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(54) **Pressurized gas driven liquid dispensing device comprising a piercing unit**

(57) Liquid dispensing device comprising:
• a container for containing a liquid;
• a cartridge (10) containing a pressurized propellant gas closed by a colure (11); and
• a piercing unit (101) for piercing the closure (11) of the cartridge (10) and thus bringing the pressurized propellant gas into fluid communication with the container, said piercing unit comprising:
o a piercing member (1) arranged to pierce the closure (11) of the cartridge (10) by a linear motion thereof along a first direction (d);
o an actuating unit (2) to actuate the linear motion of the piercing member (1) along said first direction (d);

wherein the actuating unit (2) is activated to actuate the linear motion of the piecing member (1) by application thereto of a compression or a tensile force (F) along a second direction, substantially normal to the first direction (d).

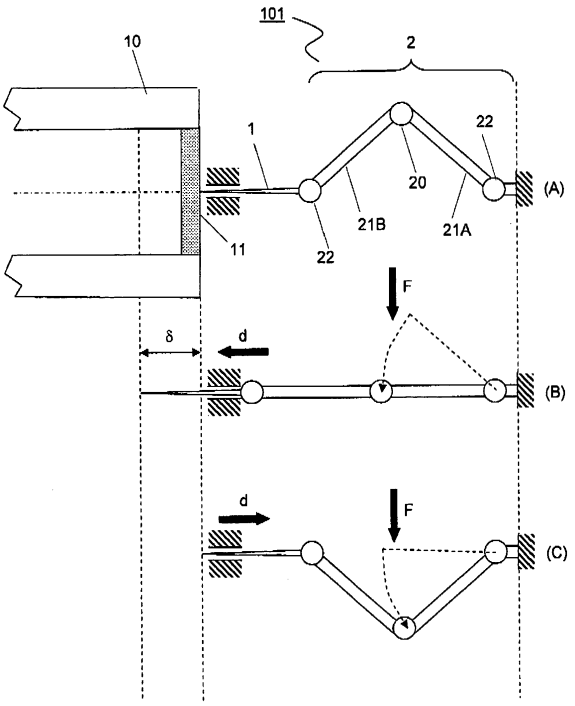

FIGURE 2

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Description

Field of invention

[0001] The present invention relates to the field of dispensing devices for liquids, in particular beverages. It concerns dispensers activated by a propellant gas contained in a pressure container or cartridge which needs be pierced open before use. The present invention proposes a solution to optimize the piercing of the propellant gas cartridge.

Background of the Invention

[0002] Liquid dispensing devices have been on the market for ages. Many of them rely on a pressurized gas raising the pressure in the interior of a container containing the liquid to be dispensed, in particular a beverage like beer or other carbonized beverages. The gas is either fed directly into the container containing the liquid like e.g., in US 5,199,609 or between an external, rather stiff container and an inner, flexible vessel (e.g., a bag or a flexible bottle) containing the liquid to be dispensed, like in US 5,240,144. Both applications have their pros and cons which are well known to the persons skilled in the art. The present invention applies equally to both types of delivery systems.

[0003] The compressed gas may be provided by a compressor, included in a specific appliance (cf. US 5,251,787), or contained in a compressed gas bottle (cf. US 5,383,576, Figure 7). More recently, a market for disposable, stand alone, home appliances has been developing rapidly. For obvious technical and economic reasons, no compressor or large compressed gas bottle can be used in such disposable devices, and the propellant gas is then usually contained in a rather small pressurized cartridge closed by a cap or a membrane. The cap or membrane of these home dispensers may be pierced open in plant but, to avoid risks of leakage, it is usually preferred that the piercing of the closure be performed by the end-user prior to using the device for the first time.

[0004] An example of such devices is disclosed in EP149352 wherein a piercing member (10) is activated by a cam actuated by the rotation of a lever (19). An alternative solution using a cam (56) to push a piercing member (36) through the cap or membrane of a pressurized gas cartridge is disclosed in WO2007/145

[0005] In GB1427732 a pressurized gas cartridge (1) is forced into place against a fixed piercing member (14) upon screwing a cap (11), thus piercing the membrane thereof. In GB1163761 a gas cartridge is pierced at (180) on screwing an upper handle part (156) to a lower part (81). US3372838 discloses a pressurized gas driven dispenser, wherein the closure of a gas cartridge (32) is pierced upon screwing a cap (34) provided with a piercing member (35). In WO2006/128653 a piercing member (34) is forced through the closure of a CO_2-cartridge by rotating a knob (24) which actuates a pusher (40) against the piercing member.

[0006] All the gas cartridge piercing mechanisms reviewed supra have in common that they are mounted such as to extend axially from the elongated cartridge, thus making a compact design quite impossible. Either the gas cartridge is positioned vertically (i.e., parallel to the axis of the liquid container), and the piercing mechanism will extend vertically increasing the height of the device, or it is positioned horizontally (i.e., transverse to the axis of the container) and the system will extend over the diameter of the container. Any intermediate angle of the gas cartridge with respect to the liquid container will not solve the problem of excessive size. This problem is particularly sensitive with home dispensing devices having a limited capacity of the order of 2 to 5 litres, maybe up to 10 litres, and which size is therefore quite limited.

