(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
26 October 2012 (26.10.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/143718 A1

(51) International Patent Classification:
B65D 83/38 (2006.01) ***G01M 3/10*** (2006.01) ***G01M 7/08*** (2006.01) ***B65D 1/02*** (2006.01)

(21) International Application Number: PCT/GB2012/050857

(22) International Filing Date: 19 April 2012 (19.04.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1106668.5 20 April 2011 (20.04.2011) GB

(71) Applicant *(for all designated States except US)*: **BRITVIC SOFT DRINKS LIMITED** [GB/GB]; Britvic House, Broomfield Road, Chelmsford, Essex CM1 1TU (GB).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **DANDO, Bill** [GB/GB]; c/o Britvic Soft Drinks Limited, Britvic House, Broomfield Road, Chelmsford, Essex CM1 1TU (GB).

(74) Agent: **BARKER BRETTELL LLP**; 100 Hagley Road, Edgbaston, Birmingham, West Midlands B16 8QQ (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: AN IMPROVED BASE CUP FOR A PRESSURISED CONTAINER

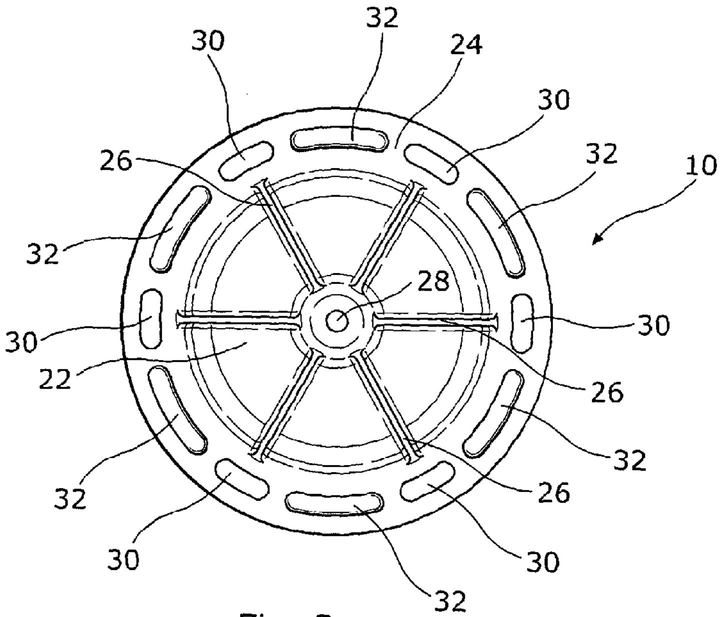

Fig. 3

(57) Abstract: The present invention provides an improved base cup (10) for a pressurised container, such as a plastic aerosol dispenser. The base cup comprises a cup-shaped body (18) for attaching to the base of the pressurised container, the cup-shaped body (18) having a base (22) including a rim (24) enclosing a plurality of support ribs (26). The rim (24) comprises a plurality of deformable zones (30), each zone being disposed on the rim (24) opposite to a respective support rib (26). In this way, the zones are able to deform under the action of an external force, which acts to disperse the force away from the ribs to mitigate against shearing of the base cup away from the container. As a result, the pressurised container is protected from the effects of an impact arising from dropping the pressurised container during transit or use etc. thereby consequently improving safety for the user.

WO 2012/143718 A1

AN IMPROVED BASE CUP FOR A PRESSURISED CONTAINER

The present invention relates to pressurised containers and particularly relates to a base cup for improving the safety of pressurised containers.

Pressurised containers, such as aerosols or aerosol dispensers, are commonly used for many applications. Aerosol dispensers may be made from metals (such as aluminium or steel) or plastic materials (such as LDPE or HDPE), and typically contain a liquid to be dispensed together with some form of propellant to facilitate ejection of the liquid from the container upon activation of a valve mechanism.

The use of pressurised plastic aerosol dispensers has increased in recent years, and in the same way as for their metal counterparts, plastic aerosols are subject to strict testing and safety regulations. Throughout Europe, the aerosol industry is regulated by the Fédération Européene des Aérosols or the European Aerosol Federation (FEA), which sets rigorous testing criteria to which all aerosols must comply. Of particular importance to plastic aerosol dispensers is FEA standard 647, which specifies the minimum technical requirements that a plastic aerosol should satisfy in order to meet the safety requirements within Europe.

As part of the testing under the FEA standard 647, a plastic aerosol dispenser must be dropped from a height of 1.8 metres onto a concrete floor, with a first sample of the aerosol being ‘conditioned’ at -20°C for 24 hours; a second sample at 40°C for 3 months and a third sample at 55°C for 6 hours - with each sample being allowed to reach room temperature before the ‘drop-test’ is carried out. Only if the dispenser does not break or leak is the aerosol allowed for consumer use.

A further test involves immersing the plastic aerosol in a hot water bath (typically at a temperature of 55°C) to determine whether any leakage of the product or propellant occurs. In addition, hot air tests are also set out in the FEA standard 647, which require the plastic aerosol to be maintained at 80°C in dry air for 5 hours to ensure that the container does not break or leak. This latter test is regarded as useful as it can provide information about the temperature induced deformation which can be different to that which occurs with hot water.

In the beverage or soft drinks industry, for example, it is common for containers to include a carbonated beverage, namely a liquid containing a sparingly soluble gas (i.e. CO_2) dissolved therein. However, in some instances it may be desirable to dispense the beverage via a plastic aerosol dispenser, as opposed to a conventional screw-top plastic bottle or metal can etc. In such cases, due consideration must then be given to the FEA standards, as the resulting product must be safe for consumer use. Existing mouldings for plastic beverage containers may typically incorporate some form of base, for example an integrally moulded 'pedestal base' or some form of separate 'base cup' that is attached to the bottom of the container.

However, in many cases conventional containers or container/base cup combinations fall far short of the standards required for FEA authorisation. Hence, it is found that a large number of plastic aerosols fail the FEA tests when conventional integral bases or base cups are used, as fractures can occur in the container during drop testing leading to leakage of the product. It is found, however, that even if a conventional base cup is able to prevent fracture of the plastic aerosol itself, it most cases the base cup will likely become detached from the aerosol due to the impact forces experienced when the aerosol is dropped on the ground. Although, the aerosol will thereby survive, it is undesirable to lose the base cup as this potentially exposes the aerosol to a subsequent failure (should it be dropped again), while also possibly inconveniencing the consumer, particularly where the product is a beverage etc. and it is desired to place the aerosol on a table or other surface while consuming the beverage.

Therefore, it is an object of the present invention to address some, if not all, of the above problems in the art, by providing an improved base cup for a pressurised container, such as a plastic aerosol, that mitigates against breakage or leakage of the container.

It is a further object of the present invention to provide an improved base cup for a plastic aerosol that renders the aerosol safe and reliable for consumer use.

According to an aspect of the present invention there is provided a base cup for a pressurised container, the base cup comprising:

a cup-shaped body for attaching to the base of the pressurised container, the cup-shaped body having a base including a rim enclosing a plurality of support ribs;

wherein the rim comprises a plurality of deformable zones, each zone being disposed on the rim opposite to a respective support rib.

The provision of a base cup having a rim comprising a plurality of deformable zones with each zone being disposed on a rim opposite to a respective support rib is found to be particularly advantageous as the deformable zones are able to essentially absorb or 'cushion' any impact when the pressurised container is dropped onto the ground or other hard surface. The resulting 'cushioning effect' manifests itself as a dispersal mechanism, in that deformation of the deformable zones serves to disperse or otherwise dissipate the forces of impact around the rim of the base cup.

