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Method of joining a retaining plate to the wall of a vacuum cleaner filter bag by means of closure by adhesive force and vacuum cleaner filter bag

The present invention relates to methods for producing an improved bond by means of closure by adhesive force between a retaining plate and the wall of a vacuum cleaner filter bag. According to a first variant, the retaining plate is not applied directly to the wall of the vacuum cleaner filter bag, but a textile material is arranged between the retaining plate and the wall. The bond between the retaining plate and the wall of the vacuum cleaner filter bag is formed by the textile material. According to a second variant, a film made of a thermoplastic material is arranged between the wall of the vacuum cleaner filter bag and the retaining plate in certain regions between the retaining plate and the wall of the vacuum cleaner filter bag. The bond between the retaining plate and the wall of the vacuum cleaner filter bag is formed by the film. The present invention also relates to vacuum cleaner filter bags in which the retaining plate is bonded to the wall of the vacuum cleaner filter bag by means of closure by adhesive force according to the above-mentioned principles.

In vacuum cleaner filter bags that consist include a thermoplastic film in a subarea or are made completely of the same it may be necessary to attach a retaining plate exactly in this area. Typically, a vacuum cleaner bag retaining plate is bonded to the nonwoven fabric of a filter bag by adhesive bonding using a thermally activatable adhesive (e.g. hot melt) or by ultrasonic welding. Because of the short welding time and the high strength and process reliability of the welded joint, this is the preferred method. Directional sensors on the holding plate as well as structures on the sonotrode or on the anvil further increase the performance of ultrasonic welding.

However, ultrasonic welding a retaining plate to a film turns out to be an unexpected challenge. The maximum tensile forces achieved are unsatisfactory, directional sensors often lead to even worse results than welding flat, smooth retaining plates to the film, and structuring the sonotrode or the anvil also hardly leads to better results.

Therefore, the problem of creating a reliable bond, in particular by welding the retaining plate to the wall of the filter bag, especially one consisting of a film, remains to be solved. Welding can be further complicated if the holding plate has a mechanism for automatically closing a flap on removal from the vacuum cleaner. These mechanisms include various metal springs that are anchored in the retaining plate. In the region of these attachments that are often force-closure or positive joints exist materials of great thickness that impede ultrasonic conduction. The spring itself also often leads to an unwanted distribution of the ultrasound in the workpiece so that there is not sufficient energy available at the actually desired welding position.

Thus, it is the task of the present invention to provide reliable methods for joining a retaining plate

to the wall of a vacuum cleaner filter bag avoiding the above-mentioned disadvantages. In particular, the bond between the retaining plate and the wall of the filter bag should be easy to realize, the bond produced should be able to withstand high tensile loads, and the results obtained should also be reproducible. In addition, it is an object of the present invention to provide respective vacuum cleaner filter bags.

DE 20 2008 002 010 U1 describes a filter bag for a vacuum cleaner, the filter bag comprising a dust collection bag connected to a retaining plate having a passage opening for a vacuum cleaner nozzle provided with a seal made of a polymeric material. The dust collection bag is directly bonded and/or welded to the seal.

DE 20 2008 004 025 U1 describes a filter, in particular a vacuum cleaner bag, with a filter material on which an inflow opening is provided in which a sealing means for producing a seal is provided with a nozzle, which is arranged adjacent to a retaining plate. The sealing means includes at least one elastic rubber layer with an opening, which is reinforced by a further layer of stiffer material with an opening aligned with the opening of the rubber layer.

From EP 2 025 278 A1 a vacuum cleaner filter bag, a filter bag material including an inner layer of nonwoven material at least in the region of the inlet opening, and a retaining plate are known which is arranged on the outside of the filter bag in the region of the inlet opening, which can be attached to a holding device of a vacuum cleaner for holding the vacuum cleaner filter bag and on which a closure device is provided for closing the inlet opening, wherein the nonwoven material in the region of the inlet opening has a surface which is adapted to avoid the formation of a filter cake on this surface.

This task is solved with the methods for joining a retaining plate to the wall of a vacuum cleaner filter bag by means of closure by adhesive force having the features patent claims 1 and 12 with respect to vacuum cleaner filter bags having the features of claims 13 and 17. The respective dependent claims represent advantageous further developments.

Thus, according to a first aspect, the invention relates to a method for joining a retaining plate to the wall of a vacuum cleaner filter bag by means of closure by adhesive force. The wall of the vacuum cleaner filter bag includes a location for the attachment of the retaining plate. This location may vary depending on the design of the vacuum cleaner filter bag to be made later from the wall of the vacuum cleaner filter bag.

According to a first variant of this aspect at least partly in the region of the attachment location of the retaining plate, a bond of the wall of the vacuum cleaner filter bag by means of closure by adhesive force, by means of force closure or by means of form closure is made to at least one, in particular exactly one layer of a textile material at least in selected regions, wherein the retaining plate is pressed against the side of the wall of the vacuum cleaner filter bag provided with the

textile material at the attachment location. Subsequently a bond by means of closure by adhesive force is produced between the wall of the vacuum cleaner filter bag, the textile material and the retaining plate.

According to this first variant of the first aspect of the invention, initially at least one layer of a textile material, for example a single layer of a textile material, is applied to the wall of the vacuum cleaner filter bag at the attachment location of the retaining plate and is bonded to the wall of the vacuum cleaner filter bag there, at least in selected regions.

The attachment location is the region of the wall of the vacuum cleaner filter bag where the retaining plate is afterwards arranged, i.e. the region of the wall that is defined by the outline of the retaining plate projected onto the wall.

The textile material may be applied only in regions of the attachment location, so that only part of the surface on which the retaining plate is arranged afterwards is provided with a textile material. This embodiment is particularly useful when it is sufficient to provide only a localized or regional reinforcement of the bond between the retaining plate and the wall of the vacuum cleaner filter bag. For reinforcement, it may also be sufficient to provide one or more strips of textile material. In particular, the region of the bond, e.g. the weld, may be reinforced which experiences the highest stress.

It is also possible to provide the entire surface defining the attachment location of the retaining plate with a textile material.

It is also possible to choose the surface area of the textile material to be larger than the surface area of the attachment location, so that after the retaining plate is connected to the wall, textile material protrudes below the retaining plate.

Joining the textile material to the wall at least in certain regions, may, for example, be effected by spot welding or spot bonding, but also by permanent or temporary mechanical fixing, such as clamp connections, etc. After the textile material has been fixed at the intended position on the wall of the vacuum cleaner filter bag according to the above-described process, the retaining plate is pressed onto the textile material in such a way that at least part of the surface of the retaining plate comes to rest on the textile material. It is also possible for the entire surface area of the retaining plate to be adapted to the textile material when the surface area of the textile material selected for this purpose has an appropriate dimension, i.e. is at least as large as the base surface of the retaining plate.

