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(54) **MOISTENING DEVICE, MOISTENING SYSTEM AND METHOD FOR CONTROLLING THE
MOISTURE CONTENT OF A SHUTTLECOCK**

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a moistening device for controlling the moisture content of one or more shuttlecocks when stored within a closed space defined by a tubular packaging.

BACKGROUND OF THE INVENTION

[0002] There are two main types of shuttlecocks, those having a flared skirt made of feathers and those having a flared skirt made of plastic material. While often those made of plastic material are used in casual play, for serious badminton play feathered shuttlecocks are used.

[0003] The behavior of a feather shuttlecock during use and the turnover of the shuttlecock are dependent of the moisture content of the feathers and the cap. The moisture content of the shuttlecock has great influence on the elasticity and toughness of the feathers and the cork-based cap which influences both the playing characteristics and the durability of the shuttlecock. The moisture content has for example an effect on the likelihood of variation in the flight speed. Shuttlecocks are therefore ideally stored in a location having a controllable relative humidity such as a humidity cabinet. The drawbacks of humidity cabinets are that they are costly, space requiring, needs a lot of maintenance and are stationary, i.e. not transportable in daily use.

[0004] EP1652792 discloses a transportable tubular packaging having a humidifying disc comprising a pad moistened with water and propylene glycol to maintain a humid environment in the packaging and thereby prevent the moisture within the feathers of the shuttlecock from evaporating off. The humidifying disc is fixed to a lid in one end of the tubular packaging. A disadvantage of the humidifying disc is that the actual moisture content within the packaging cannot be controlled. Raising relative humidity above 80%RH is known to promote mould growth on many organic materials such as feathers and cork. Another disadvantage of the humidifying disc is that propylene glycol is considered to function as a biocide in concentrations above 20%, but is prone to microbial attack in low concentrations, so possible leaking amounts to the packaging content may promote microbial growth. Consequently an additive has to be used together with the humidifying disc to prevent mould and fungus inside the tubular packaging and on the shuttlecocks.

SUMMARY OF THE INVENTION

[0005] It is desirable to provide a moistening device to be placed in a closed space together with one or more shuttlecocks where the relative humidity of the air within the closed space may be controlled and where the risk of mould and fungus is avoided.

[0006] Furthermore is it desirable to support a simple,

cheap and easily transportable storing of one or more shuttlecocks where the moisture content of the shuttlecocks is maintained and/or restored.

[0007] Furthermore is it desirable to provide a moistening device which may be easily used within a tubular packaging for storing shuttlecocks wherein the feathers of the shuttlecock is not damaged.

[0008] Disclosed herein is a moistening device for controlling the relative humidity within a closed space suitable for storing shuttlecocks, the closed space being defined by a tubular packaging, the moistening device comprising a container configured for containing a number of superabsorbent polymer grains, the container being provided with a number of through holes constituting an opening area for releasing moisture from within the container to the closed space, wherein the container is stored in a non-fixed manner within the tubular packaging and wherein an outer edge or surface of the container is a rounded edge or surface configured to slide against one or more support means of a shuttlecock.

[0009] Feather shuttlecocks usually comprises a cap and feathers. The cap is usually made of cork. The feathers may be divided into two portions, an inner skirt and an outer skirt. The inner skirt is comprised of the stems or quills of the feathers and the outer skirt is comprised of minor stems or the quill extensions that spread into the vanes. In general, the plurality of natural feathers is bound together piece by piece by usually two rows of support means comprising adhesive glue and threads. In the best feather shuttlecocks, the flared skirts are made of goose or duck wing feathers that overlap in the outer skirt. The preferred shuttlecocks typically use approximately 16 feathers per shuttlecock.

[0010] The closed space may preferably be an approximately airtight closed space. The tubular packaging may be the tubular packaging shuttlecocks typically are sold in. The tubular packaging may have at least one opening closable by a lid. The tubular packaging may have two openings, a first opening in one end of the tubular packaging and a second opening in the opposite end of the tubular packaging. Both the first and the second opening in the tubular packaging may be closable by a lid. The first opening in the tubular packaging may reveal the cap of the shuttlecock closest to the first opening and the second opening of the tubular packaging may reveal the skirt of feathers of the shuttlecock closest to the second opening. Dependent on the volume of the closed space, there may be arranged more than one moistening device within the closed space, such as two moistening devices.

[0011] The moistening device may be configured for sliding against the one or more support means when the orientation of the moistening device is shifted relatively to a center axis of the tubular packaging. This may be during transportation of the tubular packaging. This is an advantage as the support means binding the feathers together is a significantly robust part of the shuttlecock. Hereby is provided a moistening device which may be placed within the tubular packaging and being suitable

for resting and sliding against an internal surface of a shuttlecock without damaging the shuttlecock.

[0012] The moistening device may also be used to urge one or more shuttlecocks within the tubular packaging towards the end of the tubular packaging, preferably the end of the tubular packaging the caps of one or more shuttlecocks points towards. The outer edge or surface of the container being the rounded edge or surface may thereby also be configured to bump against one or more support means of the shuttlecock without damaging the feathers of the shuttlecock.

[0013] Furthermore disclosed herein is a use of superabsorbent polymer grains wherein the superabsorbent polymer grains is retained in a container according to the invention.

[0014] Throughout the description will "container", "cylindrical container", "conical container" and "squared container" address the element containing the superabsorbent polymer grains and "box", "tubular packaging" and "squared box" will address the storing element the shuttlecocks are stored within.

[0015] Superabsorbent polymer grains are a water retainable material. Superabsorbent polymer grains is a common term for a number of polymers often based on crosslinked acrylic acid, but may also be based on starch-acrylonitrile, acrylamide, PVA, carboxymethylcellulose etc. Superabsorbent polymer grains are characterised by their ability to absorb and retain extremely large amounts of water relative to their own mass without being dissolved. When exposed to dry air the superabsorbent polymer grains desorbs water to the surrounding air. The superabsorbent polymer grains may preferably have an absorption capacity of at least 300% w/w. The superabsorbent polymer grains may in one embodiment be based on acrylamide copolymers having an absorption capacity of up to 600% w/w.

[0016] The superabsorbent polymer grains may easily be regenerated by submerging the superabsorbent polymer grains or the container containing the superabsorbent polymer grains in water. The size of the through holes and the number of through holes in the container may be sufficient for regeneration of the superabsorbent polymer grains. Both distil water and tap water may be used although the water retention ability will be reduced by using water containing dissolved matter. As the superabsorbent polymer grains do not contain any essential water soluble components no leaching risk exist by using a surplus of water. Excess water can just be left to drip off.

[0017] The size of the through holes and the number of through holes may be sufficient for rinsing out any dirt from within the container.

[0018] In one or more embodiments of the invention the container is configured for containing superabsorbent polymer grains which in dry state have a diameter between 0.5 mm and 5 mm, preferably between 1 mm and 3.5 mm, more preferable between 1.5 mm and 2.5 mm, even more preferable between 1.5 mm and 2 mm.

[0019] In one or more embodiments of the invention

the container is configured for containing superabsorbent polymer grains which in saturated state have a diameter between 3 mm and 33.5 mm, preferably between 6.5 mm and 23 mm, more preferable between 10 mm and 17 mm, even more preferable between 10 mm and 12 mm.