Conventionally, many base cups include radial support ribs in the base of the cup, which are typically formed during the moulding process. The function of the support ribs is to increase the strength and integrity of the base cup, while potentially reducing the weight and quantity of plastic material used to form the base cup. However, it has been found that in conventional base cup designs, there is a high occurrence of separation between the pressured container and the base cup when the container is dropped onto the ground. Analysis by the current inventors has shown that the reason for this is that any impact forces on, or near, the rim of the base cup (for example, as occurring when the container is dropped such that is impacts the ground at an angle to the vertical) are directed along the radial support ribs closest to the region of impact, which results in shearing forces being created at the centre of the base cup. The shearing forces are thus ‘focussed’ towards the centre of the base cup, where conventionally the base cup is bonded to the base of the pressurised container (via adhesive or heat welding etc.).

As a result, the shearing forces typically lead to a separation of the base cup from the container, as the bond is sheared or broken, which then leaves the base of the container exposed. In addition, the focussing of the forces towards the centre of the base cup may also lead to direct failure of the pressurised container, as plastic aerosols are usually weakest at the centre of their bases, as the polymer has not been stretched and hardened in this region unlike the remainder of the container, as the base is usually the injection moulding attachment point.

Hence, in the present invention, the provision of deformable zones that are able to disperse any forces of impact away from the centre of the base cup is advantageous, as this reduces the likelihood of separation between the base cup and the pressurised container, while also reducing the risk that forces will be directed to the weakest point of the container. In this way, the chances of the pressurised container breaking or leaking are significantly lowered, which consequently improves safety for the consumer, while maintaining convenience of use.

Moreover, and in particular, it is found that the base cup of the present invention is able to impart sufficient safety and integrity to plastic aerosol dispensers intended for use within the beverage industry, such that the dispensers are able to satisfy the FEA standards, allowing their use throughout Europe.

It is to be understood that any references herein to 'a pressurised container' or 'pressurised containers' is intended to encompass any form of aerosol, plastic aerosol or plastic aerosol dispenser etc., including but not limited to, plastic aerosol dispensers for use in the beverage or soft drinks industry, typically of a form containing a liquid to be dispensed and a propellant to facilitate ejection of the liquid via a valve mechanism. No limitation as to the nature of the liquid or propellant is implied, and no particular shape or configuration of the container or bottle is to be construed, other than those having a base or base portion that is able to securely attach to the present base cup.

The cup-shaped body is preferably a 'squat cylinder' having an open end defining an interior recess for receiving the base of a pressurised container, such as a plastic aerosol. By 'squat cylinder' we mean that the height dimension is relatively shorter than the width dimension of the cylindrical body. The interior recess may contain a concave receiving surface for bonding to the base of the plastic aerosol. However, it is to be appreciated that any suitable shape or surface may be used as an interface for bonding to the plastic aerosol. The base cup may be bonded to the plastic aerosol via an adhesive or heat welding etc.

The body comprises an external base including a rim enclosing a plurality of support ribs. The rim defines the outer edge of the base and is preferably in the form of a flattened edge to enhance stability of the base cup (and plastic aerosol dispenser combination). The central part of the base is preferably recessed, but with a generally convex surface (which is reciprocal to the concave receiving surface for the base of the plastic aerosol). The recessed portion preferably includes the plurality of support ribs, each of which preferably extends from the rim inwards towards a central hub along a respective radial direction. The provision of the radial support ribs increases the strength and rigidity of the base cup.

The rim comprises a plurality of deformable zones, with each zone being disposed on the rim opposite to a respective support rib. By ‘opposite’ we mean that each zone resides on the rim at a position which lies on the line defined by the direction of a respective radial support rib, or putting this another way, each zone is located on the rim at the end of each support rib. In this way, each deformable zone is thereby operable to deform under the action of an external force at the end of a respective support rib, which is found to disperse the force throughout the rim, and importantly, not (solely) along the rib. Therefore, by locating each zone opposite to a respective support rib there is never a direct line of force to the centre of the base cup, which significantly reduces or otherwise eliminates, the emergence of any shearing forces at the centre of the base cap. As a result, the likelihood of the base cap separating from the plastic aerosol is markedly reduced, which also reduces the risk that forces can be concentrated at the base of the plastic aerosol, diminishing the chances that fracture or breakage of the aerosol will occur.

The plurality of deformable zones are preferably in the form of apertures (or holes) in the rim. Each zone corresponds to a respective aperture that is located at the end of a respective radial support rib. The presence of an aperture in the rim permits the rim to more easily deform in the region of the aperture, such that when the rim or edge of the external wall of the body is compressed or squeezed (by action of an impact force etc.), the aperture can 'collapse' to absorb and cushion the force on the base cup. The action of deforming the aperture serves to disperse the force away from the radial direction defined by the respective support rib, so that shearing forces are reduced or eliminated at the centre of the base cup.

In preferred embodiments, each aperture extends circumferentially around a portion of the rim substantially tangential to a respective support rib. The centre of each aperture preferably resides on the line defined by the direction of the respective support rib, with each aperture preferably being arcuate and elongate in shape. Hence, the length dimension of each aperture preferably follows the circumferential direction defined by the rim, and as such each arcuate aperture is concentric with the centre of the base cup.

The angle subtended by each aperture (as measured relative to the centre of the base cup) is preferably in the range of about 12 degrees to about 24 degrees. However, it is found that an aperture which subtends an angle of close to 12 degrees is optimum in terms of dispersing the force and avoiding a separation event of the base cup and plastic aerosol. Therefore, although other aperture sizes may be used in conjunction with the present invention, an aperture size of around 12 degrees is preferred and indeed is found to be the best size for complying with the FEA standards for the base cap / plastic aerosol combination.

Of course, it is to be appreciated that any other shape of aperture may alternatively be used in conjunction with the present invention, while still achieving the benefits of the invention. Thus, circular holes could be used instead etc., provided that deformation of the aperture results in the forces being dispersed around the rim, as opposed to along the radial support rib.

Notwithstanding the advantageous effect of the apertures in cushioning and dispersing external forces away from the centre of the base cup, the apertures also serve another important function, in that they further allow any trapped liquid (e.g. water) to drain from the interior of the base cup. Recalling, from above, the hot water bath test of the FEA standards, each plastic aerosol is subjected to a water bath test during production line filling to check for leaks of product and/or propellant. Hence, as the connection between the base cup and the plastic aerosol is generally not water-tight, water ingress usually occurs into the base cup. If left unchecked, such water retention can lead to microbial growth in the inside of the base cup, which is undesirable, particularly in beverage dispensers, as this can pose a health risk to the consumer. Thus, the apertures in the present base cup serve the secondary function of facilitating draining of residual water from the base cup following water bath testing. In this way, the interior of the base cup remains dry after testing, which avoids microbial development.

In another preferred embodiment, the base cup may further comprise a second plurality of deformable zones disposed in the surface of the side wall of the cup-shaped body. As discussed above, the body is preferably a squat cylinder, with the side wall of the body being preferably upstanding from the base. The second plurality of deformable zones are preferably disposed circumferentially around the side wall and most preferably proximal to the rim. Any suitable arrangement and spacing of the deformable zones may be adopted, but it is preferred that the zones are spaced uniformly.

