impeller (116) is rotatable for pumping the fluid, wherein the inlet (112), the funnel (118) and the flange (114) are formed as one piece from at least one plastic material;
- at least two metal inlays (120) at least partially overmolded by the plastic material of the inlet (112), the funnel (118) and the flange (114).

2. The centrifugal pump casing (110) according to the preceding claim, wherein the funnel (118) comprises at least one outlet (126) through which the fluid is dischargeable from the centrifugal pump casing (110).

3. The centrifugal pump casing (110) according to any one of the preceding claims, wherein the metal inlays (120) are circular metal inlays.

4. The centrifugal pump casing (110) according to any one of the preceding claims, wherein the metal inlays (120) have a rotationally symmetrical shape with respect to at least one axis (134).

5. The centrifugal pump casing (110) according to any one of the preceding claims, wherein at least one of the metal inlays (120) has an L-shaped cross section.

6. The centrifugal pump casing (110) according to the two preceding claims, wherein the horizontal part (136) of the L-shaped cross section extends radially outward, away from the axis (134), wherein the vertical part (138) of the L-shaped cross section is arranged parallel to the axis (134).

7. The centrifugal pump casing (110) according to any one of the two preceding claims, wherein at least a part of one side of a bend (140) of the L-shaped cross section, specifically an outer side of the bend of the L-shaped cross section, of the metal inlays are exposed and not covered by the plastic material of the inlet, the funnel and the flange.

8. The centrifugal pump casing (110) according to any one of the preceding claims, wherein at least two of the metal inlays (120) have different diameters.

9. The centrifugal pump casing (110) according to any one of the preceding claims, wherein the centrifugal pump casing (110) comprises exactly two metal inlays (120).

10. The centrifugal pump casing (110) according to the two preceding claims, wherein the metal inlay (122) arranged closer to the inlet (112) has a smaller diameter than the metal inlay (124) arranged farther away from the inlet (112).

11. The centrifugal pump casing (110) according to any one of the preceding claims, wherein the funnel (118) is arranged between the inlet (112) and the flange (114).

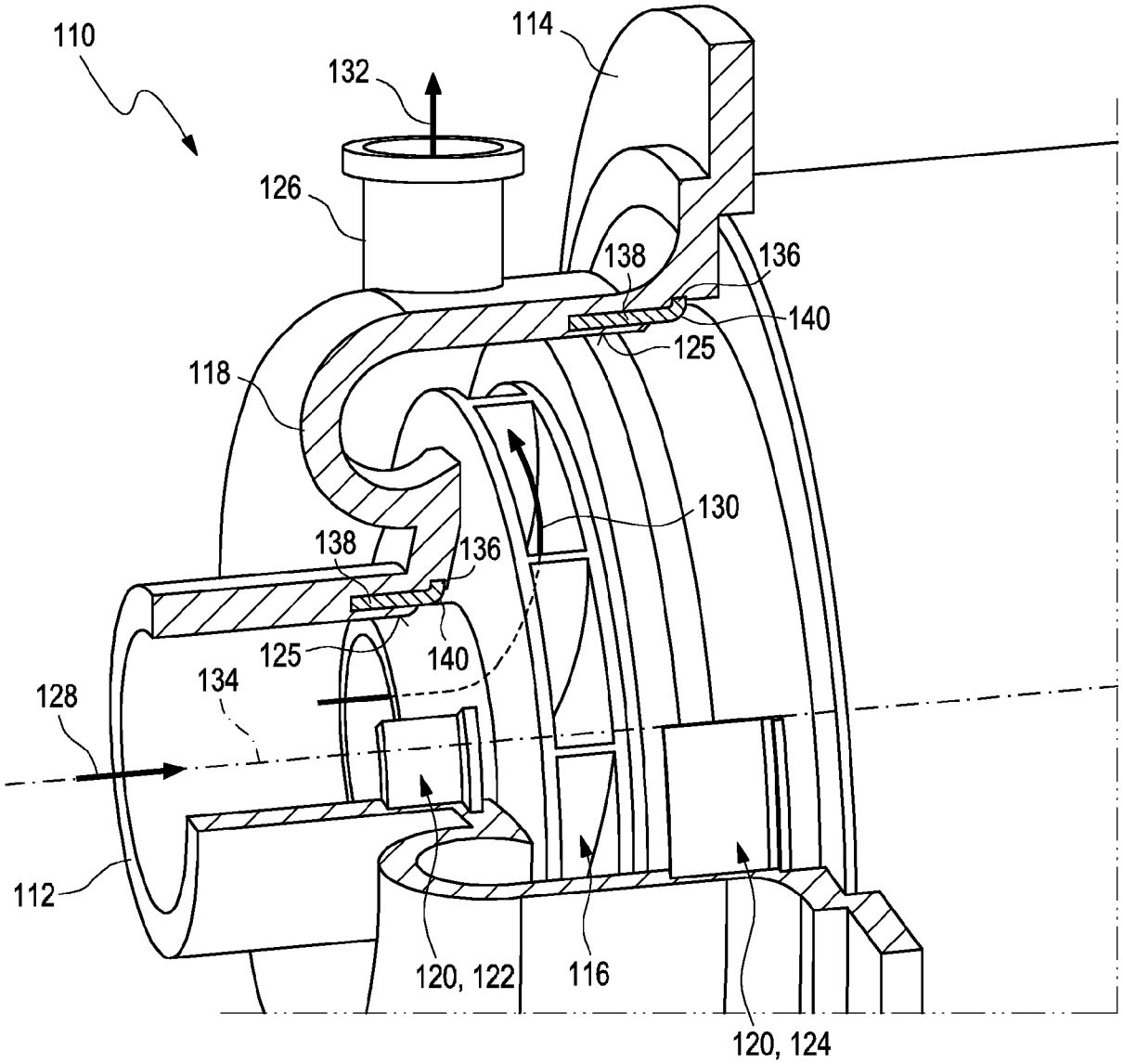
12. The centrifugal pump casing (110) according to any one of the preceding claims, wherein the fluid comprises at least one liquid selected from the group consisting of: water, oil, dielectric oil, refrigerant fluid, heat transfer fluid, insulating oil and glycol.

13. The centrifugal pump casing (110) according to any one of the preceding claims, wherein the plastic material comprises at least one material selected

from the group consisting of glycol resistant plastic, oil resistant plastic, polypropylene (PP), polyamide (PA), polyamide 6 (PA6), polyketone (PK), polyamide 66 (PA66), polyoxymethylene (POM) and polyamide 9T (PA9T).

14. The centrifugal pump casing (110) according to the preceding claim, wherein the plastic material, as a filler, comprises one or more of glass fibers (GF) in the range of from 5 %-weight to 60 %-weight of the plastic material, and carbon fibers (CF) in the range of from 5 %-weight to 60 %-weight of the plastic material.

15. The centrifugal pump casing (110) according to any one of the preceding claims, wherein at least one of the metal inlays (120) comprise at least one metal material selected from the group consisting of: copper, steel, and aluminum.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120, 124

Fig. 1

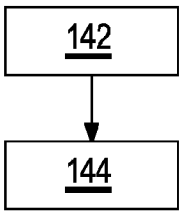
142
144

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 5755

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The present search report has been drawn up for all claims

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The Hague	5 February 2024	De Tobel, David

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