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(54) **TREATMENT MACHINE WITH SOLID PARTICLES AND A DEFLECTING BAFFLE**

BEHANDLUNGSMASCHINE MIT FESTSTOFFPARTIKELN UND PRALLBLECH

MACHINE DE TRAITEMENT AVEC PARTICULES SOLIDES ET DÉFLECTEUR

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Description

[0001] The present invention relates to a treatment machine comprising a baffle.

[0002] The present invention also relates to a method of treating a substrate with such.

Background

[0003] Conventional methods for treating and cleaning of textiles and fabrics typically involve aqueous cleaning using large volumes of water. These methods generally involve aqueous submersion of fabrics followed by aqueous soil suspension, soil removal and water rinsing. The use of solid particles to provide improvements in, and advantages over, these conventional methods is known in the art. For example, PCT patent publication WO2007/128962 discloses a method for cleaning a soiled substrate using a multiplicity of solid particles. Other PCT patent publications which have related disclosures of cleaning methods include: WO2012/056252; WO2014/006424; WO2015/004444; WO2014/147390; WO2014/147391; WO2014/006425; WO2012/035343; WO2012/167545; WO2011/098815; WO2011/064581; WO2010/094959; and WO2014/147389. These disclosures teach apparatus and methods for treating or cleaning a substrate which offer several advantages over conventional methods including improved treating/cleaning performance, reduced water consumption, reduced consumption of detergent and other treatment agents, and better low temperature treating/cleaning (and thus more energy efficient treating/cleaning).

[0004] Conventional treatment machines, such as washing machines may typically comprise a baffle that extends from the tub to the casing at the door opening. This baffle typically comprises rubber and prevents water in the drum from exiting the tub or door during a treatment cycle. The baffle is typically shaped with a bellows or U-shaped bend to accommodate motion of the tub relative to the casing so that transmission of vibrations to the casing is reduced and that a seal is retained during motion.

[0005] The washing machine, the solid particles and the wash cycles have all been significantly developed over the years by the present applicant such that at the end of the wash cycle the solid particles have been successfully removed from the wash region of the drum and from the fabrics. Documents CN 202 500 017 U and WO 2016/193703 A1 disclose such washing machines using solid particles during the wash cycle and comprising a baffle arranged between the tub opening and the door.

[0006] That said, the present inventors have discovered that when solid particles are employed with treatment machines that comprise a baffle there is an undesirable problem originating from a tendency for the solid particles to be retained in, on or around the baffle surfaces. This was found to lead to incomplete recovery of the solid particles by the treatment machine.

[0007] Additionally, the inventors observed that the solid particles retained in the baffle would often be dislodged when opening and closing the door. Such dislodged solid particles would enter the drum and fall onto the washed fabrics. Thus, the user of the washing machine noted the undesirable presence of solid particles.

[0008] It is an object of the present invention provide improvements generally and/or to address, at least in part, the abovementioned problem.

Summary of the invention

[0009] According to the invention, there is provided a treatment machine comprising: a casing; a tub moveably mounted within the casing; a drum rotatably mounted within the tub; and a door for loading a substrate into the drum, wherein the door is mounted to the casing and operable between open and closed configurations. The treatment machine is configured to dispense solid particles into the drum and to extract solid particles from the drum. The treatment machine further comprises a baffle, the baffle comprising: a tub connector portion connecting the baffle to the tub of the treatment machine; a door contacting portion that contacts the door of the treatment machine when the door is in a closed configuration; and a barrier extending between the tub connector portion and the door contacting portion and inclined so solid particles deposited on the barrier are diverted into the drum of the treatment machine.

[0010] The invention thus provides a treatment machine such that solid particles added to the drum of a treatment machine are prevented by the baffle from accumulating on the baffle or adjacent to the door and are instead moved into the drum.

[0011] Further embodiments of the present invention may comprise any of the following optional features.

[0012] When in use, the barrier of the baffle may bias the door contacting portion against the door of the treatment machine when the door of the treatment machine is in the closed configuration. The biasing of the door contacting portion against the door by the barrier may further reduce the likelihood of solid particles moving between the door contacting portion and the door.

[0013] The barrier may be shaped so that at least 75 %, or at least 80 %, or at least 90 % of the barrier, measured from the tub connector portion to the door contacting portion is linear or monotonically curved. A non-linear or non-monotonic portion may be positioned proximal to the tub connector portion. The barrier may comprise a single arc curved approximately towards the rotational axis of the drum; the curved arc may extend into a non-monotonic portion.

[0014] The barrier may be shaped so that the barrier extends in a linear or monotonically curved manner between the tub connector portion and the door contacting portion. Such shapes are free from protuberances or troughs that may retain solid particles.

[0015] The tub connector portion may comprise attach-

ment means for attachment to the tub. The attachment means may comprise a feature to cooperate with a corresponding feature on the tub. The attachment means may comprise a feature to attach to a corresponding feature on the tub, for example, one or more protrusions, lips or rims to cooperate with a corresponding lip, flange or other structure on the tub, or a bead and eyelet. The attachment means may comprise any of hooks, loops, pins, screws, clips and other known mechanical retention devices. Alternatively, the attachment means may comprise an adhesive or melt bonding of the baffle to the tub. The tub connector portion may be integrally formed with the barrier or may comprise separate connection means for connecting the tub connector portion to the barrier. The separate connection means may be attached to the barrier.

[0016] The door contacting portion may comprise a portion of the baffle that contacts the door when in use. The door contacting portion may comprise a surface adapted to contact the door, which may for example, comprise an angled surface to contact a corresponding surface of the door when the door is in a closed configuration. The door contacting portion may have a higher stiffness than the barrier, and may, for example, comprise a rigid or semi rigid annulus to maintain the door contacting portion in an annular shape to cooperate with the shape of the door.

[0017] The tub connector portion may comprise an annulus positioned or positionable between the drum and tub. The annulus may reduce the gap between the tub and the drum to prevent or reduce the likelihood of solid particles passing through the gap. The annulus may reduce the gap to no greater than 10 mm, or no greater than 8 mm or no greater than 7 mm or no greater than 5 mm or no greater than 2 mm. The gap may be at least 5 mm, or at least 2 mm, or at least 1 mm, or at least 0.5 mm. The annulus may be formed from a rigid or semi-rigid material, e.g. a metal such as aluminium or stainless steel or a polymer such as nylon or polyethylene. The annulus may comprise a smooth or low friction coating on the side facing the drum. The annulus may be secured in position by a connection to the tub connector portion. The annulus may alternatively be positioned radially inwards from the tub or drum and axially aligned with the gap and may optionally comprise a lip extending towards or into the drum.

[0018] The treatment machine may have a rotational axis aligned with the centre of rotation of the drum. The baffle may be annular in form and thus may also have an axis through the annular centre of the baffle. The axis of the baffle may be coincident with the axis of rotation of the treatment machine when the baffle is applied to the treatment machine. Alternatively, the axis of the baffle may be parallel to and close to axis of rotation of the treatment machine when the baffle is applied to the treatment machine. Close to in this context may refer to a spacing between axes no greater than 5 centimetres.

[0019] The baffle may be inclined relative to the hori-

zontal plane so that when applied to a treatment machine, the barrier may be inclined at an average angle to the horizontal between 10 and 90 degrees, or between 15 and 60 degrees, or between 20 and 30 degrees, or any range formed from any of these endpoints. A hypothetical line extends from a point where the barrier contacts the tub connector portion at its lowermost point and the point where the barrier contacts the door contacting portion at its lowermost point. The average angle is that between the hypothetical line and the horizontal.

[0020] The barrier of the baffle may have a length measured parallel to the axial direction from the tub connector portion to the door contacting portion. When the door is in an open configuration (i.e. the door contacting portion does not contact the door and the baffle is unloaded in the axial direction) the length may be between 10 and 65 mm, or between 15 and 50 mm, or between 20 and 40 mm, or between any range formed from any of these endpoints. When the door is in a closed configuration, the length of the baffle may decrease by 5 to 20 mm, or by 7 to 15mm, or a range formed from any combination of these end points.

[0021] The door contacting portion of the baffle, when applied to a treatment machine, may impart a force in the axial direction against the door of the treatment machine when the door is in a closed configuration. The force may be between 2 and 20N, or between 3 and 15N, or between 4 and 10N, or between 5 and 8N, or any range of any combination of the aforesaid endpoints.

[0022] The door of the treatment machine may comprise a dome or truncated cone extending into the drum when the door is in a closed configuration. The door contacting portion of the baffle may contact the dome or cone when the door is in a closed configuration.

[0023] Use with a dome or cone may assist in self-centring the door contacting portion of the baffle around the door. This may further improve the distribution of axial force of the door contacting portion against the dome or cone.

[0024] The door of the treatment machine may comprise an inwardly projecting element. The inwardly projecting element may be transparent and may be formed from a glass or a transparent polymer. The inwardly projecting element may be a dome or cone as referred to above. The inwardly projecting element, dome or cone may additionally comprise a deviation formed on the drum facing side of the inwardly projecting element. The deviation may be in the form of rib, ridge, thickened portion, fold, bend or shoulder on the drum facing side of the inwardly projecting element. The deviation may be formed integral with the inwardly projecting element or may be affixed thereto. The deviation may extend annularly around the drum facing side of the inwardly projecting element. The deviation may be shaped to match the door contacting portion of the baffle. The deviation may present a feature or surface against which the door contacting portion of the baffle may contact when the door is in a closed configuration. In particular the deviation

may present an inclined surface, at a different angle to adjacent regions of the inwardly projecting element. The inclined surface may be closer to vertical than adjacent regions of the inwardly projecting element or may be aligned vertically. The deviation may present a surface the door contacting portion can impart a force against when the door is in a closed configuration. The deviation may further reduce any oscillatory motion, in particular in the horizontal/lateral direction of the door contacting portion against the inwardly projecting element, when the treatment machine is in use.

[0025] The door contacting portion of the baffle may comprise an annulus. Preferably, the door contacting annulus is rigid or semi-rigid. The door contacting annulus may be formed from a rigid or semi-rigid material, e.g. a metal such as aluminium or stainless steel or a polymer such as nylon or polyethylene. The door contacting annulus may have a length in the axial direction of between 0.5 and 20 mm, or between 0.75 and 8 mm, or between 1 and 5 mm, or range of any of the aforesaid endpoints. A door contacting annulus, particularly where the door contacting annulus is rigid, may provide further improved distribution of force against the door and thus may provide further improved retention of solid particles in the drum.

[0026] The barrier may comprise a resilient material, such that the resilience of the barrier provides a biasing force on the door. For example, the barrier may comprise, amongst others, polymers (including polyethylene, aramid etc), rubbers (including EPDM rubber, neoprene and silicone rubber). The material may be formed as a mesh or sheet. The sheet may comprise slits or pores. The material may have a thickness between 0.2 mm to 6 mm or between 0.5 mm to 4 mm, or between 1 mm and 2 mm, or between any range comprising any of the preceding endpoints. The barrier of the baffle may comprise an extensible material such as neoprene, a porous polymer sheet, a polymer or metallic mesh, latex rubber or other highly elastic materials or spring elements.

[0027] The baffle may be formed from a single resilient material. The barrier may comprise, amongst others, polymers (including polyethylene, aramid etc), rubbers (including EPDM rubber, neoprene and silicone rubber). The thickness of the baffle material may vary in different regions of the baffle. Regions of lower thickness may provide increased baffle flexibility to reduce transmission of vibrations. The regions of comparatively greater thickness may provide greater resistance to wear and deformation. The baffle may comprise reduced thickness at the barrier, and/or adjacent to the door contacting portion. The baffle may comprise reduced thickness at any angle, fold, or bend in the baffle, in particular at any angle, fold or bend in the baffle between the tub connector portion and the door contacting portion. A lower thickness region may be considered to be a region of the baffle where the thickness is lower than other regions of the baffle. In some embodiments the door contacting portion may present a reduced opening through which a user unloads and loads

the treatment substrate. A baffle that comprises lower thickness in the barrier or either side of the door contacting portion may enable the door contacting portion to readily deflect when contacted by the user. A lower thickness region may comprise a material thickness of 0.8 to 1.8 mm and greater thickness regions may have a thickness of from 2.0 mm to 5mm. These values are particularly applicable where the baffle is formed from a rubber, (e.g. EPDM rubber).

[0028] In some embodiments, the baffle may comprise stiffening ribs. The stiffening ribs may be positioned at regions of lower thickness. The stiffening ribs may be positioned at any angle, fold, or bend in the baffle. The stiffening ribs may be circumferentially spaced around baffle. In particular, the stiffening ribs may be positioned at an angle of intersection between a length of baffle extending from the door contacting portion and from the tub contacting portion. Stiffening ribs may provide increased localised stiffness to help the baffle to maintain its shape whilst still being readily deformable by a user loading the machine. Stiffening ribs may comprise thickened portions of the baffle. For example, the stiffening rib may be a rib of 0.5 to 5mm width. The ribs may be formed of a stiff material, such as rubber. The stiffening ribs may extend in the radial direction.

[0029] The barrier may be porous to fluids. This may further improve drying of the baffle in between washes. The barrier may comprise a plurality of pores. The size of the pores may prevent passage of the solid particles. The size of the pores may be between 0.1 mm and 15 mm in width, or between 3 mm and 10 mm in width, or between 3 mm and 7 mm in width, or between any range formed from any of the aforesaid end points. Pore size may refer to the largest linear dimension of the pores. In the case of openings in the form of a circular hole the smallest linear dimension corresponds to the diameter of the circular hole.

[0030] The baffle may comprise a seal. The seal may be positioned radially outwards of the barrier. The seal may extend from the tub to the casing. The seal may comprise rubber. The seal may further prevent water passing around or through the baffle from exiting the drum and the tub.

[0031] The baffle may comprise a casing connection, the casing connection may be connectable to the casing of the treatment machine. The casing connection may be joined to the door contacting portion of the baffle by an extension of the seal or barrier extending therebetween. This may provide further stability for the door contacting portion.

[0032] Alternatively, the door contacting portion may be comprised as part of the barrier and the baffle may comprise a casing connection to connect the baffle to the casing. The door contacting portion may be positioned between the tub connector portion and the casing connection. The barrier may be arranged as a zigzag, sinusoid or U-shape when viewed in cross section through the radial direction. The door contacting portion may be

positioned close to or on a door facing part of an apex or highest point of the zigzag, sinusoid or U-shape. The highest point may be relative to the vertical direction at bottom dead centre of the drum. In these embodiments, the barrier may comprise a non-porous material, and optionally may comprise rubber (examples include EPDM rubber).

[0033] In embodiments, the barrier of the baffle may be formed from two or more intersecting frustoconical sections of material. At the point of intersection an angle may be formed between the two intersecting sections. The angle may be defined as the smallest measurable angle between the two intersecting sections, measured at bottom dead centre. When viewed as a radial cross section through the baffle, the frustoconical sections may appear as two approximately linear sections, the intersection forming an angle therebetween. The barrier of the baffle may comprise two sections with a single angle of intersection, or three sections with two angles of intersection or four sections with three angles of intersection etc. The angles may be between 135 and 15 degrees, or 105 and 30 degrees, or 90 and 45 degrees, or 75 and 60 degrees, or any range of any combination of these end points. A barrier formed from two or more intersecting sections as described above may flex to permit lengthening between the door contacting portion and the tub connection. The barrier may flex around the angle or angles of intersection. One or more of the intersecting sections of the barrier may be angled relative to the shortest line extending from the door contacting portion to the tub connection at bottom dead centre, so that the one or more sections may flex as the tub moves relative to the door. The same construction as described above may also be used for the baffle between the door contacting portion and a casing connection.

