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(54) **PLASTIC SPOUT AND POUCH PACKAGING**

(57) A spout having a plastic spout body which comprises an attachment portion having a vertical first plane of symmetry with a vertical first sealing wall and an opposed vertical second sealing wall, and with a transverse wall, which is integrally connected to an upper edge of the first sealing wall and to an upper edge of the second sealing wall, wherein the first sealing wall and the second sealing wall each depend from said transverse wall and each have a bottom edge remote from the upper edge. Each sealing wall is, seen in a bottom view of the attachment portion, composed of a first rectilinear portion, a central curved portion, and a second rectilinear portion. The spout body has a tubular neck having a bore that adjoins an opening in the transverse wall. The attachment portion further comprises curved stabilizing ribs extending between associated connection points to the opposed rectilinear portions of the sealing walls.

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# PLASTIC SPOUT AND POUCH PACKAGING

The present invention relates to a spout having a plastic spout body, which is adapted to be heat sealed in a non-bonded region between opposed first and second walls made of heat-sealable film material of a pouch.

The present invention also relates to such a spout combined with a cap and/or a valve to form a closure assembly.

The present invention further relates to a pouch packaging comprising such a spout or closure assembly, to the use of such a spout or closure assembly, and to methods for manufacturing such a pouch packaging.

The document DE202006013587 discloses a spout according to the preamble of claim 1. A further development of this spout is disclosed in US2013/284769 which also corresponds to the preamble of claim 1. In these prior art documents spouts are disclosed that have an attachment portion wherein each of the sealing walls is composed of a first rectilinear portion, a central curved portion, and a second rectilinear portion. The vertical plane of symmetry extends through the first and second pointed ends of the attachment portion. The transverse wall forms a horizontal wall connecting the upper edges of the sealing walls. The attachment portion further comprises a pair of first stabilizing ribs between the second rectilinear portion of the first sealing wall and the first rectilinear portion of the second sealing wall, and a pair of second stabilizing ribs between the first rectilinear portion of the first sealing wall and the second rectilinear portion of the second sealing wall. These stabilizing ribs are, seen in a bottom view onto the spout, rectilinear, i.e. straight, and extend perpendicular to the vertical plane of symmetry.

In the US2013/284769 document, it is discussed that the stabilizing ribs disclosed in the DE202006013587 document cannot cope with the loads exerted on the spout by the jaws during an ultrasonic welding process as breaks occur at the connection points where the stabilizing rib adjoins the sealing walls. Therefore, the US document proposes to have rounded corner transitions between each of the ends of the rectilinear stabilizing rib, where the rib is integral with the respective sealing wall.

Ultrasonic welding of the spout into a pouch is less common than the use of continuously heated sealing jaws for heat sealing the spout into the non-bonded region of the pouch.

In the field of spouted pouch production, it is also known to make use of an impulse heat sealing device, such as offered by ROPEX Industrie-Elektronik GmbH, Bietigheim-Bissingen, Germany. In known embodiments of such an impulse heat sealing device at least one of the jaws has a single, elongated, impulse heatable resistor band that extends along the contoured front surface of the jaw and is covered by a heat-resistant non-stick covering, e.g. a Teflon tape. The device is configured to perform an impulse heat sealing cycle, wherein an actuator device is configured to bring the first and second jaws into the clamped position, with the spout and the two pouch walls of heat sealable film material in between. The sealing device is configured to, in the clamped position, temporarily pass an electric current through the resistor band so as to generate an impulse of heat that is emitted by the resistor band. This brief impulse of heat seals or fuses the pouch walls onto the attachment portion of the spout and, left and right of the spout, seals the two pouch walls onto each other to close the entire seam. The resistor band cools down after termination of the energizing of the resistor band, assisted therein by operation of the associated cooling device. The actuator device is configured to move the first and second jaws into the opened position after the cooling down has been achieved. The temperature of the resistor band may in practical embodiments increase from room temperature or a slightly elevated temperature extremely fast to 200°C or much higher temperatures like 300°C, 400°C or even 500°C, so in general very fast to a very high temperature which is maintained only for a very short duration. The impulse sealing approach is, for instance, discussed in DE19737471.

It is an object of the present invention to provide a spout which enhances the quality of the seal that is obtained between the pouch walls and the vertical sealing walls of the spout, and/or enhances the execution of the heat sealing process, e.g. in view of speed, uniformity, etc.

It is an object of the present invention to provide a spout that allows for application of an impulse heat sealing technique to seal the spout between the pouch walls, e.g. to obtain a better quality seal and/or to allow for a shorter duration of the sealing cycle.

It is an object of the present invention to at least to provide an alternative spout.

It is an object of the present invention to provide enhanced heat sealing of spouts into pouches.

According to a first aspect thereof, the present invention provides spout according to claim 1. Herein the attachment portion is embodied such that, seen in a bottom view of the attachment portion, the at least one first stabilizing rib is, between the associated connection points, curved toward the first pointed end, and the at least one second stabilizing rib is, between the associated connection points, curved toward the second pointed end.

Compared to the prior art spouts discussed herein above wherein the stabilizing ribs are straight, the curved stabilizing ribs allow to achieve a desirable balance between strength on the one hand and flexibility on the other hand. As will be explained herein, this design has been found to be particularly advantageous when an impulse heat sealing technique is applied to seal the spout into the pouch.

The curvature in the stabilizing ribs provides that the stiffness when under load of clamping by the sealing jaws is reduced compared to a straight rib, and that the curved ribs provide for an enhanced resilient behaviour under the influence of a clamping by the jaws of the heat sealing device. The improved behaviour allows for the shape of the sealing walls, in particular of the rectilinear portions thereof, to better conform to the complementary shaped front or contact faces of the sealing jaws during clamping, which allows to obtain a better sealing. It is observed that, as is preferred, this enhanced conformity does not require any large clamping force. In fact, as preferred, hardly any clamping force is applied by the jaws in a heat sealing process using the inventive spout designs discussed herein, as the clamping effectively only serve to bring the pouch walls against the outer surfaces. In particular, it is considered that in an impulse heat sealing process, the clamping force does not form a relevant parameter in the actual sealing process, contrary to common heat sealing wherein continuously heated sealing jaws are applied and the sealing is based on the combination of temperature, time, and clamping pressure as main parameters.

It is observed that the prior art design with the straight stabilizing ribs is prone to non-linear deformations during clamping, for example a buckling deformation, of these ribs. Such buckling is a typical example of a non-linear and unstable deformation, because the stiffness of the straight rib is initially very high, but suddenly drops, thereby resulting in collapsing and sudden deformation of the clamped attachment portion.

The spout according to the first aspect of the present invention, having the gradual and stable deformation of the curved stabilizing ribs when under clamping load, forms a

significant improvement which translates into an improved seal quality between the spout and the walls of the pouch.

During clamping by means of the jaws, the first and second stabilizing ribs will become curved or bent to a further extent. As a result of this bending, the connection points of these ribs are subjected to a resultant force vector in the plane of the sealing walls and in a direction away from the respective pointed end, resulting from an overall equilibrium of forces acting on the stabilizing rib. As the at least one first stabilizing rib is bent, its connection points are effectively pressed away from the first pointed end. This resultant force subjects the second rectilinear portion of the first sealing wall and the first rectilinear portion of the second sealing wall to a tensile stress. As the at least one second stabilizing rib is bent, its connection points are pressed away from the second pointed end. This resultant force subjects the second rectilinear portion of the second sealing wall and the first rectilinear portion of the first sealing wall to a tensile stress as well. These tensile stresses in the sealing walls are considered to have the beneficial effect that the rectilinear portions of the sealing walls become elongated and straightened, all of course of a small magnitude, such that an enhanced conformity of the sealing walls to the corresponding parts of the sealing jaws is achieved and thus an improved sealing.

Furthermore, the provision of these curved ribs in between the opposed sealing walls provides for a more evenly distributed mechanical loading of the sealing walls when a, possibly light, clamping load is applied thereon.

The curved shape of the stabilizing ribs is considered of particular advantage when the spout is sealed between the pouch walls by means of impulse heat sealing. Herein, as preferred, the outer sealing surfaces of the sealing walls are smooth outer sealing surfaces in order to obtain a full surface seal or fusion between the outer sealing surface and the pouch wall. So, herein, the outer sealing surfaces are - preferably - devoid of any weld lines, or any other relief thereon; that is devoid of any relief that might result in an entrapment of air between the pouch wall and the outer sealing surface of the sealing wall, even when a very light clamping force is applied by the sealing jaws, as is preferred. The above described behaviour of the spout due to the curved ribs contributes to avoiding entrapped air. Entrapped air is observed to affect the heat transfer during impulse heat sealing in undesirable manner. Instead of countering air entrapment by a high clamping force, it proposed as an embodiment that for impulse heat sealing of the spouts discussed herein no significant clamping force is applied. It has been observed that to enable a high quality seal between the spout and the pouch walls, it is rather important to obtain a full surface contact between the sealing jaws of the

impulse heat sealing device and the spout, with the pouch walls therein between, in order to transfer the heat impulse evenly across the sealing surface of the spout. The known spouts having straight stabilizing ribs, as described above, are considered to be locally too rigid to obtain the desired conformity to the shape of the sealing jaw, giving rise to insufficient sealing quality.

In a practical embodiment, as in the mentioned prior art, each of the stabilizing ribs depends from the transverse wall, to which it is integral, downward in vertical direction. For example, the spout is manufactured as a single piece by means of an injection-moulding manufacturing process.

In a practical embodiment, the attachment portion has a second vertical plane of symmetry, perpendicular to the plane of symmetry through the pointed ends and through a center of the opening in the transverse wall.

In an embodiment, the at least one first stabilizing rib comprises or consists of:
- an inner first stabilizing rib, disposed adjacent to the passage,
- an outer first stabilizing rib, disposed closer to the first pointed end, and

wherein the at least one second stabilizing rib comprises or consists of:
- an inner second stabilizing rib, disposed adjacent to the passage,
- an outer second stabilizing rib, disposed closer to the second pointed end.

In a practical embodiment, the spout has a pair of first inner and outer stabilizing ribs and a pair of second inner and outer stabilizing ribs. The provision of two curved stabilizing ribs between opposed rectilinear portions allows to provide a resilient stabilization of the rectilinear portions whilst clamped and enhanced uniformity of the contact between the outer sealing surfaces and the pouch walls.

For a larger spout, one could envisage three or four first stabilizing ribs and three or four second stabilizing ribs.

In an embodiment, at least one first stabilizing rib, e.g. the inner first stabilizing rib, and at least one second stabilizing rib, e.g. the inner second stabilizing rib, are arranged in proximity of the opening in the transverse wall and are connected to the rectilinear portions in proximity of the join to the respective central curved portion of the sealing wall. Under influence of the, preferably light, clamping force of the jaws during the sealing cycle, this arrangement results in a tensile stress in the rectilinear portion between the pointed end and the location of the

connection between the stabilizing rib and the rectilinear portion. This causes a straightening of the clamped rectilinear portion, enhancing sealing quality, e.g. avoiding non-uniform contact between the rectilinear portion and the pouch wall.

In an embodiment, a radius of curvature of the at least one first stabilizing rib, e.g. of each first stabilizing rib, and of the at least one second stabilizing rib, e.g. of each second stabilizing rib, is larger than a radius of a circular opening in the transverse wall. The benefit of a relatively large radius of curvature is that the curved stabilizing ribs provide a desirable combination of flexibility and strength to absorb the clamping forces applied on the attachment portion by sealing jaws during heat sealing.

In a further embodiment, the attachment portion of the spout comprises a first connecting rib, which extends between the outer first stabilizing rib and the inner first stabilizing rib, and a second connecting rib, which extends between the outer second stabilizing rib and the inner second stabilizing rib, wherein the first connecting rib and the second connecting rib each extend in the plane through the first pointed end and the second pointed end. These connecting ribs form a coupling between the respective inner and outer stabilizing ribs and cause the stabilizing ribs to act as a resilient whole when under load of the clamping by the sealing jaws. The provision of the connecting ribs further contributes in enhancing uniformity of contact between the rectilinear portions and the pouch walls. As preferred, the connecting ribs do not extend between the outer stabilizing rib and the neighbouring pointed end.

The tubular neck extends upward from the transverse wall and does not extend downward in between the sealing walls. As a result of the tubular neck not projecting below the transverse wall, no undue ‘dead zones’ are present, in which otherwise substance would remain as a result of not being able to be emptied.

In an embodiment, the spout is made of a plastic mono-material, for example a polyolefin material, such as polyethylene (PE) or polypropylene (PP).

In an embodiment, the outer sealing surface of the first sealing wall and of the second sealing wall are smooth outer sealing surfaces.

In an embodiment, the outer sealing surface of the first sealing wall and of the second sealing wall are smooth outer sealing surfaces and these outer sealing surfaces are each bordered by an inwardly-recessed bottom edge of the sealing wall.

The inwardly-recessed bottom edge extends over a minor portion of the height of the sealing walls.

The bottom edge has a vertical face that is stepped inward from the smooth outer sealing surfaces of the sealing walls.

The inwardly-recessed bottom edges of the sealing walls provide that, when the spout together with the pouch walls is clamped between sealing jaws during a sealing cycle, an open bottomed groove is initially present at the bottom edge of the sealing walls of the spout, between the inwardly-recessed bottom edge and the pouch wall. No clamping force is applied at the height of this groove, since the respective vertical face of the recess is spaced from the pouch wall. When the heat is applied during the sealing cycle, e.g. in an impulse heat sealing process, the smooth outer sealing surfaces of the sealing walls and the pouch walls are locally melted and fused together as a result of the applied heat. As a result of the melting of the contacting areas of the spout and pouch walls, some of the molten plastic material will seek to flow away, e.g. under the influence of the applied clamping force, and will flow into the groove initially formed by the inwardly-recessed bottom edge of the sealing wall.

It is noted that the smooth design of the outer sealing surfaces, enhances this flow towards the inwardly-recessed bottom edge and also does not provide other locations where the molten material seeking to flow away could be collected. As preferred, the front surfaces of the jaws of the sealing device are equally smooth.

It is observed that, with a properly dimensioned inwardly-recessed bottom edge, this flow of molten material will fill-up the recess or groove at the bottom edge of the sealing walls and will even, as preferred, when solidified form a bead of plastic material protruding below bottom edge of the sealing walls, the bead being fused to the pouch wall and to the bottom edge. It is observed that this bead or weld fillet, preferably extending all around the lower periphery of the sealing walls, provides for improved mechanical properties of the seal between the spout and the pouch walls. In particular, the bead allows to enhance the ability to resist sudden shock loads acting on the seal that could result from sudden increase in pressure inside the pouch, for example when a filled pouch accidentally falls and/or is subjected to a drop test.

In embodiments, the sealing walls have a height of about 6 mm.

For impulse heat sealing of the spout, the smooth outer sealing surfaces of the sealing walls are particularly advantageous. Such impulse heat sealing is done so that these smooth outer

sealing surfaces and pouch walls are, preferably lightly, clamped by the jaws and then a brief impulse of heat is created that is transmitted from the front face of the sealing jaws, through the heat sealable film-material pouch walls, to the interface of the pouch wall and the smooth outer sealing surface. Due to the full surface contact between the outer sealing surface and the pouch wall, and preferably also between the front or contact surface of the sealing jaw and the pouch wall, the presence of entrapped air, even in very small volumes, in this heat transfer path is avoided which would otherwise impair the uniformity of impulse type heat transfer. As explained, the structure of the attachment portion contributes to this effect. Also, in the impulse sealing process, a cooling is effected after the heat impulse, yet prior to opening sealing jaws of the sealing device. The provision of smooth outer sealing surfaces enables enhanced conduction of heat from the spout towards cooling features in the sealing jaw (e.g. cooling liquid passed through one or more coolant channels of the sealing jaws), in order to ensure that the spout and the obtained weld with the pouch is cooled rapidly. In the absence of smooth outer sealing surfaces, for example when the outer sealing surfaces would comprise protruding weld lines as explained in US2013/284769, minute air pockets are present in between the pouch wall and the sealing wall of the pouch, which acts as an insulator for the conduction of heat and which also reduces the rate at which the spout can be cooled after sealing.

In an embodiment, the inwardly-recessed bottom edge extends in the vertical direction over minor portion of the height of the sealing walls, for example between 5% and 20% of the height of the sealing walls. In practical embodiments, the height may lie between 0.5 mm and 2 mm, for example 1 mm, whereas an overall height of the attachment portion may be in between 5 mm and 20 mm, for example being 6 mm. Seen in the vertical direction, the inwardly-recessed bottom thus only spans over a minor portion of the height, for example being in between 5% and 20% thereof. Accordingly, the remainder of the height of the sealing walls, for example in between 80% and 95%, is occupied by the smooth outer sealing surface that is to be sealed to the pouch wall.

In an embodiment, a section of the sealing walls above the inwardly-recessed bottom edge is defined as a nominal section of the sealing walls. The sealing walls have a thickness at the inwardly-recessed bottom edge that is smaller than a nominal thickness of the nominal section of the sealing walls. According to this embodiment, as preferred, the sealing walls are thus thinner at the inwardly-recessed bottom edge than in the nominal section of the sealing walls. The inwardly-recessed bottom edge does not bear loads resulting from the clamping force, but is rather configured to receive a flow of some molten plastic during the sealing and to be filled by that flow, preferably so as to form a bead below the bottom edge as discussed

herein. At the inwardly-recessed bottom edges, the sealing walls may be thin in order to save weight for the spout and to reduce the amount of plastic that is required for forming the spout.

In an embodiment, the nominal thickness of the nominal sections of the sealing walls may be in between 1 mm and 2 mm, for example 1,5 mm, wherein the inwardly-recessed bottom edge may have a face that is offset inward between 0.05 mm and 0.2 mm, for example 0.1 mm, relative to the outer faces of the nominal thickness sections of the sealing walls.

In an embodiment the sealing walls may have a nominal thickness between 0.8 mm and 2.2 mm.

In an embodiment, the stabilizing ribs do not project downward beyond the nominal section of the sealing walls. For example, these ribs have a height that corresponds to the height of the nominal section of the sealing walls.

As preferred, the stabilizing ribs are only directly connected to the inside of the nominal sections of the sealing walls and are not directly connected to the inwardly-recessed bottom edge. This may be particularly advantageous due to the fact that only the nominal section of the sealing walls is subject to the clamping forces, as is described above.

Now the second aspect of the invention will be discussed, which has already been discussed above in the context of an embodiment of the spout according to the first aspect of the invention.

The second aspect of the invention also seeks to provide a spout which enhances the quality of the seal that is obtained between the pouch walls and the vertical sealing walls of the spout, and/or enhances the execution of the heat sealing process.

It is an object of the second aspect of the present invention to provide a spout that allows for application of an impulse heat sealing technique to seal the spout between the pouch walls, e.g. to obtain a better quality seal and/or to allow for a shorter duration of the sealing cycle.

It has been observed that spouts embodied, for instance, as disclosed in DE202006013587 and in US2013/284769, are not ideally suited for the impulse heat sealing technique and/or do not provide an optimal seal quality.

