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Vacuum cleaner filter bag for an upright vacuum cleaner

The present invention relates to a vacuum cleaner filter bag, in particular a vacuum cleaner filter bag for an upright vacuum cleaner and/or a so-called stick vacuum cleaner, in particular for cordless models.

Stick vacuum cleaners are usually, but not always, cordless devices (battery-operated cleaners) wherein an electric brush is connected to the housing of the handheld vacuum cleaner via a suction tube without a suction hose. These devices are very light and handy. The stick devices have low input powers in the range of about 150 to 600 W. Thus their volumetric flow rates are low being in the order of 10 to 30 l/s. The filter housing is typically cylindrical and has a small volume (approx. 1 to 2 litres). Usually a cyclone separator is used as a filter. The cyclone separator accelerates the suction air and the particles entrained therein. As a result, a significant proportion of the available power is consumed, leaving only little power to generate a sufficient volumetric flow rate. The cleaning effect (dust absorption) is often unsatisfactory.

From SE 1 250 019 A1 a holding plate for a vacuum cleaner bag is known which can be reversibly connected to the vacuum cleaner bag, wherein the outer contour of the holding plate can be adapted to the contour of the holding plate provided in a vacuum cleaner.

EP 2 772 173 A1 discloses a filter bag for a vacuum cleaner, wherein a filter material is fixed to a plate-shaped part and a collar is fixed to the plate-shaped part within a circular inlet opening. Alternatively, the collar may be connected to the filter material and the plate-shaped part via a single annular seam, i.e. only one connection point is provided.

A filter bag made of modern nonwoven laminates carries out the separation of dust in a much more energy-efficient way. However, it is difficult to manufacture a filter bag that fits optimally into the very small available installation space and provides sufficient filter surface area.

Conventional flat bags in which two filter material blanks are welded along their circumference and a holding plate is and one of the filter material blanks are connected to each other at their surfaces are usually not suitable as the available installation space is too small. Therefore so far, mainly bags with a bottom, such as block bottom, have been used in which the holding plate is arranged on the bottom and the bag shape of which is adapted to the installation space (so-called "three-dimensional" bags). However, manufacturing such bags, especially with a nonwoven material commonly used today proved to be difficult. As a result, manual operations are sometimes still required in the manufacture of such bags deteriorating the efficiency of the production.

It is therefore the object of the invention to provide a vacuum cleaner filter bag, in particular a vacuum cleaner filter bag for an upright vacuum cleaner and/or a stick vacuum cleaner which is

easy to use, allowing automatic manufacture and which makes the best possible use of the available installation space.

This object is solved by a vacuum cleaner filter bag according to claim 1. Particularly advantageous further embodiments can be found in the dependent claims.

The invention thus provides a vacuum cleaner filter bag comprising a bag wall and a holding plate, the holding plate being connected to a connecting piece which is at least partially cylindrical and extends in a direction perpendicular to a through opening formed in the holding plate, the bag wall being connected to the circumferential surface of the connecting piece along the periphery thereof. Due to the connection of the bag wall to the holding plate via the at least partially cylindrical connecting piece and along the circumference of the connecting piece to its outer surface the complex process for forming a bottom which often requires manual process steps can be omitted. Hence the vacuum cleaner filter bag according to the invention can be produced more efficiently. The vacuum cleaner filter bag can be provided in particular for upright vacuum cleaners and/or a so-called stick vacuum cleaner, especially for cordless models. The filling volume in the fully deployed state can therefore be between 0.5 and 3 litres, in particular between 0.5 and 2 litres.

The holding plate of the vacuum cleaner filter bag may be attached to a holding device in a vacuum cleaner housing. Thus the holding plate can be arranged, in particular fixed, at a predetermined position in the vacuum cleaner housing.

In contrast to a flat bag, in which the holding plate is connected to a flat wall part of the bag wall, when manufacturing the vacuum cleaner filter bag according to the invention, the bag wall provided with a respective opening is put over the at least partially cylindrical connecting piece and connected to the outer surface thereof. Hence the vacuum cleaner filter bag extends essentially parallel to the longitudinal axis of the connecting piece and thus perpendicular to the plane of the holding plate. So the vacuum cleaner filter bag is further better adapted to the usual filter housings of hand-held vacuum cleaners and/or stick vacuum cleaners that are typically cylindrically shaped and include the holding device for the holding plate on one of the bases of the cylinder.