[0034] In embodiments, the baffle may extend from door the contacting portion to the casing connection. The extension from the door contacting portion to the casing connection, at bottom dead centre may comprise a region of a minima i.e. a lowest point or trough shape between the door contacting portion and the casing connection. This shape may help attenuate the transmission of vibrations. The baffle may comprise a drain to drain liquid accumulating on the baffle. The drain may be located at the minima. The drain may drain liquid into the tub, or to the water outlet of the treatment machine, or to any other liquid carry apparatus in the treatment machine. The drain may comprise a conduit that connects from the baffle to any of the aforesaid apparatus of the treatment machine. The conduit may comprise piping or tubing amongst others. The conduit may empty into, amongst others, the tub, sump, drain hose or the filter of a treatment machine. The baffle may drain under the influence of gravity. The conduit may extend downwardly from the baffle to the bottom of the machine, or may be inclined towards the tub. A screen may be positioned in the baffle above the drain to prevent solid particles and/or debris (e.g. lint, dirt etc.) from blocking the drain. The screen

may comprise a mesh or apertured member. The screen may be located at the minima adjacent to the conduit.

[0035] The treatment machine is configured to dispense solid particles into the drum and to extract solid particles from the drum. The treatment machine may comprise a storage chamber for storing solid particles within the casing of the treatment machine. The treatment machine may comprise a dispensing pathway for dispensing solid particles into the drum from within the casing of the treatment machine, or preferably from within a storage chamber within the casing. The treatment machine may comprise solid particle collection apparatus for removing solid particles from the drum into a different location within the casing of the treatment machine, preferably into a storage chamber.

[0036] The treatment machine may be configured to dispense solid particles into the drum through a port in the rear wall of the drum, the port may optionally be aligned with the centre of rotation of the drum. The treatment machine may be configured to extract solid particles through lifters located within the drum.

[0037] The baffle of the present invention is especially suited for use in treatment machines, especially washing machines having a load capacity of less than 100Kg, especially less than 50Kg and particularly less than 25Kg. The load capacity is typically at least 0.1 or at least 1 Kg. The load capacity may be the weight of the total dry substrate or substrates which can be placed into a single treatment cycle.

[0038] The substrate may comprise a textile. The solid particles may comprise a polymer and optionally may have an average particle size between 1 mm and 20 mm.

[0039] According to a further aspect of the invention, there is method of treating a substrate in such a treatment machine, the method comprising: loading the drum of the treatment machine with the substrate, solid particles and a liquid medium; rotating the drum to agitate the substrate, solid particles and liquid medium.

[0040] The method may further comprise: draining the liquid medium from the drum; and rinsing the solid particles and substrate, and optionally repeatedly rinsing the solid particles one or more times. Loading the drum may further comprise adding a treatment formulation, such as a detergent, to the drum. The solid particles may then be reused in one or more further repetitions of the method. Dispensing the solid particles into the drum may comprise dispensing via solid particle dispensing apparatus. The method may comprise collecting the solid particles from the drum via solid particle collection apparatus. The method may comprise dispensing from a storage means into the drum and/or collecting the solid particles from the drum to a storage means.

[0041] The substrate may comprise a textile or animal skin amongst others. A particularly preferred substrate is a textile. The treatment may comprise any of washing or cleaning the substrate; dyeing the substrate, tanning the substrate; abrading the substrate; stonewashing the substrate; de-sizing the substrate. The treatment ma-

chine of the second to fifth aspects may comprise any one of textile dyeing apparatus, tanning apparatus, stonewashing apparatus; textile abrading apparatus and washing machines. A particularly preferred treatment machine is a washing machine.

[0042] In operation with the treatment machine the solid particles may not appreciably become associated or affixed to the substrate. Thus, for example the solid particles do not coat, impregnate or bind to the substrate.

[0043] Treatment machines typically comprise a casing, a drum and a tub. The casing forms the outer structure of the treatment machine and provides rigid mounting points for components of the treatment machine. The drum and tub are contained within the casing of the treatment machine. Treatment machines also typically comprise a door for loading a substrate into the drum, which is closable to prevent the contents of the drum and tub from exiting the treatment machine during operation. The door is openable to allow substrates to be treated to be added or removed from the drum. Typically, the drum is perforated and cylindrical to contain the load items to be treated, treatment formulation and liquid medium, such as water. The drum rotates around a rotational axis to agitate/spin the substrate items to be treated. The inner circumference of the drum may comprise a plurality of lifters or vanes which extend in the axial direction and radially inwards towards the centre of the drum. The purpose of the lifters is to lift the substrate items during a treatment cycle to improve the tumbling action. The drum is typically mounted within the tub and driven via a motor for rotating the drum. The tub is typically suspended or mounted within the casing of the treatment machine. The tub may be suspended or mounted by means including, amongst others, springs and damping units. During operation of the treatment machine rotation of the drum may cause vibrations which may also cause the tub to vibrate. The suspension of the tub within the casing provides some mechanical isolation from the casing so that transfer of vibrations to the casing is prevented or reduced. This prevents or reduces motion of the treatment machine during use.

[0044] The baffle comprises a tub connector portion for connecting the baffle to the tub. The baffle also comprises a door contacting portion which is a portion of the baffle that contacts the door of the treatment machine when the door is closed. The baffle comprises a barrier that extends between the tub connector portion and the door contacting portion. The baffle, when applied to a treatment machine and the door is in a closed configuration forms a surface shaped and inclined such that any solid particle deposited on the baffle during a treatment cycle will slide or roll down the barrier and re-enter the drum.

[0045] The tub connector portion may comprise an annular structure attached to the tub and optionally positioned or positionable between the drum and the tub, or optionally comprising a portion positioned or positionable between the drum and the tub. The annular structure may

reduce the gap between the tub and the drum to prevent solid particles from passing through the gap. The tub connector portion may comprise a connection means for connecting the baffle to the tub. For example, the connection means may comprise a pair of protrusions configured to contact either side of the tub, on the internal and external surfaces of the tub. The protrusion contacting the outer surface of the tub may also comprise an abutment that cooperates with a flange of the tub. The pair of protrusions and abutment may form a removable mechanical connection to the tub. The pair of protrusions may resist axial motion of the tub connector portion and the abutment and flange may resist radially inward motion. In other embodiments, the baffle may comprise alternative connection means such as alternative configurations comprising one or more protrusions, rims or other structures to optionally cooperate with a corresponding structure of the tub. The attachment means may comprise any of hooks, loops, pins, screws, clips and other mechanical retention devices. The tub connector portion may be integrally formed with the barrier or may comprise connection means for connecting the tub connector portion to the barrier.

[0046] The door contacting portion comprises a portion of the baffle that contacts the door when in use. The door contacting portion may comprise a surface adapted to contact the door. The surface may be contoured to match a corresponding inner surface of the door, in particular, the surface may be frustoconical or frustoconical with curved vertices to cooperate with a correspondingly shaped dome (or cone) on the inner surface of a treatment machine door. The door contacting portion may have a higher stiffness than the barrier, and may, for example, comprise a rigid or semi rigid annulus to maintain the door contacting portion in an annular shape to cooperate with the shape of the door. For example, the door contacting portion may comprise a generally annular structure which may, for example, comprise nylon or polyethylene, amongst others. The door contacting portion may be integrally formed with the barrier or may comprise connection means for connecting the door contacting portion to the barrier.

[0047] The barrier extends between the tub connector portion and the door contacting portion and prevents passage of the solid particles through the barrier. The barrier is inclined so that the likelihood of solid particles accumulating on the barrier is reduced, and solid particles are directed into the drum. The barrier may be shaped such that the radially inner surface of the barrier, when viewed in cross section, comprises a line or curve inclined towards the drum. The baffle may be shaped to comprise one or more of flutings, steps, troughs or bumps on the surface, provided none of these shapes comprise regions where solid particles may accumulate, and the radially inner surface of the barrier maintains a generally linear or curved shape overall.

[0048] The barrier is inclined towards the drum so that solid particles are diverted into the drum. The barrier may

be inclined at an average angle between 10 to 90 degrees. A hypothetical line extends from a point where the barrier contacts the tub connector portion at its lowermost point and the point where the barrier contacts the door contacting portion at its lowermost point. The average angle is that between the hypothetical line and the horizontal.

[0049] The barrier may bias the door contacting portion against the door of the treatment machine when the door of the treatment machine is in the closed configuration. The barrier may comprise a resilient material, such that the resilience of the barrier provides a biasing force on the door. For example, the resilient material may comprise, amongst others, polymers (including polyethylene, aramid etc), rubbers (including EPDM rubber, neoprene and silicone rubber). The material may be formed as a mesh or sheet. The sheet may comprise slits or pores. The material may have a thickness between 0.2 mm to 6 mm or between 0.5 mm to 4 mm, or between 1 mm and 2 mm, or between any range comprising any of the preceding endpoints. The barrier may bias the door contacting portion with a force in the axial direction when the door is in a closed configuration, wherein the force is between 2 and 20N, or between 3 and 15N, or between 4 and 10N, or between 5 and 8N, or any range of any combination of the aforesaid endpoints.

[0050] The barrier may comprise one or more ribs or stiffening members affixed to the internal or external surface of the barrier. The ribs or stiffening members may take the form of parallel hoops, tapered springs, lattices or spaced bars, amongst others. The ribs or stiffening members may be attached to the barrier by an adhesive or by melt bonding. They may function to increase the stiffness of the barrier and may prevent the barrier from forming folds or creases when the door is in a closed configuration.

[0051] The barrier may be pre-stressed along the circumferential direction. For example, prior to application of the barrier to the tub connector portion and/or the door contacting portion, the barrier in an unstressed position may have a circumferential length less than the circumference of the tub connector portion and/or the door contacting portion. Thus, the barrier is strained when applied to the tub connector portion and/or the door contacting portion. The barrier may be strained by between 0.5 to 2 %. The application of pre-stress to the barrier may further reduce sag or the formation of creases in the barrier when the door is in a closed configuration.

[0052] When the treatment machine door is in an open configuration, the baffle will be in an unloaded state. In this state, the door contacting portion may extend in the axial direction beyond the point where the door contacting portion is positioned when the door is in a closed configuration. When the door is in a closed configuration, the baffle may be in a loaded configuration with the door contacting portion of the baffle displaced axially rearwards. In this configuration, the barrier may contract, be compressed or may deviate slightly. The contraction or

deviation of the barrier may help accommodate motion of the tub such that transfer of vibrations to the door contacting portion by the barrier are minimised.

[0053] The barrier has a length measured in the axial direction from the tub connector portion to the door contacting portion, when the door is in an open configuration the length may, for example be between 10 and 65 mm.

[0054] The baffle may further comprise a seal. The seal may be in a position located radially outwards of the barrier. The seal may be annularly arranged around the rotational axis of the drum. The seal may comprise a connection to the tub. The connection may comprise a protuberance that extends over an internal surface of the tub, from an external surface of the tub. The connection may comprise an abutment portion located under a flange of the tub. However, the connection may take a range of forms, and may for example be integral with the tub connector portion of the baffle. The connection to the tub may be mechanical and may comprise hooks, clips and other mechanical retention devices which may be integrally formed with the seal. The connection to the tub may also be via an adhesive, screw or other fixing means. The connection to the tub may also be a shared connection with the tub connector portion of the baffle and may optionally be integrally formed therewith.

[0055] The other end of the seal may be connected to the casing, in particular, the seal may comprise connection means to connect to the casing immediately adjacent to the door opening. The seal may extend around the exterior of door opening such that when the door is in a closed configuration, a portion of the seal is pressed by an inner wall of the door against an outer surface of the casing to provide a seal therebetween. Alternatively, the seal may extend around the interior of the door opening such that when the door is in a closed configuration, a portion of the seal contacts the door to form a seal therebetween. A portion of the seal may extend radially inwards from the casing and an outer surface of the portion of the seal may contact the door when the door is in a closed configuration. In a further alternative, an outer portion of the seal may contact the door when the door is in a closed configuration and the seal may not be connected to the casing. The seal may connect to the door contacting portion of the baffle. In embodiments where the seal comprises connection means to connect to the casing, the door contacting portion of the baffle may be connected to the casing connection means of the seal. Connection of the seal to the door contacting portion of the baffle may further improve the location of the door contacting portion against the door.

[0056] When viewed in cross section taken through the radial direction, the seal may comprise one or more of a loop, deviation or U-shaped portion. The loop, deviation or U-shaped portion is to reduce transmission of vibration from the tub to the door or casing. When using a baffle comprising a seal, solid particles are prevented from accessing the loop, deviation or U-shaped portion, or the horizontal upper surface. Thus, solid particles have a re-

duced tendency to accumulate on the horizontal surface of or in the loops of the seal. The seal may be made of any flexible material which is impervious to water, non-limiting examples include rubber, silicone and LMWPE amongst others.

[0057] In embodiments comprising a seal which is impervious to water, the barrier of the baffle may optionally comprise a porous material as the seal will prevent water passing through the porous material from exiting the treatment machine. The porous material may comprise a mesh, a woven fabric, a slitted material or a material comprising a plurality of spaced pores. Non limiting examples include nylon mesh and neoprene optionally foamed, slitted or with pores.

[0058] A seal may be comprised in any of the baffles disclosed herein. The seal may be integrally formed with a baffle disclosed herein.

[0059] The baffle may comprise a barrier that extends as a gentle curve or line between the tub connector portion and the door contacting portion. Solid particles contacting the barrier will be diverted down the barrier and back into the drum. The baffle may further comprise a casing connection, the barrier may extend from the door contacting portion to the casing connection radially outwards, then extend in the axial direction, to form a zig-zag/saw tooth shape when viewed in cross section. The region may be formed as a loop, bend or bellows. The barrier and the continuation of the barrier extending in the axial direction may be integrally formed and may comprise a non-porous material. The barrier may prevent water in the drum from passing between the tub and the casing and/or between the casing and the door. When viewed in cross section, the barrier may form a sinusoidal shape between the tub connector portion and the casing connection; a zig-zag shape between the tub connector portion and the casing connection; or the barrier may form at the bottom part of the drum, an inverted U-shape between the tub connector portion and the casing connection (forming a U-shape at the top of the drum); or any other bellows shape. The door contacting portion may be a part of the barrier that is disposed for contact against the door when the door is in a closed configuration. The door contacting portion may alternatively comprise one or more additional structures to improve contact and/or positioning between the baffle and the door. Additional structures may include flaps, thickened regions or surfaces shaped to conform to the inner surface of the door. In embodiments where the barrier is formed as an inverted U shape, the door contacting portion may be located at or close to the highest point of the inverted U shape, preferably on a door facing aspect close to the highest point. In embodiments where the barrier forms a sinusoidal shape, the door contacting portion may also be at or close to the highest point, preferably on a door facing aspect close to the maxima, such that the barrier is predominantly a monotonically rising curve or line between the tub connector portion and the door contacting portion. The sinusoidal, "zig-zag" or inverted U-shape

may improve accommodation of motion of the tub relative to the casing and/or the door, this may additionally or separately be without transferring vibrations to the door or casing. Thus, in these embodiments, the barrier may be formed from a less extensible material and as such may be made from flexible and non-porous material, for example, rubber or silicone.

[0060] The baffle may comprise a second door contacting portion which may depend from or be attached to the casing connection. The second door contacting portion may form a seal between the door and an external surface of the casing when the door is in a closed configuration, and/or the second door contacting portion may abut against an inner surface of the door when the door is in a closed configuration.

[0061] The tub connector portion may comprise an annular structure aligned with the gap between the tub and the drum in the axial direction but radially inwards of the gap. The annular structure may be positioned as a continuance of the incline formed by the barrier, that way solid particles on the barrier move over the gap towards the tub. The annular structure may comprise a lip projecting towards the tub, and the lip may optionally extend into the tub.

[0062] The barrier may additionally comprise resilient elements aligned with and extending along the length of the barrier. The resilient elements may be spaced around the circumference of the baffle. The resilient elements may be positioned radially outwards of the barrier or radially inwards. The resilient elements may impart a force on the door contacting portion biasing it against the door when the door is in a closed configuration. The use of resilient elements in the barrier permits the use of non-resilient material or minimally resilient materials for the barrier material, examples include latex rubber, thin polymeric films and fabrics amongst others. The resilient elements function to maintain the tautness of the barrier so that an angle or curve is maintained from the tub connector portion to the door contacting portion, such that solid particles deposited on the barrier will be diverted into the drum. The resilient elements also maintain contact between the door contacting portion and the door to prevent passage of solid particles therebetween. As the tub vibrates, flexion and/or compression/expansion of the resilient elements accommodates tub vibration whilst maintaining barrier tautness and contact of the door contacting portion. The non-resilient barrier may be highly flexible and prevent passage of solid particles without impeding motion of the resilient elements. The resilient elements may be formed from, amongst others, metals and alloys thereof, or polymers. The resilient elements may comprise, amongst others, leaf springs, coil springs, Belleville springs. The resilient elements may be bonded to the barrier at spaced intervals along the length of the barrier, or they may be connected at the respective ends, or at the door contacting portion and at the tub connector portion.

