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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 July 2004 (01.07.2004)

PCT

(10) International Publication Number
WO 2004/054722 A1

(51) International Patent Classification[7]: B05B 11/00

(21) International Application Number:
PCT/GB2003/005302

(22) International Filing Date: 5 December 2003 (05.12.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0229099.7 13 December 2002 (13.12.2002) GB
0313474.9 11 June 2003 (11.06.2003) GB

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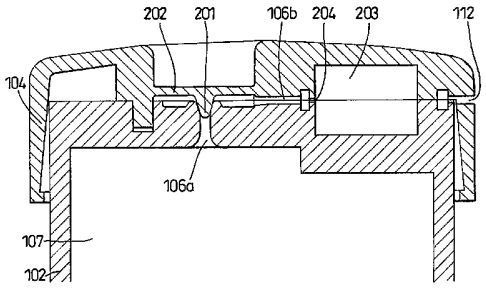
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

[Continued on next page]

(54) **Title:** PUMP-ACTION NOZZLE ARRANGEMENTS



(57) **Abstract:** The present invention to a pump-action nozzle arrangement (100) adapted to be fitted to an opening of a container and enable a liquid or air/gas to be dispensed from the interior of said container during use. The nozzle arrangements (100) have a body which defines: (i) an internal chamber (102) ; (ii) an inlet (110) through which fluid can be drawn into said chamber (102); (iii) an outlet orifice (112) ; and (iv) an internal passageway (106) that connects said chamber to said outlet orifice. The nozzle arrangement (100) also further comprises a one-way inlet valve (108a) adapted to only permit fluid to be drawn into said internal chamber (107) through the inlet when the pressure within the chamber falls below the external pressure, an actuator and a one-way precompression valve (105) disposed in the internal passageway (106) that is configured to only permit fluid to flow along said internal passageway (106) when the pressure within the chamber equals or exceeds a predetermined minimum threshold pressure. The body of nozzle arrangement (100) is configured such that the internal volume of the chamber (107) is reduced when said actuator is operated, thereby causing fluid stored in the chamber (107) to be ejected along said internal passageway (106) to the outlet office, and increased when said actuator is released, thereby causing fluid to be drawn into the chamber (107) through the inlet (110). The precompression valve (105) comprises a valve member integrally formed with a portion of the body that defines said internal passageway (106), said valve member being configured to assume a resiliently biased configuration in which said internal passageway (106) is closed when the pressure within the chamber (107) is below the predetermined minimum threshold pressure and to be displaced from said resiliently biased configuration to define an opening through which fluid can flow along the internal passageway (106) when the pressure within the chamber (107) equals or exceeds the predetermined minimum threshold pressure.

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PUMP-ACTION NOZZLE ARRANGEMENTS

The present invention relates to pump-action nozzle arrangements.

Pump-action nozzle arrangements are commonly used as a means for dispensing a liquid from the interior of non-pressurised containers. Conventional pump-action nozzle arrangements are adapted to be fitted to an outlet opening of a container and comprise an internal chamber which is compressed when an actuator of the nozzle device is operated, thereby increasing the pressure within the chamber and forcing any liquid present therein to flow out through an outlet of the device. Once the desired volume of liquid has been dispensed, or the chamber has been compressed to its fullest extent, the actuator is then released by the operator and the chamber is allowed to re-expand, which causes the pressure within the chamber to reduce, which in turn causes more liquid to be drawn into the chamber from the associated container through an inlet. One-way valves are provided at the inlet and the outlet to ensure that fluid can only be expelled from the internal chamber through the outlet and drawn into the chamber through the inlet.

The actuator is typically a portion of the body of the nozzle device that can be depressed and subsequently released by an operator (generally known as pump nozzle arrangements), or a trigger that an operator can pull and then subsequently release (generally known as trigger-actuated nozzle

arrangements), to cause the chamber to be compressed and then re-expanded respectively.

To ensure that the liquid ejected from the internal chamber with sufficient force to form a spray, it is known to provide a valve at the outlet of the chamber, generally known as a pre-compression valve, which is configured to only permit fluid to flow out of the chamber when a predetermined threshold pressure has been achieved.

A problem with these conventional pre-compression valves is that they tend to be unduly complex in design and are also bulky and/or comprise a number of separate component parts. In addition to adding to the expense of the nozzle arrangement in terms of material costs and the necessary assembly procedures required, these valve assemblies are also particularly disadvantageous if a compact nozzle arrangement is desired, which is the case, for example, if the nozzle arrangement is to be fitted to a small container.

Therefore, it is an object of the present invention to provide a nozzle arrangement comprising an alternative pre-compression valve that is simple and effective in design. It is a further object of the present invention to provide a nozzle arrangement comprising a pre-compression valve having a reduce number of components and which is compact so that it can incorporated into small pump/trigger-activated nozzle arrangements.

The present invention achieves the aforementioned objectives by providing, in a first aspect, a pump-action nozzle arrangement adapted to be fitted to an opening of a container and enable a liquid to be dispensed from the interior of said container in the form a spray, said nozzle arrangement having a body which defines:

(i) an internal chamber;

(ii) an inlet through which fluid can be drawn into said chamber;

(iii) an outlet orifice; and

(iv) an internal passageway that connects said chamber to said outlet orifice;

said device further comprising a one-way inlet valve adapted to only permit fluid to be drawn into said internal chamber through the inlet when the pressure within the chamber falls below the external pressure, a one-way pre-compression valve disposed in said internal passageway that is configured to only permit fluid to flow along said internal passageway when the pressure within the chamber equals or exceeds a predetermined minimum threshold pressure and an actuator;

wherein said body is configured such that the internal volume of the chamber is reduced when said actuator is operated, thereby causing fluid stored in the chamber to be ejected along said internal passageway to the outlet orifice, and increased when said actuator is released, thereby causing fluid to be drawn into the chamber through the inlet;;

characterised in that said pre-compression valve is integrally formed within the internal passageway and comprises a valve member that is integrally formed with a portion of the body that defines said internal passageway, said valve member being configured to assume an initial resiliently biased configuration in which said internal passageway is closed when the pressure within the chamber is below the predetermined minimum threshold pressure and to be displaced from said initial resiliently biased configuration to define an opening through which fluid can flow along the internal passageway when the pressure within the chamber equals or exceeds the predetermined minimum threshold pressure.