The connecting piece, which is at least partially cylindrical, comprises a through opening partially or completely overlapping with the through opening of the holding plate in a top view of the holding plate so that an inlet opening is formed through which in operation the dust-laden air can flow into the vacuum cleaner filter bag. The longitudinal axis of the connecting piece is defined herein as the direction in which the through opening in the connecting piece extends. In particular, this direction is perpendicular to the plane in which the through opening of the holding plate is located. "At least partially cylindrical" refers to the fact that the connecting piece comprises at least one section that is cylindrically shaped, i.e. is defined by a circumferential surface and two bases. The

cylindrical shape is not limited to a circular cylinder. The cross-section of the cylindrical section, i.e. the directrix of the general cylinder, may be of any shape. The cross section of the cylindrical section may also be a polygon. In this case, it may be referred to as a prismatic section as well. In particular, the cylindrical section may have the shape of a straight or vertical cylinder the generating lines of which extend parallel to the longitudinal axis of the connecting piece.

The connecting piece may comprise a second section, in particular adjacent to the cylindrical section having a larger circumference compared to the cylindrical section. In particular, the second section may protrude outwards beyond the circumferential surface of the cylindrical section. The connecting piece may be connected to the holding plate in the area of the second section.

In particular, the holding plate may be a flat component, especially if its extension in two directions (length, width) is significantly greater, in particular at least three times greater, than in a direction perpendicular thereto (thickness). In particular, the holding plate may entirely surround the through opening arranged therein.

The holding plate and/or the connecting piece may comprise one or more plastic materials or be made of one or more plastic materials. In particular, recycled plastics may be used, such as recycled polypropylene, (rPP) and/or recycled- (rPET). The holding plate and the connecting piece can be made of the same material.

The holding plate may include a closing member for closing the inflow opening. This allows the vacuumed material to be retained inside the bag, particularly when the bag is removed.

In particular, the holding plate may be bonded or welded to the connecting piece. A positive connection between the holding plate and the connecting piece, in particular non-destructively detachable, is also conceivable, for example by means of a bayonet lock. This type of connection may render the holding plate reusable.

The holding plate and the connecting piece are therefore two separately manufactured components connected to each other, in particular non-destructively detachable or not non-destructively detachable.

The holding plate may also comprise 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.

The holding plate may be configured as an injection-molded part or as a thermoformed part. The holding plate may also be made partially by injection molding and partially by thermoforming. The holding plate may be configured as an injection-molded part or as a thermoformed part.

The bag wall is made of an air-permeable material and may have a multilayer structure. The letter may be referred to as a laminate. Multiple layers of the laminate, in particular each single layer of the laminate, may comprise or consist of a nonwoven 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 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 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. Moreover, the plastic recyclates may be metallized, 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 in the 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 subjected to thermal recycling.

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 comprise, 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" is an entangled mesh which, however, has not undergone a bonding step, so that, unlike a nonwoven, 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 in ISO Standard ISO9092:1988 or CEM Standard EN29092. Details on the use of the definitions and/or processes described herein may also be found in the standard work "Vliesstoffe", 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 and/or an extrusion nonwoven. In particular, filament spunbond nonwoven fabrics (also abbreviated to "nonwoven 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 microcreped (Micrex).

The bag wall may also include an odour absorbent.

The bag wall may in particular include a capacitance layer. A capacitance layer provides high resistance to shock load, and allows 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 include 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 hydrocharging), 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 backing layer. A backing layer (sometimes also called a "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 grammage. 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.

In particular, the bag wall may be connected to the outer surface of the connecting piece, i.e. to the side facing away from the through opening of the connecting piece. This enables an advantageous optical control of the fastening process during production, in particular visually and/or by means of automated image processing.

The length of the side of the bag wall connected to the connecting piece may in particular correspond to the outer circumference of the cylindrical section of the connecting piece. In particular, the bag wall may be connected to the connecting piece along the entire circumference of the outer surface thereof. Both the bag wall and the circumferential surface of the cylindrical section of the connecting piece thus surround the entire circumference of the through opening thereof.

The bag wall may be bonded or welded to the circumferential surface and/or the bag wall may be clamped between the circumferential surface and a clamping element. The clamping element may in particular have the form of a hollow cylinder. In this case, it may also be referred to as a clamping ring. Fastening only by means of a clamping element enables a detachable connection and therefore reuse of the holding plate and the connecting piece.

