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(54) Forming condensation/ice on plastic

(57) A device for controlling the formation of condensation or ice on the outer surface of an article such as a beverage dispense font. The device includes a component 4 in thermal contact with a rear surface of a component 2 having a lower thermal conductivity than the component 4. Condensation or ice forms preferentially on a front surface of the device where the components 2, 4 are in thermal contact when the component 4 is cooled.

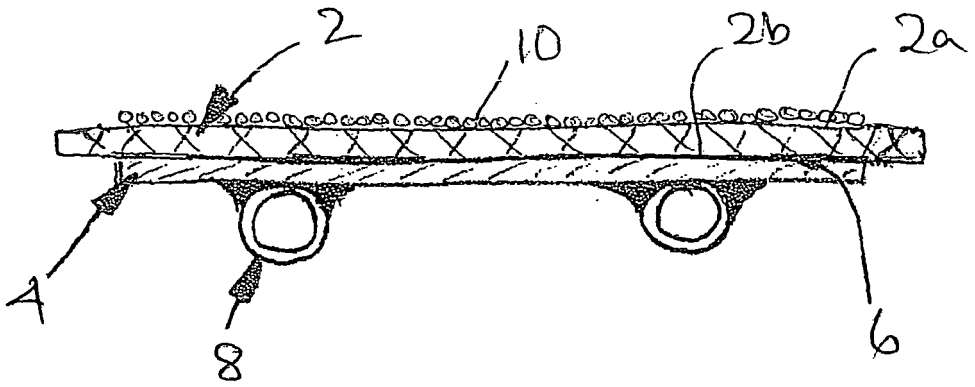

FIGURE 1

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Description

[0001] The present invention relates to the formation of condensation or ice on surfaces of low thermal conductivity such as plastics and has particular, but not exclusive, application in connection with the manufacture and use of beverage fonts wherein condensation or ice is used to enhance the appearance of the font and increase consumer appeal.

[0002] Fonts on which condensation or ice is formed are generally manufactured from high thermal conductivity materials, typically metal such as a brass casting, and are chilled by the recirculation of a cooling medium, typically water or a water/glycol mixture, through chambers or passages within the font.

[0003] There are a number of disadvantages to the present method of manufacture:-

- The raw material is rapidly increasing in cost and is heavy. This further increases cost where products are shipped great distances from low cost manufacturing locations.

- Castings require expensive hand polishing and finishing and are limited in shape by the casting process.

- Due to its conductive properties, condensation or ice will occur all over the brass casting. It is very difficult to control condensation/ice selectively. This is also wasteful of energy.

- The range of finishes is limited and is usually chromium plated. Such plating is limited to service condition 3 (service condition is a life rating based on exposure to a standard salt spray test).

- Once a font is made from a brass casting, its shape is fixed.

[0004] It is an object of the present invention to provide a means of creating condensation or ice which overcomes or at least mitigates one or more of the aforementioned problems of the present method of manufacture employing castings of metal or other high thermal conductivity materials.

[0005] It is a preferred object of the present invention to provide such means in a font for dispensing beverages.

[0006] According to a first aspect of the invention, there is provided a device having a means of creating ice or condensation on an outer surface of the device, the device comprising a first component, a second component in thermal contact with the first component on one side of the first component remote from an outer surface of the device, wherein at least part of the first component has a lower thermal conductivity than the second component, and means for cooling the second component to create ice or condensation on the outer surface of the device.

[0007] By having a lower thermal conductivity for at least part of the first component than the second component, the ice or condensation forms preferentially on the outer surface of the device in the area(s) where the first component is in thermal contact with the second component.

[0008] As a result, there is little or no tendency for the ice or condensation to form on or spread to cover the outer surface in areas of the first component that are not in thermal contact with the second component.

[0009] In this way, the ice or condensation can be created in precisely defined areas by controlling the thermal contact between the first and second components. This enables a wide range of visual effects to be created in a simple and effective manner.

[0010] In its simplest form, the first component comprises a plastics material in thermal contact with the second component which is made of a material having a higher thermal conductivity, for example a metal or alloy such as a copper plate.

[0011] The first component may have a uniform thickness. Alternatively, the thickness of the first component may be variable. The first component may comprise one or more layers of the same or different materials.

[0012] Preferably, the means of cooling the second component comprises a tube for conveying coolant or a thermoelectric wafer(s) in thermal contact with the second component, preferably attached by thermally conductive means such as a thermally conductive adhesive or solder.

[0013] In operation, the second component is cooled by the recirculation of coolant or the operation of the thermoelectric wafer(s). As this component is made from a conductive material such as copper, its whole surface becomes chilled and, as a result chills a similar area of the first component.

[0014] Because the plastics material of the first component is a relatively poor thermal conductor (compared to the material of the second component), it may be preferred to employ a relatively thin layer which forms a film or skin over the second component for effective formation of condensation or ice.

[0015] Preferably the plastics material of the first component has a thickness of 5mm or less, more preferably 2mm or less. It will be appreciated that where formation of condensation or ice is required, an effective thermal bond may be necessary between the plastics material of the first component and the second component. This can be ensured by the use of a thermally conductive adhesive or paste.