[0020] The container for containing superabsorbent polymer grains may be a sealed and easily replaceable container suitable for being placed in a closed space for storing one or more shuttlecocks, i.e. suitable for being placed in the tubular packaging. As the superabsorbent polymer grains dries out and the moistening ability of the container becomes insufficient, the container may easily be removed from within the closed space and replaced by a container having superabsorbent polymer grains in saturated state.

[0021] Alternatively the container may be a removable and openable container where dried out superabsorbent polymer grains easily may be replaced with new superabsorbent polymer grains in saturated state.

[0022] In one or more embodiments of the invention the container comprises a container body and a container lid.

[0023] Moisture from the superabsorbent polymer grains is released within the container to the closed space through the number of through holes. The through holes may have any suitable shape, such as circular, rectangular, oval, squared, triangular, or the like. The through holes in the container may be sized and shaped so that the through holes are smaller than the particle size of the superabsorbent polymer grains, i.e. the superabsorbent polymer grains in dry state. If the superabsorbent polymer grains in dry state have a diameter of approximately 1.5 mm or between 1.5 mm to 2.5 mm, the through holes may, if circular, have a diameter of 1 mm, or if rectangular, have a wideness of 1 mm, or if being oval, have a minor axis of 1 mm. The through holes may have the same surface area on the inside surface and the outside surface of the container or the through holes may have a larger surface area on the outside surface of the container, i.e. the surface of the container facing away from the superabsorbent polymer grains.

[0024] Together constitutes the through holes an opening area, wherein the opening area is the sum of all the through holes opening areas on the inside surface of the container. The opening area is the total area from where moisture from inside the container may be released to the closed space.

[0025] In one or more embodiments of the invention the number of through holes is distributed in a pattern configured to facilitate that an optimal moisture release is obtained.

[0026] The number of through holes may be sized and shaped so that the superabsorbent polymer grains being in dry state is retained and the number of through holes may be distributed in a pattern, where at most the minority of the opening area is covered by the superabsorbent polymer grains being in saturated state.

[0027] The through holes may be distributed on the container so that the optimal moisture release is secured

when the superabsorbent polymer grains are saturated. This may be accomplished by, that a minority of the opening area is covered by the superabsorbent polymer grains. The optimal moisture release is thereby secured by keeping as many through holes as free or open as possible, i.e. not covered by the superabsorbent polymer grains.

[0028] To accomplish this, the through holes may be distributed in a scattered pattern. The scattered pattern may be obtained by displacing every second row or column of through holes.

[0029] In one or more embodiments of the invention the through holes are distributed in a spiral pattern.

[0030] Two superabsorbent polymer grains in saturated state placed next to each other may meet in a mutual contact point or contact area and when being placed adjacent to the inside surface of the container may create two contact points or contact areas between each of the superabsorbent polymer grains and the container, so that the through holes are distributed in a pattern where the distances in between the through holes are different from the distance between said contact points or contact areas.

[0031] It will be understood that due to the softness of the saturated superabsorbent grains the contact points in this description will not be mathematical exact points but are circular areas which may cover or partly cover the opening area of a through hole if the opening area is near the contact point.

[0032] The optimal moisture release may also be secured by using a through hole geometry with one dimension larger than the contact area between the inside surface of the container and the saturated superabsorbent polymer grains.

[0033] The through holes may have a minor dimension so that the superabsorbent polymer grains being in dry state is retained and optionally a major dimension larger than the minor dimension.

[0034] In one or more embodiments of the invention the number of through holes has the minor dimension being smaller than 0.5 mm, 1.0 mm or 1.5 mm to facilitate that the superabsorbent polymer grains being in dry state is retained.

[0035] In one or more embodiment of the invention the minor dimension is a diameter of a circle, a minor axis in an oval or a width in a rectangle.

[0036] In one or more embodiments of the invention the through holes have the minor dimension so that the superabsorbent polymer grains being in dry state is retained and a major dimension being at least 20% of the diameter of the superabsorbent polymer grains being in saturated state.

[0037] Alternatively the major dimension may be at least 30% of the diameter of the superabsorbent polymer grains being in saturated state

[0038] The major dimension may be the major axis in an oval or the length in a rectangle.

[0039] In one or more embodiments of the invention

the container is a cylindrical container.

[0040] The cylindrical container may be configured for being used in the tubular packaging and placed through one of the first and/or second openings. The cylindrical container may be placed in the tubular packaging through the second opening revealing the outer skirt of the feathers of the shuttlecock closest to the second opening. When the cylindrical container is placed through the second opening, the cylindrical container may be sized and shaped so that at least one end of the cylindrical container may rest against the one or more support means of the shuttlecock. This is an advantage as the support means binding the feathers together is a significantly robust part of the shuttlecock. The cylindrical container may have rounded edges in at least one end of the cylindrical container, so that there are no sharp edges damaging the feathers of the shuttlecock. Preferably the cylindrical container may have rounded edges in both ends of the cylindrical container, so that the cylindrical container may be placed with either of the ends resting against the internal surface of a shuttlecock without damaging the shuttlecock.

[0041] The cylindrical container may have a size suitable for being contained in a tubular packaging full of shuttlecocks.

[0042] In one or more embodiments of the invention the cylindrical container have a diameter in between 25 mm and 40 mm, preferably between 30 mm and 35 mm. The cylindrical container may have a length in between 35 mm and 50 mm, preferable between 40 mm and 45 mm.

[0043] In one or more embodiments of the invention the container is a conical container, including a conical frustum container. The conical container may have a top end and a bottom end wherein the top end has a smaller radius than the bottom end. A top end surface, i.e. conical surface, or top end edge or bottom end edge is sized and shaped so that the top and/or bottom end is configured for resting and sliding against the one or more support means of the shuttlecock. The top end may include the top end edge or a top end tip. The top end edge or the top end tip and/or the bottom end edge may be rounded to avoid that a pointy tip or any sharp edges should damage the feathers of the shuttlecock.

[0044] The conical container may have a size suitable for being contained in a tubular packaging full of shuttlecocks.

[0045] Alternatively, the top end edge or the rounded top end tip and/or the bottom end edge of the conical container may have a diameter in between 25 mm and 40 mm, preferably between 30 mm and 35 mm. The conical container may have a length in between 35 mm and 50 mm, preferable between 40 mm and 45 mm.

[0046] In one or more embodiments of the invention the moistening device keeps the relative humidity of the closed space within 50%RH to 90%RH, preferably within 60%RH to 80%RH.

[0047] The relative humidity of the closed space may

more or less constantly be kept in between 60%RH and 80%RH (relative humidity) so that the moisture content of the one or more shuttlecocks is maintained or even restored without the risk of getting condensed water on the inside surface of the closed space, i.e. on the inside surface of the tubular packaging, and so mould and/or fungus will not begin growing on the shuttlecocks.

[0048] Furthermore is disclosed a kit comprising a moistening device as described above and a hygrometer.

[0049] The hygrometer may be arranged so that the hygrometer may measure the relative humidity within the closed space and so that the measured relative humidity may be visible without opening the tubular packaging enclosing the closed space.

[0050] The hygrometer may be mounted in one of the lids for closing the first and/or second opening in a tubular packaging.