The function of the second plurality of deformable zones is preferably similar to the deformable zones in the rim, in that the second zones serve to disperse or dissipate external (impact) forces around the body of the base cup when the plastic aerosol is dropped onto the ground in a substantially vertical orientation. Hence, as above, the deformation of the deformable zones serve to 'cushion' and disperse the effect of the impact forces, which further avoids or eliminates the generation of shearing forces at the centre of the base cup.

Preferably, the second plurality of deformable zones are in the form of apertures in the side wall of the body, and are most preferably arcuate and elongate in shape. The second apertures may be located so that they are each in line with a respective support rib on the underside of the body, or alternatively may be disposed in some other arrangement around the side wall (e.g. in regions of the wall located between support rib positions etc.).

In addition to the impact cushioning effect of the second plurality of deformable zones, the zones also further facilitate draining of any liquid from within the interior of the base cup. Hence, in this way, the first and second zones act together to ensure that the interior of the base cup remains dry, thus avoiding or inhibiting any microbial growth.

It is to be appreciated that any number of first deformable zones and second deformable zones may be used in the base cup of the present invention. However, in the first case, it is required that there be at least one deformable zone opposite each support rib, whereas there may be any suitable number of second deformable zones, subject to preserving the structural integrity and strength of the base cup. Hence, in practice, there will be an optimum number of second deformable zones depending on the size of the base cup and the plastic aerosol to be used.

In all embodiments, the deformation of the deformable zones and the overall cushioning and dispersal effect can be altered by selecting appropriate plastic materials. Hence, for example, more deformation, or indeed a substantially elastic deformation, could be achieved by using softer plastics, while harder plastics would give more strength but are more likely to crack or fracture due to their less elastic properties. Testing has revealed that polypropylene tends to give rise to a base cup that is too stiff and brittle, while low density polyethylene (LDPE) is generally too soft and does not afford sufficient protection for the plastic aerosol. However, high density polyethylene is found to be preferred, as it provides a base cup having the most appropriate deformation and elastic characteristics for ensuring the plastic aerosol meets the FEA standards.

Of course, other plastics and/or resin blends may alternatively be used depending on the particular application and/or aerosol type, without sacrificing any of the benefits of the present invention.

The rim may further comprise a plurality of elevated or raised pads, which are preferably, alternately disposed relative to the first plurality of deformable zones. The elevated pads are preferably arranged to extend/protrude slightly above the flattened surface of the rim to essentially act as multiple 'feet' on which the base cup and plastic aerosol can stand when not in use. In this way, the stability of the base cup can be further improved, while also leaving a small amount of clearance at the base of the base cup for potentially draining any fluid from within the base cup.

The pads are preferably arcuate and elongate in shape, and preferably have a length or angular extent determined by the size and number of deformable zones in the rim. However, in preferred embodiments there would be one pad between each adjacent pair of support ribs, which for a base cup having 6 support ribs, would mean there would also be 6 pads etc. Of course, any number of pads could be used with the base cup of the present invention, provided a symmetrical configuration is adopted to maintain stability of the base cup. Hence, it is preferred that the elevated pads are equally spaced around the circumference of the rim.

The base cup may be fabricated by any suitable moulding process, and is most preferably moulded as a single-injection moulded component according to conventional techniques.

The present invention is also directed to a pressurised container, such as a plastic aerosol dispenser, comprising a base cup according to any of the preceding embodiments. Most preferably, the plastic aerosol and base cup combination may be used in the beverage and soft drinks industry, wherein the liquid to be dispensed is a consumable beverage.

It is to be understood that none of the preceding embodiments are intended to be mutually exclusive, and therefore features described in relation to any particular embodiment may be used additionally and/or interchangeably with features described in relation to any other embodiment without limitation.

Embodiments of the present invention will now be described in detail by way of example and with reference to the accompanying drawings in which:

Figure 1 – is a perspective view of a preferred embodiment of a base cup according to the present invention as attached to an example pressurised container;

Figure 2 – is a bottom plan view of the underside of a conventional base cup;

Figure 3 – is a bottom plan view of the underside of a base cup according to a particularly preferred embodiment of the present invention;

Figure 4 – is a bottom plan view of the underside of the base cup of Figure 3, showing deformation of the base cup under the action of an external force;

Figure 5 – is a bottom plan view of the underside of a base cup according to an exemplary embodiment of the present invention;

Figure 6 – is a bottom plan view of the underside of a base cup according to another embodiment of the present invention;

Figure 7 – is a bottom plan view of the underside of a base cup according to a further embodiment of the present invention;

Figure 8 – is a side perspective view of a base cup according to another particularly preferred embodiment of the present invention, shown attached to part of an example pressurised container.

Referring to Figure 1, there is shown a preferred embodiment of a base cup 10 according to the present invention, as attached to an example pressurised container, in this case, a plastic aerosol dispenser 12 having an actuator 14 and a hollow body 16 for holding a liquid beverage and propellant.

The base cup 10 comprises a substantially cup-shaped body 18 in the form of a 'squat cylinder', having an open end (not shown) defining an interior recess for receiving the base of the plastic aerosol dispenser 12 and a circumferential wall 20 upstanding from the base 22 of the base cup. The interior recess contains a concave receiving surface (not shown) for bonding to the base of the hollow body 16, via a water-proof adhesive.

The diameter of the cup-shaped body 18 is approximately 6 cm, and the height dimension of the wall 20 is approximately 3 cm. However, it is to be appreciated that the base cup of the present invention is inherently scalable and therefore any suitable diametrical and height dimensions may be used without sacrificing the benefits of the present invention.

Referring to Figure 3, there is shown an exemplary embodiment of a base cup 10 according to the present invention. The base cup 10 is depicted in plan view showing the underside or base 22 of the base cup. The base 22 comprises a flattened rim 24, which defines the outer edge of the base and which circumferentially encloses a plurality of radial support ribs 26.

The central part of the base 22 is recessed, but has a generally convex surface (which is reciprocal to the concave receiving surface for the base of the hollow body 16). The recessed portion includes the plurality of support ribs 26, each of which extends from the rim 24 inwards towards a central hub 28 along a respective radial direction. The provision of the radial support ribs 26 increases the strength and rigidity of the base cup 10, without significantly increasing the weight of the base cup.

As shown in Figure 3, the rim 24 comprises a plurality of deformable zones 30, with each zone 30 being disposed on the rim opposite to a respective support rib 26. By ‘opposite’ we mean that each zone 30 resides on the rim at a position which lies on the line defined by the direction of a respective radial support rib 26, or putting this another way, each zone 30 is located on the rim 24 at the end of each support rib 26 (see Figure 3). In this way, each deformable zone 30 is thereby operable to deform under the action of an external force at the end of a respective support rib 26, which is found to disperse the force throughout the rim 24, and importantly, not (solely) along the rib 26.

Therefore, by locating each zone 30 opposite to a respective support rib 26 there is never a direct line of force to the centre of the base cup 10, which significantly reduces or otherwise eliminates, the emergence of any shearing forces at the centre of the base cup. As a result, the likelihood of the base cup 10 separating from the plastic aerosol dispenser 12 is markedly reduced, which also reduces the risk that forces can be concentrated at the base of the plastic aerosol dispenser 12, diminishing the chances that fracture or breakage of the aerosol will occur.

In the example of Figure 3, the plurality of deformable zones 30 are in the form of arcuate apertures (or holes) in the rim 24. The presence of an aperture 30 in the rim 24 permits the rim to more easily deform in the region of the aperture, such that when the rim 24 or edge of the external wall 20 of the body 18 is compressed or squeezed (by action of an impact force etc.), the aperture can ‘collapse’ to absorb and cushion the force on the base cup 10, thereby better protecting the plastic aerosol dispenser 12 (cf. Figure 4).

