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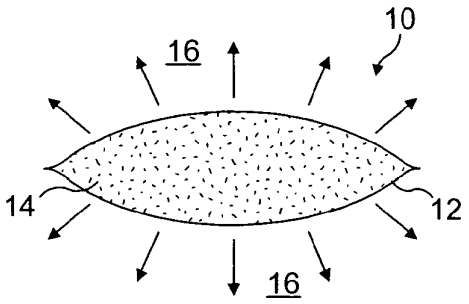


FIG. 1

(57) Abstract: A humidifier (10) for use with tobacco products comprises a closed capsule (12) fabricated at least partially from material comprising a thermo-mechanically expanded polymer membrane having micropores to render the material permeable to moisturising vapour such as water vapour, and a source of the moisturising vapour (14) encapsulated within the closed capsule. Vapour is then emitted to the surrounding environment through the closed capsule. The vapour source may be liquid water or may be water absorbed into a water- absorbing material inside the closed capsule. The capsule may have a shape intended to maximise its surface area for a given volume.

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HUMIDIFYING CAPSULE FOR USE WITH TOBACCO PRODUCTS

BACKGROUND OF THE INVENTION

The present invention relates to a humidifying capsule for use with tobacco products.

The tobacco in products such as cigarettes, cigars and loose tobacco for pipe smoking or roll-your-own cigarettes is prone to drying out both during the pre-use storage period and particularly after the product packaging has been opened. This is undesirable, since tobacco becomes less palatable as it dries.

Expensive cigars are generally stored in specially designed humidors specifically to address this problem by keeping the cigars at a desired level of humidity to prevent drying. A more rudimentary approach is often used by consumers of loose tobacco; a piece of apple or potato peel placed in the tobacco pouch or tin can help to keep the tobacco moist or can re-moisten tobacco that has become too dry. However, this method may not be considered hygienic, and may taint the tobacco with unwanted scents or flavours.

Various humidification devices and moisture dispensers have therefore been proposed for use with tobacco products, in particular for use in tobacco pouches and tins and cigarette packs. Typically, the devices comprise a source of moisture that can emit water vapour which is surrounded by a permeable enclosure such as a housing, casing, layer or pouch which keeps the moisture source separate from the tobacco but allows the water vapour to be transmitted to the tobacco. The moisture source is often some form of water-absorbent medium such as cotton wool, blotting paper, sponge, florists' foam, or polyacrylamide gel or crystals, which is soaked with water or salt solution. The permeable enclosure may be rigid or flexible, and may be made permeable by the provision of perforations or apertures therein, or may be an inherently permeable membrane material. Examples include: a plastics or metal case with a slotted front face (GB 2,265,295); a pouch of porous crepe rubber (GB 741,475); a cylindrical tube with pin-hole perforations (GB 567,141); a flat metal sheath with open sides for sandwiching a sheet of blotting paper (GB 308,127); a spunbonded web of polypropylene filaments (EP 348,840); a plastic tube with removable end caps (US 5,957,380); a mesh screen (US 5,957,277); a container made from propionate (US 5,829,452); spherical capsules made from polyethylene, amorphous organic resin and

wax and having microscopic pores (US 3,801,011); tissue paper and fine-meshed cloth (US 1,871,419); textile or non-woven material (WO 02/12089); a water-impermeable sleeve with ends closed by cotton wool (DE 20 2005 008 520); and a stainless steel mesh tube (DE 20 2005 010 286). Further example can be found in GB 2,345,431, GB 1,369,992, GB 119,489, EP 531,075, EP 363,194, US 1,874,989, DE 4000143, and FR 2,619,289. Some devices are incorporated into tobacco packages, while others are independent devices that can be inserted into a tobacco product container. Some devices include an outer non-permeable enclosure to prevent moisture loss before the device is used. For example, US 5,957,380 describes a plastic tube containing a porous material holding a humidification solution of glycol, water and saturated salt, the tube having end caps which are removed to let water vapour out when the device is placed in a cigar container. US 3,801,011 describes a humidity control device comprising a sheet-like carrier such as an adhesive tape which carries a layer of water-containing capsules having vapour-transmissive walls, and which is supplied in a sealed plastic bag.

Many of these examples are intended for re-use, in that the user is able to hydrate the water-absorbent medium before first use and many subsequent uses. Such devices are generally bulky and awkward, and comprise several parts to give the user access to the water-absorbent medium. Thus production of these devices can be complex and expensive. On the other hand, devices that are sealed and intended for only one use tend to be made from relatively delicate membrane materials which are at risk of puncture or bursting.

SUMMARY OF THE INVENTION

Accordingly, a first aspect of the present invention is directed to a humidifier for use with tobacco products comprising: a closed capsule fabricated at least partially from material comprising a thermo-mechanically expanded polymer membrane having micropores that render the material permeable to moisturising vapour; and a source of moisturising vapour encapsulated within the closed capsule.

This attractively simple structure, in part made possible by the use of thermo-mechanically expanded polymer membranes, allows a tobacco humidifier to be provided very easily. The membranes are porous microstructured materials that are permeable to water vapour and impermeable to liquid water and which are particularly well-adapted for use as a membrane

to encapsulate a source of moisturising vapour in a humidifier. Among their many useful properties is the ability to tailor the pore structure during manufacture, so that the rate at which vapour can be released is selectable. Also, they are tough and strong so a capsule made from these membranes are unlikely to become damaged and spill liquid over the tobacco products is the materials are inert, so do not interact with the tobacco. Further, they can be readily made into a wide range of capsule shapes and sizes.

The polymer may be polytetrafluoroethylene, polybutylene terephthalate, or polyethylene oxide, for example. Other polymers are not excluded, however.