[0016] The thermal conductivity of the plastics material can be used to selectively create condensation or ice in different ways, for example, by creating gaps locally between the plastics material and the second component. This can be achieved, for example, by locally deforming either component by such means as vacuum forming or pressing so as to prevent direct thermal contact between

the two components.

[0017] It will be appreciated that air should preferably be prevented from circulating within any gap(s) between the components to prevent condensation or ice being formed within the gap. In some embodiments, selective cooling can be used to create images such as logos or patterns in the condensation or ice.

[0018] In some embodiments of the invention it is possible to create condensation or ice on surfaces which are curved or shaped to suit the design of a beverage font by providing the components with a corresponding shape and ensuring good thermal contact between the components.

[0019] It is also possible to create areas with no ice or condensation by the method described above for creating an air gap. As an alternative to leaving an air gap between the components, an infill material of thermally insulating material may be provided in any gap to prevent or reduce heat transfer between the components,

[0020] The plastics material of the first component can be provided with a variety of finishes such as chromium plating. In this way the appearance of a product made from metal can be achieved. Metal plating on a plastics material can achieve greater service conditions than metal plating on, for instance, brass. Thus, chromium plating the plastics material may achieve service condition 5 compared to service condition 3 normally achieved when chromium plating on brass.

[0021] As an alternative to using metal such as copper plate or alloy for the second component, the second component could be injection moulded from a thermally conductive plastics material and the plastics material forming the first component either applied in the moulding tool or vacuum formed on to it. An adhesive film may be required to ensure an adequate thermal bond.

[0022] Some pre-finished plastics material has light transmission properties, even when plated, and this can be used to provide illumination either exclusively or in combination with condensation or ice. By printing on the reverse of a plated plastics material it may be possible to provide branding, messages, etc. which would be invisible until the illumination is switched on. The plating acts in much the same way as a two way mirror.

[0023] Plastics generally have poor thermal conductivity (when compared with most metals) and this means that conduction takes place through the thickness of the plastics material of the first component at the point(s) of contact with the second component with almost no conduction in a lateral direction.

[0024] This has two benefits; firstly the area of condensation or ice can be defined precisely by the configuration of one or both components to achieve the desired point(s) of contact, and secondly any condensation or ice rapidly disappears on switching off the cooling means.

[0025] This offers the possibility of numerous options such as cycling the formation of condensation or ice, providing more than one area of thermal contact and sequencing operation, with or without lighting, etc.

[0026] A faster response could be achieved by providing a means of heating to remove the condensation or ice more rapidly such as heating elements within or adjacent to the second component, an air curtain to dry the outer surface of the first component or, in the case of thermoelectric cooling, reversal of the supply polarity which will cause the outer surface to become heated.

[0027] According to a second aspect of the invention, there is provided a device having a means of creating ice or condensation on an outer surface of the device, the device comprising a component having an outer surface and an inner surface, wherein the component comprises at least in part a plastics material, and means for cooling a selected area of the component to create ice or condensation on the outer surface of the component in the selected area.

[0028] Plastics are generally a poor conductor of heat and by selectively cooling an area of plastics, condensation or ice can be caused to form preferentially on the outer surface of the selected area.

[0029] The outer surface may be plated, for example chromium plated. The plastics may be thermally conductive.

[0030] The coolant may be circulated through a channel or duct formed in the plastics material of the component or by attaching a second component to the inner surface to define the channel or duct therebetween. For example, the second component may be made of plastics and secured to the first component in a fluid tight manner, for example by adhesive or by welding, such as ultrasonic welding.

[0031] According to a third aspect of the invention there is provided a device for forming condensation or ice on a surface, the device including means for controlling the formation of condensation or ice in response to humidity in the ambient air.

[0032] The control means may include a sensor for monitoring the humidity in the ambient air and control cooling means for creating the condensation or ice in response to the detected humidity.

[0033] The cooling means may comprise a coolant. Alternatively, the cooling means may comprise a thermoelectric device,

[0034] According to a fourth aspect of the invention, there is provided a structure having a component with a front surface and a rear surface, and means for cooling the rear surface of the component to form ice or condensation on the front surface, wherein the component comprises at least in part a low thermal conductivity material such that ice or condensation forms on the front surface where the rear surface is in thermal contact with the cooling means.

[0035] The component may comprise plastics or similar material and the cooling means may comprise metal or similar material that is arranged behind the component and has a higher thermal conductivity than the component.

[0036] The component may comprise one or more lay-

ers. The layers may be of the same or different materials. The outermost layer may provide the component with a desired surface finish. For example, the outermost layer may give the component a metallic appearance.

[0037] The cooling means may comprise an element such as a plate. The component may extend over and cover the element on the outer surface of the structure.

[0038] The component and/or element may be configured to provide one or more areas or points of thermal contact at which the component is cooled so that ice or condensation forms preferentially on the outer surface of the structure where the component is cooled.

