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(54) Benævnelse: **Holdeplade til en støvsugerfilterpose**

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Holding plate for a vacuum cleaner filter bag

The present invention relates to a holding plate for a vacuum cleaner filter bag and to a vacuum cleaner filter bag comprising this holding plate.

Many existing solutions for fixing vacuum cleaner filter bags in the interior of the vacuum cleaner are known. Most commonly used are so-called holding plates, i.e. flat components connected to the bag wall of the vacuum cleaner filter bag and having a through opening overlapping with the inflow opening of the bag wall. Prior to operation the holding plate is introduced in a mating receptacle in the vacuum cleaner so that it is disposed in a given position. After subsequently closing the vacuum cleaner a connection piece of the vacuum cleaner engages in the through opening of the holding plate so that the air to be filtered can flow into the vacuum cleaner filter bag. Other known solutions do not use holding plates but depend, for example, on connection pieces which are fitted onto corresponding counterparts in the interior of the vacuum cleaner, as is disclosed, for example, in US 2,068,332. DE 298 19 699 U1 discloses a holding plate according to the preamble of independent claim 1.

Due to limitations in terms of the interior space holding plates were proposed which include flexible regions so that the inherently flat components can also be inserted into curved guides. This serves to enable better adaptation to the interior space. Examples of such holding plates are known from WO 2017/194081 A1 and WO 2017/196211 A1. In one proposed solution film hinges are employed to make an area of the holding plate flexible. This may, however, lead to failure of components due to insufficient strength of film hinges. In particular, film hinges can be still further weakened by the use of recycled plastics such as recycled polypropylene (rPP). However, the use of recycled plastics is becoming increasingly desirable from an environmental perspective. In addition, forming the film hinges by injection molding is also costly.

It is therefore the object of the invention to provide an improved holding plate for a vacuum cleaner filter bag, which is in particular more reliable to use and easier to manufacture.

This object is solved by a vacuum cleaner filter bag according to claim 1. Particularly advantageous further embodiments are disclosed in the subclaims.
Hence, the invention provides a holding plate comprising a first plate and a second plate which are arranged in a first plane, and a third plate arranged in a second plane extending parallel to the

first plane, the third plate having smaller bending stiffness than the first plate and the second plate, the first plate and the second plate being connected to each other via the third plate so that a hinge is formed between the first plate and the second plate, wherein the first plate and/or the second plate can be bent about the hinge axis thereof with the respective part of the third plate connected thereto.

Since the hinge is not formed by a line of weakness in the material, as is common in the prior art, but by a combination of the three plates the holding plate, in particular the hinge, can be designed to be more reliable in operation and more flexible in terms of the potential properties. For example, plates may be combined that have been produced using different manufacturing methods. Thus, one or more plates with a particularly sophisticated geometry can be injection molded parts. Simpler structures lend themselves for thermoforming. Thus different materials may be combined. The third plate, for instance, which is bent in use, may also comprise or consist of a material particularly suitable for this purpose, such as a thermoplastic elastomer (TPE). Thus a seal can be implemented around the connecting piece of the vacuum cleaner integrally using the third TPE plate.

The term "plate" is used here to refer to a flat component, i.e. a component whose extent in a plane (plate width and plate length) is significantly greater than its extent perpendicular to this plane (plate thickness).

The bending stiffness refers to the resistance of the plate against elastic deformation by a bending moment and is defined in a manner known to those skilled in the art.

The third plate may be formed in one piece or may be made of several interconnected parts. Anyway, the third plate is formed so that it connects the first plate to the second plate.

The holding plate may in particular comprise one or more plastics or be made of one or more plastics. In particular, recycled plastics may also be used, e.g. recycled polypropylene (rPP) and/or recycled polyethylene terephthalate (rPET). The recycled plastic material may be used in particular for the first plate and the second plate. The third plate may also comprise or consist of virgin plastic material.

The holding plate may be formed from a combination of injection molded parts or from a combination of thermoformed parts. The holding plate may also comprise elements made partially by injection molding and partially by thermoforming.

In particular, the first plate may be connected to the second plate solely via the third plate. In other words, the first plate and the second plate may be completely separate components. However, this does not rule out physical contact between the first plate and the second plate or in certain positions. In this case the contact surface may be specifically formed for this purpose, for example raised at the edge, in order to achieve a larger contact area and/or to permit movement in only one direction and/or to limit the possible bending angle.