Finally, a bond by means of closure by adhesive force is produced between the wall of the vacuum cleaner filter bag and the retaining plate via the textile material. This can be done, for example, by welding, especially ultrasonic welding, or by means of adhesive bonding. In this case, for example, an adhesive is already applied to the textile material, the retaining plate or both the textile material

and the retaining plate before pressing the retaining plate onto the textile material.

A second variant of the first aspect according to the invention provides that, at least in selected regions on the retaining plate, a bond of the retaining plate by means of closure by adhesive force, by means of force closure or by means of form closure is made to at least one, in particular exactly one layer of a textile material and the retaining plate is pressed against the wall of the vacuum cleaner filter bag at the attachment location with the side thereof provided with the textile material. In this case, too, subsequently a bond of the retaining plate by means of closure by adhesive force is produced between the wall and the textile material in the manner described above.

In contrast to the above-described first variant in the second variant the textile material is fixed to the retaining plate at least in selected regions thereof, and the retaining plate is then pressed together with the textile material fixed at least in selected regions thereof, onto the wall of the vacuum cleaner filter bag at the attachment location and connected thereto via the textile material. The textile material can, for example, be applied only in certain regions of the retaining plate, e.g. in such a way that the textile material does not cover the entire surface area of the retaining plate, or that one edge of the retaining plate is overlapped by the textile material, but not the entire surface area of the retaining plate later attached to the wall is covered by the textile material. It is also possible for the textile material to cover the entire surface area of the retaining plate, also in such a way that the textile material protrudes beyond the edge of the retaining plate. If the retaining plate has an entrance opening for a vacuum cleaner nozzle, and the textile material is arranged on the retaining plate in such a way that the entrance opening is partially or completely covered a passage opening can be made in the textile material before or after it is applied to the retaining plate. The passage opening can also be inserted after producing the bond between the retaining plate and the wall of the vacuum cleaner filter bag.

Joining the textile material to the retaining plate can be carried out in the same way as the textile material is joined to the wall in accordance with the first variant, i.e. also by spot welding, spot gluing, but also by mechanical permanent or temporary fixings, such as clamp connections, etc. Moreover the textile material can be molded to the retaining plate during the process of manufacturing the same. In particular, if the retaining plate is produced by means of injection molding, the textile material may, for example, be introduced into the injection mold in advance and thus be bonded to the retaining plate during the actual injection molding process.

Joining the retaining plate provided with the textile material is identical to the first variant, i.e. in the second variant, too, appropriate gluing or welding of the retaining plate to the wall can be carried out via the textile material.

According to a third variant of the first aspect of the method according to the invention, it is provided that at least one, in particular precisely one layer of a textile material is introduced between the

wall of the vacuum cleaner filter bag and the retaining plate at least partly in the region of the attachment location of the retaining plate and the retaining plate is pressed together with the film against the wall of the vacuum cleaner filter bag at the attachment location. In the third variant, too, a bond by means of closure by adhesive force is finally produced between the wall and the retaining plate via the textile material. According to this variant, the textile material is introduced between the wall and the retaining plate without prior fixation, for example inserted at the intended location, and only a single joining process is carried out in which the retaining plate is connected to the wall of the vacuum cleaner filter bag via the textile material.

In this third variant, too, as in the above-described embodiments the textile material may be applied only in regions of the attachment location so that only part of the surface on which the retaining plate is later arranged is provided with a textile material. It is possible as well to provide the entire surface defining the attachment location of the retaining plate with a textile material. It is also possible to choose the surface area of the textile material to be larger than the surface area of the attachment location, so that after the retaining plate is connected to the wall, textile material protrudes below the retaining plate.

Surprisingly, it was found that when a bond was produced between a retaining plate and a wall of a vacuum cleaner filter bag, a significant improvement in the welding result could be achieved. In particular, it was found that the maximum tensile force required to tear the connected retaining plate from the wall of the vacuum cleaner filter bag can be significantly increased. This can be observed in particular if the wall of the vacuum cleaner filter bag is formed of a film, at least in the region where the attachment of the retaining plate takes place or is intended to take place.

According to the invention, the textile material and/or at least the support side of the retaining plate at the wall of the vacuum cleaner filter bag comprises a thermoplastic material or consists of or is formed entirely therefrom at least in the region of the attachment point of the retaining plate. Preferred thermoplastic materials suitable for the wall of the vacuum cleaner filter bag are polyolefins, in particular polyethylene, polypropylene or polystyrene, polyesters, in particular PET, PBT, PC or PLA, thermoplastic elastomers, in particular TPE-O, TPE-V, TPE-U, TPE-E, TPE-S or TPE-A, poly(meth)acrylates, polyamides, polybenzimidazoles, polyethersulfones, polyetheretherketones, polyetherimides, polyphenylene oxides, polyphenylene sulfides and polytetrafluoroethylene, as well as mixtures, blends or combinations thereof. The wall of the vacuum cleaner filter bag can be formed, for example, as a film or as a nonwoven fabric, at least in the region of the attachment point of the retaining plate.

It is also preferred that the textile material comprises or consists of or is formed from thermoplastic fibres and/or thermoplastic filaments.

The thermoplastic fibres or filaments of the textile material may be formed from the same or other

materials as described above for the wall of the vacuum cleaner filter bag.

Furthermore, it is advantageous if at least the support side of the retaining plate comprises a thermoplastic material at least in selected regions or consists of or is formed entirely from a thermoplastic material or the entire retaining plate consists of or is formed from a thermoplastic material.

The thermoplastic materials described above for the wall of the vacuum cleaner filter bag are also suitable for the retaining plate. The materials of the retaining plate can be the same or different materials as the ones used for the wall of the vacuum cleaner filter bag or the textile material.

According to a particularly preferred embodiment, the thermoplastic fibres and/or the thermoplastic filaments of the textile material are formed from a material which has a melting temperature which is less than or equal to, preferably less than, particularly preferably less than, by at least 10 °C, in particular by at least 20 °C, the melting temperature of the thermoplastic material of the wall of the vacuum cleaner filter bag and/or the melting temperature of the thermoplastic material of the retaining plate, the melting temperature being determined in accordance with ISO 11357, and/or has a melt flow rate (MFR), which is greater than or equal to, preferably greater than, particularly preferably by a factor of 5 to 20 greater than the melt flow index of the thermoplastic material of the wall of the vacuum cleaner filter bag and/or than the melt flow index of the thermoplastic material of the retaining plate, the melt flow index being determined in accordance with ISO 1133, at a nominal load of 2.16 kg and a temperature of 230 °C. These parameters for determining the melt flow index may have to be adapted depending on the thermoplastics used. It is essential that only MFIs determined with the same parameters are compared. The temperature is set for largely differing plastics (e.g. PP and TPE) in such a way that both plastics melt at this temperature. The nominal load is set in such a way that the discharge rate for both melts is within a range that can be easily measured. These adaptations are familiar to those skilled in the art.