The holding plate and the connecting piece may be arranged on a short side of the bag wall. In other words, the longitudinal axis of the vacuum cleaner filter bag may extend parallel to the longitudinal axis of the connecting piece.

The bag wall may include surface pleats consisting of at least five individual pleats. The surface pleats of the filter medium offer considerable advantages. Due to the surface pleats, the area

through which the flow passes is considerably larger than the regular area available for the flow (face area). In other words, by means of the surface pleats the bag wall may be at least partially pleated.

In the context of the present invention the term "pleats" is defined as a sequence of two or more pleats, a single pleat being defined as comprising two pleat legs and one pleat hinge.

A surface pleat is a sequence of individual pleats provided on the bag wall. Such a surface pleat may be fixed by a part of the hem along one side edge. This part of the hem is, however, neither a pleat hinge nor a part of the pleat leg of one of the pleats of the fold.

The vacuum cleaner filter bag, in particular its bag wall, may also comprise at least one side pleat or gusset.

A gusset is a sequence of pleats in the area of the side edge of the vacuum cleaner filter bag. The hem along the respective side edge of the vacuum cleaner filter bag is part of one of the individual pleats forming the gusset; for example, the hem is a pleat hinge in the area of the respective side edge or the hem is included completely in one pleat leg.

The at least five individual pleats of the surface pleats may extend along the longitudinal axis of the filter bag. Alternatively, the folds may also extend at right angles to the longitudinal axis.

A fixing device may also be provided to prevent at least one of the at least five pleats from unfolding completely.

The pleats of a bag wall may be at least partially connected to each other by means of a fixing device. The fixing device may also serve to keep folds in the bag wall at a predetermined distance to each other.

The fixing device may comprise at least one strip of material, in particular a strip of non-woven material, or consist of at least one strip of material, in particular at least one strip of non-woven material. A plurality of strips of material may be arranged at a distance from each other or directly adjacent to each other.

A plurality of strips of material may extend transversely, in particular perpendicularly or at a predetermined angle, to the longitudinal direction of the pleats. The predetermined angle may be greater than 0° and smaller than 180°, in particular greater than 30° and smaller than 150°.

The fixing device is preferably arranged on the so-called face side with respect to the bag wall. The face side is the side facing the inside of the vacuum cleaner filter bag. The fixing device may be at least partially connected, in particular directly connected, in particular bonded and/or welded, to the bag wall, in particular to the pleats of the bag wall. Furthermore, the fixing device may be bonded and/or welded on at points where the pleat legs of two pleats of the bag wall adjoin each other.

The fixing device may be bonded and/or welded to the bag wall in one or more areas of the bag wall respectively arranged between two pleats of the bag wall. In particular in case of horizontal or lying pleats not overlapping each other this facilitates manufacture of the vacuum cleaner filter bag.

Two or more pleats of the bag wall may also be connected to each other by means of the fixing device, while two or more pleats of the bag wall are not connected to each other via the fixing device.

Alternatively or additionally the fixing device may be bonded and/or welded to one or more pleats of the bag wall in such a way that the connection is released during the use of the vacuum cleaner filter bag. Hence the air flow inside the vacuum cleaner filter bag may be influenced by the at least partially detaching fixing device.

In other words, parts of the fixing device may serve as air distributors during the use of the vacuum cleaner filter bag.

The surface pleats, gussets and/or fixing devices may be configured in particular as described in the European patent application EP 2 366 319 or the European patent application EP 2 366 320.

The side of the bag wall opposite the holding plate may form to be concave or convex. This enables a more efficient utilization of available installation space.

The invention further provides a method for manufacturing a vacuum cleaner filter bag according to claim 10, in particular for manufacturing a vacuum cleaner filter bag as described above. The method according to the invention thus comprises the following steps:

a) forming a tubular bag of filter material open at one side;
b) arranging an at least partially cylindrical connecting piece at the wide end of a conical guiding member so that the connecting piece abuts against the outer surface of the conical guiding member;
c) putting the bag over the conical guiding member;
d) connecting the bag to the circumferential surface of the connecting piece facing away from the guiding member;
e) lifting the bag connected to the connecting piece off the guiding member; and
f) connecting the connecting piece to a holding plate.

This method enables efficient automated production.