[0007] Another problem arising with most of the piercing mechanisms reviewed above is that once the cartridge is pierced the piercing member remains in its piercing position, thus hindering the fluid communication between the cartridge and the container. The piercing member may be retrieved by unscrewing the corresponding cap or knob that forced the piercing member through the closure of the cartridge, but this is not always possible as the cartridge is sometimes held in place upon screwing a cap like in GB1427732. Alternatively, complex spring systems are required (cf. e.g., WO2006/128653), which render the mechanism much more expensive, a particularly sensitive issue with disposable dispensing devices.

[0008] Finally, in particular with the screw driven piercing mechanisms, the force to be applied by the end user to pierce the gas cartridge could be above the limit of comfort of use or would require larger knobs which are detrimental to the compactness of the system as a whole.

[0009] There thus remains a need in the art for gas driven liquid dispensing devices, in particular disposable ones, with a more compact and economical gas cartridge piercing mechanism.

Summary of the invention

[0010] The present invention is defined in the appended independent claim. Preferred embodiments are defined in the dependent claims. The present invention provides a liquid dispensing device comprising

- a container for containing a liquid;
- a cartridge containing a pressurized propellant gas closed by a closure which may be a cap or a membrane; and
- a piercing unit for piercing the closure of the cartridge and thus bringing the pressurized propellant gas into fluid communication with the container, said piercing unit comprising:

    - o a piercing member arranged to pierce the closure of the cartridge by a linear motion thereof

along a first direction (d);
o an actuating unit to actuate the linear motion of the piercing member (1) along said first direction;

characterized in that, the actuating unit is activated to actuate the linear motion of the piecing member by application thereto of a compression or a tensile force (F) along a second direction, substantially normal to the first direction (d).

[0011] A particularly advantageous embodiment of the present invention is to use a toggle mechanism to actuate the linear motion of the piercing member. Several designs of toggle mechanisms according to the present invention and being suitable for the piercing of a gas cartridge can be envisaged and are presented in the detailed description of the invention.

[0012] The present invention is advantageous over the piercing mechanisms of the prior art in that:

- it allows more freedom to design a compact dispenser as the actuating unit is transverse to the axis of the cartridge;
- the force to be applied by the end user to pierce the gas cartridge is rather low;
- it allows to easily integrate a feature wherein the piercing member is retrieved from the cartridge after piercing, and cannot be actuated again;
- it allows for a simplified and economical design particularly adapted for disposable devices.

Brief description of the Figures

[0013]

Figure 1: schematic representation of two embodiments of a device according to the present invention:
Figure 2: schematic representation of an embodiment of a piercing unit according to the present invention;
Figure 3: schematic representation of another embodiment of a piercing unit according to the present invention:
Figure 4: various embodiments of the actuating units according to the present invention;
Figure 5: schematic representation of a piercing unit in relation with a pressure regulating chamber according to the present invention.

Detailed description of the invention

[0014] Figure 1 shows two alternative embodiments of liquid dispensing devices according to the present invention, in both cases the dispensing of a liquid, generally a beverage like a beer or a carbonated soft drink, is driven by a pressurized gas contained in a gas cartridge (10). Upon piercing of the closure (11) of the pressurized gas cartridge (10) by actuation by an actuator (102) of a piercing unit (101), the gas contained in the cartridge (10) is brought into fluid communication with the container (30) at a reduced pressure via the pressure regulating valve (103). In Figure 1(a) the gas is introduced through the gas duct (104) directly into the container (30) and brought into contact with the liquid contained therein, whilst in the embodiment depicted in Figure 1(b), the gas is injected at the interface between an outer, rather rigid container (30) and an flexible inner container or bag (31) containing the liquid. In this latter embodiment, the gas never contacts the liquid to be dispensed.

[0015] In both embodiments, the pressure in the vessel (30, 31) increases and forces the liquid up the dispensing duct (32). For the bag-in-container as illustrated in Figure 1(b), however, the dispensing duct (32) needs not necessarily penetrate in the container and dip in the beverage, because the bag (30) collapses upon pressurization of the volume comprised between the bag (30) and the container (31), thus allowing the beverage to contact the channel opening (6) without necessarily requiring a drawing stem. Dispensing of a liquid can then be controlled by means, like a valve, well known to the person skilled in the art and not represented in the Figures. A top casket (33), generally made of plastic, such as polypropylene, serves for aesthetic as well as safety reasons, to hide and protect from any mishandling or from any impact the dispensing systems and pressurized gas container. A bottom stand (34) generally made of the same material as the top casket (33) gives stability to the dispenser when standing in its upright position.

[0016] As illustrated in Figures 2 to 4, the piercing unit (101) comprises:

- a piercing member (1) arranged to pierce the closure (11) of the cartridge (10) by a linear motion thereof along a first direction (d);
- an actuating unit (2) to actuate the linear motion of the piercing member (1) along said first direction (d);

[0017] The piercing member (1) generally comprises a hard, sharp needle or pin made for example of metal mounted on a plastic insert (cf. Figure 5)) to connect it to the actuating unit (2). The plastic insert can conveniently be injection moulded over the needle or pin and advantageously forms an integral part of the actuation unit (2). Depending on the design of the piercing unit (101), the needle may need sealing means (25) -which can advantageously be integrated in the plastic insert- to seal any opening (111) in the chamber housing the piercing unit (101) upon retrieval of the piercing member.