[0051] The hygrometer may allow the user of the moistening device to know when the the superabsorbent polymer grains is about to dry out and has to be regenerated, i.e. hydrated, or replaced.

[0052] In a second embodiment of a moistening device for controlling the relative humidity within a closed space suitable for storing shuttlecocks, the moistening device comprising a container for containing a number of superabsorbent polymer grains, wherein the container is provided with a number of through holes constituting an opening area for releasing moisture from within the container to the closed space, the number of through holes being sized and shaped so that the superabsorbent polymer grains being in a dry state is retained and the number of through holes being distributed in a pattern, where at most the minority of the opening area is covered by the superabsorbent polymer grains being in saturated state.

[0053] The closed space may preferably be an approximately airtight closed space. The closed space may be a transportable closed space which easily may be transported by one or two persons. The closed space may be enclosed by any box suitable for storing multiple shuttlecocks. The box may be a squared box. The box may have at least one opening closable by a lid. Dependent on the volume of the closed space, there may be arranged more than one moistening device within the closed space, such as two moistening devices.

[0054] The superabsorbent polymer grains used in the container according to the second embodiment may be the superabsorbent polymer grains described for use in the container according to the invention.

[0055] The superabsorbent polymer grains may easily be regenerated by submerging the superabsorbent polymer grains or the container containing the superabsorbent polymer grains in water. The size of the through holes and the number of through holes in the container may be sufficient for regeneration of the superabsorbent polymer grains. Both distil water and tap water may be used although the water retention ability will be reduced by using water containing dissolved matter. As the superabsorb-

ent polymer grains do not contain any essential water soluble components no leaching risk exist by using a surplus of water. Excess water can be left to drip off.

[0056] The size of the through holes and the number of through holes may be sufficient for rinsing out any dirt from within the container.

[0057] The container may be configured for containing superabsorbent polymer grains which in dry state have a diameter between 0.5 mm and 5 mm, preferably between 1 mm and 3.5 mm, more preferable between 1.5 mm and 2.5 mm, even more preferable between 2 mm and 2.5 mm.

[0058] The container may be configured for containing superabsorbent polymer grains which in saturated state have a diameter between 3 mm and 33.5 mm, preferably between 6.5 mm and 23 mm, more preferable between 10 mm and 17 mm, even more preferable between 15 mm and 17 mm.

[0059] The container for containing superabsorbent polymer grains may be a sealed and easily replaceable container suitable for being placed in the closed space for storing one or more shuttlecocks. As the superabsorbent polymer grains dries out and the moistening ability of the container becomes insufficient, the container may easily be removed from within the closed space and replaced by a container having superabsorbent polymer grains in saturated state.

[0060] Alternatively the container may be a removable and openable container where dried out superabsorbent polymer grains easily may be replaced with new superabsorbent polymer grains in saturated state.

[0061] Alternatively the container may be a built in and openable container where the superabsorbent polymer grains are removed from the container when the superabsorbent polymer grains are dried out and replaced by new saturated superabsorbent polymer grains. The built in container may be part of the box suitable for storing shuttlecocks.

[0062] The container may have any form suitable for containing superabsorbent polymer grains in dry and saturated state. The container may be cylindrical, squared, rectangular, triangular, polyhedral, tubular, conical, ovoidal and the like.

[0063] Moisture from the superabsorbent polymer grains is released within the container to the closed space through the number of through holes. The through holes may have any suitable shape, such as circular, rectangular, oval, squared, triangular, or the like. The through holes in the container may be sized and shaped so that the through holes are smaller than the particle size of the superabsorbent polymer grains, i.e. the superabsorbent polymer grains in dry state. If the superabsorbent polymer grains in dry state have a diameter of approximately 1.5 mm or between 1.5 mm to 2.5 mm, the through holes may, if circular, have a diameter of 1 mm, or if rectangular, have a wideness of 1 mm, or if being oval, have a minor axis of 1 mm. The through holes may have the same surface area on the inside surface and the outside sur-

face of the container or the through holes may have a larger surface area on the outside surface of the container, i.e. the surface of the container facing away from the superabsorbent polymer grains.

[0064] Together constitutes the through holes the opening area, wherein the opening area is the sum of all the through holes opening areas on the inside surface of the container. The opening area is the total area from where moisture from inside the container may be released to the closed space.

[0065] The through holes may be distributed on the container so that the optimal moisture release is secured when the superabsorbent polymer grains are saturated. This may be accomplished by, that a minority of the opening area is covered by the superabsorbent polymer grains. The optimal moisture release is thereby secured by keeping as many through holes as free or open as possible, i.e. not covered by the superabsorbent polymer grains.

[0066] The through holes may to accomplish this be distributed in a scattered pattern. The scattered pattern may be obtained by displacing every second row or column of through holes.

[0067] The through holes may for example be distributed in a spiral pattern

[0068] Two superabsorbent polymer grains in saturated state placed next to each other may meet in a mutual contact point or contact area and when being placed adjacent to the inside surface of the container creating two contact points or contact areas between each of the superabsorbent polymer grains and the container, so that the through holes are distributed in a pattern where the distances in between the through holes are different from the distance between said contact points or contact areas.

[0069] It will be understood that due to the softness of the saturated superabsorbent grains the contact points in this description will not be mathematical exact points but are circular areas which may cover or partly cover the opening area of a through hole if the opening area is near the contact point.

[0070] The optimal moisture release may also be secured by using a through hole geometry with one dimension larger than the contact area between the inside surface of the container and the saturated superabsorbent polymer grains.

[0071] The through holes may have a minor dimension so that the superabsorbent polymer grains being in dry state is retained and a major dimension larger than the minor dimension. The minor dimension may be the minor axis in an oval or the width in a rectangle. The major dimension may be a major axis in an oval or the length in a rectangle.

[0072] The through holes may have the minor dimension so that the superabsorbent polymer grains being in dry state is retained and the major dimension may be at least 20% of the diameter of the superabsorbent polymer grains being in saturated state. Alternatively the major

dimension may be at least 30% of the diameter of the superabsorbent polymer grains being in saturated state

[0073] The container may comprise a spacer for dividing the closed space into a number of compartments.

5 The container may hereby be configured for storing the superabsorbent polymer grains so that they will lie in one layer only independently of the orientation of the container. This may be an advantage as superabsorbent polymer grains having a size above 2 mm in saturated state and laying in more than one layer may compress fluid from the lower layer of superabsorbent polymer grains into the closed space. This may increase the risk of mould and fungus on the shuttlecocks being stored in the box.

10 **[0074]** The spacer may be in-molded or fixed to an inside surface of the container. Alternatively the spacer may be a separate part arranged in a non-fixed manner within the container.

15 **[0075]** The container may be a squared container. The squared container may preferably be a flat squared container having a length and wideness larger than the thickness. This may be particular advantages as a large surface area per volume is provided. Thereby may a more efficient moisture release be obtained with a minimum of superabsorbent polymer grains.

20 **[0076]** The squared container may cover parts of or the entire of one or more inside surfaces of the box wherein the squared container is placed. The inside surface may be the bottom of the box and/or on or more of the sides of the box.