Forming the tubular bag open at one side may comprise overlapping two webs of filter material and forming two longitudinal and one transverse weld seam. Alternatively, forming the tubular bag open at one side may comprise folding over a single web of filter material and forming a longitudinal weld seam for connecting two edges of the web of filter material overlapping after the folding over as well as forming a transverse weld seam.

Forming the tubular bag open at one side may moreover comprise forming the surface pleats and/or side as described above.

In particular, the surface pleats may be introduced along the conveying direction of the web of filter material. If the pleats are to extend along the longitudinal direction of the vacuum cleaner filter bag, the open side is provided transverse to the conveying direction of the web of filter material. If the pleats are to extend transverse to the longitudinal direction of the vacuum cleaner filter bag, the open side is provided along the conveying direction of the web of filter material.

The conical guiding member may be arranged on a worktable, in particular a rotary table. In particular, a plurality of conical guiding members may be provided, especially along the circumference of the rotary table. The radius of the conical guiding member may, in particular, decrease in the direction away from the worktable.

The conical guiding member may be configured so that its diameter can be changed or adjusted on the surface of the worktable. For example, the conical guiding member may be arranged in a through hole in the worktable and may be moved perpendicular to the surface of the worktable. Alternatively, the conical guiding member may be formed from several radially displaceable elements.

Arranging the at least partially cylindrical socket at the wide end of a conical guiding member may include putting the socket over the conical guiding member. The inner diameter of the at least partially cylindrical connecting piece, i.e. the diameter of its above-mentioned through opening, may correspond to the outer diameter of the conical guiding member on the surface of the worktable, so that the connecting piece abuts against the outer surface of the conical guiding member. To this end the conical guiding member may have a cylindrical section at its wide end, the shape and extent of which correspond to the shape and extent of the cylindrical section of the connecting piece, wherein, however, the outer radius of the cylindrical section of the conical guiding member corresponds to the inner diameter of the cylindrical section of the connecting piece.

Putting the bag over the conical guiding member may comprise gripping and opening the tubular bag open at one side. Putting the bag over the conical guiding member may be carried out automatically, in particular by a gripper of a robot.

In case the pleats are provided transversely to the longitudinal direction of the vacuum cleaner filter bag the open side of the bag is provided along the conveying direction of the web of filter material. In this case, the robot gripper turns the bag before putting it over the conical guiding member.

In case the pleats are provided along the longitudinal direction of the vacuum cleaner filter bag the open side of the bag is provided transversely to the conveying direction of the web of filter

material. In this case, the robot gripper may pick up the bag along the conveying direction of the web of filter material and put it over the conical guiding member.

The bag may be connected to the outer surface of the connecting piece facing away from the guiding member, in particular by ultrasonic welding. The conical guiding member provides the anvil for the sonotrode. Welding may be carried out in a plurality of steps. For example, a rotary table can be used to move the conical guiding member with the bag fitted over it to various welding stations, which are arranged and configured such that they weld various segments of the circumference of the connecting piece to the bag wall. Alternatively, a circumferentially movable welding sonotrode may also be used.

Alternatively or additionally connecting the bag to the outer surface of the connecting piece facing away from the guiding member may comprise arranging a clamping element over the bag wall so that the bag wall is clamped in a region of the outer surface of the connecting piece between the outer surface of the connecting piece and the clamping element.

The bag connected to the connecting piece may be lifted off the guiding member automatically using a gripper of a robot. Lifting the bag connected to the connecting piece off the guiding member may also comprise reducing the diameter of the conical guiding member on the surface of the worktable, for example by lowering the conical guiding member in a through hole in the worktable.

Connecting the connecting piece to a holding plate may comprise bonding, welding and/or positive connection as described above.

The method may also comprise a visual inspection of the connection between the bag wall and the outer surface according to step d). In particular, at least one digital image of the connecting area of the bag wall with the outer surface sheet may be generated. This digital image may be subjected to automated image processing in order to detect defects in the joint, such as insufficiently formed weld seams. Based on the detection of an insufficient joint a warning signal may be issued and/or the bag in question may be removed.

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

Fig. 1 shows a cross section through an exemplary vacuum cleaner filter bag;

Fig. 2 is a perspective view of an exemplary at least partially cylindrical connecting piece;

Fig. 3 is a top view of an exemplary tubular bag open at one side for the manufacture of a vacuum cleaner filter bag;

Fig. 4 is a perspective view of an exemplary conical guiding member for the manufacture of a vacuum cleaner filter bag; and

Fig. 5 is an illustration of a manufacturing step in the production of an exemplary vacuum cleaner filter bag.