In particular, the hinge axis may be parallel to the dividing line between the first plate and the second plate. In this case the hinge axis lies in a plane parallel to the first and second planes, particularly in the second plane.

In particular, the third plate may be thinner than the first plate and/or the second plate. The thickness is measured perpendicular to the first and second planes. If the thickness is not constant, the average thickness can be used as a dimension. Due to the smaller thickness it is easy to achieve higher flexibility, i.e. a lower bending stiffness, especially if the same material is used for all plates. The third plate, for example, may have a thickness of 0.05 to 1.0 mm, whereas the first plate and the second plate each have a thickness of 1.0 to 3.0 mm.

Alternatively or additionally the third plate may be formed of a different material than the first plate and/or the second plate, the material of the third plate having a lower modulus of elasticity than the material of the first plate and/or the second plate.

The first plate and the second plate can be bonded, welded or positively connected to the third plate. The connection may or may not be designed to be non-destructively detachable. A positive connection may in particular be configured as a rivet connection.

A through opening may be formed in the first plate, particularly overlapping with a through opening in the third plate. The through opening or openings form the filling hole when the holding plate is connected to a vacuum cleaner filter bag.

The holding plate may also include a sealing lip surrounding the through opening. The sealing lip may comprise or consist of a thermoplastic elastomer, based, for example, on polypropylene. The sealing lip is designed to prevent or limit the leakage of dust from the vacuum cleaner filter bag by sealing the area between the inner edge of the through opening and the outside of a connection

piece of the vacuum cleaner. In particular, it is possible to form the sealing lip from parts of the third plate if it comprises or consists of a thermoplastic elastomer and the through opening in the third plate has a smaller diameter than the through opening in the first plate.

One or more positioning openings may be provided in the second plate for positioning and/or fastening in a receptacle for the holding plate. Corresponding overlapping positioning openings may be provided in the third plate so that the positioning openings are provided in the holding plate in the form of through-openings. However, the positioning openings may also be configured as blind holes. In operation, positioning elements of the holder for the holding plate of the vacuum cleaner may engage in the positioning openings and thus position and/or fix the holding plate.

Moreover the invention provides a vacuum cleaner filter bag comprising a bag wall and a holding plate connected thereto as described above.

The bag wall is made of an air-permeable material and may have a multilayer structure. The latter may be referred to as a laminate. Several layers of the laminate, in particular each single layer of the laminate, may comprise or consist of a nonwoven fabric and/or a fibrous web.

A wide variety of plastics may be used as the material for the bag wall, in particular for one or more layers of nonwoven fabric or fibrous web, for example polypropylene and/or polyester. The bag wall may also comprise or consist of recycled plastic and/or recycled material from the manufacture of textiles (Textile Left-Over - TLO).

For many recycled plastics international standards apply. For PET plastic recyclates, for example, DIN EN 15353:2007 is the relevant standard. PP recyclates are specified in DIN EN 15345:2008. With regard to the corresponding special plastic recyclates, the present patent application adopts the definitions of these international standards. The plastic recyclates may be unmetallized. Flakes or chips of plastic recovered from PET beverage bottles are one example. On the other hand the plastic recyclates may be metallized as well, for example if the recyclates were obtained from metallic plastic films, in particular metallized PET films (MPET).
For example, recycled polyethylene terephthalate (rPET) can be obtained from beverage bottles, in particular from so-called bottleflakes, i.e. pieces of ground beverage bottles.

The recycled plastics, in particular recycled PET and/or recycled PP, both metallized and non-metallized, can be spun to fibers from which the staple fibers or meltblown or spunbond nonwoven fabrics can be obtained for the purposes of the present invention.

Recycled material from the manufacture of textiles (TLO) is obtained during processing of textile materials (in particular textile fibres and filaments, as well as linear, planar and three-dimensional textile structures produced therefrom), such as production (comprising carding, spinning, cutting and drying) or recycling of textile materials. These powdery and/or fibrous materials are waste materials that can settle on the machinery or filter materials used in processing the textiles. The dusts (powders) or fibres are normally disposed of and utilised for heat production.

The recycled material in powder and/or fibre form is therefore, for example, production waste; this applies in particular to material obtained as a waste product during the carding, spinning, cutting or drying of textile materials. Such material is also referred to as "pre-consumer waste".