As shown in Figure 4, the action of deforming an aperture 30 serves to disperse the force (represented as arrows) away from the inward radial direction defined by the respective support rib 26, and spreads it throughout the rim 24, such that any shearing forces are reduced or eliminated at the centre of the base cup 10. As a result, the likelihood of the base cup 10 separating from the plastic aerosol dispenser 12 is significantly reduced, which ensures that the overall integrity of the base cup and plastic aerosol dispenser is preserved, while also satisfying the FEA drop test standards.

The base cup 10 of Figure 3 should be contrasted with the base cup shown in Figure 2, which offers little or no protection against impact forces being directed along the radial support ribs. Hence, the use of such an base cup on a plastic aerosol dispenser would in virtually all cases fail the FEA drop test standards, as the forces of impact would be directed along the nearest rib(s) to the point of impact, thereby focussing the forces to the centre of the base cup, leading to likely shearing of the base cup from the plastic aerosol dispenser and probable failure of the aerosol itself, as the forces will tend to act on the weakest point of the aerosol, namely, the injection moulding attachment point (not shown).

As shown in the examples of Figures 5 to 7, the angle subtended by each arcuate aperture 30 (as measured relative to the centre of the base cup) is ideally in the range of about 12 degrees to about 24 degrees. However, it is found that an aperture which subtends an angle of close to 12 degrees is optimum in terms of dispersing the force and avoiding a separation event of the base cup 10 and plastic aerosol dispenser 12. In fact, testing has revealed that in virtually all cases with an aperture size of 12 degrees, no damage is sustained to the plastic aerosol dispenser, while in more than 80% of the tests no separation occurs between the base cup and plastic aerosol dispenser. This level of success is more than adequate to satisfy the FEA drop test standards, and consequently the base cup of Figure 5 is suitable for ensuring that the plastic aerosol dispenser meets the FEA regulations.

Therefore, although other aperture sizes may be used in conjunction with the present invention, an aperture size of 12 degrees is preferred and indeed is found to be the best size for complying with the FEA standards for the base cap / plastic aerosol dispenser combination. Although larger aperture sizes still serve to disperse impact forces around the rim, this comes at the price of potentially reducing the rigidity and strength of the base cup. Therefore, there is a practical upper limit to the size of the aperture without unduly weakening the overall stability of the base cup.

The apertures 30 also serve another important function, besides from protecting/cushioning the plastic aerosol dispenser from external forces, in that they further allow any trapped liquid (e.g. water) to drain from the interior of the base cup. To satisfy FEA standards, each plastic aerosol is subjected to a water bath test during production line filling to check for leaks of product and/or propellant. Hence, as the connection between the base cup and the hollow body 16 of the plastic aerosol dispenser is generally not water-tight, water ingress usually occurs into the base cup. If left unchecked, such water retention can lead to microbial growth in the inside of the base cup, which is undesirable, particularly in beverage dispensers, as this can pose a health risk to the consumer. Thus, the apertures 30 in the base cup 10 serve the secondary function of facilitating draining of residual water from the base cup following water bath testing. In this way, the interior of the base cup remains dry after testing, which avoids microbial development.

Referring again to Figures 3 and 5 to 7, the rim 24 also comprises a plurality of elevated or raised pads 32, which are alternately disposed relative to the apertures 30. The elevated pads 22 are arranged to extend/protrude slightly above the flattened surface of the rim 24 to essentially act as multiple 'feet' on which the base cup 10 and plastic aerosol dispenser 12 can stand when not in use. In this way, the stability of the base cup 10 can be further improved, while also leaving a small amount of clearance at the base 22 of the base cup 10 for potentially draining any fluid from within the base cup.

The pads 32 are arcuate and elongate in shape, and generally have a length or angular extent determined by the size and number of apertures 30 in the rim 24 (cf. Figures 5 to 7). Typically, as shown in Figures 5 to 7, there will be one pad 32 between each adjacent pair of support ribs 26, which for a base cup 10 having six support ribs 26, would mean there would also be six pads etc. Of course, any number of pads 32 could be used with the base cup 10 of the present invention, provided a symmetrical configuration is adopted to maintain stability of the base cup. Hence, in practice the elevated pads are equally spaced around the circumference of the rim 24.

Referring to Figure 8, there is shown another preferred embodiment of a base cup 10 according to the present invention. In this example, the base cup 10 further comprises a second plurality of deformable zones 34 disposed in the surface of the side wall 20 of the cup-shaped body 18. As shown in Figure 8, the second plurality of deformable zones 34 are disposed uniformly and circumferentially around the side wall 20, and are proximal to the rim 24 near to the base 22 of the base cup.

The function of the second plurality of deformable zones 34 is similar to the apertures 30 in the rim 24, in that the second zones 34 serve to disperse or dissipate external (impact) forces around the body 18 of the base cup 10 when the plastic aerosol dispenser is dropped onto the ground in a substantially vertical orientation. Hence, as above, the deformation of the deformable zones 34 serve to 'cushion' and disperse the effect of the impact forces, which further avoids or eliminates the generation of shearing forces at the centre of the base cup 10.

Much like in Figures 3, and 5 to 7, the second plurality of deformable zones are in the form of apertures 34, which are generally arcuate and elongate in shape. The second set of apertures 24 can be located so that they are each in line with a respective support rib 26 on the underside of the body 18, or alternatively can be disposed in some other arrangement around the side wall 20 (e.g. in regions of the wall located between support rib positions etc.).

In addition to the cushioning effect that the second set of apertures 34 provide, the apertures 34 also further facilitate draining of any liquid from within the interior of the base cup 10. Hence, in this way, the first and second sets of apertures 30, 34 act together to ensure that the interior of the base cup 10 remains dry, thus avoiding or inhibiting any microbial growth.

In each of the examples of Figures 3 to 8, the base cup 10 can be fabricated from high density polyethylene (HDPE), which is found to be ideally suited for this purpose, as it gives the base cup the most appropriate deformation and elastic characteristics for ensuring that the plastic aerosol dispenser meets the FEA standards.

It is to be appreciated that other modifications and/or alterations may be used in conjunction with the base cup of the present invention. Thus, for example, the deformable zones may not be open apertures, but instead may be regions in the rim and/or wall that have a reduced thickness compared to their surroundings. Hence, the zones could be in the form of a thin (elastic) membrane (e.g. formed by reducing the wall thickness), which is able to undergo deformation by action of an external force. However, in such arrangements, there would be no draining function, and so the zones would not be able to assist with the draining of the interior of the base cup, and so in practice apertures are preferred.

In other arrangements, it would also be possible to substitute the second set of apertures for a collapsible wall structure, such that it is able to concertina, which could serve to absorb and cushion any impacts when the dispenser is dropped in a substantially vertical orientation.

Although the base cup of the present invention is ideally suited for ensuring that plastic aerosol dispensers within the beverage and soft drinks industry meet the FEA drop test standards, it will be recognised that one or more of the principles of the invention may extend to other pressurised container applications (e.g. shaving foams and creams, personal hygiene, or spray paints etc.), whereby it is desirable to avoid damage to the container should there be a risk that the container may be dropped during transit or use etc. In particular, it should also be noted that the present base cup is inherently scalable and therefore could be used with pressurised containers of different size, without sacrificing any of the benefits of the present invention.