The nozzle arrangements of the present invention comprise a pre-compression valve of simple construction which has the added advantage that it does not require the insertion of a separate component that forms the pre-compression valve because valve member is integrally formed within the portion of the body that defines the internal passageway. Thus, the pre-compression valve is an integral component of the portion of the body that defines the internal passageway and can therefore be readily formed when the body of the device is moulded from a suitable material, such as plastic. The provision of such a pre-compression valve is also advantageous in that it is compact because it is formed by the body of the nozzle arrangement rather than requiring the insertion of additional separate component parts (and thus, can be incorporated into a small area and small nozzle arrangements). Another

advantage of the nozzle arrangements of the present invention is that the valve member can be small so it does not require too much energy to displace it and, therefore, it does not take too much pressure from the form the fluid to maintain it in its displaced position.

The nozzle arrangement may be adapted to be fitted to an opening of a container by any suitable means. In most cases, the nozzle arrangement will comprise a screw thread formed in the base of the body, which can be screwed onto or into a correspondingly threaded portion of the container.

It is an important feature of the nozzle arrangements of the present invention that the nozzle arrangement is adapted to enable a liquid to be dispensed from the interior of said container in the form a spray where it is necessary for the fluid to flow through the internal passageway and the outlet orifice with sufficient speed and force to ensure that the liquid droplets are broken up to form a spray of suitable quality.

Any suitable one-way valve may be provided at the inlet. Suitable constructions of such valves are well known in the art. The inlet valve may also be formed in exactly the same way as the pre-compression valve defined herein. In other words the inlet valve is also preferably formed between two component parts of the body of the nozzle arrangement as for the pre-compression valve defined herein.

The actuator may be any suitable means by which the compression and subsequent re-expansion of the chamber may be facilitated. For instance, the

actuator may be a portion of the body that can be pressed by an operator to facilitate the compression of the chamber or, alternatively, the nozzle arrangement may further comprise a trigger actuator that can be pulled by an operator to facilitate the compression of the chamber.

Preferably, the nozzle arrangement further comprises a resilient means to cause said chamber to increase in volume when said actuator is released. For instance, a portion of the body defining the chamber may be resiliently deformable so that it can be pushed inwards when the actuator is operated to reduce the volume of the chamber, and then allowed to return to its original configuration, and thus, cause the volume of the chamber to increase back to its initial volume when the applied pressure is removed. Alternatively, the chamber may be compressed by the displacement of a resiliently biased piston or by sliding a resiliently biased portion of the body, which defines a portion of the chamber, relative to another portion of the body which also defines a portion of the chamber.

It is preferable that the opening defined by the one-way pre-compression valve is narrow rather than being a large chamber, for example, which would allow the liquor to drop in pressure.

Preferably, at least a portion of the internal passageway is defined between the abutment surfaces of two or more component parts of the nozzle arrangement. Most preferably, at least one of said component parts comprises the valve member integrally formed thereon.

In certain embodiments of the invention a portion of the internal passageway may be defined by just one of said component parts. In such embodiments, the valve member may be formed on said part and disposed within said portion of the internal passageway.

Preferably, however, the valve is disposed in the at least a portion of the internal passageway defined between the abutment surfaces of the two or more component parts of the body. Most preferably, the valve member is formed on one of the parts and resiliently biased against the opposing surface of another of said component parts, thereby closing the internal passageway formed there between.

In preferred embodiments of the invention, each of said parts has an abutment surface which contacts the abutment surfaces of the other parts when the parts are contacted together in the assembled nozzle arrangement and at least one of said abutment surfaces has one or more groove and/or recesses formed thereon which define the internal passageway between the respective abutment surfaces when said parts are contacted together.

It is most preferred that the at least a portion of the internal passageway is defined between just two component parts of said body. In such cases, the at least a portion of the passageway is defined between opposing abutment surfaces of said two parts and at least one of said abutment surfaces has one or more grooves and/or recesses formed thereon which define said passageway when the abutment surfaces of said parts are contacted together. Most

preferably, both of said abutment surfaces have one or more grooves and/or recesses formed thereon which align to define said passageway when the abutment surfaces of said parts are contacted together.

The outlet orifice is positioned at the end of the internal passageway. Preferably, the outlet orifice is formed at an edge of the abutment surfaces of the at least two parts. Thus, when the pressure within the chamber exceeds a predetermined minimum threshold pressure, the pre-compression valve opens and permits fluid to flow from the chamber through the initial portion of the internal passageway and into the portion defined between the opposing surfaces of the first and second component parts.

Preferably, the valve member is in the form of a resiliently deformable flap that is mounted to one of said component parts and is resiliently biased into a configuration whereby the flap extends across the internal passageway and closes the passageway. The flap is further configured to be displaced or resiliently deform when the pressure within the chamber is at or exceeds a predetermined minimum threshold pressure to define an opening or channel through which fluid from the chamber can flow along the internal passageway to the outlet orifice, where it is ejected in the form of a spray. The flap may simply extend across the passageway, but it is preferable that the flap is resiliently biased against an opposing abutment surface or surfaces, which define the internal passageway. It is especially preferred that the flap is mounted within chamber formed within the internal passageway. The chamber

provides sufficient space for the flap to be deflected from its resiliently biased position to open the valve when the pressure within the chamber is at or exceeds the predetermined minimum threshold. The flap will typically be configured to be deflected away from the chamber, but cannot be deflected the other way, i.e. by pressure acting in the opposite direction (along the internal passageway towards the chamber). This means that the valve is a one-way valve and only permits fluid to flow towards the outlet orifice and thereby prevents air being sucked into the chamber from the outside when the pressure within the chamber falls below the external pressure.