Recycling of textile materials, i.e. the processing (e.g. shredding) of used textile materials or textiles (e.g. old clothes) also produces recycled material in powder and/or fibre form referred to as "post-consumer waste".

Thus, recycled material from the manufacture of textiles (TLO) may include, in particular, fibres and/or filaments obtained from waste materials from the textile and clothing industry, from post-consumer waste (textiles and the like) and/or from products collected for recycling.

In the context of the present invention, a nonwoven fabric refers to an entangled mesh that has undergone a bonding step so that it has sufficient strength to be wound or unwound into rolls, for example, by machine (i.e., on an industrial scale). The minimum web tension required for winding is 0.044 N/mm. The web tension should not exceed 10 % to 25 % of the lowest maximum tensile force (according to DIN EN 29073-3:1992-08) of the material to be wound. This results in a lowest maximum tensile force for a material to be wound of 8.8 N per 5 cm strip width.

A fibrous web, or simply "nonwoven" corresponds to a entangled mesh which, however, has not undergone a bonding step, so that, unlike a nonwoven fabric, such an entangled web does not have sufficient strength, for example, to be wound or unwound into rolls by machine.

The term nonwoven fabric or simply nonwoven is used in other words following the definition according to ISO Standard ISO9092:1988 or CEM Standard EN29092. Details regarding the use of the definitions and/or processes described herein may also be found in the standard work "Vliesstoffe" by authors W. Albrecht, H. Fuchs, W. Kittelmann (Wiley-VCH, 2000).

In particular, the nonwoven fabric layers of the bag wall may comprise a staple fiber nonwoven fabric and/or an extrusion nonwoven fabric. In particular, filament spunbond nonwoven fabrics (also abbreviated to "spunbond fabric" or "spunbond") and/or meltblown nonwoven fabrics can be used.

One or more layers of the bag wall may comprise a carded material. Both mechanical processes (e.g. needling) and thermal processes (e.g. calendering) are conceivable as binding steps. It is also possible to use binding fibres or adhesives, such as a latex adhesive. Airlaid materials can be employed as well.

The nonwoven fabric of one or more layers of the bag wall may comprise bicomponent fibers. Bicomponent fibres (BiCo fibres) may consist of a core and a sheath surrounding the core. In addition to core/sheath bicomponent fibres the other common variants of bicomponent fibres, e.g. of the side-by-side type, can also be used.

The bicomponent fibers may be in the form of staple fibers or filaments in case of an extrusion nonwoven fabric (for example, meltblown nonwoven fabric).

As mentioned above, appropriate unbonded fiber webs are also conceivable.

The nonwoven fabric of one or more layers of the bag wall may also be microcrepped (Micrex).

The bag wall may also include an odour absorbent.

The bag wall may also include capacitance layer. A capacitance layer provides high resistance against shock load and enables filtration of large dirt particles, filtration of a significant portion of small dust particles, and collection or retention of large quantities of particles, while allowing the air to pass through easily, resulting in a low pressure drop at high particle loading.

The bag wall may also comprise a fine filter layer. A fine filter layer is used to increase the filtration performance of the multi-layer filter material by collecting particles that pass through the capacitance layer, for example. To further increase the separation efficiency, the fine filter layer can preferably be electrostatically charged (e.g., by means of corona discharge or hydro-charging), in particular to increase the separation of fine dust particles.

The fine filter layer may link up to the capacitance layer, especially towards the outside of the bag wall.

The fine filter layer may be followed by a support layer. A backing layer (sometimes also called "reinforcement layer") is a layer that provides the necessary mechanical strength to the multilayer composite structure of the filter material. In particular, the backing layer may be an open, porous nonwoven fabric of small weight per unit area. In particular, the backing layer may be a spunbond nonwoven fabric.

It is, however, also possible to use a single-layer filter material for the bag wall. In this case a meltblown nonwoven fabric may be employed. A suitable material for such a single-layer bag wall is known from EP 2 311 360 B1, for example.

The holding plate may include one or more of the above-mentioned features.

In particular, the bag wall may be welded to the third plate, wherein the third plate comprises a plastic compatible with the plastic material of the outermost layer of the bag wall to which the third plate is welded. In other words, the material of the third plate can be selected so that it can be welded as tightly as possible to the bag wall.

To obtain good welding results, it is necessary that the materials to be joined are matched as closely as possible, both in terms of their melting points and their chemical nature (amorphous/partially crystalline). This can be achieved when using compatible materials. It is also conceivable to use the same material for the outermost layer of the bag wall to which the third plate is welded and for the third plate.