[0039] According to a fifth aspect of the invention, there is provided a beverage dispense font incorporating a device or structure according to the first, second, third or fourth aspects of the invention.

[0040] The device or structure could be provided as an integral part or as a detachable part of a beverage dispense font or other merchandising product. For example, the device or structure may be formed in the shape of the font. Alternatively, the device or structure may be formed in the shape of part of the font and may comprise a detachable panel such that the font can be customised by fitting the appropriate panel.

[0041] According to a sixth aspect of the invention, there is provided a method of forming ice or condensation on an outer surface of a device comprising providing a first component which on one side provides the outer surface of the device and on the opposite side is in thermal contact with a second component, the first component having a lower thermal conductivity than the second component, and cooling the second component whereby the outer surface is cooled by heat transfer between the first component and the second component causing ice or condensation to form on the outer surface where the first and second components are in thermal contact.

[0042] Preferably, the thermal contact is controlled to form ice or condensation in a selected area or areas of the outer surface.

[0043] Embodiments of the invention will now be described in more detail by way of example only with reference to the accompanying drawings in which like reference numerals are used to indicate corresponding parts and wherein:

Figure 1 shows a device according to a first embodiment of the invention;

Figures 2a and 2b show modifications to the device of Figure 1;

Figure 3 shows a device according to a second embodiment of the invention;

Figure 4 shows a modification to the device of Figure 3;

Figures 5a and 5b show alternative forms of a device according to a third embodiment of the invention;

Figure 6 shows an alternative cooling system for the device of the invention; and

Figure 7 shows a device with branding.

[0044] Referring first to Figure 1 of the drawings, there is shown a device embodying the invention comprising a first component 2 and a second component 4. The first component 2 has an outer surface 2a on one side that, in use, forms the outer or front surface of the device and of an article (not shown) incorporating the device, and an inner or rear surface 2b on the opposite side in thermal contact with the second component 4.

[0045] In this embodiment, the first component 2 comprises a sheet of plastics material such as ABS (acrylonitrile butadiene styrene) and the second component 4 comprises a plate of metal such as copper. The first component 2 may be moulded or vacuum formed (thermoformed) or glued onto the second component 4 so that the components 2,4 are in thermal contact at an interface 6 between the inner or rear surface 2b of the first component 2 and the front surface of the second component 4. The interface 6 is an internal surface of the device that is remote from the surface on which the ice or condensation is to be formed in use of the device. Thermal contact between the components 2,4 may be enhanced by the provision of a thermal paste (not shown) or adhesive at the interface 6 between the components 2,4.

[0046] In this embodiment, the device is essentially flat and may form a panel that is incorporated into a beverage dispense font (not shown). The plastics material of the first component 2 forms a layer of uniform thickness covering the metal plate of the second component 4. This is not essential and the first component may be of variable thickness and/or may comprise more than one layer of the same or different materials. It will also be understood that the device may have other shapes according to the intended application and that the device may take a variety of forms. For example the device may comprise a panel with the outer surface 2a of the component 2 forming part of the outer surface of a font where the panel may be detachable for customising the font. Alternatively, the device may be formed integrally with the font.

[0047] The second component 4 is provided with cooling means 8 in the form of tubes for circulating a cooling medium such as chilled water or an aqueous glycol mixture or binary ice for cooling the second component 4. In this embodiment the tubes of the cooling means 8 are attached to the rear surface of the second component 4 by solder or other suitable means but it will be understood the tubes could formed integrally with the second component 4. The tubes are preferably connected to a coolant circuit by quick-fit connectors that allow the device to be disconnected for repair, maintenance or replacement.

[0048] In use, the metal plate of the second component

4 is cooled by coolant circulated through the cooling means 8. The metal plate is a good conductor of heat and in turn cools the first component 2 at the interface 6 between the components 2,4. Insulation (not shown), for example a foam material, may be applied to exposed surfaces on the back of the device to reduce heat exchange with the environment at these surfaces thereby making the device more energy efficient.

[0049] The plastics material of the first component 2 has a lower thermal conductivity than the metal plate of the second component 4 and is a poor conductor of heat (compared to the metal plate of the second component). As a result, the cooling effect of the second component 4 is limited to the area of contact between the components 2,4 at the interface 6 such that condensation 10 or ice forms preferentially on the outer surface 2a of the first component 2 in an area corresponding to the area of contact between the components 2,4 leaving other areas of the outer surface 2a free of condensation or ice.

[0050] We have found that formation of ice or condensation can be precisely controlled to areas in which the components 2,4 are in thermal contact where the first component may have a thickness up to 5mm, more preferably up to 3mm, more especially 2-3mm and where the second component can have a thickness of 1mm, 2mm or 3mm. These thicknesses are not intended to be limiting and are provided by way of example only.

[0051] In some embodiments, the outer surface 2a of the first component may be plated with a metal or alloy, for example chromium, to give the appearance that the device is made of solid metal. We have found that plating on a plastics substrate results in an improved service condition (corrosion rating) compared to similar plating on a metal substrate, for example on brass. The metal plating is an optional feature and can be omitted if the device is not required to have a metallic appearance.