The thermoplastic materials of the textile material thus melt sooner, i.e. at lower temperatures than the thermoplastic materials of the wall and/or the retaining plate, and/or have lower viscosity at the same temperature. Due to earlier melting and/or the lower viscosity of the melt of these materials result in improved wetting of the wall and the retaining plate, in particular in case of a welded joint so that a more significant improvement in the bond between the retaining plate and the wall of the vacuum cleaner filter bag can be observed.

A particularly preferred thermoplastic material for the wall of the vacuum cleaner filter bag is chosen from polyolefins, in particular polypropylene or polyethylene, polyester or if the wall is designed as a film laminate at least at the point of attachment thermoplastic polymers, in particular TPE or TPU as the layer of this laminate facing the retaining plate.

Polyolefins, such as polypropylene or polyethylene, or polyester, in particular PET, are employed

as materials for the retaining plate.

Preferred materials that are particularly suitable for the textile material are thermoplastic elastomers, such as TPE or TPU. It is, however, also possible for the textile material to be formed from the same thermoplastics as the retaining plate or the wall, but in this case, as described above, it is preferred for the thermoplastic material to have a lower melting point. If, for example, the wall, the retaining plate and the textile material are formed from PP, it is advantageous to use a type of PP for the textile material that has a lower melting point and/or a higher MFI than the types of PP used for the retaining plate and the wall.

According to a preferred embodiment the textile material is selected from the group consisting of nonwovens, nets, woven fabrics, warp knitted fabrics and weft knitted fabrics, non-crimped fabrics, knitted fabrics, braided fabrics, stitch-bonded fabrics and felts, and combinations thereof. In particular, nonwovens and nettings are preferred, with spunbonded and carded nonwovens being especially preferred among the nonwovens.

According to another preferred embodiment the textile material is of sheet-like design and in particular has an area weight of 5 to 200 g/m², preferably 10 to 100g/m², particularly preferably 15 to 50 g/m².

The advantages of the present invention take effect in particular when the wall of the vacuum cleaner filter bag, at least in the region in which the retaining plate is to be fixed, is formed as a film of a thermoplastic material, a film laminate in which at least the side to which the retaining plate is applied consists of a thermoplastic material, or a nonwoven fabric of a thermoplastic material.

It is particularly advantageous if the thermoplastic material of the film or of the side of the film laminate to which the retaining plate is applied is formed from a material that has a melting temperature which is less than or equal to, preferably less than, particularly preferably less than by at least 10 °C, in particular by at least 20 °C, than the melting temperature of the thermoplastic material of the retaining plate (5), the melting temperature being determined in accordance with ISO 11357, and/or has a melt flow rate (MFR) which is greater than or equal to, preferably greater than, particularly preferably by a factor of 5 to 20 greater than the melt flow index of the thermoplastic material of the retaining plate (5), the melt flow index being determined in accordance with ISO 1133, at a nominal load of 2.16 kg and a temperature of 230 °C.

The smooth surface of the film makes it difficult to weld a retaining plate securely to the film. It is assumed here that complete wetting of the film or film laminate cannot take place, particularly not during the welding process. Surprisingly, wetting of the film or film laminate in particular can be improved by interposing a textile material between the retaining plate and the film or film laminate. It is particularly preferred if the textile material itself consists of a thermoplastic, in particular a

thermoplastic elastomer, and also melts during the welding process, for example. This enables significantly better wetting of the film, so that the resulting maximum tensile force that can act on the retaining plate before partial or complete tearing of the retaining plate, can be significantly improved.

It is particularly preferred when the joining of the wall of the vacuum cleaner filter bag with the textile material by means of closure by adhesive force, by means of force closure or by means of form closure at least in selected regions, the joining of the retaining plate with the textile material by means of closure by adhesive force, by means of force closure or by means of form closure at least in selected regions; and/or the final making of the bond by means of closure by adhesive force between the wall of the vacuum cleaner filter bag, the textile material and the retaining plate are effected by means of a welding process, in particular an ultrasonic welding process, or by means of adhesive bonding, in particular by means of a liquid adhesive, a two-component adhesive or a thermally liquefiable adhesive.

According to the present invention, it is possible to make a bag inlet opening in the wall of the vacuum cleaner filter bag and/or a passage opening in the textile material, respectively, and to align the respective openings in the various variants of the above described method. In this case, an inlet opening included in the retaining plate into which, for example, a vacuum cleaner nozzle can be inserted, is also arranged in alignment with the bag inlet opening and the passage opening. Particularly in the first variant of the process according to the invention mentioned above, it is preferred to initially make a bond of the textile material with the wall of the vacuum cleaner filter bag at least partly in the region of the attachment location of the holding plate and, in a subsequent step, for example by means of a punching process, to simultaneously introduce a congruent bag inlet opening into the wall of the vacuum cleaner filter bag and a passage opening into the textile material. Subsequently, the retaining plate can be applied with its inlet opening aligned with the passage opening of the textile material.

The geometric shape of the textile material can be based on the geometry of the weld to be achieved. Typically, the weld is round and has a width of a few mm to cm. It is therefore sufficient to position a corresponding ring of textile material between the film and the retaining plate and to join it to the film and retaining plate in one step using the known ultrasonic welding process.

Basically, it is also possible to first provisionally fix the textile material to the retaining plate or to the film and then process it in a second step (ultrasonic welding).

The textile material may, for example, be formed as a strip of material, which may also be wider than the targeted weld to facilitate positioning.

The bag inlet opening of the wall of the vacuum cleaner filter bag and/or the passage opening of the textile material may be dimensioned to have a diameter of a smaller or the same size as that

of the inlet opening of the retaining plate.

According to this embodiment either the bag inlet opening of the wall of the vacuum cleaner filter bag, or the passage opening of the textile material, or the bag inlet opening of the wall of the vacuum cleaner filter bag and the passage opening of the textile material are dimensioned to have a smaller diameter than that of the inlet opening of the retaining plate. This protrusion in the direction of the recess (filling hole) created in the process, forms a seal which can be used to seal the nozzle of the vacuum cleaner which is to be inserted into the interior of the resulting vacuum cleaner filter bag via the inlet opening of the retaining plate. In particular, a good sealing all can be observed with a smaller dimensioning of the passage opening of the textile material (and possibly also of the bag inlet opening of the wall of the vacuum cleaner filter bag). For example, in the region of this resulting protrusion, the textile material can be additionally connected, for example welded, to the wall of the vacuum cleaner filter bag. However, it is also possible to leave the textile material in this region unbounded to the wall of the vacuum cleaner filter bag.