Alternatively, the valve member is in the form of a plug which is resiliently biased into a position in which the plug blocks the internal passageway, but is configured to also be displaced to define an opening or channel through which fluid can flow when the when the pressure within the chamber is at or exceeds the predetermined minimum threshold. Although the plug itself may be configured to deform so as to define a channel or opening through which fluid can flow when the pressure within the chamber (and acting on the plug) is at or exceeds the predetermined minimum threshold, it is most preferable that the plug is mounted to a resiliently deformable surface which can deform to withdraw the plug from the internal passageway when the requisite pressure within the chamber has been achieved.

As a further alternative, the valve member may be adapted to resiliently collapse inwards or otherwise deform away side of the internal passageway,

thereby forming a channel through which fluid can pass when a minimum pressure within the chamber has been achieved.

As yet another alternative, the valve member could define an opening or passageway that extends through the member. The sides of the opening will be configure to assume a resiliently biased configuration in which the sides of the internal passageway contact one another and define a closed passageway and to deform to define an open channel through which liquid can flow only when the pressure within the chamber is at or exceeds a pre-determined minimum pressure.

In a preferred embodiment of the invention, a first of said component parts of the body of the nozzle arrangement defines at least one internal wall of the internal chamber and comprises an orifice which forms an initial section of the internal passageway. The remainder of the internal passageway is defined between the outer surface of the first component part of the body and the opposing surface of a second of said component part. In such embodiments, the valve member may be a flap, as previously defined, or, alternatively, it may be in the form of a plug. In the latter case, the plug is preferably formed on the second of said component parts and is configured to fit into the aperture of first component part that forms the initial section of the internal passageway. The plug is mounted to a resiliently deformable support of said second part which is configured such that the plug is resiliently biased within the opening of said aperture, thereby closing the internal passageway, but can be displaced from the

aperture when the pressure within the chamber is at or exceeds a predetermined minimum threshold pressure and forces the plug to be displaced from the aperture so that fluid can flow past the valve member and along the internal passageway.

Preferably, the internal passageway further comprises one or more internal spray-modifying features. As an alternative, the nozzle arrangement may be configured to receive an insert which comprises one or more spray-modifying features. The insert can be positioned in relation to the nozzle arrangement so that fluid exiting the outlet orifice flows into an inlet of the insert, through the one or more internal spray modifying features present therein, and is then ejected through an outlet orifice of the insert.

Suitable spray-modifying features that may be incorporated within the internal fluid flow passageway or present in an insert fitted thereto are known in the art and are described further in, for example, International Patent Publication No. WO 01/89958, the entire contents of which are incorporated herein by reference. Illustrative examples of such features include one or more features selected from the group consisting of: an expansion chamber, a swirl chamber, an internal orifice, multiple passageway branches, a dog-leg arrangement (where the passageway comprises a turn in one direction, typically through ninety degrees, followed by a turn back in the opposing direction), a venturi chamber (where air is drawn into the fluid stream by venture), an outlet orifice in the form of a slit, or multiple outlet orifices.

It is preferable that pre-compression valve is positioned before (or upstream from) the one or more spray modifying features, such that fluid can only flow through the spray modifying features when the pre-compression valve is open.

The nozzle arrangements of the present invention may comprise multiple pre-compression valves as defined herein. For instance, the nozzle arrangement may comprise two or more separate internal chambers, or two or more separate compartments within the internal chamber, each of which comprises a pre-compression valve as defined herein. In an especially preferred embodiment of the present invention, the body of the nozzle arrangement comprises an additional air chamber which is compressed at the same time as the internal chamber and comprises an outlet channel through which a pressurised air stream is introduced into the internal passageway to mix with liquid dispensed from the internal chamber. The outlet channel is preferably provided with a pre-compression valve as defined herein to ensure that air is only ejected when a predetermined minimum pressure is achieved within the internal passageway.

Thus, it will be appreciated that the nozzle arrangements of the present invention may comprise numerous pre-compression valves as defined herein and said valve may be configured to control the ejection of liquids and/or air from the nozzle arrangement. Furthermore, as these valves are all defined by the body, i.e. no extra components are required, any extra valve can be simply formed by the moulding of the body and thus, no extra costs will be incurred.

The nozzle arrangements of the present invention are preferably formed from plastic. The component parts of the nozzle arrangement may be moulded individually and then connected together to form the assembled nozzle arrangement. Alternatively, some or all of the components may be formed by a bi-injection moulding process whereby a first component is moulded during a first moulding stage and a second component part is then moulded onto the first component part during a second moulding stage. The first and second component parts may be made from the same or a different material.

In embodiments where the housing is composed of two component parts which define the internal passageway, each component part may be moulded separately and then joined together or formed by a bi-injection moulding process, as described above. Thus, it will be possible in some embodiments of the invention to form one of said parts from a softer plastic. This will enable the integrally formed valve member formed on one of said parts from a softer or more deformable plastic material so that it is configured to deform to open the valve thus formed when the two parts are contacted together to define the internal passageway of the device.

As an additional alternative, the two component parts may be connected to one another by a hinge or foldable connection element and moulded in a single moulding operation and then folded over about said hinge or connection element to form the assembled housing component. In this case, the component parts will be made from the same material in a single moulding step.

The respective parts, once formed, may be permanently fixed together by, for example, ultrasonic welding, or alternatively, the parts may be releasably connectable to one another. This latter form of assembly is preferred because it enables the respective parts to be separated to expose the interior of the nozzle device for cleaning.

According to a second aspect of the present invention, there is provided a container comprising a pump-action nozzle arrangement as defined herein fitted thereto.