[0063] Alternatively, or in addition, the barrier may

comprise bellows which deviate radially outwards from the barrier surface. To prevent solid particles accumulating in the bellows the barrier comprises an extensible cover which maintains the incline or angle of the barrier. The bellows may function to isolate the door contacting portion from tub vibrations. The extensible cover may comprise an extensible material (such as latex rubber, extensible polymeric films and fabrics amongst others), so that flexing of the bellows is accommodated by the extensible cover without the cover transferring vibrations to the door contacting portion. The extensible cover may be joined to the barrier by melt-bonding, adhesives, or mechanical fasteners. Alternatively, or additionally, the extensible cover may comprise features to cooperate with corresponding features on the barrier, in a non-limiting example, this may comprise a beading that is retained by eyelets in the barrier.

[0064] The tub connector portion, door contacting portion and barrier may be integrally formed from a rigid flexible material e.g. polypropylene, aramid, polyethylene, polyethylene terephthalate amongst others. The barrier and door contacting portion may be split into multiple flexible fingers. The fingers, at the door contacting portion may additionally comprise a resilient hoop which may be formed from an elastic cord for example. The resilient hoop retains the ends of the fingers against the door dome/cone. The fingers may permit the barrier to flex so that vibrations are not transferred from the tub to the door.

[0065] In an alternative arrangement, the door contacting portion may be rigidly connected to the door. The door contacting portion may be rigidly connected via any of an adhesive, mechanical fixing means or it may be integrally formed with the door dome/cone. The barrier may be formed from two parts, a first part is connected to the tub connector portion and a second part is connected to the door contacting portion. When the door is in an open configuration, the second part of the barrier is moved away from the drum with the door, so that a treatment substrate (e.g. laundry) can be added to the drum. When the door is in a closed configuration, the second part of the barrier is adjacent to the first part of the barrier and the two parts of the barrier form a seal to prevent passage of solid particles during a wash cycle. The first part and/or the second part may be made from a rigid but compliant material, for example EPDM rubber, amongst others. Compliance between one of both parts of the barrier may provide a better seal. The baffle may optionally comprise a seal as described herein.

[0066] The drum may also comprise lifters located on the inner surface of the drum. The lifters may comprise one or more collecting apertures into which solid particles can enter the lifters. Inside the lifters a collecting flow path may be provided, through which the solid particles can move from the interior of the drum to the storage means at the rear of the drum

[0067] The lifters may also comprise a second dispensing flow path for movement of solid particles from the

storage means to the interior of said drum. The flow paths may be shaped such that rotation of the drum in one direction may dispense solid particles from the storage means into the drum via dispensing apertures in the lifters. Rotation of the drum in the other direction may move solid particles from the drum to the storage means. Alternatively, the lifters may be configured such that solid particles are collected regardless of the direction of rotation of the drum. The drum may optionally comprise a valve on the end wall of the drum, the valve openable to dispense solid particles from the rear wall of the drum.

[0068] The solid particles preferably comprise a multiplicity of solid particles. Typically, the number of solid particles is no less than 1000, more typically no less than 10,000, even more typically no less than 100,000. A large number of solid particles is particularly advantageous in preventing creasing and/or for improving the uniformity of treating or cleaning of the substrate, particularly where the substrate is a textile. Preferably, the solid particles have an average mass of from about 1 mg to about 1000 mg, or from about 1mg to about 700 mg, or from about 1 mg to about 500 mg, or from about 1 mg to about 300 mg, preferably at least about 10 mg, per particle. In one preferred embodiment, the solid particles preferably have an average mass of from about 1 mg to about 150 mg, or from about 1 mg to about 70 mg, or from about 1 mg to about 50 mg, or from about 1 mg to about 35 mg, or from about 10 mg to about 30 mg, or from about 12mg to about 25 mg. In an alternative embodiment, the solid particles preferably have an average mass of from about 10 mg to about 800 mg, or from about 20mg to about 700mg, or from about 50 mg to about 700 mg, or from about 70 mg to about 600 mg, or from about 20mg to about 600mg. In one preferred embodiment, the solid particles have an average mass of about 25 to about 150 mg, preferably from about 40 to about 80 mg. In a further preferred embodiment, the solid particles have an average mass of from about 150 to about 500 mg, preferably from about 150 to about 300 mg.

[0069] The average volume of the solid particles is preferably in the range of from about 5 to about 500 mm³, from about 5 to about 275 mm³, from about 8 to about 140 mm³, or from about 10 to about 120 mm³, or at least 40 mm³, for instance from about 40 to about 500 mm³, or from about 40 to about 275 mm³, per particle. The average surface area of the solid particles is preferably from 10 mm² to 500 mm² per particle, preferably from 10mm² to 400mm², more preferably from 40 to 200mm² and especially from 50 to 190mm².

[0070] The solid particles preferably have an average particle size of at least 1 mm, preferably at least 2mm, preferably at least 3mm, preferably at least 4 mm, and preferably at least 5mm. The solid particles preferably have an average particle size no more than 100mm, preferably no more than 70mm, preferably no more than 50mm, preferably no more than 40mm, preferably no more than 30mm, preferably no more than 20mm, preferably no more than 10mm, and optionally no more than

8mm. Preferably, the solid particles have an average particle size of from 1 to 50mm, preferably from 1 to 20mm, more preferably from 1 to 10mm, more preferably from 2 to 10mm, more preferably from 5 to 10mm. Solid particles which offer an especially prolonged effectiveness over a number of treatment cycles are those with an average particle size of at least 5mm, preferably from 5 to 10mm. The size is preferably the largest linear dimension (length). For a sphere this equates to the diameter. For non-spheres this corresponds to the longest linear dimension. The size is preferably determined using Vernier callipers. The average particle size is preferably a number average. The determination of the average particle size is preferably performed by measuring the particle size of at least 10, more preferably at least 100 solid particles and especially at least 1000 solid particles. The above-mentioned particle sizes provide especially good performance (particularly cleaning performance) whilst also permitting the solid particles to be readily separable from the substrate at the end of the treatment method.

[0071] The solid particles preferably have an average particle density of greater than 1g/cm^3 , more preferably greater than 1.1g/cm^3 , more preferably greater than 1.2g/cm^3 , even more preferably at least 1.25g/cm^3 , even more preferably greater than 1.3g/cm^3 , and even more preferably greater than 1.4g/cm^3 . The solid particles preferably have an average particle density of no more than 3g/cm^3 and especially no more than 2.5g/cm^3 . Preferably, the solid particles have an average density of from 1.2 to 3g/cm^3 . These densities are advantageous for further improving the degree of mechanical action which assists in the treatment process and which can assist in permitting better separation of the solid particles from the substrate after the treatment.

[0072] Unless otherwise stated, reference herein to an "average" is to a mean average, preferably an arithmetic mean average, as is conventional in this art.

[0073] The solid particles may be polymeric and/or non-polymeric solid particles. Suitable non-polymeric solid particles may be selected from metal, alloy, ceramic and glass solid particles. Preferably, however, the solid particles are polymeric solid particles.

[0074] Preferably the solid particles comprise a thermoplastic polymer. A thermoplastic polymer, as used herein, preferably means a material which becomes soft when heated and hard when cooled. This is to be distinguished from thermosets (e.g. rubbers) which will not soften on heating. A more preferred thermoplastic is one which can be used in hot melt compounding and extrusion.

[0075] The solid particles preferably have a solubility in water of no more than 1wt%, more preferably no more than 0.1wt% in water and most preferably the polymer is insoluble in water. Preferably the water is at pH 7 and a temperature of 20°C whilst the solubility test is being performed. The solubility test is preferably performed over a period of 24 hours. The polymer is preferably not degradable. By the words "not degradable" it is preferably

meant that the polymer is stable in water without showing any appreciable tendency to dissolve or hydrolyse. For example, the polymer shows no appreciable tendency to dissolve or hydrolyse over a period of 24hrs in water at pH 7 and at a temperature of 20°C . Preferably a polymer shows no appreciable tendency to dissolve or hydrolyse if no more than about 1 wt.%, preferably no more than about 0.1 wt.% and preferably none of the polymer dissolves or hydrolyses, preferably under the conditions defined above. The solubility and degradability characteristics are preferably assessed on a polymeric solid particle as disclosed herein. The solubility and degradability characteristics are preferably equally applicable to non-polymeric solid particles.

[0076] The polymer of the solid particles may be crystalline or amorphous or a mixture thereof. The polymer can be linear, branched or partly cross-linked (preferably wherein the polymer is still thermoplastic in nature), more preferably the polymer is linear.

[0077] The polymer of the solid particles preferably is or comprises a polyalkylene, a polyamide, a polyester or a polyurethane and copolymers and/or blends thereof, preferably from polyalkylenes, polyamides and polyesters, preferably from polyamides and polyalkylene, and preferably from polyamides. A preferred polyalkylene is polypropylene.

[0078] Preferably, the matrix of the solid particles optionally comprises filler(s) and/or other additives extends throughout the whole volume of the solid particles. The solid particles can be spheroidal or substantially spherical, ellipsoidal, cylindrical or cuboid. Solid particles having shapes which are intermediate between these shapes are also possible.

[0079] The best results for treatment performance (particularly cleaning performance) and separation performance (separating the substrate from the solid particles after the treating steps) in combination are typically observed with ellipsoidal solid particles. Spheroidal solid particles tend to separate best but may not provide optimum treatment or cleaning performance. Conversely, cylindrical or cuboid solid particles separate poorly but treat or clean effectively. Spheroidal and ellipsoidal solid particles are particularly useful where improved fabric care is important because they are less abrasive. Spheroidal or ellipsoidal solid particles are particularly useful in the present invention which is designed to operate without a pump for the solid particles and wherein the transfer of the solid particles between the storage means and the interior of the drum is facilitated by rotation of the drum.

The term "spheroidal", as used herein, encompasses spherical and substantially spherical solid particles. Preferably, the solid particles are not perfectly spherical. Preferably, the solid particles have an average aspect ratio of greater than 1, more preferably greater than 1.05, even more preferably greater than 1.07 and especially greater than 1.1. Preferably, the solid particles have an average aspect ratio of less than 5, preferably less than 3, preferably less than 2, preferably less than 1.7 and preferably

less than 1.5. The average is preferably a number average. The average is preferably performed on at least 10, more preferably at least 100 solid particles and especially at least 1000 solid particles. The aspect ratio for each solid particle is preferably given by the ratio of the longest linear dimension divided by the shortest linear dimension. This is preferably measured using Vernier Callipers. Where a good balance between treating performance (particularly cleaning performance) and substrate care is required, it is preferred that the average aspect ratio is within the abovementioned values. When the solid particles have a very low aspect ratio (e.g. highly spherical solid particles), the solid particles may not provide sufficient mechanical action for good treating or cleaning characteristics. When the solid particles have an aspect ratio which is too high, the removal of the solid particles from the substrate may become more difficult and/or the abrasion on the substrate may become too high, which may lead to unwanted damage to the substrate, particularly wherein the substrate is a textile.

[0080] It will be appreciated that the features, preferences and embodiments described hereinabove may be applicable where combinations allow, to each of the figures. The invention is further described with reference to the following figures.

Summary of the Figures

[0081]

Figure 1 shows cross sectional schematic of a baffle attached to a treatment machine according to the invention, the cross section is taken in the radial direction through a bottom portion of the baffle and treatment machine.

Figure 2 shows cross sectional schematic of an alternative embodiment baffle attached to a treatment machine, the cross section is taken through in the radial direction through a bottom portion of the baffle and treatment machine.

Figure 3a shows cross sectional schematic of an alternative embodiment baffle attached to a treatment machine, the cross section is taken through in the radial direction through a bottom portion of the baffle and treatment machine.

Figure 3b shows a cross sectional schematic of an alternative embodiment baffle attached to a treatment machine.

Figure 4 shows cross sectional schematic of an alternative embodiment baffle and treatment machine, the cross section is taken through in the radial direction through a bottom portion of the baffle and treatment machine.

Figure 5 shows cross sectional schematic of an alternative embodiment baffle attached to a treatment machine, the cross section is taken through in the radial direction through a bottom portion of the baffle and treatment machine.

Figure 6 is a perspective illustration of a segment of an alternative embodiment baffle attached to a treatment machine.

Figure 7a is an illustration of an alternative embodiment baffle attached to a treatment machine.

Figure 7b is an illustration of an alternative embodiment baffle attached to a treatment machine.

Figure 8 shows a treatment machine drum.

10 Detailed Description

[0082] With reference to figure 1, a cross sectional schematic through a bottom portion of a treatment machine 1 is shown. Treatment machines typically comprise a casing 2, a drum 6 and a tub 4. The casing 2 forms the outer structure of the treatment machine and provides rigid mounting points for components of the treatment machine. The drum 6 and tub 4 are contained within the casing 2 of the treatment machine. Treatment machines also typically comprise a door 8 which is closable to prevent the contents of the drum 6 and tub 4 from exiting the treatment machine during operation. The door 8 is openable to allow substrates to be treated to be added or removed from the drum 6. The drum 6 is perforated and cylindrical (not shown) to contain the load items to be treated, treatment formulation and liquid medium, such as water. The drum 6 rotates around a rotational axis 3 to agitate/spin the substrate items to be treated. The inner circumference of the drum 6 may comprise a plurality of lifters or vanes (not shown) which extend in the axial direction and radially inwards towards the centre of the drum. The drum 6 has a radial direction 5. The purpose of the lifters is to lift the substrate items during a treatment cycle to improve the tumbling action. The drum 6 is typically mounted within the tub 4 and driven via a motor (not shown) for rotating the drum 6. The tub 4 is typically suspended or mounted within the casing 2 of the treatment machine. The tub 4 may be suspended or mounted by means including, amongst others, springs and damping units. During operation of the treatment machine rotation of the drum 6 causes vibrations which also causes the tub 4 to vibrate. The suspension of the tub 4 within the casing 2 provides some mechanical isolation from the casing so that transfer of vibrations to the casing 2 is prevented or reduced. This prevents or reduces motion of the treatment machine during use.

[0083] With reference to figure 1, a baffle in accordance with the present invention is shown. The baffle 10 comprises a tub connector portion 12 for connecting the baffle to the tub 4. The baffle 10 also comprises a door contacting portion 14 which is a portion of the baffle 10 that contacts the door 8 of the treatment machine 1 when the door 8 is closed. The baffle 10 comprises a barrier 16 that extends between the tub connector portion 12 and the door contacting portion 14. The baffle, when applied to the treatment machine and the door is in a closed configuration forms a surface shaped and inclined such that any solid particle deposited on the baffle during a

treatment cycle will slide or roll down the barrier and re-enter the drum.

[0084] The tub connector portion 12 may comprise an annular structure 13 attached to the tub and optionally positioned or positionable between the drum and the tub, or optionally comprising a portion positioned or positionable between the drum and the tub. The annular structure may reduce the gap between the tub and the drum to prevent solid particles from passing through the gap as shown in figure 1. The tub connector portion 12 may comprise a connection means for connecting the baffle to the tub 4. An exemplary connection means is shown in figure 1, which comprises a pair of protrusions 19, 21 configured to contact either side of the tub, on the internal and external surfaces of the tub 4. The protrusion 21 contacting the outer surface of the tub 4 may also comprise an abutment 29 that cooperates with a flange 28 of the tub 4. The pair of protrusions 19, 21 and abutment 29 form a removable mechanical connection to the tub. The pair of protrusions may resist axial motion of the tub connector portion 12 and the abutment 29 and flange 28 may resist radially inward motion. In other embodiments, the baffle may comprise alternative connection means such as alternative configurations comprising one or more protrusions, rims or other structures to optionally cooperate with a corresponding structure of the tub. The attachment means may comprise any of hooks, loops, pins, screws, clips and other mechanical retention devices. The tub connector portion 12 may be integrally formed with the barrier 16 or may comprise connection means for connecting the tub connector portion to the barrier.