It is also possible to introduce an additional seal, for example a flat sealing element, during the manufacture of the bond by means of closure by adhesive force according to the invention.

Preferably at least one flat sealing element is introduced at the attachment location of the retaining plate on the inside of the wall of the vacuum cleaner filter bag, between the wall of the vacuum cleaner filter bag and the textile material and/or between the textile material and the retaining plate, which is preferably made of TPE or TPU and which has a passage opening arranged in alignment with the passage opening of the retaining plate but has a diameter smaller than that of the passage opening of the retaining plate.

Furthermore, it is preferred that the support side of the retaining plate is structured at least in selected regions and/or includes directional sensors for ultrasound. A directional sensor can be formed, for example, as a raised groove on the attachment side of the retaining plate.

As an alternative or in addition thereto it is also possible that, in case the wall of the vacuum cleaner filter bag is formed as a film or as a film laminate at least in the region of the attachment location of the retaining plate, the film or the film laminate has a structured configuration at least at the attachment location, in particular consisting of recesses and projections, e.g. knurling.

In addition or alternatively, the film used can also be a laminate of two different thermoplastics. In this case the layer of the laminate more easily activatable by ultrasound faces the retaining plate. If this layer is a TPE, for example, and the retaining plate is equipped with the TPE welding aid described in EP231 1358 A1, a particularly good bond is achieved. In this case, too, it is even more advantageous if a textile material is additionally inserted.

In another particularly preferred embodiment at least at the attachment location of the retaining plate, on the wall and/or on the side of the textile material facing the wall and/or on the side of the

textile material facing the retaining plate a thermoplastic elastomer, such as in particular TPE-O, TPE-V, TPE-U, TPE-E, TPE-S or TPE-A, is applied at least in selected regions, e.g. by means of a printing process, in particular by means of functional screen printing. The thermoplastic elastomer can be applied to the respective surface in the form of dimples or concentric circles, for example.

According to a second aspect, the present invention relates to another method for joining a retaining plate to the wall of a vacuum cleaner filter bag by means of closure by adhesive force at an attachment location dedicated to this purpose. In contrast to the first aspect, no textile material is used to reinforce the bond between the retaining plate and the wall, but a film made of a thermoplastic material is used only in a region of the attachment location. Like the first aspect, the second aspect of the method according to the invention is embodied in three variants.

According to a first variant partly in the region of the attachment location of the retaining plate, a bond of the wall of the vacuum cleaner filter bag by means of closure by adhesive force, by means of force closure or by means of form closure is produced to at least one, in particular exactly one layer of a film of a thermoplastic material at least in selected regions, wherein the retaining plate is pressed against the side of the wall vacuum cleaner filter bag provided with the film at the attachment location and subsequently a bond by means of closure by adhesive force is produced between the wall of the vacuum cleaner filter bag, the film and the retaining plate.

According to a second variant, partly at the retaining plate, a bond of the retaining plate by means of closure by adhesive force, by means of force closure or by means of form closure is produced to at least one, in particular exactly one layer of a film of a thermoplastic material at least in selected regions, and the retaining plate is pressed with the side provided with the film against the wall of the vacuum cleaner filter bag at the attachment location and subsequently a bond by means of closure by adhesive force is produced between the wall of the vacuum cleaner filter bag, the film and the retaining plate.

According to a third variant at least one, in particular precisely one layer of a film of a thermoplastic material is introduced between the wall of the vacuum cleaner filter bag and the retaining plate partly in the region of the attachment location of the retaining plate, the retaining plate is pressed together with the film against the wall of the vacuum cleaner filter bag at the attachment location, and subsequently a bond by means of closure by adhesive force is produced between the wall of the vacuum cleaner filter bag, the film and the retaining plate.

According to the invention the wall, the film and/or the retaining plate comprises a thermoplastic material or consists or is formed thereof.

It must be ensured that when the final bond is produced between the wall, the film and the retaining plate, the bond is produced at least in the region where the film is present.

Surprisingly, according to this aspect of the invention, too, it turned out that when a bond was produced between a retaining plate and a wall of a vacuum cleaner filter bag, there was a significant improvement in the welding result. In particular, it was found that the maximum tensile force required to tear the connected retaining plate from the wall of the vacuum cleaner filter bag can be significantly increased. This can be observed in particular if the wall of the vacuum cleaner filter bag is formed of a film, at least in the area where the attachment of the retaining plate takes place or is intended to take place.

Preferably, the film is formed from a thermoplastic material that has a melting temperature which is less than or equal to, preferably less than, particularly preferably less than by at least 10 °C, in particular by at least 20 °C, than the melting temperature of the vacuum cleaner filter bag or the melting temperature of the thermoplastic material of the retaining plate (5), the melting temperature being determined in accordance with ISO 11357, and/or has a melt flow rate (MFR) which is greater than or equal to, preferably greater than, particularly preferably greater by a factor of 10 to 20 than the melt flow rate of the thermoplastic material of the wall (1) of the vacuum cleaner filter bag and/or than the melt flow rate of the thermoplastic material of the retaining plate (5), the melt flow index being determined in accordance with ISO 1133, at a nominal load of 2.16 kg and a temperature of 230 °C.

According to a preferred embodiment, the materials that can be used in particular for the film correspond to the materials specified as preferred materials for the textile materials mentioned above.

Preferably, the film that is inserted between the retaining plate and the wall is formed as a strip of material.

Further preferably, the film is not arranged in the region of the entry opening of the retaining plate or the bag inlet opening of the wall of the vacuum cleaner filter bag, but preferably in the edge region of the attachment location of the retaining plate.

In this case, the region in which the film is arranged preferably accounts for 5 to 70%, more preferably 10 to 50 %, particularly preferably 15 to 25 % of the surface area of the attachment location of the retaining plate.

The film inserted between the wall and the retaining plate may be formed to be continuous or slotted and/or perforated.

In another particularly preferred embodiment at least at the attachment location of the retaining plate, on the wall and/or on the side of the film facing the wall and/or on the side of the film facing the retaining plate a thermoplastic elastomer, such as in particular TPE-O, TPE-V, TPE-U, TPE-E, TPE-S or TPE-A, is applied at least in selected regions, e.g. by means of a printing process, in particular by means of functional screen printing. The thermoplastic elastomer can be applied to

the respective surface in the form of dimples or concentric circles, for example.

In all other respects, in particular with respect to the design of the wall of the filter bag and the design of the retaining plate, this second aspect of the invention is identical to the first aspect. In order to avoid repeated description reference is made to the above explanations with respect to the first aspect of the invention.