Fig. 1 shows a cross-section of an exemplary vacuum cleaner filter bag 1 having a bag wall 2 and a holding plate 3. The holding plate 3 serves to fix the vacuum cleaner filter bag in a corresponding holder in a housing of a vacuum cleaner.

In contrast to the prior art the bag wall is not directly connected to the holding plate but to a connecting piece 4 that is at least partially cylindrical. In particular, the connecting piece extends in a direction perpendicular to a through opening 5 formed in the holding plate 3, i.e. perpendicular to the plane in which the through opening 5 lies. The bag wall 2 is connected along the circumference of the connecting piece 4 to the outer surface thereof which also extends in the direction perpendicular to the through opening 5 formed in the holding plate 3.

Fig. 2 shows a perspective view of an exemplary connecting piece 4 that is at least partially cylindrical. The connecting piece 4 comprises a cylindrical section 10. The shape of the cylindrical section 10 may be randomly selected and is not limited to the shape of a circular cylinder. The axis of the cylindrical section 10 defines the longitudinal axis of the connecting piece 4. A through opening is provided along this longitudinal axis of the cylindrical section 10. In combination with the through opening 5 of the holding plate 3 this through opening provides an inflow opening for the suction material into the filter bag, as is shown in Fig. 1.

The exemplary connecting piece 4 of Fig. 2 comprises a second section 11 adjacent to the cylindrical section 10 having a larger circumference than the cylindrical section10. In particular, the second section 11 protrudes radially outwards beyond the outer surface of the cylindrical section 10. As shown in Fig. 2, the connecting piece 4 may be connected to the holding plate 3 in the region of the second section 11.

In particular, Fig. 1 shows that the connecting piece 4 is connected to the holding plate via a weld seam 9. Instead of the weld seam 9, an adhesive connection or a positive connection could also be utilized.

In the exemplary embodiment shown in Fig. 1, the bag wall 2 is welded to the circumferential surface of the cylindrical section 10 of the connecting piece 4. In particular, the ultrasonic weld seams 7 can be seen. In addition, in this exemplary embodiment a clamping ring 8 is shown which clamps the bag wall 2 to the circumferential surface of the cylindrical section 10 of the connecting piece 4. A clamping ring 8 of this type is able to provide the connection of the bag wall to the circumferential surface on its own.

In the exemplary embodiment in Fig. 1, moreover a sealing lip 6 at the through opening 5 is shown.

Fig. 3 shows a top view of an exemplary tubular bag open at one side that may be used in the manufacture of a vacuum cleaner filter bag according to Fig. 1. The bag wall 2 of the exemplary bag of Fig. 3 comprises two longitudinal weld seams 12, 13 and a transverse weld seam 14. At

the short side 15 the bag is open, i.e. has no weld seam to enable a connection to a connecting piece as is shown in the example in Fig. 2.

For better utilization of the installation space the transverse weld seam 14 could also be concavely or convexly curved. A bottom in the form of a block bottom or a gusset would also be conceivable in the area of the transverse weld seam 14.

Moreover the bag wall 2 in Fig. 3 comprises a plurality of surface pleats 16 extending along the longitudinal weld seams 12, 13. At the open end 15, the pleats are fixed in position by a fixing device 17.

As stated above, in the context of the present invention the term "pleats" is defined as a sequence of two or more pleats, a single pleat being defined as comprising two pleat legs and one pleat hinge.

The term "pleat hinge" refers to the point of a pleat having the smallest radius of curvature. The imaginary connection of the pleat hinges creates a so-called pleat axis. The pleat axis is also referred to as the pleat spine. The pleat axis may correspond to the longitudinal axis of a pleat. Areas of a pleat having a radius of curvature that is greater than the minimum radius of curvature of the pleat are referred to as pleat legs. The area between the pleat legs of a pleat is referred to as the pleat core. In particular, the pleat legs of a pleat may therefore also have a curvature.

Pleats may also include inflection points. Inflection points are those points of a pleat, in particular the pleat legs, where the curvature of the pleat changes from concave to convex. A connecting line that links several inflection points of a pleat is referred to as an inflection line (turning line).

Two adjacent pleats may also share a pleat leg. In case a plurality of pleats are provided a package of pleats or a train of pleats can be realized.