[0052] Modifications of the device of Figure 1 are shown in Figures 2a and 2b.

[0053] In Figure 2a. the sheet of plastics material forming the first component 2 is provided with at least one raised area 12, for example by thermoforming. The raised area 12 creates an air gap 14 between the first component 2 and the second component 4 in the region of the raised area 12 when the components 2,4 are secured together. In Figure 2b, the second component 4 is formed with at least one recessed area 16, for example by pressing or stamping. The recessed area 16 creates an air gap 14 between the first component 2 and the second component 4 in the region of the recessed area 16 when the components 2,4 are secured together.

[0054] Air is a poor thermal conductor (compared to the plastics and metal of the components 2,4). As a result, condensation 10 or ice forms preferentially on the outer surface 2a' of the first component 2 in the area surrounding the raised area 12 in Figure 2a or the recessed area in Figure 2b where the first and second components 2,4 are in thermal contact when coolant is circulated through the cooling means 8 to cool the metal plate forming the second component 4. The outer surface 2a" of the first component 2 in the region of the raised area 12 in Figure 2a or the recessed area 16 in Figure 2b which is not in thermal contact with the second component 4 is not cooled and remains free of the condensation or ice

[0055] In this way different visual effects can be created by appropriate configuration of the raised area 12 in Figure 2a or recessed area in Figure 2b. More than one raised area 12 or recessed area 16 may be provided. A combination of raised and recessed areas 12,16 may be provided. The raised and/or recessed areas 12,16 may be used to create information and/or patterns in the condensation or ice. Thus, in a beverage dispense font, information relating to the product being dispensed such as logos, branding, advertising etc may be created for display to the customer. For example the raised and/or recessed areas 12,16 may define lettering.

[0056] An alternative device embodying the invention is shown in Figure 3. in which the second component 4 is made of a thermally conductive plastics material or metal or alloy having a higher thermal conductivity than the plastics material of the first component 2. The second component 4 may be formed, for example by injection moulding or casting or machining, with cooling means 8 for circulating coolant incorporated therein. The cooling means 8 may comprise pipes embedded in the second component. Insulation (not shown), for example a foam material, may be applied to exposed surfaces on the back of the device to reduce heat exchange with the environment at these surfaces thereby making the device more energy efficient.

[0057] The first component 2 may comprise a sheet of plastics material, optionally plated on the outer surface 2a as described previously. Alternatively, the first component 2 may comprise a metallised or paint effect plastics film, typically a clearcoat plastics film which may be applied during moulding of the second component 4 or vacuum formed over the second component with a thermally conductive adhesive layer between. In a modification (not shown), the second component 4 may comprise a metal or alloy plate to which the cooling means 8 is attached ' as shown in Figures 1, 2a and 2b.

[0058] The thermal conductivity of the plastics sheet or plastics film forming the first component 2 is lower than the thermal conductivity of the second component 4. As a result, when coolant is circulated through the cooling means 8 to cool the second component 4, condensation 10 or ice forms preferentially on the outer surface 2a of the first component in the areas that correspond to where the first and second components 2.4 are in thermal contact. The components 2,4 may be provided with raised and/or recessed areas as in Figures 2a and 2b to form air gaps to create visual effects such as information or patterns in the condensation or ice.

[0059] A modification of the device of Figure 3 is shown in Figure 4, wherein the second component 4 is provided with a recessed area 16 that forms an air gap 14 such that condensation 10 or ice forms preferentially on the

outer surface 2a' of the first component in the area surrounding the recessed area 16 that is in thermal contact with the second component 4 when coolant is circulated through the cooling means 8. The outer surface 2a" of the first component aligned with the recessed area 16 remains free of condensation or ice and the recessed area contains a light source 18, for example an array of light emitting diodes (LEDs) for back lighting the outer surface 2a". In a modification (not shown), the light source 18 may be arranged in the air gap formed by a raised area of the first component 2.

[0060] The back lighting may be used to reveal and/or enhance the display of any information or patterns provided on the outer surface 2a" and/or on the aligned inner surface 2b" and/or created in the condensation or ice. The light source may provide continuous or intermittent illumination. For example, the light source may be switched on and off in a random or pre-determined sequence. Alternatively, the characteristics of the light source may be altered in a random or pre-determined sequence, for example the colour or intensity (brightness) of the light source may be changed.

[0061] The device may be provided with a plurality of illuminated areas and the illumination controlled to create different visual effects by any one or more of the above methods including switching the light sources on and off in a random or pre-determined sequence or by changing the colour or intensity of the light sources in a random or pre-determined sequence.

[0062] In a modification (not shown) of the device shown in Figure 4, the light source may illuminate a narrow gap between two adjacent areas of the outer surface on which condensation or ice is formed so that the illumination appears through the condensation or ice.

[0063] Alternative devices embodying the invention are shown in Figures 5a and 5b.