In addition to being used in nozzle arrangements adapted to dispense liquids in the form of a spray, the nozzle arrangements of the present invention may also be used to dispense air or other gases present in a container. Such nozzle arrangements may be, for example, fitted to the opening or a wine bottle to permit the air or other gases that have accumulated in the bottle to be dispensed. Thus, according to a further aspect of the present invention, there is provided a pump-action nozzle arrangement adapted to be fitted to an opening of a container and enable air or other gases to be dispensed from the interior of said container, said nozzle arrangement having a body which defines:

(i) an internal chamber;

(ii) an inlet through which fluid can be drawn into said chamber;

(iii) an outlet orifice; and

(iv) an internal passageway that connects said chamber to said outlet orifice;

said device further comprising a one-way inlet valve adapted to only permit fluid to be drawn into said internal chamber through the inlet when the pressure within the chamber falls below the external pressure, a one-way pre-compression valve disposed in said internal passageway that is configured to only permit fluid to flow along said internal passageway when the pressure within the chamber equals or exceeds a predetermined minimum threshold pressure and an actuator;

wherein said body is configured such that the internal volume of the chamber is reduced when said actuator is operated, thereby causing fluid stored in the chamber to be ejected along said internal passageway to the outlet orifice, and increased when said actuator is released, thereby causing fluid to be drawn into the chamber through the inlet;;

characterised in that said pre-compression valve is integrally formed within the internal passageway and comprises a valve member that is integrally formed with a portion of the body that defines said internal passageway, said valve member being configured to assume an initial resiliently biased configuration in which said internal passageway is closed when the pressure within the chamber is below the predetermined minimum threshold pressure and to be displaced from said initial resiliently biased configuration to define an opening through which fluid can flow along the internal passageway when the

pressure within the chamber equals or exceeds the predetermined minimum threshold pressure.

According to yet another aspect of the present invention, there is provided a container comprising a pump-action nozzle arrangement as defined above fitted thereto.

How the invention may be put into effect will now be described further by way of example only in reference to the following Figures, in which:

Figure 1A is a cross-sectional view taken through a first embodiment of a nozzle arrangement according to the present invention;

Figure 1B is an exploded cross-sectional view showing the components which make up the device shown in Figure 1A; and

Figure 2 is a cross-sectional view of an alternative embodiment of the nozzle arrangement of the present invention.

In the following description of the Figures, like reference numerals will be used to denote like or corresponding parts in different Figures.

A first embodiment of a nozzle arrangement 100 according to the present invention is shown in Figures 1A and 1B. The nozzle arrangement 100 has a body which is formed from separate component parts, namely a base 101, a housing 102, and a lid 104, which together define an internal chamber 107, an inlet 110, an internal passageway 106 and an outlet orifice 112.

The base 101 comprises a cavity 150 having a screw thread formed in

the internal wall thereof. This internal cavity 150 is adapted to receive a corresponding shaped screw threaded neck of a container, thereby enabling the nozzle arrangement 100 to be screwed onto a container for use.

The housing 102 is slidably mounted within a recessed groove 103 formed on the upper surface of the base 101. The base is provided with an inwardly projecting rim 101a which abuts against an outwardly projecting rim 102a formed on the housing 102 to prevent the housing from sliding out of engagement with the base during use and thus, also limits the extent to which the housing can slide upwards relative to the base. The base also defines the inlet 110.

The base 101 and the housing 102 together define an internal chamber 107 in which a plunger 108, which is seated on the base 101, is positioned. The plunger 108 extends across the entire width of the chamber 107 and forms a tight seal with the wall of the chamber formed by the housing 102. The plunger 108 also has an integrally formed, downwardly extending valve member 108a, which is received within a valve seat 109 formed in the base 101. The valve member 108a, together with the valve seat 109, forms the one-way inlet valve of the nozzle arrangement. An inlet channel 110 is also formed in the base 101 and a dip tube (not shown) is fitted to this channel to enable the contents of the container to which the nozzle arrangement is fitted to be drawn into the internal chamber 107 when the pressure within the chamber is reduced relative to the pressure within the container.

The upper surface of the housing 102 possesses an orifice which forms an initial section of the internal passageway 106. The remainder of the internal passageway 106 is defined between the upper surface of the housing 102 and the under surface of the lid 104. The lid 104 has a resiliently mounted flap 105, which forms the valve member of the pre-compression valve, formed on it under surface. The flap 105 is positioned within a chamber 105a formed within the portion of the internal passageway defined between the upper surface of the housing 102 and the under surface of the lid 104. The flap 105 is resiliently biased against the upper surface of the housing 102 so as to close the internal passageway and thereby prevent fluid from flowing along the internal passageway to the outlet orifice 112.

A coiled spring 111 is positioned within the chamber 107. The spring is biased at one end against the housing 102 and the base 101 at its other end. The housing additional comprises a support member 102b which extends downwards from its upper surface and is positioned inside the bore defined by the coiled spring 111. The support member 102b provides support to the spring and also enables the spring to be kept in place while the device is assembled.

The spring forces the housing upwards relative to the base so that the rim 102a of the housing abuts the internal rim 101a of the base. In this position (and as shown in Figure 1A) the internal chamber 107 possesses its maximum internal volume. During use, the lid 104 of the housing 102 can be pressed

downwards by an operator so as to cause the housing 102 to slide relative to the base 101, against the action of the spring 111. During this process, the internal volume of the chamber 107 is reduced and this in turn compresses the contents present within the chamber. The resultant increase in pressure pushes the valve member 108a of the plunger into a sealing engagement with the valve seat 109, thereby closing the one-way inlet valve and preventing the contents of the chamber flowing from the chamber 107 into the interior of the container. Once the pressure within the chamber reaches a predetermined minimum threshold pressure, for example 5 bars, the contents of the container cause the resiliently mounted flap 105 positioned over the chamber outlet 105a to be displaced from its resiliently biased position in which the outlet is blocked to define a channel through which fluid can flow past the flap (i.e. the pre-compression valve is open), thereby enabling the contents stored within the chamber 107 to flow through the internal passageway 106 and then be dispensed from the device through the nozzle outlet 112. The pressure within the chamber will reduce as fluid is expelled through the internal passageway 106 and the outlet orifice 112. Once the pressure within the chamber falls below the minimum threshold, the resiliently mounted flap 105 will return to its original position, as shown in figure 1A, in which it closes the internal passageway 106.