25 **[0077]** Alternatively the squared container may have a thickness in between 10 mm and 30 mm, preferably between 15 mm and 25 mm. The inside thickness, i.e. the thickness of the closed space within the container may correspond to or be larger than the diameter of the superabsorbent polymer grains in saturated state. The inside thickness of the container may hereby allow for at least one layer of superabsorbent polymer grains in saturated state without deforming the superabsorbent polymer grains significantly. The inside thickness of the container may allow for one or two layers of superabsorbent polymer grains in saturated state without deforming the superabsorbent polymer grains significant. The two layers may preferably be separated by the spacer. The squared container may have a length in between 75 mm and 100 mm and wideness in between 25 mm 75 mm.

30 **[0078]** The moistening device may keep the relative humidity of the closed space within 50%RH to 90%RH, preferably within 60%RH to 80%RH.

35 **[0079]** The relative humidity of the closed space may more or less constantly be kept in between 60%RH and 80%RH (relative humidity) so that the moisture content of the one or more shuttlecocks is maintained or even restored without the risk of getting condensed water on the inside surface of the closed space, i.e. on the inside surface of the box, and so mould and/or fungus will not begin growing on the shuttlecocks.

40 **[0080]** A kit may comprise a moistening device according to the second embodiment and a hygrometer.

[0081] The hygrometer may be arranged so that the hygrometer may measure the relative humidity within the closed spaces and so that the measured relative humidity may be visible without opening the box enclosing the closed space.

[0082] The hygrometer may be mounted in the lid, in one of the side walls of the box or to the inside surface of a transparent box, e.g. a squared box or the like.

[0083] The hygrometer may allow the user of the moistening device to know when the the superabsorbent polymer grains is about to dry out and has to be regenerated, i.e. hydrated, or replaced.

[0084] The kit may further comprise a fastening device for temporarily fixating the moistening device within the closed space. The fastening device may be built in on or mountable to the inside surface of the box enclosing the closed space and suitable for storing shuttlecocks. The fastening device may be a snap fit fastening device.

[0085] Another kit may comprise the moistening device according to the second embodiment and the fastening device as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0086] An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, as follows;

Fig. 1 schematically shows an embodiment of a moistening device according to the invention arranged in a closed space together with a number of shuttlecocks;

Fig. 2a schematically shows a cross sectional view of a moistening device similar to the moistening device in Fig. 1 containing dry superabsorbent polymer grains;

Fig. 2b schematically shows a cross sectional view of a moistening device similar to the moistening device in Fig. 1 containing saturated superabsorbent polymer grains;

Fig. 3 schematically shows a moistening device similar to the moistening device in Fig. 1 and 2a-b having through holes distributed in a scattered pattern;

Fig. 4 schematically shows a moistening device similar to the moistening device in Fig. 1 to 3, and

Fig. 5 schematically shows a second embodiment of a moistening device arranged in a closed space together with a number of shuttlecocks;

Fig. 6 schematically shows a top view of a moistening device similar to the moistening device in Fig. 5;

Fig. 7a schematically shows a cross sectional view

of a moistening device similar to the moistening device in Fig. 5 and 6 containing saturated superabsorbent polymer grains;

Fig. 7b schematically shows a cross sectional view of a moistening device similar to the moistening device in Fig. 5 and 6 containing saturated superabsorbent polymer grains;

Fig. 8 schematically shows a cross sectional view of a moistening device similar to the moistening device in Fig. 5 to 7a-b containing dry superabsorbent polymer grains;

Fig. 9 schematically shows a graph of test results of the relative humidity within a closed space when using a moistening device according to the invention and when using a moistening device according to the second embodiment.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0087] Fig. 1 schematically shows an embodiment of a moistening device 1 according to the invention. The moistening device is arranged in a closed space 30 together with a number of shuttlecocks 20. The moistening device 1 comprises a container 2 suitable for containing superabsorbent polymer grains 4. In the presently illustrated embodiment and as shown on Fig. 3, the container is a cylindrical container which may have rounded edges 7 at each end of the cylindrical container. The cylindrical container may have a diameter of 35 mm and be 45 mm long.

[0088] As shown on Fig. 2a-b to 4 the container is provided with a number of through holes 3 for releasing moisture from within the container to the closed space 30. As shown in Fig. 2a, the through holes 3 is sized and shaped so that the superabsorbent polymer grains being in a dried state 4" are retained. And as shown in Fig. 2b and 3, the through holes are distributed in a pattern, where at most the minority of the opening area is covered by the superabsorbent polymer grains being in a saturated state 4'. In the presently illustrated embodiment the superabsorbent polymer grains 4 may be between 1.5 mm and 2 mm in dry state and between 10 mm and 12 mm in saturated state. The through holes may therefore have a diameter of 1 mm.

[0089] As shown in Fig. 3, the container 2 may comprise a container body 5 and a container lid 6 so that the superabsorbent polymer grains within the container may be replaced by new saturated superabsorbent polymer grains when dried out.

[0090] The closed space 30 is in the presently illustrated embodiment a tubular packaging 31 wherein the tubular packaging has two openings, one opening in each end of the tubular packaging. Each opening is closable by a lid 33. The openings may preferably be approximately hermetic closed by the lids. The lids may easily

be removed from the openings in order to give easy access to the shuttlescocks 20 and/or the moistening device 1 in the tubular packaging. The tubular packaging 31 may be the tubular packaging the shuttlescocks were sold in.

[0091] A hygrometer 40 may be placed or mounted in the tubular packaging 31 so that the hygrometer can measure the relative humidity of the air of the closed space 30 within the tubular packaging 31 and so that the value of the measured relative humidity is visible without opening the tubular packaging 31. In the presently illustrated embodiment, the hygrometer is mountable in the lid 33 of the tubular packaging 31. The lid may be one of the lids sold with the tubular packaging 31 or an additional lid with a pre-mounted hygrometer sold separately from the tubular packaging 31 and/or together with the moistening device 1.

[0092] Fig. 4 schematically shows how the moistening device 1 according to the invention lean and may slide against the support means 23 attached to the feathers 22 of the shuttlecock 20 closest to the opening the moistening device is placed through. The moistening device 1 may slide against an inner surface of the one or more support means 23 when the orientation of the moistening device 1 is shifted relatively to a center axis 32 of the tubular packaging 31. Fig. 4 likewise shows how the rounded edge 7 at the end of the container 2 assures that the feathers of the shuttlecock 20 are not damaged during e.g. transportation of the tubular packaging 31.

[0093] The weight of the moistening device 1 may also be used to urge the shuttlecocks 20 within the tubular packaging 31 towards the end of the tubular packaging the caps 21 of the shuttlecocks points towards.

[0094] Fig. 2b schematically shows how two superabsorbent polymer grains in saturated state 4' placed next to each other meets in a mutual contact point 51 and how the two superabsorbent polymer grains when placed adjacent to the inside surface of the container 2 creates two contact points 52, 53 between each of the superabsorbent polymer grains and the container. The through holes may preferably be distributed in a pattern where the distances in between the through holes are different from the distance between the two contact points 52, 53.