[0018] According to the present invention, the actuating unit (2) is activated by applying a compression or a tensile force in a direction normal to the translation direction of the piercing member (1). In the Figures, embodiments using a compression force only are depicted, but it is obvious to invert up side down the orientation of the drawings of Figures 2 to 4 to yield a similar system actuated by a tensile force.

[0019] In its simplest form, the actuating unit (2) illustrated in Figure 4(d) may comprise an L-shaped structure hinged at its corner with a fixed hinge (24) and rotatably connected at (22) at one of its ends to the piercing member (1). Application of a compression force (F) on the free end permits the swinging of the L-structure around '24), thus thrusting the piercing member forward in a direction (d) normal to the force (F). To control the linear translation of the piercing member (1), guiding means represented by shaded areas, may be provided. Though very simple, this mechanism requires a fixed hinge which may increase the production cost.

[0020] A preferred embodiment is to use a toggle mechanism for the actuating unit (2) as depicted in Figures 2, 3, 4(a) to (c), and 5. Toggle mechanisms are well known, e.g., in electrical applications for switches (cf. e.g., http://www.roymech.co.uk/Useful_Tables/ Cams_ Springs/Mechanism.html). A toggle mechanism allows the creation of a force in a first direction (d) by the extension of the end-to-end span of a wavy or zigzagging structure upon acting so as to reduce the waviness or zigzagginess thereof.

[0021] In Figure 2 a first toggle mechanism suitable for the present invention is illustrated. The actuating unit (1) comprises at least two rigid sections (21 A) and (21 B) hinged together by a central joint (20). The free end of a first rigid section (21A) is rotatably connected to a fixed point by an articulation (22) and the free end of the at least second rigid section (21 B) is rotatably connected to the piercing member (1). Figure 2(A) shows the actuating unit (2) in its actuatable configuration (A), with the central joint (20) hinging the two sections (21) in a bent position, like a knee. Upon application of a compression force (F) at the central joint (20) it will be pushed downwards, straightening the initially bent structure and stretching it by a distance, δ, along a direction normal to the applied compression force (F). As illustrated in figure 2(B). The translation, δ, of one end of the toggle mechanism is transmitted to the piercing member (1), which is shifted linearly over said distance, δ, and forced through the closure (11) of the cartridge (10).

[0022] The embodiment illustrated in Figure 2 is particularly advantageous because, as shown in Figure 2 (C), upon further application of a compression force (F), the straightened structure is bent downwards at the central joint (20), thus reducing the end-to-end span of the actuating unit (2) by a distance, δ. The piercing member can thus be permanently retrieved from the cartridge with the same continuing application of a force (F) in the same direction. No reactivation of the piercing system is possible, thus reducing any risk of mishandling of the mechanism. This particular embodiment is advantageous for disposable dispensing devices wherein the whole device with cartridge, container, etc. is to be disposed of after use.

[0023] The solution proposed in Figure 2 can be manufactured very economically by injection moulding in one piece the whole structure depicted in Figure 4(a) over the metal needle or pin of the piercing member (1). The central joint (20a) as well as the articulations (22a) can be made integrally with the rest of the structure as thinned sections, giving them flexibility whereas the thicker sections (21 A) and (21B) are rigid. Preferably, the thinned sections of the central joint (20a) and/or of the articulations (22a) have a curved geometry giving some elasticity to the joints. The injection moulded structure may include a seal (25) which acts as connection between the actuating unit (2) and the piercing member (1), as well as sealing means after the cartridge closure (11) has been pierced and the piercing member (1) retrieved to seal any aperture at the back of the piercing member (1).

[0024] An alternative actuating unit (2) comprising two rigid sections hinged by a central joint (20) is illustrated in Figure 4(c). This embodiment differs from the one depicted in Figure 2 or 4(a) in that the actuating unit is activated by a lever, like a switch, which is a continuation of the rigid section (21A) which is mounted on a fixed hinge (24). By pressing the extended free end of the rigid section (21 A) the whole mechanism toggles thus triggering the movement of the piercing member through the closure (11) of the cartridge. This embodiment, though elegant, requires a fixed hinge which may result less economical than the previous embodiment of Figure 4(a).

[0025] Yet another example of toggling actuation unit (2) is illustrated in Figure 3, which is quite similar to the one depicted in Figure 2 but where the central joint (20) hinging at least two rigid sections (21) is replaced by a continuous arched structure (23). As in the example depicted in Figure 4(a) the articulations (22) at each end of the arch can be a continuous, but thinned section of the arched structure (23). Other designs for the articulations (20) can of course be applied depending on the mechanical requirements and on processing economics considerations. The actuation unit (2) according to this embodiment may comprise more than one arched structure as illustrated in Figure 4(b), wherein two "waves" are laid side by side forming an 'M'. Such design may have the advantage, on the one hand, of decreasing the height of the toggling actuation unit (2) and, on the other hand, of reducing the stress applied over a single arch, by an order corresponding to the number of arches set side by side. It is clear that a similar multi-toggle system can also be obtained with the design of Figures 2 and 4(a), by simply providing several joints (20) hinging two adjacent rigid sections (21).