Once the desired amount of product has been dispensed, or the housing has been depressed to its fullest extent so that the maximum quantity of product has been dispensed from the chamber, then the operator will release the

pressure applied to the housing 102 and the housing will then slide back to its initial position shown in Figure 1A under the action of the spring 111. In doing so and the internal volume of the chamber 107 is increased and this in turn causes the pressure within the chamber to reduce. This reduced pressure within the chamber 107 will cause the pre-compression valve to close, as discussed above, and the inlet valve to open, i.e. the valve member 108a of the plunger 108 is displaced from the valve seat 110 by the pressure acting on the vale member 108a, and the contents of the container are drawn into the chamber 107 to replenish the contents previously dispensed.

Figure 2 shows a portion of an alternative nozzle arrangement 200 of the present invention. The nozzle arrangement 200 is similar in many respects to the nozzle arrangement shown in Figure 1A, as shown by the like reference numerals. As before, the internal passageway 106 comprises an initial portion 106a, which is an opening formed in the upper surface of the housing 102, and the remainder of the internal passageway 106b through to the outlet orifice 112 is defined between the upper surface of the housing 102 and the under surface of the lid 104. The pre-compression valve consists of a plug 201 formed on the under surface of the lid 104, which is mounted on a resiliently deformable support 202. When the lid 104 and the housing 102 are connected together, the plug 201 is received within the opening of the initial portion of the internal fluid flow passageway 106a, as shown in Figure 2 to close the internal passageway. However, when the chamber 107 is compressed and the pressure

therein exceeds a predetermined minimum value, the plug 201 will be pushed upwards, thereby causing the support member 202 to deform and defining an open channel through which fluid can flow out of the chamber and along the passageway 106 to the outlet 112, where it is dispensed in the form of a spray.

An expansion chamber 203 with a constricted inlet opening 204 is positioned in the passageway 106 downstream from the plug 201. This arrangement of spray-modifying features causes the fluid passing through the internal passageway 106 to be sprayed into the expansion chamber 203, which has been found to further atomise the droplets ultimately dispensed through the outlet orifice 112.

Claims

1. A pump-action nozzle arrangement adapted to be fitted to an opening of a container and enable a liquid to be dispensed from the interior of said container in the form a spray, said nozzle arrangement having a body which defines:

(i) an internal chamber;

(ii) an inlet through which fluid can be drawn into said chamber;

(iii) an outlet orifice; and

(iv) an internal passageway that connects said chamber to said outlet orifice;

said device further comprising a one-way inlet valve adapted to only permit fluid to be drawn into said internal chamber through the inlet when the pressure within the chamber falls below the external pressure, a one-way pre-compression valve disposed in said internal passageway that is configured to only permit fluid to flow along said internal passageway when the pressure within the chamber equals or exceeds a predetermined minimum threshold pressure and an actuator;

wherein said body is configured such that the internal volume of the chamber is reduced when said actuator is operated, thereby causing fluid stored in the chamber to be ejected along said internal passageway to the outlet orifice,

and increased when said actuator is released, thereby causing fluid to be drawn into the chamber through the inlet;

characterised in that said pre-compression valve is integrally formed within the internal passageway and comprises a valve member that is integrally formed with a portion of the body that defines said internal passageway, said valve member being configured to assume an initial resiliently biased configuration in which said internal passageway is closed when the pressure within the chamber is below the predetermined minimum threshold pressure and to be displaced from said initial resiliently biased configuration to define an opening through which fluid can flow along the internal passageway when the pressure within the chamber equals or exceeds the predetermined minimum threshold pressure.

2. A pump-action nozzle arrangement according to claim 1, wherein at least a portion of the internal passageway is defined between the abutment surfaces of two or more component parts of the body of the nozzle arrangement.

3. A pump-action nozzle arrangement according to claim 2, wherein at least one of said component parts comprises the valve member of said pre-compression valve formed thereon.

4. A pump-action nozzle arrangement according to claim 1 or claim 2, wherein a portion of the internal passageway is defined by just one of said component parts.

5. A pump-action nozzle arrangement according to claim 4, wherein said valve is formed on said part and disposed within said portion.

6. A pump-action nozzle arrangement according to any one of claims 2 to 4, wherein the valve is disposed in the at least a portion of the internal passageway defined between the abutment surfaces of the two or more component parts of the body.

7. A pump-action nozzle arrangement according to claim 6, wherein the valve member is formed on one of said parts and is resiliently biased against the opposing surface of the other component part or parts, thereby closing the internal passageway formed there between.

8. A pump-action nozzle arrangement according to any one of claims 2 to 7, wherein each of said parts has an abutment surface which contacts the abutment surfaces of the other parts when the parts are contacted together in the assembled nozzle arrangement, at least one of said abutment surfaces having one or more groove and/or recesses formed thereon which define said internal

passageway between the abutment surfaces when said parts are contacted together.

9. A pump-action nozzle arrangement according to any one of claims 2 to 8, wherein at least a portion of said passageway is defined between two component parts of said body.

10. A pump-action nozzle arrangement according to claim 9, wherein said at least a portion of the passageway is defined between opposing abutment surfaces of said two parts and at least one of said abutment surfaces having one or more grooves and/or recesses formed thereon which define said passageway when the abutment surfaces of said parts are contacted together.

11. A pump-action nozzle arrangement according to claim 10, wherein both of said abutment surfaces have one or more grooves and/or recesses formed thereon which align to define said passageway when the abutment surfaces of said parts are contacted together.

12. A pump-action nozzle arrangement according to any one of claims 2 to 11, wherein the outlet orifice is formed at an edge of the abutment surfaces of the two parts.