A plurality of pleats may also be arranged in a zigzag pattern.

Pleats may also have legs extending parallel to the bag wall. Such legs may be located between pleats that protrude from the plane of the bag wall and thus have an opening at the face side with respect to the bag wall. In particular, the width of the parallel leg can be smaller than the width of the opening of the pleat protruding from the bag wall, preferably less than half of the width or most preferably less than a quarter of the width thereof.

In particular, the pleat legs of the pleats may be smooth. The term "smooth" refers to the fact that the pleat legs do not have any compressions and/or patterns to stabilize the shape of the pleats, in particular.

One or more pleat legs of one or more pleats may comprise one or more embossing patterns wherein, in particular, the embossing patterns do not serve to stabilize the shape of the pleats. Thus the surface area available for filtration may be further increased.

In particular, the bag wall 2 may include more than 5, 10, 20, 30, 40 or 50 pleats that may be pleated themselves in their turn.

The pleats of the bag wall may be regularly spaced from each other. In other words, the distance between the backs of two adjacent pleats may be essentially constant.

Pleats may be formed horizontally or vertically. Horizontal or lying pleats are pleats whose pleat legs are arranged essentially parallel to the bag wall 2. Vertical or upright pleats are pleats whose pleat legs form an angle greater than 0° and smaller than 180°, in particular greater than 20° or greater than 45°, with the bag wall 2.

An upright pleat is a pleat in which a plane in which both the pleat axis and the turning line of the pleat lie forms an angle greater than 45°, in particular greater than 30°, particularly greater than 10°, with a flat, horizontal surface on which the first and/or second bag wall is arranged. In this case, a lying pleat is a pleat in which the plane forms an angle of less than 45° with this surface, in particular less than 30°, particularly less than 10°.

For measuring or determining the above-mentioned angles, the vacuum cleaner filter bag, in particular the folded non-woven material is placed on a flat horizontal surface. To this end the vacuum cleaner filter bag may also be cut open and placed on the surface in such a way that the face side or inside of the original vacuum cleaner filter bag rests on the surface.

Lying pleats may be formed to be mutually overlapping, non-overlapping and/or partially overlapping.

For manufacturing an exemplary vacuum cleaner filter bag as shown in Fig. 1 the bag wall 2 has to be connected to the connecting piece 4. Although the connecting piece 4 made of plastic has certain strength in case of a connection by welding it is advantageous to provide an anvil that forms an abutment. Fig. 4 shows such an anvil in the form of a conical guiding member 18.

As shown in Fig. 5, the conical guiding member 18 may be arranged vertically on a worktable. The conical guiding member 18 is configured such that its outer diameter at the wide end corresponds to the inner diameter of the cylindrical section of the connecting piece 4. The connecting piece 4 is then put over the conical guiding member 18 as shown in Fig. 5. A gripper of a robot may then grip a tubular bag open at one side as shown in Fig. 3, for example, and put it over the conical guiding member 18, too. In this respect, too, the conical shape of the guiding member 18 is advantageous. The bag wall 2 can then be welded to the circumferential surface of the cylindrical section 10 of the connecting piece 4 from outside. This is advantageous in so far as the welding result can be checked, for example by means of image processing.

Eventually, the connecting piece 4 and the bag wall 2 connected thereto are pulled off the conical guiding member 18. Finally, the connecting piece 4 is connected to a holding plate 3, for example by ultrasonic welding as well.

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. Støvsugerfilterpose (1) omfattende en posevæg (2) og en holdeplade (3), hvor holdepladen (3) er forbundet med et forbindelsesstykke (4), der i det mindste i sektioner er cylindrisk og strækker sig mod en dannet gennemgående åbning (5) i holdepladen (3),
kendetegnet ved, at
posevæggen (2) er forbundet med den ydre overflade af forbindelsesstykket (4) langs omkredsen deraf, og
hvor posevæggen (2) er limet eller svejset til den ydre overflade.

2. Støvsugerfilterpose ifølge krav 1, hvor posevæggen (2) er fastspændt mellem den ydre overflade og et spændeelement (8).

3. Støvsugerfilterpose ifølge krav 1 eller 2, hvor forbindelsesstykket (4) er klæbet eller svejset eller formtilpasset forbundet med holdepladen (3).