The above embodiments are described by way of example only. Many variations are possible without departing from the invention.

CLAIMS

1. A base cup for a pressurised container, the base cup comprising:

a cup-shaped body for attaching to the base of the pressurised container, the cup-shaped body having a base including a rim enclosing a plurality of support ribs;

wherein the rim comprises a plurality of deformable zones, each zone being disposed on the rim opposite to a respective support rib.

2. The base cup of Claim 1, wherein each deformable zone is operable to deform under the action of an external force to thereby disperse the force throughout the rim.

3. The base cup of Claim 1 or Claim 2, wherein the deformable zones are in the form of apertures in the rim.

4. The base cup of any preceding claim, wherein each aperture extends circumferentially around a portion of the rim substantially tangential to a respective support rib.

5. The base cup of any preceding claim, wherein each aperture is arcuate.

6. The base cup of Claim 5, wherein each aperture subtends an angle in the range of about 12 to about 24 degrees.

7. The base cup of any preceding claim, wherein each aperture further acts as a drain hole for draining liquid from the interior of the base cup.

8. The base cup of any preceding claim, wherein the rim is substantially flat.

9. The base cup of any preceding claim, wherein the cup-shaped body further comprises a cylindrical side wall upstanding from the base.

10. The base cup of Claim 9, further comprising a second plurality of deformable zones disposed in the surface of the side wall.

11. The base cup of Claim 10, wherein the second plurality of deformable zones are disposed circumferentially around the side wall and proximal to the rim.

12. The base cup of Claim 10 or Claim 11, wherein the second plurality of deformable zones are spaced uniformly.

13. The base cup of any of Claims 10 to 12, wherein the second plurality of deformable zones are in the form of apertures in the side wall.

14. The base cup of any of Claims 10 to 13, wherein each deformable zone is operable to deform under the action of an external force to thereby dissipate the force throughout the side wall.

15. The base cup of any preceding claim, wherein the rim further comprises a plurality of elevated pads alternately disposed relative to the plurality of deformable zones.

16. The base cup of Claim 15, wherein the elevated pads are equally spaced around the circumference of the rim.

17. The base cup of any preceding claim, wherein the support ribs are coupled to the rim.

18. The base cup of any preceding claim, wherein the base cup is a single injection-molded component.

19. A pressurised container comprising a base cup according to any of Claims 1 to 18.

20. A base cup substantially as hereinbefore described with reference to Figures 1 to 8 of the accompanying drawings.

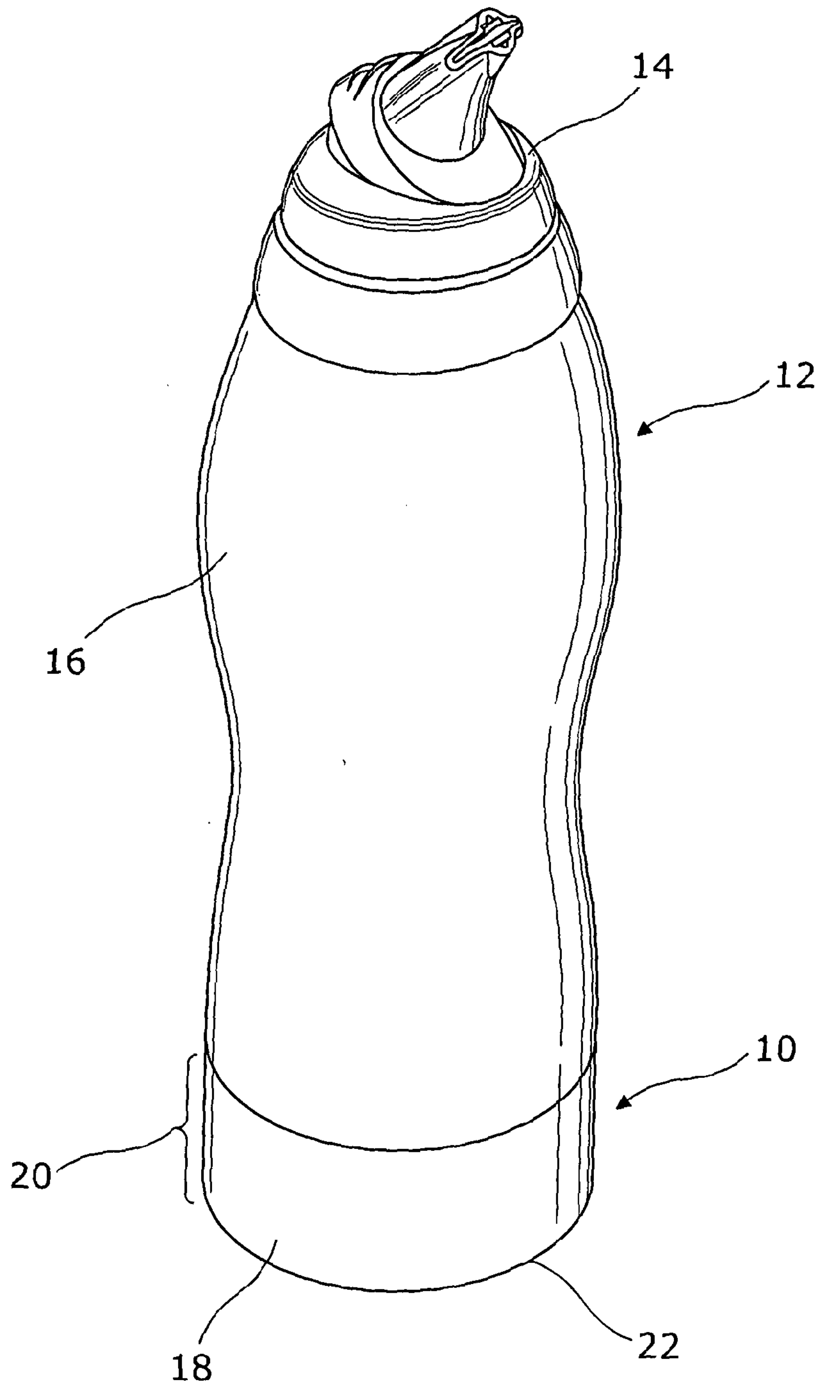

Fig. 1

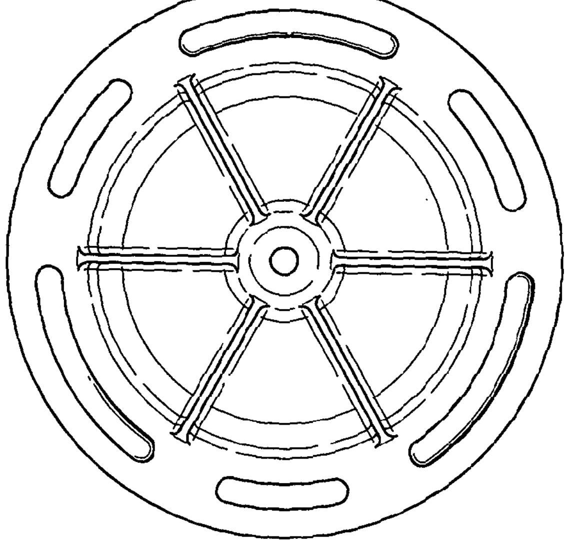

Fig. 2
(Prior Art)