[0026] In practice, and as illustrated in Figure 1, the piercing unit (101) is in fluid communication with a pressure regulating chamber (103) comprising a pressure regulation valve. After piercing of the cartridge closure (11), the pressure in the pressure regulating chamber (103) rises to the level of the gas pressure in the cartridge. It is essential to seal off any aperture in the piercing unit (101) other than the one (113) communicating with the pressure regulating chamber (103). In particular, it may be necessary to seal the section of the piercing unit comprising the actuation unit (2) from the section comprising

the piercing member which upon piercing is at the same pressure as the gas cartridge. This can be achieved for example by separating the chamber of the piercing unit (101) in two compartments (105), (106) separated by a wall provided with an aperture (111) sufficiently large to allow the free translation of the piercing member and toggling mechanism. The first compartment (105) is in fluid communication with the cartridge opening (11) as well as with the pressure regulating chamber (103). It contains the piercing member (1). The second compartment (106) contains the piercing unit (2). The piercing member (1) is provided with a sealing ring (25) as illustrated in Figure 4(a).

[0027] As shown in Figure 5(A), in its actuatable position the sealing ring (25) rests against the wall orifice (111), thus sealing the first compartment (105) from the second (106). At this stage, the sealing is not critical since both compartments are at atmospheric pressure, P_{atm}. Upon actuation of the piercing member (cf Figures 2(B) and 3(B)), the latter is pushed through to pierce the closure (11) of the cartridge. As shown in Figure 5(C), by the combined effect of further pressing down the toggling mechanism of the actuation unit (2) and of the sudden burst of gas in the first compartment (105) raising the pressure from atmospheric to the value P_{gas}, the piercing member (1) is pushed back against the wall dividing the two compartments and the orifice (111) is sealed by the action of the sealing ring (25) pressed against the wall by the high pressure reigning in the first compartment (105). This simple solution gives the engineers more freedom to design the actuation unit (2) and the actual actuator (102) as the second compartment (106), housing the actuation unit (2) and part of the actuator (102) remains at atmospheric pressure.

Claims

1. Liquid dispensing device comprising:

- a container for containing a liquid;
- a cartridge (10) containing a pressurized propellant gas closed by a closure (11); and
- a piercing unit (101) for piercing the closure (11) of the cartridge (10) and thus bringing the pressurized propellant gas into fluid communication with the container, said piercing unit comprising:
  - o a piercing member (1) arranged to pierce the closure (11) of the cartridge (10) by a linear motion thereof along a first direction (d);
  - o an actuating unit (2) to actuate the linear motion of the piercing member (1) along said first direction (d);

characterized in that, the actuating unit (2) is activated to actuate the linear motion of the piecing member (1) by application thereto of a compression or a tensile force (F) along a second direction, substantially normal to the first direction (d).

2. Device according to claim 1 wherein the actuating unit (2) triggers the linear motion of the piercing member (1) via a toggle mechanism.

3. Device according to claim 2 wherein the actuating unit (2) comprises at least two rigid sections (21) hinged together by a central joint (20) allowing the actuating unit (2) to pass from a bent, inactive position (A) to a stretched, activating position (B) by application of a compression or tensile force (F) at the central joint (20).

4. Device according to claim 3, wherein the actuating unit (2) is injection moulded in one piece, with the central joint (20a) being of thinner section than the rigid sections (21A) and (21B) it connects and, preferably, said joint (20a) has a curved geometry.

5. Device according to claim 2 wherein the actuating unit (2) comprises at least one arched section connecting the piercing member (1) to a fixed point, such that the application of a compression or tensile force (F) at the summit of said arched section allows the actuating unit (2) to pass from a bent, inactive position (A) to a stretched, activating position (B).

6. Device according to any of claims 2 to 5, wherein further application of a compression or tensile force (F) to the actuating unit (2) allows it to pass from a stretched, activating position (B) to a bent, irreversibly inactive position (C).

7. Device according to claim 6, wherein:

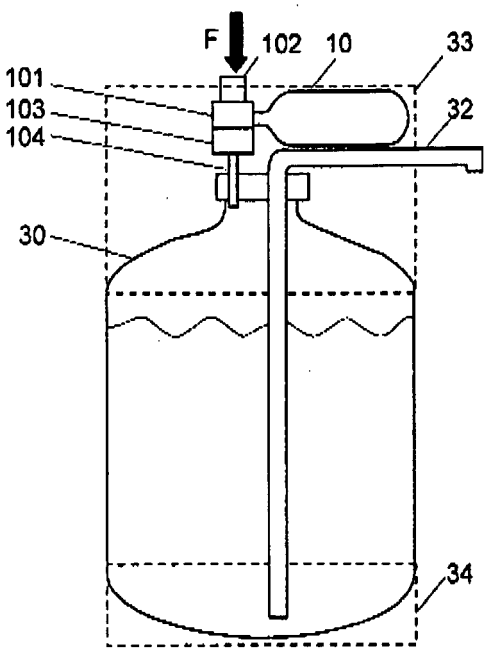
- the piercing unit (1) comprises two compartments separated by a wall provided with an orifice (111),
  - o the first compartment (105) containing the piercing member (1) and being in fluid communication with the cartridge closure (11) and a pressure regulating chamber (103); and
  - o the second compartment (106) contains the actuating unit (2), connected to the piercing member through said orifice (111); and
- the piercing member is provided with a sealing ring (25) extending radially around its cross section, such that when the actuating unit (2) is in a bent, irreversibly inactive position (C), the sealing ring is pressed against the separating wall

and effectively seals the orifice (111) connecting the two compartments.