[0085] The door contacting portion 14 may comprise a portion of the baffle that contacts the door 8 when in use. The door contacting portion 14 may comprise a surface adapted to contact the door. The surface may be contoured to match a corresponding inner surface of the door, in particular, the surface may be frustoconical or frustoconical with curved vertices to cooperate with a correspondingly shaped dome (or cone) on the inner surface of a treatment machine door. The door contacting portion 14 may have a higher stiffness than the barrier 16, and may, for example, comprise a rigid or semi rigid annulus to maintain the door contacting portion in an annular shape to cooperate with the shape of the door. For example, the door contacting portion 14 may comprise a generally annular structure which may, for example, comprise nylon or polyethylene, amongst others. The door contacting portion 14 may be integrally formed with the barrier 16 or may comprise connection means for connecting the door contacting portion to the barrier.

[0086] The barrier 16 extends between the tub connector portion 12 and the door contacting portion 14 and prevents passage of the solid particles through the barrier. The barrier is inclined so that the likelihood of solid particles accumulating on the barrier is reduced, and solid particles are directed into the drum. The barrier may be shaped such that the radially inner surface of the barrier, when viewed in cross section, comprises a line or

curve inclined towards the drum. The baffle may be shaped to comprise one or more of flutings, steps, troughs or bumps on the surface, provided none of these shapes comprise regions where solid particles may accumulate, and the radially inner surface of the barrier maintains a generally linear or curved shape overall.

[0087] As illustrated in figure 1, the barrier is inclined towards the drum so that solid particles are diverted into the drum. The barrier may be inclined at an average angle between 10 to 90 degrees. A hypothetical line extends from a point where the barrier contacts the tub connector portion at its lowermost point and the point where the barrier contacts the door contacting portion at its lowermost point. The average angle 18 is that between the hypothetical line and the horizontal as shown in Figure 1.

[0088] The barrier 16 may bias the door contacting portion 14 against the door 8 of the treatment machine 1 when the door of the treatment machine is in the closed configuration. The barrier 16 may comprise a resilient material, such that the resilience of the barrier provides a biasing force 20 on the door. For example, the resilient material may comprise, amongst others, polymers (including polyethylene, aramid etc), rubbers (including EPDM rubber, neoprene and silicone rubber). The material may be formed as a mesh or sheet. The sheet may comprise slits or pores. The material may have a thickness between 0.2 mm to 6 mm or between 0.5 mm to 4 mm, or between 1 mm and 2 mm, or between any range comprising any of the preceding endpoints. The barrier may bias the door contacting portion with a force in the axial direction when the door is in a closed configuration, wherein the force is between 2 and 20N, or between 3 and 15N, or between 4 and 10N, or between 5 and 8N, or any range of any combination of the aforesaid endpoints.

[0089] The barrier 16 may comprise one or more ribs or stiffening members affixed to the internal or external surface of the barrier. The ribs or stiffening members may take the form of parallel hoops, tapered springs, lattices or spaced bars, amongst others. The ribs or stiffening members may be attached to the barrier by an adhesive or by melt bonding. They may function to increase the stiffness of the barrier and may prevent the barrier from forming folds or creases when the door is in a closed configuration.

[0090] The barrier may be pre-stressed along the circumferential direction. For example, prior to application of the barrier 16 to the tub connector portion 12 and/or the door contacting portion 14, the barrier in an unstressed position may have a circumferential length less than the circumference of the tub connector portion 12 and/or the door contacting portion 14. Thus, the barrier is strained when applied to the tub connector portion 12 and/or the door contacting portion 14. The barrier may be strained by between 0.5 to 2 %. The application of pre-stress to the barrier may further reduce sag or the formation of creases in the barrier when the door is in a closed configuration.

[0091] When the treatment machine door 8 is in an open configuration (not shown), the baffle 10 will be in an unloaded state. In this state, the door contacting portion 14 may extend in the axial direction beyond the point where the door contacting portion 14 is positioned when the door is in a closed configuration. When the door 8 is in a closed configuration, the baffle may be in a loaded configuration with the door contacting portion 14 of the baffle 10 displaced axially rearwards. In this configuration, the barrier 16 may contract, be compressed or may deviate slightly (as shown in figure 1). The contraction or deviation of the barrier 16 may help accommodate motion of the tub 4 such that transfer of vibrations to the door 8 contacting portion by the barrier are minimised.

[0092] The barrier has a length measured in the axial direction from the tub connector portion 12 to the door contacting portion, when the door is in an open configuration the length may, for example be between 10 and 65 mm.

[0093] Referring to figure 2, a baffle 10 further comprises a seal 30. The seal 30 is shown in a position located radially outwards of the barrier 16. The seal 30 may be annularly arranged around the rotational axis 3 of the drum 6. The seal 30 comprises a connection 37 to the tub 4. The connection 37 may comprise a protuberance 38 that extends over an internal surface of the tub, from an external surface of the tub, as shown in figure 2. The connection may comprise an abutment portion 39 located under a flange 35 of the tub 4. However, the connection may take a range of forms, and may for example be integral with the tub connector portion 12 of the baffle 10. The connection to the tub may be mechanical and may comprise hooks, clips and other mechanical retention devices which may be integrally formed with the seal. The connection 37 to the tub 4 may also be via an adhesive, screw or other fixing means. The connection 37 to the tub 4 may also be a shared connection with the tub connector portion 12 of the baffle 10 and may optionally be integrally formed therewith.

[0094] The other end of the seal 30 may be connected to the casing 2, in particular, the seal may comprise connection means 36 to connect to the casing immediately adjacent to the door opening. The seal may extend around the exterior of door opening such that when the door is in a closed configuration, a portion of the seal is pressed by an inner wall of the door against an outer surface of the casing to provide a seal therebetween (not shown). Alternatively, the seal may extend around the interior of the door opening such that when the door is in a closed configuration, a portion of the seal 34 contacts the door 8 to form a seal therebetween. A portion of the seal may extend radially inwards from the casing and an outer surface of the portion of the seal 30 may contact the door 8 when the door is in a closed configuration. In a further alternative, an outer portion of the seal 30 may contact the door when the door is in a closed configuration and the seal 30 may not be connected to the casing 2 (not shown). The seal 30 may connect to the door con-

tacting portion 14 of the baffle 10. In embodiments where the seal 30 comprises connection means to connect to the casing, the door contacting portion 14 of baffle 10 may be connected to the casing connection means of the seal 30. Connection of the seal to the door contacting portion of the baffle 10 may further improve the location of the door contacting portion 14 against the door 8.

[0095] When viewed in cross section taken through the radial direction, the seal 30 may comprise one or more of a loop, deviation or U-shaped portion. In figure 2, the seal 30 is shown with a U-shaped portion 32. The loop, deviation or U-shaped portion is to reduce transmission of vibration from the tub to the door or casing. When using a baffle 10 comprising a seal 30, solid particles are prevented from accessing the loop, deviation or U-shaped portion, or the horizontal upper surface 33. Thus, solid particles have a reduced tendency to accumulate on the horizontal surface of or in the loops of the seal. The seal 30 may be made of any flexible material which is impervious to water, non-limiting examples include rubber, silicone and LMWPE amongst others.

[0096] In embodiments comprising a seal 30 which is impervious to water, the barrier 16 of the baffle 10 may optionally comprise a porous material as the seal will prevent water passing through the porous material from exiting the treatment machine. The porous material may comprise a mesh, a woven fabric, a slitted material or a material comprising a plurality of spaced pores. Non limiting examples include nylon mesh and neoprene optionally foamed, slitted or with pores.

[0097] The seal 30 is shown in figure 2 with a baffle of the type shown in figure 1, however, the seal 30 may be comprised in any other baffle disclosed herein.

[0098] Referring to figure 3a an alternative baffle 40 in accordance with the present invention is shown. The baffle 40 comprises a tub connector portion 42 and a door contacting portion 44 and a barrier 46 extending therebetween. The barrier 46 extends as a gentle curve (not shown) or line between the tub connector portion 42 and the door contacting portion 44. Solid particles contacting the barrier will be diverted down the barrier and back into the drum 6. The baffle 40 further comprises a casing connection 47, the barrier 46 extends from the door contacting portion 44 to the casing connection 47 radially outwards as shown by region 48, then extends in the axial direction, to form a zig-zag/saw tooth shape when viewed in cross section. The region may be formed as a loop, bend or bellows. The barrier 46 and the continuation of the barrier in region 48 may be integrally formed and may comprise a non-porous material. The barrier 46 may prevent water in the drum from passing between the tub 4 and the casing 2 and/or between the casing 2 and the door 8. When viewed in cross section, the barrier may form a sinusoidal shape between the tub connector portion 42 and the casing connection 47; a zig-zag shape between the tub connector portion 42 and the casing connection 47 as shown in figure 3a; or the barrier may form at the bottom part of the drum, an inverted U-shape (not

shown) between the tub connector portion 42 and the casing connection 47 (forming a U-shape at the top of the drum); or any other bellows shape. The door contacting portion may be a part of the barrier that is disposed for contact against the door when the door is in a closed configuration. The door contacting portion may alternatively comprise one or more additional structures to improve contact and/or positioning between the baffle and the door. Additional structures may include flaps, thickened regions or surfaces shaped to conform to the inner surface of the door. In embodiments where the barrier is formed as an inverted U shape, the door contacting portion may be located at or close to the highest point of the inverted U shape, preferably on a door facing aspect close to the highest point. In embodiments where the barrier forms a sinusoidal shape, the door contacting portion may also be at or close to the highest point, preferably on a door facing aspect close to the maxima, such that the barrier is predominantly a monotonically rising curve or line between the tub connector portion and the door contacting portion. The sinusoidal, "zig-zag" or inverted U-shape may improve accommodation of motion of the tub relative to the casing and/or the door, this may additionally or separately be without transferring vibrations to the door or casing. Thus, in these embodiments, the barrier may be formed from a less extensible material and as such may be made from flexible and non-porous material, for example, rubber or silicone.

[0099] The baffle 40 may comprise a second door contacting portion 49 which may depend from or be attached to the casing connection 47. The second door contacting portion may form a seal between the door 8 and an external surface of casing 2 when the door 8 is in a closed configuration, and/or the second door contacting portion may abut against an inner surface of the door when the door 8 is in a closed configuration.

[0100] Figure 3a also shows the tub connector portion comprising an annular structure 13 aligned with the gap between the tub 4 and the drum 6 in the axial direction but radially inwards of the gap. In the particular embodiment shown in figure 3a, the annular structure may be positioned as a continuance of the incline formed by the barrier, that way solid particles on the barrier move over the gap towards the tub. The annular structure 13 may comprise a lip 23 projecting towards the tub, and the lip 23 may optionally extend into the tub 4. The tub connector portion shown in figure 3a is applicable with any other aspect disclosed herein.

[0101] Referring to figure 3b a radial cross section of an alternative baffle 40 in accordance with the present disclosure is shown in a treatment machine. The baffle 40 comprises a tub connector portion 42 and a door contacting portion 44 and a barrier 46 extending therebetween. The barrier 46 is formed from two frustoconical sections that intersect at point 43. One section 461 is connected to the tub connector portion 42 and the other section 441 is connected to the door contacting portion 44. The barrier 40 may flex at the point 43 where the two

sections intersect to reduce transmission of vibrations between the tub 4 and the door 8, and/or one or more of the sections may flex to reduce transmissions.

[0102] The baffle 40 extends from door contacting portion 44 to the casing connection 47 and may comprise a second door contacting portion 49 which may depend from or be attached to the casing connection 47. This extension provides improved seal reliability by functioning as a seal between the casing (not shown) and the door contacting portion 44.

[0103] The door contacting portion 44 prevents the passage of solid particles towards the casing, however wash liquids may still pass through and accumulate on region 45 of the baffle between the casing connection 47 and door contacting portion 44. The baffle 40 comprises a drain 41 in the form of a conduit that extends downwardly to return the liquid to the bottom of the tub. The drain may be preceded by a screen 51 in region 45 to filter solid particles and/or debris (e.g. lint, dirt etc.) to prevent blocking of the drain. Placing the door 8 in the closed configuration will displace the door contacting portion 44 inwards towards the drum, the barrier 46 of the baffle will flex to accommodate this. The flexing of the barrier 46 will cause the door contacting portion 44 to impart a force against the door in the closed configuration. By imparting a force against the door, the door contacting portion 44 is prevented from moving against the door dome during operation of the treatment machine. The door 8 in figure 3b is shown comprised as a door dome, the door dome comprises a deviation 8b shown as an annular bend or ridge in the door dome. The deviation 8b presents a surface to resist lateral motion of the door contacting portion 44 towards the front of the treatment machine (i.e. lateral motion away from the drum 6).

[0104] The baffle 40 shown in figure 3b is formed from a flexible material (e.g. EPDM rubber amongst others). The thickness of the material varies in different regions of the baffle 40 to give different stiffness in those regions. For example, the barrier 46 and door contacting portion 44 are less stiff than region 45 and are shown in figure 3b as being formed from a thinner material. This is to reduce transmission of vibration from the tub to the door. The door contacting portion 44 extends radially inwards and presents an opening through which a user unloads and loads the treatment substrate. A lower stiffness barrier 46 and door contacting portion 44 may further enable the door contacting portion 44 to deflect when contacted by the user, minimising any impediment to the user. The baffle 40 may comprise intermittent stiffening ribs. These may be circumferential spaced around baffle. In particular, they may be located at the barrier 46, the intersection region 43 and at the door contacting portion 44 or regions where the baffle comprises folds, angles, or corners. Stiffening ribs are shown at the corners of the door contacting portion 44 in figure 3b. Stiffening ribs may provide localised stiffening in lower stiffness regions to further improve the ability of the baffle to hold its shape.

[0105] Referring to figure 4 an alternative baffle 50 is

shown. The baffle 50 comprises a tub connector portion 52 and a door contacting portion 54 and a barrier 56 extending therebetween. The barrier 56 additionally comprises resilient elements 58 aligned with and extending along the length of the barrier 56. The resilient elements 58 may be spaced around the circumference of the baffle 50. The resilient elements 58 may be positioned radially outwards of the barrier (as shown in figure 5) or radially inwards. The resilient elements 58 impart a force on the door contacting portion 54 biasing it against the door 8 when the door is in a closed configuration. The use of resilient elements 58 in the barrier 56 permits the use of non-resilient material or minimally resilient materials for the barrier material, examples include latex rubber, thin polymeric films and fabrics amongst others. The resilient elements 58 function to maintain the tautness of the barrier so that an angle or curve is maintained from the tub connector portion 52 to the door contacting portion 54, such that solid particles deposited on the barrier will be diverted into the drum. The resilient elements 58 also maintain contact between the door contacting portion and the door 8 to prevent passage of solid particles therebetween. As the tub vibrates, flexion and/or compression/expansion of the resilient elements 58 accommodates tub vibration whilst maintaining barrier 56 tautness and contact of the door contacting portion 54. The non-resilient barrier 56 is highly flexible and prevents passage of solid particles without impeding motion of the resilient elements 58. The baffle 50 may additionally comprise a seal 30 as exemplified in figure 2 and/or the barrier may extend to a casing connection as exemplified in figure 3a. The resilient elements 58 may be formed from, amongst others, metals and alloys thereof, or polymers. The resilient elements 58 may comprise, amongst others, leaf springs, coil springs, Belleville springs. The resilient elements 58 may be bonded to the barrier 56 at spaced intervals along the length of the barrier, or they may be connected at the respective ends, or at the door contacting portion 54 and at the tub connector portion 52.