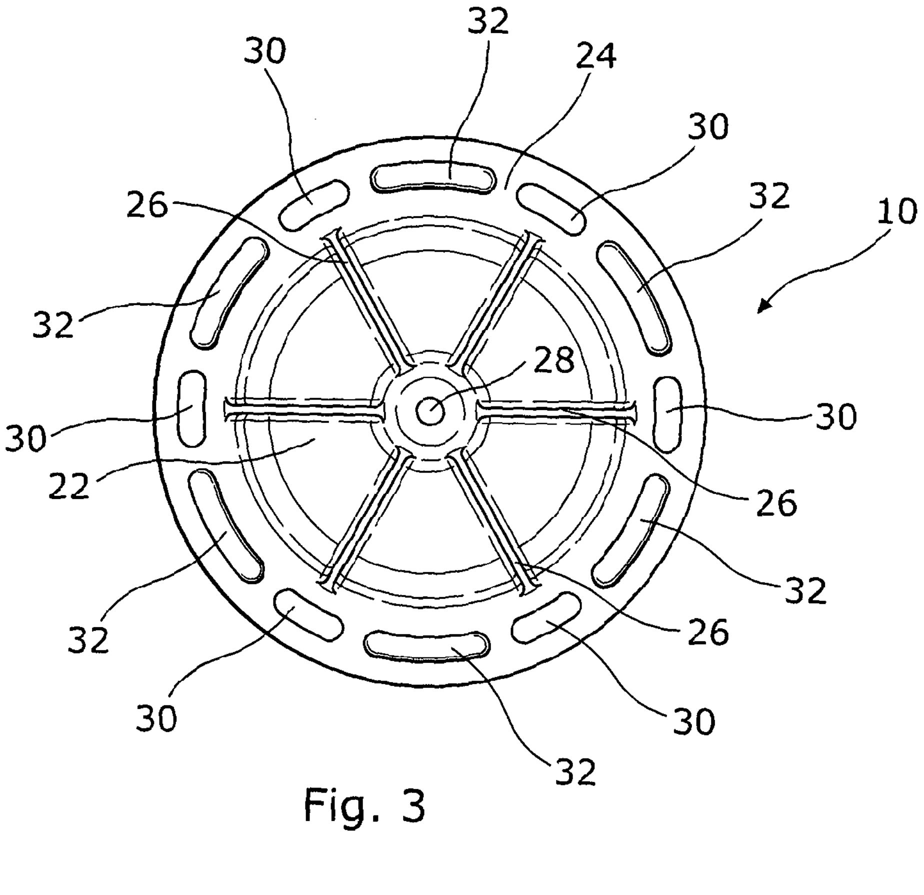

Fig. 3

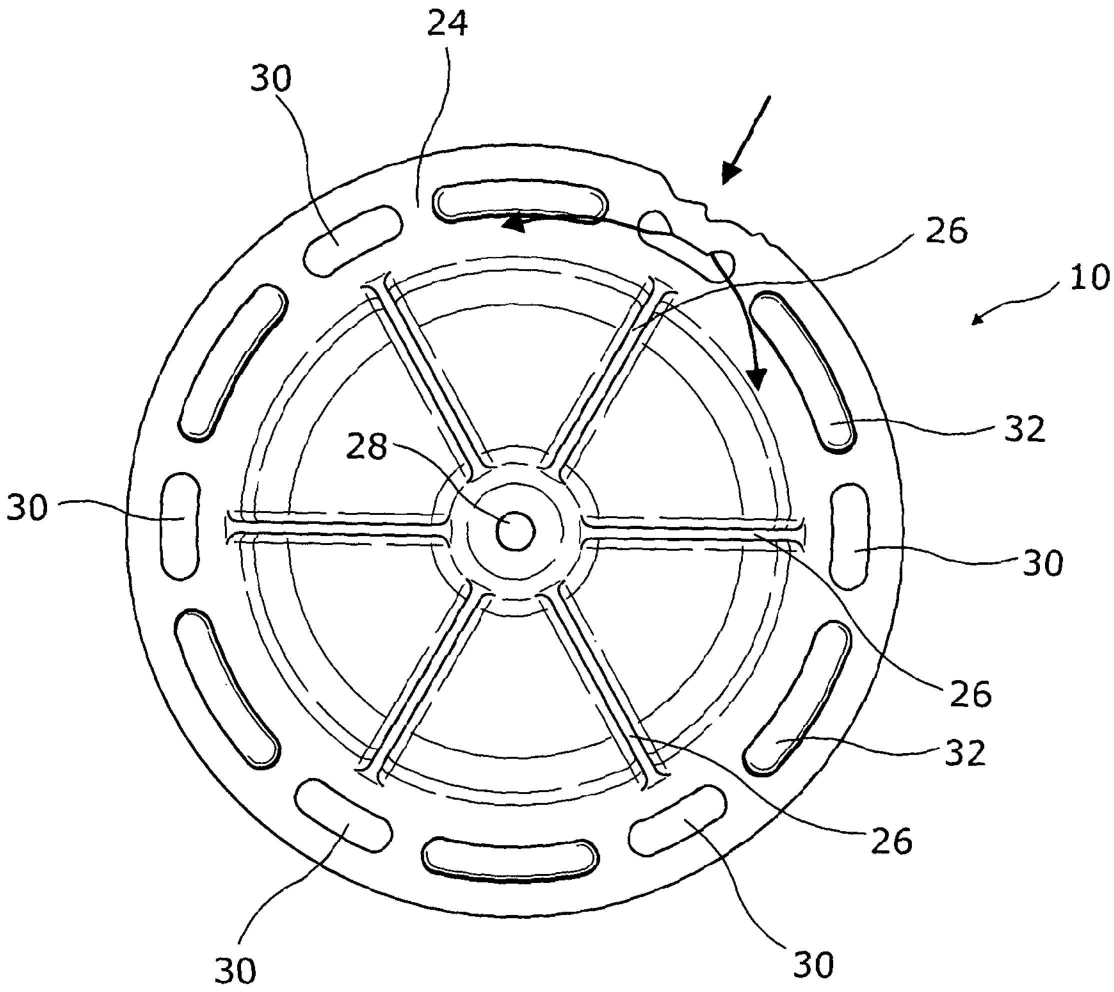

Fig. 4

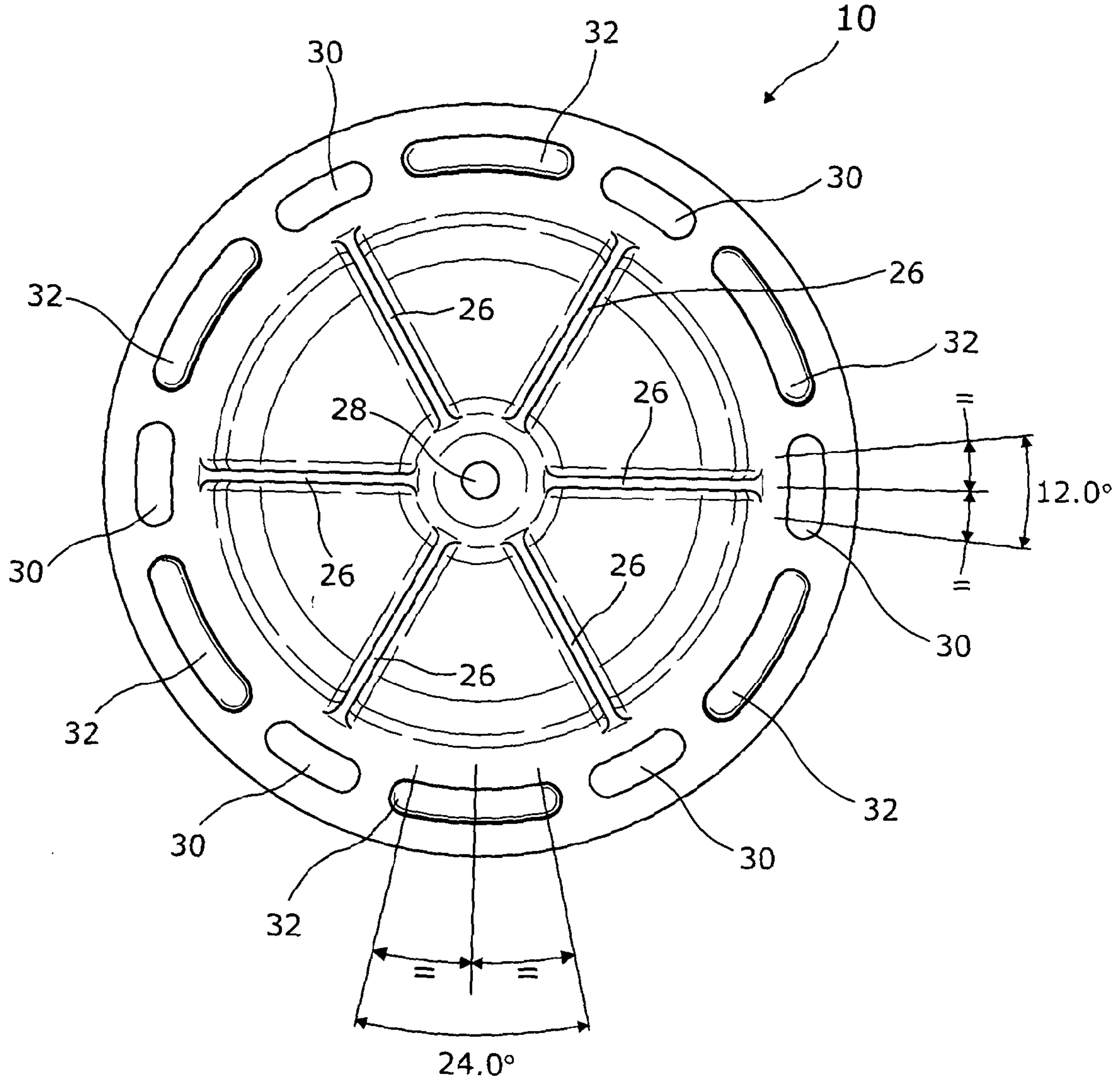

Fig. 5

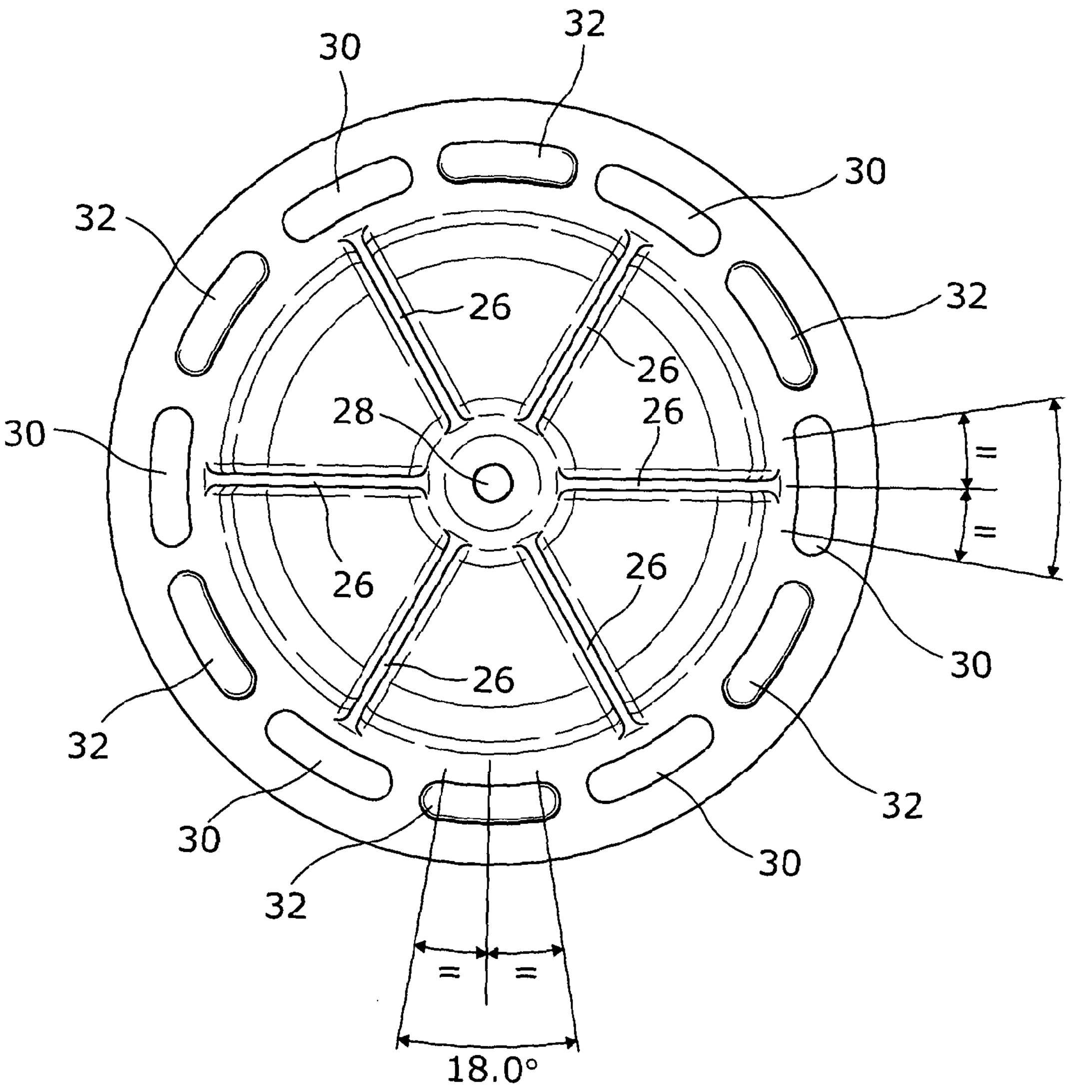

Fig. 6

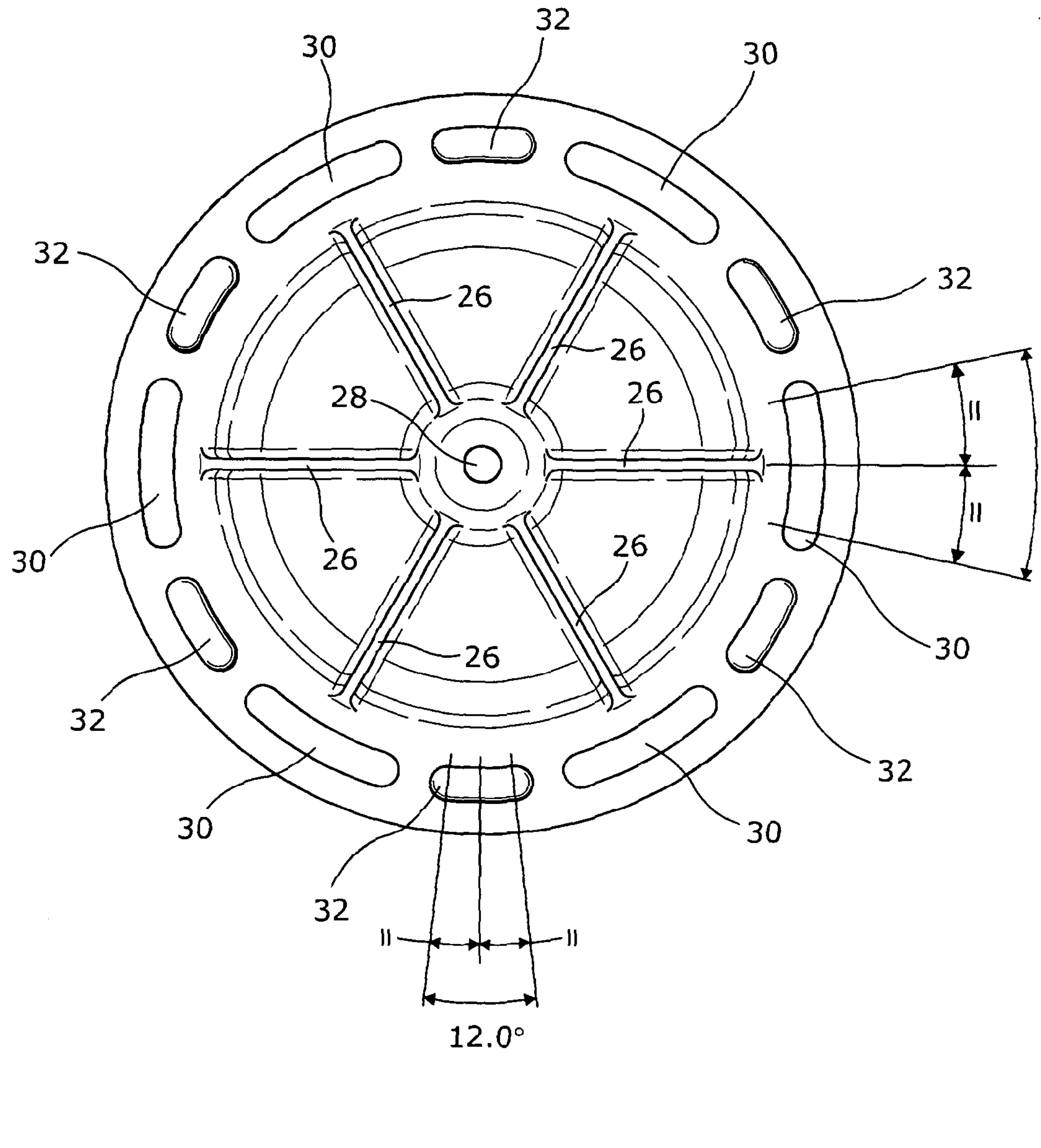

Fig. 7

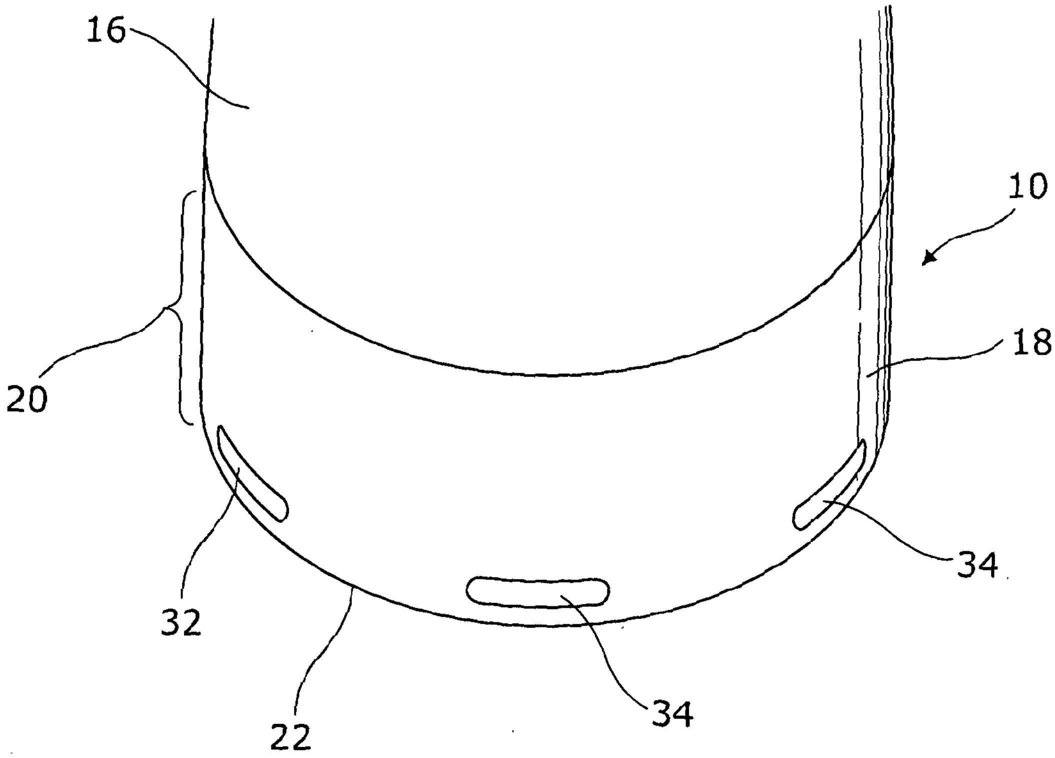

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2012/050857

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D83/38
ADD. G01M7/08 G01M3/10 B65D1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7 051 889 B2 (BOUKOBZA MICHEL [FR]) 30 May 2006 (2006-05-30) column 5, line 29 - line 32; figures 1,2A,2B	1,2,9, 15-18,20