According to a second aspect, the present invention provides a spout according to the preamble of claim 13, based on US2013/284769, which is characterized in that the outer sealing surfaces of the first sealing wall and of the second sealing wall are smooth, and in that the outer sealing surfaces of the first sealing wall and of the second sealing wall are each bordered by an inwardly-recessed bottom edge of the respective sealing wall.

So, the second aspect envisages the presence of smooth outer sealing surfaces in combination with these surfaces being bordered, along their lower perimeter, by an inwardly-recessed bottom edge, yet possibly without the presence of any stabilizing ribs, or possibly with one or more stabilizing ribs between the opposed rectilinear portions of the attachment portion, yet not necessarily stabilizing ribs embodied according to the first aspect of the invention.

As already explained above, the inwardly-recessed bottom edges of the sealing walls provide that, when the spout together with the pouch walls is clamped, preferably lightly, between sealing jaws during a sealing cycle, an open bottomed groove is initially present at the bottom edge of the sealing walls of the spout, between the inwardly-recessed bottom edge and the pouch wall. No noticeable clamping force is applied at the height of this groove, since the respective vertical face of the recess is spaced from the pouch wall. When the heat is applied during the sealing cycle, e.g. in an impulse heat sealing process, the smooth outer sealing surfaces of the sealing walls and the pouch walls are locally melted and fused together as a result of the applied heat. As a result of the melting of the contacting surfaces of the spout and pouch walls, some of the molten plastic material will seek to flow away under the influence of the applied clamping force and will flow into the groove initially formed by the inwardly-recessed bottom edge.
It is noted that the smooth design of the outer sealing surfaces, enhances this flow towards the bottom edge and also does not provide other locations where the molten material could be collected. As preferred, the front or contact surface of the jaws of the sealing device are equally smooth.
It is observed that, with a properly dimensioned inwardly-recessed bottom edge, this flow of molten material will fill-up the recess or groove at the bottom edge of the sealing walls and will even, as preferred, when solidified form a bead of plastic material protruding below bottom edge of the sealing walls, the bead being joined to the pouch wall and to the bottom edge. It is observed that this bead, preferably extending all around the lower periphery of the sealing walls, may provide for improved mechanical properties of the seal between the spout and the pouch walls. In particular, the bead allows to enhance the ability to resist sudden

shock loads acting on the seal that could result from sudden increase in pressure inside the pouch, for example when a filled pouch accidentally falls and/or is subjected to a drop test.

Further advantageous embodiments of the spout according to the second aspect of the invention are mentioned in the subclaims, and/or are discussed herein in the context of the first aspect of the invention.

The second aspect also relates to a spout adapted to be heat sealed in a non-bonded region between opposed first and second walls of a pouch, comprising a plastic spout body that has a passage for filling the pouch with a substance and/or for discharging a substance from the pouch,

wherein the spout body comprises:
- an attachment portion having a vertical first plane of symmetry with a vertical first sealing wall and an opposed vertical second sealing wall, which sealing walls each have an upper edge and a bottom edge remote from the upper edge,

wherein each sealing wall has an outer sealing surface, wherein the outer sealing surfaces of the sealing walls are to be heat sealed to a respective one of the pouch walls,

- a tubular neck having a bore that which tubular neck is integral with and extends upwards from the attachment portion, which tubular neck forms at least a portion of the passage,

characterized in that

the outer sealing surface of the first sealing wall and the outer sealing surface of the second sealing wall is smooth,

and in that the outer sealing surfaces of the first sealing wall and of the second sealing wall are each bordered by an inwardly-recessed bottom edge of the sealing wall.

It will be appreciated that the measures according to the first aspect of the invention and according to the second aspect of the invention can be readily combined, e.g. in an embodiment of a spout that is optimal for application of impulse heat sealing, e.g. induction based impulse heat sealing, of the spout in a non-bonded region between opposed walls of a pouch.

The present invention further provides a closure assembly comprising a spout as described herein, e.g. according to any one of claims 1 – 22 and a closure device mounted to the neck of the spout, e.g. a cap and/or a valve, e.g. a self-closing valve. For example, the cap is a screw cap, a quarter-turn cap, a flip-top cap.

The present invention also relates to a pouch packaging configured to contain, or containing, a substance, comprising:
- a collapsible pouch comprising opposed first and second walls made of a heat-sealable film material, defining an interior of the pouch in between the walls, and
- a spout as described herein,
wherein the spout has been positioned, with its attachment portion, in a non-bonded edge region between the opposed first and second walls of the pouch, wherein the first pouch wall has been heat sealed to the outer sealing surface of the first sealing wall of the attachment portion, and wherein the second pouch wall has been heat sealed to the outer sealing surface of the second sealing wall of the attachment portion.

In an embodiment of the pouch packaging a spout according to second aspect of the invention, a groove initially, so prior to fusing, defined by the inwardly-recessed bottom edge of the sealing walls is filled with solidified molten plastic material. More preferably, e.g. in view of strength in a drop test of a filled pouch, a bead of solidified molten plastic material is present under the filled groove initially formed by the inwardly-recessed bottom edge of the sealing walls, which bead is joined to the bottom edge and to the respective pouch wall.

In an embodiment, the heat-sealable film material of the pouch walls is devoid of a metal layer therein. This embodiment, is favoured in combination with the first and/or second aspect of the invention, as sealing can be done at low clamping force so that the metal layer, which commonly provides strength in the pouch wall to avoid damage due to said clamping force is no longer required. This applies in particular to the use of the impulse heat sealing process.

In an embodiment, the heat-sealable film material of the pouch walls is a plastic mono-material, for example of a polyolefin material, for example, polyethylene (PE), preferably linear low-density polyethylene (LLDPE), or polypropylene (PP), or polyethylene terephthalate (PET). According to this embodiment, the film material is made entirely from a single type of polymer. The use of only a single polymer may improve the recyclability of the pouch. The film material may comprises multiple layers of the same polyolefin material, e.g.

with slightly different properties due to treatments to which the layers have been subjected and/or slight variations of the composition.

In an embodiment the spout body is made from the same plastic material as the plastic mono- material of the film of the pouch walls, for example both consisting of a polyolefin material, for example polyethylene (PE) or polypropylene (PP). With the spout being injection moulded from the same polymer as the walls of the pouch, the recycling of the packaging is further enhanced.

The present invention further provides the use of the spout as described herein in a pouch for forming a passage for filling the pouch with a substance and/or for discharging a substance from the pouch.

The present invention further relates to a method for manufacturing a pouch packaging configured to contain a substance, or containing a substance, the method comprising the steps of:

- positioning a spout as described herein with the attachment portion thereof in a non-bonded edge region between opposed first and second walls of the pouch, which pouch walls are made of heat-sealable film material, preferably plastic mono-material film material,
- heat sealing the pouch walls onto the outer sealing surfaces of the sealing walls of the spout using a heat sealing device comprising a first jaw and a second jaw, wherein the heat sealing comprises clamping the first pouch wall with the first jaw of a sealing device onto the outer sealing surface of the first sealing wall, and clamping the second pouch wall with the second jaw onto the outer sealing surface of the second sealing wall, wherein the heat sealing device is operated to provide heat from each of the jaws so as to heat seal the pouch walls onto the outer sealing surfaces of the sealing walls.

In a preferred embodiment, the heat sealing involves an impulse heat sealing cycle, in which cycle:

- initially the first jaw and the second jaw are in an opened position thereof, spaced from the non-bonded region of the pouch in which the spout has been inserted with its attachment portion,
- upon operation of an actuator system the first jaw and second jaw are moved into contact with the respective pouch wall and into a clamped position, so that said pouch walls are clamped, lightly as preferred, onto the outer sealing surface of the first and second sealing wall respectively,

- a heat impulse is generated that is emitted from each of the first and the second jaw, which heat impulses cause the pouch walls and outer sealing surfaces of the spout to be fused with each other,

- after termination of the heat impulse generation, the jaws remain in the clamped positions and a cooling of the spout and pouch walls is effected, preferably as cooling liquid is being circulated through ducts in the jaws, preferably this circulation of cooling liquid being continued during all steps of the impulse heat sealing cycle,

- after said cooling, the first jaw and the second jaw are moved away from each other, into the opened position, for example allowing the pouch with spout to be moved to another processing station, e.g. for filling and/or capping.

In an embodiment, the spout is embodied according to the first aspect of the invention, wherein the clamping by means of the first jaw and the second jaw of the heat sealing device causes a bending of the stabilizing ribs.

In an embodiment, the spout is embodied according to the second aspect of the invention, wherein the inwardly-recessed bottom edges of the sealing walls provide that, when the spout together with the pouch walls is clamped between the first and second jaws, an open bottomed groove is initially present at the bottom edge of the sealing walls of the spout, between the inwardly-recessed bottom edge and the pouch wall, and
wherein, when the heat impulses are generated, the outer sealing surfaces of the sealing walls and the pouch walls are locally melted and fused together,
wherein, as a result of the melting of the contacting surfaces of the spout and pouch walls, some of the molten plastic material flows away and into said groove initially formed by the inwardly-recessed bottom edge,
wherein this flow of molten material fills up said groove initially formed by the inwardly-recessed bottom edge,
wherein, preferably, said flow of molten material also forms, when solidified, a bead of plastic material protruding below bottom edge of the sealing walls, the bead being joined to the pouch wall and to the bottom edge.

In an embodiment, the first and second jaws each comprise:
- a recessed contact face portion defining a recess that is shaped complementary to a half of the attachment portion of the spout that is received therein, preferably, said recessed contact face portion including rectilinear face portions and a central curved face portion of the recess to match the shape of the attachment portion, wherein the first and second pouch walls are,

in the clamped position of the first and second jaws, clamped against the sealing walls of the attachment portion by means of the recessed portion, and
- coplanar face portions on opposite sides of the respective recessed face portion and adjoining said recessed face portion, wherein the first and second pouch walls are, in the clamped positions of the first and second jaws, clamped against one another by means of the coplanar face portions.

In an embodiment, use is made of an impulse heat sealing device, wherein each of the first and second jaws comprises:
- at least one susceptor element comprising electrically conductive material, which extends along a recessed face portion and coplanar face portions of the contact face of the jaw and which is covered by a heat-resistant non-stick covering for contacting the first and second pouch walls in the clamped position of the first and second jaws,
- an inductor which is electrically insulated from the respective susceptor element, wherein the inductor, preferably, comprises an elongated inductor section that extends along a rear side of the respective at least one susceptor element,
wherein the sealing device is configured and operated to perform a sealing cycle, wherein - with the first and second jaws in the clamped positions thereof - a high frequency electric current source of the impulse sealing device is operated to temporarily feed a high frequency electric current to the inductor of each jaw, thereby generating a high frequency electromagnetic field with the inductors, thereby inducing eddy currents in the respective susceptor element with the high frequency electromagnetic field and generating an impulse of heat that is emitted by the susceptor element, which impulses of heat seal the first and second walls to the outer sealing surfaces of the attachment portion of the spout and to each other on opposite sides of the attachment portion. A cooling, after termination of the high frequency electromagnetic field, is performed, e.g. by cooling liquid circulating through one or more ducts in the jaws, whilst the jaws remain in the clamped position.

Induction based impulse heat sealing of a spout is, preferably, done with a spout having an attachment portion with sealing walls having smooth outer sealing surfaces.

Induction based impulse heat sealing is based on generating a high frequency electromagnetic field with an inductor associated with each of the jaws of the sealing device, wherein the electromagnetic field induces eddy currents in a respective susceptor element of the jaw, thereby generating an impulse of heat that is emitted by the susceptor element.

In an embodiment at least one elongated inductor section of the inductor extends at a rear side of at least one susceptor element of the jaw, preferably in close proximity to said rear side, which susceptor element extends along a contoured contact face of the jaw. This provides that the development of heat over the extension of the front of the jaw takes place in an attractive manner, in particular in a rather uniform manner. The elongation of the inductor section contributes to the homogeneity of the current density within the inductor section, e.g. compared to a coiled or another rather irregular shape of an inductor section. This homogeneity translates into homogeneity of the high frequency field, and thereby to homogeneity of the impulse heating of the susceptor element. The latter contributes to a reliable and effective heat sealing. The homogeneity of the heat sealing and the impulse process allow to have a relatively low clamping force, that may effectively only serve to assure an intimate surface contact between the pouch walls and the attachment portion, e.g. so as to exclude any presence of pockets of air between the surfaces to be joined by the heat sealing.

In embodiments, the at least one elongated inductor section is a solid cross-section metal or other, preferably high conductivity material inductor section, e.g. made of copper which is preferred. This arrangement allows to avoid undue variations of current density within the inductor section, and thereby undesirable variation in the generated field, e.g. compared to an internally hollow inductor section. In alternative embodiment, the at least one elongated inductor section is a multi-strand Litz wire. It has been observed that in such embodiment, heating of the Litz-wire may become problematic and cooling is difficult.

In embodiments, the at least one elongated inductor section has a constant cross-section, preferably a solid cross-section, over its length along the contoured front surface of the respective jaw. This design avoids undue variations of current density within the inductor section, which might otherwise occur at locations where the cross-section changes, and thereby undesirable variation in the generated field.

In embodiments, the uniform cross-section elongated inductor section has, seen in a top view onto the jaw, a shape corresponding to the contoured front surface of the jaw and maintains a uniform distance between the susceptor element and the elongated inductor section. This arrangement enhances uniformity of the development of heat in the susceptor element.

In embodiments, the inductor of a jaw comprises multiple elongated inductor sections that are parallel to one another.

In embodiments, the inductor of a jaw comprises multiple elongated inductor sections that extend horizontally and are parallel to one another and are vertically spaced from one another by a horizontal slit, e.g. an air slit or a slit filled with electrically insulating material. In embodiments, there is just one pair of elongated inductor sections that are parallel to one another and vertically spaced from one another by a horizontal slit arranged in proximity of the rear side of the susceptor element.

In embodiments, said slit between neighbouring inductor sections that are arranged above one another has a height between 0.01 and 5 mm, more preferably between 0.1 and 2 mm.

In an embodiment, the inductor of a jaw comprises a pair of parallel inductor sections arranged at the rear side of the susceptor element, the one inductor section above the other inductor section, spaced from one another by an elongated slit, e.g. an air slit or a slit filled with electrically insulating material. In practical embodiments, there is just one pair of inductor section above one another in the jaw.

The presence of the slit between the parallel elongated inductor sections allows for a desirable concentration of the field that is generated by the inductor of the jaw. In an embodiment the susceptor element extends, seen in a view onto the front surface of the jaw, over a horizontal slit between parallel inductor sections.

In an embodiment, the susceptor element, seen in a view onto the front of the jaw, extends over the slit between parallel elongated inductor sections and overlaps in said view with each of the parallel inductor sections.

In an embodiment, the susceptor element is embodied as one strip that extends over the slit between parallel elongated inductor sections and overlaps in said view with each of the parallel inductor section.

In an embodiment, a strip shaped susceptor element has an upper edge and a lower edge defining a height of the strip, preferably said height corresponding to the height of the outer sealing surface of the attachment portion of the spout.
Preferably, the height of the strip is at least 50% of the height of the single pair of inductor sections including the slit that are arranged at the rear of the strip above one another, e.g. between 75% and 125% of said height, e.g. about 100% of said height.

In an embodiment, a strip shaped susceptor element has an upper edge and a lower edge defining a height of the strip, wherein the inductor of a jaw comprises a number of, e.g. multiple, inductor sections that each extend along the rear side of the susceptor element. Herein the height of the strip is preferably at most the same as the height of the number of one or more inductor sections, preferably the upper edge and the lower edge of the strip not protruding above and below the height of the one or more inductor sections.

In an embodiment, the inductor of a jaw is embodied so that in a pair of adjacent and parallel inductor sections that are arranged at the rear side of the susceptor element, the current flows in the same direction through the inductor sections.

In an embodiment, the inductor of a jaw is embodied so that in a pair of adjacent and parallel inductor sections arranged at the rear side of the susceptor element, the current flows in opposite directions through the inductor sections.

In an embodiment, the inductor of a jaw comprises a C-shaped inductor element having parallel first and second inductor sections interconnected, e.g. by a bent portion, in series, wherein the free ends of the inductor sections have terminals for electrical connection to the current source.

In an embodiment, the first and/or second jaw is provided with one C-shaped inductor element, having parallel horizontal first and second elongated inductor sections above one another and interconnected in series, wherein the free ends of the inductor sections have terminals for electrical connection to the current source.

In an embodiment, the inductor of a jaw comprises a C-shaped inductor element having parallel first and second inductor sections interconnected in series and arranged above one another, wherein the inductor sections are separated by a horizontal slit, e.g. an air slit or a slit filled with electrically insulation material.

In an embodiment, the inductor of a jaw comprises multiple, e.g. just two, elongated inductor sections arranged parallel to one another and arranged above one another behind the susceptor element.

In an embodiment, the susceptor element has a height and the inductor of a jaw comprises multiple inductor sections arranged parallel to one another and arranged above one another behind the susceptor element.

In an embodiment, the inductor of a jaw has an inductor element that is generally U-shaped seen from above, wherein each of the first and second elongated inductor sections thereof has a constant cross-section, preferably a solid cross-section, over its length and wherein each of said first and second inductor sections has a shape corresponding to the contoured front surface of the respective jaw when seen in said view from above.

In an embodiment, the at least one elongated inductor section has a thickness of between 1.0 and 4.0 mm, seen perpendicular to the front surface of the jaw, for example between 1.5 and 3.0 mm. The limited thickness of the inductor element enhances the cooling of the jaw, including the conductor of the jaw, e.g. as one or more cooling fluid ducts are preferably arranged in proximity of a rear side of the at least one inductor element.

In an embodiment, the at least one elongated inductor section has a rectangular cross-section with a height that is greater than the thickness of the inductor section. This arrangement allows to limit the thickness, which allows for efficient cooling.

Each jaw may be provided with one or more cooling fluid ducts, e.g. the cooling fluid being a cooling liquid, e.g. water, being passed through the cooling fluid ducts, e.g. using a pump assembly, e.g. a cooling liquid circuit being a closed circuit including a heat exchanger configured to remove heat from the cooling liquid.

In an embodiment, or in combination with cooling by means of cooling liquid, air cooling can be employed for the jaws. Yet, due to the capacity, cooling by means of cooling liquid is preferred. Preferably the cooling liquid is passed in close proximity to the inductor of the jaw, e.g. directly behind the one or more elongated inductor sections. Preferably, no cooling fluid is passed in a region between the inductor and the susceptor as that would unduly increase the distance between them and would impair effectivity of the impulse heating induced by the field. It will be appreciated, that in view of the desired very close proximity of the susceptor element to the front surface of the jaw, there is in practice no space for any cooling duct in said region. So, in practical embodiments, cooling of the jaw is preferably done using a control flow of cooling fluid, e.g. liquid, through one or more ducts that are arranged behind, and preferably in close proximity to, the inductor sections.

In an embodiment, at least one cooling fluid duct extends along the at least one conductor section that extends along the rear side of the susceptor element.

It is preferred for the sealing device to be configured such that cooling of the jaw is active during the entire impulse sealing cycle, so also during the creation of the heat impulse which happens so fast that it is generally not impaired by the cooling. In another configuration the cooling may be interrupted or reduced around the moment of the heat impulse.