The source of moisturising vapour may be a volume of liquid water or, alternatively, may be water absorbed in a water-absorbing medium contained within the closed capsule. This gives a large choice of humidifier compositions, which can be selected according to factors such as cost, ease of manufacture, and control over vapour release. Hence the design is very flexible. Liquid water will likely be the least expensive way of providing a source of moisturising vapour for vapour release. However, a variety of water-absorbing media offer alternatives, including the use of one or more of polyacrylamide granules, an alginate, microcrystalline cellulose, ispaghula husk, saturated silica gel, rice, a starch gel, a pectin, natural sponge, synthetic sponge, a sepeolite, bentonite or other clay material, gelatin, agar agar, and a modified cellulosic gum. Also, the moisture source need not be water; other liquids suitable for moisturising tobacco may also be used.

In some embodiments, the closed capsule may be wholly fabricated from the material comprising thermo-mechanically expanded polymer membrane. This minimises the component materials of the humidifier, and allows many shapes of capsule to be readily provided. For example, the capsule may have a corrugated or folded surface. Alternatively, the capsule may have a shape comprising a plurality of fingers radiating from a central core region. More generally, the capsule may have a shape intended to maximise its surface area for a given volume. The rate of vapour release depends on the area through which the vapour can escape the capsule, so a larger area for a given volume will decrease the time in which the available moisture can be released, giving a faster moisture rejuvenation for the tobacco.

In other embodiments, the capsule comprises a moulded plastic tray that is substantially impermeable to moisturising vapour, and a layer of material comprising a thermo-mechanically expanded polymer membrane sealed to the moulded plastic tray to close it. This configuration exploits the desirable properties of the membranes for vapour release while offering an alternative construction to bonding or stitching together several pieces of membrane material

The humidifier may further comprise one or more water-soluble flavorants, fragrances or additives dissolved in the encapsulated source of moisturising vapour. A smoker can thereby customise his tobacco by adding a fragrance or other characteristic of his choice in a very simple manner.

Also, the humidifier may further comprise a removable outer layer that is substantially impermeable to the passage of water vapour, the outer wrapper disposed over the material comprising a thermo-mechanically expanded polymer membrane and intended to be removed before use of the humidifier. This keeps the moisture inside the capsule until the humidifier is needed, so that the humidifier can be supplied as a separately packaged item for use at any required time with any tobacco product that needs moisturising.

The removable outer layer may completely enclose the closed capsule, for example as a bag, envelope or sachet inside which the capsule is sealed.

Optionally, the humidifier may further comprise a visual humidity indicator on an exterior surface of the removable outer layer. If the humidifier is kept with the tobacco product, the smoker can use the indicator to determine when a release of moisturising vapour would be beneficial.

The humidifier may be incorporated into a package for tobacco products. A second aspect of the present invention is directed to a package for tobacco products comprising a humidifier according to the first aspect. The humidifier may be disposed on an interior surface of the package, for example, or may be provided loose inside the package.

A third aspect of the present invention is directed to a package for tobacco products containing one or more tobacco products and a humidifier according to the first aspect. The humidifier may be disposed on an interior surface of the package. The package may be a container for cigarettes, cigars or cigarillos, or a receptacle for loose tobacco, such as a pouch or a tin.

A fourth aspect of the present invention is directed to a method of fabricating a humidifier for use with tobacco products, the method comprising: forming a closed capsule at least partially from material comprising a thermo-mechanically expanded polymer membrane having micropores that render the material permeable to moisturising vapour; and injecting a liquid source of moisturising vapour into the closed capsule.

The method may further comprise placing inside the capsule a liquid-absorbing medium before the capsule is closed. The liquid-absorbing medium may be one or more of polyacrylamide granules, an alginate, microcrystalline cellulose, ispaghula husk, saturated silica gel, rice, a starch gel, a pectin, natural sponge, synthetic sponge, a sepeolite, bentonite or other clay material, gelatin, agar agar, and a modified cellulosic gum.

The liquid source of moisturising vapour may be liquid water.

A fifth aspect of the present invention is directed to a method of fabricating a humidifier for use with tobacco products, the method comprising: forming a partially assembled capsule at least partly from material comprising a thermo-mechanically expanded polymer membrane having micropores that render the material permeable to moisturising vapour; forming a block of frozen water; placing the block of frozen water inside the partially assembled capsule; and sealing the partially assembled capsule around the frozen water to form a closed capsule encapsulating the frozen water. This approach avoids any drawbacks that may be associated with using liquid water in the production process. The frozen water may be contained within a water-absorbing medium such as one or more of polyacrylamide granules, an alginate, microcrystalline cellulose, ispaghula husk, saturated silica gel, rice, a starch gel, a pectin, natural sponge, synthetic sponge, a sepeolite, bentonite or other clay material, gelatin, agar agar, and a modified cellulosic gum.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention and to show how the same may be carried into effect reference is now made by way of example to the accompanying drawings in which:

Figure 1 shows a cross-sectional view of a humidifier according to an embodiment of the present invention;

Figure 2 shows a cross-sectional view of a humidifier according to a further embodiment of the invention;

Figure 3 shows a cross-sectional view of a humidifier according to a yet further embodiment of the invention;

Figure 4 shows a cross-sectional view of a humidifier provided with an impermeable outer layer according to an embodiment of the invention;

Figure 5 shows a plan view of the humidifier of Figure 4;

Figure 6 shows a plan view of humidifier provided with an impermeable outer layer according to an alternative embodiment;

Figures 7, 8 and 9 show examples of tobacco product packaging incorporating humidity indicators according to embodiments of the invention;

Figure 10 shows a cross-sectional view of a humidifier according to another embodiment;

Figure 11 illustrates an example method of fabricating a humidifier according to an embodiment of the invention; and

Figures 12A to 12E illustrate steps in an alternative method of fabricating a humidifier according to an embodiment of the invention.

DETAILED DESCRIPTION

The present invention proposes the use of thermo-mechanically expanded amorphous-locked polytetrafluoroethylene (referred to henceforth as ePTFE) as a porous membrane for a humidifier intended for use with tobacco products. This material is often known by trade names including GORE-TEX (RTM). The present invention recognises that this material is well-suited for use as a porous membrane for this particular application.