4. Støvsugerfilterpose ifølge et af de foregående krav, hvor holdepladen (3) og forbindelsesstykket (4) er anbragt ved en kortside af posevæggen (2).

5. Støvsugerfilterpose ifølge et af de foregående krav, hvor posevæggen (2) indbefatter overfladefolder (16) bestående af mindst fem folder.

6. Støvsugerfilterpose ifølge krav 5, hvor de mindst fem folder strækker sig langs længdeaksen eller på tværs af filterposens (1) længdeakse.

7. Støvsugerfilterpose ifølge krav 5 eller 6, hvor der er tilvejebragt en fastgørelsesindretning (17), som forhindrer mindst en af de mindst fem folder i at folde sig fuldstændigt ud.

8. Støvsugerfilterpose ifølge et af de foregående krav, yderligere omfattende mindst en sidefold.

9. Støvsugerfilterpose ifølge et af de foregående krav, hvor siden af posevæggen (2) modsat holdepladen er udformet til at være konkav eller konveks.

10. Fremgangsmåde til fremstilling af en støvsugerfilterpose ifølge et af de foregående krav, omfattende følgende trin:

a) at danne en rørformet pose af filtermateriale, der er åben på den ene side;

b) at anbringe et i det mindste i sektioner cylindrisk forbindelsesstykke (4) ved den brede ende af et konisk styreelement (18), således at forbindelsesstykket (4) ligger an mod den ydre overflade af det koniske styreelement (18);

c) at sætte posen over det koniske styreelement (18);

d) at lime eller svejse posen til den ydre overflade af forbindelsesstykket (4), der vender væk fra styreelementet (18);

e) at løfte posen, der er forbundet med forbindelsesstykket (4), af styreelementet (18); og.

f) at forbinde forbindelsesstykket (4) med en holdeplade (3).