The means for connecting the film to the wall or the retaining plate at least in selected regions correspond to the ones already explained with reference to the first aspect of the present invention. In particular, spot welding or full welding or bonding can be considered.

The final making of the bond between the wall, the film and the retaining plate is also carried out in the same way as the production of the bond between the wall, the textile material and the retaining plate according to the first aspect of the invention.

The retaining plate may also include a closing flap which projects through the bag inlet opening into the interior of the vacuum cleaner filter bag and by means of which the bag inlet opening may be closed from the inside. This flap may, for example, include a spring by means of which automatic closure of the bag inlet opening with the flap is possible.

In addition, the present invention relates to a vacuum cleaner filter bag, comprising a wall having an attachment location for a retaining plate, and a retaining plate joined to the wall by means of closure by adhesive force at the attachment location which is joined to the wall at least in selected regions via a layer of a textile material.

According to a preferred embodiment the wall of the vacuum cleaner filter bag is formed at least at the attachment location of the retaining plate, of a film made of a thermoplastic material, a film laminate at least the side of which to which the retaining plate is applied is made of a thermoplastic material, or from a nonwoven fabric of a thermoplastic material.

Preferably further the wall of the vacuum cleaner filter bag has a bag inlet opening in the region of the attachment location, the textile material has a passage opening and the retaining plate has an entry opening, wherein the bag inlet opening, the passage opening and the entry opening are brought into alignment on top of each other wherein in particular the bag inlet opening and/or the passage opening are dimensioned to have a diameter of a smaller or the same size as that of the entry opening.

According to another preferred embodiment at least one flat sealing element is introduced at the attachment location of the retaining plate on the inside of the wall of the vacuum cleaner filter bag, between the wall of the vacuum cleaner filter bag and the textile material and/or between the textile material and the retaining plate, which is preferably made of TPE or TPU and which has a passage opening which is arranged in alignment with the passage opening of the retaining plate but has a smaller diameter than that of the passage opening of the retaining plate.

Furthermore the invention relates to a vacuum cleaner filter bag comprising a wall having an attachment location for a retaining plate and a retaining plate joined to the wall by means of closure by adhesive force at the attachment location which is joined to the wall in selected regions via at least one, in particular exactly one, layer of a film of a thermoplastic material.

The vacuum cleaner filter bag according to this variant is essentially identical to the above-described embodiment, except for the fact that the retaining plate is connected to the wall of the filter bag via a film, which is provided only in selected regions at the attachment location.

In this case, the preferred passage opening is made in the film.

Furthermore, the invention relates to a vacuum cleaner filter bag comprising a wall having an attachment location for a retaining plate and a retaining plate joined to the wall by means of closure by adhesive force at the attachment location wherein the wall of the vacuum cleaner filter bag is formed at least in the region of the attachment location of the retaining plate from a film made of a thermoplastic material or a film laminate at least the side of which to which the retaining plate is applied consists or is formed of a thermoplastic material, wherein the thermoplastic material of the film or the film laminate has a melting temperature which is less than or equal to, preferably less than, particularly preferably less than by at least 10 °C, in particular by at least 20 °C, than the melting temperature of the thermoplastic material of the retaining plate (5), the melting temperature being determined in accordance with ISO 11357, and/or has a melt flow rate (MFR) which is greater than or equal to, preferably greater than, particularly preferably by a factor of 5 to 20 greater than the melt flow index of the thermoplastic material of the retaining plate (5), the melt flow index being determined in accordance with ISO 1133, at a nominal load of 2.16 kg and a temperature of 230 °C.

The vacuum cleaner filter bags according to all embodiments can be made up from the above-described walls produced according to the invention using manufacturing methods known from the prior art, e.g. as flat bags or as block bottom bags.

The present invention will be explained in more detail with reference to the following drawings, without, however, limiting the present invention to the specifically illustrated embodiments, wherein Fig. 1 illustrates a first variant for the manufacture of a vacuum cleaner filter bag according to the invention,

Fig. 2 illustrates a second variant of a vacuum cleaner filter bag according to the invention, and Fig. 3 illustrates a third variant for the manufacture of a vacuum cleaner filter bag according to the invention.

Fig. 1 illustrates a first method according to the invention for the manufacture of a wall for a vacuum cleaner filter bag according to the invention including an inlet opening. In the first step shown in Fig. 1a), a wall 1 of a vacuum cleaner filter bag is provided. The wall can be a nonwoven material

or a film, for example. Laminates made of nonwovens or films are also conceivable. These materials can be supplied, for example, from rolls and can be unwound continuously. In Fig. 1a) (as in all subsequent drawings), only a small section of the material of the wall 1 of the vacuum cleaner filter bag is shown.

Fig. 1b) shows the condition after a textile material 2 has been applied to one side of the wall 1 of the vacuum cleaner filter bag by means of four separate welding spots 3. The remaining surface of the textile material 2 is loose and not connected to the wall of the filter bag. As an alternative to the separate welding points 3, the textile material 2 can also be spot-glued to the wall 1 of the vacuum cleaner filter bag. It is also possible to carry out full bonding, for example welding or gluing, of the textile material 2 to the wall 1 of the vacuum cleaner filter bag.

A common opening (bag inlet opening 4 in the textile material 2 and passage opening 4' in the textile material 2) is subsequently made in the structure produced in Fig. 1b) (see Fig. 1c).

Making of this opening can be done, for example, by joint punching, cutting or similar processes.

Fig. 1d) shows the state after a retaining plate 5 with an associated inlet opening 6 has been applied in alignment to the common opening (4, 4') of the composite of the wall 1 of the filter material and the textile material 2. It can be seen that the passage opening 6 of the retaining plate 5 has a larger diameter than the common opening (4, 4') of the wall of the filter bag and the textile material. This protrusion, which is visible inside the entry opening of the retaining plate, acts as a seal for a nozzle of a vacuum cleaner to be inserted through the entry opening 6 of the retaining plate 5.

The joint bond between the retaining plate 5 and the wall 1 of the vacuum cleaner filter bag via the textile material 2 is produced, for example, by an ultrasonic welding process in which ultrasound is introduced into the retaining plate by means of a sonotrode and an anvil. The weld seam may, for example, be configured annularly around the entry opening 6 of the retaining plate 5, but it is also possible for the retaining plate 5 to be spot-welded to the wall 1 of the vacuum cleaner filter bag via the textile material 2. It is also possible to fully weld the retaining plate 5 to the wall 1 of the vacuum cleaner filter bag via the textile material 2.

Both the wall 1 and the textile material 2 as well as the retaining plate 5 are formed from thermoplastic materials in the present example.

Fig. 2 shows another embodiment for the manufacture of a vacuum cleaner filter bag according to the invention.