The cooling of the jaws may, as preferred, be configured to cause cooling of the heat-sealed region of the pouch walls before the jaws are opened, e.g. the film material and spout being cooled to below 60°C before opening, e.g. to below 40°C.

The cooling of the jaws may, as preferred, be configured to cause cooling of the heat-sealed edge region before the jaws are opened, e.g. the film material and spout being cooled to below the crystallization temperature of the polymer material involved in the join.

A benefit of the cooling is that, before the release from the jaws, the region of the pouch will acquire a strength and rigidity that is greater than in absence of such cooling. This, for instance, may allow for an increased production speed of the machine wherein higher forces may be exerted on the walls of the pouch, e.g. in view of transport of the pouch or string of interconnected pouches through the machine. Undue stretching of the pouch, e.g. in the area of the spout, is preventable to a large degree by use of the invention disclosed herein.

In an embodiment, the susceptor element is made of metal material, e.g. a metal or a metal alloy, e.g. of a thin metal strip.

For example, the susceptor element is made of, or comprises, aluminium, nickel, silver, stainless steel, and/or nickel-chrome.

In an embodiment, the susceptor element is embodied as a strip having opposed front and rear main faces that define the thickness of the strip between them. In an embodiment, the thickness of the susceptor element strip is constant over the extension of the strip.

In an embodiment, the susceptor element is embodied as a planar strip, most preferably the jaw having a single planar strip susceptor element.

In an embodiment, the susceptor element comprises a paramagnetic material, a diamagnetic material, or a ferromagnetic material. Such magnetic materials may be effected by an electromagnetic field, in order to achieve eddy currents that cause the mentioned rapid heating in the impulse sealing technique.

In an embodiment, the susceptor element is a strip, e.g. of a metal, e.g. of aluminium, wherein the height of the strip is between 3 and 10 millimetres, e.g. between 4 and 8 millimeters. For example, as preferred, the strip has a constant height over its length.

Preferably, the susceptor element strip lacks apertures over its extension.

In an embodiment, the jaw is provided with a single continuous susceptor element embodied as a strip, e.g. of metal.

In an embodiment, the susceptor element, e.g. embodied as a strip, has a thickness of between 0.01 and 5 mm, preferably between 0.05 and 2 mm, more preferably between 0.08 and 0.8 mm, e.g. of between 0.3 and 0.5 mm. In general, it is considered desirable to have a minimum thickness of the susceptor element in view of the desire to rapid cool the jaw, including the inductor and the susceptor, after termination of the heat impulse. A thin design of the susceptor, contributes to this desire. It is noted that, in contrast to the impulse sealing device addressed in the introduction, no electric current from a current source is passed through the susceptor, so the cross-section need not be designed to deal with such a current flow.

In an embodiment, the jaw is provided with a single continuous susceptor element embodied as a strip, e.g. of metal, having a height of the strip between 3 and 10 millimetres, e.g. between 4 and 8 millimeters, and a thickness of between 0.08 and 0.8 mm, e.g. of between 0.3 and 0.5 mm. For example, the strip is made of aluminium material.

In embodiments, the frequency of the alternating electric current supplied to the inductor is between 250 KHz and 750 KHz.

In an embodiment, a jaw is embodied such that the high frequency electromagnetic field generated by the inductor primarily causes the very rapid development of heat within a frontal skin layer of the susceptor element due to the so-called skin effect. The skin effect is the tendency of an alternating electric current to become distributed within a conductor such that the current density is largest near the surface of the conductor and decreases, exponentially, with greater depths of the conductor. At high frequencies the skin depth becomes smaller. This depth may, for example, be 0.15 mm for an aluminium susceptor element if the frequency of the field is 350 KHz. The thickness of the susceptor element is envisaged to be more than this skin depth, yet not too much for the reason addressed herein.

In another embodiment of the impulse heat sealing device, as described in the introduction, impulse heat sealing involves temporarily passing an electric current through a resistor band in each of the jaws of the sealing device so as to generate an impulse of heat that is emitted by the resistor band.

A third aspect of the invention relates to a method of production of a pouch packaging, wherein a spout is heat sealed in a non-bonded region between opposed first and second walls of a pouch, the spout comprising a plastic spout body that has a passage for filling the pouch with a substance and/or for discharging a substance from the pouch,

wherein the spout body comprises:

- an attachment portion having a first vertical plane of symmetry, a vertical first sealing wall, and an opposed vertical second sealing wall, and with a transverse wall which is integral with an upper edge of the first sealing wall and with an upper edge of the second sealing wall, wherein the first sealing wall and the second sealing wall each depend from said transverse wall and each have a bottom edge remote from the upper edge,

wherein each sealing wall has an outer sealing surface, wherein the outer sealing surfaces of the sealing walls are to be heat sealed to a respective one of the pouch walls,

wherein each sealing wall is, seen in a bottom view of the attachment portion, composed of a first rectilinear portion, a central curved portion, and a second rectilinear portion,

wherein the second rectilinear portion of the first sealing wall is integrally connected to the first rectilinear portion of the second sealing wall at a first pointed end of the attachment portion to define an acute angle between them,

wherein the second rectilinear portion of the second sealing wall is integrally connected to the first rectilinear portion of the first sealing wall at a second pointed end of the attachment portion to define an acute angle between them,

wherein the transverse wall has an opening therein,

- a tubular neck having a bore that adjoins the opening in the transverse wall, which tubular neck is integral with and extends upwards from the transverse wall, which tubular neck together with the opening in the transverse wall forms the passage,

wherein the heat sealing of the pouch walls onto the outer sealing surfaces of the sealing walls of the spout is performed with a heat sealing device comprising a first jaw and a second jaw, wherein the heat sealing comprises clamping the first pouch wall with the first jaw of a sealing device onto the outer sealing surface of the first sealing wall, and clamping the second pouch wall with the second jaw onto the outer sealing surface of the second sealing wall, wherein the heat sealing device is operated to provide heat from each of the jaws so as to heat seal the pouch walls onto the outer sealing surfaces of the sealing walls,

characterized in that

use is made of an induction based impulse heat sealing device, wherein each of the first and second jaws comprises:
- at least one susceptor element comprising electrically conductive material, e.g. one susceptor element dimensioned corresponding to the outer sealing surface of the sealing wall, e.g. as a single elongated metallic strip, which susceptor element extends at least along a recessed face portion, said recessed contact face portion including rectilinear face portions and a central curved face portion of the recess corresponding to the attachment portion, and preferably also along coplanar face portions of the front face of the jaw, and which susceptor element is covered by a heat-resistant covering for contacting the first and second pouch walls in the clamped position of the first and second jaws,
- an inductor which is electrically insulated from the respective susceptor element, wherein, preferably, the inductor comprises an elongated inductor section that extends along a rear side of the respective at least one susceptor element,

and in that the induction based impulse heat sealing device is configured and operated to perform a sealing cycle, wherein - with the first and second jaws in the clamped positions thereof - a high frequency electric current source of the impulse sealing device is operated to temporarily feed a high frequency electric current to the inductor of each jaw, thereby generating a high frequency electromagnetic field with each of the inductors, thereby inducing eddy currents in the respective susceptor element with the high frequency electromagnetic field and generating an impulse of heat that is emitted by the susceptor element, which impulses of heat seal the first and second walls to the outer sealing surfaces of the attachment portion of the spout and, preferably, also to each other on opposite sides of

the attachment portion, e.g. in a top seam of a pouch, and wherein, after termination of the high frequency electromagnetic field, a cooling is effected, e.g. by cooling liquid circulating through one or more ducts in the jaws, whilst the jaws remain in the clamped position, and wherein the jaws are brought into said opened position once the cooling is completed.

The third aspect of the invention is based on the insight that the described induction based impulse heat sealing is advantageous for sealing a spout having the so-called diamond shape attachment portion between the pouch walls. In particular, the presence of the rectilinear portions in the sealing walls of the spout, with a complementary shaped recess in the front of the jaws also having rectilinear face portions and a central curved face portion, is advantageous in view of the desired to achieve uniformity of full surface contact between the jaws and the pouch wall, in particular in the area of the susceptor element, and between the pouch wall and the outer sealing surface of the attachment portion of the spout. Preferably, the contoured front faces of the two jaws as well as the outer sealing surfaces of the attachment portion of the spout are smooth. In particular, this approach avoids entrapment of air, even with a low or even minimal clamping force of the jaws, providing the related benefits as discussed herein. The induction based heat impulse sealing allows for optimal uniformity of the heat created in the susceptor element. This is in particular true for a design wherein the inductor extends along the rear of the susceptor element.

It will be appreciated, that in the context of the third aspect of the invention, it is possible, or even preferred, to include one or more of the measures according to the first aspect and/or the second aspect of the invention and/or as otherwise described herein. For example, the heat-sealable film material is preferably of a single polymer.

The third aspect of the invention also relates to an induction based impulse heat sealing device configured to perform the above method.

The invention will be explained below, with reference to embodiments, which are displayed in the appended drawings. In the drawings:

Figure 1 shows an embodiment of a spout according to the invention,

Figure 2A shows the spout of figure 1 from another angle,

Figure 2B shows the attachment portion and part of the neck of the spout of figure 1,

Figure 3 shows a bottom view of the spout of figure 1,

Figures 4A and 4B respectively illustrate a spout having straight stabilizing ribs and a simulation with clamping forces applied thereon,

Figures 5A and 5B respectively illustrate the spout of figure 1 and a simulation with clamping forces applied thereon,

Figure 6A shows a bottom perspective view on the spout of figure 1,

Figure 6B shows a magnification of the encircled area A-A in figure 6A,

Figure 7A illustrates in a cross-sectional view the second aspect of the invention,

Figure 7B shows a detail of figure 7A on a larger scale,

Figure 7C shows another detail of figure 7A on a larger scale,

Figure 8 illustrates the use of an embodiment of an induction based impulse heat sealing device according to the invention,

Figure 9 schematically shows the susceptor element and inductor of figure 8,

Figure 10 schematically shows the electromagnetic field generated by the jaw of figure 8 and the interaction with the susceptor element,

Figure 11 illustrates schematically the operation of a continuous motion impulse heat sealing device.

Throughout the figures, the same reference numerals are used to refer to corresponding components or to components that have a corresponding function.

The figures illustrate an embodiment of the spout according to the present invention, indicated with reference numeral 1. The spout 1 is adapted to be heat sealed in a non-bonded region between opposed first and second walls of a collapsible pouch.

The spout 1 has a plastic spout body that is made as a single by injection-moulding, for example of polyethylene (PE) material or polypropylene (PP).

The spout body is generally comprised of an attachment portion and a tubular neck.

The attachment portion 10 has an outer contour that is commonly identified as a so-called 'diamond' shape, when seen from below. The structure will be discussed in more detail below.

The attachment portion 10 has a first vertical plane of symmetry M' with a vertical first sealing wall 11 and an opposed vertical second sealing wall 12, and with a transverse wall 20 which is integral with an upper edge of the first sealing wall 11 and with an upper edge of the second sealing wall 12. The first sealing wall and the second sealing wall each depend from the transverse wall 20 and each have a bottom edge 114 remote from the upper edge.

Each sealing wall 11, 12 has one outer sealing surface 110, 120. These outer sealing surfaces 110, 120 of the sealing walls are to be heat sealed to a respective one of the pouch walls.

In practical embodiments, as illustrated, each outer sealing surface 110, 120 forms one continuous elongated area with, preferably parallel, upper and lower borders extending from one pointed end 13 to the other pointed end 14 of the attachment portion 10.

Each sealing wall 11, 12 is, seen in a bottom view of the attachment portion 10, composed of a first rectilinear portion, a central curved portion, and a second rectilinear portion. In more detail, the first sealing wall 11 is composed of a first rectilinear portion 111, a central curved portion 113, and a second rectilinear portion 112, which are integrally interconnected end to end. Similarly, the second sealing wall 12 is composed of a first rectilinear portion 121, a central curved portion 123, and a second rectilinear portion 123, which are integrally interconnected end to end as well.

The second rectilinear portion 112 of the first sealing wall 11 is integrally connected to the first rectilinear portion 121 of the second sealing wall 12 at a first pointed end 13 of the attachment portion 10 to define an acute angle between them.

The second rectilinear portion 122 of the second sealing wall 12 is integrally connected to the first rectilinear portion 111 of the first sealing wall 11 at a second pointed end 14 of the attachment portion 10 to define an acute angle between them.

The transverse wall 20 extends generally horizontally, so generally perpendicular to the walls 11, 12. The transverse wall 20 has a diamond shape that corresponds to the shape of the sealing walls 11, 12.

The transverse wall 20 has an opening 21 therein, that is located in the center between the opposed curved portions of the sealing walls. In practical embodiments, as here, the opening 21 is circular.

In practical embodiments, as shown here, the attachment portion 10 has a second vertical plane of symmetry M'' that is perpendicular to the first plane of symmetry M'. As shown here, preferably, the second plane M'' extends through the center of the opening 21.

The relative size of the curved portions 113, 123 may be varied, e.g. smaller so that the rectilinear portions of the sealing walls become relatively longer.

The spout body further has a tubular neck 30 having a bore 31 therein. The bore 31 in the neck 30 adjoins the opening 21 in the transverse wall 20. The tubular neck 30 is integral with and extends upwards from the transverse wall 20. The bore 31 of the neck together with the opening 21 in the transverse wall forms a passage P for filling the pouch with a substance and/or for discharging a substance from the pouch.

A central vertical axis C-C of the tubular neck 30 is arranged here on the intersection line between the first plane of symmetry M' and the second plane of symmetry M''.

The tubular neck 30 only extends away from the transverse wall 20 in the upward direction V and does not extend in between the first sealing wall 11 and the second sealing wall 12, that is beneath the transverse wall 20.

It is illustrated here that the neck 30 is provided with a thread 32 to accommodate a screw cap thereon, e.g. as shown in WO2018194454. Other designs of closure assemblies include the inventive spout are also envisaged, e.g. snap caps, quarter turn caps, e.g. as in WO2018034562, or more complex embodiments, e.g. as disclosed in WO2017053228, WO2017135824.

As illustrated the attachment portion 10 further comprises:
- at least one first stabilizing rib 15, here ribs 151, 152, extending between associated connection points to the second rectilinear portion 112 of the first sealing wall 11 and to the first rectilinear portion 121 of the second sealing wall 12, and
- at least one second stabilizing rib 16, here ribs 161, 162, between associated connection points to the first rectilinear portion 111 of the first sealing wall 11 and to the second rectilinear portion 122 of the second sealing wall 12.

As illustrated, seen in a bottom view of the attachment portion as in figure 3, the at least one first stabilizing rib 15 is, between the associated connection points, curved toward the first pointed end 13, and the at least one second stabilizing rib 16 is, between the associated connection points, curved toward the second pointed end 14.

The at least one first stabilizing rib 15 here consists of an inner first stabilizing rib 151, disposed adjacent to the opening 21, and an outer first stabilizing rib 152, disposed closer to the first pointed end 13.

The at least one second stabilizing rib 16 here consists of an inner second stabilizing rib 161, disposed adjacent to the opening 21, and an outer second stabilizing rib 162, disposed closer to the second pointed end 14.

As discussed the number of curved stabilizing ribs can be different, e.g. just one curved stabilizing rib between opposed rectilinear portions of the sealing walls or with three or four such ribs instead of the depicted two ribs.

It is illustrated that the curved stabilizing ribs 15,151,152,16,161,162 form the sole stabilizers between the opposed sealing walls 11, 12.

The inner stabilizing ribs 151,161 have a continuous curvature over the length thereof, curved towards the first pointed end 13 and second pointed end 14, respectively. This means that the central portion of the inner stabilizing ribs 151, 161 does not lie on a straight line between its respective connection points to the first sealing wall 11 and to second sealing wall 12. Also the outer stabilizing ribs 152, 162 are curved towards the respective pointed end 13, 14.

The stabilizing ribs are integral at their upper end to the transverse wall 20.

As shown, in practical embodiments, the curved stabilizing ribs have a greater height than their thickness.

It is illustrated, as is optional, that the radius of curvature of the outer stabilizing ribs 152, 162 is larger than the radius of curvature of the inner stabilizing ribs 151, 162. This difference in curvature between the ribs of each set of stabilizing ribs, may be provided in order to achieve that the outer stabilizing rib is relatively stiff under clamping load of the sealing jaws compared to the inner stabilizing rib.

It is illustrated, as is practically preferred, that the radius of curvature of all of the stabilizing ribs is larger than the radius of the circular opening 21 in the transverse wall 20, e.g. at least in the non-deformed state of the spout 1, when no clamping force is applied thereon.

The attachment portion 10 of the spout 1 further comprises a first connecting rib 153, which extends between the inner first stabilizing rib 151 and the outer first stabilizing rib 152. In particular, the first connecting rib 153 is connected to a central portion of the inner first stabilizing rib 151 and a central portion of the outer first stabilizing rib 152. Similarly, the attachment portion 10 comprises a second connecting rib 163, which is connected to a central portion of the inner second stabilizing rib 161 and a central portion of the outer second stabilizing rib 162. Both connecting ribs 153, 163 are located in the first plane of symmetry M', so on a straight line between the first pointed end 13 and the second pointed end 14.

As illustrated, in practical embodiments, the connecting ribs 153, 163 have their upper end integral with the transverse wall.

As illustrated, in practical embodiments, the connecting ribs 153, 163 have a lower height than the stabilizing ribs.

It is noted that, in an embodiment with just one first curved stabilizing rib and just one second curved stabilizing rib, e.g. the inner stabilizing ribs, a connecting rib could be present that connects to the central portion of the curved rib and to the transverse wall so as to provide additional support in the center of the curved rib.

With reference to the figures 4A – 5B, the working principle of the curved stabilizing ribs according to the first aspect of the invention is discussed.

Figure 4A shows the attachment portion and part of the neck of a spout 201 that is presented here to illustrate an embodiment wherein the stabilizing ribs are straight, similar to the mentioned prior art design. The attachment portion of the spout is of the so-called diamond shape and has two sealing walls 211, 212. The spout 201 further comprises straight stabilizing ribs 215, 216 between opposed rectilinear portions of the sealing walls 211, 212.

The spout 201 has been modelled by means of a finite element analysis (FEA). The figure 4A indicates clamping forces F, F' that would be exerted by jaws of a heat sealing device, and which are modelled to act on both sealing walls of the spout 201.

In figure 4B, the resulting deformation of sealing wall of the spout 201 is illustrated. It is visible that within each rectilinear portion of the sealing walls significant differences in the degree of deformation occur. The reference numerals 202, 203, 204, 205 denote zones

where hardly any deformation under a clamping load, that is a relatively light clamping load as preferred, occurs, with the remainder of the sealing wall denoted by 206 showing a fair degree of deformation. These significant local variations in deformation of the sealing walls due to clamping are undesired, since they give rise to uneven sealing between the sealing walls of the spout and the pouch walls. Furthermore, the variations in deformation may result in localized stress concentrations that could cause failure of the spout.