[0106] Referring to figure 5 an alternative baffle 60 is shown. The baffle 60 comprises a tub connector portion 62 and a door contacting portion 64 and a barrier 66 extending therebetween. The barrier 66 comprises bellows 68 which deviate radially outwards from the barrier surface. To prevent solid particles accumulating in the bellows 68 the barrier 66 comprises an extensible cover 69 which maintains the incline or angle of the barrier. The bellows 68 function to isolate the door contacting portion 64 from tub vibrations. The extensible cover 69 comprises an extensible material (such as latex rubber, extensible polymeric films and fabrics amongst others), so that flexing of the bellows 68 is accommodated by the extensible cover without the cover transferring vibrations to the door contacting portion 64. The extensible cover 69 may be joined to the barrier 66 by melt-bonding, adhesives, or mechanical fasteners. Alternatively, or additionally, the extensible cover 69 may comprise features to cooperate with corresponding features on the barrier 66,

in a non-limiting example, this may comprise a beading that is retained by eyelets in the barrier (not shown). The baffle 60 may additionally comprise a seal 30 as exemplified in figure 3a and/or the barrier may extend to a casing connection as exemplified in figure 3a.

[0107] Referring to figure 6 an alternative baffle 90 is shown. The baffle 90 comprises a tub connector portion 92, a door contacting portion 94 and a barrier 96. The tub connector portion, door contacting portion and barrier are integrally formed from a rigid flexible material e.g. polypropylene, aramid, polyethylene, polyethylene terephthalate amongst others. The barrier and door contacting portion are split into multiple flexible fingers 93. The fingers, at the door contacting portion 94 additionally comprise a resilient hoop 95 which may be formed from an elastic cord for example. The resilient hoop 95 retains the ends of the fingers against the door dome/cone. The fingers 93 permit the barrier to flex so that vibrations are not transferred from the tub to the door. The barrier 96 provides an inclined surface so that solid particles deposited on the barrier during a treatment cycle roll back into the drum. The baffle 90 optionally comprises a seal 30 as shown in figure 2.

[0108] Referring to figure 7a an alternative baffle is shown. The baffle comprises a tub connector portion 82, a door contacting portion 84 and a barrier 86. The door contacting portion is rigidly connected to the door 8. The door contacting portion may be rigidly connected via any of an adhesive, mechanical fixing means or it may be integrally formed with the door dome/cone. The barrier 86 is formed from two parts, a first part 86a is connected to the tub connector portion 82 and second part 86b is connected to the door contacting portion 84. When the door 8 is in an open configuration, the second part of the barrier 86b is moved away from the drum 6 with the door 8, so that a treatment substrate (e.g. laundry) can be added to the drum 6. When the door 8 is in a closed configuration, the second part of the barrier 86b is adjacent to the first part of the barrier 86a and the two parts of the barrier 86 form a seal to prevent passage of solid particles during a wash cycle. The first part 86a and/or the second part 86b may be made from a rigid but compliant material, for example EPDM rubber, amongst others. Compliance between one of both parts of the barrier may provide a better seal. The baffle optionally comprises a seal 30 as shown in figure 2.

[0109] Referring to figure 7b an alternative baffle is shown. The baffle comprises a tub connector portion 82, a door contacting portion 84 and a barrier 86. The barrier 86 is annular in shape and extends approximately radially inwards from the tub connector portion 82 and towards the door 8. The barrier 86 terminates at the door contacting portion 84. The barrier 86 is inclined so that particles deposited on the barrier 86 will fall down the barrier into drum 6. The door contacting portion 84 extends annularly around the door opening and is sized to sit around an inwardly projecting element of the door 8, which in Figure 7b is shown in the form of a dome. The door dome is

shown as rotationally symmetrical around a central axis, to cooperate with a similarly shaped opening in the door contacting portion 84. When the door is in an open configuration a user may pass the treatment substrate through the opening presented by the door contacting portion 84. When the door 8 is in a closed configuration, the dome of the door 8 contacts the door contacting portion 84 preventing the passage of solid particles past the barrier 86. The barrier 86 is made of a resilient material. For example, the resilient material may comprise EPDM rubber, amongst others. When the door 8 is closed, the door displaces the door contacting portion 84 inwards towards the drum 6. This displacement is accommodated by the flex of the barrier material, such that in the closed configuration, a force is imparted against the door 8 by the door contacting portion 86 to maintain contact throughout use to improve the seal therebetween. The baffle optionally comprises a seal 30 as shown in figure 2.

[0110] The baffle of the present invention is used with a treatment machine to which solid particles have been added to the drum.

[0111] Referring to figure 8 a treatment machine drum 70 is shown. The treatment machine drum comprises an open end of the drum 72 for introducing said substrates into said drum. The drum comprises storage means 73 located within the drum which is isolated from the drum volume where treatment of the substrates takes place. The storage means is for storage of solid particles. The storage means shown in figure 8 is located on a rear wall of the drum, however, the storage means may be located elsewhere in the drum, e.g. in the lifters or may be located elsewhere in the treatment machine.

[0112] The drum also comprises lifters 74a, 74b, 74c located on the inner surface of the drum. The lifters comprise one or more collecting apertures 75 into which solid particles can enter the lifters. Inside the lifters a collecting flow path is provided, through which the solid particles can move from the interior of the drum to the storage means at the rear of the drum

[0113] The lifters may also comprise a second dispensing flow path for movement of solid particles from the storage means to the interior of said drum. The flow paths may be shaped such that rotation of the drum in one direction may dispense solid particles from the storage means into the drum via dispensing apertures in the lifters 76. Rotation of the drum in the other direction may move solid particles from the drum to the storage means. The drum may optionally comprise a valve 78 on the end wall of the drum, the valve openable to dispense solid particles from the rear wall of the drum.

[0114] Features described herein in conjunction with a particular aspect or example of the disclosure are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith. As used herein, the words "a" or "an" are not limited to the singular but are understood to include a plurality, unless the context requires otherwise. The term "comprising" encompasses "including" as well as

"consisting" and "consisting essentially of" e.g. a feature "comprising" X may consist exclusively of X or may include something additional e.g. X + Y.

[0115] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features. The invention is not restricted to the details of any foregoing embodiments.

[0116] The claims should not be construed to cover merely the foregoing embodiments, but also any embodiments which fall within the scope of the claims.

Claims

1. A treatment machine (1) comprising:
 - a casing (2);
 - a tub (4) moveably mounted within the casing;
 - a drum (6, 70) rotatably mounted within the tub;
 - a door (8) for loading a substrate into the drum (6, 70), wherein the door (8) is mounted to the casing (2) and operable between open and closed configurations:
 - wherein the treatment machine is configured to dispense solid particles into the drum (6, 70) and to extract solid particles from the drum (6, 70);
 - and wherein the treatment machine further comprises a baffle (10, 40, 50, 60, 90); the baffle comprising:
 - a tub connector portion (12, 42, 52, 62, 82, 92) connecting the baffle to the tub (4) of the treatment machine;
 - a door contacting portion (14, 44, 54, 64, 84, 94) that contacts the door (8) of the treatment machine when the door (8) is in a closed configuration;
 - a barrier (16, 46, 56, 66, 86, 96) extending between the tub connector portion (12, 42, 52, 62, 82, 92) and the door contacting portion (14, 44, 54, 64, 84, 94);
 - and wherein the barrier (16, 46, 56, 66, 86, 96) is inclined so solid particles are diverted by the barrier (16, 46, 56, 66, 86, 96) into the drum (6, 70) of the treatment machine
2. A treatment machine according to claim 1, wherein the barrier (16, 46, 56, 66, 86, 96) biases the door contacting portion (14, 44, 54, 64, 84, 94) against the door (8) of the treatment machine when the door of the treatment machine is in the closed configuration.
3. A treatment machine according to claim 1 or 2,

wherein the barrier (16, 46, 56, 66, 86, 96) extends in a linear or monotonically curved manner between the tub connector portion (12, 42, 52, 62, 82, 92) and the door contacting portion (14, 44, 54, 64, 84, 94).

4. A treatment machine according to any of claims 1 to 3, wherein the tub connector portion (12, 42, 52, 62, 82, 92) comprises an annulus positioned between the drum (6, 70) and tub (4).
5. A treatment machine according to any of claims 1 to 4, wherein the barrier (16, 46, 56, 66, 86, 96) is inclined at an average angle between 10 and 90 degrees, wherein the average angle measured between the horizontal and a hypothetical line extending from where the barrier contacts the tub connector portion (12, 42, 52, 62, 82, 92) at its lowermost point and where the barrier contacts the door contacting portion (14, 44, 54, 64, 84, 94) at its lowermost point.
6. A treatment machine according to any of claims 1 to 5, wherein the treatment machine has an axial direction aligned with the centre of rotation of the drum (6, 70), and the barrier (16, 46, 56, 66, 86, 96) has a length measured in the axial direction from the tub connector portion (12, 42, 52, 62, 82, 92) to the door contacting portion, (14, 44, 54, 64, 84, 94), when the door (8) is in an open configuration the length is between 10 and 65 mm, or between 15 and 50 mm, or between 20 and 40 mm.
7. A treatment machine according to any of claims 1 to 6, wherein the force in the axial direction of the door contacting portion (14, 44, 54, 64, 84, 94) against the door (8), when the door is in a closed configuration is between 2 and 20 N.
8. A treatment machine according to any of claims 1 to 7, wherein the door (8) comprises a dome shaped portion extending into the drum (6, 70) when in a closed configuration, and wherein the door contacting portion (14, 44, 54, 64, 84, 94) of the baffle (10, 40, 50, 60, 90) contacts the dome shaped portion
9. A treatment machine according to any of claims 1 to 8, wherein the door contacting portion (14, 44, 54, 64, 84, 94) comprises a rigid annulus.
10. A treatment machine according to any of claims 1 to 9, wherein the barrier (16, 46, 56, 66, 86, 96) comprises neoprene, a porous polymer sheet, a mesh, latex rubber or spring elements.
11. A treatment machine according to any of claims 1 to 9, wherein the door contacting portion (14, 44, 54, 64, 84, 94) is comprised as part of the barrier (16, 46, 56, 66, 86, 96) and wherein the baffle (10, 40, 50, 60, 90) comprises a casing connection (47), the

casing connection connected to the casing (2) and joined to the door contacting portion by the barrier; and optionally wherein the barrier is arranged as a zigzag, sinusoid or U-shape when viewed in cross section through the radial direction.

12. A treatment machine according to claim 11, wherein the barrier (16, 46, 56, 66, 86, 96) comprises a non-porous material.
13. A treatment machine according to any of claims 11 or 12, wherein the barrier (16, 46, 56, 66, 86, 96) comprises an elastomer.
14. A treatment machine according to any of claims 1 to 13, wherein the baffle (10, 40, 50, 60, 90) further comprises a seal (30) positioned radially outwards of the barrier (16, 46, 56, 66, 86, 96); and optionally wherein the seal (30) comprises rubber.
15. A treatment machine according to any of claims 1 to 14, wherein the treatment machine (1) comprises a washing machine, and/or wherein the substrate is a textile.
16. A method of treating a substrate in a treatment machine (1) of any of claims 1 to 15, the method comprising:
 - loading the drum (6, 70) of the treatment machine (1) with the substrate, solid particles and a liquid medium
 - rotating the drum (6, 70) to agitate the substrate, solid particles and liquid medium
17. The method according to claim 16 further comprising:
 - draining the liquid medium from the drum (6, 70); and
 - rinsing the solid particles and substrate; and optionally wherein the rinsed solid particles are re-used in a subsequent repeat of the method.
18. The method according to any of claims 16 or 17, wherein the substrate is a textile and/or wherein the treatment machine (1) is a washing machine

Patentansprüche

1. Behandlungsmaschine (1) umfassend:

ein Gehäuse (2);
einen Bottich (4), der bewegbar innerhalb des Gehäuses montiert ist;
eine Trommel (6, 70), die drehbar innerhalb des Bottichs montiert ist;

- eine Tür (8) zum Laden eines Substrats in die Trommel (6, 70),
wobei die Tür (8) an dem Gehäuse (2) montiert ist und zwischen einer offenen und einer geschlossenen Konfiguration betreibbar ist;
wobei die Behandlungsmaschine dazu konfiguriert ist, Feststoffpartikel in die Trommel (6, 70) abzugeben und Feststoffpartikel aus der Trommel (6, 70) zu extrahieren;
und wobei die Behandlungsmaschine ferner ein Blech (10, 40, 50, 60, 90) umfasst;
wobei das Blech Folgendes umfasst:
- einen Bottichverbinderabschnitt (12, 42, 52, 62, 82, 92), der das Blech mit dem Bottich (4) der Behandlungsmaschine verbindet;
einen Türberührungsabschnitt (14, 44, 54, 64, 84, 94), der die Tür (8) der Behandlungsmaschine berührt, wenn sich die Tür (8) in einer geschlossenen Konfiguration befindet;
eine Barriere (16, 46, 56, 66, 86, 96), die sich zwischen dem Bottichverbinderabschnitt (12, 42, 52, 62, 82, 92) und dem Türberührungsabschnitt (14, 44, 54, 64, 84, 94) erstreckt;
und wobei die Barriere (16, 46, 56, 66, 86, 96) geneigt ist, sodass Feststoffpartikel durch die Barriere (16, 46, 56, 66, 86, 96) in die Trommel (6, 70) der Behandlungsmaschine umgeleitet werden.
2. Behandlungsmaschine nach Anspruch 1, wobei die Barriere (16, 46, 56, 66, 86, 96) den Türberührungsabschnitt (14, 44, 54, 64, 84, 94) gegen die Tür (8) der Behandlungsmaschine vorspannt, wenn sich die Tür der Behandlungsmaschine in der geschlossenen Konfiguration befindet.
 3. Behandlungsmaschine nach Anspruch 1 oder 2, wobei sich die Barriere (16, 46, 56, 66, 86, 96) auf lineare oder monoton gekrümmte Art und Weise zwischen dem Bottichverbinderabschnitt (12, 42, 52, 62, 82, 92) und dem Türberührungsabschnitt (14, 44, 54, 64, 84, 94) erstreckt.
 4. Behandlungsmaschine nach einem der Ansprüche 1 bis 3, wobei der Bottichverbinderabschnitt (12, 42, 52, 62, 82, 92) einen Ring umfasst, der zwischen der Trommel (6, 70) und dem Bottich (4) positioniert ist.
 5. Behandlungsmaschine nach einem der Ansprüche 1 bis 4, wobei die Barriere (16, 46, 56, 66, 86, 96) in einem durchschnittlichen Winkel zwischen 10 und 90 Grad geneigt ist, wobei der durchschnittliche Winkel zwischen der Horizontalen und einer hypothetischen Linie gemessen, die sich von dort, wo die Barriere den Bottichverbinderabschnitt (12, 42, 52, 62, 82, 92) an ihrem untersten Punkt berührt, und dort, wo die Barriere den Türberührungsabschnitt (14, 44, 54, 64, 84, 94) an ihrem untersten Punkt berührt, erstreckt.
 6. Behandlungsmaschine nach einem der Ansprüche 1 bis 5, wobei die Behandlungsmaschine eine axiale Richtung aufweist, die an dem Drehzentrum der Trommel (6, 70) ausgerichtet ist, und die Barriere (16, 46, 56, 66, 86, 96) eine in der axialen Richtung von dem Bottichverbinderabschnitt (12, 42, 52, 62, 82, 92) zu dem Türberührungsabschnitt (14, 44, 54, 64, 84, 94) gemessene Länge aufweist, wenn sich die Tür (8) in einer offenen Konfiguration befindet, die Länge zwischen 10 und 65 mm oder zwischen 15 und 50 mm oder zwischen 20 und 40 mm beträgt.
 7. Behandlungsmaschine nach einem der Ansprüche 1 bis 6, wobei die Kraft in der axialen Richtung des Türberührungsabschnitts (14, 44, 54, 64, 84, 94) gegen die Tür (8), wenn sich die Tür in einer geschlossenen Konfiguration befindet, zwischen 2 und 20 N beträgt.
 8. Behandlungsmaschine nach einem der Ansprüche 1 bis 7, wobei die Tür (8) einen kuppelförmigen Abschnitt umfasst, der sich in einer geschlossenen Konfiguration in die Trommel (6, 70) erstreckt, und wobei der Türberührungsabschnitt (14, 44, 54, 64, 84, 94) des Blechs (10, 40, 50, 60, 90) den kuppelförmigen Abschnitt berührt.
 9. Behandlungsmaschine nach einem der Ansprüche 1 bis 8, wobei der Türberührungsabschnitt (14, 44, 54, 64, 84, 94) einen starren Ring umfasst.
 10. Behandlungsmaschine nach einem der Ansprüche 1 bis 9, wobei die Barriere (16, 46, 56, 66, 86, 96) Neopren, eine poröse Polymerfolie, ein Netz, Latexgummi oder Federelemente umfasst.
 11. Behandlungsmaschine nach einem der Ansprüche 1 bis 9, wobei der Türberührungsabschnitt (14, 44, 54, 64, 84, 94) als Teil der Barriere (16, 46, 56, 66, 86, 96) umfasst ist und wobei das Blech (10, 40, 50, 60, 90) eine Gehäuseverbindung (47) umfasst, wobei die Gehäuseverbindung mit dem Gehäuse (2) verbunden und durch die Barriere mit dem Türberührungsabschnitt zusammengefügt ist; und wobei die Barriere optional im Querschnitt durch die radiale Richtung betrachtet als Zickzack-, Sinusoid- oder U-Form angeordnet ist.
 12. Behandlungsmaschine nach Anspruch 11, wobei die Barriere (16, 46, 56, 66, 86, 96) ein nichtporöses Material umfasst.