[0064] In both Figures 5a and 5b. the second component 4 has recessed areas 16 filled with a thermally insulating material 20 such as a plastics material. The insulating material 20 provides the second component with a flat surface for attaching the first component 2 although this is not essential. The first component 2 may be made of sheet plastics or plastics film with optional metallic outer surface. The second component 4 may be made of a thermally conductive plastics material, for example by moulding or thermoforming or of metal or alloy, for example by casting or pressing or stamping.

[0065] The insulating material 20 has a low thermal conductivity and prevents heat transfer between the first and second components in the areas separated by the material 20. As a result, condensation 10 or ice forms preferentially on the outer surface 2a' of the first component 2 in the areas in thermal contact with the second component 4 and the outer surface 2a" remains free of condensation or ice when the second component is cooled.

[0066] In a modification (not shown), the recessed areas shown in Figures 5a and 5b may form channels or conduits for circulation of coolant. In this modification, the condensation or ice forms preferentially on the outer surface of the first component 2 forming part of the channel or conduit that is cooled by the coolant.

[0067] An alternative means 22 for cooling the second component of a device embodying the invention is shown in Figure 6 which comprises a base 24 open one side and provided with an inlet connection 26 and an outlet connection 28 for coolant, and a labyrinth arrangement of baffles 30 to prevent "short circuit" of coolant between the connections 24,26.

[0068] The base 24 could be secured on the open side to the back of the second component of the devices previously described and illustrated to form a closed chamber for circulation of coolant for cooling the second component 4. The base 24 is shown to be of rectangular shape but this is not essential and other shapes and/or sizes are envisaged to suit the shape and/or size of the device and in particular of the second component 4.

[0069] Another device embodying the invention is shown in Figure 7 in which the second component 4 comprises a casting or machining of metal or alloy, for example an aluminium die casting or machining, and the first component 2 comprises a moulding of a plastics material having a lower thermal conductivity than the second component 4. The second component 4 may incorporate passages for circulating a coolant or may be attached to coolant pipes as shown in Figure 1 or be secured to the base of the cooling means shown in Figure 6.

[0070] The metal casting or machining of the second component 4 has raised areas forming letters 32 and the plastics material of the first component 2 overlying the letters 32 is of reduced thickness such that condensation or ice preferentially forms on the outer surface of the first component 2 in the regions of reduced thickness corresponding to the letters 32. The letters could be replaced by patterns or other suitable graphics as required.

[0071] It can be seen that, using the materials and methods described above, it is possible to make a device, for example a panel, which could form a detachable part of a modular design of a product, for example a beverage dispense font, whereby the appearance of the same basic product design could be changed in accordance with the requirements of individual customers by selection and fitment of the appropriate device allowing a variety of bespoke products to be provided in a simple modular design using interchangeable devices and a common body.

[0072] In the case of beverage dispense fonts, such devices could be changed in trade quickly and simply and the need to switch off and drain cooling systems could be avoided by the provision of self sealing connectors between the body of the font and the device. The above features could increase product (font) life and reduce costs in rebranding (labour) and operation (energy) of the product (font).

[0073] In the above-described embodiments, localised cooling of the outer surface of the device is achieved to

form preferentially condensation or ice in a precisely defined area or areas of the outer surface by utilising the lower thermal conductivity of the component providing the outer surface so that cooling to create the condensation or ice is restricted to areas of the first component in thermal contact with the second component.

[0074] Although the invention has been described for cooling the outer surface of the first component by cooling the second component to form the condensation or ice, it will be understood that the outer surface of the first component could be heated by heating the second component so that condensation or ice formed on the outer surface is removed more rapidly.

[0075] Moreover, cooling and heating could be provided in any desired sequence and could be applied to some or all of the outer surface of the first component to achieve different visual effects as desired. Heating may be achieved by any suitable means, for example by circulating a hot fluid in place of the coolant. Alternatively, heating and cooling may be provided using thermoelectric means by reversing the polarity. Other means of heating and cooling will be apparent to those skilled in the art.

[0076] Cooling the outer surface of the first component to produce condensation and/or ice may be provided in several areas. Where more than one area can be cooled, different visual effects may be achieved by controlled cooling of individual areas. For example, different areas may be cooled in a random or pre-determined sequence. Alternatively, different areas may be cooled simultaneously. As described previously, removal of condensation and/or ice formed on any area of the outer surface may be enhanced by heating the outer surface.

[0077] The amount of condensation or ice formed will typically depend on various factors such as the humidity in the ambient air and the temperature of the outer surface that is being cooled. In the above-described embodiments, we may control the formation of condensation or ice in response to one or more of these factors by the use of appropriate means such as one or more sensors. For example, we may provide a sensor to monitor the humidity in the ambient air and control the cooling means in response to the detected humidity. Alternatively or additionally we may provide a sensor to monitor the temperature of the outer surface of the device and control the cooling- means in response to the detected temperature. The number and type of sensors may be chosen as desired.

[0078] Thus, where the cooling means comprises a coolant circuit for circulating coolant we may provide a flow restrictor in the coolant circuit that is operable by a stepper motor in response to a feedback signal from the humidity sensor. Alternatively, where the cooling means comprises a thermoelectric device we may provide a regulator such as a voltage or current regulator that is operable to control the thermoelectric device in response to a feedback signal from the humidity sensor. Any other suitable means for controlling the cooling means may be employed.