In figure 5A, the attachment portion and part of the neck of the spout 1 of figure 1 has been modelled, onto which the same clamping forces F, F' have been modelled. It is shown in figure 5B that the corresponding deformation of the sealing walls nearly uniform over the entire outer sealing surface, including over the rectilinear portions thereof. Only very minor zones 250, 251 show no deformation. The majority of the outer surface of the sealing walls of the spout according to the first aspect of present invention is thus evenly deformed, as indicated in red.

As explained herein, the effect shown in figure 5B is the result of resilient bending of the curved stabilizing ribs under the influence of the clamping force. As a result of this bending, the connection points of these ribs are subjected to a resulting force in the plane of the sealing walls and in a direction away from the respective pointed end. In figure 5A, these resulting forces R are displayed. These resulting forces R effect tensile stresses in the sealing walls and provide the result that the rectilinear portions become elongated and straightened.

As shown the outer sealing surfaces of the first sealing wall 11 and of the second sealing wall 12 are each embodied as a smooth outer sealing surface, so lacking any relief that would lead to entrapment of air, e.g. lacking weld lines, etc.

These smooth outer sealing surfaces 110,120 are each bordered along their lower perimeter by an inwardly-recessed bottom edge 114, 115 of the sealing wall 11, 12. A vertical face of the edge 114, 115 is stepped inward of the vertical outer sealing surface 110, 120.

It is shown that the inwardly-recessed bottom edges 114, 115 together extend along the entire bottom periphery of both sealing walls 11, 12 to form a peripheral inwardly-recessed bottom edge of the attachment portion 10.

It is shown that the inwardly-recessed bottom edge 114, 115 extends in vertical direction over a minor portion of the height of the respective sealing wall 11, 12. For example, the

edge 114, 115 extends over between 5% and 20% of the height of the sealing wall and/or over a height between 0.5 mm and 2 mm, e.g. over about 0.8 to 1.5 mm.

A section of each of the sealing walls 11, 12 above the inwardly-recessed bottom edge 114 is defined as a nominal section 116 of the sealing wall. It is shown, e.g. in figure 6B, that the sealing walls each have a thickness “t” of the inwardly-recessed bottom edge thereof that is smaller than a nominal thickness “T” of the nominal section 116 of the sealing wall. In the present embodiment, the thickness “t” of the inwardly-recessed bottom edge 114 is between 80% and 95% of the nominal thickness “T”.

It is illustrated that the thickness “t” of the inwardly-recessed bottom edge of the sealing walls is between 0.05 mm and 0.2 mm less than the nominal thickness “T”, e.g. approximate 0.1 mm.

It is illustrated the at least one first stabilizing rib 15 and the at least one second stabilizing rib 16 do not project downwardly beyond the nominal section 116 of the sealing walls 11, 12.

In figure 6B, a magnification of the encircled area A-A in figure 6A is displayed. Figure 6B shows part of the first sealing wall 11 of the attachment portion 10. In particular, figure 6B shows the central curved portion 113 of the first sealing wall 11.

It is shown in figure 6B that the first sealing wall 11 has the inwardly-recessed bottom edge 114. The second sealing wall 12 has a similar inwardly-recessed bottom edge, although this is not visible in the figures.

The inwardly-recessed bottom edge 114 extends over a portion h’ of the overall height H of the first sealing wall 11. As preferred and illustrated, this portion h’ lies in between 5% and 20% of the overall height H, for example having a height in between 0.5 mm and 2 mm, whereas the overall height H may be in between 5 mm and 20 mm.

A portion h of the height of the first sealing wall 11 above the inwardly-recessed bottom edge 114, is furthermore defined as the nominal section 116 of the first sealing wall 11 that forms the outer sealing surface 110. The height h of the nominal section 116 is, in the present embodiment, in between 75% and 95% of the overall height H of the first sealing wall 11.

The inwardly-recessed bottom edge 114 is, seen from the outer sealing surface 110 of the nominal section 116 of the first sealing wall 11, set in an inward direction

At the inwardly-recessed bottom edge 114, the first sealing wall has a thickness t that is smaller than a nominal thickness T at the nominal section 116 of the first sealing wall 11.

Referring to figure 6A, it is shown that the ribs 151, 152, 153, 161, 162, 163 do not project over the entire height of the sealing walls 11, 12, but only over the nominal sections of the sealing walls 11, 12. The stabilizing ribs here have a height that corresponds to the height h of the nominal sections of the sealing walls 11, 12.

Figures 7A - C are now discussed, in particular to elucidate the second aspect of the invention.

The figure 7A shows the spout 1 in cross-section, here in the second plane of symmetry M''. Also depicted, yet with an exaggerated thickness, are a first pouch wall 101 and a second pouch wall 102. The figure 7A further illustrates two sealing jaws 210, 220 of a heat sealing device applied to heat seal the pouch walls onto the attachment portion 10 of the spout.

For the purpose of the following discussion, the figure 7A illustrates on the left, and in the enlargement of figure 7B, that the first sealing wall 11 has not yet been sealed against the first pouch wall 101, but is lightly clamped into contact by means of jaw 210. The figure 7A illustrates on the right, and in the enlargement of figure 7C, that the second sealing wall 12 has been sealed against the second pouch wall 102.

For the purpose of discussion, and as preferred, it is assumed herein that the sealing device is an impulse heat sealing device. Contrary to common heat sealing devices having continuously heated jaws, the jaws 210, 220 are configured and operated to create a brief heat impulse and subsequent cooling whilst the jaws 210, 220 are in the clamped position.

Figure 7C and the left-hand part of figure 7A illustrate the clamped position of the jaws 210, 2020, preferably lightly clamped, wherein the inwardly-recessed bottom edge 114 defines an initially present groove “G” directly below the smooth outer sealing surface. This groove “G” is effectively formed between the inward offset vertical face of the edge 114 and the pouch wall, which pouch wall 101 is in full surface contact with the smooth outer sealing surface of the sealing wall.

As discussed, and as preferred, the front or contact surface of the sealing jaws 210, 220 have a complementary shape so as to achieve intimate full surface contact between the jaws and the pouch walls, and between the pouch walls and the smooth outer sealing surfaces.

In general terms, when the heat impulses are generated by means of the jaws 210, 220, the outer sealing surfaces of the sealing walls and the pouch walls are locally melted and fused together. As a result of the melting of the contacting surfaces of the spout and pouch walls, assisted by the clamping force, some of the molten plastic material flows away and into the groove “G” initially formed by the inwardly-recessed bottom edge 114.

This flow of molten material fills up the groove “G” that is initially formed by the inwardly-recessed bottom edge 114. The figure 7C illustrates that, as preferred, herein this escaping flow of molten material also forms, when solidified, a bead 103 of plastic material that protrudes below the bottom edge 114 of the sealing walls 11, 12. It is shown that this bead 103 is joined both to the pouch wall and to the bottom edge 114.

As explained, the formation of the bead 103 contributes to the strength of the seal, e.g. when tested in the drop test of a liquid filled pouch.

As explained, the effect illustrated in figure 7A-C is enhanced when the structure of the first aspect of the invention is applied in the spout, yet that is not a necessity. As discussed, this effect may also be achieved when the spout has another design of the one or more stabilizing ribs, e.g. straight as in the mentioned prior art. One could even envisage a completely different structure of the attachment portion, as long as the sealing walls 11, 12 have the smooth outer sealing surfaces border by the inwardly-recessed bottom edge.

As discussed, the jaws 210, 220 could include an elongated, impulse heatable resistor band that extends along the contoured front surface of the jaw and is covered by a heat-resistant non-stick covering, e.g. a Teflon tape. The heat impulse is then generated by briefly passing an electric current through the band, which is done with the jaws in clamped position. A cooling down is then allowed, or forced, e.g. by passing coolant through one or more ducts 216 in the jaws. The coolant could be circulated continuously through the jaws, as that does not impair the generation of the heat impulse.

In an embodiment illustrated in figure 7A, use is made of an impulse heat sealing device, wherein each of the first and second jaws comprises:

- at least one susceptor element 212, 222 comprising electrically conductive material, which extends along a recessed face portion and coplanar face portions of the contact or front face of the jaw 210, 220 and which is covered by a heat-resistant non-stick 213, 223 covering for contacting the first and second pouch walls in the clamped position of the first and second jaws,
- an inductor 211, 221 which is electrically insulated from the respective susceptor element 212, 222, wherein, preferably, the inductor comprises an elongated inductor section that extends along a rear side of the respective at least one susceptor element.

This sealing device is configured and operated to perform a sealing cycle, wherein - with the first and second jaws 210, 220 in the clamped positions thereof - a high frequency electric current source of the impulse sealing device is operated to temporarily feed a high frequency electric current to the inductor 211, 221 of each jaw, thereby generating a high frequency electromagnetic field with the inductors, thereby inducing eddy currents in the respective susceptor element 212, 222 with the high frequency electromagnetic field and generating an impulse of heat that is emitted by the susceptor element, which impulses of heat seal the first and second walls 101, 102 to the outer sealing surfaces of the attachment portion 10 of the spout and to each other on opposite sides of the attachment portion 10, e.g. in a top seam of a pouch. A cooling, after termination of the high frequency electromagnetic field, is performed, e.g. by cooling liquid circulating through one or more ducts 216 in the jaws, whilst the jaws 210, 220 remain in the clamped position.

In figure 8, an embodiment of an induction based impulse heat sealing device 200 is displayed schematically, partially in exploded-view, along with a pouch 100 and spout 1 that has already been sealed in the upper edge region of the pouch 100.

The sealing device 200 comprises:
- a first jaw 210 and a second jaw 220,
- an actuator device, here with actuator 201 for jaw 210 and actuator 202 for jaw 220, configured to move the first and second jaws 210, 220 relative to one another between an opened position and a clamped position,
- a cooling device 300 configured to cool each of the first and second jaws 210, 220.

The first jaw 210 has a first contoured front surface configured to contact the edge region of a respective first wall 101 of the pouch.

The second jaw 220 has a second contoured front surface configured to contact the edge region of a respective second wall 102 of the pouch.

The first and second contoured front surfaces each have a recessed face portion defining a recess R configured to receive therein a half of the attachment portion 10 of the spout 1.

The first and second contoured front surfaces each define, on opposite sides of the respective recessed face and adjoining said recessed face, coplanar face portions.

The recessed face is shaped to match the shape of the attachment portion 10 of the spout 1 and is composed of a central curved face portion between adjoining rectilinear face portions.

Each of the first and second jaws 210, 220 comprises at the respective contoured front surface thereof one single elongated, impulse heatable member 212, 222 that extends along the recessed face portion and the coplanar face portions of the respective front surface and that is covered by a heat-resistant non-stick covering (not shown in figure 8 for clarity).

The device is configured to perform an impulse sealing cycle as discussed herein, so that the spout 1 is sealed in the upper edge region and, as preferred, the entire upper edge region of the pouch 100 is hermetically sealed.

In the cycle, the actuator device 201, 202 is configured to bring the first and second jaws 210, 220 into the clamped position, so that - in the edge region - the first and second walls 101, 102 are clamped against the attachment portion 10 by the recessed faces in the front of the first and second jaws and so that - in the edge region - the first and second walls 101, 102 on opposite sides of the spout 1 are clamped against one another by the coplanar faces of the first and second jaws 210, 220.

Each impulse heatable member is a susceptor element 212, 222 comprising electrically conductive material. Each susceptor element has a rear side facing away from the respective contoured front surface of the jaw.

Each of the first and second jaws 210, 220 comprises an inductor 211, 221 which is electrically insulated from the respective susceptor element 212, 222. The inductors each comprises an elongated inductor section, here one pair of inductor sections, that extends along the respective contoured front surface at the rear side of the respective susceptor element.

The induction based heat sealing device further comprises a high frequency alternating electric current source 250, which is connected to the inductor 211, 221 of each of the first and second jaws 210, 220. In an embodiment, both the inductors 211, 212 are connected to one and the same source 250.

The device is configured to perform an impulse sealing cycle. Once the jaws 210, 220 have been moved into the clamped position as indicated above, the electric current source 250 is operated to temporarily feed a high frequency electric current to the inductors 211, 221. This generates a high frequency electromagnetic field by means of the inductors. In turn the high frequency electromagnetic field induces eddy currents in the respective susceptor element 212, 222 generating an brief and vehement impulse of heat that is emitted by the susceptor element 212, 222. These impulses of heat seal the edge region of the walls 101, 102 to the sealing faces of the attachment portion 10 and to each other in the portions of the upper edge region.

So the device is temporarily energizes the susceptor elements 212, 222 on the basis of induction, so as to generate an impulse of heat that is emitted by each of the elements 212, 222.

The first and second jaws 210, 220, at least the susceptor elements 212, 222 thereof, cool down after termination of the energizing assisted therein by operation of the cooling device 300.

The actuator device 201, 202 is configured to move the first and second jaws 210, 220 into the opened position after the cooling down has taken place in satisfactory manner.

It is shown in figures 8 and 9, that in each jaw 210, 220 there is just one pair of elongated inductor sections 221a, b that extend horizontally, are parallel to one another, and are vertically spaced from one another by a horizontal slit 221c. The pair of inductor sections is arranged in proximity of the rear side of the susceptor element.

In an embodiment, the elongated inductor section 221a, b is made from a metal, e.g. of copper.

It is shown in figures 8 and 9, that the at least one elongated inductor section 221a,b is a solid cross-section metal or other, preferably high conductivity material inductor section, e.g.

made of copper which is preferred. This arrangement allows to avoid undue variations of current density within the inductor section, and thereby undesirable variation in the generated field, e.g. compared to an internally hollow inductor section.

It is shown in figures 8 and 9, that the at least one elongated inductor section 221a,b has a constant cross-section, preferably a solid cross-section, over its length along the contoured front surface of the respective jaw. This design avoids undue variations of current density within the inductor section, which might otherwise occur at locations where the cross-section changes, and thereby undesirable variation in the generated field.

It is shown in figures 8 and 9, that the uniform cross-section elongated inductor section 221a, b has, seen in a top view onto the jaw, a shape corresponding to the contoured front surface of the jaw and maintains a uniform distance between the susceptor element 222 and the elongated inductor section 221a,b. This arrangement enhances uniformity of the development of heat in the susceptor element.

The horizontal slit 221c can be air slit or a slit filled with electrically insulating material.

In embodiments, said slit 221c between neighbouring inductor sections 221a, b that are arranged above one another has a height between 0.01 and 5 mm, more preferably between 0.1 and 2 mm.

The presence of the slit 221c between the parallel elongated inductor sections 221a, b allows for a desirable concentration of the field that is generated by the inductor of the jaw onto the susceptor element 222. This is illustrated in figure 10.

In figure 11, the impulse heat sealing of edge regions of a first pouch wall 101 and of a second pouch wall 102, with a spout 1 in between them, is displayed schematically by means of steps (a) – (e).

In the displayed embodiment, the heat sealing device 200 comprises a first jaw 210 and a second jaw 220. During the production of the spouted pouches, the pouch or the pouch walls that are to be formed into a pouch, is/are moved continuously in a transportation direction (TR), from left to right in figure 11.

In the depicted embodiment, the jaws of the device 200 are configured to move along with the pouch walls 101, 102 in the transportation direction (TR), at least during the sealing cycle.

The sealing cycle starts with a step (a), shown on the left side of figure 11. The first jaw 210 and the second jaw 220 are initially in an opened position and spaced from the pouch walls 101, 102. These walls have a non-bonded, here upper, region, between them, with the spout 1 having been inserted with its attachment portion 10 in this opened region.

Upon operation of a first actuator device 201, the first jaw 210 is moved towards its clamping position, wherein the first jaw 210 comes in contact with the first pouch wall 101 and clamps, preferably lightly, the wall onto the corresponding outer sealing surface. Similarly, the second jaw 220 is moved towards its first contact position by a second actuator device 202, such that the second jaw 220 comes in contact with the second pouch wall 102 and clamps, preferably lightly, the wall onto the corresponding outer sealing surface. The spout 1 is now clamped, lightly as preferred, as no significant pressure is involved in the impulse heat sealing process, in between the first pouch wall 101 and the second pouch wall 102 and within the contour recesses in the front faces of the jaws.

Next, during step (b), the jaws 210, 220 remain in the clamped position and move along with the pouch walls 101, 102. Step (b) is an impulse sealing step, during which the heat impulse is generated. Here, as preferred, an electromagnetic field is created by means of the first inductor 211 and the second inductor 221, in order to induce eddy currents in the susceptor elements 212, 222, which generates respective heat impulses emitted by these elements 212, 222.

Under the influence of the brief heat impulses, the first pouch wall 101 and the second pouch wall 102 are locally fused with each other and with the spout 1 in between them, in order to heat seal the pouch walls 101, 102 to the spout attachment portion 10 and to fuse the pouch walls 101, 102 against each other next to the portion 10.

During step (c), the heat impulses have terminated as the inductors are no longer energized, but the jaws 210, 220 remain in their clamped positions. Cooling liquid is being circulated through the ducts 216 in the jaws 210, 220. Preferably, this supply of cooling liquid is continued during all steps (a) – (e) of the process. Accordingly, heat is removed from the fused areas as well.

Once cooling is sufficient, during step (d), the first jaw 210 and the second jaw 220 are moved away from each other, into the opened position.

As such, the pouch 100 provided with the spout 1 may be taken over by a further handling device, to allow for further processing thereof, such as filling of the pouch and/or closing of the pouch by application of a closure on the neck of the spout, etc. Upon moving them away from each other, the jaws 210, 220 again become spaced.

Finally, during step (e), the first jaw 210 and the second jaw 220 are moved back towards their initial position. This movement may take place in a direction opposite to the transportation direction (T), in order to effect that the jaws 210, 220 become arranged in their initial positions, similar as on the onset of step (a).

After moving the jaws 210, 220 back during step (e), the impulse heat sealing cycle is repeated, starting with step (a) again.

It will be appreciated that the path of the jaws 210, 220 can be of any suitable shape, e.g. circular, oval, linear, etc.