[0095] Fig. 5 schematically shows a graph of test results of the relative humidity within a closed space 30 when using the moistening device 1 according to the invention and the moistening device 1 according to the second embodiment containing superabsorbent polymer grains 4, see Fig. 1 and 5. Tests has shown that by using superabsorbent polymer grains, retained in one or more containers placed within a closed space, the relative humidity of the air within the closed space is more or less constantly kept in between 60%RH and 80%RH so that the moisture content of the one or more shuttlecocks is maintained or even restored. This is obtained without the risk of getting condensed water on the inside surface of the closed space, i.e. on the inside surface of the tubular packaging 31, so that the shuttlecocks will not be exposed to mould and fungus. Superabsorbent polymer

grains therefore seem to have an analogous behaviour to the known behaviour of saturated solutions of salts in water used to maintain a particular value of relative humidity inside a container where a constant relative humidity below 100% is obtained. The test was conducted at approximately 19°C to 22°C.

[0096] As an alternative the moistening device according to the second embodiment may be placed in a stationary cabinet used for storing shuttlecocks.

Claims

1. A moistening device (1) for controlling the relative humidity within a closed space (30) suitable for storing shuttlecocks (20) with feathers (22) and support means (23), the closed space (30) being defined by a tubular packaging (31), the moistening device (1) comprising a container (2) containing a number of superabsorbent polymer grains (4), the container (2) being provided with a number of through holes (3) constituting an opening area for releasing moisture from within the container (2) to the closed space (30), **characterised in that** the container (2) is configured for being stored in a non-fixed manner within the tubular packaging (31) and sized and shaped to be slidable within the contour of a shuttlecock (20) to bump against a support means (23), an outer edge or surface of the container (2) is a rounded edge (7) or surface configured to slide against said support means (23).
2. The moistening device according to claim 1, wherein the container (2) is a cylindrical container.
3. The moistening device according to claim 2, wherein the cylindrical container has a diameter in between 25 mm and 40 mm, preferably between 30 mm and 35 mm and a length in between 35 mm and 50 mm, preferable between 40 mm and 45 mm.
4. The moistening device according to claim 1, wherein the container (2) is a conical container.
5. The moistening device according to any one or more of the preceding claims, wherein the container (2) comprises a container body (5) and a container lid (6).
6. The moistening device according to any one or more of the preceding claims, wherein the number of through holes (3) has a minor dimension being smaller than 0.5 mm, 1.0 mm or 1.5 mm to facilitate that the superabsorbent polymer grains being in a dry state (4") is retained.
7. The moistening device according to claim 6, wherein the minor dimension is a diameter of a circle, a minor

axis in an oval or a width in a rectangle.

8. The moistening device according to any one or more of the preceding claims, wherein the number of through holes (3) are distributed in a pattern configured to facilitate that an optimal moisture release is obtained. 5
9. The moistening device according to any one or more of the preceding claims, wherein the container (2) is configured for containing superabsorbent polymer grains which in dry state (4") have a diameter between 0.5 mm and 5 mm, preferably between 1 mm and 3.5 mm, more preferable between 1.5 mm and 2.5 mm, even more preferable between 1.5 mm and 2 mm. 10
10. The moistening device according to any one or more of the preceding claims, wherein the container (2) is configured for containing superabsorbent polymer grains which in saturated state (4') have a diameter between 3 mm and 33.5 mm, preferably between 6.5 mm and 23 mm, more preferable between 10 mm and 17 mm, even more preferable between 10 mm and 12 mm. 15
11. The moistening device according to any one or more of the preceding claims, wherein through holes (3) are distributed in a spiral pattern. 20
12. The moistening device according to any one or more of the preceding claims, wherein the moistening device (1) keeps the relative humidity of the closed space (30) within 50%RH to 90%RH. 25
13. Use of superabsorbent polymer grains **characterised in that**, the superabsorbent polymer grains (4) are retained in a container (2) according one or more of claims 1 to 12 30
14. A kit comprising a moistening device (1) according to one or more of claims 1 to 12 and a hygrometer (40). 35
15. A moistening system comprising a tubular packaging (31) for storing shuttlecocks (20) and a moistening device (1) placed within the tubular packaging (31), the moistening device (1) comprising a container (2) containing a number of superabsorbent polymer grains (4), the container (2) being provided with a number of through holes (3) constituting an opening area for releasing moisture from within the container (2) to the closed space (30), **characterised in that** the container (2) is configured for being stored in a non-fixed manner within the tubular packaging (31) and sized and shaped to be slidable within the contour of a shuttlecock (20) to bump against a support means (23), an outer edge or surface of the container 40

(2) is a rounded edge (7) or surface configured to slide against said support means (23).

16. Method of controlling relative humidity within a closed space (30) for storing shuttlecocks (20), the closed space (30) being defined by a tubular packaging (31) having a first and a second opening, the method is performed by placing through the opening revealing an outer skirt of feathers (22) of the shuttlecocks (20) a moistening device (1) according to one or more of the claims 1 - 14 in non-fixed manner in the closed space for releasing moisture from the moistening device (1) to the closed space (30) controlling the moisture content of one or more shuttlecocks (20). 45

Patentansprüche

1. Befeuchtungsvorrichtung (1) zur Steuerung der relativen Luftfeuchtigkeit in einem geschlossenen Raum (30), der zur Lagerung von Federbällen (20) mit Federn (22) und Stützmitteln (23) geeignet ist, wobei der geschlossene Raum (30) durch eine rohrförmige Verpackung (31) definiert ist, wobei die Befeuchtungsvorrichtung (1) einen Behälter (2) mit einer Anzahl von superabsorbierenden Polymerkörnern (4) umfasst, wobei der Behälter (2) mit einer Anzahl von Durchgangslöchern (3) versehen ist, die einen Öffnungsbereich zur Freigabe von Feuchtigkeit aus dem Behälter (2) in den geschlossenen Raum (30) bilden, **dadurch gekennzeichnet, dass** der Behälter (2) so ausgebildet ist, dass er auf eine nicht fixierte Weise innerhalb der rohrförmigen Verpackung (31) gelagert werden kann, und so bemessen und geformt ist, dass er innerhalb der Kontur eines Federballs (20) verschiebbar ist, um gegen ein Stützmittel (23) zu stoßen, wobei eine Außenkante oder Fläche des Behälters (2) eine abgerundete Kante (7) oder Fläche ist, die dazu ausgelegt ist, gegen das Stützmittel (23) zu gleiten. 50
2. Befeuchtungsvorrichtung nach Anspruch 1, wobei der Behälter (2) ein zylindrischer Behälter ist. 55
3. Befeuchtungsvorrichtung nach Anspruch 2, wobei der zylindrische Behälter einen Durchmesser zwischen 25 mm und 40 mm, vorzugsweise zwischen 30 mm und 35 mm und eine Länge zwischen 35 mm und 50 mm, bevorzugt zwischen 40 mm und 45 mm, aufweist.
4. Befeuchtungsvorrichtung nach Anspruch 1, wobei der Behälter (2) ein konischer Behälter ist.
5. Befeuchtungsvorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei der Behälter (2) einen Behälterkörper (5) und einen Behäl-

terdeckel (6) umfasst.

6. Befeuchtungsvorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Anzahl von Durchgangslöchern (3) eine kleinere Abmessung aufweist, die kleiner als 0,5 mm, 1,0 mm oder 1,5 mm ist, um zu ermöglichen, dass die superabsorbierenden Polymerkörner in einem trockenen Zustand (4'') gehalten werden.
7. Befeuchtungsvorrichtung nach Anspruch 6, wobei die Nebenabmessung ein Durchmesser eines Kreises, eine Nebenachse in einem Oval oder eine Breite in einem Rechteck ist.
8. Befeuchtungsvorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Anzahl von Durchgangslöchern (3) in einem Muster verteilt ist, das ausgelegt ist, um zu ermöglichen, dass eine optimale Feuchtigkeitsfreigabe erzielt wird.
9. Befeuchtungsvorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei der Behälter (2) zum Enthalten von superabsorbierenden Polymerkörnern ausgelegt ist, die im trockenen Zustand (4'') einen Durchmesser zwischen 0,5 mm und 5 mm, vorzugsweise zwischen 1 mm und 3,5 mm, besonders bevorzugt zwischen 1,5 mm und 2,5 mm, noch bevorzugt zwischen 1,5 mm und 2 mm, aufweisen.
10. Befeuchtungsvorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei der Behälter (2) zum Enthalten von superabsorbierenden Polymerkörnern ausgelegt ist, die im gesättigten Zustand (4') einen Durchmesser zwischen 3 mm und 33,5 mm, bevorzugt zwischen 6,5 mm und 23 mm, mehr bevorzugt zwischen 10 mm und 17 mm, noch mehr bevorzugt zwischen 10 mm und 12 mm, aufweisen.
11. Befeuchtungsvorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei Durchgangslöcher (3) in einem Spiralmuster verteilt sind.
12. Befeuchtungsvorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Befeuchtungsvorrichtung (1) die relative Feuchtigkeit des geschlossenen Raums (30) innerhalb von 50 % RH bis 90 % RH hält.
13. Verwendung von superabsorbierenden Polymerkörnern, **dadurch gekennzeichnet, dass** die superabsorbierenden Polymerkörner (4) in einem Behälter (2) nach einem oder mehreren der Ansprüche 1 bis 12 gehalten werden.

14. Kit umfassend eine Befeuchtungsvorrichtung (1) nach einem oder mehreren der Ansprüche 1 bis 12 und ein Hygrometer (40).

15. Befeuchtungssystem umfassend eine rohrförmige Verpackung (31) zur Lagerung von Federbällen (20) und eine innerhalb der rohrförmigen Verpackung (31) angeordnete Befeuchtungsvorrichtung (1), wobei die Befeuchtungsvorrichtung (1) einen Behälter (2) umfasst, der eine Anzahl von superabsorbierenden Polymerkörnern (4) enthält, wobei der Behälter (2) mit einer Anzahl von Durchgangslöchern (3) versehen ist, die einen Öffnungsbereich zur Freigabe von Feuchtigkeit aus dem Behälter (2) in den geschlossenen Raum (30) bilden, **dadurch gekennzeichnet, dass** der Behälter (2) so ausgelegt ist, dass er auf eine nicht fixierte Weise innerhalb der rohrförmigen Verpackung (31) gelagert werden kann, und so bemessen und geformt ist, dass er innerhalb der Kontur eines Federballs (20) verschiebbar ist, um gegen ein Stützmittel (23) zu stoßen, wobei eine Außenkante oder Fläche des Behälters (2) eine abgerundete Kante (7) oder Fläche ist, die dazu ausgelegt ist, gegen das Stützmittel (23) zu gleiten.
16. Verfahren zur Steuerung der relativen Luftfeuchtigkeit innerhalb eines geschlossenen Raumes (30) zur Lagerung von Federbällen (20), wobei der geschlossene Raum (30) durch eine rohrförmige Verpackung (31) mit einer ersten und einer zweiten Öffnung definiert ist, wobei das Verfahren dadurch ausgeführt wird, dass eine Befeuchtungsvorrichtung (1) nach einem oder mehreren der Ansprüche 1 bis 14 durch die Öffnung, welche eine äußere Schürze aus Federn (22) der Federbälle (20) enthüllt, zur Freigabe von Feuchtigkeit aus der Befeuchtungsvorrichtung (1) in den geschlossenen Raum (30), der den Feuchtigkeitsgehalt eines oder mehrerer Federbälle (20) steuert, auf eine nicht fixierte Weise in dem geschlossenen Raum angeordnet wird.

Revendications

1. Dispositif d'humidification (1) pour réguler l'humidité relative dans un espace clos (30) approprié pour stocker des volants (20) avec des plumes (22) et des moyens de support (23), l'espace clos (30) étant défini par un emballage tubulaire (31), le dispositif d'humidification (1) comprenant un récipient (2) configuré pour contenir un certain nombre de grains de polymère super absorbant (4), le récipient (2) étant pourvu d'un certain nombre de trous traversant (3) constituant une zone d'ouverture pour libérer de l'humidité depuis l'intérieur du récipient (2) à l'espace clos (30), **caractérisé en ce que** le récipient (2) est configuré pour être stocké de manière non fixe dans l'emballage tubulaire (31) et dimensionné et conçu