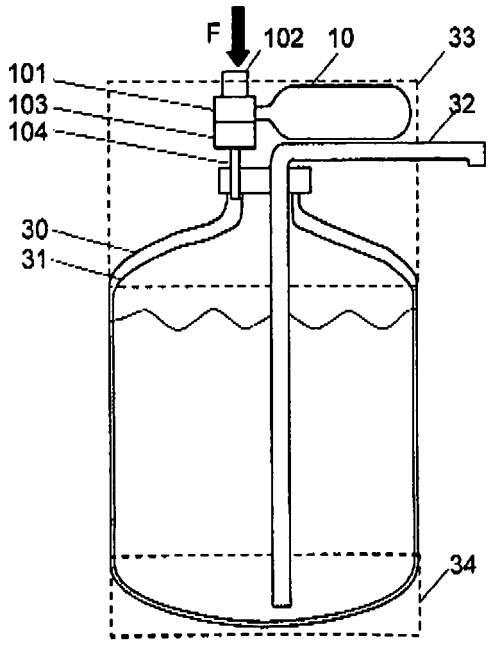
8. Device according to any of the preceding claims, wherein the device is disposable and is not meant to be refilled after use.

9. Device according to any of the preceding claims, wherein a gas connecting pipe (104) brings in fluid communication the pressurized gas cartridge with the liquid contained in the container (30).

10. Device according to any of claims 1 to 8, wherein a gas connecting pipe (104) brings in fluid communication the pressurized gas cartridge with a space comprised between an outer, rather rigid container (30) and a flexible inner container or bag (31) containing the liquid.



(a)



(b)