13. Behandlungsmaschine nach einem der Ansprüche 11 oder 12, wobei die Barriere (16, 46, 56, 66, 86, 96) ein Elastomer umfasst.
14. Behandlungsmaschine nach einem der Ansprüche 1 bis 13, wobei das Blech (10, 40, 50, 60, 90) ferner eine Dichtung (30) umfasst, die radial außen von der Barriere (16, 46, 56, 66, 86, 96) positioniert ist; und wobei die Dichtung (30) optional Gummi umfasst.
15. Behandlungsmaschine nach einem der Ansprüche 1 bis 14, wobei die Behandlungsmaschine (1) eine Waschmaschine umfasst und/oder wobei das Substrat ein Textil ist.
16. Verfahren zum Behandeln eines Substrats in einer Behandlungsmaschine (1) nach einem der Ansprüche 1 bis 15, wobei das Verfahren Folgendes umfasst:
- Beladen der Trommel (6, 70) der Behandlungsmaschine (1) mit dem Substrat, Feststoffpartikeln und einem flüssigen Medium
- Drehen der Trommel (6, 70), um das Substrat, die Feststoffpartikel und das flüssige Medium in Bewegung zu versetzen.
17. Verfahren nach Anspruch 16, ferner umfassend:
- Ablassen des flüssigen Mediums aus der Trommel (6, 70); und
- Spülen der Feststoffpartikel und des Substrats; und wobei die gespülten Feststoffpartikel optional bei einer anschließenden Wiederholung des Verfahrens wiederverwendet werden.
18. Verfahren nach einem der Ansprüche 16 oder 17, wobei das Substrat ein Textil ist und/oder wobei die Behandlungsmaschine (1) eine Waschmaschine ist.

Revendications

1. Machine de traitement (1) comprenant :

une enveloppe (2) ;

une cuve (4) montée mobile à l'intérieur de l'enveloppe ;

un tambour (6, 70) monté rotatif à l'intérieur de la cuve ;

une porte (8) destinée à charger un substrat dans le tambour (6, 70), ladite porte (8) étant montée sur l'enveloppe (2) et pouvant fonctionner entre des configurations ouverte et fermée ; ladite machine de traitement étant configurée pour distribuer des particules solides dans le tambour (6, 70) et pour extraire des particules solides du tambour (6, 70) ;

et ladite machine de traitement comprenant en outre un déflecteur (10, 40, 50, 60, 90) ;

le déflecteur comprenant :

une partie de raccord de cuve (12, 42, 52, 62, 82, 92) reliant le déflecteur à la cuve (4) de la machine de traitement ;

une partie de contact de porte (14, 44, 54, 64, 84, 94) qui entre en contact avec la porte (8) de la machine de traitement lorsque la porte (8) se trouve dans une configuration fermée ;

une barrière (16, 46, 56, 66, 86, 96) s'étendant entre la partie de raccord de cuve (12, 42, 52, 62, 82, 92) et la partie de contact de porte (14, 44, 54, 64, 84, 94) ; et ladite barrière (16, 46, 56, 66, 86, 96) étant inclinée de sorte que les particules solides soient déviées par la barrière (16, 46, 56, 66, 86, 96) dans le tambour (6, 70) de la machine de traitement.

2. Machine de traitement selon la revendication 1, ladite barrière (16, 46, 56, 66, 86, 96) sollicitant la partie de contact de porte (14, 44, 54, 64, 84, 94) contre la porte (8) de la machine de traitement lorsque la porte de la machine de traitement se trouve dans la configuration fermée.
3. Machine de traitement selon la revendication 1 ou 2, ladite barrière (16, 46, 56, 66, 86, 96) s'étendant de manière incurvée linéaire ou monotone entre la partie de raccord de cuve (12, 42, 52, 62, 82, 92) et la partie de contact de porte (14, 44, 54, 64, 84, 94).
4. Machine de traitement selon l'une quelconque des revendications 1 à 3, ladite partie de raccord de cuve (12, 42, 52, 62, 82, 92) comprenant un anneau positionné entre le tambour (6, 70) et la cuve (4).
5. Machine de traitement selon l'une quelconque des revendications 1 à 4, ladite barrière (16, 46, 56, 66, 86, 96) étant inclinée suivant un angle moyen compris entre 10 et 90 degrés, ledit angle moyen étant mesuré entre l'horizontale et une ligne hypothétique s'étendant de l'endroit où la barrière entre en contact avec la partie de raccord de cuve (12, 42, 52, 62, 82, 92) en son point le plus bas et de l'endroit où la barrière entre en contact avec la partie de contact de porte (14, 44, 54, 64, 84, 94) en son point le plus bas.
6. Machine de traitement selon l'une quelconque des revendications 1 à 5, ladite machine de traitement présentant une direction axiale alignée avec le centre de rotation du tambour (6, 70), et ladite barrière (16, 46, 56, 66, 86, 96) présentant une longueur mesurée dans la direction axiale depuis la

- partie de raccord de cuve (12, 42, 52, 62, 82, 92) jusqu'à la partie de contact de porte (14, 44, 54, 64, 84, 94), lorsque la porte (8) se trouve dans une configuration ouverte, ladite longueur étant comprise entre 10 et 65 mm, ou entre 15 et 50 mm, ou entre 20 et 40 mm.
7. Machine de traitement selon l'une quelconque des revendications 1 à 6, ladite force dans la direction axiale de la partie de contact de porte (14, 44, 54, 64, 84, 94) contre la porte (8), lorsque la porte se trouve dans une configuration fermée, étant comprise entre 2 et 20 N.
8. Machine de traitement selon l'une quelconque des revendications 1 à 7, ladite porte (8) comprenant une partie en forme de dôme s'étendant dans le tambour (6, 70) lorsqu'elle se trouve dans une configuration fermée, et ladite partie de contact de porte (14, 44, 54, 64, 84, 94) du déflecteur (10, 40, 50, 60, 90) entrant en contact avec la partie en forme de dôme.
9. Machine de traitement selon l'une quelconque des revendications 1 à 8, ladite partie de contact de porte (14, 44, 54, 64, 84, 94) comprenant un anneau rigide.
10. Machine de traitement selon l'une quelconque des revendications 1 à 9, ladite barrière (16, 46, 56, 66, 86, 96) comprenant du néoprène, une feuille de polymère poreux, un treillis, du caoutchouc latex ou des éléments à ressort.
11. Machine de traitement selon l'une quelconque des revendications 1 à 9, ladite partie de contact de porte (14, 44, 54, 64, 84, 94) étant comprise en tant que partie de la barrière (16, 46, 56, 66, 86, 96) et ledit déflecteur (10, 40, 50, 60, 90) comprenant un raccord d'enveloppe (47), ledit raccord d'enveloppe étant relié à l'enveloppe (2) et joint à la partie de contact de porte par la barrière ; et éventuellement ladite barrière étant agencée en forme de zigzag, de sinusoïde ou de U lorsqu'elle est observée en coupe transversale dans la direction radiale.
12. Machine de traitement selon la revendication 11, ladite barrière (16, 46, 56, 66, 86, 96) comprenant un matériau non poreux.
13. Machine de traitement selon l'une quelconque des revendications 11 ou 12, ladite barrière (16, 46, 56, 66, 86, 96) comprenant un élastomère.
14. Machine de traitement selon l'une quelconque des revendications 1 à 13, ledit déflecteur (10, 40, 50, 60, 90) comprenant en outre un joint d'étanchéité (30) positionné de manière radiale à l'extérieur de la barrière (16, 46, 56, 66, 86, 96) ; et éventuellement ledit joint d'étanchéité (30) comprenant du caoutchouc.
15. Machine de traitement selon l'une quelconque des revendications 1 à 14, ladite machine de traitement (1) comprenant une machine à laver, et/ou ledit substrat étant un textile.
16. Procédé de traitement d'un substrat dans une machine de traitement (1) selon l'une quelconque des revendications 1 à 15, le procédé comprenant : le chargement du tambour (6, 70) de la machine de traitement (1) avec le substrat, les particules solides et un milieu liquide faisant tourner le tambour (6, 70) de manière à agiter le substrat, les particules solides et le milieu liquide.
17. Procédé selon la revendication 16, comprenant en outre :
- la vidange du milieu liquide du tambour (6, 70) ;
 - et
 - le rinçage des particules solides et du substrat ; et éventuellement lesdites particules solides rincées étant réutilisées dans une répétition ultérieure du procédé.
18. Procédé selon l'une quelconque des revendications 16 ou 17, ledit substrat étant un textile et/ou ladite machine de traitement (1) étant une machine à laver.