However, it is also possible for the bag wall to be connected to the first plate or the second plate. In this case, the respective plate may comprise a plastic that is compatible with the plastic material of the outermost layer of the bag wall to which the respective plate is welded.

Moreover the invention provides a system comprising a vacuum cleaner filter bag as described above and a holder for the holding plate in a vacuum cleaner housing, wherein the holder is formed such that in the operating position the first plate and/or the second plate and the respective part of the third plate connected thereto are bent about the hinge axis relative to the first and second planes. The operating position refers to the position in which the holding plate is arranged during operation of the vacuum cleaner.

The vacuum cleaner filter bag may include one or more of the above-mentioned features.

In particular, the holder may comprise a guide along which the holding plate can be inserted into the holder. This guide may include a straight section and a curved section. The curved section can effect bending about the hinge axis.

The holder may be designed in particular as described in WO 2018/095519 A1.

Additional features and advantages of the invention will be described below with reference to the exemplary drawings, wherein:

Fig 1 shows a top view of an exemplary holding plate;

Fig 2 shows a cross-section of an exemplary holding plate;

Fig. 3 shows a side view of an exemplary holding plate in a first position;

Fig. 4 shows a side view of an exemplary holding plate in a second position; and

Fig 5 shows a top view of an exemplary vacuum cleaner filter bag.

Fig. 1 shows a top view of an exemplary holding plate 1 comprising a first plate 2 and a second plate 3 configured as separate components. In this example, the plates 2, 3 are spaced apart by a gap 7. It is also conceivable for plates 2, 3 to touch in this arrangement as long as they remain separate components. The first plate 2 and the second plate 3 are connected solely by a third plate not shown in Fig. 1 which is arranged in a plane parallel to the plane of the first plate 2 and the second plate 3 and provided in particular in the area below the gap 7.

FIG. 2 shows a cross-section of the exemplary holding plate 1. The third plate 8 is located under the first plate 2, the second plate 3 and in particular below the gap 7, so that the third plate 8 interconnects the plates 2, 3. The third plate 8 is located on the side of the holding plate 1 intended for connection to the bag wall of a vacuum cleaner filter bag.

Moreover the third plate 8 has a lower bending stiffness than the first plate 2 and/or the second plate 3. In the present example, this is achieved by making the third plate 8 thinner than both the first plate and the second plate 3. Alternatively or additionally the third plate 8 may be formed of a different material than the first plate 2 and/or the second plate 3, the material of the third plate having a lower modulus of elasticity than the material of the first plate 2 and/or the second plate 3.

Due to the higher flexibility of the third plate and the reduced thickness of the holding plate 1 in the area of the gap 7 between the plates 2, 3 a hinge is formed. The hinge axis A is indicated by a dashed line in Fig. 1. The second plate 3 can be bent or pivoted relative to the first plate 2 about this hinge axis A together with the part of the third plate 8 connected thereto. This is illustrated in Figs. 3 and 4. In Fig. 3, all plates 2, 3, 8 are entirely located in two parallel planes, while in Fig. 4, the second plate 3 and the part of the third plate 8 connected thereto are bent about the hinge axis A perpendicular to the planes of Fig. 3. This means that the holding plate 1 can be inserted into receptacles including a curved guide thus requiring a holding plate with flexible regions.

As shown in Figs. 1 and 2, a through opening 4 is formed in the first plate 2, which also extends through the third plate 8, as is shown in Fig. 2. Thus, an inflow opening is formed in combination with a through opening of the bag wall of a vacuum cleaner filter bag. It is, however, also conceivable that the third plate 8 does not extend over the entire underside of the first plate 1 and thus does not overlap with the through opening 4 in the first plate 2. In this case the inflow opening is formed solely by the through opening 4 in the first plate 2 together with the through opening of the bag wall.

As is conventionally known, the holding plate 1 includes a sealing lip 10 made of a thermoplastic elastomer (TPE) which in this example is molded onto the edge of the through opening 4 of the first plate 2. It is possible, however, to form the sealing lip 10 from the third plate 8 if it comprises or consists of a thermoplastic elastomer and the through opening in the third plate 8 has a smaller

diameter than the through opening 4 in the first plate 2. According to further alternatives, the sealing lip 10 may also be glued or welded onto the first plate 2 from above or below. "Above" in this case refers to the side facing away from the third plate 8, and "below" refers to the side facing towards the third plate 8.