A humidifying device requires a source of moisture to be enclosed in an outer layer or casing, which layer needs to be permeable to water vapour given off by the moisture source

but impermeable to the passage of liquid water, which would make the tobacco too wet, and also ruin products like cigarettes and cigars.

ePTFE has the necessary properties of permeability to water vapour and impermeability to liquid water (hence its common use in "breathable" waterproof garments). In addition, the porous microstructure of ePTFE can be precisely controlled during manufacture (by controlling the temperature and rate of expansion). It contains many microscopic pores (micropores) which are too small for droplet of liquid water (or other liquids that might be used for moisturising tobacco) to pass through, but which transmit water vapour (or vapour of another moisturising liquid). Therefore, for use in a humidifier, the rate of water vapour release can be controlled by selection of an ePTFE with a suitable pore size and density. Also, the material has the form of a flexible sheet material, so it can be used to manufacture humidifiers of any desired shape and size. Pieces of the membrane can be bonded by an adhesive or cement material. ePTFE bonds to itself very readily because the bonding agent can penetrate a significant distance into the pores which form a large network through the ePTFE, and after drying, hardening or curing of the bonding agent, the two joined pieces are locked together. Alternatively, the ePTFE can be laminated with layers of fabric (such as nylon, polyester or polypropylene, for example) to create a fabric-like material. This can be stitched together (with treatment of the seams to improve waterproofing if required). Reference to ePTFE or to a material comprising ePTFE in the present document includes both ePTFE alone and a laminated ePTFE fabric.

Also, ePTFE is a particularly strong, tough material. This arises from the fabrication process, in which the expansion of the material increases the strength of its polymeric matrix. For use in a humidifier, this is a valuable property because the membrane of the humidifier is highly resistance to puncture or bursting. Combined with the ability to make secure seams and joins between individual pieces of ePTFE, as described in the preceding paragraph, this allows robust humidifiers in a wide range of shapes to be produced.

ePTFE further has a high level of chemical inertness and a resistance to undesirable physical changes over a wide range of temperatures. These are further beneficial properties for use with tobacco products, where any interaction between the tobacco and a

humidifying element in contact or near-proximity is undesirable, both from a health perspective, and for maintaining the quality of the tobacco product.

A detailed description of ePTFE and its manufacture can be found in US 3,953,566, "Process for producing porous products". The polymer is heated and stretched to a superthin layer, which causes the microscopic pores to form in the polymer structure. Control of the temperature and the rate and amount of stretching (expansion) can control the size and density of the pores, and hence also the permeability.

Other polymers can also be made into membranes with micropores by a thermo-mechanical expansion process, to give membranes similar to ePTFE and hence also suitable for use in the present invention. The present invention is therefore directed to materials comprising thermo-mechanically expanded polymer membranes in general, where the membranes have micropores that make the material porous or permeable to moisturising water vapour, but not to liquid. As with ePTFE, the other polymers may be laminated to fabrics or used as the membrane alone. Other examples of suitable polymers are polybutylene terephthalate and polyethylene oxide, plus some other fluoro-polymers.

Water is a particularly convenient moisture source for hydrating tobacco via evaporation from a humidifier, but according to the invention, other sources of moisture that can be retained by the polymer membrane until released in vapour form by evaporation through the micropores can also be used, if the moisture is suitable for moisturising tobacco.

Notwithstanding the foregoing, for the sake of convenience and simplicity, the following description is presented in terms of ePTFE and water, but all embodiments can be implemented using other polymer membranes and other liquids.

According to the invention, a humidifier for use with tobacco products has the form of a closed pouch or capsule formed at least partially from ePTFE and filled with a moisture-releasing element that emits water vapour. In its simplest form, the moisture-releasing element comprises a reservoir of liquid water, which is encapsulated by the ePTFE pouch.

Figure 1 shows a schematic cross-sectional view of a humidifier according to a first embodiment. The humidifier 10 comprises a closed (sealed so as to be impermeable to the passage of liquid water) capsule or pouch 12 fabricated from ePTFE. For example, two similarly shaped sheets of ePTFE can be stitched or bonded together around their edges to make a closed water-tight compartment. Inside the capsule 12 is a moisture-releasing element 14 in the form of a volume of liquid water. The liquid water 14 slowly evaporates at room temperature in the known manner, and the resulting water vapour 16 passes through the ePTFE into the surrounding environment, as indicated by the arrows in the Figure. Thus, if the surrounding environment includes tobacco product, the tobacco is moisturised.

As an alternative to liquid water, the humidifier may comprise a moisture-releasing element 14 in the form of any medium that is capable of absorbing, holding or otherwise providing a quantity or reservoir of water, and giving up the water as water vapour, preferably at room temperature. For example, a paper matrix incorporating polyacrylamide granules may be used. A further example of a suitable water absorbing medium is one or more alginates. These materials are linear copolymers produced by various brown algae including seaweed (such as giant kelp) and bacteria (such as Azotobacter species), which are insoluble in water but absorb water quickly. Thus, a quantity of alginate can be soaked with water before being enclosed in the capsule 12. Alginates are fully biocompatible and are used in food stuffs and medicines, so they are a particularly attractive option for use with tobacco products.

Further examples of suitable materials for making the moisture-releasing element 14 include micro-crystalline cellulose, ispaghula husk, saturated silica gel, rice, starch gels, pectins, natural sponge, synthetic sponge and clay materials such as sepeolite, bentonite or the like, gelatin, agar agar, and modified cellulosic gums. Combinations of these materials may also be used. As in the previous examples, a portion of the relevant material is soaked with water before encapsulation in the ePTFE capsule 12.

However, the invention is not limited to these particular examples of water absorbing media for the moisture-releasing element. Any material which has the necessary properties

to allow it to absorb an adequate amount of water and then release the water as water vapour by evaporation can be used.