# C O N C L U S I E S

1. Spout (1) ingericht om met warmte te worden gesealed in een niet-verbonden gebied tussen tegenovergelegen eerste en tweede wanden (101, 102) van een pouch, omvattende een kunststof spoutlichaam met een doorgang voor het met substantie vullen van de pouch en/of het uit de pouch legen van een substantie,

waarbij het spoutlichaam omvat:

- een bevestigingsgedeelte (10) met een eerste symmetrievlak (M'), een verticale eerste sealwand (11), en een tegenovergelegen verticale tweede sealwand (12), en met een dwarswand (20) die integraal is met een bovenrand van de eerste sealwand (11) en met een bovenrand van de tweede sealwand (12), waarbij de eerste sealwand en de tweede sealwand elk afhangen vanaf de dwarswand en elk een onderrand (114, 115) hebben die op afstand is gelegen van de bovenrand,

waarbij elke sealwand een buitenste sealoppervlak (110, 120) omvat, waarbij de buitenste sealoppervlakken van de sealwanden met warmte dienen te worden gesealed aan een respectieve van de pouchwanden,

waarbij elke sealwand (11, 12), gezien in een onderaanzicht op het bevestigingsgedeelte, is gevormd door een eerste rechtlijnig gedeelte (111, 121), een gekromd middengedeelte (113, 123), en een tweede rechtlijnig gedeelte (112, 122),

waarbij het tweede rechtlijnige gedeelte (112) van de eerste sealwand integraal is verbonden met het eerste rechtlijnige gedeelte (121) van de tweede sealwand aan een eerste puntig uiteinde (13) van het bevestigingsgedeelte, om daartussen een scherpe hoek te vormen,

waarbij het tweede rechtlijnige gedeelte (122) van de tweede sealwand integraal is verbonden met het eerste rechtlijnige gedeelte (111) van de eerste sealwand aan een tweede puntig uiteinde (14) van het bevestigingsgedeelte, om daartussen een scherpe hoek te vormen,

waarbij de dwarswand (20) een opening (21) daarin heeft,

- een buisvormige nek (30) met een boring (31) die aansluit op de opening (21) in de dwarswand, waarbij de buisvormige nek integraal is met en zich opwaarts uitstrekt vanaf de dwarswand, waarbij de buisvormige nek samen met de opening in de dwarswand de

doorgang (P) vormt,

waarbij het bevestigingsgedeelte (10) verder omvat:

- ten minste een eerste stabilisatierib die zich uitstrekt tussen verwante verbindingspunten naar het tweede rechtlijnige gedeelte van de eerste sealwand en naar het eerste rechtlijnige gedeelte van de tweede sealwand, en
- ten minste een tweede stabilisatierib tussen verwante verbindingspunten naar het eerste rechtlijnige gedeelte van de eerste sealwand en naar het tweede rechtlijnige gedeelte van de tweede sealwand,

**met het kenmerk dat,** gezien in een onderaanzicht op het bevestigingsgedeelte,

- de ten minste ene eerste stabilisatierib (15, 151, 152) tussen de verwante verbindingspunten is gekromd naar het eerste puntige uiteinde, en
- de ten minste ene tweede stabilisatierib (16, 161, 162) tussen de verwante verbindingspunten is gekromd naar het tweede puntige uiteinde.

2. Spout volgens conclusie 1, waarbij de buitenste sealoppervlakken (110, 120) gladde buitenste sealoppervlakken zijn om te worden gesealed aan een respectieve van de pouchwanden (101, 102).

3. Spout volgens een van de voorgaande conclusies, waarbij de ten minste ene eerste stabilisatierib omvat of bestaat uit:

- een binnenste eerste stabilisatierib (151), die zich naast de doorgang (P) bevindt,
- een buitenste eerste stabilisatierib (152), die zich dichter bij het eerste puntige uiteinde (13) bevindt, en

waarbij de ten minste ene tweede stabilisatierib omvat of bestaat uit:

- een binnenste tweede stabilisatierib (161), die zich naast de doorgang (P) bevindt,
- een buitenste tweede stabilisatierib (162), die zich dichter bij het tweede puntige uiteinde (14) bevindt.

4. Spout volgens een van de voorgaande conclusies, waarbij ten minste een eerste stabilisatierib, bijvoorbeeld de binnenste eerste stabilisatierib (151), en ten minste een tweede stabilisatierib, bijvoorbeeld de binnenste tweede stabilisatierib (161), in de nabijheid van de opening (21) in de dwarswand zijn aangebracht en zijn verbonden met de rechtlijnige gedeeltes in de nabijheid van een aansluiting op het respectieve gekromde middengedeelte van de sealwand (11, 12).

5. Spout volgens een van de voorgaande conclusies, waarbij een kromtestraal van de ten minste ene eerste stabilisatierib, bijvoorbeeld van elke eerste stabilisatierib (15, 151,

152), en van de ten minste ene tweede stabilisatierib, bijvoorbeeld van elke tweede stabilisatierib (16, 161, 162), groter is dan een straal van een cirkelvormige opening (21) in de dwarswand.

6. Spout volgens een van de voorgaande conclusies, verder omvattende een eerste verbindingsrib (153), die zich uitstrekt tussen een buitenste eerste stabilisatierib (152) en een binnenste eerste stabilisatierib (151), en een tweede verbindingsrib (163), die zich uitstrekt tussen een buitenste tweede stabilisatierib (162) en een binnenste tweede stabilisatierib (161), waarbij de eerste verbindingsrib en de tweede verbindingsrib zich elk uitstrekken in het eerste symmetrievlak (M').

7. Spout volgens een van de voorgaande conclusies, waarbij de buitenste sealoppervlakken (110, 120) van de eerste sealwand en van de tweede sealwand elk zijn uitgevoerd als een glad buitenste sealoppervlak, en waarbij deze gladde buitenste sealoppervlakken (110, 120) elk zijn begrensd door een binnenwaarts versprongen onderrand (114, 115) van de sealwand (11, 12).

8. Spout volgens conclusie 7, waarbij de binnenwaarts versprongen onderranden (114, 115) zich uitstrekken langs de gehele onderomtrek van beide sealwanden (11, 12) om een binnenwaarts versprongen onderomtreksrand te vormen.

9. Spout volgens conclusie 7 of 8, waarbij de binnenwaarts versprongen onderrand (114, 115) zich in verticale richting uitstrekt over een klein gedeelte van de hoogte van de respectieve sealwand (11, 12), bijvoorbeeld tussen 5% en 20% van de hoogte van de sealwand en/of over een hoogte van tussen 0.5 mm en 2 mm.

10. Spout volgens een van de conclusies 7 – 9, waarbij een gedeelte van elk van de sealwanden boven de binnenwaarts versprongen onderrand is gedefinieerd als een nominaal deel (116) van de sealwand, en waarbij de sealwanden elk een dikte (t) hebben bij de binnenwaarts versprongen onderrand ervan, die kleiner is dan een nominale dikte (T) van het nominale deel van de sealwand.

11. Spout volgens conclusie 10, waarbij de dikte (t) van de binnenwaarts versprongen onderrand van de sealwanden tussen 0.05 mm en 0.2 mm kleiner is dan de nominale dikte (T).

12. Spout volgens conclusie 10 of 11, waarbij de ten minste ene eerste stabilisatierib (15, 151, 152) en de ten minste ene tweede stabilisatierib (16, 161, 162) benedenwaarts niet uitsteken voorbij het nominale deel (116) van de sealwand.

13. Spout (1) ingericht om met warmte te worden gesealed in een niet-verbonden gebied tussen tegenovergelegen eerste en tweede wanden (101, 102) van een pouch, omvattende een kunststof spoutlichaam met een doorgang voor het met substantie vullen van de pouch en/of het uit de pouch legen van een substantie,

waarbij het spoutlichaam omvat:

- een bevestigingsgedeelte (10) met een eerste symmetrievlak (M'), een verticale eerste sealwand (11), en een tegenovergelegen verticale tweede sealwand (12), en met een dwarswand (20) die integraal is met een bovenrand van de eerste sealwand (11) en met een bovenrand van de tweede sealwand (12), waarbij de eerste sealwand en de tweede sealwand elk afhangen vanaf de dwarswand (20) en elk een onderrand (114, 115) hebben die op afstand is gelegen van de bovenrand,

waarbij elke sealwand een buitenste sealoppervlak (110, 120) omvat, waarbij de buitenste sealoppervlakken van de sealwanden met warmte dienen te worden gesealed aan een respectieve van de pouchwanden,

waarbij elke sealwand (11, 12), gezien in een onderaanzicht op het bevestigingsgedeelte, is gevormd door een eerste rechtlijnig gedeelte, een gekromd middengedeelte, en een tweede rechtlijnig gedeelte,

waarbij het tweede rechtlijnige gedeelte van de eerste sealwand integraal is verbonden met het eerste rechtlijnige gedeelte van de tweede sealwand aan een eerste puntig uiteinde van het bevestigingsgedeelte, om daartussen een scherpe hoek te vormen,

waarbij het tweede rechtlijnige gedeelte van de tweede sealwand integraal is verbonden met het eerste rechtlijnige gedeelte van de eerste sealwand aan een tweede puntig uiteinde van het bevestigingsgedeelte, om daartussen een scherpe hoek te vormen,

waarbij de dwarswand (20) een opening (21) daarin heeft,

- een buisvormige nek (30) met een boring (31) die aansluit op de opening (21) in de dwarswand, waarbij de buisvormige nek integraal is met en zich opwaarts uitstrekt vanaf de dwarswand, waarbij de buisvormige nek samen met de opening in de dwarswand de doorgang (P) vormt,

**met het kenmerk dat**

het buitenste sealoppervlak (110) van de eerste sealwand en het buitenste sealoppervlak (120) van de tweede sealwand glad is,

en dat waarbij deze buitenste sealoppervlakken (110, 120) van de eerste sealwand en van de tweede sealwand elk zijn begrensd door een binnenwaarts versprongen onderrand (114, 115) van de sealwand (11, 12).

14. Spout volgens conclusie 13, waarbij de binnenwaarts versprongen onderranden (114, 115) zich uitstrekken langs de gehele onderomtrek van beide sealwanden en een binnenwaarts versprongen onderomtreksrand vormen.

15. Spout volgens conclusie 13 of 14, waarbij de binnenwaarts versprongen onderrand (114, 115) zich in verticale richting uitstrekt over een klein gedeelte van de hoogte van de respectieve sealwand (11, 12), bijvoorbeeld tussen 5% en 20% van de hoogte van de sealwand en/of over een hoogte van tussen 0.5 mm en 2 mm.

16. Spout volgens een van de conclusies 13 – 15, waarbij een gedeelte van elk van de sealwanden boven de binnenwaarts versprongen onderrand is gedefinieerd als een nominaal deel (116) van de sealwand, en waarbij de sealwanden elk een dikte (t) hebben bij de binnenwaarts versprongen onderrand ervan, die kleiner is dan een nominale dikte (T) van het nominale deel van de sealwand.

17. Spout volgens conclusie 16, waarbij de dikte (t) van de binnenwaarts versprongen onderrand van de sealwanden tussen 0.05 mm en 0.2 mm kleiner is dan de nominale dikte (T).

18. Spout volgens een van de conclusies 13 – 17, waarbij het bevestigingsgedeelte (10) verder omvat:

- ten minste een eerste stabilisatierib (15, 151, 152) die zich uitstrekt tussen verwante verbindingspunten naar het tweede rechtlijnige gedeelte van de eerste sealwand en naar het eerste rechtlijnige gedeelte van de tweede sealwand, en
- ten minste een tweede stabilisatierib (16, 161, 162) tussen verwante verbindingspunten naar het eerste rechtlijnige gedeelte van de eerste sealwand en naar het tweede rechtlijnige gedeelte van de tweede sealwand.

19. Spout volgens conclusie 18, waarbij, gezien in een onderaanzicht op het bevestigingsgedeelte,

- de ten minste ene eerste stabilisatierib (15, 151, 152) tussen de verwante verbindingspunten is gekromd naar het eerste puntige uiteinde, en

- de ten minste ene tweede stabilisatierib (16, 161, 162) tussen de verwante verbindingspunten is gekromd naar het tweede puntige uiteinde.

20. Spout volgens conclusie 18 of 19, waarbij de ten minste ene eerste stabilisatierib omvat of bestaat uit:
- een binnenste eerste stabilisatierib (151), die zich naast de doorgang bevindt,
- een buitenste eerste stabilisatierib (152), die zich dichter bij het eerste puntige uiteinde (13) bevindt, en
waarbij de ten minste ene tweede stabilisatierib omvat of bestaat uit:
- een binnenste tweede stabilisatierib (161), die zich naast de doorgang bevindt,
- een buitenste tweede stabilisatierib (162), die zich dichter bij het tweede puntige uiteinde (14) bevindt.

21. Spout volgens een van de conclusies 18 – 20, waarbij ten minste een eerste stabilisatierib, bijvoorbeeld de binnenste eerste stabilisatierib, en ten minste een tweede stabilisatierib, bijvoorbeeld de binnenste tweede stabilisatierib, in de nabijheid van de opening (21) zijn aangebracht in de dwarswand en zijn verbonden met de rechtlijnige gedeeltes in de nabijheid van een hechting aan het respectieve gekromde middengedeelte van de sealwand.

22. Spout volgens een van de conclusies 18 – 21, verder omvattende een eerste verbindingsrib (153), die zich uitstrekt tussen een buitenste eerste stabilisatierib en een binnenste eerste stabilisatierib, en een tweede verbindingsrib (163), die zich uitstrekt tussen een buitenste tweede stabilisatierib en een binnenste tweede stabilisatierib, waarbij de eerste verbindingsrib en de tweede verbindingsrib zich elk uitstrekken in het eerste symmetrievlak.

23. Een afsluitsamenstel omvattende een spout volgens een van de conclusies 1 – 22 en een afsluitinrichting die aan de nek van de spout is bevestigd, bijvoorbeeld een dop en/of een klep.

24. Een pouchverpakking die is ingericht om een substantie te bevatten, of een substantie bevat, omvattende:
- een samenvouwbare pouch omvattende tegenovergelegen eerste en tweede wanden (101, 102) die zijn vervaardigd van een met warmte sealbaar foliemateriaal, die een inwendige van de pouch definieert tussen de wanden, en
- een spout (1) volgens een van de voorgaande conclusies 1 – 22,
waarbij de spout, met diens bevestigingsgedeelte (10), is gepositioneerd in een niet-verbonden gebied tussen de tegenovergelegen eerste en tweede wanden (101, 102) van

de pouch, waarbij de eerste pouchwand met warmte is gesealed aan het buitenste sealoppervlak van de eerste sealwand van het bevestigingsgedeelte, en waarbij de tweede pouchwand met warmte is gesealed aan het buitenste sealoppervlak van de tweede sealwand van het bevestigingsgedeelte.

25. Verpakking volgens conclusie 24, waarbij de spout (1) tenminste is uitgevoerd volgens conclusie 13, waarbij een groef (G) die initieel is gedefinieerd tussen de binnenwaarts versprongen onderrand (114, 115) van elk van de sealwanden (11, 12) is gevuld met gestold gesmolten kunststofmateriaal.

26. Verpakking volgens conclusie 25, waarbij een rups (103) van gestold gesmolten kunststofmateriaal aanwezig is beneden de groef (G) die initieel is gevormd door de binnenwaarts versprongen onderrand (114, 115) van de sealwanden (11, 12), waarbij de rups is versmolten met de onderrand (114, 115) en met de respectieve pouchwand (101, 102).

27. Verpakking volgens een van de conclusies 24 – 26, waarbij het met warmte sealbare foliemateriaal van de pouchwand (101, 102) een kunststof-monomateriaal is, bijvoorbeeld een polyolefine materiaal, bijvoorbeeld polyethyleen (PE), bij voorkeur lage-dichtheid polyethyleen (LLDPE) of polypropyleen (PP).

28. Verpakking volgens een van de conclusies 24 – 27, waarbij het spoutlichaam is vervaardigd van hetzelfde kunststofmateriaal als het kunststof-monomateriaal van de folie van de pouchwanden (101, 102), bijvoorbeeld beide bestaande uit een polyolefine materiaal, bijvoorbeeld polyethyleen (PE) of polypropyleen (PP).

29. Gebruik van een spout (1) volgens een van de conclusies 1 – 22 in een pouch voor het vormen van een doorgang voor het met substantie vullen van de pouch en/of het uit de pouch legen van een substantie.

30. Werkwijze voor het vervaardigen van en pouchverpakking die is ingericht om een substantie te bevatten, of die een substantie bevat, waarbij de werkwijze de stappen omvat van:

- het met diens bevestigingsgedeelte (10) positioneren van een spout (1) volgens een van de conclusies 1 – 22 in een niet-verbonden gebied tussen de tegenovergelegen eerste en tweede wanden van de pouch, waarbij de pouchwanden (101, 102) zijn vervaardigd van een met warmte sealbaar foliemateriaal, bij voorkeur een kunststof-monomatariaal foliemateriaal,
- het met warmte op de buitenste sealoppervlakken (110, 120) van de sealwanden van de spout sealen van de pouchwanden, gebruik makende van een warmte-

sealinrichting omvattende een eerste bek en een tweede bek, waarbij het warmte-sealen het met de eerste bek (210) van een sealinrichting op het buitenste sealoppervlak (110) van de eerste sealwand klemmen van de eerste pouchwand omvat, en het met de tweede bek (220) op het buitenste sealoppervlak (120) van de tweede sealwand klemmen van de tweede pouchwand omvat, waarbij de warmte-sealinrichting (200) wordt aangestuurd om warmte te voorzien vanuit elk van de bekken (210, 220) om de pouchwanden met warmte te sealen op de buitenste sealoppervlakken van de sealwanden.

31. Werkwijze volgens conclusie 30, waarbij het met warmte sealen een impulswarmte-sealcyclus betreft, waarbij in de cyclus:

- aanvankelijk de eerste bek (210) en de tweede bek (220) in hun geopende posities zijn, op afstand van het niet-verbonden gebeid van de pouch waarin de spout (1) is gestoken met dies bevestigingsgedeelte (10),
- bij bediening van een actuatorsysteem (201, 202) de eerste bek (210) en de tweede bek (220) naar in contact met de respectieve pouchwand worden bewogen in een geklemde positie, zodat de pouchwanden (101, 102) worden geklemd, bij voorkeur licht geklemd, op het buitenste sealoppervlak (110, 120) van de respectievelijke eerste en tweede sealwand (110, 120),
- een warmte-impuls wordt opgewekt die wordt uitgestraald vanuit de eerste en de tweede bek (210, 220), waarbij de warmte-impulsen de pouchwanden en de buitenste sealoppervlakken (110,120) van de spout met elkaar laten versmelten,
- na beëindiging van de warmte-impuls, de bekken (210, 220) in de geklemde posities blijven en koeling van de spout en de pouchwanden wordt bewerkstelligd, bij voorkeur waarbij koelvloeistof wordt gecirculeerd door een of meer kanalen (216) in de bekken, waarbij bij voorkeur deze circulatie wordt doorgevoerd tijdens alle stappen van de impulswarmte-sealcyclus,
- na het koelen, de eerste bek (210) en de tweede bek (220) van elkaar weg worden bewogen, naar de geopende positie, waarbij, bijvoorbeeld, wordt toegelaten dat de pouch met spout wordt bewogen naar een ander verwerkingsstation, bijvoorbeeld voor vullen en/of van een dop voorzien.

32. Werkwijze volgens conclusie 30 of 31, waarbij de spout (1) tenminste volgens conclusie 1 is, en waarbij het klemmen door middel van de eerste bek (210) en de tweede bek (220) van de warmte-sealinrichting een buiging van de gekromde stabilisatieribben (15, 151, 152, 16, 161, 162) veroorzaakt.