FIGURE 1

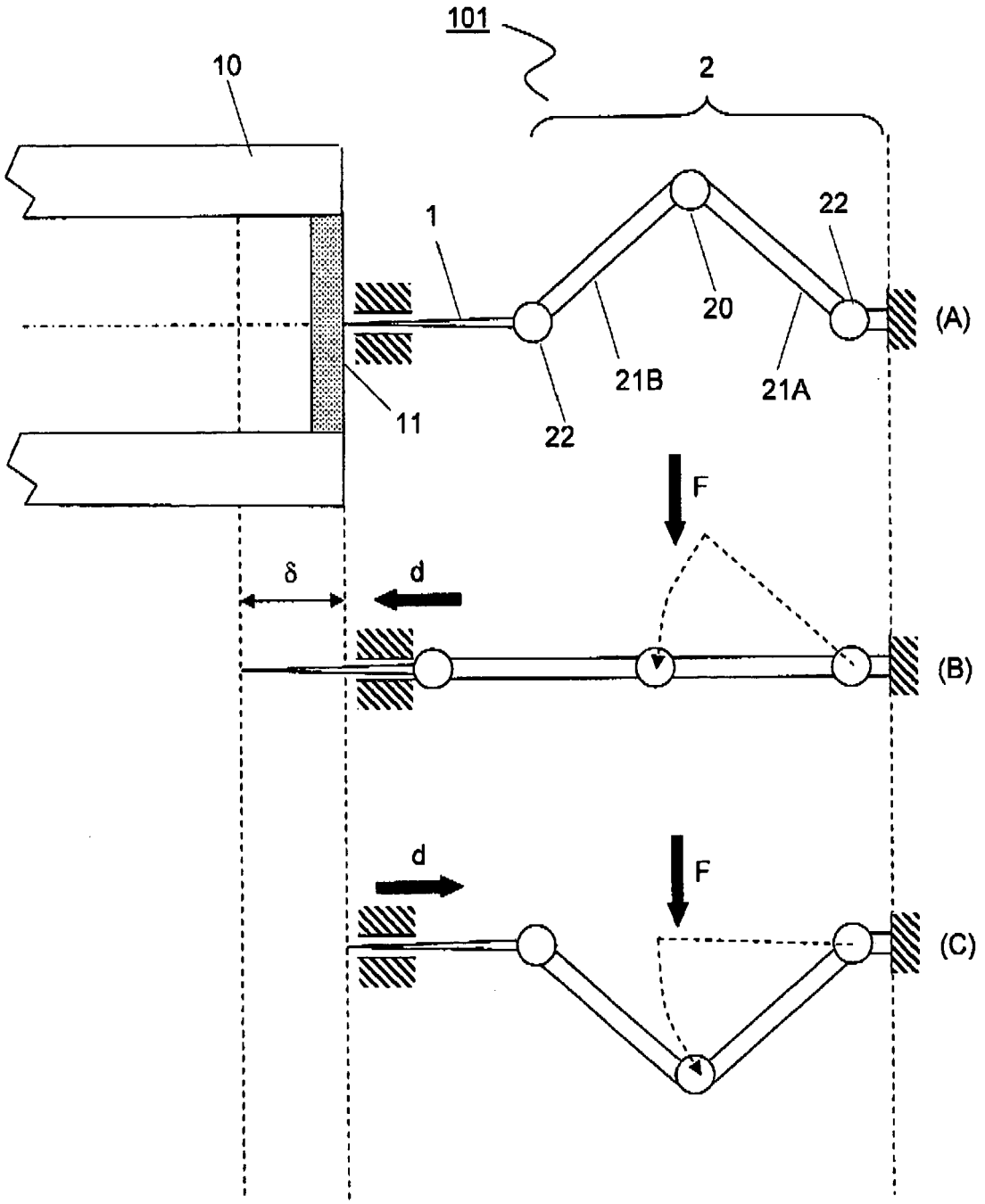


FIGURE 2