For either liquid water or water held in a water-absorbing material, the water need not be plain water. An aqueous salt solution may be used instead, which can give control over the evaporation by determining the humidity level of the surrounding environment below which the water vapour will be released. Other non-volatile liquid ingredients such as glycerol (glycerine), or propylene glycol, may alternatively be used, as these also control evaporation of the water.

Additionally or alternatively, the moisture-releasing element may also contain one or more water-soluble additives that can be carried through the ePTFE capsule by the water vapour and hence delivered to the tobacco. These may include flavourants and fragrances. For example, a moisture-releasing element containing menthol can be used to impart a menthol flavour and smell to the tobacco. Vanilla, coffee and other flavours may be similarly provided. In this way, the consumer has a mechanism for flavouring a tobacco product with a flavour of their choice.

A particular benefit to using ePTFE to encapsulate the water vapour source is that it can be easily made into capsules of a wide range of shapes and sizes, for example by joining individual pieces of ePTFE together to form a closed shape. In the context of the present invention, it is convenient to maximise the amount of water vapour releasable from a given capsule in a given time. This speeds up the humidifying process and also allows a small and hence more convenient capsule to be used. To achieve this, the ratio of the surface area of the capsule to its volume can be made large, or even maximised. Any shape that has a large surface area with respect to its volume can be used.

Figure 2 shows an embodiment that provides a large surface area to volume ratio. In this example, the humidifier 10 has a capsule 12 is formed as a multi-pointed, three-dimensional star shape, with a plurality of spokes or fingers 18 extending from a central core; these together form a single closed volume. This volume is filled with water 14 (liquid or absorbed in a material as discussed above). The star provides a very large surface area

through which water vapour 16 is released, so that a large amount of water vapour is delivered relatively quickly.

Figure 3 shows a further embodiment designed to increase the surface area. In this example, the humidifier 10 has a capsule 12 formed from ePTFE with a corrugated surface 20, which again provides a large surface area for the release of water vapour 16.

A humidifier according to the present invention can be included inside a package of tobacco product as the package is filled and before it is sealed for shipping and/or storage before purchase and use by a customer. The presence of the humidifying capsule inside the package keeps the tobacco moist until it is used.

Alternatively, the humidifier may be supplied separately for use as and when a smoker finds that their tobacco product needs additional moisture, whereupon the humidifier can be inserted into the container holding the product. However, for this it is necessary to prevent the water inside the capsule from evaporating before it is desired to use the humidifier. It is therefore proposed that the humidifier may be supplied packaged inside an outer layer that is substantially impermeable to the passage of water vapour and liquid water and which is removed from the humidifier before use. In this form, the humidifier can be supplied as a separate item, or may be included inside a package of tobacco product for optional use after the package is opened. The outer layer will retain the water substantially inside the capsule until such time as the outer layer is removed, whereupon the time water vapour can escape through the ePTFE to the environment of the humidifier.

Figure 4 shows a cross-sectional view of a humidifier according to this embodiment. The humidifier 10, shown in the low surface area form of Figure 1 for simplicity (the capsule may in reality have any shape) is sealed inside an impermeable outer layer 22. Any suitable configuration and material may be used for the outer layer 22, including a sealed plastics material packet or a tin or plastic box with a removable resealable lid. A box or tin may be used to supply a plurality of humidifiers in a single batch. In this example, however, the outer layer 22 is made from a flexible plastics material configured as a sachet inside which the capsule 12 containing the water 14 is sealed. The sachet 22 may be, for example, of the type commonly used to provide individual portions of condiments in catering

establishments, since these are simple and economical to manufacture, easy to open and remove, and use known packaging technology.

Figure 5 shows a plan view of the packaged humidifier of Figure 4. The sachet 22 is sealed across each end by sealing lines 24 made for example by plastics welding. Portions of the sachet material extend a short distance beyond the sealing lines 24 and terminate in serrated edges 26, which facilitate tearing open of the sachet for removal of the humidifier 10 prior to use. The outer surface of the sachet 22 may be printed with any desired design, for example a brand name and instructions for use of the humidifier 10.

Further in this regard, the outer surface of the humidifier capsule 12 may also be provided with a desired design such as a brand name or logo if the ePTFE is of the laminated fabric form, since a design can be woven into or printed onto the fabric with which the ePTFE is laminated.

For a humidifier that is enclosed inside an impermeable outer layer, the user may be assisted in determining when the humidifier should be employed by the inclusion of a humidity indicator on the exterior surface of the outer layer. If the humidifier, inside its outer layer, is stored inside the packaging of the tobacco product, the indicator can then show when it should be used. The indicator can be any type of compact humidity measuring device or sensor that gives a visual indication of the humidity level. A convenient example is a cardboard or paper device comprising one or more sensor areas of water-sensitive material that absorb moisture from the atmosphere and change colour according to whether the humidity is above or below some threshold value. A range of sensor areas having different threshold values may be provided, to give a visual humidity scale from which the user can make a decision as to whether his tobacco product is appropriately moist; if the atmosphere becomes dry the outer layer can be opened and the humidifier removed for use. Alternatively, a single sensor area can be provided to give one threshold humidity measurement so that the humidifier can be activated if the humidity drops below the threshold. The threshold can be selected at a useful level for humidity at which tobacco is satisfactorily moist.

Figure 6 shows a plan view of a humidifier packaged in a sachet 22 as shown in Figure 5 which has a humidity indicator 28 on its exterior surface. The humidity indicator 28 has a plurality of sensor areas 30.

As mentioned above, humidifiers according to the present invention can be supplied as products in their own right for insertion in a package or container of tobacco product by the user, in which case the humidifier has a removable impermeable outer layer. Alternatively, humidifiers can be included inside the packaging of pre-packaged tobacco products. In the latter case, the humidifier may lack the impermeable outer layer, so that it maintains the moisture level of the tobacco before the package is opened by the user, or it may include an outer layer so that it is available for use after the package is opened if the user wants to raise the moisture level. For either of these possibilities, the humidifier can either be included loose inside the packaging, or it can be incorporated into the packaging, for example by being glued to an interior surface of the packaging. Such a humidifier is widely applicable to many types of tobacco packaging.