X	WO 2008/017748 A1 (SIDEL PARTICIPATIONS [FR]; BOUKOBZA MICHEL [FR]) 14 February 2008 (2008-02-14) page 9, line 29 - line 33; figures 1,2	1,2,8,9, 15-20
X	US 4 403 706 A (MAHAJAN GAUTAM K [US]) 13 September 1983 (1983-09-13)	20
A	figures 6,7	1-19
X	JP 6 336240 A (MITSUBISHI PLASTICS IND) 6 December 1994 (1994-12-06)	20
A	figures 1,2	1-19

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 August 2012	28/08/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Gineste, Bertrand

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2012/050857

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7051889 B2	30-05-2006	AT 285945 T	15-01-2005
		BR 0208556 A	02-03-2004
		CA 2441593 A1	17-10-2002
		CN 1500049 A	26-05-2004
		DE 60202450 D1	03-02-2005
		DE 60202450 T2	09-02-2006
		EP 1373076 A1	02-01-2004
		ES 2235031 T3	01-07-2005
		FR 2822804 A1	04-10-2002
		JP 3741689 B2	01-02-2006
		JP 2004524236 A	12-08-2004
		MX PA03009067 A	17-02-2004
		PT 1373076 E	31-05-2005
		US 2004094502 A1	20-05-2004
		WO 02081312 A1	17-10-2002
WO 2008017748 A1	14-02-2008	AT 492477 T	15-01-2011
		CN 101522533 A	02-09-2009
		EP 2084070 A1	05-08-2009
		FR 2904810 A1	15-02-2008
		JP 2010500242 A	07-01-2010
		WO 2008017748 A1	14-02-2008
US 4403706 A	13-09-1983	NONE	
JP 6336240 A	06-12-1994	NONE	