FIG. 1

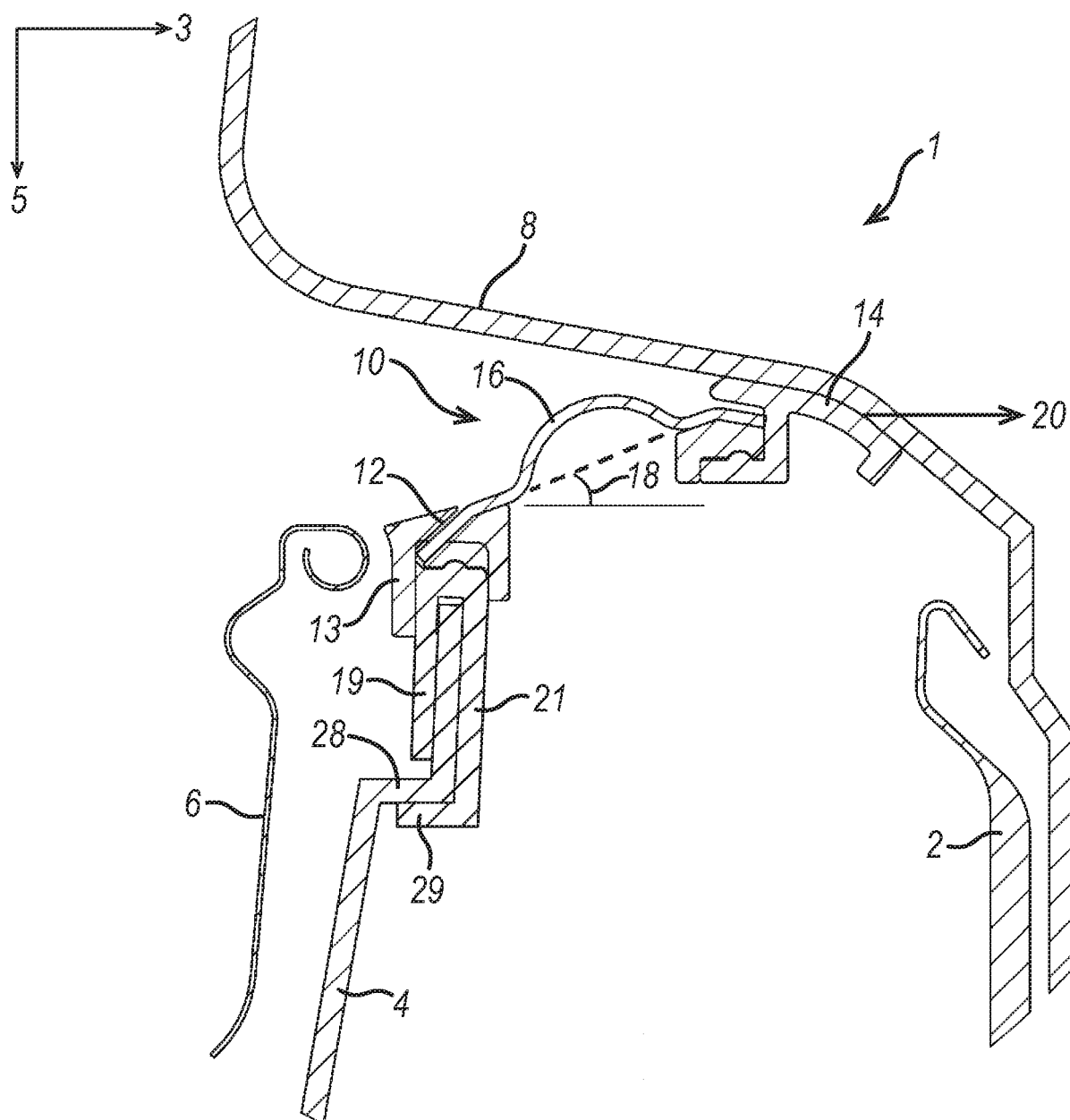


FIG. 2

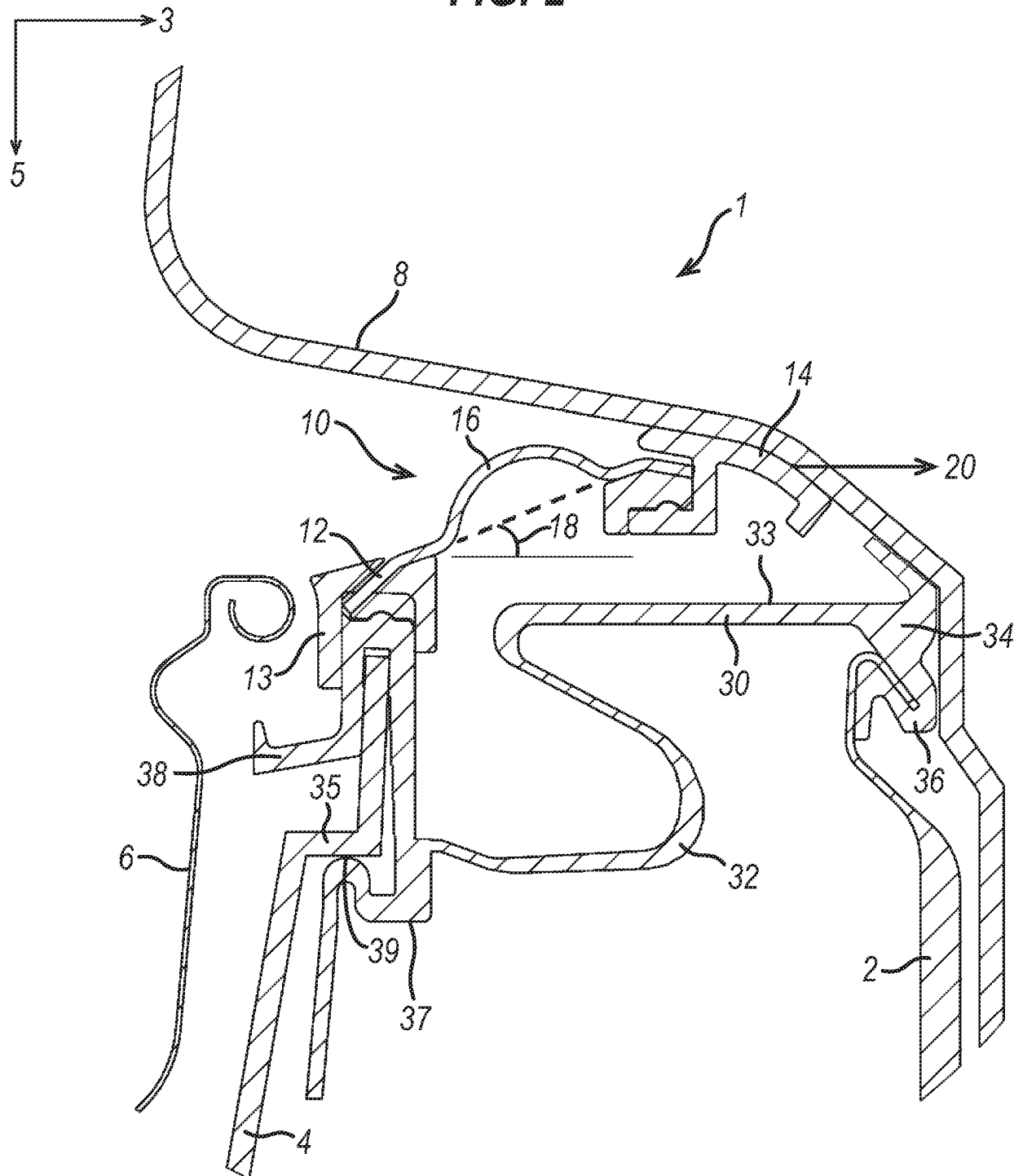


FIG. 3a

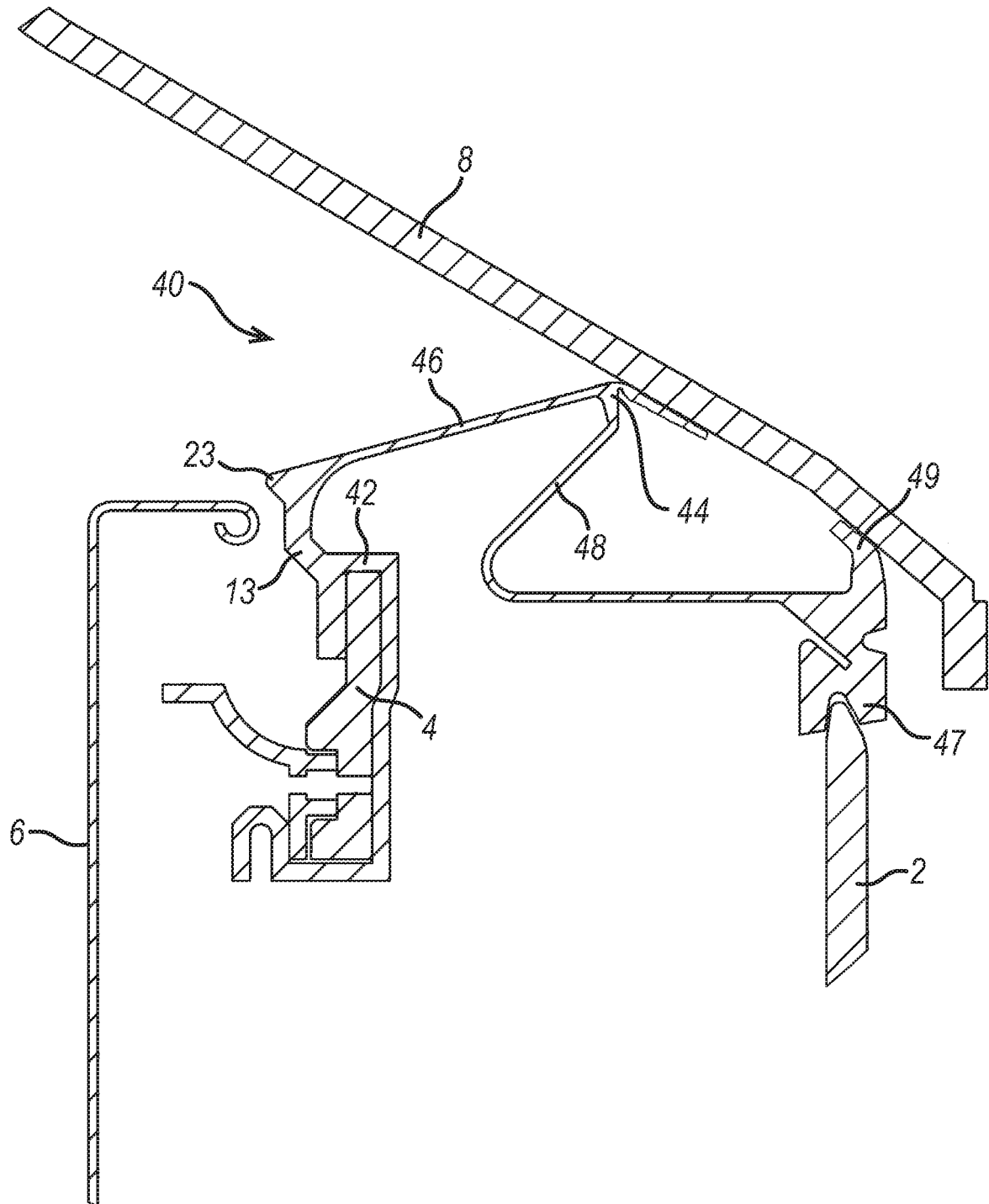


FIG. 3b

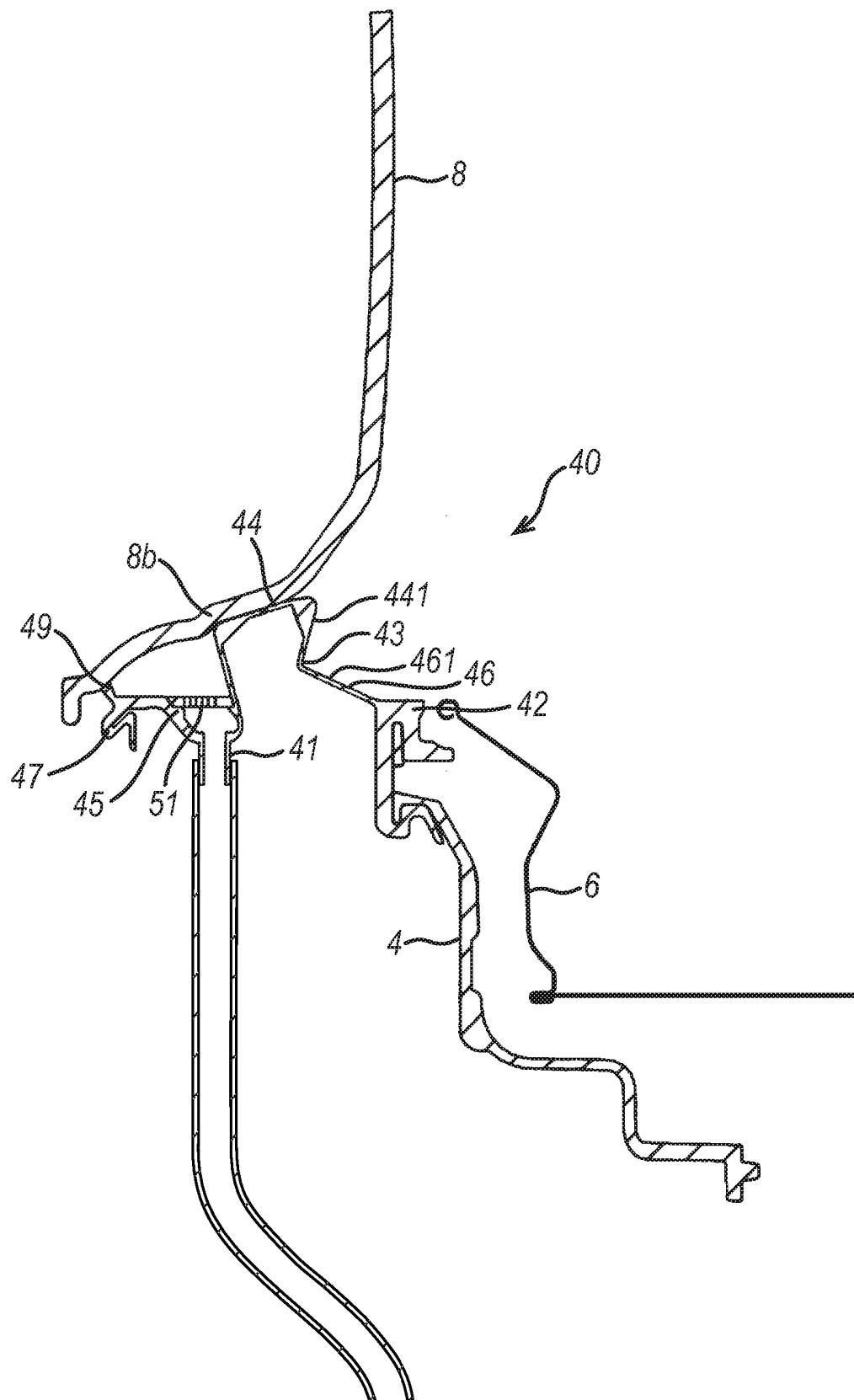


FIG. 4

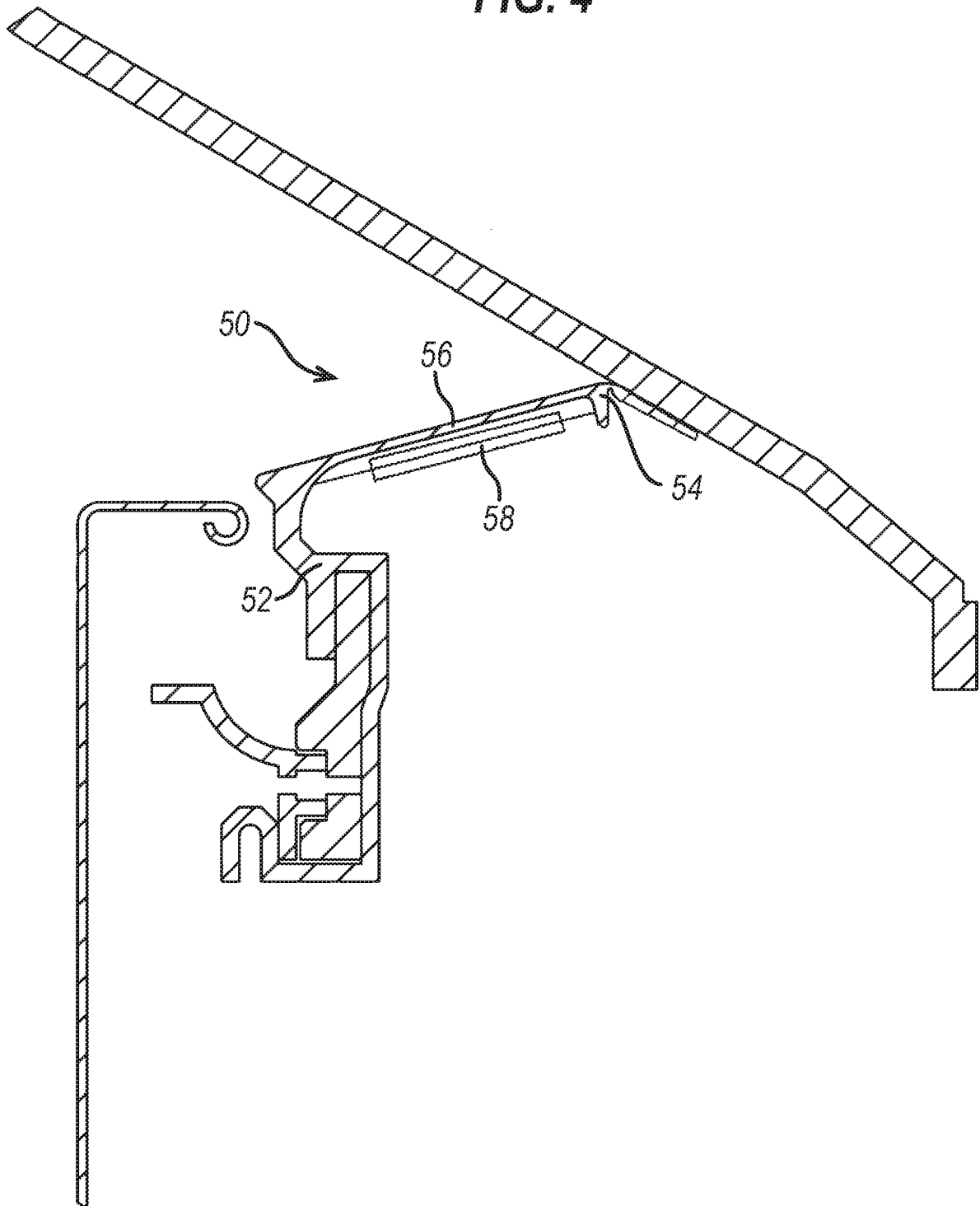


FIG. 5

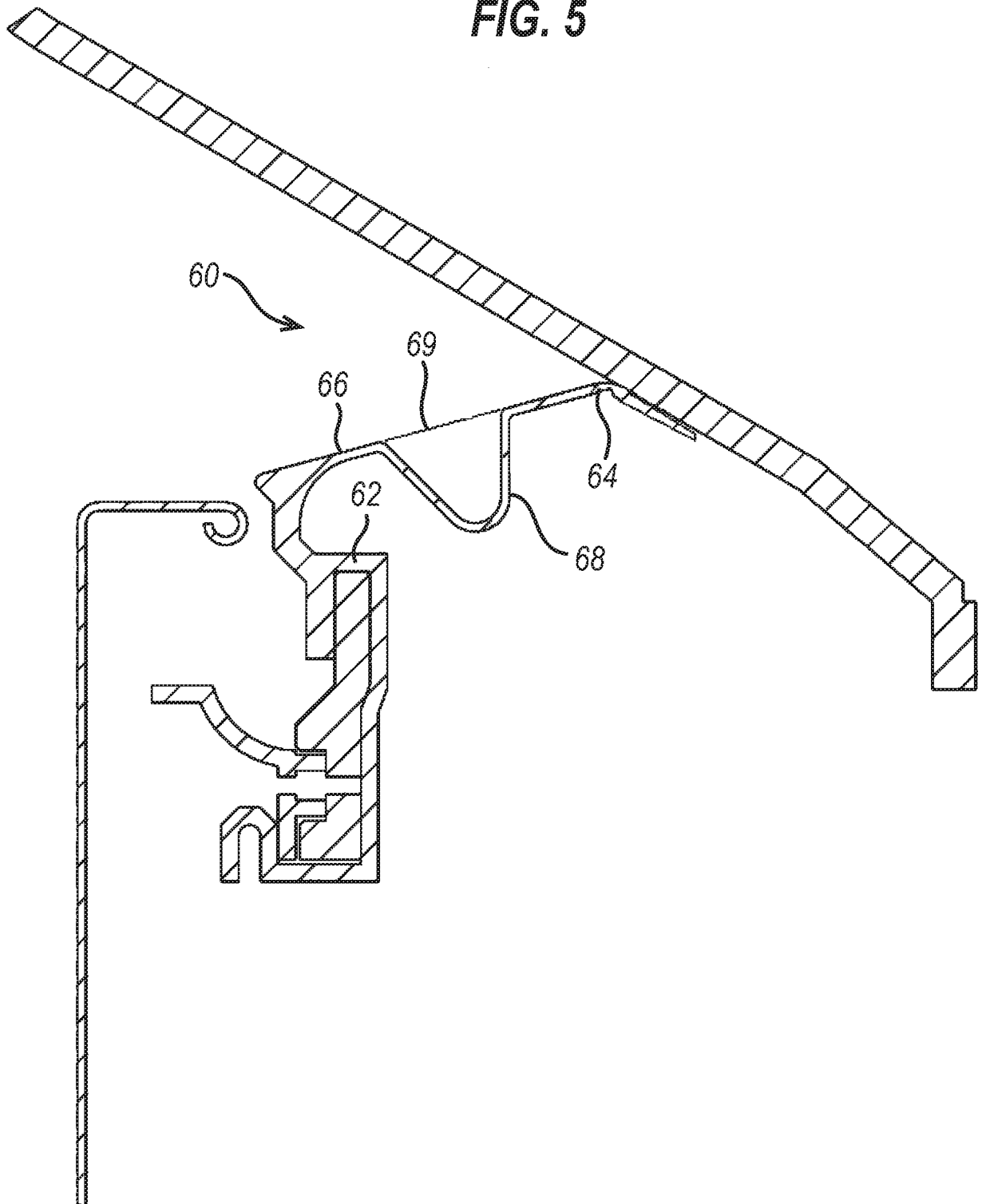