Figure 7 shows a perspective view of the top part of a pack 38 for smoking articles such as cigarettes or cigars. The pack 38 has a hinged flip-top lid 40 which has a humidifier 10 according to an embodiment of the present invention adhered to the inside surface of its upper face, where it can be easily seen and accessed by a user. It may be positioned elsewhere on the inner surface of the pack, however. Note that the smoking articles which would be supplied in the pack 38 have been omitted from the Figure in the interests of clarity.

Figure 8 shows a cross-sectional side view of a pouch 42 containing loose tobacco for rolling or pipe smoking. The pouch 12 comprises a bag-like container portion 46 for holding the tobacco 44, and a closure portion 48 in the form of a flap that folds over and wraps around the container portion to keep the pouch 42 closed and the tobacco 44 moist. A humidifier 10 is adhered to the upper part of the inside surface of the rear wall of the container portion 46.

Figure 9 shows a perspective view of a tin 50 for holding loose tobacco 44, the tin 50 having a lid 52 with a humidifier on its inside surface.

In each of the examples of Figure 7, 8, and 9, the humidifier 10 may be provided with an impermeable outer layer that can be removed to allow the humidifier to be brought into use by the smoker after the package is opened. Since the rear surface of the humidifier is in contact with the package, there is no need for the outer layer to completely enclose the humidifier. Instead, a peel-off layer of impermeable material such as foil or plastic may be adhered over the humidifier using non-permanent adhesive.

Also, in each of the examples of Figures 7, 8 and 9, the capsule 12 of the humidifier 10 need not be wholly fabricated from ePTFE. A rear surface of the humidifier 10 is adhered to an inside surface of the packaging, so water vapour cannot escape through that part of the capsule. Hence, a non-permeable material may be used for part of the capsule if preferred, for example for cost reasons. Additionally, it may be advantageous for the part of the capsule that is in contact with the packaging not to release water vapour, since the water may adversely affect the packaging material, for example in the case of a cardboard cigarette or cigar pack.

Further in this regard, embodiments of humidifier which are not intended to be adhered to the inner surface of tobacco product packaging may also have a capsule that is only partially comprised from ePTFE. The ePTFE can be used to provide a "window" through which water vapour is released from an otherwise impermeable capsule, for example. This gives a further flexibility in designing the rate of water vapour release, where the size of the window in conjunction with the size and density of the pores in the ePTFE determines the release of the water vapour.

Figure 10 shows a cross-sectional side view of a humidifier according to an example of this embodiment. The humidifier 10 has a capsule that comprises an open tray portion 54 that is filled with water 14 (as liquid or absorbed in a material). The tray 54 is sealed with a layer of ePTFE 56 over its upper surface. The tray 54 maybe formed from plastics material by blow moulding or vacuum moulding, before the water is added and the ePTFE layer 56 sealed around the perimeter of the tray 54. The structure is similar to that of a single cell in the blister packs used to package tablets, with the difference that the contents are not intended to be removed. A removable impermeable outer layer (not shown) may be

provided over the ePTFE layer to seal in the water vapour prior to use. Alternatively, a humidifier according to this embodiment may be sealed inside a fully enclosing outer layer, such as the sachet of Figures 4 and 5.

Humidifiers of the present invention may be fabricated according to any convenient technique.

Figure 11 illustrates one example technique in which the capsule 12, in this example fully fabricated from ePTFE, is fully constructed so as to form a sealed pouch. Then, liquid water 14 is injected into the capsule 12 using a needle that penetrates through the capsule 12. A simple syringe 58 is shown for illustrative purposes. For large scale manufacturing, a larger injection unit will be more appropriate. For embodiments which have a moisture releasing element in the form of a water-absorbing medium into which water is absorbed, the water-absorbing medium is placed inside the capsule 12 before it is fully sealed (or the capsule is constructed around the material if more convenient). The water 14 is then injected into the material inside the capsule 12.

Figures 12A-12E illustrate steps in a further example technique intended to address any difficulties arising from manufacturing with liquid water. In this example, the water 14 is provided in frozen form, as shown in Figure 12A. The frozen water may be simply an ice-cube, if a reservoir of plain liquid water is required. Alternatively, the frozen water may include one or more of the additional substances described above, such as flavorants. Also, for some of the water-absorbing materials that can be used as a moisture releasing element, it may be possible to provide these, with the water already absorbed inside, in frozen form.

A partially assembled, still open, capsule 12 is provided. This may be merely the separate pieces of the ePTFE which will form the capsule, or these pieces may be partially formed into a capsule 12 which is not yet sealed shut. Figure 12B shows a partially formed open capsule 12 of this type, the capsule having the form of a bag into which the frozen water 14 can be placed.

As shown in Figure 12C, the frozen water 14 is then placed inside the partially assembled capsule 12, either by inserting it into an open bag-like capsule or by placing the separate pieces of ePTFE around the frozen water.

Next, the capsule is sealed shut around the frozen water. Any as yet unmade joins between the pieces of ePTFE are bonded, stitched or otherwise completed. Figure 12D shows the result, in which the frozen water 14 is fully encapsulated in the capsule 12.

Finally, the frozen water 14 melts to provide the required moisture-releasing element 14 (liquid water or water absorbed in a medium) inside the capsule 14, giving the finished humidifier 10.

The invention is not limited to the fabrication techniques of Figures 11 and 12. Any suitable technique may be employed.

It is intended that humidifiers according to the present invention will generally be disposable. However, once all the encapsulated water has evaporated, it would be possible for the humidifier to be re-used if the user injected more water into the capsule.