13. A pump-action nozzle arrangement according to any preceding claim, wherein the valve member is in the form of a resiliently deformable flap that is mounted to one of said component parts and which is resiliently biased into a configuration whereby the flap extends across the internal passageway and closes the passageway, said flap being further configured to resiliently deform when the pressure within the chamber is at or exceeds a predetermined minimum threshold pressure to define an opening or channel through which fluid from the chamber can flow along the internal passageway to the outlet orifice.

14. A pump-action nozzle arrangement according to claim 13, wherein said flap is resiliently biased against the opposing abutment surface that defines the internal passageway.

15. A pump-action nozzle arrangement according to claim 15 or 14, wherein said flap is mounted within chamber formed in the internal passageway.

16. A pump-action nozzle arrangement according to any one of claims 1 to 12, wherein the valve member is in the form of a plug which is resiliently biased into a position in which the plug blocks the internal passageway, but is configured be displaced to define an opening or channel through which fluid can flow when the when the pressure within the chamber is at or exceeds the predetermined minimum threshold.

17. A pump-action nozzle arrangement according to claim 16, wherein the plug is mounted to a resiliently deformable surface which can deform to withdraw the plug from the internal passageway when the requisite pressure within the chamber has been achieved.

18. A pump-action nozzle arrangement according to any one of claims 9 to 17, wherein a first of said component parts of the body of the nozzle arrangement defines at least one internal wall of the internal chamber and comprises an orifice which forms an initial section of the internal passageway, the remainder of the internal passageway being defined between the outer surface of the first component part of the body and the opposing surface of a second of said component part.

19. A pump-action nozzle arrangement according to claim 18, wherein said valve member is plug formed on the second of said component parts which is configured to fit into the aperture of first component part that forms an initial section of the internal passageway, said plug being mounted to a resiliently deformable support such that said plug is resiliently biased within the opening of said aperture, thereby closing the internal passageway, and also being configured to be displaced from the aperture when the pressure within the chamber is at or exceeds a predetermined minimum threshold pressure and the

plug and/or the mounting is caused to deform so as to withdraw the plug from the aperture so that fluid can flow past the valve member.

20. A pump-action nozzle arrangement according to any one of the preceding claims, wherein said internal passageway further comprises one or more internal spray-modifying features.

21. A pump-action nozzle arrangement according to any one of claims 1 to 19, wherein said nozzle arrangement is configured to receive an insert comprising one or more spray modifying features, said insert being configured such that fluid exiting the outlet orifice flows into said insert, through the one or more spray modifying features, and is ejected through an outlet of the insert

22. A pump-action nozzle arrangement according to claims 20 or 21, wherein said spray-modifying features include one or more features selected from the group consisting of: an expansion chamber, a swirl chamber, an internal orifice, multiple passageway branches, a dog-leg arrangement, a venturi chamber, an outlet orifice in the form of a slit, or multiple outlet orifices.

23. A pump-action nozzle arrangement according to any one of claims 20 to 22, wherein said pre-compression valve is positioned before the one or more

spray modifying features, such that fluid can only flow through the spray modifying features when the pre-compression valve is open.

24. A pump-action nozzle arrangement according to any one of the preceding claims, wherein said actuator is a portion of the body of the nozzle arrangement which can be pressed in order to facilitate the compression of the internal chamber and subsequently released to enable the volume of the chamber to increase.

25. A pump-action nozzle arrangement according to any one of claims 1 to 23, wherein said nozzle arrangement further comprises a trigger actuator which is actuator can be pulled to facilitate the compression of the internal chamber and subsequently released to enable the volume of the chamber to increase.

26. A pump-action nozzle arrangement according to any one of the preceding claims, wherein said nozzle arrangement comprises a resilient means to cause said chamber to increase in volume when said actuator is released.

27. A container comprising a pump-action nozzle arrangement as defined in any one of claims 1 to 26 fitted thereto.

28. A pump-action nozzle arrangement adapted to be fitted to an opening of a container and enable air or other gases to be dispensed from the interior of said container, said nozzle arrangement having a body which defines:

(i) an internal chamber;

(ii) an inlet through which fluid can be drawn into said chamber;

(iii) an outlet orifice; and

(iv) an internal passageway that connects said chamber to said outlet orifice;

said device further comprising a one-way inlet valve adapted to only permit fluid to be drawn into said internal chamber through the inlet when the pressure within the chamber falls below the external pressure, a one-way pre-compression valve disposed in said internal passageway that is configured to only permit fluid to flow along said internal passageway when the pressure within the chamber equals or exceeds a predetermined minimum threshold pressure and an actuator;

wherein said body is configured such that the internal volume of the chamber is reduced when said actuator is operated, thereby causing fluid stored in the chamber to be ejected along said internal passageway to the outlet orifice, and increased when said actuator is released, thereby causing fluid to be drawn into the chamber through the inlet;;

characterised in that said pre-compression valve is integrally formed within the internal passageway and comprises a valve member that is integrally

formed with a portion of the body that defines said internal passageway, said valve member being configured to assume an initial resiliently biased configuration in which said internal passageway is closed when the pressure within the chamber is below the predetermined minimum threshold pressure and to be displaced from said initial resiliently biased configuration to define an opening through which fluid can flow along the internal passageway when the pressure within the chamber equals or exceeds the predetermined minimum threshold pressure.