33. Werkwijze volgens conclusie 31, waarbij de spout (1) tenminste volgens conclusie 13 is, waarbij de binnenwaarts versprongen onderranden (114, 115) van de sealwanden (11,

12) bewerkstelligen dat, wanneer de spout tezamen met de pouchwanden is geklemd tussen de eerste en tweede bekken (210, 220), een van onderen open groef (G) initieel aanwezig is aan de onderrand van de sealwanden van de pouch, tussen de binnenwaarts versprongen onderrand en de pouchwand, en

waarbij, wanneer de warmte-impulsen worden opgewekt, de buitenste sealoppervlakken (110, 120) van de sealwanden en de pouchwanden (101, 012) worden gesmolten en met elkaar worden versmolten,

waarbij, als gevolg van het smelten van de contactoppervlakken van de spout en de pouchwanden, een gedeelte van het gesmolten kunststofmateriaal wegstroomt en in de groef (G) stroomt die initieel is gevormd door de binnenwaarts versprongen onderrand, waarbij deze stroom van gesmolten materiaal de groef (G) die initieel is gevormd door de binnenwaarts versprongen onderrand (114, 115) opvult,

waarbij, bij voorkeur, de stroom van gesmolten materiaal ook, wanneer gestold, een rups (103) van kunststofmateriaal vormt die beneden de onderrand (114, 115) van de sealwanden uitsteekt, waarbij de rups is gehecht aan de pouchwand en aan de onderrand.