The humidifiers described herein are suitable for use with any tobacco product (and also with any other packaged product that requires moisture levels to be maintained or rejuvenated). The size of any humidifier will therefore be selected according to the tobacco packaging in which it is intended to be used. Based on the typical size of a tobacco pouch or tin or a cigarette or cigar pack, the humidifiers will typically have dimensions of between 10 and 50 millimetres. Other sizes are not precluded, however.

Humidifiers according to the invention may include further features in various combinations. For example, the encapsulated moisture source may comprise a gel configured for the controlled release of moisture. Humidifiers incorporating such gels are described in our co-pending application GB 0710784.0 "Controlled moisture release humidifier for use with tobacco products", filed in the United Kingdom on 5th June 2007. Also, the humidifiers may include an additional sealed compartment containing a supercoolable salt hydrate solution that can be activated to crystallise and release heat to

the moisture-releasing element, thereby increasing the rate of moisture release by evaporation. Humidifiers comprising such "heat releasing gels" are described in our co-pending application GB 0710776.6 "Heatable humidifying device for use with tobacco products", filed in the United Kingdom on 5th June 2007.

CLAIMS

1. A humidifier for use with tobacco products comprising:

a closed capsule fabricated at least partially from material comprising a thermo-mechanically expanded polymer membrane having micropores that render the material permeable to moisturising vapour; and

a source of moisturising vapour encapsulated within the closed capsule.

2. A humidifier according to claim 1, in which the polymer comprises polytetrafluoroethylene, polybutylene terephthalate or polyethylene oxide.

3. A humidifier according to claim 1 or claim 2, in which the source of moisturising vapour is a volume of liquid water.

4. A humidifier according to claim 1 or claim 2, in which the source of moisturising vapour is water absorbed in a water-absorbing medium contained within the closed capsule.

5. A humidifier according to claim 4, in which the water-absorbing medium is one or more of polyacrylamide granules, an alginate, microcrystalline cellulose, ispaghula husk, saturated silica gel, rice, a starch gel, a pectin, natural sponge, synthetic sponge, a sepeolite, bentonite or other clay material, gelatin, agar agar, and a modified cellulosic gum.

6. A humidifier according to any one of claims 1 to 5, in which the closed capsule is wholly fabricated from the material comprising thermo-mechanically expanded polymer membrane.

7. A humidifier according to any one of claims 1 to 6, in which the capsule has a corrugated or folded surface.

8. A humidifier according to any one of claims 1 to 7, in which the capsule has a shape comprising a plurality of fingers radiating from a central core region.

9. A humidifier according to any one of claims 1 to 7, in which the capsule has a shape intended to maximise its surface area for a given volume.

10. A humidifier according to any one of claims 1 to 5, in which the capsule comprises a moulded plastic tray that is substantially impermeable to moisturising vapour, and a layer of material comprising a thermo-mechanically expanded polymer membrane sealed to the moulded plastic tray to close it.

11. A humidifier according to any preceding claim, in which the humidifier further comprises one or more water-soluble flavorants, fragrances or additives dissolved in the encapsulated source of moisturising vapour.

12. A humidifier according to any preceding claim, in which the humidifier further comprises a removable outer layer that is substantially impermeable to the passage of water or water vapour, the outer wrapper disposed over the material comprising a thermo-mechanically expanded polymer membrane and intended to be removed before use of the humidifier.

13. A humidifier according to claim 12, in which the removable outer layer completely encloses the closed capsule.

14. A humidifier according to claim 12 or claim 13, in which the humidifier further comprises a visual humidity indicator on an exterior surface of the removable outer layer.

15. A humidifier according to any one of the preceding claims, in which the humidifier is incorporated into a package for tobacco products.

16. A package for tobacco products comprising a humidifier according to any one of claims 1 to 14.

17. A package for tobacco products containing one or more tobacco products and a humidifier according to any one of claims 1 to 14.

18. A package for tobacco products according to claim 16 or claim 17, in which the humidifier is disposed on an interior surface of the package.

19. A package for tobacco products according to any one of claims 16 to 18, in which the package is a container for cigarettes, cigars or cigarillos.

20. A package for tobacco products according to any one of claims 16 to 18, in which the package is a receptacle for loose tobacco.

21. A package for tobacco products according to claim 20, in which the receptacle is a pouch or a tin.

22. A method of fabricating a humidifier for use with tobacco products, the method comprising:

forming a closed capsule at least partially from material comprising a thermo-mechanically expanded polymer membrane having micropores that render the material permeable to moisturising vapour; and

injecting a liquid source of moisturising vapour into the closed capsule.

23. A method according to claim 22, further comprising placing inside the capsule a liquid-absorbing medium before the capsule is closed.

24. A method according to claim 23, in which the liquid-absorbing medium is one or more of polyacrylamide granules, an alginate, microcrystalline cellulose, ispaghula husk, saturated silica gel, rice, a starch gel, a pectin, natural sponge, synthetic sponge, a sepeolite, bentonite or other clay material, gelatin, agar agar, and a modified cellulosic gum.

25. A method according to any one of claims 22 to 24 in which the liquid source of moisturising vapour is liquid water.

26. A method of fabricating a humidifier for use with tobacco products, the method comprising:

forming a partially assembled capsule at least partly from material comprising a thermo-mechanically expanded polymer membrane having micropores that render the material permeable to moisturising vapour;

forming a block of frozen water;

placing the block of frozen water inside the partially assembled capsule; and

sealing the partially assembled capsule around the frozen water to form a closed capsule encapsulating the frozen water.

27. A method according to claim 26, in which the frozen water is contained within a water-absorbing medium.

28. A method according to claim 27, in which the water-absorbing medium is one or more of polyacrylamide granules, an alginate, microcrystalline cellulose, ispaghula husk, saturated silica gel, rice, a starch gel, a pectin, natural sponge, synthetic sponge, a sepeolite, bentonite or other clay material, gelatin, agar agar, and a modified cellulosic gum.