29. A container comprising a pump-action nozzle arrangement as defined in claim 28 fitted thereto.

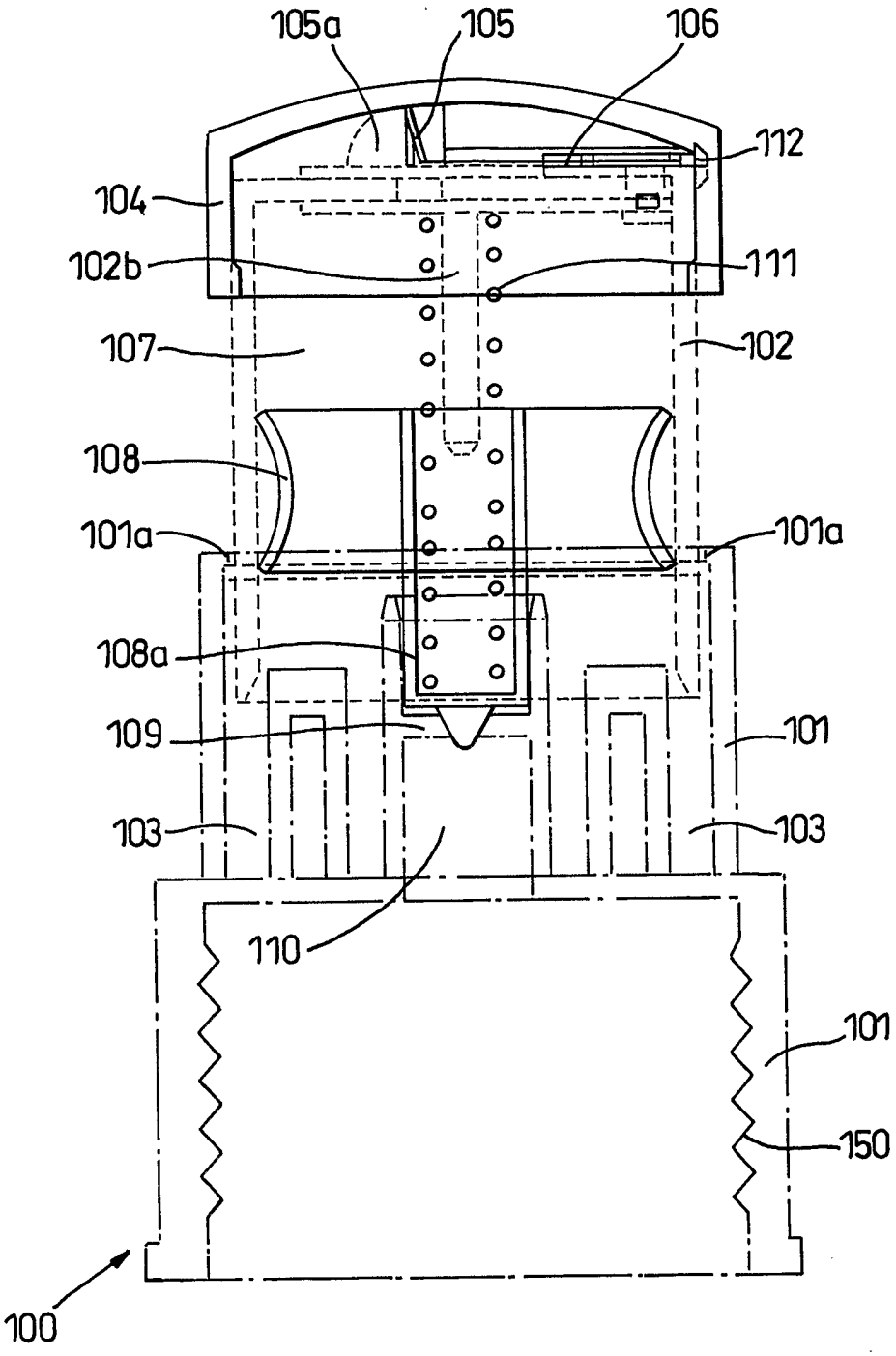
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Fig. 1A

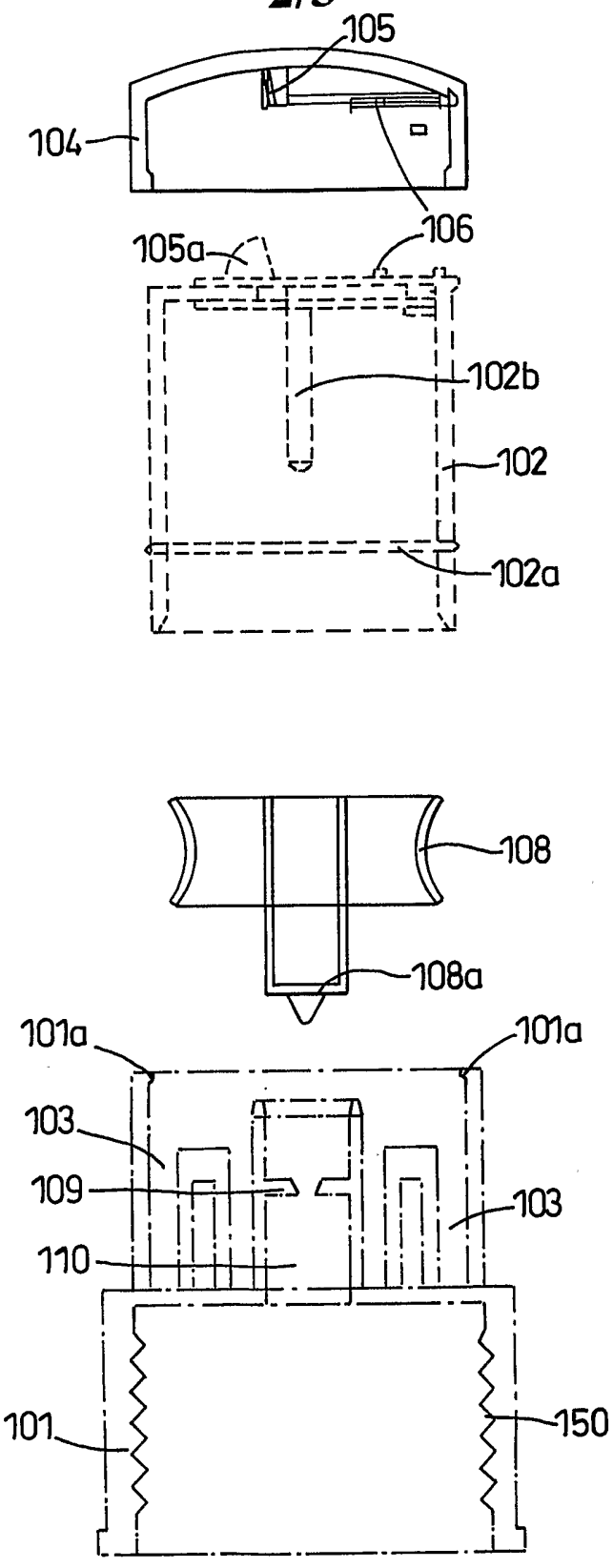
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Fig. 1B