The steps shown are essentially identical to the sequence of steps illustrated in Fig. 1.

The only substantial difference to the embodiment according to Fig. 1 is that the textile material is of smaller dimensions. In the example shown in Fig. 2, the textile material is only fixed to the wall 1 of the vacuum cleaner filter bag via two points 3 (for example by welding or gluing).

Due to the smaller dimensions, the textile material 2 does not cover the bag inlet opening 4, which in Fig. 2c) is merely made in the wall of the vacuum cleaner filter bag.

When the retaining plate 5 is superimposed and the inlet opening of the retaining plate 6 is also aligned with the bag inlet opening 4, the retaining plate 5 is merely supported on the textile material 2 in certain regions. When finally a bond of the retaining plate to the wall 1 of the vacuum cleaner filter bag (for example by welding) is made via the textile material 2 only the region thereof is particularly reinforced where the textile material 2 is present. This is sufficient, for example, if the tensile load on the vacuum cleaner filter bag is known in advance.

Fig. 3 shows another embodiment of a method according to the invention for the manufacture of a vacuum cleaner filter bag according to the invention. Fig. 3a is identical to Fig. 1a) and Fig. 2a), respectively. In the example shown in Fig. 3, the material the wall of the vacuum cleaner filter bag is made of is nonwoven fabric.

In a first step, shown in Fig. 3b), a recess A is made in the wall 1 of the vacuum cleaner filter bag. This can be done, for example, by punching or cutting.

As shown in Fig. 3c), a thermoplastic film F is fixed to the back of the wall 1 of the vacuum cleaner filter bag, as shown in perspective, covering the recess A on the wall 1 of the vacuum cleaner filter bag, for example by welding or gluing.

Subsequently, as shown in figures 3d), as seen in a perspective front view, a textile material 2 is fixed to the film F, for example, by means of four welding spots 3.

The final steps e) and f) are essentially identical to those already described with reference to Figs. 1c) and 1d), respectively.

In this embodiment, too, an opening is made jointly through all of the material layers, i.e., as seen from above, the textile material 2, the wall of the vacuum cleaner filter bag 1, and the film F situated behind it.

After applying the retaining plate 5 including the inlet opening 6, the retaining plate is fixed by the textile material 2 with the film F, which forms the wall 1 of the vacuum cleaner filter bag in this region.

P a t e n t k r a v

1. Fremgangsmåde til at forbinde en holdeplade (5) til væggen (1) af en støvsugerfilterpose materialesluttende på et fastgørelsessted, der er tilvejebragt til dette formål, hvor

a) i det mindste områdevist i området af fastgørelsesstedet af holdepladen (5) er der i det mindste i områder fremstillet en materiale-, kraft- eller formmæssig binding (3) af støvsugerfilterposens væg (1) med mindst ét, især nøjagtigt ét lag af et tekstilmateriale (2), hvor holdepladen (5) presses mod den side af støvsugerfilterposens væg, der er forsynet med tekstilmaterialet (2) på fastgørelsesstedet, eller

b) der i det mindste områdevis af holdepladen (5) fremstilles i det mindste i områder en materiale-, kraft- eller formlåsende binding af holdepladen (5) med mindst et, især nøjagtigt et lag af et tekstilmateriale (2), og holdepladen (5) presses med den side, der er forsynet med tekstilmaterialet (2), mod støvsugerfilterposens væg (1) på fastgørelsesstedet, eller

c) mellem støvsugerfilterposens væg (1) og holdepladen (5) anbringes mindst et, især nøjagtigt et, lag af et tekstilmateriale (2) i det mindste områdevist i området af holdepladens (5) fastgørelsessted, hvor holdepladen (5) sammen med tekstilmaterialet (2) presses mod støvsugerfilterposens væg (1) på fastgørelsesstedet,

og derefter skabes der en materialesluttende binding mellem støvsugerfilterposens væg (1), tekstilmaterialet (2) og holdepladen (5), hvor støvsugerfilterposens væg (1) i det mindste i området af holdepladens (5) fastgørelsessted omfatter et termoplastisk materiale eller henholdsvis består eller er dannet af et termoplastisk materiale,

tekstilmaterialet (2) omfatter termoplastiske fibre og/eller termoplastiske filamenter eller henholdsvis består af eller er dannet af sådanne fibre og/eller filamenter, og/eller

i det mindste støttesiden af holdepladen (5) omfatter et termoplastisk materiale i det mindste områdevist eller består af eller er dannet helt af et termoplastisk

materiale, eller hele holdepladen (5) består af eller er dannet af et termoplastisk materiale.

5 2. Fremgangsmåde ifølge krav 1, **kendetegnet ved, at** det termoplastiske materiale i støvsugerfilterposens væg (1), det materiale, hvoraf de termoplastiske fibre og/eller de termoplastiske filamenter af tekstilmaterialet (2) er dannet, og/eller det termoplastiske materiale af holdepladen (5) hver især er valgt uafhængigt af hinanden fra gruppen bestående af polyolefiner især polyethylen, polypropylen eller polystyren, poly(meth)acrylater, polyamider, polyestere, 10 især PET, PBT, PC eller PLA, termoplastiske elastomerer (TPE), især TPE-0, TPE-V, TPE-U, TPE-E, TPE-S eller TPE-A, polybenzimidazoler, polyethersulfoner, polyetheretherketoner, polyetherimider, polyphenylenoxider, polyphe-nylsulfider og polytetrafluorethylen samt blandinger eller kombinationer heraf.

15 3. Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at** tekstilmaterialet (2) er valgt fra gruppen bestående af ikke-vævede stoffer, net, kædestrikkede stoffer og skudstrikkede stoffer, ikke-krympede stoffer, strik-stoffer, flettede stoffer, sting-bundne stoffer og filt og kombinationer heraf.

20 4. Fremgangsmåde ifølge det foregående krav, **kendetegnet ved, at** det ikke-vævede stof er valgt fra gruppen bestående af filterduge og kartede ikke-vævede stoffer.

25 5. Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at** det tekstile materiale (2) er fladt og især har en fladevægt på 5 til 200 g/m², fortrinsvis 10 til 100 g/m², særligt foretrukket 15 til 50 g/m².

30 6. Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at** støvsugerfilterposens væg (1) i det mindste ved fastgørelsespunktet af holdepladen (5) er dannet af en folie (F) af et termoplastisk materiale, et folielaminat,

hvor i det mindste den side, som holdepladen (5) er anbragt på, består af et termoplastisk materiale, eller af et ikke-vævet stof af et termoplastisk materiale.