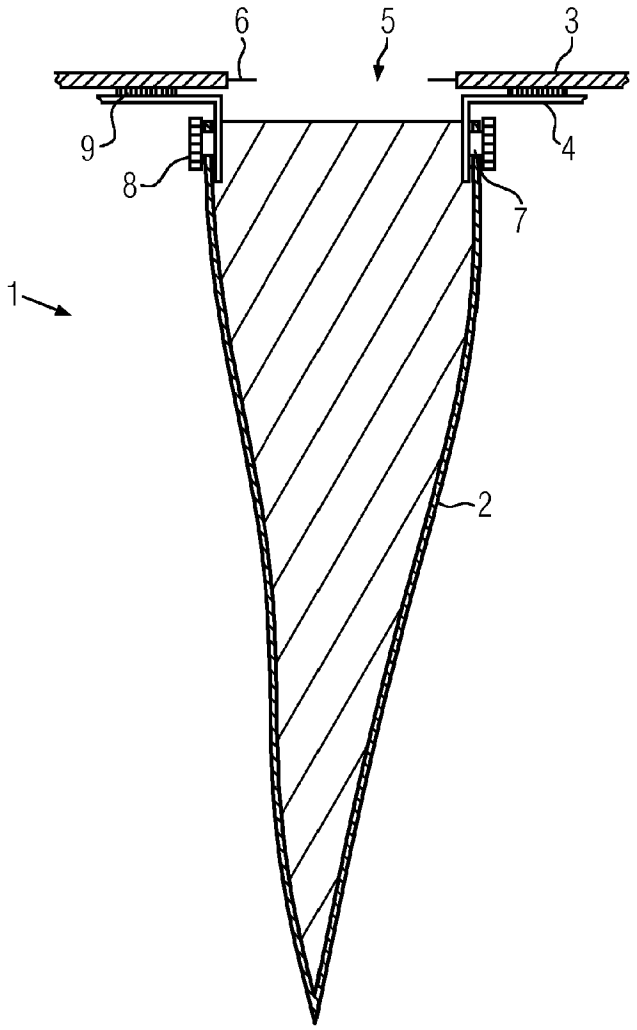

FIG. 1

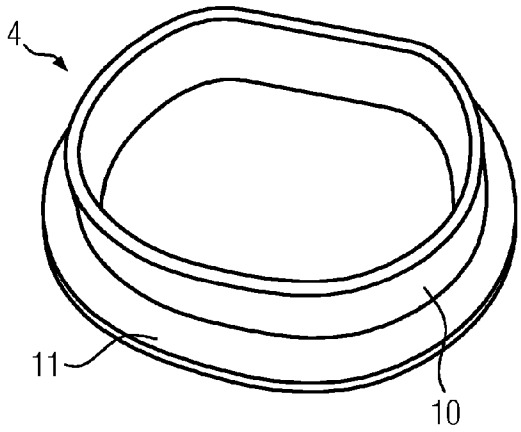

FIG. 2

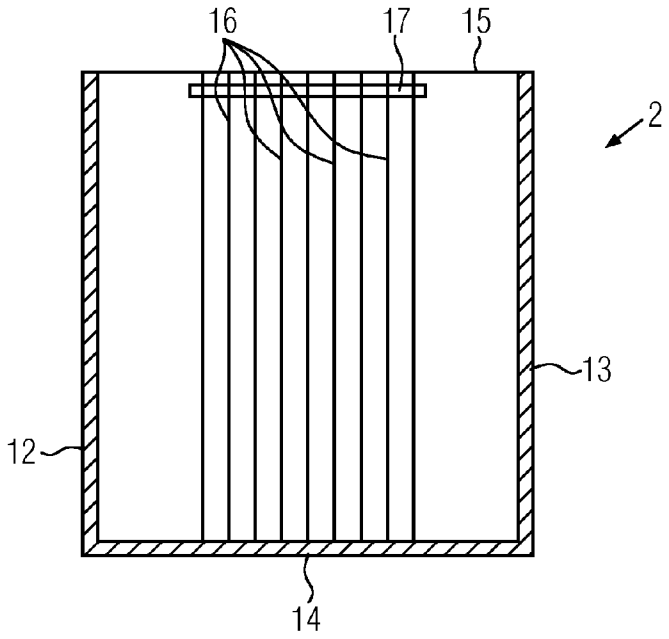

FIG. 3

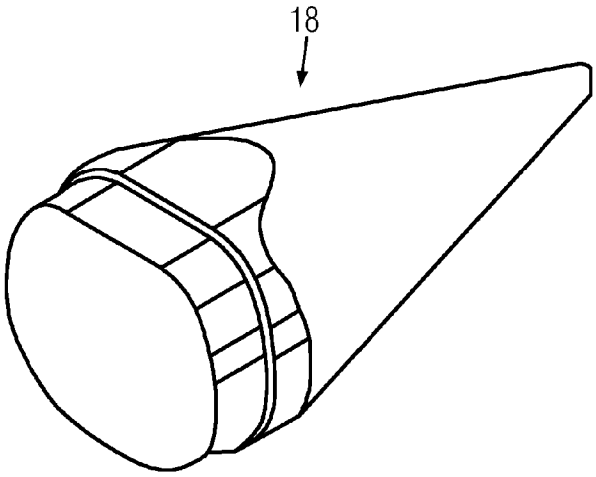

FIG. 4

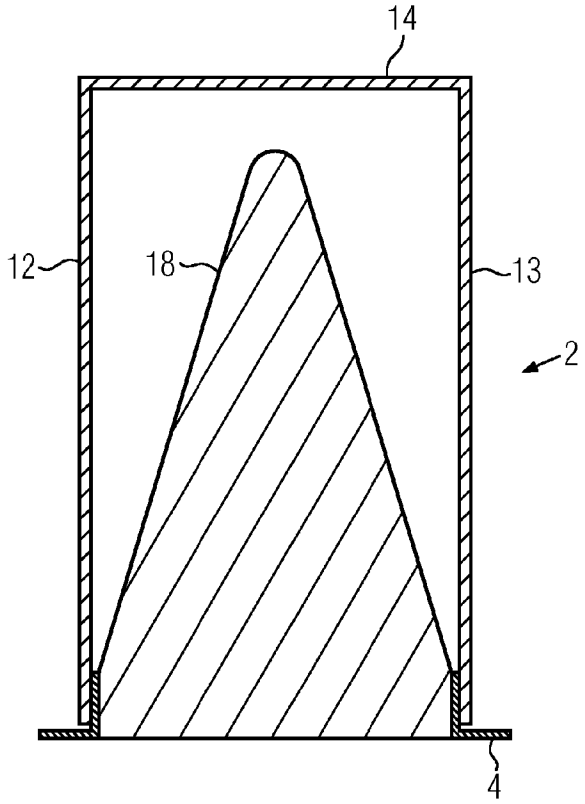

FIG. 5