- pour pouvoir glisser dans le contour d'un volant (20) pour heurter contre un moyen de support (23), un bord extérieur ou une surface du récipient (2) est un bord arrondi (7) ou une surface configurée pour glisser contre le moyen de support (23).
2. Dispositif d'humidification selon la revendication 1, dans lequel le récipient (2) est un récipient cylindrique.
 3. Dispositif d'humidification selon la revendication 2, dans lequel le récipient cylindrique présente un diamètre compris entre 25 mm et 40 mm, de préférence entre 30 mm et 35 mm, et une longueur comprise entre 35 mm et 50 mm, de préférence entre 40 mm et 45 mm.
 4. Dispositif d'humidification selon la revendication 1, dans lequel le récipient (2) est un récipient conique.
 5. Dispositif d'humidification selon l'une quelconque ou plusieurs des revendications précédentes, dans lequel le récipient (2) comprend un corps de récipient (5) et un couvercle de récipient (6).
 6. Dispositif d'humidification selon l'une quelconque ou plusieurs des revendications précédentes, dans lequel le nombre de trous traversant (3) présente une petite dimension étant inférieure à 0,5 mm, 1,0 mm ou 1,5 mm pour faciliter la rétention des grains de polymère super absorbant à l'état sec (4").
 7. Dispositif d'humidification selon la revendication 6, dans lequel la petite dimension est un diamètre d'un cercle, un petit axe dans un ovale ou une largeur dans un rectangle.
 8. Dispositif d'humidification selon l'une quelconque ou plusieurs des revendications précédentes, dans lequel le nombre de trous traversant (3) est distribué selon un motif configuré pour faciliter l'obtention d'une libération d'humidité optimale.
 9. Dispositif d'humidification selon l'une quelconque ou plusieurs des revendications précédentes, dans lequel le récipient (2) est configuré pour contenir des grains de polymère super absorbant qui, à l'état sec (4"), ont un diamètre compris entre 0,5 mm et 5 mm, de préférence entre 1 mm et 3,5 mm, plus préférablement entre 1,5 mm et 2,5 mm, encore plus préférable entre 1,5 mm et 2 mm.
 10. Dispositif d'humidification selon l'une quelconque ou plusieurs des revendications précédentes, dans lequel le récipient (2) est configuré pour contenir des grains de polymère super absorbant qui, à l'état saturé (4), ont un diamètre compris entre 3 mm et 33,5 mm, de préférence entre 6,5 mm et 23 mm, plus
- préférablement entre 10 mm et 17 mm, encore plus préférable entre 10 mm et 12 mm.
11. Dispositif d'humidification selon l'une quelconque ou plusieurs des revendications précédentes, dans lequel les trous traversants (3) sont répartis en un motif en spirale.
 12. Dispositif d'humidification selon l'une quelconque ou plusieurs des revendications précédentes, dans lequel le dispositif d'humidification (1) maintient l'humidité relative de l'espace clos (30) dans une plage d'humidité relative de 50% à 90%.
 13. Utilisation de grains de polymère super absorbant, **caractérisée en ce que** les grains de polymère super absorbant (4) sont retenus dans un récipient (2) selon une ou plusieurs des revendications 1 à 12
 14. Kit comprenant un dispositif d'humidification (1) selon une ou plusieurs des revendications 1 à 12 et un hygromètre (40).
 15. Système d'humidification comprenant un emballage tubulaire (31) pour stocker des volants (20) et un dispositif d'humidification (1) arrangé dans l'emballage tubulaire (31), le dispositif d'humidification (1) comprenant un récipient (2) contenant un certain nombre de grains de polymère super absorbant (4), le récipient (2) étant pourvu d'un certain nombre de trous traversant (3) constituant une zone d'ouverture pour libérer de l'humidité de l'intérieur du récipient (2) à l'espace clos (30), **caractérisé en ce que** le récipient (2) est configuré pour être stocké de manière non fixe dans l'emballage tubulaire (31) et dimensionné et conçu pour pouvoir glisser dans le contour d'un volant (20) pour heurter contre un moyen de support (23), un bord extérieur ou une surface du récipient (2) est un bord arrondi (7) ou une surface configurée pour glisser contre ledit moyen de support (23).
 16. Procédé destiné à réguler l'humidité relative dans un espace clos (30) pour stocker des volants (20), l'espace clos (30) étant défini par un emballage tubulaire (31) ayant une première et une deuxième ouverture, le procédé étant effectué par le positionnement à travers l'ouverture révélant une jupe extérieurs de plumes (22) des volants (20) d'un dispositif d'humidification (1) selon l'une ou plusieurs des revendications 1 à 14 de manière non fixe dans l'espace clos pour libérer de l'humidité depuis le dispositif d'humidification (1) à l'espace clos (30) régulant la teneur en humidité d'un ou plusieurs volants (20).