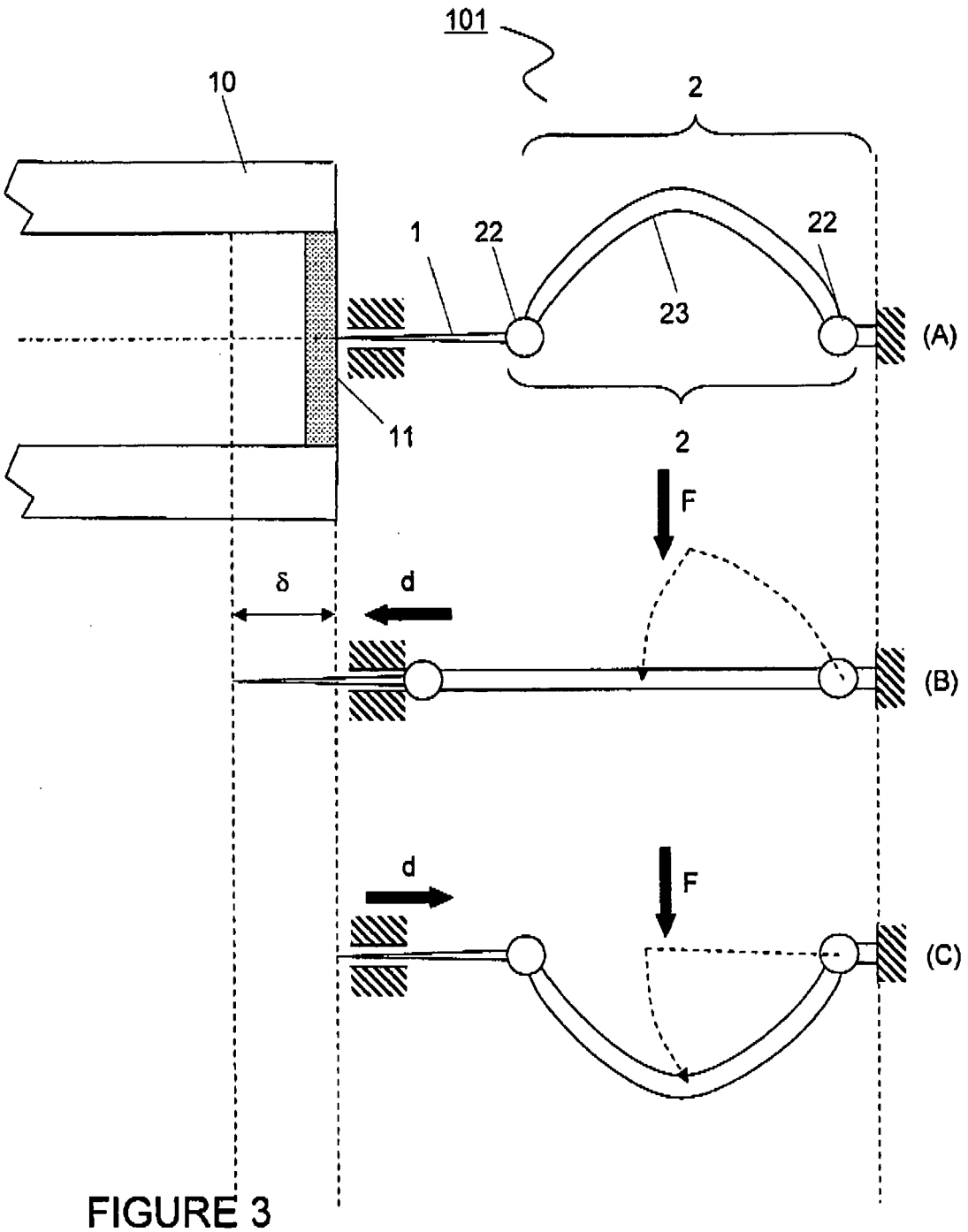
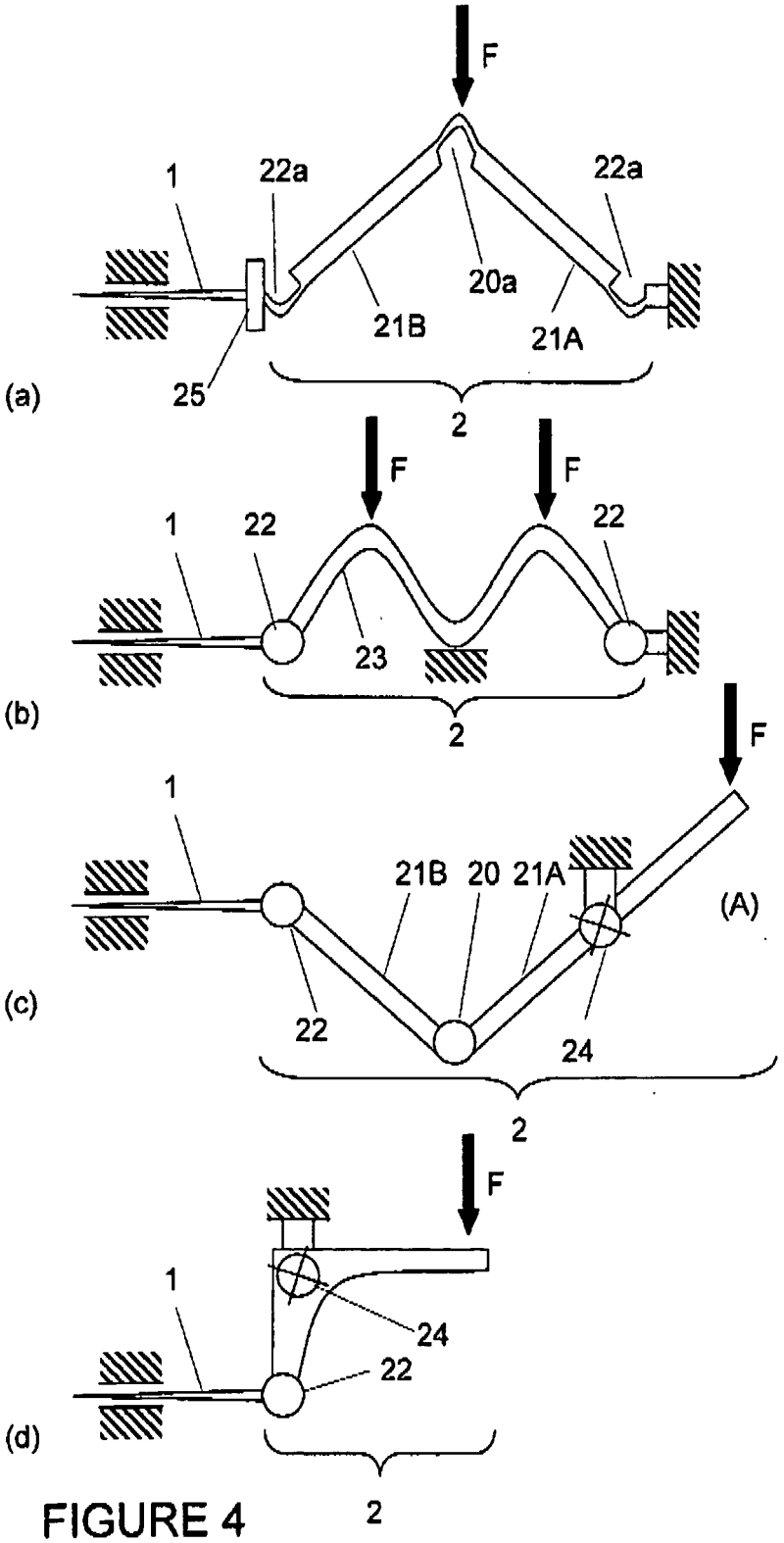