AMENDED CLAIMS
received by the International Bureau on 10 November 2008 (10.11.2008)

1. A package for tobacco products comprising a humidifier, the humidifier comprising:

a closed capsule fabricated at least partially from material comprising a thermo-mechanically expanded polymer membrane having micropores that render the material permeable to moisturising vapour; and

a source of moisturising vapour encapsulated within the closed capsule.

2. A package according to claim 1, in which the polymer comprises polytetrafluoroethylene, polybutylene terephthalate or polyethylene oxide.

3. A package according to claim 1 or claim 2, in which the source of moisturising vapour is a volume of liquid water.

4. A package according to claim 1 or claim 2, in which the source of moisturising vapour is water absorbed in a water-absorbing medium contained within the closed capsule.

5. A package according to claim 4, in which the water-absorbing medium is one or more of polyacrylamide granules, an alginate, microcrystalline cellulose, ispaghula husk, saturated silica gel, rice, a starch gel, a pectin, natural sponge, synthetic sponge, a sepeolite, bentonite or other clay material, gelatin, agar agar, and a modified cellulosic gum.

6. A package according to any one of the preceding claims, in which the closed capsule is wholly fabricated from the material comprising thermo-mechanically expanded polymer membrane.

7. A package according to any one of the preceding claims, in which the capsule has a corrugated or folded surface.

8. A package according to any one of the preceding claims, in which the capsule has a shape comprising a plurality of fingers radiating from a central core region.

9. A package according to any one of claims 1 to 7, in which the capsule has a shape intended to maximise its surface area for a given volume.

10. A package according to any one of claims 1 to 5, in which the capsule comprises a moulded plastic tray that is substantially impermeable to moisturising vapour, and a layer of material comprising a thermo-mechanically expanded polymer membrane sealed to the moulded plastic tray to close it.

11. A package according to any one of the preceding claim, in which the humidifier further comprises one or more water soluble flavourants, fragrances or additives dissolved in the encapsulated source of moisturising vapour.

12. A package according to any one of the preceding claim, in which the humidifier further comprises a removable outer layer that is substantially impermeable to the passage of water or water vapour, the outer wrapper disposed over the material comprising a thermo-mechanically expanded polymer membrane and intended to be removed before use of the humidifier.

13. A package according to claim 12, in which the removable outer layer completely encloses the closed capsule.

14. A package according to claim 12 or claim 13, in which the humidifier further comprises a visual humidity indicator on an exterior surface of the removable outer layer.

15. A package for tobacco products according to any one of the preceding claims, in which the humidifier is disposed on an interior surface of the package.

16. A package according to any one of the preceding claims, containing one or more tobacco products.

17. A package according to claim 16, in which the package is a container for cigarettes, cigars or cigarillos.

18. A package according to claim 16, in which the package is a receptacle for loose tobacco.

19. A package according to claim 18, in which the receptacle is a pouch or a tin.

20. A method of fabricating a package according to any one of the preceding claims, the method comprising:

forming a closed capsule at least partially from material comprising a thermo-mechanically expanded polymer membrane having micropores that render the material permeable to moisturising vapour; and

injecting a liquid source of moisturising vapour into the closed capsule.

21. A method according to claim 20, further comprising placing inside the capsule a liquid-absorbing medium before the capsule is closed.

22. A method according to claim 21, in which the liquid-absorbing medium is one or more of polyacrylamide granules, an alginate, microcrystalline cellulose, ispaghula husk, saturated silica gel, rice, a starch gel, a pectin, natural sponge, synthetic sponge, a sepeolite, bentonite or other clay material, gelatin, agar agar, and a modified cellulosic gum.

23. A method according to any one of claims 20 to 22 in which the liquid source of moisturising vapour is liquid water.

24. A method of fabricating a package according to any one of claims 1 to 19, the method comprising:

forming a partially assembled capsule at least partly from material comprising a thermo-mechanically expanded polymer membrane having micropores that render the material permeable to moisturising vapour;

forming a block of frozen water;

placing the block of frozen water inside the partially assembled capsule; and

sealing the partially assembled capsule around the frozen water to form a closed capsule encapsulating the frozen water.

25. A method according to claim 24, in which the frozen water is contained within a water-absorbing medium.

26. A method according to claim 25, in which the water-absorbing medium is one or more of polyacrylamide granules, an alginate, microcrystalline cellulose, ispaghula husk, saturated silica gel, rice, a starch gel, a pectin, natural sponge, synthetic sponge, a sepeolite, bentonite or other clay material, gelatin, agar agar, and a modified cellulosic gum.