Also shown in Fig. 1 are two positioning openings 5, 6 in the second plate 3 for positioning and/or fastening in a holding plate receptacle. The positioning openings 5, 6 can also be provided as through openings in the third plate 8. In operation, positioning elements of the holder for the holding plate of the vacuum cleaner may engage in the positioning openings 5, 6 and thus position and/or fix the holding plate 1.

In Fig. 5, the holding plate 1 is connected to a bag wall 9 of a vacuum cleaner filter bag. In particular, the bag wall 9 may be welded to the third plate, wherein the third plate 8 comprises a plastic compatible with the plastic material of the outermost layer of the bag wall 9 to which the third plate 8 is welded. Thus the strength of the welded joint between the holding plate 1 and the bag wall 9 can be improved.

The bag wall 9 comprises a plurality of nonwoven fabric layers or a plurality of nonwoven fabric and fibrous nonwoven layers overlapping each other in the direction from the bag interior to the bag exterior. The nonwoven fabric or fibrous nonwoven layers may loosely superimpose each other or be bonded together. The connections may be made continuous (e.g. via spray adhesive) or discontinuous (e.g. via a calendering pattern).

In particular, the individual layers may comprise different plastic materials, both amongst each other and/or within a respective layer.

The exemplary vacuum cleaner filter bag of Fig. 5 is a so-called flat bag, wherein the bag wall 9 comprises a top side and a bottom side, which are connected to each other by a circumferential weld seam. As mentioned above both the top side and the bottom side of the flat bag comprise a plurality of filter material layers, in particular a plurality of nonwoven fabric layers or a plurality of nonwoven fabric and fibrous nonwoven layers. Both the top side and the bottom side may be formed, in particular, from a laminate of a plurality of nonwoven fabric layers. The invention is, however, not limited to flat bags, but can also be applied, for example, to bags with side gussets or block bottom bags.

Advantageously the holding plate 1 of the present example comprises a recycled plastic material, for instance recycled polypropylene (rPP) or recycled polyethylene terephthalate (rPET).

It is to be understood that features mentioned in the previously described embodiments are not limited to these particular combinations but may be combined in any other way. Furthermore, it is to be understood that geometries shown in the drawings are merely exemplary and can be embodied in any other way.

Patentkrav

1. Holdeplade (1) omfattende en første plade (2) og en anden plade (3), som er anbragt i en første plan, og en tredje plade (8), der er anbragt i et andet plan, som forløber parallelt med det første plan, hvor den første plade (2) og den anden plade (3) således er forbundet med hinanden via den tredje plade (8), at der mellem den første plade (2) og den anden plade (3) er udformet et hængsel, omkring hvis hængselakse (A) den første plade (2) og/eller den anden plade (3) kan bøjes med den respektivt dermed forbundne del af den tredje plade (8), **kendetegnet ved, at** den tredje plade (8) har en mindre bøjningsstivhed end den første plade (2) og den anden plade (3).

2. Holdeplade ifølge krav 1, hvor den tredje plade (8) er tyndere udformet end den første plade (2) og/eller den anden plade (3).

3. Holdeplade ifølge krav 1 eller 2, hvor den tredje plade (8) er dannet af et andet materiale end den første plade (2) og/eller den anden plade (3), hvor materialet af den tredje plade (8) har et mindre elasticitetsmodul end materialet af den første plade (2) og/eller den anden plade (3).

4. Holdeplade ifølge et af de foregående krav, hvor den første plade (2) og den anden plade (3) er sammenklæbet, sammensvejset eller formsluttende forbundet med den tredje plade (8).

5. Holdeplade ifølge et af de foregående krav, hvor der i den første plade (2) er anbragt en gennemgangsåbning (4), som især overlapper med en gennemgangsåbning (4) i den tredje plade (8).

6. Holdeplade ifølge et af de foregående krav, hvor der i den anden plade (3) er tilvejebragt en eller flere positionsåbninger (5, 6) til positionering og/eller fastgørelse i en holdepladeoptagelse.

7. Støvsugerfilterpose omfattende en posevæg (9) og en dermed forbundet holdeplade (1) ifølge et af de foregående krav.

8. Støvsugerfilterpose ifølge krav 7, hvor posevæggen (9) er sammensvejset med den tredje plade (8), og hvor den tredje plade (8) omfatter et kunststof, som er kompatibelt med kunststofmaterialet af det yderste lag af posevæggen (9), som den tredje plade (8) er sammensvejset med.