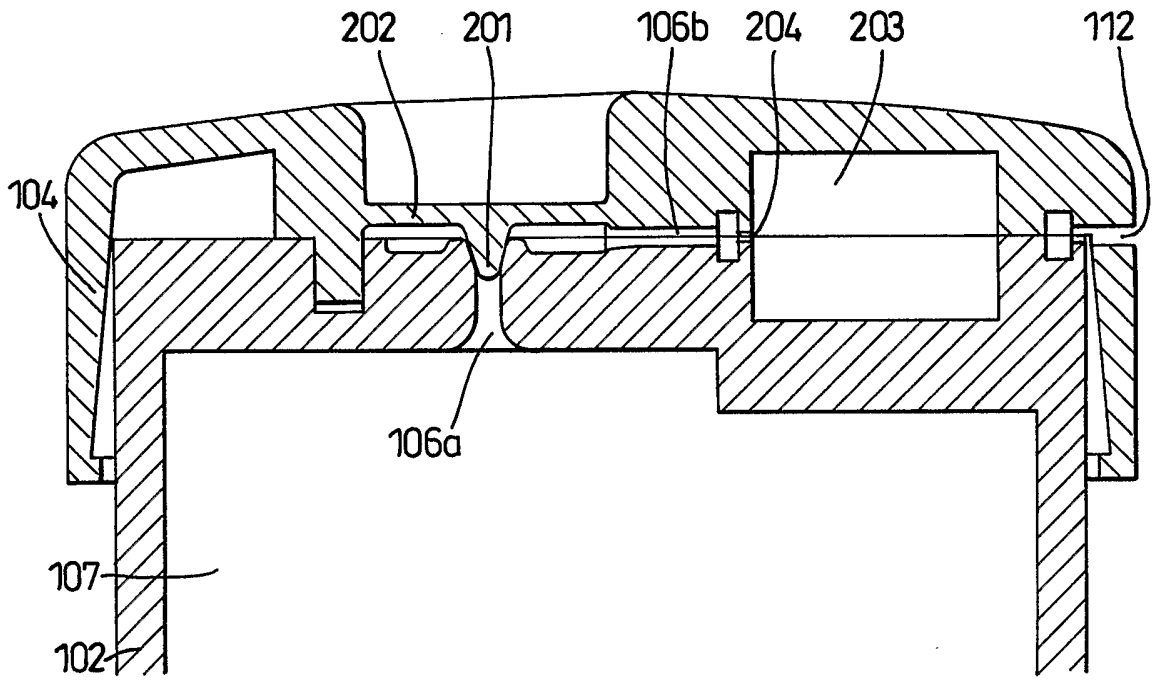

Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 03/05302

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05B11/00

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)
IPC 7 B05B

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 140 509 A (JORDAN GMBH & CO KG GEBR) 28 November 1984 (1984-11-28) the whole document	1-6, 12-15, 24-29
A	EP 0 484 835 A (PFEIFFER ERICH GMBH & CO KG) 13 May 1992 (1992-05-13) column 6, line 36 - column 8, line 11; figure 1	16
X	US 5 617 976 A (GUERET JEAN-LOUIS) 8 April 1997 (1997-04-08) column 2, line 38 - column 4, line 57; figure 1	1-7,9
A	US 3 923 949 A (KANE NEIL G ET AL) 2 December 1975 (1975-12-02) the whole document	2-5

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[X] *Further documents are listed in the continuation of box C.*

[X] *Patent family members are listed in annex.*

° Special categories of cited documents :

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"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*
6 April 2004	26/04/2004

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 03/05302

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1 509 827 A (PLASTIC RES PROD INC) 4 May 1978 (1978-05-04) page 8, line 1 - line 37	16
A	GB 230 310 A (MAX AFTERGUT) 12 March 1925 (1925-03-12) figure 1	20-22

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 03/05302

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2140509 A	28-11-1984	DE 3310029 A1	20-09-1984
		FR 2542820 A1	21-09-1984
EP 0484835 A	13-05-1992	DE 4035663 A1	14-05-1992
		AT 120385 T	15-04-1995
		DE 59105049 D1	04-05-1995
		EP 0484835 A1	13-05-1992
		ES 2070392 T3	01-06-1995
		JP 3157879 B2	16-04-2001
		JP 4282084 A	07-10-1992
		US 5437398 A	01-08-1995
US 5617976 A	08-04-1997	FR 2731992 A1	27-09-1996
		AT 173225 T	15-11-1998
		CA 2172229 A1	22-09-1996
		DE 69600939 D1	17-12-1998
		DE 69600939 T2	12-05-1999
		EP 0733559 A1	25-09-1996
		ES 2126365 T3	16-03-1999
		JP 8258858 A	08-10-1996
US 3923949 A	02-12-1975	NONE	
GB 1509827 A	04-05-1978	AU 1577776 A	12-01-1978
		BE 844197 A1	17-01-1977
		CA 1043304 A1	28-11-1978
		DE 2632675 A1	03-02-1977
		DE 7622920 U1	08-06-1977
		ES 449932 A1	01-07-1977
		FR 2317969 A1	11-02-1977
		IT 1066044 B	04-03-1985
		JP 52038620 A	25-03-1977
		NL 7607953 A	20-01-1977
		SE 7608055 A	19-01-1977
		US 4057176 A	08-11-1977
GB 230310 A	12-03-1925	DE 400394 C	18-08-1924
		AT 103339 B	10-05-1926
		DE 410499 C	03-03-1925
		FR 581565 A	02-12-1924
		NL 17448 C	
		US 1517932 A	02-12-1924