[0079] In the embodiments above-described, the devices may comprise interchangeable modular components such as panels that can be selectively fitted to a product such as a beverage dispense font or other merchandising to improve product aesthetics and/or to provide product information. Such panels can be detachable enabling the panel to be removed and replaced to change the aesthetics and/or information. Also damaged panels can be removed and replaced. Such detachable panels may allow product branding or advertising to be altered by removing and replacing one panel with another panel of similar size and shape. Alternatively, the devices may be built-into a product in a semi-permanent manner or as an integral part of the product.

[0080] In the embodiments above-described, the use of low thermal conductivity material for the first component enables the area(s) of the outer surface that is cooled to be controlled so that ice or condensation forms preferentially on the outer surface in a desired area(s). This may be referred to as directional or zonal cooling of the first component that results in the temperature of selected area(s) of the outer surface being lowered sufficiently so that moisture in the ambient air forms ice or condensation on the outer surface. Such directional or zonal cooling may be controlled by appropriate design of the thermal contact between the first component and the cooling means to achieve any desired shape or pattern of ice or condensation on the outer surface.

[0081] The invention may provide a means of creating ice or condensation on a surface exposed to ambient, the means including a first component, a second component in thermal contact with the first component on one side of the first component at an interface remote from the surface, wherein at least part of the first component has a low thermal conductivity, preferably a lower thermal conductivity than the second component, whereby cooling the second component causes ice or condensation to form on the surface from moisture in the ambient air in the area(s) where the components are in thermal contact.

[0082] The invention may also provide a means of creating ice or condensation on a surface exposed to ambient by directional or zonal cooling of the surface through the use of material such as plastics which is a poor conductor of heat so that cooling the material remote from the surface restricts or controls where the ice or condensation forms.

[0083] It will be understood that the invention is not limited to the embodiments described herein and that features of any of the embodiments may be employed separately or in combination with any other feature to provide a device or structure according to the invention.

Claims

1. A device having a means of creating ice or condensation on an outer surface of the device, the device

comprising a first component, a second component in thermal contact with the first component on one side of the first component remote from an outer surface of the device, wherein the first component has a lower thermal conductivity than the second component, and means for cooling the second component to create ice or condensation on the outer surface of the device.

2. A device according to claim 1 wherein the ice or condensation forms preferentially on the outer surface of the device in an area of the first component in thermal contact with the second component.

3. A device according to claim 1 or claim 2 wherein the first component comprises at least one layer of plastics material in thermal contact with the second component which is made of a material having a higher thermal conductivity, for example, the second component may be made of a metal or alloy or thermally conductive plastics.

4. A device according to any preceding claim wherein the means of cooling the second component comprises a tube for conveying coolant or a thermoelectric wafer(s) in thermal contact with the second component.

5. A device according to any preceding claim wherein the first component is selectively cooled to control formation of condensation or ice on the outer surface of the device

6. A device according to claim 5 wherein the first component is selectively cooled by the provision of a gap or gaps between the first and second components and wherein an infill material of thermally insulating material is optionally provided in the gap or gaps.

7. A device according to any preceding claim wherein the first component is provided on the other side remote from the second component with a surface finish, for example metal plating such as chromium plating.

8. A device according to any preceding claim including a means of heating to remove the condensation or ice.

9. A device according to any preceding claim including a means of illuminating the outer surface of the device.

10. A device according to claim 9 wherein the illumination means illuminates an area of the outer surface free from condensation or ice.

11. A device according to claim 9 wherein the illumination means illuminates an area of the outer surface on which the condensation or ice forms.

12. A device according to any preceding claim including a means of controlling the formation of condensation or ice.

13. A device according to claim 12 wherein the control means includes a sensor to monitor the humidity in the ambient air and control the cooling means in response to the detected humidity, for example the cooling means may include a coolant circuit having a flow restrictor that is operable by a stepper motor in response to a feedback signal from the humidity sensor.

14. A method of forming ice or condensation on an outer surface of a device comprising providing a first component which on one side provides the outer surface of the device and on the opposite side is in thermal contact with a second component, the first component having a lower thermal conductivity than the second component, and cooling the second component whereby the outer surface is cooled by heat transfer between the first component and the second component causing ice or condensation to form on the outer surface where the first and second components are in thermal contact.

15. A method according to claim 14 wherein the thermal contact is controlled to form ice or condensation in a selected area or areas of the outer surface.