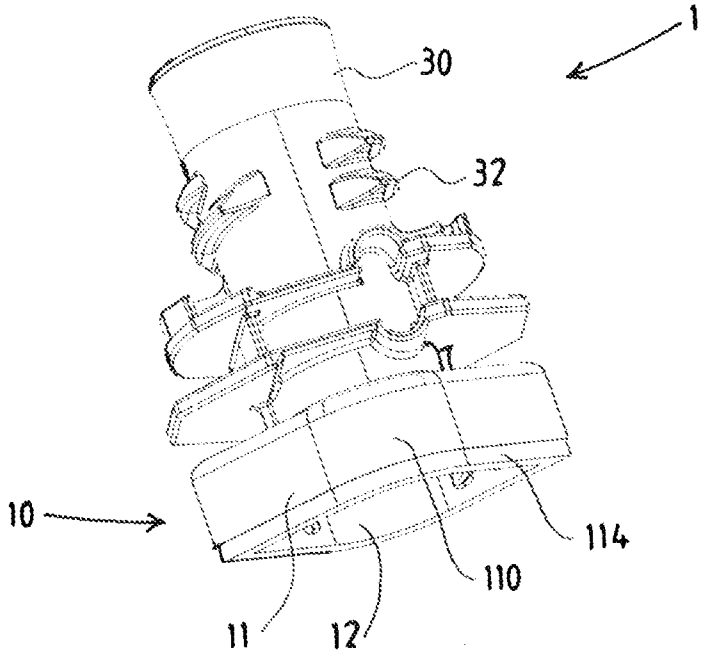



Fig.1

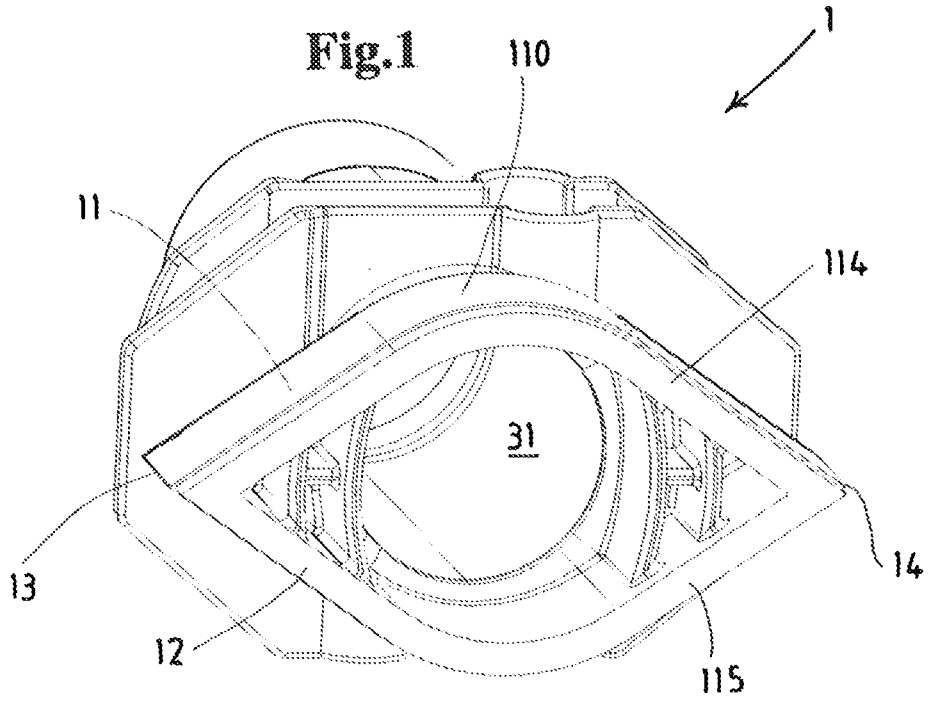



Fig.2a

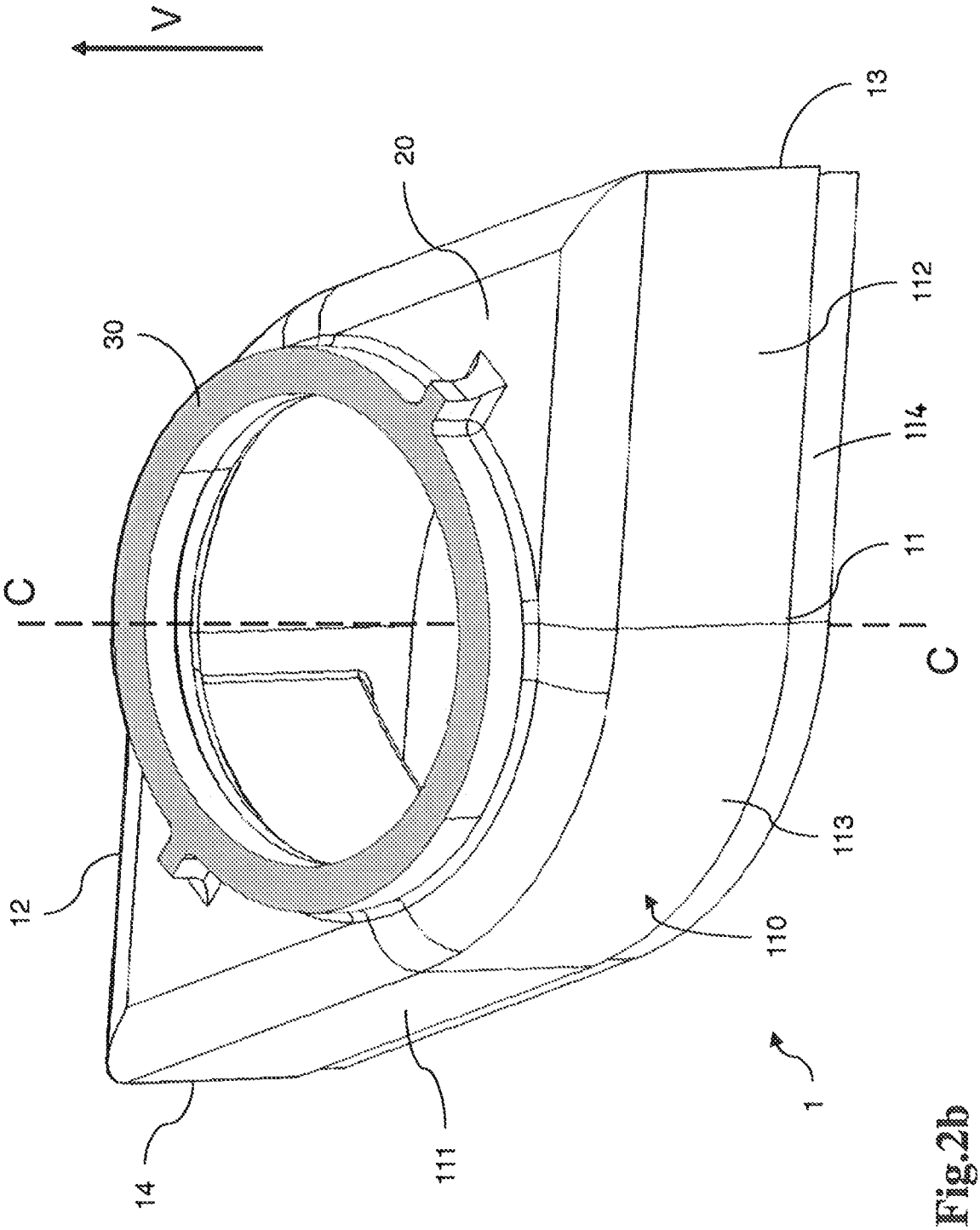



Fig.2b

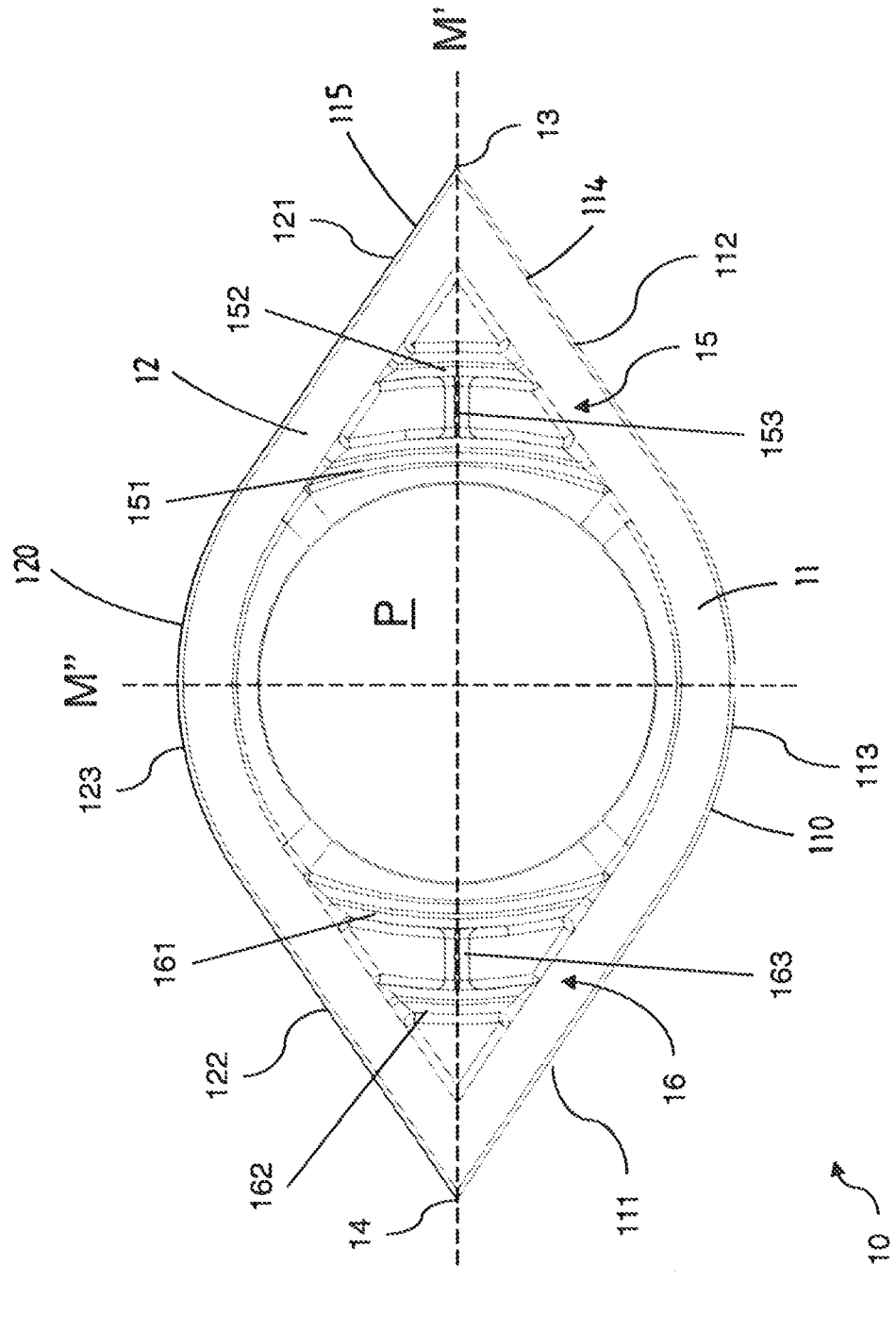

M'
115
13
121
114
112
152
15
12
153
151
120
P
11
M''
123
113
110
161
163
122
16
162
14
111
10

Fig.3

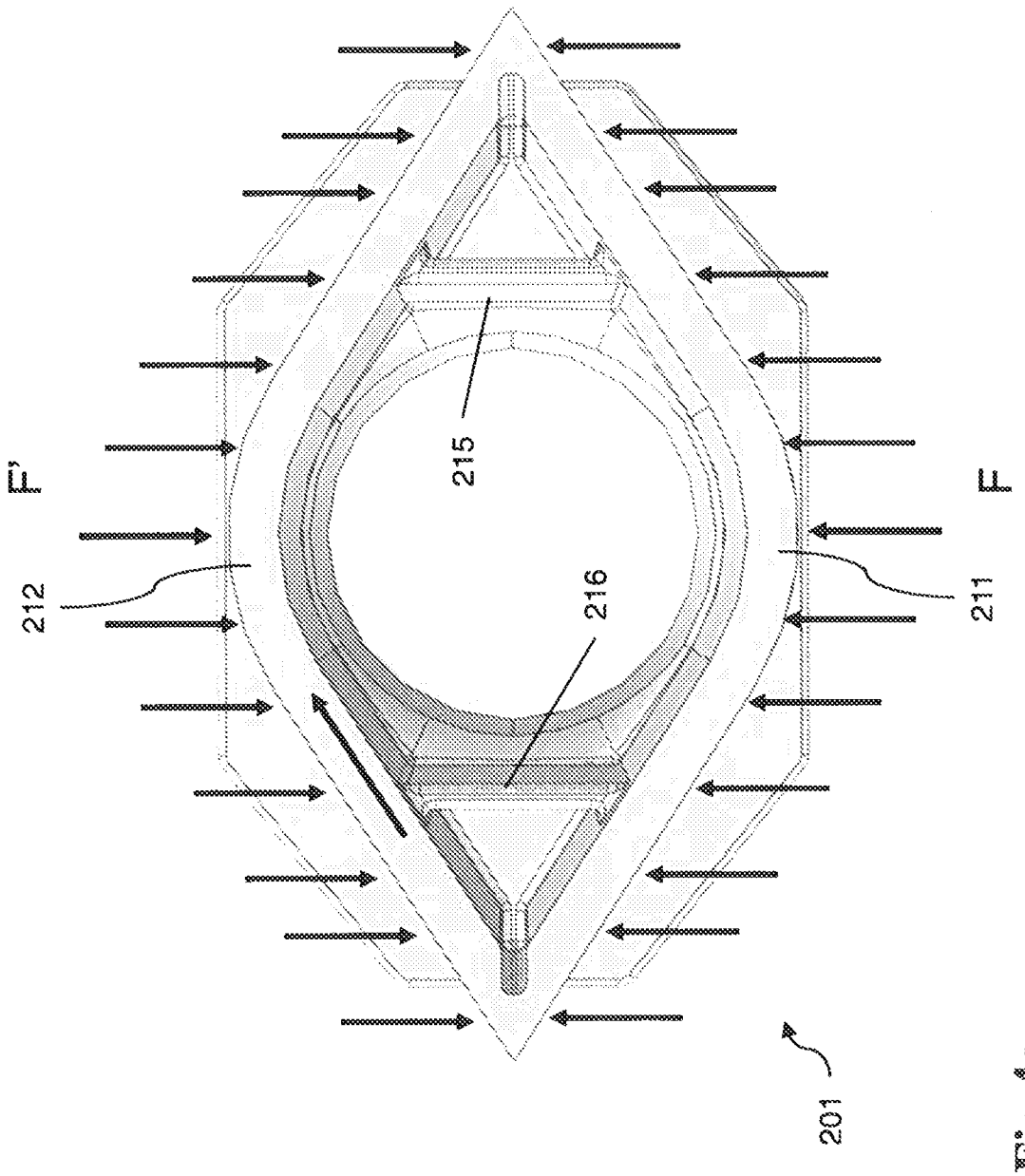



Fig.4a

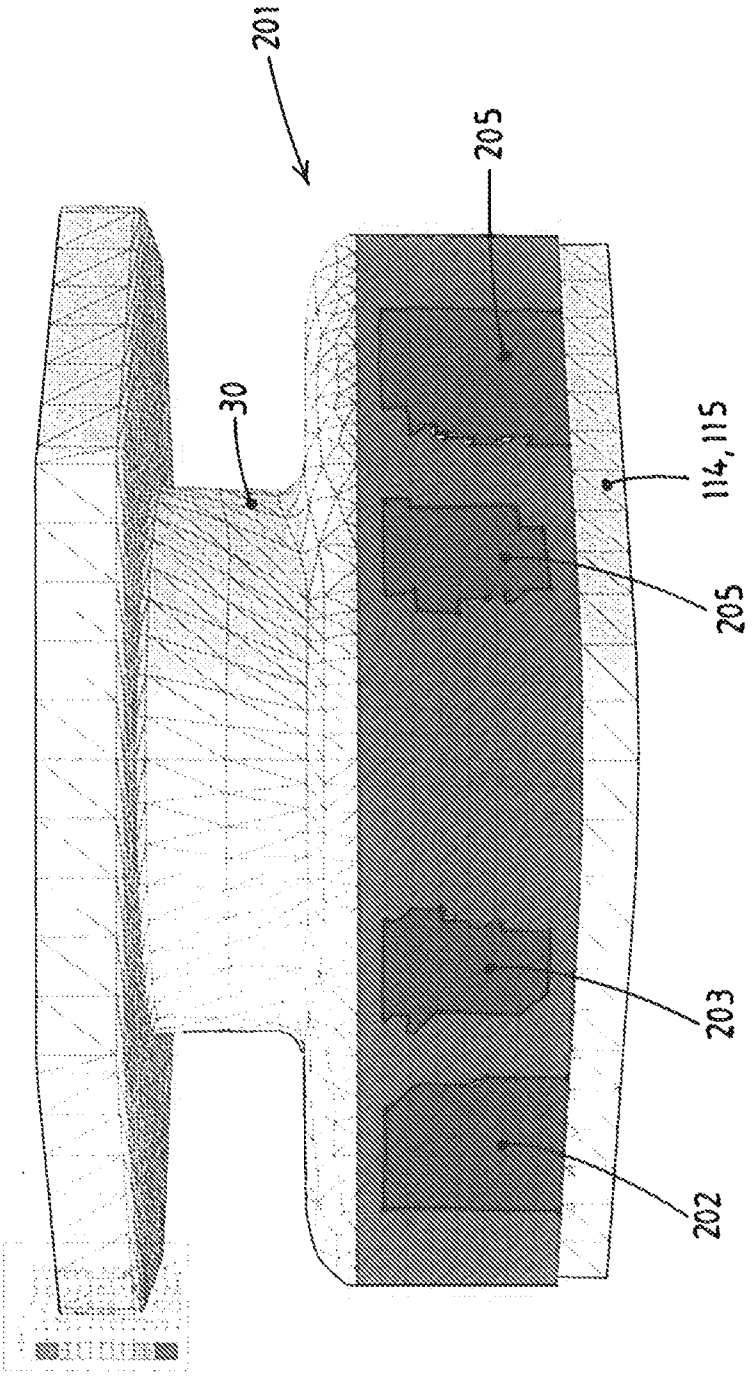



Fig.4b

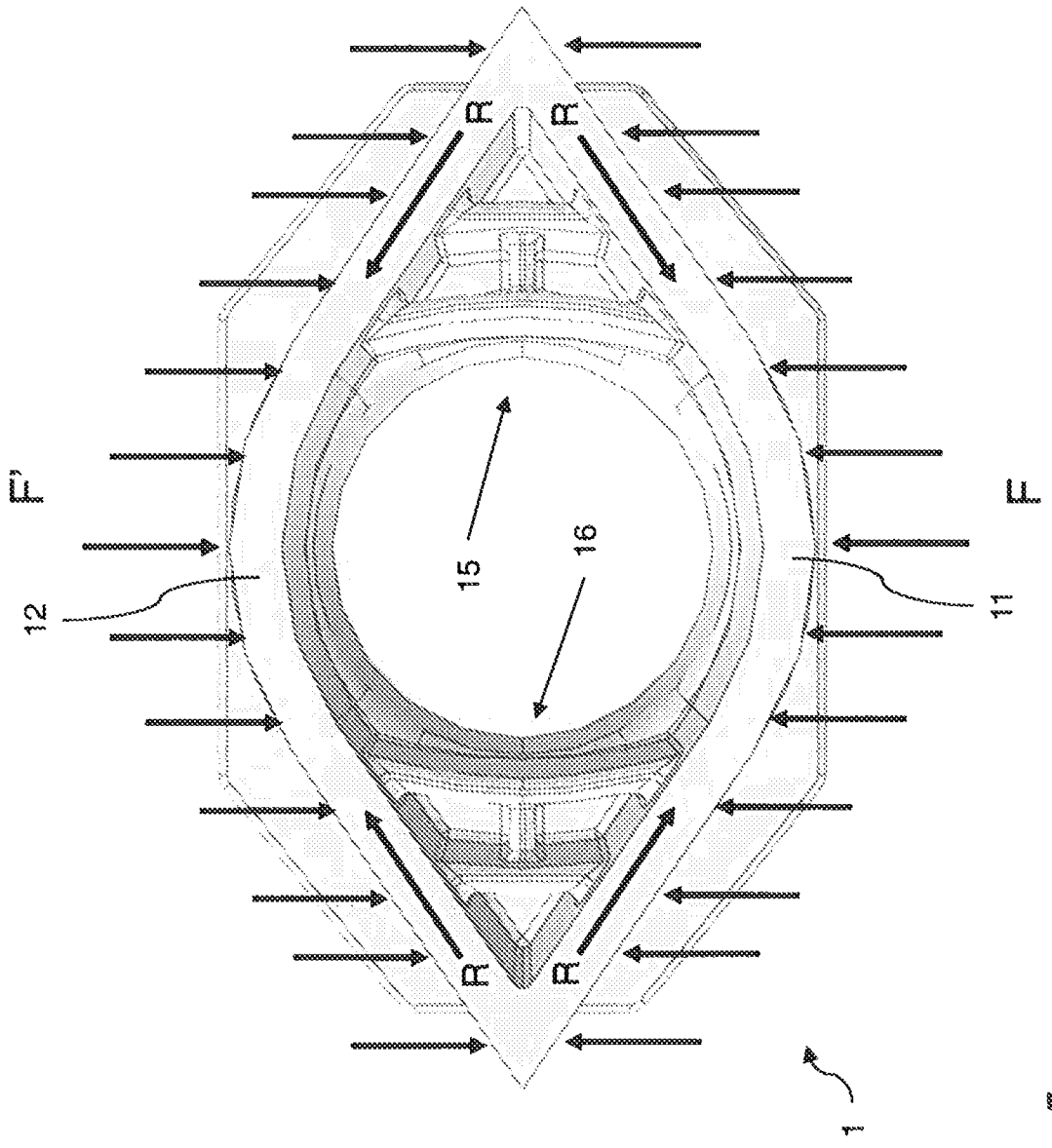



Fig.5a

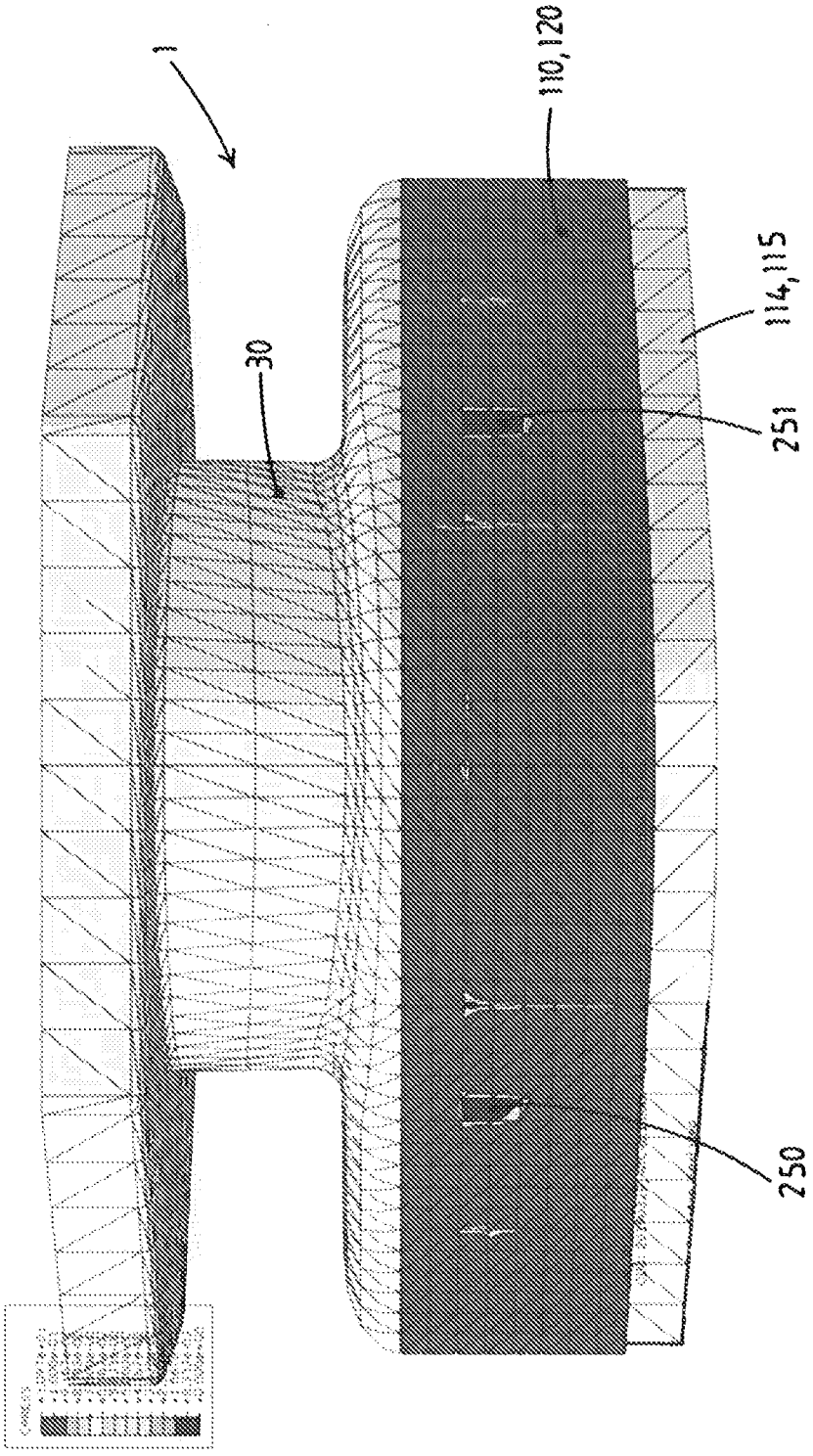



Fig.5b

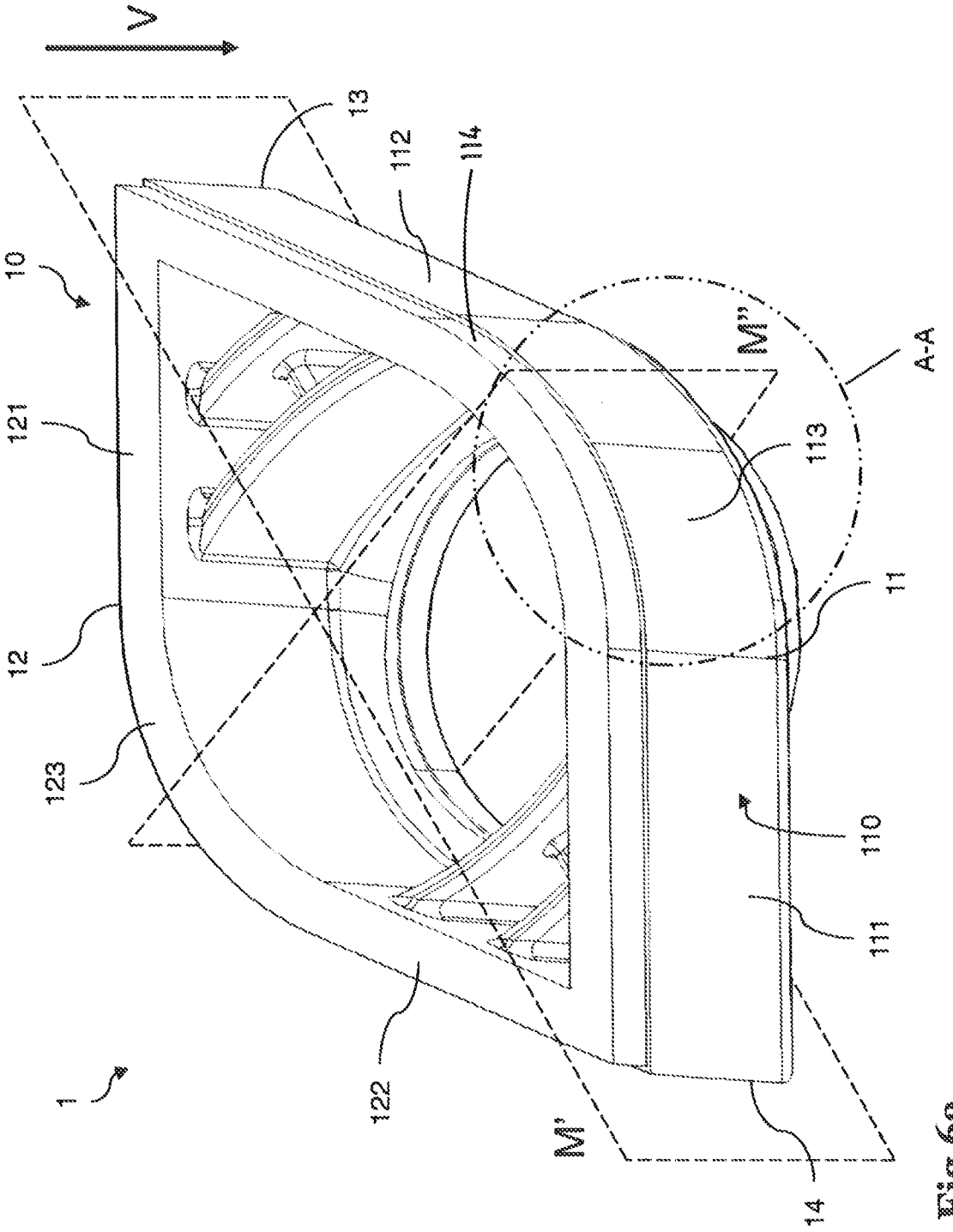



Fig.6a

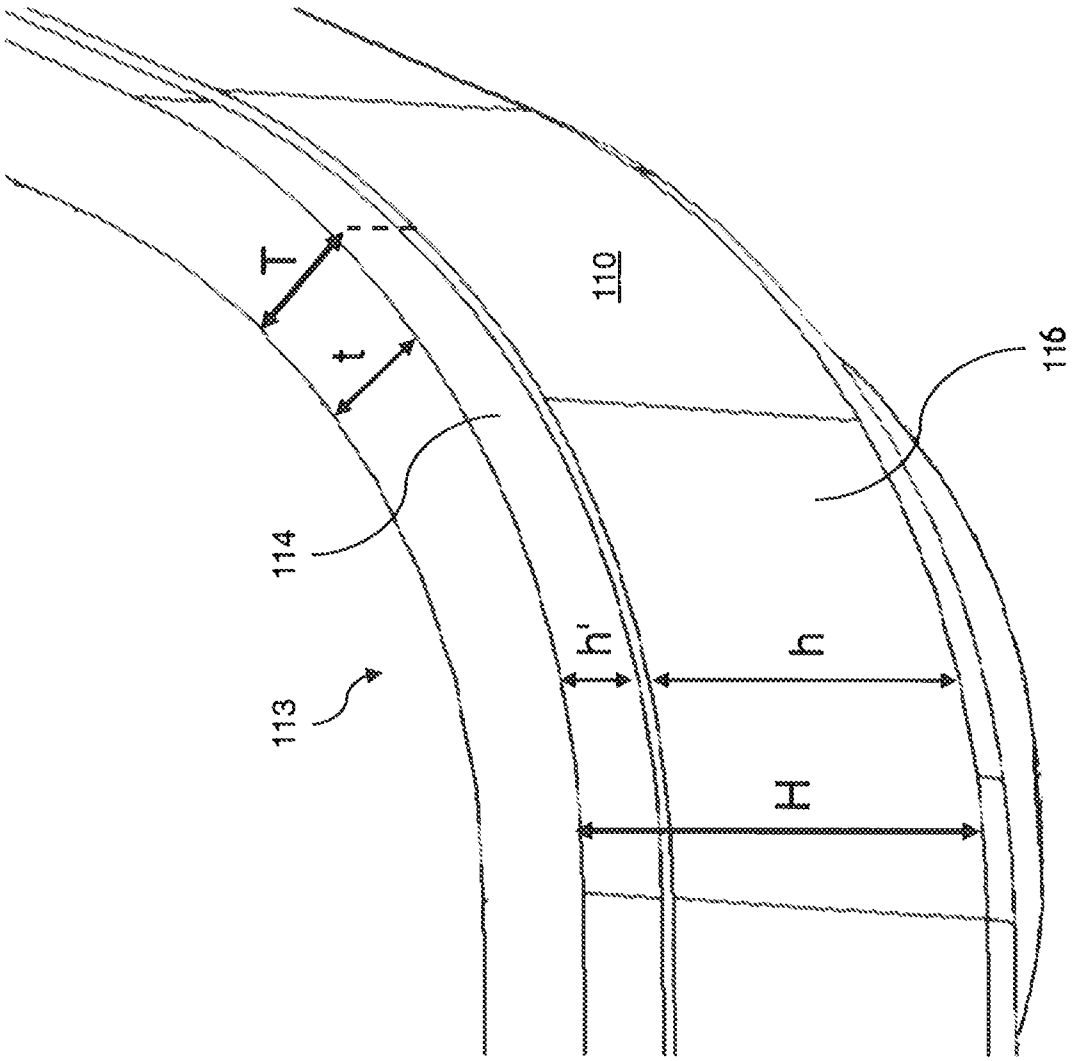
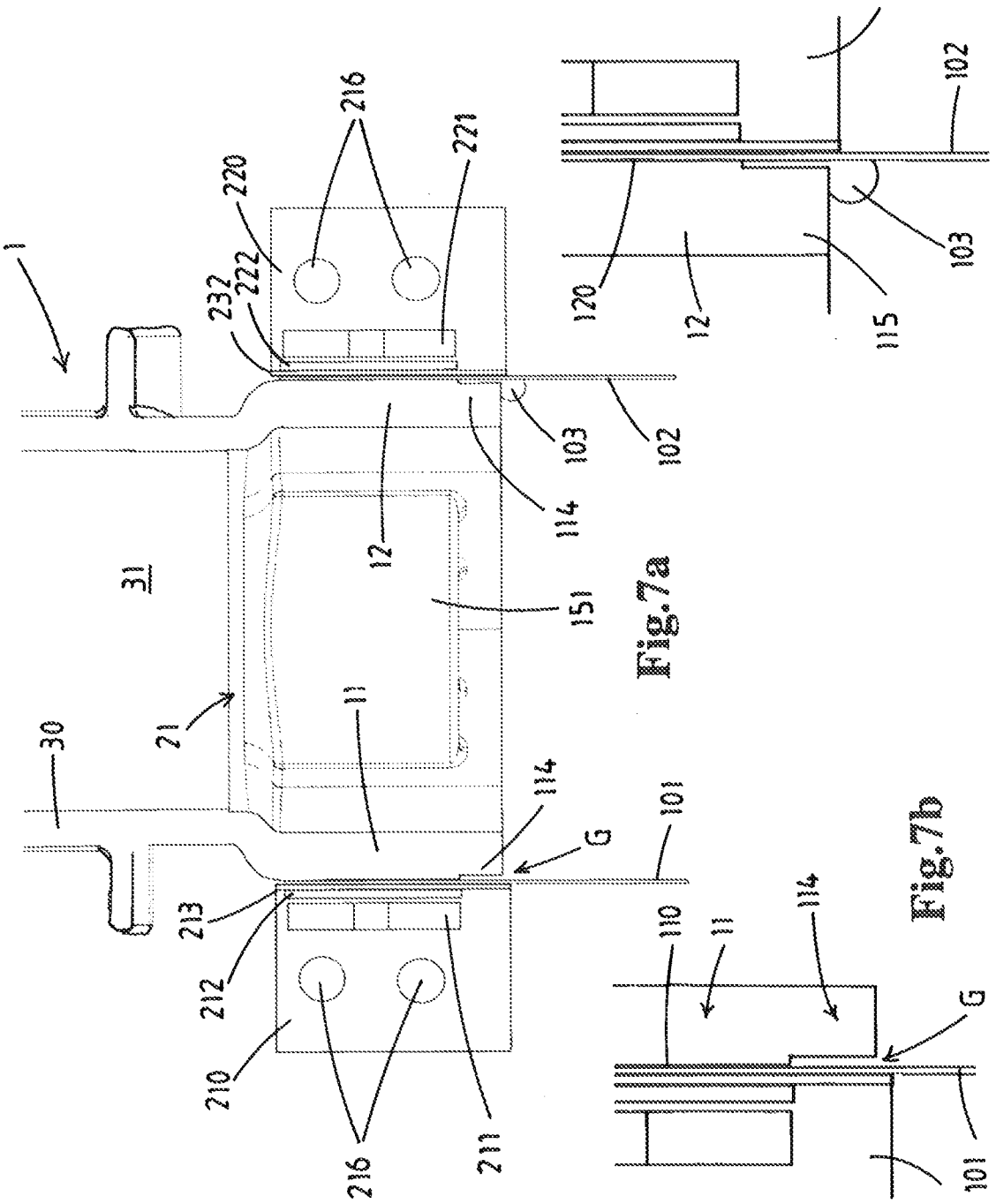