FIGURE 3


F
1
22a
22a
20a
21B
21A
25
(a)
2
F
F
1
22
22
23
(b)
2
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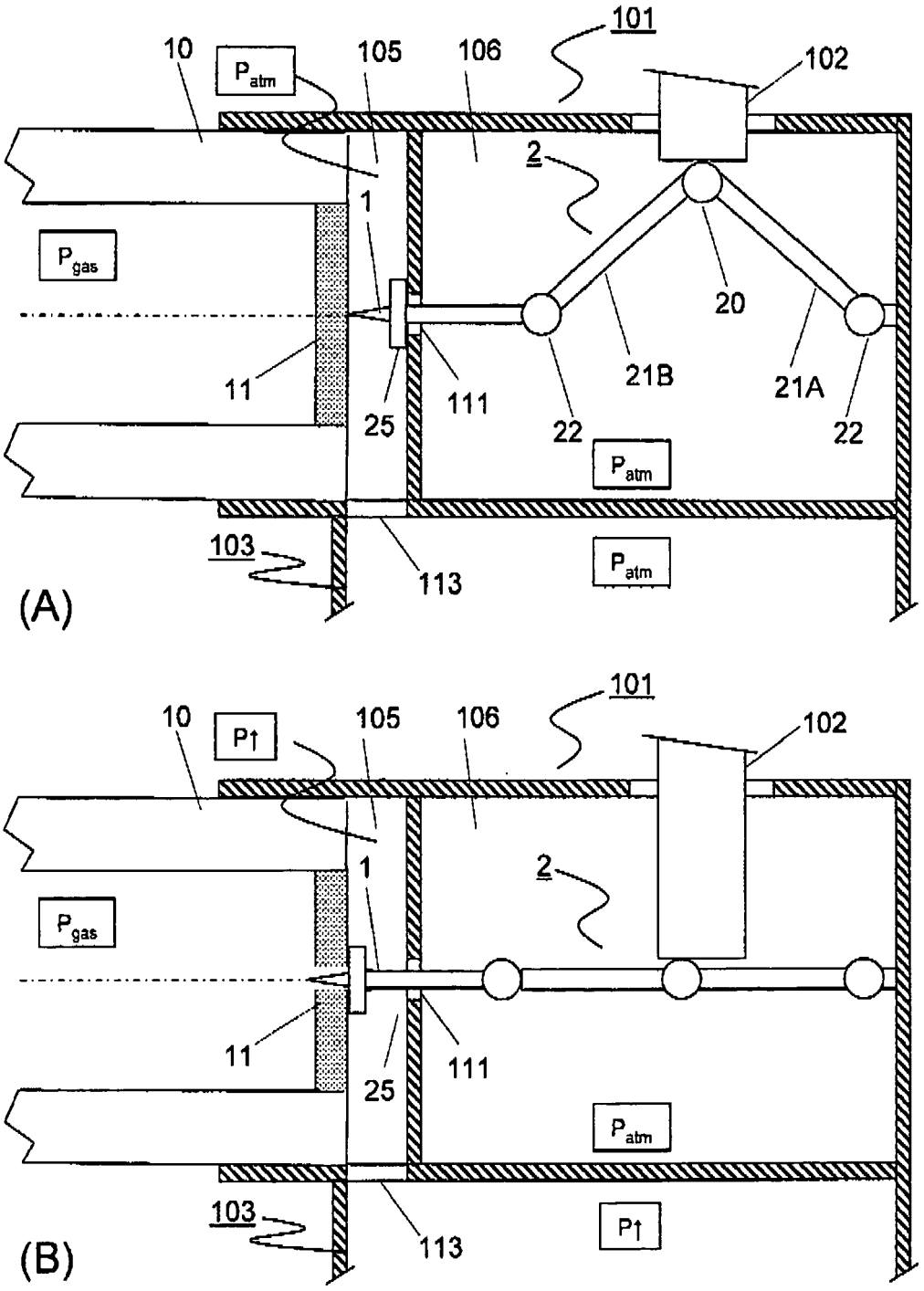
2
F
1
24
22
(d)
2

FIGURE 4


101
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P↑
(B)

FIGURE 5

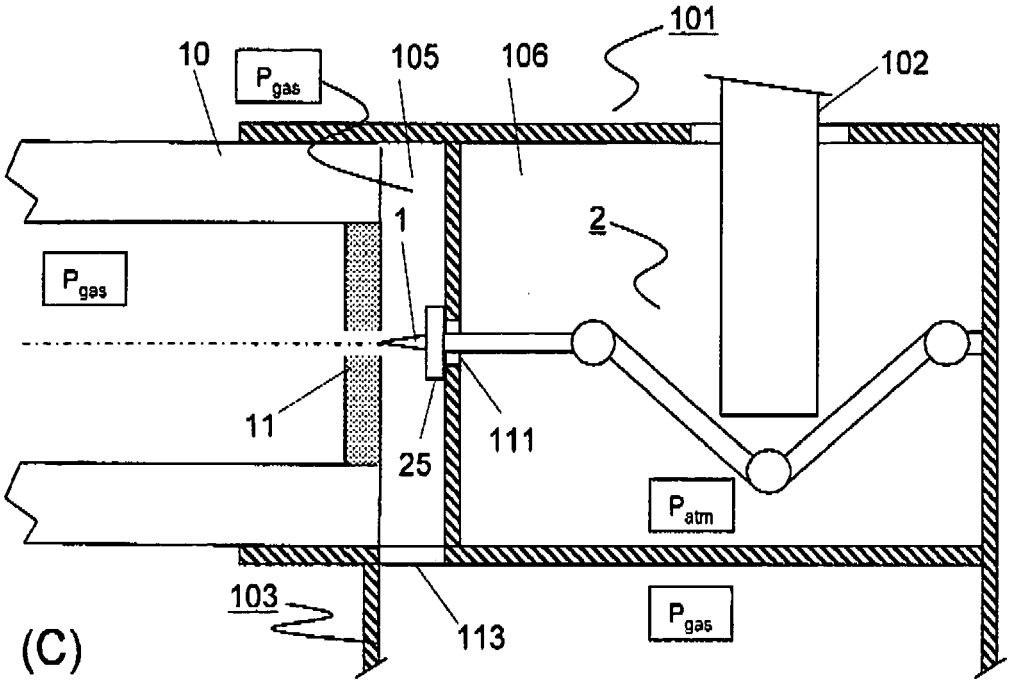

FIGURE 5 (contd)

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EUROPEAN SEARCH REPORT

Application Number
EP 09 01 5694

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A	* page 8, paragraph 2 - page 11, paragraph 2; figures 2-6 *	2	ADD. B67D1/00
A	WO 2008/060152 A1 (HEINEKEN SUPPLY CHAIN BV [NL]; PAAUWE ARIE-MAARTEN [NL]; WILLEMEN ANTO) 22 May 2008 (2008-05-22) * abstract * * page 9, line 20 - page 12, line 7; figures 7,8 *	1,2	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 April 2010	Ferrien, Yann

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)

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