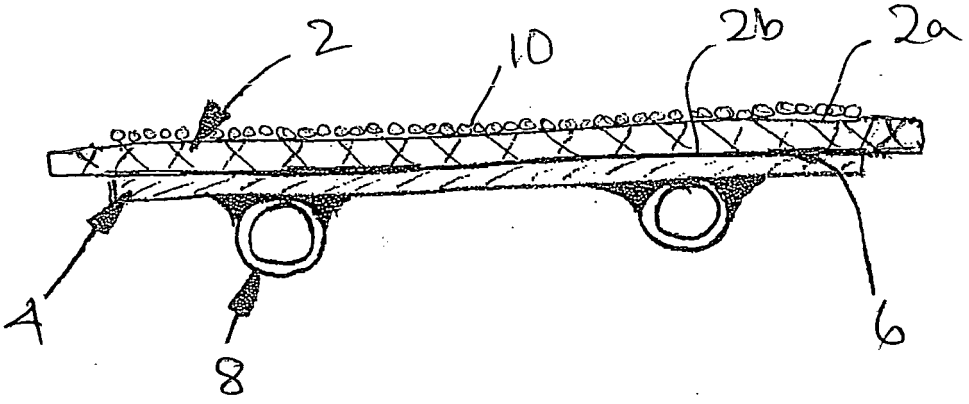

FIGURE 1

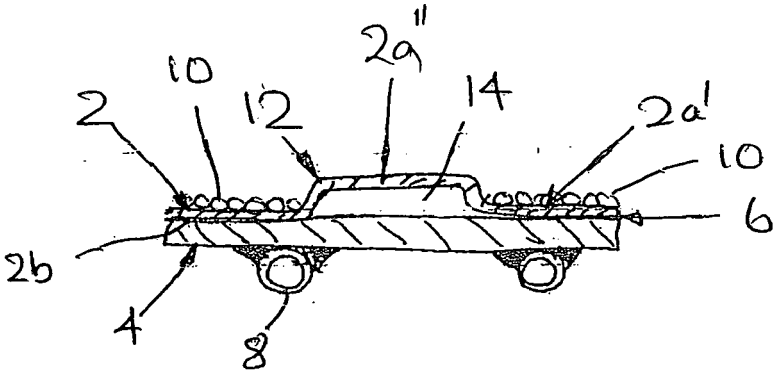

FIGURE 2a

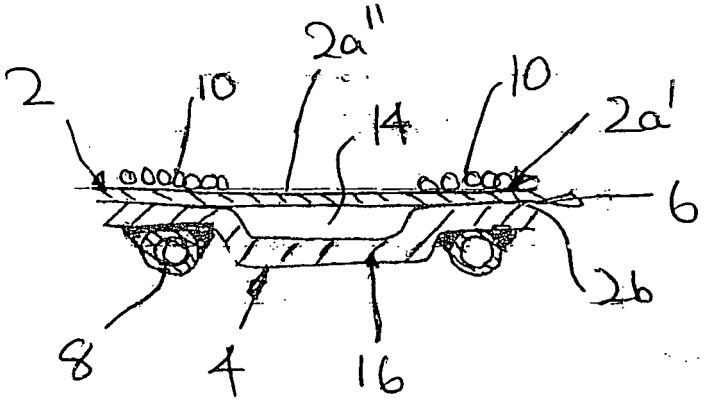

FIGURE 2b

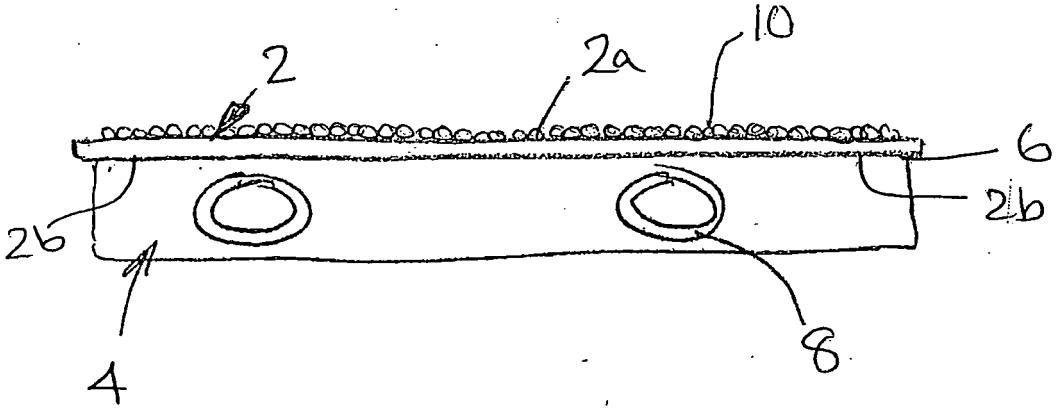

FIGURE 3

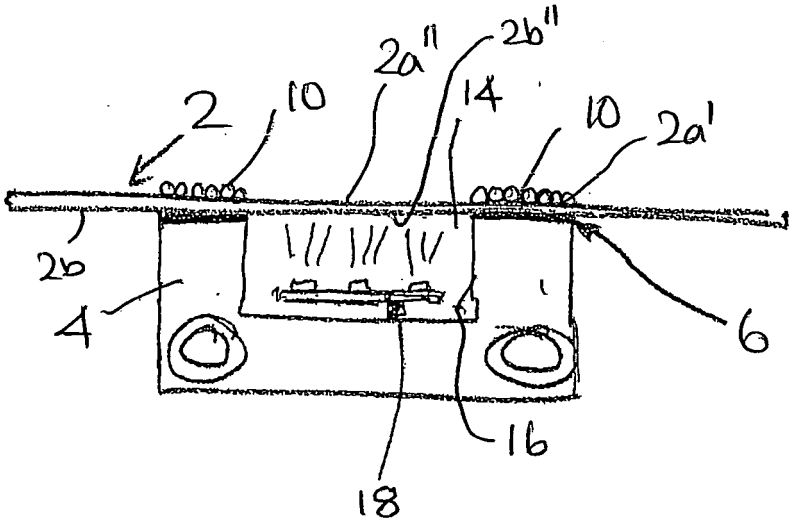