9. System omfattende en støvsugerfilterpose ifølge krav 7 eller 8 og en holder til holdepladen (1) i et støvsugerhus, hvor holderen er udformet således, at den første plade (2) og/eller den anden plade (3) og den respektivt dermed forbundne del af den tredje plade (8) i driftsstillingen er bøjet omkring hængselaksen (A) i forhold til det første og andet plan.

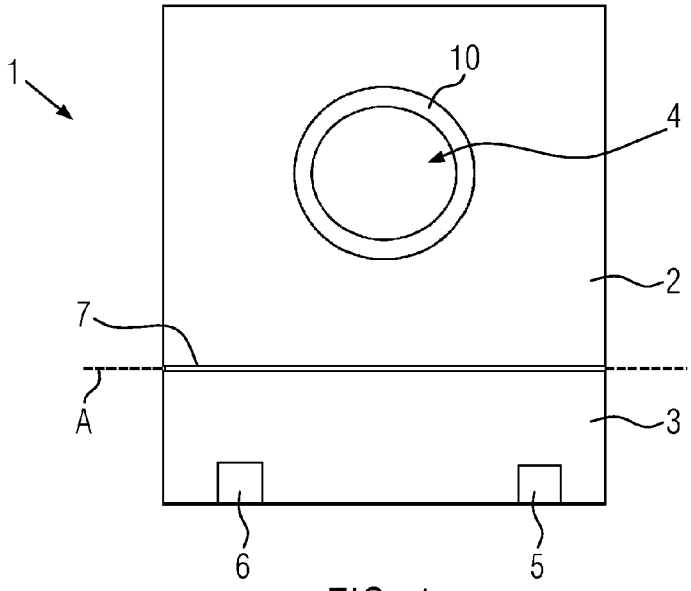

FIG. 1

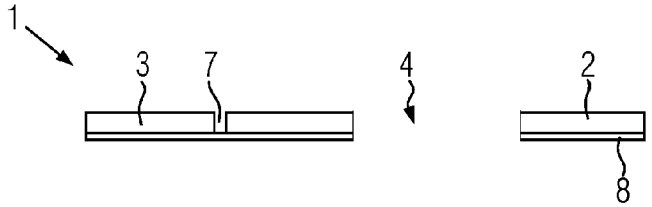

FIG. 2

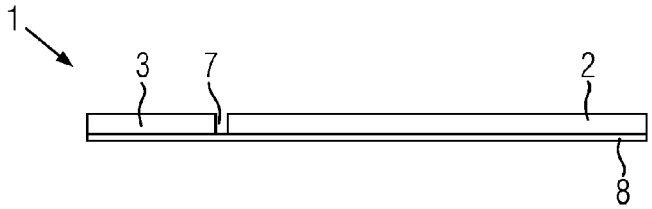

FIG. 3

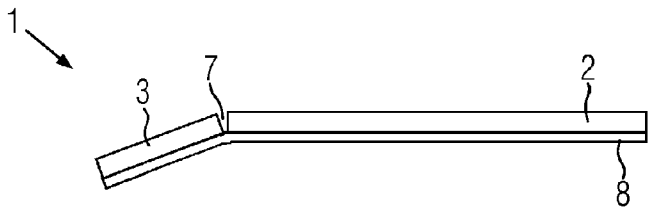

FIG. 4

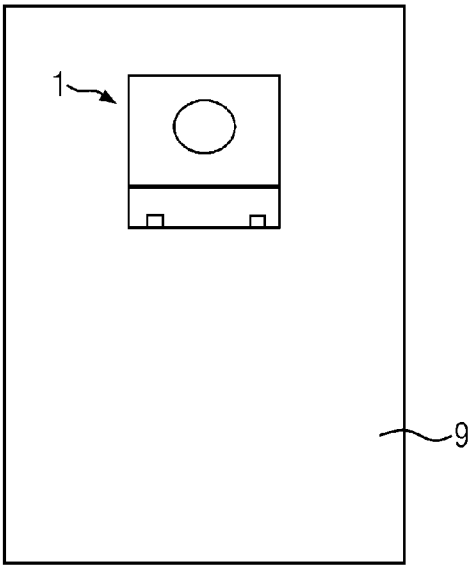

FIG. 5