Fig.6b


1
232
222
220
216
221
102
103
120
12
115
114
151
31
21
30
11
213
212
210
211
G
101
110
Fig.7a
Fig.7b
Fig.7c

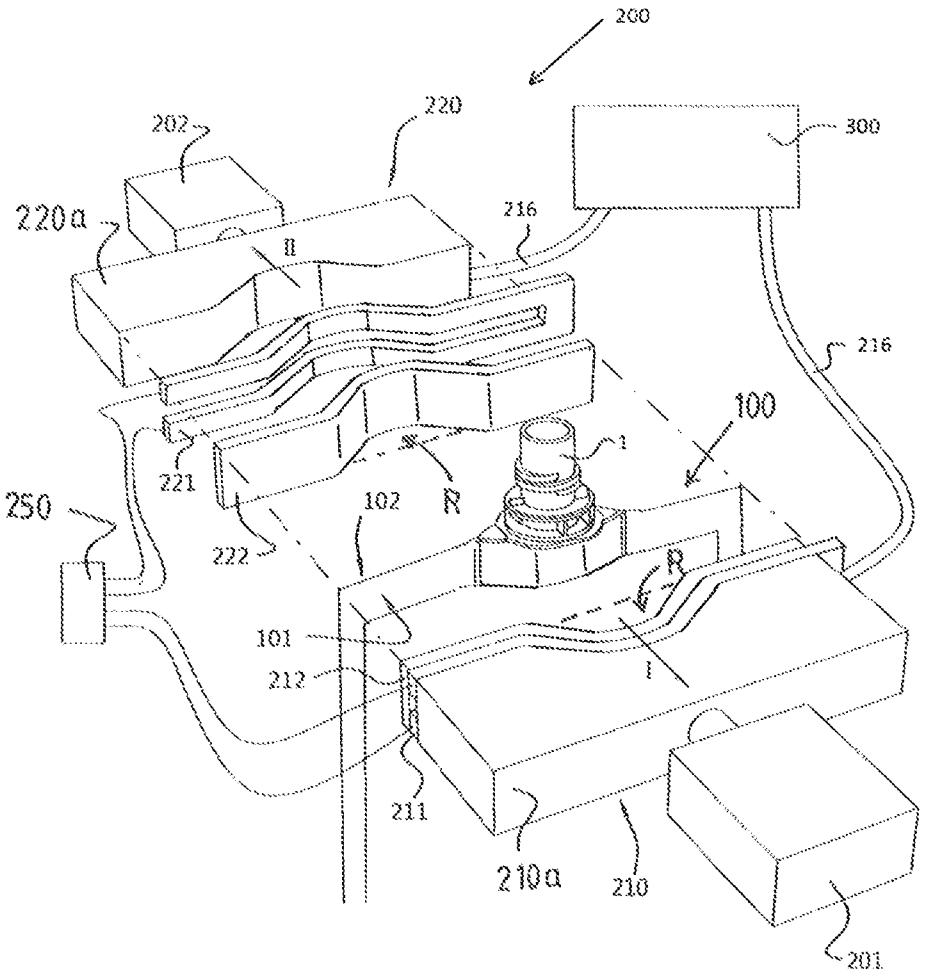

200
202
220
300
220a
II
216
216
100
1
221
250
102
R
222
R
101
212
I
211
210a
210
201

**Fig.8**

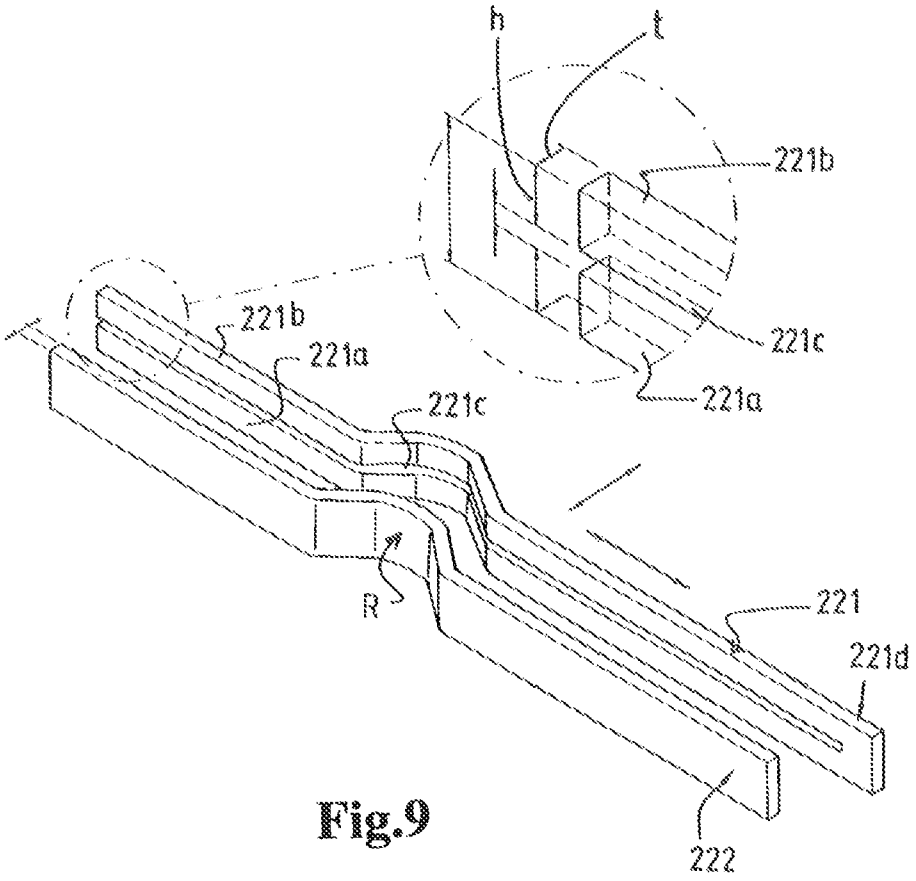



Fig.9

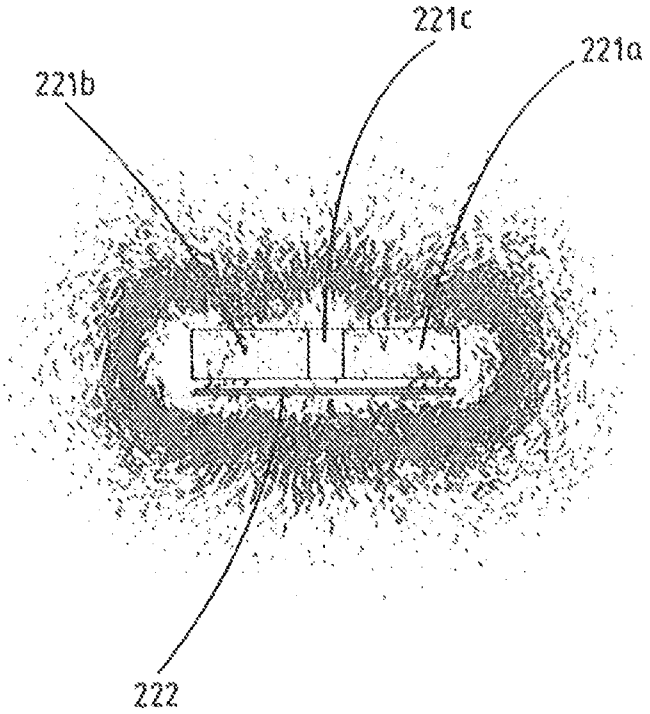



**Fig.10**

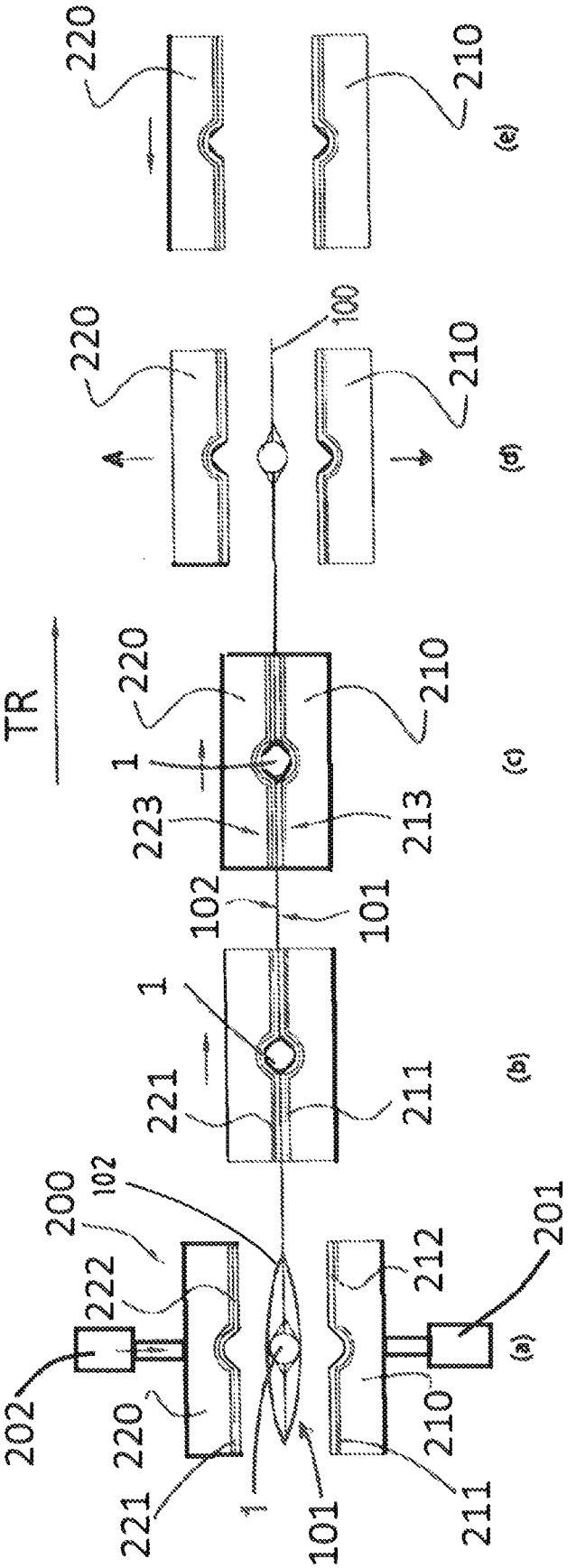



Fig.11

# SAMENWERKINGSVERDRAG (PCT)

## RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

| IDENTIFICATIE VAN DE NATIONALE AANVRAGE | KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE |
|---|---|
| | **P34326NL00/HJB** |
| Nederlands aanvraag nr.<br>**2024915** | Indieningsdatum<br>**14-02-2020** |
| | Ingeroepen voorrangsdatum |
| Aanvrager (Naam)<br>**SCHOLLE IPN IP B.V.** | |
| Datum van het verzoek voor een onderzoek van internationaal type<br>**11-04-2020** | Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.<br>**SN75972** |

**I. CLASSIFICATIE VAN HET ONDERWERP** (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

**Zie onderzoeksrapport**

**II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK**

Onderzochte minimumdocumentatie

| Classificatiesysteem | Classificatiesymbolen |
|---|---|
| **IPC** | **Zie onderzoeksrapport** |

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

**III.** ☐ **GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES** (opmerkingen op aanvullingsblad)

**IV.** ☐ **GEBREK AAN EENHEID VAN UITVINDING** (opmerkingen op aanvullingsblad)

# ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2024915

A. CLASSIFICATIE VAN HET ONDERWERP
INV. B65D75/58 B29C65/00
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)
B65D B29C

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

| Categorie ° | Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages | Van belang voor conclusie nr. |
|---|---|---|
| A,D | US 2013/284769 A1 (SCHICK WERNER [DE])<br>31 oktober 2013 (2013-10-31)<br>in de aanvraag genoemd<br>* alineas [0003], [0005], [0008], [0012], [0034] - [0039]; figuren 1-3 * | 1-33 |
| A,D | DE 20 2006 013587 U1 (POEPPELMANN HOLDING GMBH & CO [DE])<br>31 januari 2008 (2008-01-31)<br>in de aanvraag genoemd<br>* samenvatting *<br>* alineas [0022], [0025]; figuren 1-8 * | 1-33 |
| A | JP 2002 104453 A (TOYO SEIKAN KAISHA LTD)<br>10 april 2002 (2002-04-10)<br>* alinea [0011]; figuur 3c * | 1 |

-/--

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

| Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid | Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type |
|---|---|
| 18 september 2020 | |

| Naam en adres van de instantie | De bevoegde ambtenaar |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Leijten, René |

1

**ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2024915

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

| Categorie ° | Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages | Van belang voor conclusie nr. |
|---|---|---|
| A | WO 2013/074953 A1 (MEADWESTVACO CALMAR INC [US]) 23 mei 2013 (2013-05-23) * alinea [0042]; figuur 5 * | 1 |
| A | US 2016/272379 A1 (SKILLIN CLIFFORD [US] ET AL) 22 september 2016 (2016-09-22) * alinea [0034]; figuur 6 * | 1 |

**ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2024915

| In het rapport genoemd octrooigeschrift | Datum van publicatie | Overeenkomend(e) geschrift(en) | Datum van publicatie |
|---|---|---|---|
| US 2013284769 A1 | 31-10-2013 | DE 202012003293 U1 | 01-07-2013 |
| | | EP 2644530 A1 | 02-10-2013 |
| | | US 2013284769 A1 | 31-10-2013 |
| DE 202006013587 U1 | 31-01-2008 | DE 202006013587 U1 | 31-01-2008 |
| | | EP 1897815 A2 | 12-03-2008 |
| JP 2002104453 A | 10-04-2002 | GEEN | |
| WO 2013074953 A1 | 23-05-2013 | GEEN | |
| US 2016272379 A1 | 22-09-2016 | CN 105636875 A | 01-06-2016 |
| | | EP 3033279 A1 | 22-06-2016 |
| | | US 2016272379 A1 | 22-09-2016 |
| | | WO 2015023829 A1 | 19-02-2015 |

# WRITTEN OPINION

| File No. | Filing date *(day/month/year)* | Priority date *(day/month/year)* | Application No. |
|---|---|---|---|
| SN75972 | 14.02.2020 | | NL2024915 |

International Patent Classification (IPC)
INV. B65D75/58 B29C65/00

Applicant
SCHOLLE IPN IP B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

| | Examiner |
|---|---|
| | Leijten, René |

# WRITTEN OPINION

## Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

## Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|---|---|---|---|
| Novelty | Yes: | Claims | 1-33 |
| | No: | Claims | |
| Inventive step | Yes: | Claims | 1-33 |
| | No: | Claims | |
| Industrial applicability | Yes: | Claims | 1-33 |
| | No: | Claims | |

2. Citations and explanations

**see separate sheet**

## Re Item V

1 Reference is made to the following documents:

D1 US 2013/284769 A1

D2 DE 20 2006 013587 U1

D3 JP 2002 104453 A

D4 WO 2013/074953 A1

D5 US 2016/272379 A1

2 INDEPENDENT CLAIM 1

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (as indicated by the applicant in the description) a spout according to the preamble of claim 1.

The subject-matter of claim 1 differs from this known D1 in that:

*gezien in een onderaanzicht op het bevestigingsgedeelte,*

*- de ten minste ene eerste stabilisatierib tussen de verwante verbindingspunten is gekromd naar het eerste puntige uiteinde, en*

*- de ten minste ene tweede stabilisatierib tussen de verwante verbindingspunten is gekromd naar het tweede puntige uiteinde.*

The subject-matter of claim 1 is therefore new.

The problem to be solved by the present invention may be regarded as:

How to provide a spout that allows for application of an impulse heat sealing technique to seal the spout between the pouch walls to obtain an improved seal and/or to allow for a shorter sealing cycle.

Technical effect:

Compared to straight stabilising ribs, the curved ribs allow to achieve a desirable balance between strength on the one hand and flexibility on the other hand.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step for the following reasons:

In D1 the ribs are straight and are provided with a curvature at the transition between the ribs and the sealing wall. There is no suggestion that the ribs itself could be curved towards the pointed end. In D2 the ribs are straight as well. D3 discloses a spout having ribs which are pointed inwardly, whereas D5 discloses a spout having straight ribs which are provided crosswise. D4 discloses a spout having ribs ribs 118 which seem to be curved, however, the description of D4 is silent about this aspect and even from figure 5 it is not clearly disclosed that these ribs are curved. Furthermore, the sealing wall construction of the spout disclosed in D4 is very different from the sealing wall of the spout known from D1 and it is therefore considered not to be obvious for the skilled person to combine the teachings of D1 and D4.

Therefore, none of the prior art documents discloses or suggests a spout as defined in claim 1.

## 3 INDEPENDENT CLAIM 13

The document D2 is regarded as being the closest prior art to the subject-matter of claim 13, and discloses (as indicated by the applicant in the description) a spout according to the preamble of claim 13. Furthermore, D2 discloses that *"het buitenste sealoppervlak van de eerste sealwand en het buitenste sealoppervlak van de tweede sealwand glad is"*.

The subject-matter of claim 13 differs from this known D2 in that:

*dat waarbij deze buitenste sealoppervlakken van de eerste sealwand en van de tweede sealwand elk zijn begrensd door een binnenwaarts versprongen onderrand van de sealwand .*

The subject-matter of claim 13 is therefore new.

The problem to be solved by the present invention may be regarded as:

How to provide a spout that allows for application of an impulse heat sealing technique to seal the spout between the pouch walls to obtain an improved seal strength.

Technical effect:

The inwardly-recessed bottom edges of the sealing walls provide that, when the spout together with the pouch walls is clamped between sealing jaws during a sealing cycle, an open bottomed groove is initially present at the bottom edge of the sealing walls of the spout, between the inwardly-recessed bottom edge and the pouch wall. No clamping force is applied at the height of this groove, since the respective vertical face of the recess is spaced from the pouch wall. When the heat is applied during the sealing cycle, e.g. in an impulse heat sealing process, the smooth outer sealing surfaces of the sealing walls and the pouch walls are locally melted and fused together as a result of the applied heat. As a result of the melting of the contacting areas of the spout and pouch walls, some of the molten plastic material will seek to flow away, e.g. under the influence of the applied clamping force, and will flow into the groove initially formed by the inwardly-recessed bottom edge of the sealing wall. It is observed that, with a properly dimensioned inwardly-recessed bottom edge, This flow of molten material forms a bead being joined to the pouch wall and to the bottom edge. This bead provides for improved mechanical properties of the seal between the spout and the pouch walls.

The solution to this problem proposed in claim 13 of the present application is considered as involving an inventive step for the following reasons:

None of the prior art documents discloses or suggests a sealing wall having a smooth sealing surface being bordered by an inwardly recessed bottom edge.

## 4 INDEPENDENT CLAIMS 29 AND 30

The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent claims 29 (use of a spout according to any of the claims 1-22) and 30 (method of manufacturing a pouch package comprising the spet of positioning a spout according to any of the claims 1-22), which therefore are also considered to be new and to involve an inventive step.

5 DEPENDENT CLAIMS 2-12, 14-28 and 31-33

Dependent claims 2-12, 14-28 and 31-33 are dependent on claims 1, 13 and 30 respectively and as such also meet the requirements of novelty and inventive step.