FIGURE 4

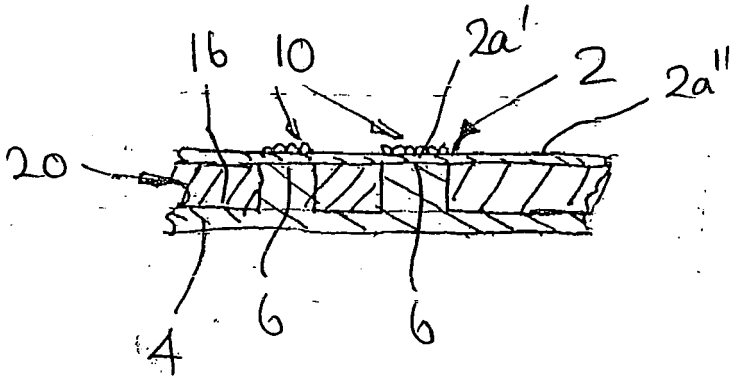

FIGURE 5a

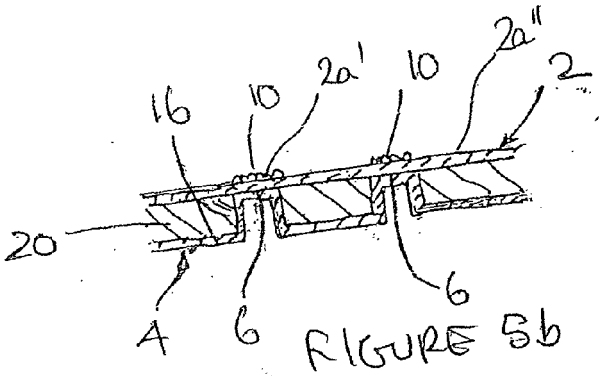

FIGURE 5b

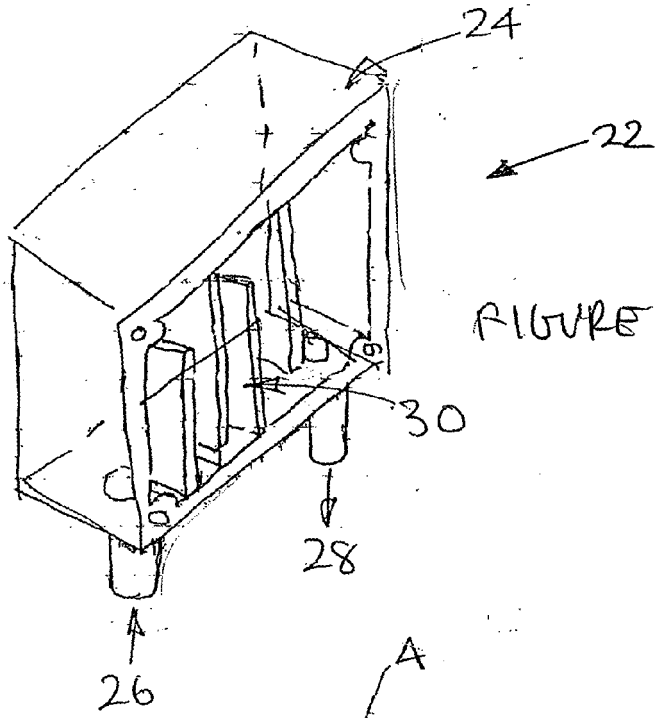

FIGURE 6

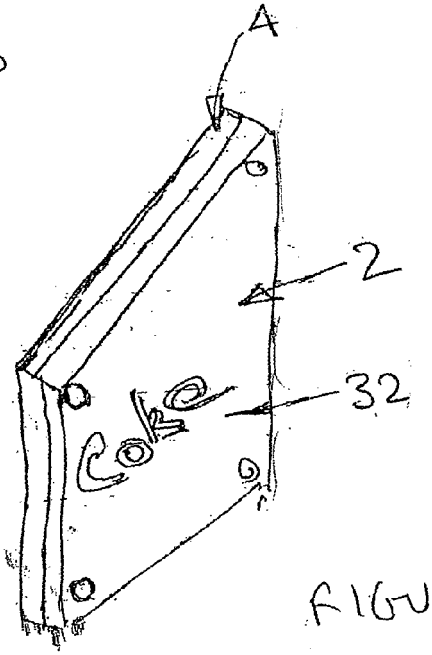

FIGURE 7