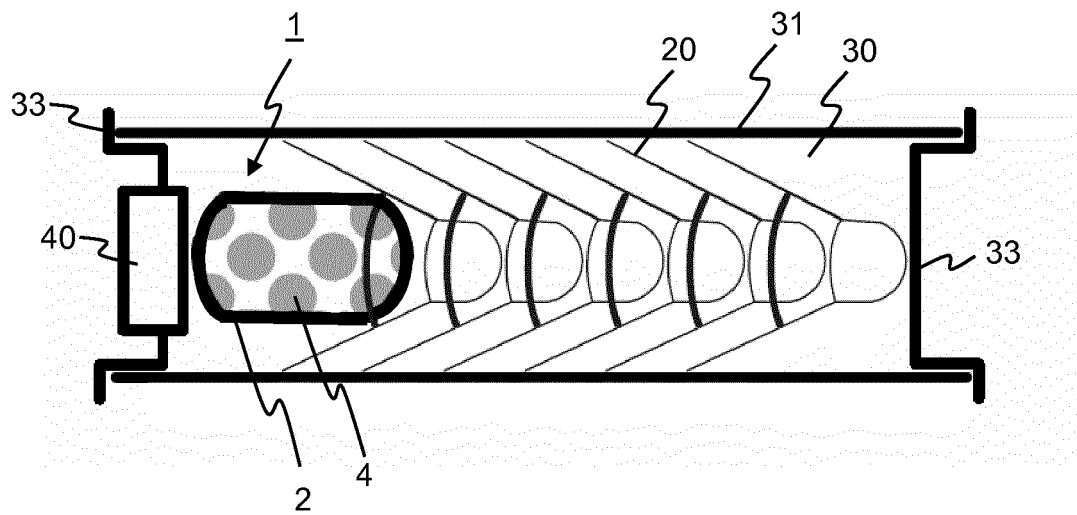


Fig. 1

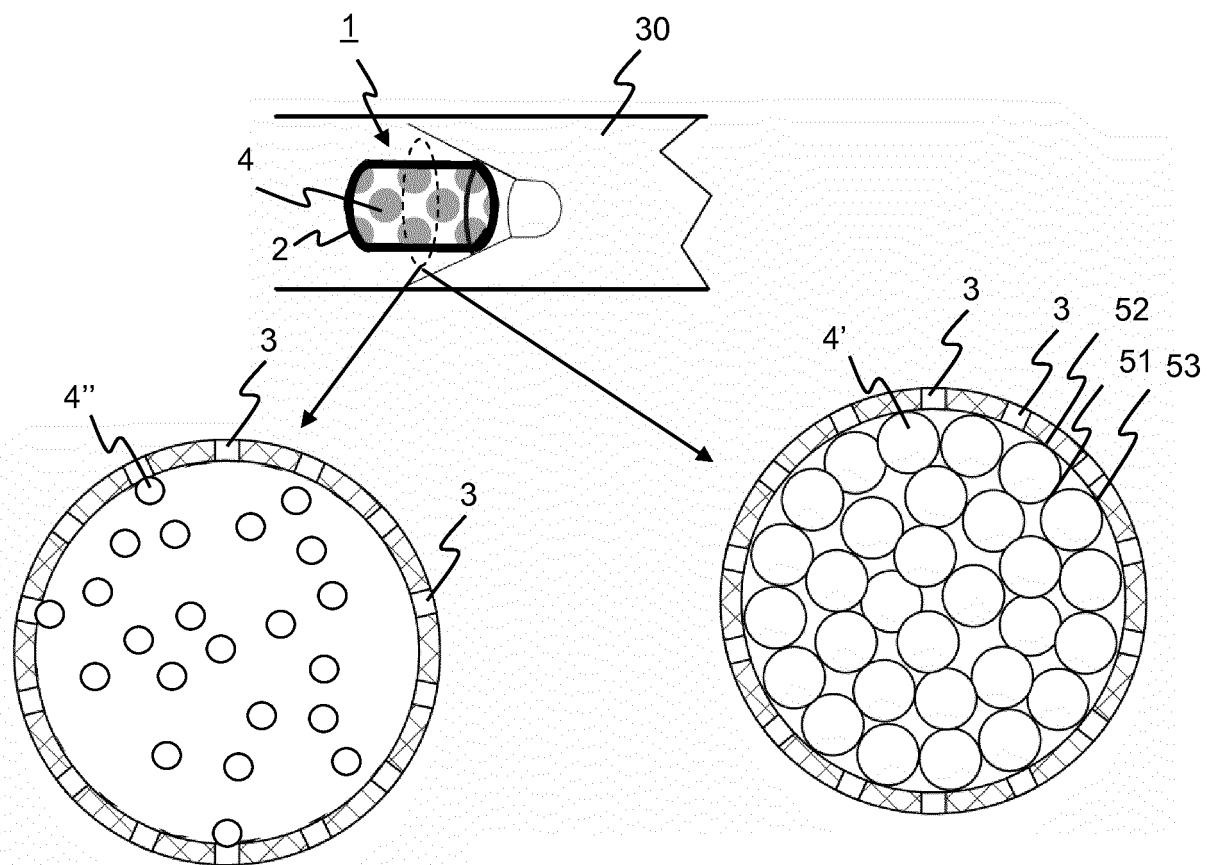


Fig. 2a

Fig. 2b

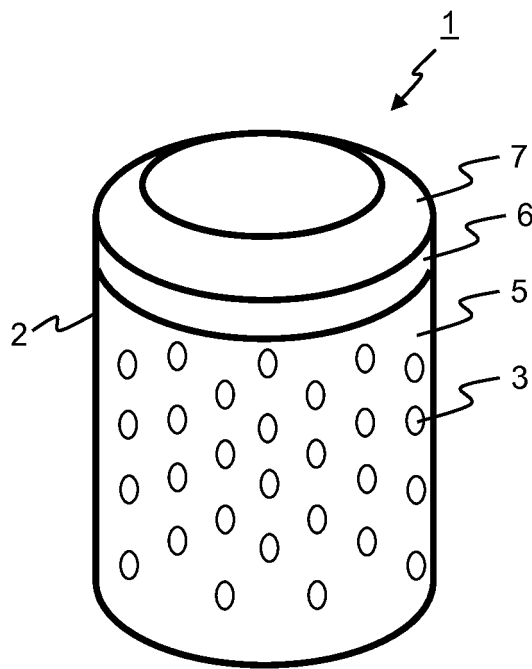


Fig. 3

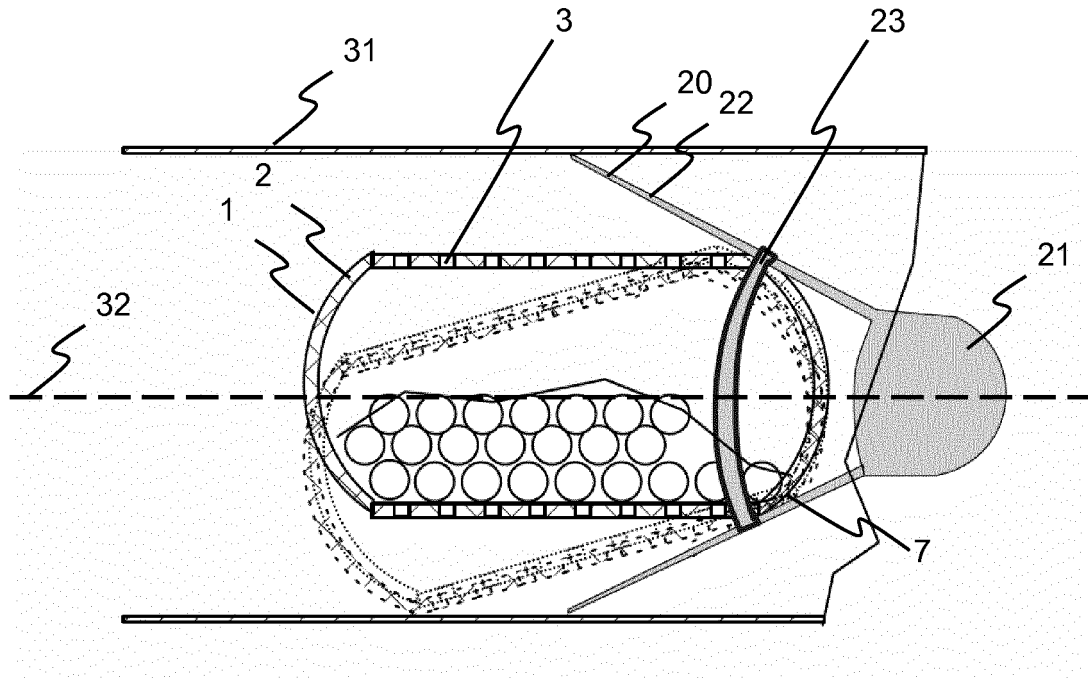


Fig. 4

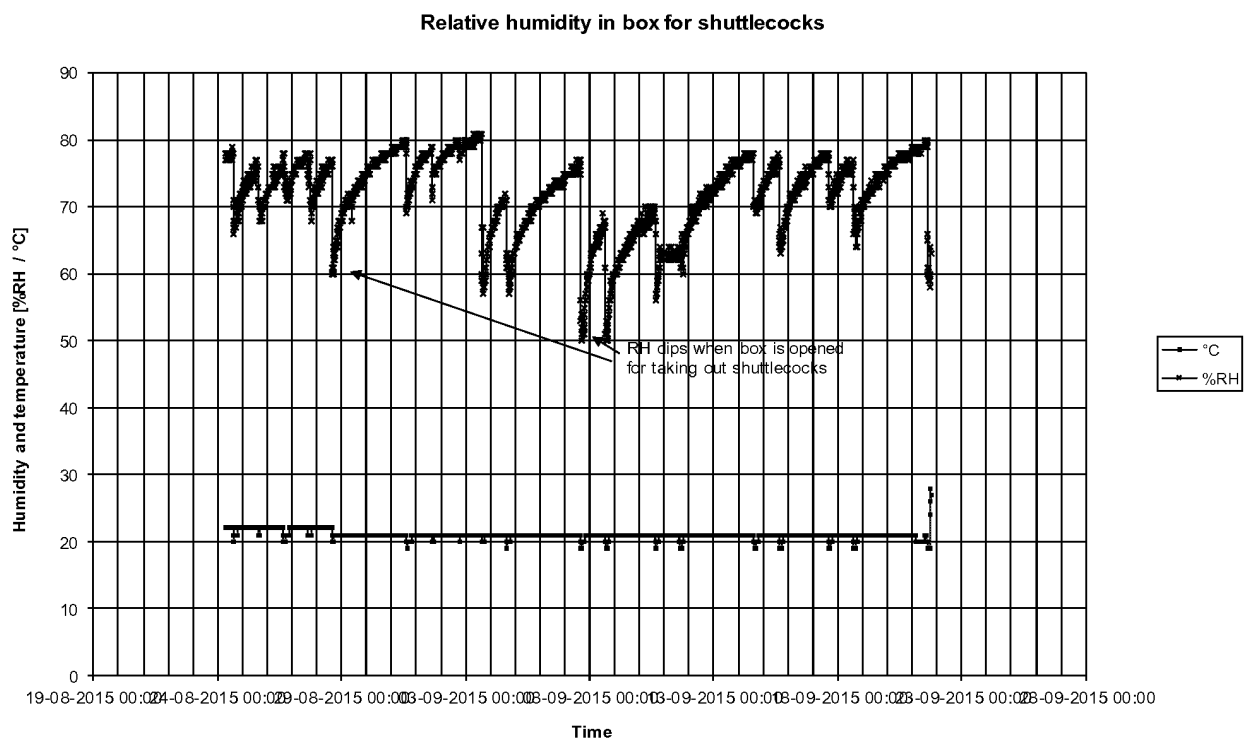


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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