FIG. 6

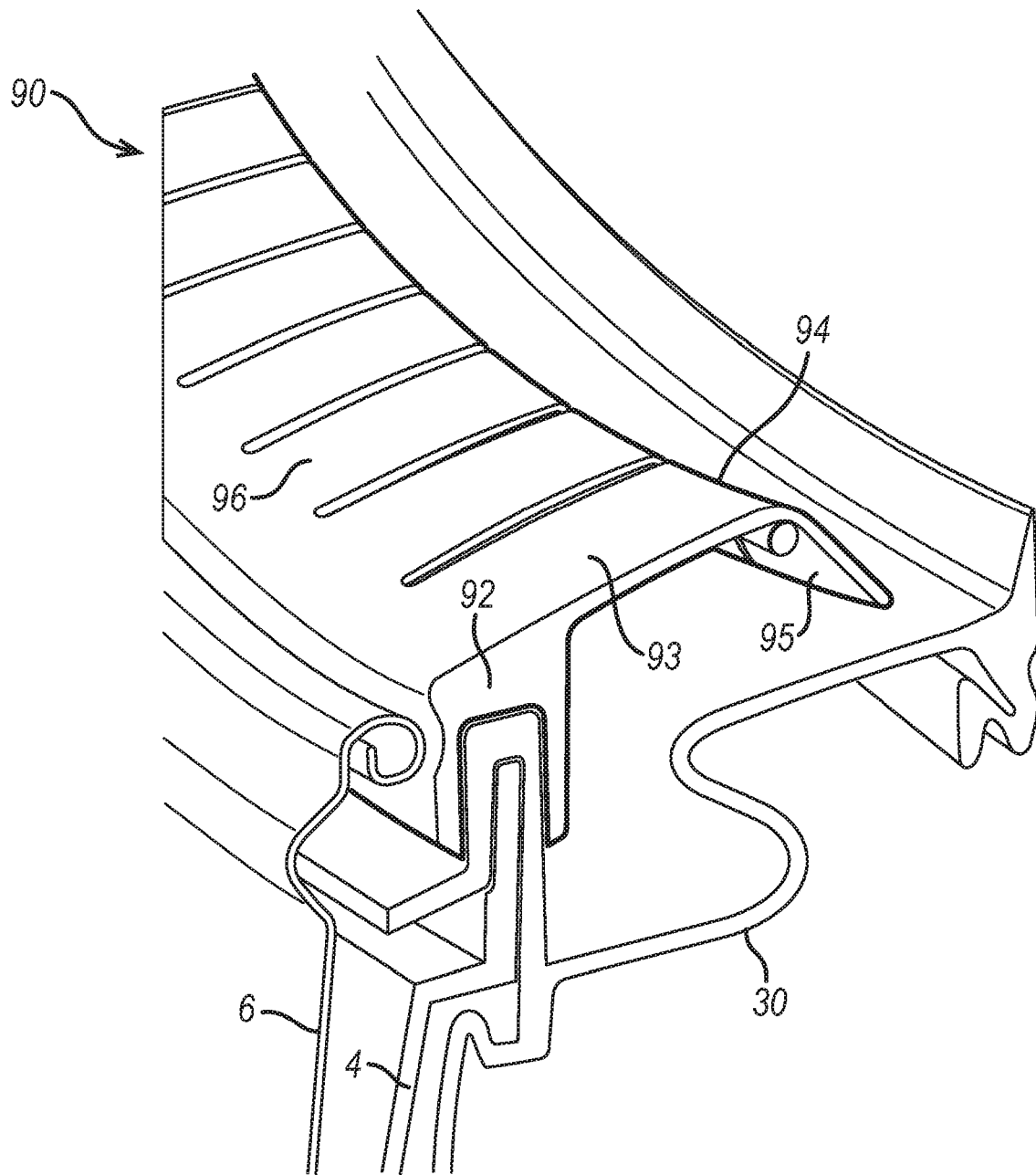


FIG. 7a

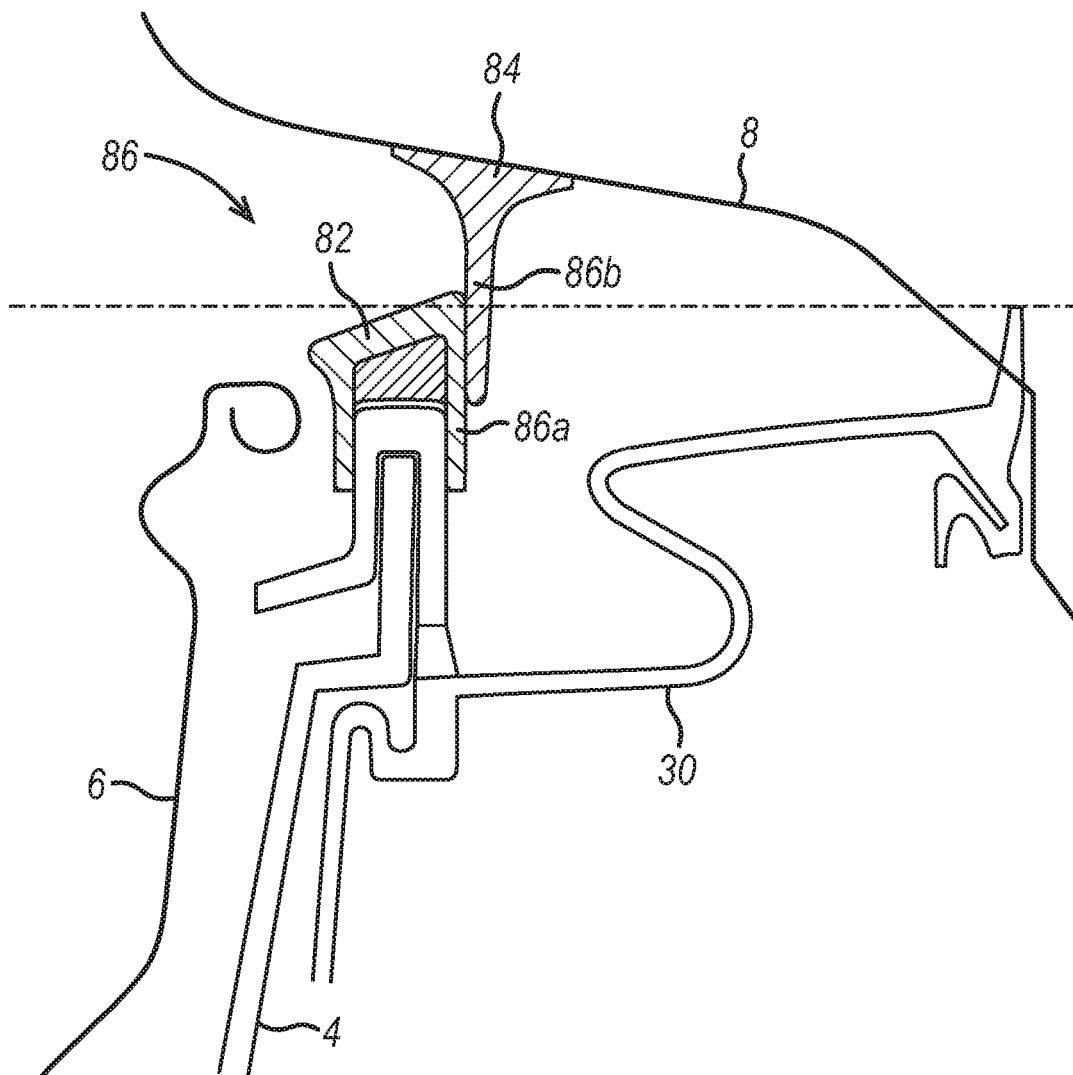


FIG. 7b

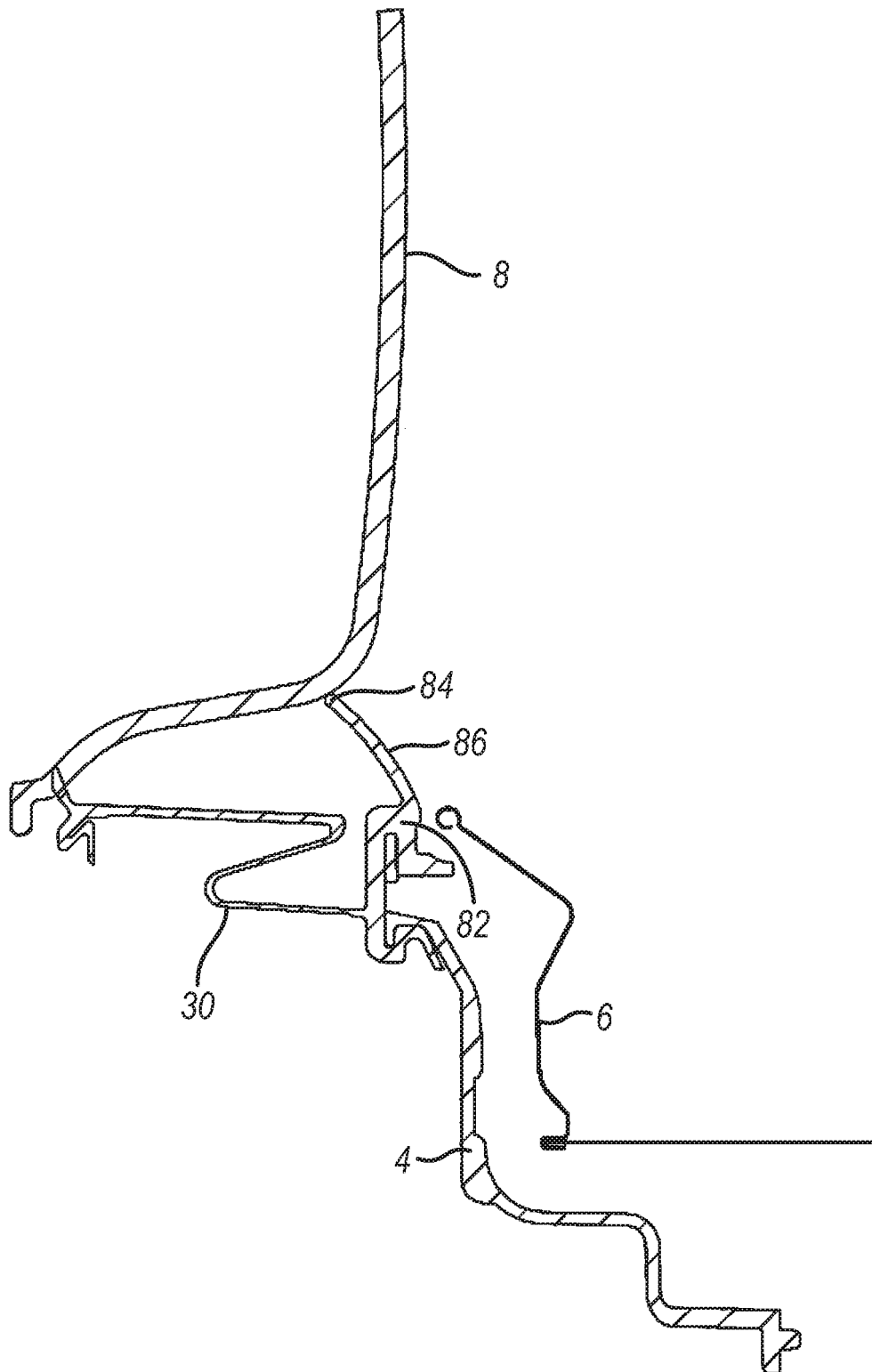
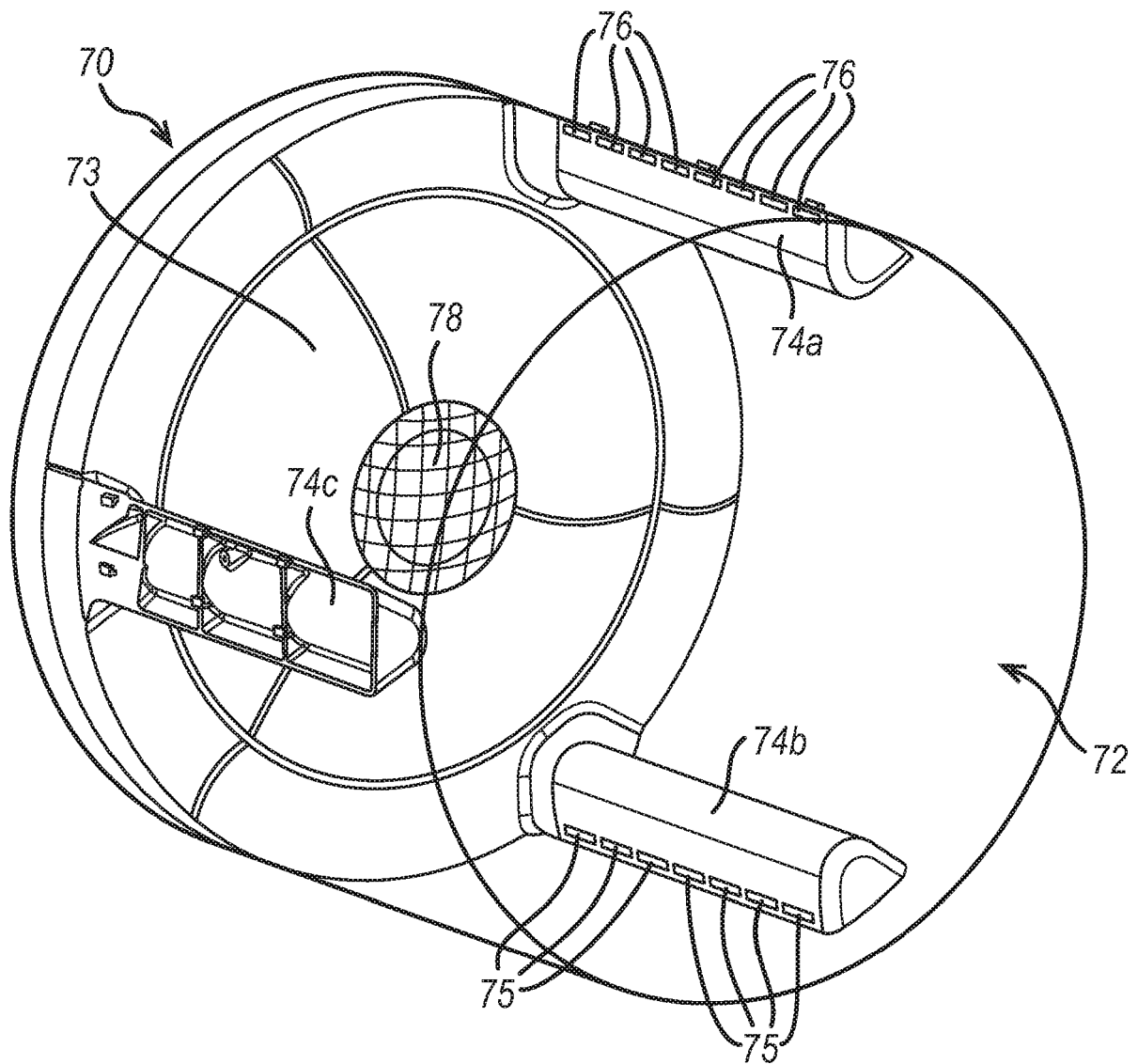


FIG. 8



REFERENCES CITED IN THE DESCRIPTION

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