- 5 **7. Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at****
- a) forbindelsen af støvsugerfilterposens væg (1) med tekstilmaterialet (2) på en materiale-, kraft- eller formtilpasset måde, i det mindste områdevist,
- b) forbindelsen af holdepladen (5) med tekstilmaterialet (2) på en materiale-, kraft- eller formtilpasset måde, i det mindste områdevist, og/eller
- 10 c) den endelige produktion af den materialesluttende forbindelse mellem væggen (1) af støvsugerfilterposen, tekstilmaterialet (2) og holdepladen (5) sker ved hjælp af en svejseproces, især en ultralydssvejsesproces, eller ved hjælp af en klæbeforbindelse, især ved hjælp af et flydende klæbemiddel, et 2-komponentklæbemiddel eller et termisk flydende klæbemiddel.

15

- 8. Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at****
- støvsugerfilterposens væg (1) har en poseindløbsåbning (4) i området af fastgørelsesstedet, tekstilmaterialet (2) har en gennemgangsåbning (4), og holdepladen (5) har en indløbsåbning (6), hvor poseindløbsåbningen (4), gennemgangsåbningen (4) og indløbsåbningen (6) er anbragt på linje med hinanden,
- 20 eller

20

- i støvsugerfilterposens væg (1) i området af fastgørelsesstedet indføres en poseindløbsåbning, (4) og/eller i tekstilmaterialet (2) indføres en gennemgangsåbning (4), og poseindløbsåbningen (4), gennemgangsåbningen (4) og en indløbsåbning (6) af holdepladen (5) anbringes på linje med hinanden.
- 25

25

- 9. Fremgangsmåde ifølge det foregående krav, **kendetegnet ved, at**** poseindløbsåbningen (4) og/eller gennemgangsåbningen (4) er mindre eller har samme diameter som indløbsåbningen (6).

30

- 5 **10.** Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at** der på fastgørelsesstedet af holdepladen (5) på indersiden af støvsugerfilterposens væg (1), mellem støvsugerfilterposens væg (1) og tekstilmaterialet (2) og/eller mellem tekstilmaterialet (2) og holdepladen (5), indføres mindst et fladt tætningselement, som fortrinsvis er dannet af TPE eller TPU, og som har en gennemgangsåbning, der er anbragt på linje med gennemgangsåbningen af holdepladen (5), men har en mindre diameter end diameteren af gennemgangsåbningen af holdepladen (5).
- 10 **11.** Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at** holdepladens (5) støttesiden i det mindste områdevist er struktureret og/eller har retningssensorer til ultralyd og/eller
- 15 hvis støvsugerfilterposens væg (1) er udformet som en folie (F) eller som et folielaminat i det mindste i området af fastgørelsespunktet af holdepladen (5), er folien (F) eller folielaminatet struktureret, især meget dybt struktureret, f.eks. riflet, i det mindste ved fastgørelsespunktet.
- 20 **12.** Fremgangsmåde til at fastgøre en holdeplade (5) materialesluttende til væggen (1) af en støvsugerfilterpose på et fastgørelsessted, der er beregnet til dette formål, hvor
- 25 a) en materiale-, kraft- eller formlåsende binding (3) af støvsugerfilterposens væg (1) med mindst et, især nøjagtigt et lag af en folie (F) af et termoplastisk materiale fremstilles i det mindste områdevist i området for fastgørelsesstedet af holdepladen (5), hvor holdepladen (5) presses mod den side af støvsugerfilterposens væg, der er forsynet med folien på fastgørelsesstedet, eller
- 30 b) områdevist på holdepladen (5) i det mindste i områder fremstilles en materiale-, kraft- eller formmæssig binding af holdepladen (5) med mindst ét, især nøjagtigt ét lag af en folie (F) af et termoplastisk materiale, og holdepladen (5) presses med den side, der er forsynet med folien, mod støvsugerfilterposens væg (1) på fastgørelsesstedet, eller

c) mellem støvsugerfilterposens væg (1) og holdepladen (5) indføres mindst et, især præcis et, lag af en folie (F) af et termoplastisk materiale områdevist i området af holdepladens (5) fastgørelsessted, hvor holdepladen (5) presses sammen med folien mod støvsugerfilterposens væg (1) på fastgørelsesstedet, og derefter skabes der en materialesluttende binding mellem støvsugerfilterposens væg (1), folien (F) og holdepladen (5), hvor støvsugerfilterposens væg (1) i det mindste i området af holdepladens (5) fastgørelsessted omfatter et termoplastisk materiale eller henholdsvis består eller er dannet af et termoplastisk materiale,

folien (F) omfatter eller består af eller er dannet af et termoplastisk materiale, og/eller

i det mindste støttesiden af holdepladen (5) omfatter et termoplastisk materiale i det mindste områdevist eller består af eller er dannet helt af et termoplastisk materiale, eller hele holdepladen (5) består af eller er dannet af et termoplastisk materiale.

13. Støvsugerfilterpose, der omfatter en væg (1) med et fastgørelsessted for en holdeplade (5) og en holdeplade (5), der er forbundet materialesluttende med væggen (1) på fastgørelsesstedet, og som er forbundet med væggen (1) i det mindste områdevist via et lag af et tekstilmateriale (2), hvor væggen (1) af støvsugerfilterposen omfatter et termoplastisk materiale i det mindste i området for fastgørelsesstedet for holdepladen (5) eller består af eller er dannet af et sådant materiale,

tekstilmaterialet (2) omfatter termoplastiske fibre og/eller termoplastiske filamenter eller henholdsvis består af eller er dannet af sådanne fibre og/eller filamenter, og/eller

i det mindste støttesiden af holdepladen (5) omfatter et termoplastisk materiale i det mindste områdevist eller består af eller er dannet helt af et termoplastisk materiale, eller hele holdepladen (5) består af eller er dannet af et termoplastisk materiale.

5 **14.** Støvsugerfilterpose ifølge det foregående krav, **kendetegnet ved, at** støvsugerfilterposens væg (1) er dannet, i det mindste ved fastgørelsespunktet af holdepladen (5), af en folie (F) af et termoplastisk materiale, et folielaminat, hvor i det mindste den side, som holdepladen (5) er påført, er dannet af et termoplastisk materiale eller af et ikke-vævet stof af et termoplastisk materiale.

10 **15.** Støvsugerfilterpose ifølge et af de to foregående krav, **kendetegnet ved, at** støvsugerfilterposens væg (1) har en poseindløbsåbning (4) i området af fastgørelsesstedet, tekstilmaterialet har en gennemgangsåbning (4'), og holdepladen (5) har en indløbsåbning (6), hvor poseindløbsåbningen (4), gennemgangsåbningen (4') og indløbsåbningen (6) er anbragt over hinanden, især ved at poseindløbsåbningen (4) og/eller gennemgangsåbningen (4') er mindre i diameter eller har samme størrelse som indløbsåbningen (6).