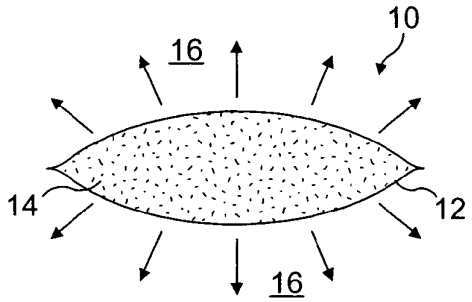


FIG. 1

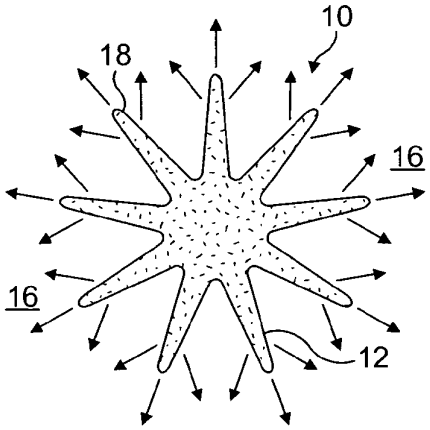


FIG. 2

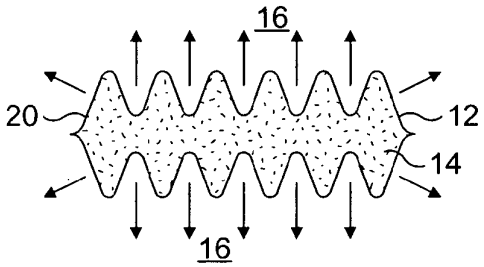


FIG. 3

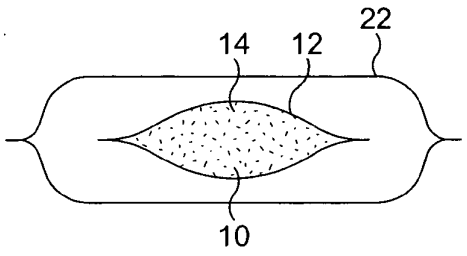


FIG. 4

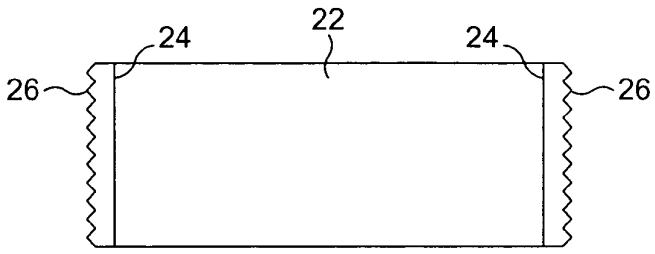


FIG. 5

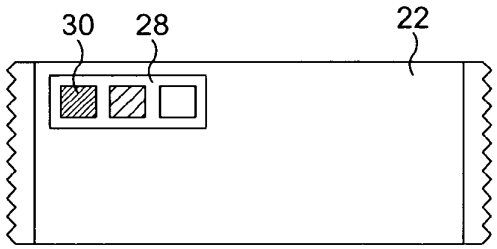


FIG. 6

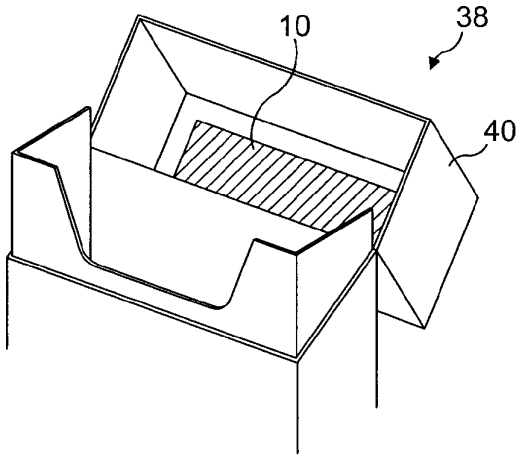


FIG. 7

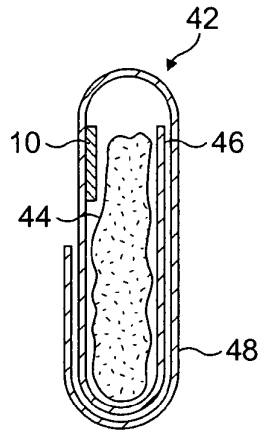


FIG. 8

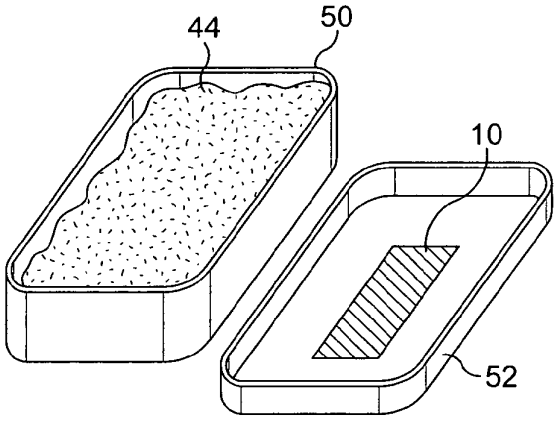


FIG. 9

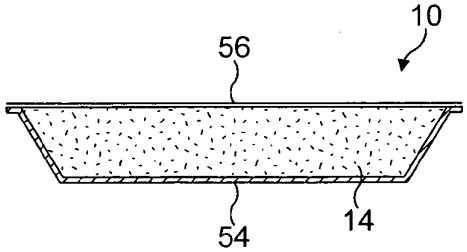


FIG. 10

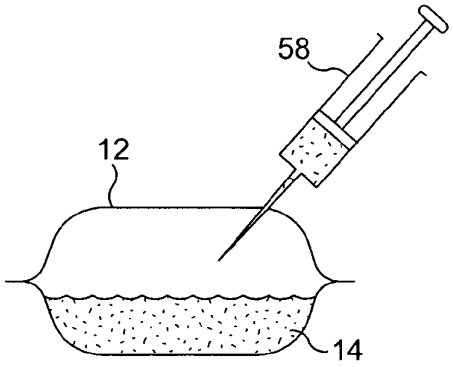


FIG. 11

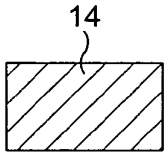


FIG. 12A

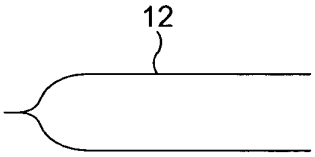


FIG. 12B

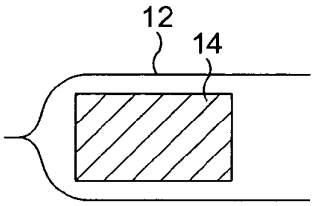


FIG. 12C

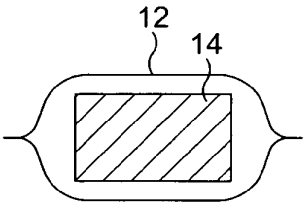


FIG. 12D

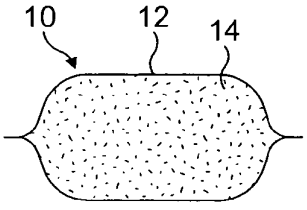


FIG. 12E