15 **16.** Støvsugerfilterpose ifølge et af kravene 13 til 15, **kendetegnet ved, at** på fastgørelsesstedet af holdepladen (5) på indersiden af støvsugerfilterposens væg (1), mellem støvsugerfilterposens væg (1) og tekstilmaterialet (2) og/eller mellem tekstilmaterialet (2) og holdepladen (5) er der indført mindst et fladt tætningselement, som fortrinsvis er dannet af TPE eller TPU, og som har en
20 gennemgangsåbning, der er anbragt på linje med gennemgangsåbningen (6) af holdepladen (5), men har en mindre diameter end diameteren af gennemgangsåbningen (6) af holdepladen (5).

25 **17.** Støvsugerfilterpose, der omfatter en væg (1) med et fastgørelsessted for en holdeplade (5), og en holdeplade (5), der er forbundet materialesluttende med væggen (1) på fastgørelsesstedet, og som er forbundet med væggen (1) områdevist via et lag af en folie (F) af et termoplastisk materiale, **kendetegnet ved, at** støvsugerfilterposens væg (1) i det mindste i området af fastgørelsesstedet af holdepladen (5) omfatter et termoplastisk materiale eller består af
30 eller er dannet af et sådant materiale,

folien (F) omfatter eller består af eller er dannet af et termoplastisk materiale, og/eller

i det mindste støttesiden af holdepladen (5) omfatter et termoplastisk materiale

i det mindste områdevist eller består af eller er dannet helt af et termoplastisk

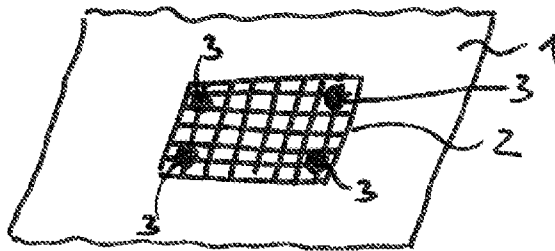
5 materiale, eller hele holdepladen (5) består af eller er dannet af et termoplastisk materiale.

Fig. 1

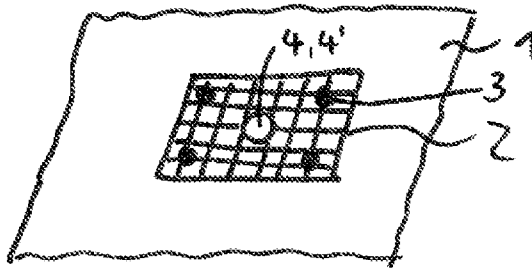
a)



b)



c)



d)

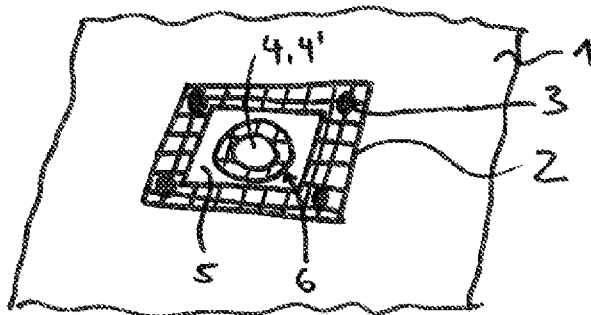
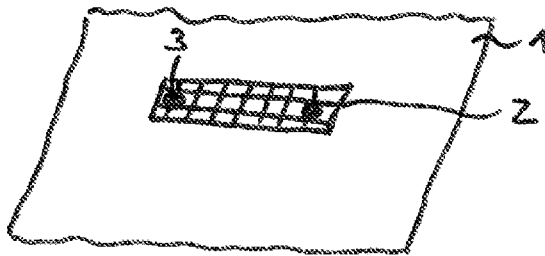


Fig 2

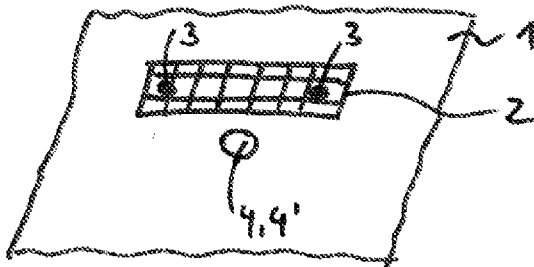
a)



b)



c)



d)

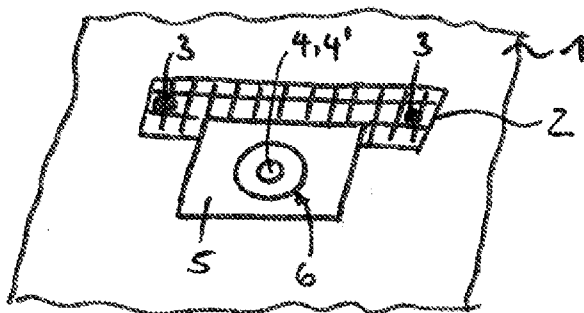


Fig. 3

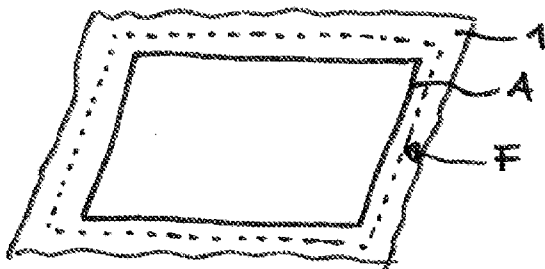
a)



b)



c)



d)

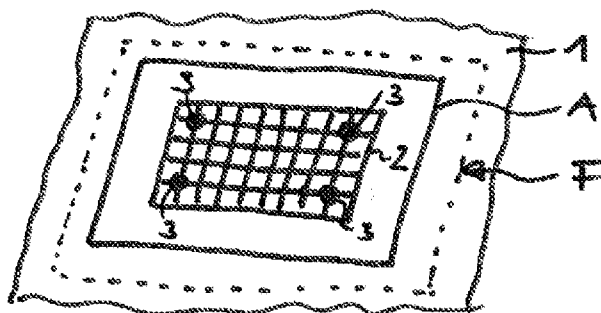
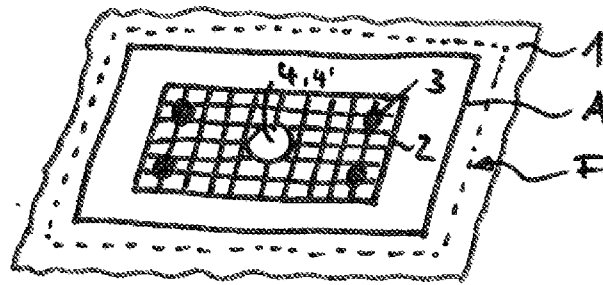


Fig. 3

e)



f)

